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Environmental Survey and Health Seeking Behavior of Caregivers of Children Suspected to have Malaria in Takwa-Bay, Lagos State

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Malaria is the single most important cause of illness and deaths in Nigerian children especially in rural areas where effective case management and prevention are compromised by delayed recognition of the disease and poor treatment decisions, poor access to integrated malaria vector control and therapeutic intervention strategies. To design efficacious and cost-effective malaria control activity with potentials for optimal social benefits in a rural area, an understanding of perception of malaria and health seeking behaviors of caregivers is highly imperative. This study was carried out to characterize Takwa-Bay for malaria risk factors and document existing knowledge, attitudes and practices related to malaria recognition, control and treatment in the area. This cross-sectional descriptive study enrolled 112 respondents from 47 households of 171 under 5 years of age children that were selected by multistage random sampling method from 11 clusters drawn from the 4 major settlements in Takwa-Bay: Takwa-Bay, Ebute-Oko, Abagbo and Ogogoro in Lagos, Nigeria. The respondents, who were caregivers were administered open/close-ended pilot tested questionnaire that was designed based on key informant interviews to capture demographic and socio-economic variables coupled with their knowledge of malaria and health seeking behavior. The area was also environmentally assessed to capture malaria transmission indicators. Data were analyzed statistically using SPSS software version 11.0. A total of 112 respondents aged 21 - 53 years (mean ± SD age = 32.9±8.7 years).were studied. Of the 112 respondents, 59 (52.7%) were females (P >0.05), 76.8% had formal education predominated by primary school attendance (50.9%; P <0.05), 27.7% were traders, 13.4% were artisans, 18.8% were housewives and 8% were unemployed. The respondents (88.5%) were ranked within the 1st and 2nd quartiles of wealth index suggesting poor to moderately poor socio-economic status. The respondents had good knowledge of malaria aetiology (77.7 – 100%) and classical symptoms of uncomplicated malaria such as fever, malaise, headache and loss of appetite (87.5 - 96.4 %). But knowledge of danger signs seen in severe malaria such as convulsion, coma, jaundice and respiratory distress (28.6 – 57.6%) were significantly low (P < 0.05) Community members and the health post were mentioned as the major sources of information by the respondents compared to radio, television and traditional medicine practitioners (4.5 – 11.6 vs. 19.6 – 58%; P <0.05). Data on health seeking behavior indicated that the respondents employed allopathic medicines (71.4%), traditional medicines (20.5%) or both (8%) to treat their sick children. Self medication was practiced by 57.1% of the respondents. Reasons given for self medication included timeliness, knowledge about treatment of malaria, non-availability of doctors in the health post, poor attitude of health workers and lack of drugs at the health post, while the use of traditional medicines was based on cultural belief of efficacy of natural products, and the free to low cost associated with their procurement. Western medicines used were CQ (32.5%), SP (42.5%), artemisinin monotherapy (13.8%) and ACT (3.8%), analgesics (75%), antibiotics (46.3%) and haematinnics (51.3%). The use of allopathic medicine was associated with having a formal education (OR (95%CI) = 11.6 (3.8-36.4) and younger age [OR (95%CI) = 5.0 (1.5-16.3)], while self medication was favorably practiced by the male gender [(OR (95%CI) = 5.4 (2.2-13.4)]. Leaves of *Vernonia amygdalina, Morinda lucida* and *Azadirachta indica* were among the plants used for malaria treatments. More than 60% of the households' survey were located < 400 m to water bodies and surrounded by mosquito breeding promoting factors. We conclude that Takwa-Bay is a malaria prone and poor rural area that is currently characterized by poor home management of the disease despite good awareness of malaria among the caregivers. Therefore, there is a need to improve perception of malaria and bridge the existing gap between knowledge and health seeking behaviour in Takwa-Bay through provision of health education with emphasis on danger signs of malaria and training of health care providers with emphasis on the procurement and sales of ACTs as nationally approved therapies for malaria in Nigeria. Home management of malaria (HMM) by caregivers should also be improved through provision of key messages regarding malaria treatment using information, education and communication (IEC) materials. The formal health system in Takwa-Bay should also be strengthened through regular supply of ACT to avert stock outs, provision of doctors and training of health personnel on the treatment guidelines and client friendliness. Ownership and use of long lasting insecticidal nets (LLIN) should also be improved in the area.

Key words: Environmental Survey, malaria, Home Based Care, Takwa Bay, Lagos State.

