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Emmanue l Nnamonu
Department of Biology,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

Obiageli C Ejilibe
Department of Biology,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

John I Ezeude
Department of French,
Federal College of Education,
Aha-Amufu, Enugu State,
Nigeria

Martha U Okeke
Department of Music,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

Mercy O Nnamani
Department of General Studies,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

Bonaventure C Nnamani
Department of Biology,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

Ogonna C Ani
Department of Applied Biology,
Ebonyi State University,
Abakaliki, Ebonyi State Nigeria

Pamela A Ndukwe-Ani
Department of Economics,
Ebonyi State University,
Abakaliki, Ebonyi State Nigeria

Correspondence
Emmanue l Nnamonu
Department of Biology,
Federal College of Education,
Eha-Amufu, Enugu State,
Nigeria

Evaluation of predisposing factors, burden and management of malaria among agrarian settlers, South East Nigeria

Emmanue l Nnamonu, Obiageli C Ejilibe, John I Ezeude, Martha U Okeke, Mercy O Nnamani, Bonaventure C Nnamani, Ogonna C Ani and Pamela A Ndukwe-Ani

Abstract
The present study was designed to evaluate predisposing factors, burden and management practices of malaria in an agrarian settlement, south east Nigeria. The study adopted a hospital-based cross-sectional survey design. Data were collected using a structured questionnaire. Overgrown bushes around residence (286, 71.5%), much farming (400, 100.0%) and staying late night outdoors (400, 100.0%) were major factors that predispose the residents to malaria. Episodes of fever, headache, cough, catarrh and anorexia (169, 42.2%, 221 and 55.2%) were most frequent. There was moderate effect on productivity (258, 64.5%). Most participants (355 (88.8%) used drug alone, 29 (7.2%) combined drug with insecticide nets, 7 (1.8%) combined insecticide spray, nets and drugs while all respondents use local herbs (400, 100.0%). Poor health care delivery (318, 79.5%) was the major reason for dissatisfaction on hospital-based treatment. There is high malaria predisposition, high burden of malaria and poor health care delivery in our study area.

Keywords: Malaria, predisposing factors, burden, management, agrarian settlement

1. Introduction
Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden but five countries Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%)) accounted for nearly half of all malaria cases worldwide [1].

Poor housing quality (with regards to walls, roofs, doors, and window materials) [2], the nearness of communities to bushes, forest and water sources [3] have been reported as main factors that predispose people to malaria especially in rural settlements. The factors mentioned above clearly describe the nature and organization of agrarian settlements in Nigeria and other African nations. These same factors severs as environmental markers for accessing mosquitoes and malaria endemic regions.

In view of the fact that malaria cases are more on the poor households and rural settlements, preventative measures should be taken (especially in agrarian settlements) towards reducing its burden. The present study was designed to evaluate predisposing factors, burden and management of malaria in an agrarian settlement, south east Nigeria.

2. Materials and Methods
2.1 Study Area
This study was conducted among residents of Isi-Uzo Local Government Area in Enugu State, South-East, Nigeria. Isi-Uzo is an integral of Enugu East Senatorial Zone with an area of 877 km², a population of 148,415 (2006 census) but currently has an estimated population of 217, 952. The postal code of the area is 412 while its Global Positioning System is 6°43'50.38" N 7°41'34.58" E. It shares boundaries north with Udenu Local Government Area, north east with Benue State, east with Ebonyi State, south with Enugu East Local Government Area and west with Nsukka Local Government Area. The dry season stretches from November to April while the rainy season begins from May and ends in October. It is an agrarian settlement [4].

2.2 Study Design
The study adopted a hospital-based cross-sectional survey design. The participants were recruited without the prior knowledge of their clinical and family history. Inclusion criteria for participation was all residents who had lived in the study area for at least one year; attending health centers in the five communities in Isi-Uzo Local Government Area: Eha-Amufu, Ikem, Mbu, Neke and Umualor. Selection of eligible participants was carried out randomly in each of the health facilities. Data on malaria predisposing factors, demographic information, burden indices and management practices were collected using structured questionnaire.

2.3 Ethical Clearance
Ethical clearance was obtained from Enugu State Ministry of Health (No. MH/MSD/REC18/045) to enable prompt consent and participation of the different hospital heads and medical personnel, as well as the study subjects.

2.4 Study Population and Sample Size
The sample population for all residents is 217, 952. From the study population, sample size of 400 was randomly selected. The size was deduced from the sample size estimation [5] using the formula: $n = \frac{N}{1+ N e2}$ (Where n = sample size, N = population size, e = level of precision, 0.05).

The number of residents recruited from each community depended on the percentage ratios available from the National Population Commission. The following number of residents were recruited from the five communities; Eha-Amufu (144), Ikem (76), Mbu (72), Neke (64) and Umualor (44).

