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Attitudinal Change; A Panacea for Malaria Control, Case Study: Four Communities of Jos South LGA Plateau State, Nigeria

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ABSTRACT

Introduction: Malaria poses serious challenge to public health in Nigeria, and its burden adversely impacting on individuals and household's wellbeing, productivity, nation's economy, urban and rural development particularly in the study area. This study "Attitudinal Change; A Panacea for Malaria Control" was carried out in four communities; viz, Chakarum, Kogon Rak, KogonTah and Chaha of Jos South Local Government Area, Plateau State, Nigeria. The knowledge, perception and attitude towards control and prevention programs (Roll Back Malaria in Nigeria) affect community compliance for effective eradication of malaria in the endemic areas.

Materials and Methods: With ethical approval the subjects were recruited through advocacy visit. Semi-structured Questionnaires were administered to 500 respondents (ie.125 samples from each community). 2 ml of blood sample was collected from each subject into EDTA bottle. Thick and thin blood films were made and stained using 1 in 10 diluted Giemsa stain.

Result: Out of the five hundred (500) blood samples examined, 314 (62.80%) were positive. From the positive samples, 179 (57.0 %) had high malaria density while 135 (43.0 %) had low density. The density was higher in Chakarum community having 75.3%, followed by KogonRak (73.5%), KogonTah (50.6%) and Chaha (34.8%). Those who involve in self-medication have 81.6% positivity while those who go to hospital for treatment have 51.3 % positivity. Out of 314 positive cases, those that do not use bed net were 59.6% (187) positive while those that use bed net were 40.5% (127) positive. Among those who net-screened their windows, only 12.4% were malaria positive while 87.65% were positive in those who do not screen their windows with net.

Conclusion: The negative attitude of the respondents towards control measures and treatment greatly attributed to high malaria infection in the study area. From the results, it may be deduced that a combination of the various control measures, viz, screening windows with net, use of Treated Mosquito Bed Net and a positive attitudinal observance of other preventive/control measures confer adequate protection from malaria infection. Medical Laboratory blood diagnostic screening and adhering to Physicians prescription for treatment will reduce the prevalence of malaria infection.

INTRODUCTION

Malaria is an issue of public Health concern with thousands of human infections seen around the Tropics each year. Besides the *Plasmodium falciparum* which is the virulent species causing the most severe malaria disease among the conventional species, two other zoonotic species, *Plasmodium knowlesi* and *P. cynomolgi* have evolved with serious challenge to humans (1). These simian malaria which usually infect macaques has been overlooked until its recent molecular differentiation and have been known to become a big issue of public health importance in malariology (2).

Acute respiratory distress syndrome (ARDS), numerous seizures, and other clinical features are some of the signs and symptoms of severe malaria, a systemic disease, frustration, shock, abnormal bleeding, jaundice, and acute kidney injury (AKI). It has been reported that *P. falciparum* infection has been linked to severe malaria's multi-organ dysfunction (3) (4). However, over the past 15 to 20 years, there have been a number of instances of complicated malaria infection linked to *P. vivax* and *P. knowlesi*, prompting the WHO to list these species as sources of complicated malaria infection (5).

A non-immune person with *P. falciparum* often has manifestation 10–15 days after being bitten by an infectious mosquito vector. The initial signs of malaria, including fever, headache, and chills, can be subtle and challenging to diagnose. If *P. falciparum* malaria is not treated within 24 hours of manifestation, it might worsen and frequently result in death (6).

Each year, according to estimate from the WHO, there are more than 1 million malaria fatalities and 350-500 million medical cases worldwide (7). The majority of malaria cases and fatalities worldwide occur in Africa. Sub-Saharan Africa is home to more than 80% of malaria deaths and almost 60% of all cases (8) (9).

Transmission of malaria is widespread and occurs in the Middle East, Africa, Asia, Central and South America, and Australia. Yet, there is a large regional disparity in the rates of morbidity and mortality among the nations and areas where malaria transmission occurs. The annual number of newborn deaths attributable to malaria transmission while pregnant is predicted to be 200,000. One in five of all child fatalities in sub-Saharan Africa are caused by malaria. According to the WHO, malaria mortality rose significantly in rural Africa between the 1980s and the beginning of the 1990s, most likely as a result of rising chloroquine resistance (10).