INTRODUCTION

Malaria, an obstacle to social development and a disease of disability and economic deprivation, remains a major cause of morbidity and mortality in approximately 109 endemic countries of the world [WHO, 2008]. It has been estimated that 85% of cases and 90% of deaths due to malaria occur in the 45 endemic countries of Africa annually [WHO, 2008]. Nigeria accounts for 25% of these cases and experiences approximately 300,000 deaths every year [WHO, 2008; FMOH, 2005]. In the last 5 years, malaria persistence as the cause of 50 – 70% hospital attendance, 15 – 31.3% of hospital admission, 30% childhood deaths, 10% maternal deaths, low birth weight and maternal anaemia has become a cause for concern. The positive impacts provided by artemisinin-based combination therapy (ACT) adopted for use in the treatment of malaria since 2005 have been below expectation as malaria burden statistics remain unchanged at the national level [FMOH, 2005]. Ironically, in a few intervention studies conducted in the country to evaluate efficacy and safety of ACTs, adequate clinical and parasitological responses (ACPRs) ranging from 87 – 97% were reported, suggesting efficacy and reliability of this intervention as a therapeutic malaria control strategy [Sowunmi *et al*, 1996; Meremikwu *et al*, 2006; Agomo *et al*, 2008; Premji *et al*, 2009]. Other interventions that have been documented include prevention of malaria through distribution of insecticide treated nets (ITNs) or long lasting insecticidal nets (LILN) and administration of sulphadoxine-pyrimethamine to pregnant women during antenatal clinics [Asa *et al*, 2008; Musa *et al*, 2009]. However, majority of these interventions have been observed to lack evidence-based strategy between malaria, its perception and between health seeking behavior and health resource utilization [Ajayi *et al*, 2008; Ukwe and Ekwunife, 2008], which is aimed at developing and improving justifiable, efficacious, cost-effective and sustainable malaria control activities, developing epidemiological and behavioral baselines and identifying activity-specific indicators for monitoring and evaluating outcomes and impacts of intervention programmes. Considering the fact that current malaria control initiatives now focus on control instead of eradication, implementation as against campaign with focus on sub-Saharan Africa to reduce malaria vector propagation, vector-malaria contact, infectiousness of human to vector and averting malaria incidence, attacks, *al*, 2001]. Meanwhile, several studies conducted outside Nigeria have attributed deaths due to malaria to poor knowledge of the disease among the caregivers, delay in treatment seeking at health facility, over-reliance on knowledge fraught with misconception of malaria, poor access due to high cost of ACT or transportation to health facilities and cultural beliefs [Onwujekwe *et al*, 2000; information on perception of malaria and health seeking behaviors of populations where they were implemented [Onwujekwu *et al*, 2005]. Their coverage especially to rural areas where malaria incidence and deaths aredisproportionately higher compared to urban areas in the country has also been poor [Lawoyin, 2000; Salako *et* Okeke and Okafor, 2008; Falade *et al*, 2005; Idowu *et al*, 2008]. Consequently, in the last 5 years, an understanding of the knowledge and perception of malaria as well as health seeking behavior of a target population prior to malaria control programme implementation has been identified as a gap bridging death and their associated costs [FMOH, 2005; WHO/RBM, 2005], knowing the socio-economic, socio-demographic and cultural factors that influence perception of malaria and decision to treat, when and where to treat a malarial patients is highly imperative. The environment also plays a role in malaria transmission through its function as a medium for vector breeding and biology dynamics [Mendis *et al*, 2009]. Therefore, anti-malarial interventions that will integrate vector management via environmental manipulation and evaluation of the contribution of water bodies to malaria transmission are currently being sought as they have been predicted as a life saving and cost-effective strategy in malaria endemic areas [Awolola *et al*, 2009]. However, in Nigeria, data capturing the perception of malaria and health seeking behaviors of care givers of children with malaria are sparse and the available limited number of studies are highly heterogeneous in research outcomes and study indicators [Falade et al, 2006; Uzochukwyu et al, 2007; Sambo *et al*, 2004;Onwujekwe et al, 2008; Feyisetan et al, 1997; Akogun and Kamal, 2005; Oreagba et al, 2004].

This study was carried out to document perception of malaria and health seeking behaviors of care givers in Takwa-Bay, a conglomerate of coastal settlements in Lagos, Nigeria. Environmental survey of the study area was also conducted to assess its susceptibility to malaria transmission.

METHODOLOGY

Study Sites

This study was conducted in Takwa-Bay and its environs between March and August, 2009. The area is located on the Atlantic coast in the extreme of south-Western Nigeria. It lies on Long 20 42oE and 3 22°E and latitude 600 22°N. The area is bounded in the North by the Cowrie creek, in the south by the Atlantic Ocean and the West by the Lagos Harbor. The east opens Takwa-Bay to the hinterland reachable by water transportation to the rest of the Islands and mainland in Lagos State. The climate of the study area is equatorial in nature with two distinct periods of rainfall: March – July, which peaked in July and Sept – October. The periods of dry season are January – February, August and November – December. Temperature is highest in March and

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lowest in July. The population of estimated to be about 200,000 with more than 5% of the population being children below five years (Lagos State Bureau of Statistics, unpublished data). The study area is predominated by Yorubas speaking people who migrated from Badagry in Lagos during the slave trade era and Ijebu as a result of communal wars. The island has 4 major settlements: Takwa-Bay, Abagbo, Ebute-Oko and Ogogoro with households that are not well planned in situation and at varying distances to the water bodies in the area. The primary occupations in the area are boat transportation and petty trading. A few numbers of civil servants also live in the area. There are also cool spots for relaxation by picnickers and inhabitants of the area. The area is generally sandy with few vegetation dominated by trees, shrubs and weeds. Although, households with traditional beliefs are seen, Christianity and Islam are the two major religions practiced in Takwa-Bay and its environs. In terms of health care and education, the area is cared for by a health post (Takwa-Bay health post) and two primary schools: one public and the other private are seen in the area. Using key informant interview, malaria was mostly mentioned as one of the health problems in the area and malaria control activities were not in place at the time of this study.

Sample size

The minimum sample size for the study was estimated to be 96. This estmation was obtained by calculation using the formular: $N = Z^2pq / d^2$ on assumption that 50% of the respondents have knowledge about the aetiology and transmission of malaria ($p = 0.5$) at 95% confidence interval ($z = 1.96$) and 10% error of selection ($d = 0.1$).

Study design and Respondents

This is a community-based cross-sectional cross sectional study of caregivers as respondents residing in four settlements in Takwa-Bay. The settlements were Takwa-Bay, Abagbo, Ebutte-Oko and Ogogoro. The respondents were selected by a multistage random sampling method (Mendis *et al*, 2009). Here each settlement is stratified into clusters of 7 households per cluster. Each selection stage is a round of cluster sampling at a rate of one cluster per settlement. On whole four rounds of cluster sampling were conducted to attain the sample size investigated. Questionnaire was developed based on key informant interviews conducted prior to the survey to identify the malaria –specific and survey related questions for the questionnaire. The questionnaire was further standardized by adopting the questionnaire developed by Centre for Disease and Control (CDC, USA) for health seeking behavior for malaria survey in urban malaria endemic areas [Siri *et al*, 2008]. The questionnaire was subsequently pilot tested for feasibility and reliability using trained field staff from the various settlements to administer the questionnaire to 8 randomly selected households (2 per settlement) and assist in content interpretation in local languages (Yoruba, Igbo and Hausa). Thereafter, the questionnaire was modified to be adaptive to local context of Takwa-Bay and its environs. A household is defined as a group of people with a head and sharing the same food and income, while a caregiver refers to a mother or father or guardian who gives healthcare to at least a sick child aged $\leq$ 12 year in a household.

The households excluded from this study were those not inhabited by at least a child or The modified questionnaire administered contained questions aimed at capturing the perception of malaria such as the cause, transmission, treatment of malaria, time to treatment and source of treatment, socio-demographic data such as age, sex, education, and occupation and knowledge about malaria prevention regarding the use of insecticidal nets,vegetation and swamp drainage.