2.5 Statistical Analysis
The data were analyzed using Statistical Package for Social Sciences (SPSS) 20.0. Data on socio-demography, predisposing factors, and burden and management practices were analyzed using Chi-square (χ^2) test and simple percentages as appropriate. Probability values of $P<0.05$ was regarded as significant.

3. Results
3.1 Socio-demographic characteristics of the subjects in the study area
The socio-demographic characteristics of the subjects are presented on Table 1. The greater preponderance of the participants are females 238 (59.5) at age groups 45–54 years (126, 31.5%). Many of the respondents have secondary level education (175, 43.7%) and are mostly farmers (202, 50.5%). The most practiced religion in the study area is Christianity (352, 88.0%).

Table 1: Socio-demographic characteristics of the subjects in the study area

Characteristics	Rank	Communities Frequency (%)					Total
		Eha-Amufu	Ikem	Mbu	Neke	Umualor	
Sex	Male	**(n=144)** 63 (43.8)	**(n=76)** 27 (35.5)	**(n=72)** 26 (36.1)	**(n=64)** 25 (39.1)	**(n=44)** 21 (47.7)	**(n=400)** 162 (40.5)
	Female	81 (56.3)	49 (64.5)	46 (63.9)	39 (60.9)	23 (52.3)	238 (59.5)
Age	11 – 14	3 (2.1)	1 (1.3)	2 (2.8)	1 (1.6)	0 (0.0)	7 (1.8)
	15 – 24	30 (20.8)	10 (13.2)	6 (8.3)	11 (17.2)	5 (11.4)	62 (15.5)
	25 – 34	30 (20.8)	19 (25.0)	10 (13.9)	20 (31.3)	10 (22.7)	89 (22.3)
	35 – 44	40 (27.8)	21 (27.6)	24 (33.3)	15 (23.4)	16 (36.4)	116 (29.0)
	45 – 54	41 (28.5)	25 (32.9)	30 (41.7)	17 (26.6)	13 (29.5)	126 (31.5)
Education	Primary	20 (13.9)	18 (23.7)	15 (20.8)	8 (12.5)	11 (25.0)	72 (18.0)
	Secondary	64 (44.4)	30 (39.5)	29 (40.3)	34 (53.1)	18 (40.9)	175 (43.7)
	Tertiary	40 (27.8)	18 (23.7)	22 (30.6)	17 (26.6)	13 (29.5)	110 (27.5)
	Post-tertiary	20 (13.9)	10 (13.2)	6 (8.3)	5 (7.8)	2 (4.5)	43 (10.8)
Occupation	House chores	8 (5.6)	2 (2.6)	2 (2.8)	4 (6.3)	1 (2.3)	17 (4.2)
	Salary Employed	27 (18.8)	24 (31.6)	14 (19.4)	12 (18.8)	5 (11.4)	82 (20.0)
	Self-Employed	16 (11.1)	8 (10.5)	12 (16.7)	8 (12.5)	6 (13.6)	50 (44.0)
	Farming	78 (54.2)	36 (47.4)	34 (47.2)	30 (46.9)	24 (54.5)	202 (50.5)
	Student	15 (10.4)	6 (7.9)	10 (13.9)	10 (15.6)	8 (18.2)	49 (12.3)
Religion	Christianity	131 (91.0)	67 (88.2)	65 (90.3)	51 (79.7)	38 (86.4)	352 (88.0)
	Islam	2 (1.4)	4 (5.3)	0 (0.0)	0 (0.0)	0 (0.0)	6 (11.5)
	Traditionalist	11 (2.6)	5 (6.6)	7 (9.7)	13 (20.3)	6 (13.6)	42 (10.5)

3.2 Malaria awareness and its predisposing factors among the participants in the study area
Table 2 shows the malaria awareness and predisposing factors among the participants in the study area. A total of 179 (44.8%) respondents first heard of malaria through the media broadcast, followed by health workers at hospitals (87, 21.8%) while health campaigns was (6, 1.5%). Most of the participants first heard of malaria at adulthood 369 (92.2%). The major factors that predispose the residents to malaria are presence of overgrown bushes around residence (286, 71.5%), much farming (400, 100.0%) and staying outdoors late at night (400, 100.0%) (Table 2).

