Prevention, Management and Cost Implications of Malaria in Niger Delta, Southern Nigeria

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Abstract

Background: An estimated 97.0% of Nigeria's population is reported to be at risk of malaria with about 100 million cases and over 300,000 deaths per year. The study evaluated malaria preventive strategies, its treatment as well as cost implications.

Methods: The descriptive cross sectional study was conducted in Yenagoa and Amassoma which are the two most populous towns in Bayelsa State, south-south Nigeria. A self-developed and validated questionnaire on malaria, preventive strategies, and treatment among others was administered to Five hundred and Seventy Four respondents. Information collected and analysed from the questionnaire include occurrence of malaria attack, method of diagnosis, malaria treatment modes, types of medications used, duration of treatment, forms of malaria prevention and cost implications of medication/therapy.

Results: There is high prevalence of malaria among the populace and poor attitude towards prevention in about 40.0% of the respondents. Less than 40.0% of the 123 pregnant subjects had intermittent preventive therapy for malaria using sulphadoxine-pyrimethamine tablet as recommended by World Health Organization for Africa. There was irrational drug therapy in 79.6% of the subjects with wide use of mono-therapy and the use of arthemeter/lumefantrine in only 123 (21.4%). Most of the respondents reported direct out of pocket payment for the recommended anti-malaria remedies. An average of NGN438.75±133.17 (USD2.74±0.83) was spent per subject on antimalarial drugs while the mean treatment cost per patient which represents the total amount claimed to have been spent by respondents for drugs, and consultations in some cases was NGN566.56

(USD3.54). The national cost implication is in excess of about NGN50 billion (USD312 million) for antimalarial drug alone even with wide use of sub optimal mono-therapy.

Conclusion: Prevalence of malaria is very high in the locality and modes of prevention and treatment are suboptimal. Also, Intermittent Preventive Treatment culture among the pregnant women is not encouraging hence, the need to create awareness geared towards improving health seeking behaviours among this special population. The cost implications of malaria therapy are huge and concerted efforts from stakeholders are necessary to reduce incidences thereby minimizing the cost.

Keywords: malaria; medical expenditure; cost of illness, cost of therapy

Introduction

It has been estimated that between 300 to 500 million malaria cases occur each year worldwide with more than One million resulting in death[1,2]. The condition is most prevalent in Africa, followed by several countries in Latin America and Asia respectively[2]. Sub-Saharan Africa has been reported to be home to over 90% of the world's malaria-related deaths[3].

Available records also showed that half of Nigerian population suffer from at least an episode of malaria infection each year accounting for over 45.0% of all out-patients visits[4]. An estimated 97.0% of Nigeria's population is reported to be at risk of malaria with about 100 million cases and over 300,000 deaths per year[5]. It has also been reported as the most common illness for five consecutive

years in some Niger Delta communities; accounting for 63.83% – 67.10% of the illnesses compared and usually peak around the month of April[6].

The goals of malaria prevention and control are to reduce morbidity, prevent mortality and minimize socio-economic loss[7]. Measures to achieve these include but not limited to; provision of mosquito insecticide treated nets (ITN) and insect repellents, spraying of insecticide inside houses and draining of standing or stagnant water where mosquitoes lay their eggs[2,8]. Strengthening of local capacities for basic and applied research has also been recommended[7]. Malaria remains a devastating global problem[8] particularly in Africa requiring early diagnosis and prompt treatment to achieve favourable prognosis,[9,10] absence of which may lead to complications and death[8]. The generally recommended antimalarial medications are the artemisinin based combination therapy (ACT)[1,11]. However, amodiaquine, sulphadoxine-pyrimethamine or quinine among others can be administered in appropriate combination if indicated[10].

Proper prevention and treatment of at risk groups such as pregnant mothers, children and patients with sickle cell anaemia are particularly important. This underscore why the World Health Organization (WHO) has recommended intermittent preventive treatment (IPT) by using sulphadoxine/pyrimethamine (SP) in pregnant women at predefined intervals as part of their antenatal care[12, 13,14].

One of the major obstacles to proper and sustainable management of malaria among other diseases particularly in developing countries is sub-optimal availability of funds in spite of support and overwhelming commitment of the International Community. These include the World Bank, UK Department for International Development (DFID), the Global Fund and USAID/US President Malaria Initiatives among other stakeholders[5]. The available funding is still far below the resources required to reach universal coverage of interventions for

malaria. An estimated US$5.1 billion is needed every year for this purpose[10]. In 2012, the global total of international and domestic funding for malaria was US$2.5 billion – less than half of what is needed[10]. Reliable and evidence-based local and national data in most developing countries, which are needed for accurate cost estimation are lacking, inadequate or outdated. The objective of this study was therefore to evaluate malaria preventive strategies, its management among the dwellers of the locality as well as its cost implications.