The economic status of the respondents was determined using their wealth index values. The latter was based on the outcome of principal component analysis, which identified ownership of boats, generators and television set as the primary sources of wealth among the respondents. These wealth items were weighted twice than other items owned by the respondent. The calculated wealth index values of the respondents were then ranked into quartiles [Sumba *et al*, 2008]. Environmental survey of the surroundings of clusters from where the respondents were drawn from was also conducted to capture data relating to mosquito breeding and malaria transmission in the study area.

Statistical analysis

Data obtained in this study were double entered into Excel spread sheet and Epi-INFO version 6.0. They were checked for errors and subsequently edited. Data were computed as frequency and proportions for descriptive analysis of parameters. Disparity in proportions were evaluated using appropriate chi-square statistics, mean values were compared by Student's t-test and the influence of socioeconomic status on perception of malaria and treatment practices was evaluated using the odd ratio statistics based on multivariate regression analysis. Probability value less than 0.05 was considered to be significant.

Ethical considerations

This study was approved by Lagos State Primary Health Care Board in collaboration with IRU-V/Island, LCDA. Permission to carry out the study was also sought from the community leaders in Takwa-Bay. The study objectives and methods were also explained to each o the respondents prior to interviews or administration of questionnaire prepared in English and Yoruba, the major local language spoken in the study area.

RESULTS

Settlements, Cluster Selection and Households used for the study

A total of 11 clusters from Takwa-Bay (n =5), Abagbo (n = 3), Ebute-Oko (n = 2) and Ogogoro (n = 1) were sampled to select 47 households from where 112 caregivers selected as respondents were used in this study. These households were inhabited by 171 children below 5 years (Table 1).

Demographic and Socio-Economic characteristics of the caregivers

The total number of respondents interviewed and administered questionnaires was 112. Of these, 52.7% were females ($P>0.05$) with 18.8% working as full housewives. The percentage distribution of respondents working as artisans, traders, civil servants, private workers was 13.4%, 27.7%, 9.8% and 6.3%. The respondents aged between 21-53 years with males older than the females (35.8 ± 9.6 vs. 30.3 ± 6.9; $P < 0.05$).

Table 1. Settlements, Cluster Selection and Households used for the study

Settlements	Clusters selected	No of household sampled	No. of U5s
Takwa-Bay	5	25	107
Abagbo	3	12	31
Ebute-Oko	2	7	19
Ogogoro	1	3	14
Total	11	47	171

Table 2. Demographic and Socio-economic characteristics of the respondents (N = 112)

Characteristics		n(%)	P-value
Sex	Male	53 (47.3)	> 0.05
	Female	59 (52.7)	
Age, years (mean ±SD)			
Male		35.8 ± 9.6	< 0.05
Female		30.3 ± 6.9	
Total		32.9 ± 8.7	
Tribe/Language			
Yoruba		60 (53.5)[a]	
Igbo/Ibo		30 (26.8)	
Hausa		22 (19.7)	
Formal education			
Primary		57 (50.9)	
Secondary		22 (19.6)	
Tertiary		7 (6.3)	
None		26 (23.2)	
Occupation			
Students		13 (11.6)	
Traders		31 (27.7)	
Artisans		15 (13.4)	
Housewives		21 (18.8)	
Civil servants		11 (9.8)	
Private workers		7 (6.3)	
Traditional healers		3 (2.7)	
Clergy		2 (1.8)	
Unemployed		9 (8.0)	
Socio-Economic Status			
1st Quartile		58 (51.8)	
2nd Quartile		41 (36.7)	
3rd Quartile		11 (9.8)	
4th Quartile		2 (1.7)	

The overall mean age of the respondents was 32.9 ± 8.7 years. The respondents (88.5%) were ranked within the 1st and 2nd quartiles of the wealth index suggesting poor to moderately poor socio-economic status (Table 2).

Evaluation of Knowledge and Perception of Malaria among the Respondents

Results summarized in Table 3 indicated that the respondents were aware that malaria is a disease (100%), had good knowledge of malaria aetiology (77.7 – 100%) and classical symptoms of uncomplicated malaria such as fever, malaise, headache and loss of appetite (87.5 - 96.4 %). But knowledge of danger signs seen in severe malaria such as convulsion, coma, jaundice and respiratory distress (28.6 – 57.6%) were significantly low ($P < 0.05$) Although 100% and 77.7% of the respondents knew how mosquitoes and the *Plasmodium sp* relates to malaria, only 6.3% knew that four human species of *Plasmodium* existed. Myths regarding causes of malaria such drinking dirty water, playing in the sun and doing hard labour were mentioned by 48.2%, 75.9% and 35.7% of the respondents. Community members and the health post were mentioned as the major sources of information by the respondents compared to radio, television and traditional medicine practitioners (4.5 – 11.6 vs. 19.6 – vs. 19.6 – 58%; $P <0.05$).

Reasons for and Treatment seeking behaviors of caregivers in the last malarial attacks of their children

On the whole 80 (71.4%) of the 112 respondents employed western medicines, and 32 (20.5%) respondents used traditional medicines. The use of both sources of health was mentioned by 9 (8.0%) respondents (Table 3). Further analyses revealed that 49 (43.87%) of 112 respondents practices self-medication with western medicines that was significantly ($P<0.05$) higher than other sources of health care including self-medication with traditional medicines (8.9%). The observed disparity in the percentages of respondents that patronized allopathic and traditional medicine practitioners alone was not significant (19.6 vs. 11.6%; $P>0.05$) (Table 4). Reasons for self medication given by the respondents included non-availability of doctor at the health post (95.2%), knowledge about malaria treatment (95.3%), delayed treatment at health facility (80.6%), lack of drugs at the health post (75.8%), timely intervention nature of self medication (100%), farther distance of the health post from home (19.2%) and being what

Table 3. Evaluation of Knowledge and Perception of Malaria among the Respondents.

