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Original Research Article

Malaria Parasitaemia among Primary School Children in Oko Community, Orumba North Local Government Area, Anambra State, Nigeria

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ABSTRACT

A prevalence study of malaria among primary school children in Oko community, Orumba North LGA, Anambra State, Southeastern Nigeria was carried out in 2011. Three schools, Gaius Benton, Holy Trinity and College Primary schools were investigated. A total of 216 pupils made up of equal number of boys and girls, 108 (50.0%) each, participated in the study. These were aged between 6 and 13 years. Microscopic examination of blood films was used to detect malaria parasites in their blood samples. Interview and physical observation were used to obtain biological data of the pupils as well as some predisposing environmental factors. Of the 216 pupils examined, 54 (25.0%) tested positive for malaria. More males, 38 (35.0%), than females, 16 (15.0%), tested positive for malaria. The difference was statistically significant (χ^2<0.05). Malaria prevalence was highest in the age group 6-7 years 20 (37.0%) and least in the age group 12-13 years 6 (11.0%). The differences were also statistically significant (χ^2<0.05). Pupils of parents with no formal education had the highest malaria prevalence 19 (49.0%), while pupils of parents with tertiary education had the least 7 (11.0%). The study reveals that malaria remains a serious health problem for children attending primary school in the community. This calls for more effort on the part of the parents and teachers to educate the pupils on methods of self-protection against mosquito bites and disease transmission. It is suggested that the government and the community should establish source reduction and other intervention measures to reduce vector-man contact and hence disease transmission.

Key Words: Malaria, primary schools, Oko community.

INTRODUCTION

Malaria burden varies among different regions of the world. [1] It has continued to rank high, if not first, among the commonest infectious diseases in the tropics affecting infants, children and adolescents. [2] Malaria is a major public health disease in the world, highly endemic in most tropical and sub-tropical regions and countries of the world, including Nigeria. The importance of malaria is with respect to its high morbidity and mortality, as well as heavy economic burden on households and nations. It is responsible for the high

mortality rate in susceptible children of sub-Saharan Africa, especially those of primary school age. Over 90 % of malaria cases and deaths occur in sub-Saharan Africa with most of the cases being infections of *Plasmodium falciparum.* [3]

Plasmodium falciparum is the most common and most virulent of four malaria parasites contributing significantly to the reduced daily output, school absenteeism, and even paediatric morbidity and hospitalizations in Nigeria, and sub-Saharan Africa as a whole. Childhood and maternal mortality due to *Plasmodium falciparum* malaria is relatively high. [4] Malaria was fittingly affirmed a threat to more than 40 % of the world's population. [5]

There are four identified species of the malaria-causing *Plasmodium* parasites namely: *P. falciparum*; *P. malariae; P. Ovale* and *P. vivax*. [6] They are transmitted by infected female *Anopheles* mosquitoes. Accidental infection may result from the passage of infected blood containing the erythrocytic stage of the parasite. Such infection may accompany transfusion of blood containing the parasite or ingestion of blood sample accidentally. Congenital transmission by the passage of the sexual stage of the parasite from the placenta to the feotus during pregnancy is also possible. [6]

Predisposing factors to infection with malaria include: extremes of age, pregnancy especially in the primagravidae, and in the second half of pregnancy, immuno-suppression, especially patients on steroids, anti-cancer drugs, and immune-suppressant drugs, immuno-compromised patients with advanced tuberculosis, cancer; and lack of previous exposure to malaria (non-immune) or lapsed immunity and pre-existing organ failure among other factors. [7]

The direct and indirect cost of prevention and treatment of malaria can be as high as 25 % of household annual incomes. [1] This enduring economic burden has a devastating impact on the ability of people to overcome poverty. Any meaningful poverty reduction strategy should therefore incorporate malaria containment and elimination as an important indicator and milestone. In recent years, malaria-focused initiatives have the promise of achieving far beyond what past efforts achieved. A good example is the Multilateral Initiative on Malaria (MIM) which was launched in 1997, and aimed at maximizing the impact of scientific research on the control of malaria. [8]

It has been estimated that by the turn of the century, malaria would be the number one infectious killer disease in the world. [2] The disease caused an estimated 219 (range 154–289) million cases and 660 000 (range 490 000–836 000) deaths in 2010. Approximately 80% of the cases and 90% of the deaths occur in Africa while the remaining cases and deaths occur mainly in the South-East Asia and Eastern Mediterranean Regions. [9] Every year, 30,000 visitors to endemic areas develop malaria and 1 % of them die due to lack of protective immunity.