Methods

The descriptive cross sectional study was conducted in Yenagoa and Amassoma which are the two most populous towns in Bayelsa State, south-south Nigeria, a core State in Niger Delta region. The state is geographically located within latitude 4Â°15′ North and latitude 5Â°23′ south. It is also within longitudes 5Â°22′ West and 6Â°45′ East. The state is bounded by Delta State on the north, Rivers State on the east and the Atlantic Ocean on the western and southern parts. Mangrove swamps are very extensive and rainfall is excessive which provide favourable conditions for breeding of mosquito and all year round malaria transmission.

A self-developed and validated questionnaire was administered to Five hundred and Seventy Four respondents comprising of adults and children care-givers after seeking and obtaining their consent and approval of the hospital management at General Hospital, Amassoma and the Federal Medical Centre, Yenagoa. Also included in the survey were other systematically randomised consented adults resident in Amassoma and Yenagoa by interviewing one household and skip the other. The questionnaire was interviewer administered to those who were not literate enough to fill it by themselves; proper interpretation of English language to either Ijaw language or Pidgin English was done to

facilitate understanding of questions by respondents where necessary since some of the respondents do not speak English language fluently.

Information requested in the questionnaire include occurrence of malaria attack, method of diagnosis, malaria treatment modes, types of medications used, duration of treatment, forms of malaria prevention and cost implications of medication/therapy. Statistical package for Social Sciences (SPSS) version 20, Microsoft Excel and GraphPad Prism for windows Instat Version 3 (GraphPad Software, San Diego, CA, USA) were used for analysis of data. A p value of 0.05 at two-tailed test was considered significant.

Results

Socio-demographic characteristics

Majority of the respondents 367(63.6%) were females, out of which 123 (21.4%) were pregnant. The most represented of the age groups was 21-30 years (212; 36.9%), while 73 (12.7%) of them were children aged 0 - 5 years. (Table 1)

Table 1: Demographics of respondents

Variables	Amassoma N (%)	Yenagoa N (%)	Total N (%)	p-value
Age group (year)				
0-5	31(5.4)	42 (7.3)	73(12.7)	0.0840
6-10	8(1.4)	12(2.1)	20(3.5)	
11-20	20(3.5)	48(8.4)	68(11.8)	
21-30	108(18.8)	104(18.1)	212(36.9)	
31-40	74(12.9)	77(13.4)	151(26.3)	
41-50	8(1.4)	17(3.0)	25(4.4)	
51-60	7(1.2)	11 (1.9)	18 (3.1)	
>60	4(0.7)	3 (0.5)	7 (1.2)	
Total	260(45.3)	314 842(54.7)	574 (100.0)	
Gender				
Female	157(27.4)	210(36.6)	367(63.6)	0.1163
Male	103(17.9)	104(18.1)	207 (36.1)	
Total	260(45.3)	314(54.7)	574(100.0)	
Occupation				
Student	128(22.3)	121(21.1)	249(43.4)	0.0001
Civil servant	39(6.8)	105(18.3)	144 (25.1)	
Trader	69(12.0)	55(9.6)	124(21.6)	
Others	24(4.2)	33(5.7)	57(9.9)	
	260(45.3)	314(54.7)	574(100.0)	
Level of Education				

None	2(0.3)	2(0.3)	4(0.7)	0.8059
Primary	19(3.3)	17(3.0)	36 (6.3)	
Secondary	68(11.8)	87(15.2)	155(27.0)	
Tertiary	171(29.8)	208 (36.2)	379 (66.0)	
	260(45.3)	314(54.7)	574(100.0)	

Prevalence and prevention

More than 60.0% of respondents used one form of prevention or another, however, about 39.0% claimed not to have used any form of prevention. Less than 40.0% of the 123 pregnant subjects had intermittent preventive therapy for malaria using sulphadoxine-pyrimethamine tablet as recommended by World Health Orgnization (WHO)[10]. Meanwhile, all the respondents are at risk of malaria based on the fact that factors which support breeding of mosquitoes, the carrier of malaria parasites are rampant in the environment. In addition, 96.3% of them correctly associated malarial transmission with mosquito bite. (Table 2)