The attitudes, perceptions, and beliefs of families towards malaria infection, presentation of symptom, prevention and mode of treatment are often overlooked in malaria control efforts. The beliefs and practices towards malaria infection sometimes have cultural affiliation in some parts of Africa nations, and have influence on prevention and control interventions.

There has been a major drawback due to *Plasmodium falciparum* resistance in the attempt to eradicate malaria globally particularly in Sub-Sahara Africa (11). The effective and affordable drug for the treatment of malaria due to *Plasmodium falciparum* was Chloroquine, and it was the drug of choice. The effect and potency of the drug started diminishing due to factor of human errors as there was persistence and wrong use of Chloroquine for many decades which eventually led to resistance in the falciparum malaria treatment. This was first regarded as Chloroquine resistance and later became *Plasmodium falciparum* multidrug resistance 1 transporter (Pfmdr1) which contains five amino acid polymorphisms that are suggested to be involved in altered drug transport from the parasite's cytosol into the digestive vacuole (DV) (12).

METHODOLOGY

Study Population

The study population is characterized with subsistence farming in every household, and majority of the women are petty-traders. 20% being students and pupils and 5% being civil servants. Participants from all age group of one (1) to one hundred (100) years irrespective of occupation, educational background, marital status, social class, religion and cultural affiliation were among the survey population. The participants were recruited with due consent and approval from the Ministry of health.

Questionnaire

Semi-structured Questionnaires were used to access the bio-data-information, attitudes and practices of the subjects towards treatment, prevention and control measures used by the participants in the study area.

Sample Size

The sample size considered to answer the set objectives at 95% level in this study was calculated from the formula by Bueno (13).

$$N = Z^X P(1-P)/A^2$$

Where N = the desired sample size

Z = the standard normal deviation corresponding to 95% level of confidence.

The value obtained from normal distribution is 1.96.

P = Prevalence Rate [previous study showed a prevalence rate of 48.1% for malaria parasitaemia in highland and lowland areas of Jos according to Nanvyat (14).

A^2 = degree of prevalence

Therefore Sample Size = $(1.96)^2 \times 0.481 \times 1\text{-}0.481/(0.05)^2$.

$N = 3.8416 \times 0.481 \times 0.519 / 0.0025 = 383.605272$

$N = 383.61$

Then, 10% error of 383.61 = 38.361

$N = 383.61 + 38.361 = 421.971$
$N = 422$ samples (approximately 500 samples will be collected).

Sample collection
Five (500) blood samples were collected from the study population. About 2 ml of blood sample was collected into a 2 ml 'Ethylene Di-amine Tetra-acetic Acid (EDTA)' plastic container pre-labeled.