Nigeria is a frontline malaria endemic country, contributing significantly to the world's total cases. However, concerted efforts toward the containment of the disease are ongoing in Nigeria. This study was therefore primarily aimed at determining the malaria prevalence among primary school pupils in endemic Oko Community, Orumba North Local Government Area, Anambra State, Nigeria. The specific objectives included the determination of the prevalence, identification of groups (sex, age, and class) mostly affected, the intensity of malaria infection in the pupils, their treatment strategies, and the likely pre-disposing epidemiological factors in the community.

MATERIALS AND METHODS

Study area

The study was carried out in Oko community in Orumba North Local Government Area of Anambra State, South-east Nigeria. Oko community is one of the 16 major towns that make up the Orumba North L.G.A. of Anambra State. It has a population of about 28,980 according to the National Population Commission in 2006, with 2.8% annual growth rate. Five villages and forty-five clans make up the town. [10] The villages are: Ezioko, Eziabor, Okeani, Ihengwu and Ifite. Oko is situated between 6^0 02'N, 7^0 06'E and 6^0 05'N, 7^0 09'E. [11] It is bounded in the North by Aguluezechukwu and Ogboji, in the South by Nanka, in the east by Ekwulobia and in the West by Ndiowu and Amokpala.[1213] Oko community is in the tropical rainforest zone of Nigeria. It has two marked seasons, the dry and the wet seasons. It has about 8-9 months of wet season (March to November) and 3-4 months of dry season (November to February) with a short period of dry cold harmattan (December to January). There is also an August break in the wet season. Oko has an undulating topography with many small hills and valleys. In the dry and wet seasons, the relative humidity of Oko falls between 69-71% and 78-82% respectively. The annual rainfall is between 2000-3000mm. [11] The community hosts a Federal Polytechnic, numerous secondary and primary schools both public and private. These schools are attended by pupils resident in Oko and those from neighbouring communities. The health needs of Oko residents are taken care of at the many health facilities there including the Oko community Hospital, along with those of neighboring communities. Other public utilities include: pipe-borne water supply facility, a Power Holding Company of Nigeria (PHCN) distribution sub-station; a functional and well-equipped civic centre; a postal agency, and a Nigerian Telecommunication (NITEL) office. Federal government roads run from Ekwulobia and Nanka through Oko to Umunze and beyond.

The inhabitants of Oko community are primarily farmers, but also comprise a good number of students, skilled professionals, civil servants; and semi-skilled professionals, businessmen and women, as well as unskilled labourers.

Advocacy visits

Prior to the commencement of the studies, several advocacy visits to the Head teachers of the primary schools were made with a letter of introduction and intent obtained from the Head of the Department of Parasitology and Entomology, Faculty of Biosciences, Nnamdi Azikiwe University, Awka, Nigeria. Permission to screen the pupils for malaria was obtained through consultation with the Parents Teachers Association (PTA). Informed consent of the pupils was also obtained after thorough explanation of the intents of the study.

Selection of study participants

A total of 216 apparently healthy primary school pupils (108 males and 108 females) who did not show any signs and symptoms of malaria were selected for the study. The age bracket of the pupils was 6-13 years. Three primary schools were sampled, and these were Gaius Benton (private), Holy Trinity (Missionary) and College (public) Primary Schools. Seventy two (72) pupils (36 males and 36 females) were selected from each of these schools. The pupils' biological data such as age, sex, and class of study were collected through oral interviews.