Table 2: Modes of prevention and presence of mosquito breeding site near residence

	Amassoma N (%)	**Yenagoa N (%)**	**Total N (%)**	**p-value**
Prevention method**				
Insecticide spray	47 (8.2)	69 (12.0)	116(20.2)	0.6658
Mosquito coil	13 (2.2)	14 (2.4)	27 (4.7)	
Mosquito repellent	7 (1.2)	11 (1.9)	18 (3.1)	
Insecticide solution (sniper)	39 (6.8)	43 (7.5)	82 (14.3)	
Drug (IPT in pregnancy; n=126)*	21 (3.7)	29 (5.1)	50 (8.7)	
Window/door nets	17 (3.0)	20 (3.5)	37 (6.4)	
Ordinary bed net	11 (1.9)	9 (1.6)	20 (3.4)	
Insecticide treated net	37 (6.4)	54 (9.4)	91 (15.9)	
Others	0 (0.0)	5 (0.9)	5 (0.9)	
None	98 (17.1)	126 (22.0)	224 (39.0)	
Mosquito breeding				

site				
Marsh land	25 (4.4)	36 (6.2)	61 (10.6)	0.3600.
Retained Surface water	22 (3.8)	30 (5.2)	52 (9.1)	
Shaded/Un-shaded ponds	16 (2.8)	29 (5.1)	45 (7.8)	
Poor drainage	43 (7.5)	45 (7.8)	88 (15.3)	
Dirty environment	39 (6.8)	37 (6.4)	76 (13.2)	
Un-cleared bush	37 (6.4)	32 (5.6)	69 (12.0)	
Multiple factors	78 (13.6)	107 (18.6)	183 (31.9)	
Total	260 (45.3)	314 (54.7)	574 (100.0)	

*IPT= Intermittent preventive therapy ** Some respondents used more than one methods

Two-thirds of respondents suffered from malaria within the previous six months while the entire subjects had malaria attack within the previous one year. The prevalence was higher in Yenagoa, the state capital compared to Amassoma with malaria incidences of 137(23.8%) and 105(18.3%) of the total respondents respectively within the preceding four weeks. The proportion of the respondents that had malaria attack once was 36.6% in the last six months while another 35% had malaria attacks at frequencies ranging from twice to more than thrice within the same period. (Table 3)

Table 3: Incidence and Frequency of malaria

Variables	**Amassoma N (%)**	**Yenagoa N (%)**	**Total N (%)**	**p-value**
Malaria Incidence				
0-4 weeks	105(18.3)	137 (23.8)	242 (42.2)	0.3537
1 month-< 6 months	57 (9.9)	54 (9.4)	111 (19.3)	
6 months-1 year	98 (17.1)	123 (21.4)	221(30.5)	
	260 (45.3)	314 (54.7)	574 (100.0)	
Frequency of malaria in the last 6 months				

Once	99 (17.2)	111 (19.3)	210 (36.6)	0.0001
Twice	26 (4.5)	77 (13.4)	103 (17.9)	
Thrice	17 (3.0)	26 (4.5)	43 (7.5)	
>Three time	35 (6.1)	26 (4.5)	61 (10.6)	
Not at all	83 (14.5)	74 (12.9)	157 (27.4)	
	260 (45.3)	314 (54.7)	574 (100.0)	

*IPT, required in the pregnant women (n = 123), 47 (38.21%).

Management

Appreciable number of the respondents (223; 38.5%) claimed to have self-diagnosed their malaria using signs and symptoms such as feverish conditions and headache. while others had visited hospitals, health centres, and pharmacies/drug stores. Orthodox method of treatment was the main strategy employed by majority of the subjects (515; 89.7%). However, some of the subjects still patronized traditional medical practitioners either as a sole strategy or in combination with orthodox method. There was irrational drug therapy in 79.6% of the respondents due to non-conformity with the current treatment guidelines. The medications utilized in the treatment of malaria by the respondents were either prescribed as mono-therapies or fixed combination therapies. These include artemether/lumefantrin; 123(21.4), sulphadoxine/pyrimethamine; 92(16.0), artesunate; 87(15.2), and chloroquine; 103(17.9). Others were camoquine, quinine as well as halofantrine.. (Table 4)

Table 4: Treatment of Malaria

Variable	**Amassoma N (%)**	**Yenagoa N (%)**	**Total N (%)**	**p-value**
Treatment method				
Orthodox	232 (40.4)	283 (49.3)	515 (89.7)	0.9136
Traditional	18 (7.0)	19 (3.3)	37 (6.4)	