Sample analysis.
Thick blood film
On a clean-grease-free glass slide, a drop of the fresh blood collected was placed at the center. With the aid of another slide, the drop of blood was spread round to about a centimeter in diameter. It was light enough so that the hour hand of the wrist watch was seen through it. It was allowed to air-dry and was ready for stain (15).
Thin blood film
On a clean-grease-free glass slide, a drop of the fresh blood collected was placed at the edge of the slide (about 1 cm away from one end of the plain slide). A smooth-edged spreader was placed at the front of the blood; with an angle of 65ºC it was withdrawn backwards to have contact with the blood. The drop of blood was allowed to spread to the edges of the spreader. With a quick forward motion the spreader was pushed forward to leave the thin film with a head, body and a tongue-shaped tail. It was allowed to air-dry, ready for staining (15).
Preparation of stock solution of Giemsa stain
To prepare 500 ml, 35 grams of giemsa powder was placed in a flat bottom conical flask. About 250 ml of methanol was added and mixed until the giemsa powder completely dissolved. 250 ml of Glycerol was then added and mixed well. The bottle was plugged with cotton wool and placed close to the window to be assessable by the sun light. It was allowed to stand for two weeks with mixing at an interval of three days until the two weeks was reached. The solution was well-mixed and tested for staining ability (15).
Testing for staining ability of the newly prepared Giemsa stain
Two thin and thick blood films were made, one from positive control and the other from negative control. One in 10 dilutions was made from the new giemsa stain and from an old giemsa stain with good staining quality. The slides of thick and thin blood films from positive and negative control samples were stained with new and old stains respectively. On examination, since the new stain had the same staining quality as the old stain, it means the new stain was ready for use. It was then kept in a brown bottle in a dark cupboard avoiding light.
Preparation of 1 in 10 dilution of stock Giemsa
One part of the stock Giemsa stain was placed in a conical flask. Nine part of Buffered Distilled Water pH 7.2 was added and mixed thoroughly. The mixture was filtered through a funnel containing a whatmann No 1 filter paper. The filtrate was ready for use.
Note: This solution was used immediately the dilution was made because it does not keep.
Giemsa staining
Thick film: The dried thick blood film was placed across a staining rack across the sink. It was flooded with the 1 in 10 diluted giemsa and was allowed to stain for 45 minutes. It was rinsed with buffered Distilled Water pH 7.2. The back of the stained slide was wiped with absorbent cotton wool. It was kept on a draining rack and allowed to air-dry. A drop of immersion oil was placed and was examined using the oil immersion (x 100 objective of the microscope).
Thin blood film: The dried thin blood film was placed across a staining rack across the sink. It was flooded with absolute methanol and was allowed to fix for two (2) minutes after which it was poured out and was allowed to air-dry. It was flooded with the 1 in 10 diluted giemsa stain, and was allowed to stain for 45 minutes. It was washed with Buffered Distilled Water and the back was cleaned with absorbent cotton wool and allowed to air-dry. A drop of immersion oil was placed on the dried film and was examined using x 100 objective of the microscope. The result was determined. The species of the parasites was identified from the positive slide using this stained thin film.
Malaria Density: The malaria density was determined using the method described by the author (Oyibo *et al*., 2023), and the examination was done using the x100 oil immersion objective. This involves the use of thick blood film. It counts the number of parasite per µl of blood in relation to the patient's WBC count.
Formula: D = WBC count x parasites counted against 100 WBC / 100 (/µl).
D = Density
WBC= Patient's White Blood Cells Count [Patient's WBC Counts were used for my calculation (normal range = 4,300/ µl to 10,000/ µl)
Expression of result: when the density count of a patient was 1000/µl of blood and above, it was considered a high density. But when it was below 1000/µl, it was considered a low density

RESULT

Table 1: Malaria infection partern in the study area

Communities	*Number Examined*	Numbers Positive	Overall Percentage (%)	Specific percentage (%)
Chakarum	125	77	15.4	61.6
KogomRak	125	68	13.6	54.4
KogomTah	125	77	15.4	61.6
Chaha	125	92	18.4	73.6
Total	500	314	62.8	62.8

$\chi^2 = 10.171;\ \ DF = 3;\ \ P - value = 0.017\ **$

Key: Specific percentage = [Community + /4

Table 2: Malaria Density among positive subjects in study area

Study Area	*Number Examined*	Number Positive (%)	Density (%)	
			High Density	Low Density
Chakarum	125	77 (15.4)	58 (18.5)	19 (6.1)
KogonRak	125	68 (13.6)	50 (15.9)	18 (5.7)
KogonTah	125	77 (15.4)	39 (12.4)	38 (12.1)
Chaha	125	92 (18.4)	32 (10.2)	60 (19.1)
Total	500	314 (62.8)	179 (57.0)	135 (43.0)

$\chi^2 = 37.926;\ \ DF = 3;\ \ P - value = 0.000\ ***$

Keys: High Density = 1,000 parasites/µl of blood and above

Low Density = below 1,000 parasites/µl of blood.

(%) = Percent.