(i) Awareness of malaria and symptoms pronounced by the respondents (N = 112)

Signs and Symptoms	n (%)
Awareness	112(100%)
Uncomplicated malaria	
Fever (Iba)	108 (96.4)
Loss of Appetite	102 (91.1)
Sweating	100 (89.2)
Chill	100 (89.2)
Joint pain	98 (87.5)
Headache	97 (86.7)
Malaise	91 (81.3)
Nausea	87 (77.7)
Sore throat	80 (71.4)
Vomiting	74 (66.1)
Abdominal pain	70 (62.5)
Irritability	70 (62.5)
Diarrhea	63 (56.3)
Complicated malaria	
Jaundice	64 (57.1)
Severe anaemia	49 (43.8)
Convulsion	47 (42)
Coma	35 (31.3)
Fast breathing	32 (28.6)

□2 = 38.2; P < 0.05 (Uncomplicated vs. Complicated malaria)

Table 3 (ii). Causes of malaria mentioned by the respondents (N = 112)

Causes	n (%)
Mosquitoes	112 (100)
Plasmodium sp.	87 (77.7)
Four human malaria parasites exist	7 (6.3)[a]
Drinking dirty water	54 (48.2)
Pool of stagnant water	32 (28.8)
Playing in the sun	85 (75.9)
Doing hard labor	40 (35.7)

[a]P<0.05 (Compared to other causes) □2

Table 3 (iii).Sources of knowledge about malaria mentioned by the respondents

Sources	n (%)
Neighbors in the community	65 (58)[a]
Health facility	22 (19.6)[b]
TMP	13 (11.6)
Radio	7 (6.3)
Newspapers	5 (4.5)

TMP = Traditional Medicine Practitioner; [a]P<0.05 (Neighbors vs. other information sources); [b]P<0.05 (health facility vs. TMP), □2-Mantel Haenzel modification.

others do in the community (81.3%). The 32 respondents who used herbal medicines attributed their reasons to the efficacy of herbs (100%), the availability and affordability of herbs (68.8%), herbs being a cultural heritage (59.4%) that don't cause itching (43.8) and can be obtained freely (31.3%) coupled with the fact that there are fake malaria medicines in circulation (28.1%) (Table 4). The use of western medicine by the respondents (71.4%) was ascribed to easy access to western medicines (61.3%), rapid action of western medicine (65.2%) and lack of knowledge about effective traditional medicines (31.1%) (Table 4). Time taken by the respondents to treat a sick child after detection of fever or malaria are also presented in Table 4. Seventy-three (65.2%) respondents treated their children within 24 h of malaria detection, 28.6% of the respondent administered treatment within 48 h and 6.3% carried out intervention within 72 h (P <.005). Western medicines used were CQ (32.5%), SP (42.5%), artemisinin monotherapy (13.8%) with dihydroartemisinin treatment given and Artemisinin based combination therapy (ACT) with Arthemeter – lumefatrine given (3.8%). Other western medicines used by the respondents were analgesics (75%), antibiotics (46.3%), haematinnics (51.3%) and sedatives (Table 4). The antimalarials were mostly combined with analgesics (%)and the analgesics used include acetaminophen (25%), acetylsalicyclic acid (40%) and ibruprofen (10%). Non-antimalarial combinations of Analgesics-haematinnics and Analgesics-haematinnics-antibiotics were used by 5 -8% of the respondents (Table 4).

Influence of sex, education and age on health seeking behaviors of the respondents

The use of western medicines was associated with having a formal education (OR (95%CI) = 11.6 (3.8-36.4) and younger age (OR (95%CI) = 5.0 (1.5-16.3), while self medication was favorably practiced by the male gender (OR (95%CI) = 5.4 (2.2-13.4) (Table 5).

Medicinal plant usage in the area

The medicinal plants mentioned by the traditional medicine practicing respondents included the leaves of *Vernonia amygdalina, Morinda lucida, Azadirachta indica,*

Table 4. Reasons for and Treatment seeking behaviors of caregivers in the last malarial attacks of their children

(i). Types of Health seeking Behaviors

Health seeking behavior	n (%)
Western medicine self medication	49 (43.8)[a,b]
Procure drugs from a retail shop	31 (29.8)*
Obtain drugs from relatives	17 (14.0)
Western medicine practitioner patronage	22 (19.6)[b]
Seek treatment at the health post	14 (12.5)
Seek treatment from a community nurse	8 (7.1)
Traditional medicine self medication	10 (8.9)
Traditional medicine practitioner patronage	13 (11.6)
Western medicine + Traditional medicine utilization	9 (8.0)

[a]P<0.05 (Western medicine self medication vs. Others); [b]P>0.05 (Western medicine vs. Traditional medicine patronage); *P<0.05 (Retail shop vs. Relatives)
58%; P <0.05).

Table 4 (ii).Reasons for self medication (N =64 of 112 = 57.1%).

Reason	n (%)
Knowledge about malaria treatment	61 (95.3)
Health post is too far from home	19 (29.7)
Non-availability of doctors at the health post	59 (95.2)
High cost of care at the health post	60 (96.8)
Delayed treatment at the health post	50 (80.6)
Lack of drugs at the health post	47 (75.8)
Timely	64 (100)
What others do	52 (81.3)

Table 4 (iii). Reasons for choosing to treat with herbal medicines (n =32 of 112 = 28.6)

Reason	n (%)
Herbal medicine works	32 (100)
Herbal medicine more effective than allopathic medicines	13 (40.6)
Herbal medicine is free	10 (31.3)
Herbal medicine purifies the body	27 (84.4)
Herbal medicines are affordable and readily available	22 (68.8)
Herbal medicine is nature and nature is perfect	21 (65.6)
Herbal medicines are cultural heritage	19 (59.4)
Herbal medicines don't cause itching	14 (43.8)
Health facility sometimes don't have drugs	17 (53.1)
Fake western medicine	9 (28.1)
Poor attitude of health workers	13 (40.6)
Health facility is expensive	28 (87.5)

Table 4(iv). Reasons for choosing to treat with Allopathic medicine (n = 80 of 112 = 71.4%)

Reason	n(%)
Easy access to allopathic medicines	49 (61.3)
Rapid action of allopathic medicines	73 (65.2)
Lack of knowledge about traditional medicine	28 (31.1)

Table 4 (v). Time to treatment of a sick child after diagnosis of fever/malaria by the respondents (N = 112)

Variable	n (%)
Within 24 h	73 (65.2)[a,b]
Within 48 h	32 (28.6)[a]
Within 72 h	7 (6.3)

[a]P<0.05 compared to 72 h; [b]P<0.05 (24 h vs.48 h)

Ocimum gratissium and *Jatropha curcas*. The use of the barks of *Jatrophas curcas* and *Terminalia avicennoides* to treat fever were also mentioned by the respondents. These plants are prepared as water extracts by boiling and infusion and administered orally or for bathing as decoctions or concoctions (Table 6).