Collection of blood samples

Blood samples were collected from the tips of the left thumbs of the pupils. A plug of cotton wool soaked in methylated spirit was used to clean the finger tips to remove dirts and grease. Each thumb was slightly raised upwards and pricked with a

sterile disposable lancet. Upon applying gentle pressure to the thumb, the first drop of blood was expressed, and wiped off using dry cotton wool making sure no trace of wool was left on the tip. Pressure was applied subsequently to the thumb and another drop of blood expressed and collected at the middle of a dry, clean and grease free microscope slide. The blood left on the finger was thoroughly wiped off the thumb with cotton wool.

Preparation of blood film

A plastic applicator stick was used to spread the blood evenly on the slide in a circular motion to about 2 - 4cm in diameter. The smeared thick blood film was then allowed to air-dry in a flat horizontal position, protected from insects, dust and extreme heat. A pencil or marker was used to write the number of the pupils on the dry slides. The dried blood films were transported in a slide box to the Department of Parasitology and Entomology Laboratory at Nnamdi Azikiwe University, Awka, Nigeria, for examination to detect malaria parasites.

Staining and examination of the blood films

The thick blood films were stained using 10 % Giemsa stain obtained by diluting stock Giemsa stain solution with buffered distilled water of pH 7.0 (180ml H_20+20ml Giemsa stain). The blood films were thoroughly immersed in the stain and allowed to stay for 10 minutes before washing off with buffered water (pH 7.0). The slides were air-dried and examined under the microscope using X10 and X100 objectives lenses.

A sample was adjudged positive on observation of red chromatin dots with blue ring of cytoplasm; and dark brownish pigments except for the ring stages of *P. falciparum* which lacks the pigment.

Determination of malaria intensity

The intensity of malaria was recorded using the plus (+) sign thus:

a. (+) for mild infection of 1-5 parasites per High Power Fields (HPF).
b. (++) for moderate infection of 5-10 parasites per HPF.
c. (+++) for heavy infection of 10-100 parasites per HPF.

Data analysis

The data collected from the study were analyzed statistically using chi-square (χ^2). Other statistical tools used in analyzing the data and results included tables, graphs and charts.

RESULTS

Out of the 216 pupils sampled and tested for malaria parasitaemia, 54 (25.0%) were positive with malaria parasites (table 1), especially the ring forms of *P. falciparum*. Pupils of the public school (College Primary School) had the highest malaria prevalence of 25 (35.0%) when compared to 17 (24.0%) and 12 (17.0%) recorded in the Missionary (Holy Trinity Primary School) and the private (Gaius Benton Primary School). Among the total of 54 positive cases, 41 (76.0%) had mild infection, 10 (18.0%) had moderate infection, and 3 (6.0%) had heavy infection (Table 2).

Considering the gender, males had higher malaria prevalence 38 (35.0 %) than the females 16 (15.0 %) in all the schools studied (table 3). The age group 6-7 years had the highest prevalence 20 (37.0 %), followed by the group 8-9 years 17 (32.0 %), while the age group 12-13 years had the least prevalence 6 (11.0 %) in all the schools studied (table 4). The differences were statistically significant (χ^2<0.05). Prevalence of malaria in different classes ranged from 2 (5.0%) among primary 6 pupils to 14 (39.0 %) among primary 1 pupils (table 5).

With respect to area of residence of the pupils within or outside Oko community,

a larger number 140 (65.0 %) of the pupils reside within the community, and had the highest positive samples 43 (31.0%) while the non-residents were 76 (35.0%), and had 11 (15.0%) positive cases (table 6).

Prevalence among the pupils with regards to their parents' occupations did show some significant differences (χ^2<0.05). The children of unskilled parents were mostly infected, 22 (79.0%), followed by the children of semi-skilled parents such as businessmen and women, 26 (28.0%). Pupils whose parents are skilled professionals, such as medical doctors, accountants, civil servants among others were least infected, 6 (6.0 %) (table 7).

Table 1: Prevalence of malaria parasitaemia among different primary schools in Oko community.