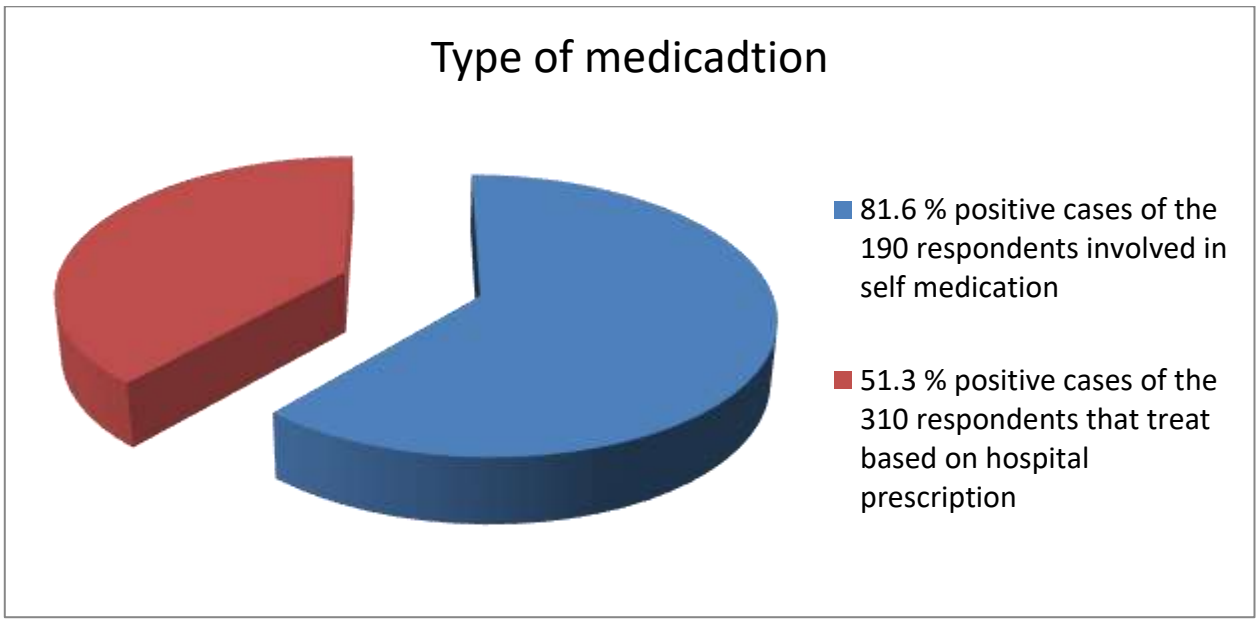

Figure 1: A Pie Chart of Questionnaire result showing the frequency of malaria infection based on Attitude towards treatment.

Table 3: Questionnaire result showing preferred malaria prevention measures

Variables	Number Examined	Yes (%)	No (%)	NP (%)	NPN (%)	Chi-sqr	Df	P-value
Use of bed net	500	213 (42.6)	287 (57.4)	127 (40.5)	187 (59.6)	10.952	1	0.001
Use of screened window	500	124 (24.8)	376 (75.2)	39 (12.4)	275 (87.6)	127.01	1	0.000
Use of insecticide/Coil	500	356 (71.2)	144 (28.8)	260 (82.8)	24 (7.4)	89.89	1	0.000

Keys: Yes = Those who use bed net; No = Those who do not use bed net
NP = Numbers Positive that use bed net, screen window and use insecticide.
NPN= Number Positive that do not use bed net, do not screen window and do not used insecticide.

Table 4: Malaria infection pattern based on educational level in the study area

	Chakarum	Kogon Rak	Kogon Tah	Chaha	Total
Number Examined	125	125	125	125	500
Numbers Positive for MP	77 (62%)	68 (54%)	77 (62%)	92 (74%)	314 (71%)
No formal education	21	25	27	24	97
Number positive	14 (67%)	13 (52%)	17 (63%)	13 (54%)	57 (59%)
Primary School level	50	47	61	67	225
Number positive	38 (76%)	30 (64%)	37 (61%)	54 (81%)	159 (71%)
Secondary School level	50	43	32	28	153
Number positive	24 (48%)	19 (44%)	19 (59%)	16 (57%)	78 (51%)
Tertiary School level	4	8	5	8	25
Number Positive	3 (75%)	4 (50%)	4 (80%)	8 (100%)	19 (76%)