Mosquito breeding and bite prevention practices in the area

Mosquito breeding and human contact prevention practices mentioned by the respondents included sleeping under mosquito nets (4.5%), burning of mosquito coil (33.9%), use of insect repellant cream (18.8%), closing of doors (93.8%) and windows (67%) at night, bush burning (17%), covering of pit latrines (100%), spaying of insecticides (9%) and burning of plants to produce smoke to chase mosquitoes at night. Seven (6.3%) respondents mentioned that they do nothing (Table 7)

Environmental assessment of Takwa-Bay and its environs

Some of the households surveyed were environmental found to have water logged surroundings (21 of 47, 44.7%), bushes/bush paths (57.4%), presence of littered water holding containers (42.6%) such as used 'pure water' nylon sachets, damaged utensils and broken bottles. Thirty-three (70.2%) households used latrines and 12 (19.2%) used water closets without a flushing system (P<0.05). The area lacked piped municipal water households were fenced with wooden barriers. Thirty-five

Table 4 (vi). Allopathic medicines used (N = 80 of 112 = 71.4%)

Allopathic medicine	**n (%)**
Non-antimalarials	6 (7.5)
Antimalarials	74 (92.5)
CQ	26 (32.5)
SP	34 (42.5)
Artemisinin monotherapy	11(13.8)
Dihydroartemisinin	3 (3.8)
Artemisinin based combination therapy	3 (3.8)
Arthemether + Lumefantrine	
Artesunate + Amodiaquine	0 (0)
Analgesics	60 (75.0)
Paracetamol	20 (25.0)
Acetylsalicyclic (Alabukun, Phensic)	32 (40.0)
Ibruprofen	8 (10.0)
Haematinnics	41 (51.3)
Folic acid	23 (28.8)
Ferrous-sulphate	31 (38.8)
Vitamin C	32 (40.0)
Antibiotics	37 (46.3)
[1]Tetracycline	8 (10.0)
[1]Ampicillin	14 (17.5)
[1]Amoxicillin	11 (13.8)
[2]Erythromycin	3 (3.8)
[2]Cefuroxime	1 (1.3)
Sedatives	14 (17.5)
[1]Promethazine	12 (15)
[3]Promethazine	2 (2.5)
Drug combinations	
Antimalarials + Antibiotics	6 (7.5)
Antimalarials + Analgesics	24 (25)
Antimalarials + Sedatives	5 (6.3)
Antimalarials + Analgesics + Haemmatinics	12 (10)
Antimalarials + Antibiotics + Haemmatinics	8 (10)
Antimalarials + Antibiotics + Analgesics	4 (5.0)
Antimalarials + Antibiotics + Sedatives	4 (5.0)
Antimalarials + Antibiotics + Analgesiscs + Haemmatinics	10 (37.5)
Antimalarials + Antibiotics + Haemmatinics + Sedatives	1 (1.3)
Analgesics and Haemmatinics	6 (7.5)
Analgesics + Antibiotics + Haematinnics	4 (5.0)

(%) and 70.2% of the households surveyed lacked screened doors and windows respectively, while 68.1% of them were located less than or equal to 400 m of the water bodies (Table 8).

Discussion

The burden of malaria in children under the age of 5 years characterized by poor growth social and mental development, hospitalization and deaths is disproportionately higher in rural areas of many endemic countries including Nigeria, where improvement in perception of malaria, home management of the disease and use of personal protection tools are critical to malaria supply and national grid electricity, 25 (53.2%) households used gasoline generators and 30 (63.8%)control and burden reduction [WHO, 2008; FMOH, 2005; Lawoyin, 2000; Salako *et al*, 2001; Orimadegun *et al*, 2008]. The results of this study provide a snapshot into perception of malaria, health seeking behavior and awareness of malaria prevention by 112 caregivers in 4 settlements on Takwa-Bay Island. All the respondents recognized malaria as a disease and had good perception of the disease by aetiology and symptoms when it is uncomplicated. Our finding that 77.7 – 96.4% of the respondents who mentioned fever, loss of appetite, joint pain, headache, malaise and nausea as symptoms of malaria agrees with recent findings from rural communities in other parts of the country (Okeke and Okafor, 2004; Falade *et al*, 2005; Idowu *et al*, 2008; Feyisetan *et al*, 1997; Akogun and Kamal, 2005; Oreagba *et al*, 2004] and countries such as Ethiopia [Tilaye *et al*, 2007], Burkina faso [Sirima *et al*, 2003] and Uganda [Nuwaha, 2002] where knowledge rates 90.2 – 96.3% were reported. It is also not surprising that females outnumbered males among our respondents because this has been the pattern of health care by caregivers in many African disease endemic areas [Okeke and Okafor, 2008; Oreagba et al, 2004; Tilaye et al, 2007]. However, the improved awareness and perception of malaria found among our respondents is a good development towards the willingness of caregivers to treat a sick child with malaria and could be used as targets for malaria control in Takwa-Bay. The currently observed improvement in the knowledge of malaria as a disease may be a reflection of malaria awareness components of the various malaria programs in sub-Saharan Africa by initiatives such as Roll Back Malaria (RBM) and National Malaria Control Programs (NMCP) [FMOH, 2005; WHO/RBM, 2005]. Until recently knowledge of malaria has been poor in many African countries. Aikins *et al* [1994] found knowledge rates of 25 – 50% among caregivers from some rural communities of Gambia, Guinea Bissau, Sierra-Leone and Senegal. In these surveys, the caregivers were reported to know mosquitoes as a nuisance disturbing their sleep rather than as the cause of malaria. Knowledge rate of 72% was also found among caregivers from a community in

Table 5. Influence of sex, education and age on health seeking behaviors of the respondents