Primary schools	Number examined	Number positive (+)	Prevalence (%)
Holy Trinity Primary School (HTPS)	72	17	24.0
Gaius Benton Primary School (GBPS)	72	12	17.0
College Primary School (CPS)	72	25	35.0
Total	216	54	25.0

Table 2: Cumulative malaria parasitaemia intensity among the pupils from different primary schools in Oko community

Primary schools	Mild infection (+)	Moderate infection (++)	Heavy infection (+++)	Total
Holy Trinity Primary School (HTPS)	14 (82.0%)	2 (12.0%)	1 (6.0%)	17 (32.0%)
Gaius Benton Primary School (GBPS)	9 (75.0%)	3 (12.0%)	0 (0.0%)	12 (22.0%)
College Primary School (CPS)	18 (72.0%)	5 (20.0%)	2 (8.0%)	25 (46.0%)
Total	41 (76.0%)	10 (18.0%)	3 (6.0%)	54 (25.0%)

Table 3: Prevalence of malaria parasitaemia by sexes among the pupils of different primary schools in Oko community

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Sexes	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. exam.	No. +ve (%)
Males	36	12(71.0%)	36	9(75.0%)	36	17(68.0%)	108	38(35.0%)
Females	36	5(29.0%)	36	3(25.0%)	36	8(32.0%)	108	16(15.0%)
Total	72	17(24.0%)	72	12(17.0%)	72	25(35.0%)	216	54(25.0%)

Table 4: Malaria parasitaemia by age groups of pupils of different primary schools

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Age groups (yrs)	No. exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)
6-7	18	6(33.0%)	18	5(28.0%)	18	9(50.0%)	54	20(37.0%)
8-9	18	5(28.0%)	18	4(22.0%)	18	8(44.0%)	54	17(32.0%)
10-11	18	4(22.0%)	18	2(11.0%)	18	5(28.0%)	54	11(20.0%)
12-13	18	2(11.0%)	18	1(6.0%)	18	3(17.0%)	54	6(11.0%)
Total	72	17(24%)	72	12(17.0%)	72	25(35.0%)	216	54(25.0%)

Table 5: Prevalence of malaria parasitaemia among the pupils in different classes of the primary schools in Oko community

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Classes	No. exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)
Primary 1	12	4(33.0%)	12	3(25.0%)	12	7(58.0%)	36	14(39.0%)
Primary 2	12	4(33.0%)	12	2(17.0%)	12	6(50.0%)	36	12(33.0%)
Primary 3	12	2(17.0%)	12	6(50.0%)	12	3(25.0%)	36	11(31.0%)
Primary 4	12	3(25.0%)	12	1(8.0%)	12	6(50.0%)	36	10(28.0%)
Primary 5	12	3(25.0%)	12	0(0.0%)	12	2(17.0%)	36	5(14.0%)
Primary 6	12	1(8.0%)	12	0(0.0%)	12	1(8.0%)	36	2(5.0%)
Total	72	17(24.0%)	72	12(17.0%)	72	25(35.0%)	216	54(24.0%)

Table 6: Prevalence of malaria parasitaemia by residence among pupils from different primary schools in Oko community

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Town of residence	No. exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)
Oko residents	53	13(25.0%)	23	7(30.0%)	64	23(36.0%)	140	43(31.0%)
Non-residents	19	4(21.0%)	49	5(10.0%)	8	2(25.0%)	76	11(15.0%)
Total	72	17(24.0%)	72	12(17.0%)	72	25(35.0%)	216	54(25.0%)

With respect to the educational status of the parents, pupils born of parents with no formal education had a higher prevalence 19 (49.0 %), followed by pupils from parents

with primary education 18 (34.0 %), while pupils whose parents had tertiary education had the least prevalence 7 (11.0 %), (table8).