Both	10 (1.7)	12(2.1)	22 (3.8)	
	260 (45.3)	314 (54.7)	574 (100.0)	
Diagnosis Centre				
At home/Personal observation	122 (21.3)	101(17.6)	223(38.5)	0.0021
Hospital	94 (16.4)	131(22.8)	225 (39.2)	
Health Centre	23 (4.0)	31 (5.4)	54 (9.4)	
Pharmacy/Drug Stores	18 (3.1)	44 (7.7)	62 (10.8)	
Others	3 (0.5)	7 (1.2)	10 (1.7)	
	260 (45.3)	314 (54.7)	574 (100.0)	
Antimalarial regimen				
Artemeter/Lumenfantrine	66 (11.5)	57 (9.9)	123 (21.4)	0.4641
Sulphadoxine/Pyrimethamine	41(7.1)	51 (8.9)	92(16.0)	
Artesunate	35 (6.1)	52 (9.1)	87 (15.2)	
Chloroquine	49 (8.5)	54 (9.4)	103 (17.9)	
Camoquine	4 (0.7)	11(1.9)	15 (2.6)	
Quinine	5 (0.9)	6 (1.0)	11(1.9)	
Halofantrine	5 (0.9)	9 (1.6)	14 (2.4)	
Others	38 (6.6)	53 (9.2)	91(15.9)	
Can’t remember	17 (3.0)	21 (3.7)	38 (6.6)	
	260 (45.3)	314 (54.7)	574 (100.0)	

Cost implications

Most of the respondents reported direct out of pocket payment for the recommended anti-malaria remedies. Mono-therapies were very rampant which were not consistent with latest standard treatment guidelines as only 123 (21.4%) respondents had arthemeter/lumefantrine. Mean cost of anti-malarial drug range from NGN133.33±57.73 (USD0.83±0.36) for chloroquine to NGN933.33±301.39 (USD5.83±1.88) for a particular brand of arthemeter-lumefantrine in Amassoma and NGN133.33±57.73 (USD0.83±0.36) to NGN741.66_±208.37 (USD4.64±1.30) in Yenagoa. Total cost of antimalarial drug for the 574 subjects was NGN 251,844.30±76443.40 (USD1574.03±477.78) giving an average of NGN438.75±133.17 (USD2.74±0.83) per subject. The mean treatment cost per patient which represents the total amount claimed to have been spent by respondents for drugs, and consultations in some cases was NGN566.56 (USD3.54). More than one-third of the respondents (222; 38.7%) spent between NGN50 (USD0.31) to NGN200 (USD1.25) which is consistent with the utilization of monotherapy such as sulphadoxine/pyrimethamine and chloroquine as well as self-diagnosis in 223 (38.9%) of the respondents. Another

206 (36.0%) spent between NGN201.00 (USD1.26) and NGN500.00 (USD3.13) while 38 (6.6%) spent between NGN2000.00 (USD12.50) and NGN5000.00 (USD31.25) for their malaria treatment. Five subjects (0.9%) were enrolee of National Health Insurance Scheme and another Four (0.7) subjects received free services (Table 5).

Table 5: Cost of Antimalaria Drugs

Variable	Amassoma			Yenagoa			Total Cost
Drug	Mean Cost ±SD (NGN(USD)	No of Subject N(%)	Sub Total Cost (NGN) (USD)	Mean Cost ±SD (NGN) (USD)	No of Subject N(%)	Sub-Total Cost (NGN) (USD)	(NGN) (USD)
ART/LUM	933.33±301.39 (5.83±1.88)	66 (11.5)	61599.78±9891.74 (385.00±61.82)	741. 66 ±208.37 (4.64±1.30)	57 (9.9)	42,279.18±11877.09 (264.25±74.23)	103879.00 ±31768.83 (649.24±198.55)
SP	190.00±22.36 (1.19±0.14)	41(7.1)	7790.00±916.76 (48.69±5.73)	180.00 ±27.38 (1.125±0.17)	51 (8.9)	9180.00±1396.38 (57.38±8.73)	16970. ±2313.14 (106.06±14.46)
ARTS	387.5±25.0 (2.42±0.16)	35 (6.1)	13562.50 ±875 (84.77±5.47)	362.5 ±47.87 (2.26±0.30)	52 (9.1)	18850.00 ±2489.24 (117.81±15.56)	32412.3 ±3364.24 (202.58±21.02)
CHL	133.33±57.73 (0.83±0.36	49 (8.5)	6533.17±2828.77 (40.83±17.68)	133.57 ±57.73 (0.83±0.36)	54 (9.4)	7199.82 ±3117.42 (45.00±19.48)	13732.99±5946.19 (85.83±37.16)
Others	600.00±250.00 (3.75±1.56)	69(12.0))	41400.00 ±17250.00 (258.75±107.81)	550.00 ±200.00 (3.44±1.25)	79 (13.7)	43450.00 ±15800.00 (271.56±98.75)	84850.00±33050.00 (530.31±206.56)
OMC	503.41±122.16 (3.15±0.76)	260 (45.3)	130885.50±31762.27 (818.03±198.51)	385.22±110 (2.41±0.69)	314 (54.7)	120,959.00±34680.13 (756.00 ±216.75)	251844.30±76443.4 (1574.03±477.78)