SEX		EDUCATION		AGE		
M	**F**	**A**	**B**	**20 -29**	**30- 39**	**40 and above**
53	59	86	26	49	38	25
Western medicine n (%)						
38 (71.7)	42 (71.1)	72 (90)	8 (10)	39 (79.6)	30 (78.9)	11 (44)
OR (95% CI)	1.03 (0.42-2.54)	11.57 (3.8-36.4)	4.96 (1.54-16.4) *	4.77 (1.33-17.03)**		
P-value	> 0.05	< 0.00001	<0.001	<0.005		
Traditional Medicine n (%)						
15 (28.3)	17 (28.1)	14 (10)	18 (90)	10 (20.4)	8 (21.1)	14 (56)
OR (95% CI)	0.98 (0.4-2.4)	0.09 (0.03-0.26)	0.2 (0.06-0.6)*	0.21 (0.06-0.71)**		
P-value	>0.05	< 0.00001	<0.05	<0.05		
Self medication n (%)						
41 (77.4)	23 (39.0)	47 (54.7)	17 (65.4)	28 (57.1)	20 (52.6)	16 (64)
OR (95% CI)	5.35(2.17-13.4)	0.64 (0.23-1.73)	0.75 (0.25 -2.26)*	0.63 (0.19-1.98)**		
P-value	<0.0001	>0.05	>0.05	>0.05		

A = Formal education defined as learning institution attendance (i.e. primary, secondary and tertiary education); B = Informal education defined as lack of learning institution attendance; OR = Odd Ratio; *OR for 20-29 vs. 40 and above years of age; **OR for 30 -39 vs. 40 and above years of age

Table 6. Herbal medicines mentioned by caregivers used for the treatment of malaria

@**Herbal medicine**	**Family**	**Vernacular name**	**Parts used**	**Administration**
Vernonia amygdalina	Asteraceae	Ewuro	L	O
Morinda lucida	Rubiaceae	Oruwo	L	O
Azadirachta indica	Meliaceae	Dongoyaro	L	O
Mangifera indica	Anacardiaceae	Mangoro	L	O
Jatropha curcas	Euphobiaceae	Botuje pupa	L, B	O
Ocimum gratissimum	Lamiaceae	Efirin	L	O
Citrus sinensis	Rutaceae	Osan	L	O
Momordica foetida	Cucurbitaceae	Ejirin	L	O
Carica papaya	*Caricaceae*	*Ibepe*	L	O, Ba
Terminalia avicennoides	Combretaceae	Idi	B	O
Cymbopogon citratus	*Poaceae*	*Ewe tea*	L	O, B
Petivera alliacea	Phytolaccacea	Awopa	B	O
Alstonia boonei	Apocynaceae	Awun	L	O, Ba

@Prepared as water extract by infusion and marceration and used decoctional or concoctionally. L = Leaf, B = Bark; O = Oral, Ba = Bathing

south/Africa [Govere *et al*, 2000]. Even in Nigeria, Oregba *et al* [2004] found a knowledge rate of 65% among the respondents surveyed in a community in southwestern part of the country. The observed low knowledge rate of malaria was attributed to myths or misconception of malaria upheld by caregivers and some of these misconceptions still persist and overlap with the knowledge of mosquito bites and *Plasmodium* as causes of malaria. In this study drinking dirty water, playing in the sun and doing hard labour were also identified as myths of malaria in Takwa-Bay in agreement with previous studies both in Nigeria [Okeke and Okafor, 2008] and

Table 7. Practices employed by the respondents to prevent mosquito bites

Practice	n (%)
Sleep under mosquito nets	5 (4.5)
Spray insecticides	25 (22.3)
Burn mosquito coil	38 (33.9)
Burn plants to produce smoke to chase mosquitoes	73 (65.3)
Burn bushes	19 (17)
Close doors at night	105 (93.8)
Close windows at night	75 (67)
Apply insecticide repellent cream	21 (18.8)
Do nothing	7 (6.3)
Fill pits and remove used water sachet around the house	100 (89.3)
Cover drinking water	97 (86)
Cover pit latrines	112 (100)

n = Number of respondents

Table 8. Environmental assessment of clusters (47 households) selected in Takwa-Bay and its environs.

Environmental attributes	n (%)
Water logged surrounding	21 (44.7)
Bushes/bush path	27 (57.4)
^Littered water holding containers	20 (42.6)
Availability of Piped municipal water supply	0 (0)
No. well water facilities	29 (61.7)
Bore hole facility	3 (6.4)
Availability of powerline electricity	0 (0)
Use of generators	25 (53.2)
Use of Latrines	33 (70.2)[a]
Use of water closets with flush system	2 (10.6)
Use of water closets without flush systems	12 (19.2)
Number of houses with brick walls	17 (36.2)
Number of houses with wooden barriers	30 (63.8)[b]
Distance to water side (Marina Lagoon/Atlantic Ocean)	
<200 m	14 (29.8)[c]
200 – 400 m	18 (38.3)[c,d]
500 - 700 m	8 (17)
800 – 1000 m	5 (10.6)
> 1000 m	2 (4.3)

^Water holding containers include water nylon sachet, broken bottles and damaged utensils. [a]P<0.05 (Use of latrines vs. water closets); [b]P<0.05 (wooden barriers vs. brick wall); [c]P<0.05 (<200 m vs > 400m); [d]P<0.05 (200 - 400 m vs. other distances), □2