Table 7: Malaria prevalence by parents'occupation among pupils from different primary schools in Oko commuity

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Parents' occupation	No. exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)
Skilled	35	3(9.0%)	54	2(4.0%)	7	1(14.0%)	96	6(6.0%)
Semi-skilled	26	7(27.0%)	13	5(39.0%)	53	14(26.0%)	92	26(28.0%)
Unskilled	11	7(24.0%)	5	5(100.0%)	12	10(83.0%)	28	22(79.0%)
Total	72	17(24.0%)	72	12(17.0%)	72	25(35.0%)	216	54(25.0%)

Table 8: Malaria prevalence by parents' educational status among pupils of different primary schools in Oko community

	Holy Trinity P. S		Gaius Benton P. S		College P. S		Total	
Parents' Educ. Status	No. exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)	No. Exam.	No. +ve (%)
Non-formal	11	4(39.0%)	4	2(50.0%)	24	13(54.0%)	39	19(49.0%)
Primary	17	5(29.0%)	15	5(33.0%)	21	8(38.0%)	53	18(34.0%)
Secondary	20	4(20.0%)	23	3(13.0%)	17	3(18.0%)	60	10(17.0%)
Tertiary	24	4(16.0%)	30	2(7.0%)	10	1(10.0%)	64	7(11.0%)
Total	72	17(24.0%)	72	12(17.0%)	72	25(35.0%)	216	54(25.0%)

Seventy seven (77) pupils, representing 36.0 % indicated living in swamp-like areas with shallow water pools, 46 (21.0 %) and 33 (15.0 %) having sand excavation holes for water collections; and blocked gutters and refuse dumps respectively.

Investigations into the malaria treatment practices of the pupils reveals that 85 (39.0 %) pupils visited hospitals/clinics, 60 (28.0 %) bought drugs from chemist shops, 37 (17.0 %) do not treat their malaria infection at all, while 17 (8.0 %) either visited herbal homes or used self-medication. On the self-protective measures used against mosquito bites by the pupils, a good number of the pupils interviewed , 85 (39.0 %) use mosquito treated nets, 34 (16.0 %) and 28 (13.0 %) use insecticide sprays and untreated mosquito nets, whereas 17 (8.0 %) use repellent coils and 4 (2.0 %) use repellent lotion. Only 47 (22.0 %) do not take any protective measures, hence the 54 (25.0 %) prevalence of malaria in the area (Figure 1).

From field observation, Oko community has undulating topography and a few streams with fresh water swamps that could be breeding grounds for Anopheles mosquitoes. The undulating topography of the community leaves depressions in many places for water collections that could breed the vectors. With the exception of the Federal roads traversing the community, other feeder roads are laterite roads with water-logged potholes especially during the wet seasons.

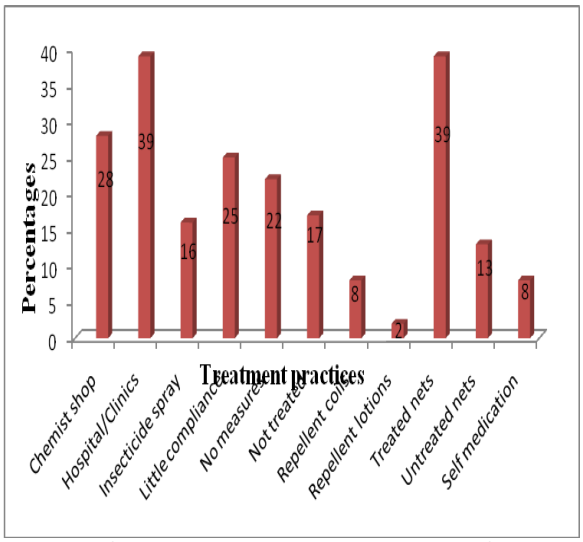

Fig. 1: Self protection and treatment practices of primary school pupils in Oko community.

DISCUSSION

An overall malaria prevalence of 54 (25.0 %) was observed among the primary school children in Oko community. The total prevalence of the infection in this study

population is far lower than that of Onyido *et al*, [14] who in a similar study in Ogbunike, Anambra State, reported 58.2% prevalence rate. It is also lower than that reported by; [15-21] who reported 46% prevalence in Nnewi, Anambra State; 76% prevalence in Azia, Anambra State; 62% prevalence in Umudioka, Anambra State; 67% prevalence in Abakaliki, Ebonyi State; 61% in Abuja, FCT; 59.4% prevalence in Umunede and Asaba, Delta State; and 58% in Awka, Anambra State respectively. However, the results were quite similar to that of, [22] who reported 17% prevalence rate in eastern Nigeria.