ART/LUM =Artemeter/Lumenfantrine, SP= Sulphadoxine/Pyrimethamine, ARTS= Artesunate, CHL= Chloroquine, OMC=Overall mean cost

National Cost implications

With an estimated 100 million malaria reported cases per year in Nigeria[5] and a mean antimalarial cost of NGN438.75±133.17 (USD2.74±0.83) per subject, the

national cost implication is in the range of 43,875,000,000.00 (about NGN44 billion) (USD274,218,750.00) (uncertainty range: NGN 30,558,000 000.00 (NGN30.56 billion) to NGN57,192,000,000.00(NGN57.2billion) (USD190, 987,500.00 to USD357,450,000.00).

The mean treatment cost per patient which represents the total amount claimed to have been spent by respondents for drugs, and consultations in some cases was NGN566.56 (N=560) which is about NGN56,600, 000, 000.00 (USD350,000,000) for 100 million cases.

Discussion

High degree of malaria prevalence among the populace, lack of malaria prevention strategies in about 40.0% of the respondents, non-usage of intermittent preventive therapy (IPT) in about 60.0% of pregnant mothers as well as rampant self-management in the diagnosis and irrational application of mono-therapy in malaria treatment observed in this study are of serious concern. In addition, an estimated annual national cost implication in excess of about NGN50 billion (USD312 million) for antimalarial drug alone is huge and mind bugging which is believed to be underestimated due to widely used of seemingly ‘cheap’ but deceptive mono-therapy employed. The indirect cost that could be attributed to the estimated 300,000 annual death cases and morbidity resulting from malaria is also huge and in the range of about NGN100 billion (USD624 million). The observation in this study underscores the reasons for persistent endemic nature of malaria in Nigeria in spite of the fact that it is preventable and curable[10,15,16]. Similar observations have been reported for other regions in sub-Saharan Africa[17] where more than ninety per cent of the total malaria incidence and mortality occurs[1,3]. Proper attention is needed to reduce the frequency of

malarial attacks, its attendant complications which in turn would reduce the overall cost of control and management.

Interventions as applicable such as educational to salvage the poor attitude to prevention need to be improved upon. Observations similar to this have also been previously reported[12, 18]. Measures to achieve improvement such as enhanced provision of mosquito insecticide treated nets (ITN) and insect repellents, spraying of insecticide inside houses and draining of standing or stagnant water where mosquitoes lay their eggs[2,5] should be strengthened by government and other stake holders at the community levels. Public enlightenment through advocacy, credible traditional leadership, town hall meetings among others which are face to face and where participants can clarify their misconceptions would be much more effective than radio jingles and the likes. Appropriate information, education and communication strategies to convince pregnant mothers to register early for antenatal clinic cannot be over emphasized in order not to miss the IPT as recommended by WHO (2013)[10]. The spouse of the pregnant women should be carried along as well for supportive roles. Folic acid at a daily dose equal or above 5mg should not be given together with SP as this counteracts its efficacy as an antimalarial[19, 20]. WHO recommends the administration of folic acid at a low dose of 0.4mg daily as this dose may be safely used in conjunction with SP[19,20]. The use of folic acid supplementation to pregnant women is to prevent neural tube defects in their infants[13] in addition to boosting blood formation thereby preventing anaemia.