other communities in sub-Saharan Africa [Tilaye et all, 2007; Nuwaha, 2002; Aikins et al, 1994; Govere et al, 2000; Kaliyaperumal and Kumera, 2010; Tumwesigire and Watson, 2002]. In Senegal, stepping on cow's urine was mentioned as a cause of malaria [Aikins et al, 1994]. Therefore, health education aimed at eliminating misconception about malaria is highly needed in these areas. We also found out that the knowledge of danger signs associated with severe malaria was relatively lower among our respondents and this may undermine responses that are critical to death aversion in children with severe malaria in Takwa-Bay. It also means that severity of malaria may not be a determining factor for taking a child to a health facility as practiced in a rural Kenyan community [Nyamongo, 2002]. Therefore, based on this observation, improvement on the recognition of danger signs of malaria through education, information and communication is urgently needed in the study area. In this study, 43.8% of the respondents practiced self medication with drugs procured from retail shops and those obtained from relatives. They also used traditional medicines. These practices occur at home and thus underscore the importance of home management in the treatment of malaria in children in rural areas. Previous studies in other parts of the country have shown that action to treat a sick child is first sought at home and private medicine vendors are well recognized as the primary source of drugs in rural areas due to their accessibility, ability to procure different classes of drugs and persistence of healthcare practices beyond the scope of their license [Salako et al, 2001; Adukwu, 1996; Erhun et al, 2001; Brugha and Zwi, 2002]. In the recent work of Uzochukwu *et al* [2008], 58.1% of caregivers from communities in eastern Nigeria utilized home management of malaria as their first treatment response before making further decisions. Okeke and Okafor [2008] also found 83.7% of caregiver practicing self-medication in another rural community in Nigeria with 19.3%, 52.3% and 8.3% of these respondents using herbal remedies, drugs from drug sellers and medications from drug hawkers respectively. Thus, different treatment options (both formal and informal) exist in rural areas. In this study, traditional medicine practitioners, retail shop drug sellers, relatives and community nurses were identified as the available informal health care providers, while the health post represented formal health system in Takwa-Bay. Private hospital or clinic patronage was not mentioned by the respondents. We sensed that this had to do with non-availability of this type of health system in Takwa-Bay. The use of self-medication by the respondents was attributed to their knowledge and experience of malaria, the ease of treatment, accessibility to and high cost of care the health post, lack of doctors and delayed treatment at the health post and what others do. The latter reason indicates that self-medication is a homogenous behavior in Takwa-Bay and needs to be addressed, while the other reasons corroborate previous findings on health seeking behavior of caregivers in rural communities [Onwujekwe et al, 2005; Salako et al, 2001; Ukwe and Ekwunife, 1997; Oreagba *et al*, 2004; Simba *et al*, 2008; Sirima *et al*, 2003; Nuwaha, 2002]. Inequity in health seeking behavior between the rich and poor and between urban and rural areas has been well documented in Nigeria [Onwujekwe *et al*, 2008; Uzochukwu *et al*, 2008]. In his study, 88.5% of our respondents fall within the 1st and 2nd quartiles of wealth

index ranking, suggesting Takwa-Bay as a poor rural community that is similar to other rural communities surveyed in Nigeria and other African countries, where poverty was found to create pre-conditions for malaria, pave way for its spread and make its control difficult (Onwujekwe et al, 2005; Salako et al, 2001; Ajayi et al, 2008; Deressa *et al*, 2008; Kaatano *et al*, 2006]. Therefore, the observed high use of self-medication with drugs obtained from relatives or from retail shops aside accessibility and convenience of care, might be due to the inability of these caregivers to finance treatments at the health post. The influence of relatives may also be a factor because of the underlying poverty and the perception of treatment at no cost. The use of herbs for treating malaria was also mentioned by our respondents with the perception that herbal medicines work, they are highly efficacious and free, they purify the body and are readily available coupled with the knowledge that herbs are cultural heritage and fake drugs abound in Nigeria. There have been studies in Nigeria in which private medicine sellers were found to receive their drug supplies from both formal and informal sectors with some of these drugs being adulterated [Adukwu, 1996]. The use of medicinal plants by care givers most especially in the rural communities has also been well documented in Nigeria and other endemic countries of Africa [Feyisetan et al, 1997; Akogun and Kamal, 2005; Thera et al, 2000]. In this study up to 28.5% of the respondents used traditional medicine either singly or in combination with western medicines. This utilization rate is lower than 50% found by Aikins *et al* (1994) but higher than 4.5% reported by Okeke and Okafor [2008],4.8% found by Oreagba et al [2004] and 1.0% found by Tumwesigire and Watson [2002] among caregivers in Kabale, Uganda. The disparity in the utilization of traditional medicines by caregivers in rural areas may be due to difference in accessibility to formal health care providers and influence of malaria treatment awareness activities in these areas. We also found poor education and lower age as predisposing factors for herbs utilization in Takwa-Bay. These predisposing factors have also been reported in previous studies (Oreagba et al, 2004; Tilaye *et al*, 2007; Thera *et al*, 2000). Contrastingly, we found age and education attainment among the caregivers as non-determinants of self-medication in Takway-Bay, which was similar to the findings of Kaatano *et al* [2006] in Tanzania, Thera *et al* [2000] in Mali and Abdel-Hammed [2000] in Sudan but contrary to the findings of Uzockuwu *et al* [2008] in southEast Nigeria. The later may be due to urban influence since inequity in health care provider utilization was observed between urban and rural caregivers in the communities studied by these workers. Aside age, cost of care, education and influence of neighbours or relatives, availability of many treatment options in a malaria endemic communities has also been found to enable multiple decisions on treatment responses among caregivers thereby making health care seeking behavior a complex but dynamic events whose understanding is important in the implementation of efficacious and cost-effective malaria control programmes. In this study, we reported six treatment seeking behaviors among caregivers in Takwa-Bay (i.e. Home, healthpost, retail shop, traditional healer, community nurse and relatives). Oregba *et al* (2004) reported 7 treatment sources for another rural community in Nigeria, while in the Phillipines, six treatment sources were also documented by Espino and Manderson [2000]. Nevertheless, our findings not only corroborate these studies but also underscore the weakness of primary health systems in sub-Saharan Africa. Programmes such as Integrated management of Childhood Illness (IMCI), Roll Back Malaria (RBM), National Malaria Control Programme (NMCP) when successfully implemented have been found to be impact driven and accelerate reduction in malaria burden in under-five year-old children in fully compliant health systems [WHO, 2008; FMOH, 2005; WHO/RBM, 2005; Tarimo *et al*, 2000]. A recent study by Ebuehi and Adebayo [2010] revealed that some Primary health Centres in Lagos are not IMCI compliant coupled with equity gap in the distribution of ACT and lack of personnel and infrastructural facility to implement and sustain parasite-based diagnosis of malaria at primary health care level in Nigeria. The demographic profiles of our respondents with majority of them having a socio-economic status of being poor is an indication that community may not benefit from the user fee-oriented Bamako initiatives in which clients pay for drugs, diagnosis and other care following presentation of a sick child to a health facility [Hussei and Mujinja, 1997] unless accessibility is improved through drug subsidy in the formal health sector especially in rural areas. At the time os this study, artemisin-based combination therapies (ACT) with arthemether-lumefantrine (AL) and artesunate-amodiaquine (AA) as first- and second line therapies for malaria treatment in Nigeria [FMOH, 2005]. In the present study, only 3.8% of the caregivers used ACT to treat their children with malaria. Artemisinin monotherapy was used by 13.8% of the caregivers, chloroquine by 32.5% and sulphadoxine-pyrimethamine by 42.5% are not in agreement with the current national malaria treatment policy thus implying non-compliance with the policy and bad treatment practices by these caregivers. This is in spite of the fact that 65.2% of the caregivers took actions to treat their sick children within 24 h, 28.6% within 48 h and 6.3% within 72h. These response patterns can be said to be better than previous studies in Nigeria [Oreagba *et al*, 2004; Uzochukwu *et al*, 2008]. Furthermore, the fact that most of these drugs were obtained outside the formal healthcare system in Takwa-Bay is a cause for concern because of the numerous treats that it presents. They include provision of selection pressure for the development, spread and sustenance of multidrug resistant *Plasmodium falciparum* strains in the area and the decrease propensity of care