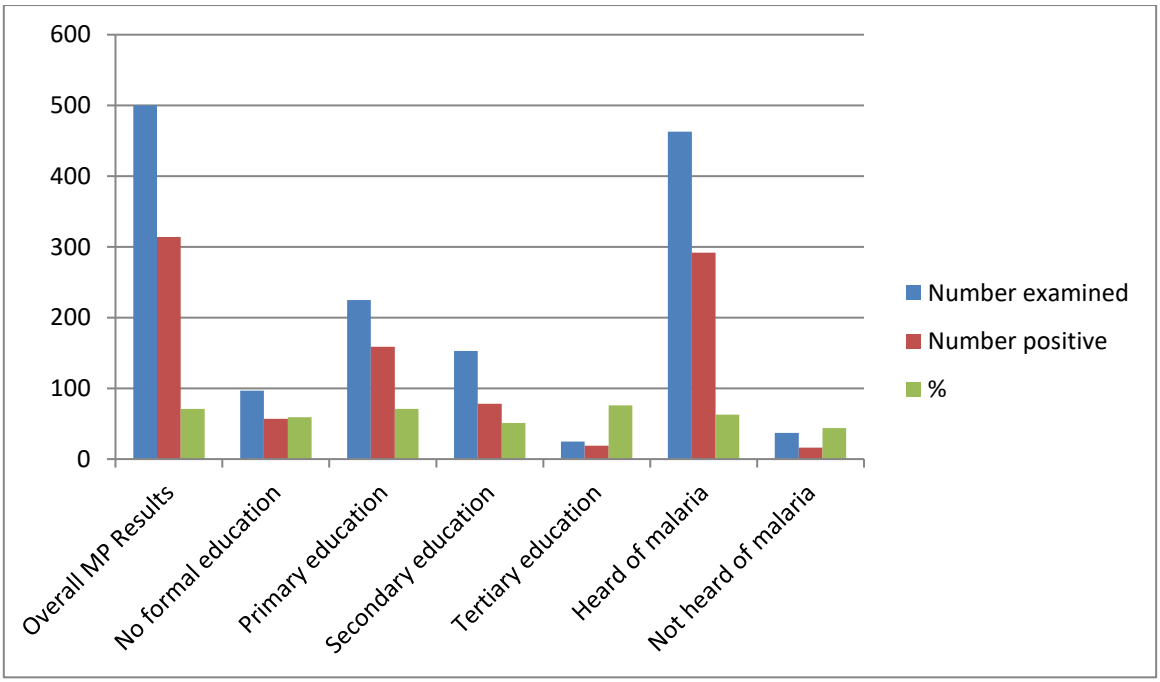

Figure 2: Level of education in comparison with awareness on malaria transmission

Table 5: Effects of malaria infection awareness on transmission

Awareness	Chakarum	Kogon Rak	Kogon Tah	Chaha	Total
Heard of Malaria	116	113	116	118	463
Number Positive	76 (66%)	62 (55%)	69 (60%)	85 (72%)	292 (63%)
Not heard of Malaria	9	12	9	7	37
Number Positive	2 (22%)	5 (42%)	6 (67%)	3 (43%)	16 (44%)

DISCUSSION

The current study revealed a substantially high Malaria Burden in the study area with statistical significance of $P < 0.05$. The prevalence of plasmodium infection was 62.8% of the total respondents out of which *Plasmodium falciparum* was 64.3% being the most prevailing species compared to *P. vivax* which was 35.7%. This high prevalence has down play the prevention/control programs established by the government from the desired goals on the study population. This could be due to the fundamental factors of "non compliance or non- enforcement of control/preventive programs" which underscores adequate monitoring. Malaria prevalence in these rural communities was highly significant with $P < 0.05$. The prevalence was seen to be higher in Chaha being 73.6 % as compared to the other communities. This agrees with a research carried out in Kano State, Nigeria, a cross-sectional community-based survey in five villages which revealed 66.6% positivity in malaria (16).

The density of malaria determined with estimated WBC count showed that the communities examined had a high percentage parasites density of 179 (57.0 %)/µl with statistically significant difference ($P < 0.05$). The high malaria density level may be due to the high prevalence of *P. vivax* which incriminated low observable hospitalization cases in the study area. Though malaria prevalence of 73.6% in Chaha community was higher, but 65.2 % of the infected subjects had low density with p-value = 0.000, while only 34.8 % had high density. This study rates the density to be 57% high and 43% low. These findings disagrees with another survey conducted in Nigeria that reported a low density of malaria infection of 29.62/µl from the six geopolitical zones of Nigeria across all age group (17). The high prevalence but low density of 43% accounted for the asymptomatic cases in Chaha community. This draws attention to the varying factors assumed to be responsible for the low density; such factors include, immune response and the prevailing *Plasmodium vivax* specie in the study community.

The questionnaire based on treatment method revealed 81.6% of those who do self medication to be positive for malaria parasites as shown in Figure 1. This indicated self medication as a factor promoting persistence, resistance and frequency of infection per year. Those who receive medical treatment have less malaria infection. From the total of 310 respondents who seek medical treatment, 159 (51.3%) were positive indicating lower infection rate among those with medical treatment as compared to the 155 (81.6%) positive cases of 190 respondents who do self medication. The study showed significant difference at $P < 0.05$ in relation to the method of treatment and malaria infection. This indicated that the method of treatment majorly determines the level of malaria prevalence within a specific population.