Irrational management of malaria among most of the respondents who managed it from direct out of pocket payment, predominantly with mono-therapy using sulphadoxine/pyrimethamine and long outdated chloroquine following unreliable self-diagnosis is a big problem. This observation is very similar to previous

reports[5,21]. Only 123 (21.4%) respondents had arthemeter/lumefantrine which is consistent with the latest standard treatment guidelines. Insignificant proportion of subjects was enrolee of National Health Insurance Scheme which needs to be encouraged and advocated. Some patients often employ less-effective combinations[22] or even visit herbalists[21]. A report indicated the prevalence of significantly higher Plasmodium parasitaemia in patients who self-administered herbal therapy than in those who did with conventional antimalarial at the recommended dosages prior to hospital visits in Nigeria[21]. The fact that a number of antimalarial medications are marketed as over the counter drugs in Nigeria does not remove the fact that anybody who is allowed by law to sell the drugs should have requisite knowledge and skills to recommend and dispense them appropriately. Improved training and enforcement could also help in this regard. Sub-optimal therapeutic dosing might be one of the reasons why chloroquine became less effective in malaria treatment. This was further demonstrated recently with a significantly higher prevalence of Plasmodium parasitaemia obtained in subjects who self-administered chloroquine therapy compared to those who did with other drugs prior to hospital visits in south-south Nigeria[19]. Similarly, some healthcare professionals in Nigeria have started administering sub-optimal dosage regimen of arthemeter injection usually as a stat dose from personal observation. Every stake holder particularly government and professional bodies should ensure optimum adherence to evidence based treatment guidelines. Timely interventions are mandatory to minimize resistance development by microbes in response to selective pressures in form of drugs and other adversities which is partly inevitable from genetic and evolutionary point of view but could largely be retarded with prudent antimicrobial usage.

The huge national cost of anti-malaria drug in the face of dwindling national resources and nose-diving nature of citizens purchasing power make the

situation more pathetic and should reinforce our collective commitment to embrace preventive modalities and rational decisions for a healthier community and nation at large. Holistic appraisal and thorough evaluation of strategies and modalities put in place as well as attainment of their respective goals are imperative. These include Global Malaria Control Strategy, Roll Back Malaria Partnership programmes[1,8] among others. The essence of these strategies to prevent new cases of infections, control the spread of the disease and provide prompt and effective treatments when needed is a far cry from desirable standard.

The endemic nature of malaria year round, it's devastating direct impact of residing in red blood cell thereby reducing the body's oxygen carrying capacity as well as the difficulty in eradicating the vector in conducive tropical setting and resultants complications make it very expensive to control and manage. Support from international community is overwhelming[5] but corruptible practices have largely affected the efficiency of national commitment and management of the various programmes design to solve these perpetual problems. More funds are required from the various stakeholders but cost effective and prudent utilization of available funds should be ensured.

Areas where improved capacities need to be built include provision of the training and affordable or subsidized right diagnostic kit for responsible and correct diagnoses of malaria at point of care and at individual patient levels[23,24,25,26]. The populace should also be reliably sensitized as to the symptoms to watch out for and benefits of prompt visitation to the clinic since malaria self-diagnostic kits are not readily available in this vicinity. They should equally be educated about its usage when the self-diagnostic kit is eventually available. Once diagnosis is accurate, needless expenditure of treating every fever cases as malaria would be tremendously reduced which in turn would

reduce the overall treatment cost implications. Rapid diagnostic tests (RDTs) of malaria have also been demonstrated through modelling to be more cost effective compared to presumptive treatment up to high prevalence of Plasmodium falciparum parasitaemia in Sub-Sahara Africa[27]. In addition, health seeking behaviour is not encouraging partly because of poverty hence, appreciable number of respondents preferred to diagnose the condition at home as noted in this study or visit herbalist.

Limitations and some weaknesses of the study include the use of just two out of the eight local government areas in the state studied thereby limiting the scope of generalization of outcomes of the study. However, the observations in the two most populous towns in the state may be similar to realities in other localities in the metropolis due to the swampy rain forest nature of the entire Niger Delta vegetation profile which facilitates breeding of mosquito: malaria vector, the control of which must be accomplished for malaria parasite to be eradicated. Another weakness is the relatively small sample size partly due to limited resources and difficult terrain in most parts of the state.

Conclusion

The study revealed that prevalence of malaria is high in this locality and that modes of prevention and treatment are suboptimal. Also, IPT culture among the pregnant women is not encouraging hence, the need to create awareness geared towards improving health seeking behaviours among this special population. The cost implications of malaria therapy are huge and concerted efforts from stakeholders are necessary to reduce incidences thereby minimizing the cost.

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