giver to receive key health education messages, information and communication on ACT as nationally recommended antimalarial combination drugs and appropriate dosages to be administered by age for their sick children . These challenges have the potentials to impact malaria control programmes in Takwa-Bay negatively. Elsewhere in the country, pre-hospital use chloroquine by 54.2% of care givers was reported [Orimadegun *et al*, 2008]. Although the scope of the present study did not capture of doses given, several studies have shown that more than 40% of caregivers still treat wrongly with chloroquine to further promote the resistance problem associated with drug and that has led to its withdrawal as an antimalarial drug in the country [FMOH, 2005; Sowunmi et al, 1996]. A further concern is the clinical outcome associated with the pre-hospital use of chloroquine, which, has been found to increase the risk of cerebral malaria by 1.83 and mortality by 4.0 [Orimadegun *et al*, 2008]. Factors implicated for persistent use of chloroquine even in the present era of ACTs adoption as first line therapies in over 90% of the endemic countries include non-availability of ACTs in public health facilities, poor compliance of health workers to national treatment policies, high cost of ACTs and cheapness/high stock rate chloroquine in the private health sector predominated by drug stores in the rural areas [Ajayi *et al*, 2008; Adukwu, 1996]. Therefore, there is a need to address this practice gap not only in Takwa-Bay but in Nigeria as a whole.

With regards to medication with traditional medicines, we documented 11 species of medicinal plants prepared as water extracts and administered as decoctions or concoctions orally or for bathing in the course of treating malaria/fever. Plants such as *Vernonia amygdalina, Morinda lucida* and *Azadiraxchta indica* are highly synonymous with malaria treatment in folk medicine [Awe and Makinde, 1998; Bosa *et al*, 2000]. These plants have scientifically been found to elicit antiplasmodial activity in rodents infected with *Plasmodium berghei* and *Plasmodium yoelli.* They have also been found to suppress parasitaemia heterogeneously coupled with their ability revert parasite-induced inflammatory response by the host [Thoh *et al*, 2010]. *Vernonia amygdalina* in particular has been found to function effectively as a chemosynthesizer thereby restoring chloroquine efficacy in previously resistant cases using a *Plasmodium berghei* mouse model [Iwalokun, 2008]. Despite these, no lead compounds produced from these plants have reached appreciable clinical stage for use in humans and concerns regarding dosing, safety and standardization have consistently been raised in their use as Complimentary alternative Medicines (CAM) [WHO, 2002].

Data obtained from the environmental surveillance of Takwa-Bay showed that the area lacked pipe borne water, an organized house structure, powerline electricity supply with less than 50% using gasoline-powered generators. Night illumination of the area is also poor as more than 80% of the reported the use of candle and lantern at night. These observed environmental conditions in Takwa-Bay have been reported to enhance egg laying activity of mosquitoes [WHO/RBM, 2005; Mendis *et al*, 2009], while the observed preponderance of water holding waste materials such as 'pure water' nylon sachet, broken bottles, damaged utensils and coconut shells in the study area further indicate availability of favorable conditions for the breeding of female Anopheles mosquitoes thereby increasing the risk of malaria transmission and higher incidence/prevalence of falciparum malaria in Takwa-Bay. Our study also found the habitation structure of Takwa-Bay to be characterized by 44.7 % of the households having water logged surroundings, 57.4% having bush paths and 70.2 – 74.4% of them lacking screened doors and windows coupled with the fact that majority of the households were located less than or equal to 400 m to the water bodies. These findings indicate inadequate barriers to human-mosquito contacts in the study area. Although the scope of the this study excludes malaria prevalence determination, over 90% of our respondents recognized malaria as a health problem and of great concern to them with respect of their young children in Takwa-Bay. Mosquito breeding and vector-human contact prevention activities mentioned by the respondents are good but there are indications that derivable positive impact may be thwarted by the habitation structure of Takwa-Bay. The presence of only one functional health facility, which offer primary health services during the day further reveal in inability of the formal health system to meet the care needs of malaria patients during emergencies and at night.

Based on our findings, we conclude that Takwa-Bay is a malaria prone and poor rural area that is currently characterized by poor home management of the disease despite good awareness of malaria among the caregivers. Therefore, there is a need to improved on perception of malaria and bridge the existing gap between knowledge and health seeking behaviour through provision of health education with emphasis on danger signs of malaria, training of health care providers in the area with emphasis on the procurement and sales of ACTs as nationally approved therapies for malaria in Nigeria. Home management of malaria (HMM) by caregivers should also be improved through provision of key messages regarding malaria treatment using information, education and communication (IEC) materials. The formal health system in Takwa-Bay should also be strengthened through regular supply of ACT to avert stock outs, provision of doctors and training of health personnel on the treatment guidelines and client friendliness. Ownership and use of long lasting insecticidal nets (LLIN) should also be improved in the

area.

Competing Interests

We hereby declare that there were no competing interests regarding this work.

Authors contributions

IBA was responsible for study design and manuscript preparation. APU was also involved in study design and coordination. ISO and AV were involved in key informant rectruitment and training, the supervision of questionnaire administered and data analysis, EKN and AMO were involved in the initial manuscript draft and key informants' interviews. Other authors were involved in site activity and questionnaire design.

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