Table 2 Malaria awareness and its predisposing factors among the participants in the study area

Variables	Rank	Communities Frequency (%)					Total
		Eha-Amufu	Ikem	Mbu	Neke	Umualor	
Source first heard	Media broadcast	(n=144)59	(n=76)	(n=72)	(n=64)	(n=44)	(n=400)
		(41.0)	39 (51.3)	32 (44.4)	31 (48.4)	18 (40.9)	179 (44.8)
	Health campaigns	2 (1.4)	4 (5.3)	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.5)
	Guardian at home	15 (10.4)	7 (9.2)	18 (25.0)	10 (15.6)	8 (18.2)	58 (14.5)
	Workers at hospital	40 (27.8)	13 (17.1)	13 (18.1)	15 (23.4)	6 (13.6)	87 (21.8)
	Education at school	28 (19.4)	13 (17.1)	9 (12.5)	8 (12.8)	12 (27.3)	70 (17.5)
Age category	Teenage	17 (11.8)	7 (9.2)	6 (8.3)	1 (1.6)	0 (0.0)	31 (7.8)
	Adulthood	127 (58.2)	69 (90.8	66 (91.7)	63 (98.4)	44 (100.0)	369 (92.2)
Overgrown bushes	Fallow ground	42 (29.2)	33 (43.4)	20 (27.8)	13 (20.3)	6 (13.6)	114 (28.5)
	No manual labour	102 (70.8)	43 (56.4)	52 (72.2)	51 (79.7)	38 (86.4)	286 (71.5)
Much farming	Means of income	144 (100.0)	76 (100.0)	72 (100.0)	64 (100.0)	44 (100.0)	400 (100.0)
Stay late outside	Cool relaxation	144 (100.0)	76 (100.0)	72 (100.0)	64 (100.0)	44 (100.0)	400 (100.0)

3.3 Burden of malaria among the subjects in the study area

The burden of malaria prevalence among the study subjects in the studied communities are presented on Table 3. Episodes of fever and headache were most frequent at monthly intervals (169, 42.2%), followed by the quarterly intervals (135, 33.8%). Other symptoms such as cough, catarrh and anorexia also had quarterly occurrence (221, 55.2%). Much lower number of the participants reported cerebral complication, still birth, postnatal death, disability and mortality; where many of the respondents responded that the ailments occurred once as follows (5.2%, 14.5%, 2.2%, 3.2% and 13.2%) respectively. Furthermore, greater number of the participants said the rate of malaria burden on their productivity is moderate (258, 64.5%).