The prevalence, intensity and regularity of malaria differ from location to location depending on factors such as rainfall patterns and proximity of human dwelling places to vector breeding sites among others. [23] The relatively low prevalence of malaria in this study could be due to the educational standards of the parents or guardians and their awareness of the causes and consequences of malaria parasitaemia. Most of the educated parents employ self and family measures and initiate treatment of their children or wards whenever the need arises, either at nearby hospital or chemist.

Among the age groups, the age group 6-7 and 8-9 years with the highest prevalence of 20 (37%) and 17 (32%) respectively, agrees with the findings of [24] who recorded higher prevalence among the younger age group in Nnewi, Anambra State. Also, [25] and [26] in similar studies in Sokoto (Northeast) and Ogbunike-Oyi (southeast) Nigeria respectively, recorded a similarly high prevalence of malaria among the age groups 0-5, 5-10 and 0-10 years respectively. Children in malaria endemic areas do not suffer as much as it is sometimes thought from malaria infections, since they are passively protected by mother's antibodies until they begin to develop some of their own. [27] Immunity in primary school age children (6-12 years) is still young and inefficient especially among those aged 6-7 years, hence the highest prevalence in these group and least in age group 12-13 years who have developed a more efficient immunity.

Majority 41 (76.0%) of all the 54 children infected showed mild infections, and fewer moderate infections 10 (18.0%) while only 3 (6.0%) had heavy infections. [28] observed that immunity to malaria infections develops after prolonged and repeated infections and subsequent infections cause no symptoms, or are of much less severity. Oko community is in a malaria endemic region of Nigeria and these children might be in various stages of immunity in their lives due to repeated infections with malaria parasites. This may have accounted for the high number of mild infections when compared to heavy infections.

More males, 38 (35%), were affected when compared to females, 16 (15%). The difference was statistically significant ($P<0.05$). This finding is in contrast with the findings of [14] who found a higher prevalence 73 (35.1%) among females as compared to males, 48 (23.1%). Oko community like others in the rain forest zone of Nigeria has warm humid climate characterized by hot weather conditions. It could be that because of the hot weather conditions, the boys might not be using the insecticide treated nets and always sleep without shirts thereby exposing their bodies to more mosquito bites. Girls on the other hand are usually more conscious of their bodies and always have their bodies covered while sleeping, creating a physical barrier to the mosquitoes.

With respect to area of residence of the pupils sampled (within or outside Oko community), a larger number 140 (65.0 %) reside within the community and had the

highest positive samples 43 (31.0%) when compared with non-residents, 76 (35.0%) with 11 (15.0%) being positive. Field observations and oral interview on the pupils of the 3 schools indicated that some vital prevalence determinant factors, ranging from the individual children; parents/guardians; environmental; malaria parasitaemia factors; treatment and protective measures data, greatly influenced the malaria prevalence rate. Our findings indicated that Oko and neighbouring communities developed as farm settlements without adequate planning for water drainages. More so, the undulating topography allows water collections in the depressions and the fresh water swamps in the community ensures constant availability of breeding grounds for the mosquito vectors in the area vis-à-vis a high rate of man-fly contact thereby exposing the pupils regularly to malaria infections. This was not the same in the neighboring communities with more or less smooth terrain and less breeding sites for the vectors. Hence, lower malaria prevalence in the communities.

A good number of the pupils interviewed use mosquito treated nets as the results showed. Lesser number of pupils used insecticide spray, untreated mosquito nets, repellent coils and lotions. Some however do not take any protective measures.

CONCLUSION

Compliance to malaria prevention and treatment regimens by all is required to combat malaria burden in our communities. The non-compliance of some people could be as a result of poor understanding of the benefits of strict compliance and therefore calls for increased effort in health education for all. The study revealed that malaria remains an essential problem for children attending primary schools in Oko and neighbouring communities. This calls for increased effort on the parents and teachers to educate the pupils on methods of self protection against mosquito bites and disease transmission by the insects. Also the community leaders in collaboration with the government of the day should establish source reduction measures and other malaria intervention measures to improve the health of the people.

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