From the 287 (57.4 %) respondents who do not like using bed net, 187 (59.6 %) was positive for malaria parasites. Whereas, of the 213 (42.6 %) that use bed net, 127 (40.5%) showed positivity for malaria parasite. Statistical test indicated more malaria infections among those that do not like using bed net ($P < 0.05$). This aligned with the research results which demonstrated that utilization of Insecticide Treated Net was low, and it was revealed that not all those who own Treated Bed Nets (TBN) actually use them (18). Hence, there is increase in transmission level despite the Role Back Malaria (RBM) initiative. Similarly, from the 376 (75.2 %) that do not use net-screened window, 275 (87.6 %) was positive for malaria infection; while from the 124 (24.8 %) that screened their window only 39 (12.4%) respondents were infected. This indicates that screening windows and doors with net confer more protection from malaria, and this should represent the primary measure to ensure prevention among a populace. Unfortunately from this study, it is revealed that though screening of windows and doors confer more protection, yet more respondents disliked screening windows and doors. Furthermore, this discovery pronounces the role of poverty in malaria control since majority of the respondents who do not screen their windows and doors are from non- good habitable or non-modern buildings.

The Chi-square test showed that the malaria infection is more with those that do not net-screened their windows($P - value = 0.000$). From the 356 (71.2 %) respondents that use only insecticide/coils, 260 (82.8 %) were positive for infection, while from the 144 (28.8 %) who do not use insecticide/coils, 24 (7.4 %) was positive for malaria. This signifies that the use of insecticide is less effective than other preventive measures. The Chi-square test conducted confirmed that most of the people in the community prefer using insecticide/coil than other preventive measures and hence, there is more infection as compared to those using mosquito net. The high prevalence among the study population was a factor of limited numbers of participants who screened their windows and who only depended on the use of insecticide and coils. This study is in contrast with the findings which postulated that the prevalence of malaria is decreased through awareness of the condition (19).

According to the majority of participants, most people were aware of malaria, and this is in accordance with the findings from prior research outcome, suggesting that almost all respondents were aware of malaria. This suggests that the attitude of the respondents is the critical element for the transmission of plasmodium infection in the study areas. Though the respondents were aware of malaria infection and preventive control measures, but lack or inadequate compliance increased the infection rates.

In this study, malaria distribution revealed practice and attitude as potential factors associated with malaria transmission, which implicated knowledge among the indigents as playing lesser role in transmission in the case of malaria. There was no significant difference in malaria infection in reference to levels of education at P-value < 0.005. Of the 463 (92.6%) respondents which was aware of malaria infection, 63% was positive for malaria while from the 37 (7.4%) respondents who were ignorant of malaria infection, 16 (44%) was positive, indicating that transmission among the educated is comparable to the transmission among the few who have not been informed of malaria. It also observed that the infection [57 (59%)] among those who had no formal education is comparable to those with tertiary education [19 (76%)], implicating that education has little or no significant effects in malaria prevalence as compared to attitude and poverty.

Though Awareness is directly proportional to consciousness and cautiousness, attitude based practices in malaria transmission are the key factors determining the prevalence of malaria infection among a population in a particular geographical location as revealed in Table 5. The 63% positivity among those who are aware of malaria as compared to the 44% positivity among those who are not aware is evident that the rate of awareness is not proportional to the number of infection. Infection was higher among those that were aware of malaria signifying negative attitude to positive practice. This finding invalidates the findings which stated that "it is assumed that, due to the effect of awareness campaign, the aware infected individuals avoid contact with mosquitoes" (20).

CONCLUSION

Self medication has been shown in this study to exponentially increase, density, prevalence, complications and resistance of malaria infection. It is empirical that screening windows with net and the use of TBN confer more protection compared to other preventive measures, the use of only insecticide or mosquito coil repellant as a measure of control does not confer the desired protection, and the combination of these protective measures will comparatively ensure effective protection than application of single measure in any given endemic areas. It is therefore recommended that for highest level protection, households should; (1) adopt good compliance to all preventive and control measures, (2) screen windows and doors with net in combination to using TBN in endemic areas, and possibly use insecticide when necessary, (3) regularly go for medical cheek up and follow the prescribed medication for adequate health improvement against malaria.

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