Table 3: Burden of malaria among the subjects in the study area

Variables	Rank	Communities Frequency (%)					Total
		Eha-Amufu	Ikem	Mbu	Neke	Umualor	
Fever	Weekly	**(n=144)**	**(n=76)**	**(n=72)**	**(n=64)**	**(n=44)**	**(n=400)**
		6 (4.2)	3 (3.9)	4 (5.6)	4 (6.3)	2 (4.5)	19 (4.8)
	Biweekly	26 (18.1)	18 (23.7)	13 (18.1)	15 (23.4)	5 (11.4)	77 (19.2)
	Monthly	60 (41.7)	30 (39.5)	29 (40.3)	27 (42.2)	23 (52.3)	169(42.2)
	Quarterly	52 (36.1)	25 (32.9)	26 (36.1)	18 (28.1)	14 (31.8)	135(33.8)
Headache	Weekly	6 (4.2)	3 (3.9)	4 (5.6)	4 (6.3)	2 (4.5)	19 (4.8)
	Biweekly	26 (18.1)	18 (23.7)	13 (18.1)	15 (23.4)	5 (11.4)	77 (19.2)
	Monthly	60 (41.7)	30 (39.5)	29 (40.3)	27 (42.2)	23 (52.3)	169(42.2)
	Quarterly	52 (36.1)	25 (32.9)	26 (36.1)	18 (28.1)	14 (31.8)	135(33.8)
Cough & Catarrh	Biweekly	20 (13.9)	8 (10.5)	3 (4.2)	5 (7.8)	3 (6.8)	39 (9.8)
	Monthly	54 (37.5)	24 (31.6)	29 (40.3)	20 (31.3)	13 (29.5)	140(35.0)
	Quarterly	70 (48.6)	44 (57.6)	40 (55.6)	39 (60.9)	28 (63.6)	221(55.2)
Anorexia	Biweekly	20 (13.9)	8 (10.5)	3 (4.2)	5 (7.8)	3 (6.8)	39 (9.8)
	Monthly	54 (37.5)	24 (31.6)	29 (40.3)	20 (31.3)	13 (29.5)	140(35.0)
	Quarterly	70 (48.6)	44 (57.6)	40 (55.6)	39 (60.9)	28 (63.6)	221(55.2)
Cerebral complication	None	140 (97.0)	74 (97.4)	71 (98.0)	58 (90.6)	36 (81.8)	379(94.8)
	Once	4 (2.8)	2 (2.6)	1 (1.4)	6 (9.4)	8 (18.2)	21 (5.2)
Still birth	None	124 (86.1)	60 (78.9)	56 (77.8)	50 (78.1)	32 (72.7)	322(80.5)
	Once	16 (11.1)	12 (15.8)	14 (19.4)	9 (14.1)	7 (15.9)	58 (14.5)
	Twice	2 (1.4)	2 (2.6)	1 (1.4)	2 (3.1)	1 (2.3)	8 (2.0)
	Thrice	1 (0.7)	1 (1.3)	0 (0.0)	2 (3.1)	0 (0.0)	4 (1.0)
	Above	1 (0.7)	1 (1.3)	1 (1.4)	1 (1.6)	4 (9.1)	8 (2.0)
Neo/postnatal death	None	139 (96.5)	72 (94.7)	70 (97.2)	60 (93.8)	39 (88.6)	380(95.0)
	Once	3 (2.1)	2 (2.6)	0 (0.0)	2 (3.1)	2 (4.5)	9 (2.2)
	Twice	1 (0.7)	0 (0.0)	1 (1.4)	1 (1.6)	2 (4.5)	5 (1.2)
	Thrice	0 (0.0)	1 (1.3)	0 (0.0)	1 (1.6)	0 (0.0)	2 (0.5)
	Above	1 (0.7)	1 (1.3)	1 (1.4)	0 (0.0)	1 (2.3)	4 (1.0)
Disability	None	140 (97.2)	74 (97.4)	70 (97.2)	61 (95.3)	42 (95.5)	387(96.8)
	Once	4 (2.8)	2 (2.6)	2 (2.8)	3 (4.7)	2 (4.5)	13 (3.2)
Mortality	None	123 (85.4)	65 (85.5)	60 (83.3)	48 (75.0)	34 (77.3)	330(82.5)
	Once	18 (12.5)	8 (10.5)	9 (12.5)	12 (18.8)	6 (13.6)	53 (13.2)
	Twice	1 (0.7)	0 (0.0)	1 (1.4)	2 (3.1)	1 (2.3)	5 (1.2)
	Thrice	0 (0.0)	1 (1.3)	1 (1.4)	0 (0.0)	1 (2.3)	3 (0.8)
	Above	2 (1.4)	2 (2.6)	1 (1.4)	2 (3.1)	2 (4.5)	9 (2.3)
Affect productivity	Low	2 (1.4)	1 (1.3)	3 (4.2)	2 (3.1)	0 (0.0)	8 (2.0)
	Moderate	96 (66.7)	55 (72.4)	45 (62.5)	43 (67.2)	19 (43.2)	258(64.5)
	High	46 (31.9)	20 (26.3)	24 (33.3)	19 (29.7)	25 (56.8)	134(33.5)

3.4 Management practices of malaria among the subjects in the study area

Table 4 shows the management practices of malaria among the studied communities. It was observed that the drug of choice for treatment and control of malaria among people in the study area are hospital drugs (223, 55.8%). Those that use drug alone are 355 (88.8%), while those that combine drug with insecticide net usage are few (29, 7.2%). Much lower number of the participants uses the combination of insecticide spray and nets and drug (7, 1.8%). The use of local herbs is common in the studied communities (400, 100.0%).

Table 4: Management practices of malaria among the subjects in the study area

Variables	Rank	Communities Frequency (%)					Total
		Eha-Amufu	Ikem	Mbu	Neke	Umualor	
Drug of choice	Hospital	(n=144)	(n=76)	(n=72)	(n=64)	(n=44)	(n=400)
		98 (68.1)	24 (31.6)	46 (63.9)	36 (56.3)	19 (43.2)	223 (55.8)
	Traditional	46 (31.9)	52 (68.4)	26 (36.1)	28 (43.8)	25 (56.8)	177 (44.2)
Drug alone	No	22 (15.3)	6 (7.9)	12 (16.7)	3 (4.7)	2 (4.5)	45 (11.2)
	Yes	122 (54.7)	70 (92.1)	60 (83.3)	61 (95.3)	42 (95.5)	355 (88.8)
Drug + net	No	123 (85.4)	72 (94.7)	71 (98.6)	62 (96.9)	43 (97.7)	371 (92.8)
	Yes	21 (14.6)	4 (5.3)	1 (1.4)	2 (3.1)	1 (2.3)	29 (7.2)
Spray + drug + net	No	143 (99.3)	74 (97.4)	71 (98.6)	62 (96.9)	43 (97.7)	393 (98.2)
	Yes	1 (0.7)	2 (2.6)	1 (1.4)	2 (3.1)	1 (2.3)	7 (1.8)
Other management	Local herbs	144 (100.0)	76 (100.0)	72 (100.0)	64 (100.0)	44 (100.0)	400 (100.0)

3.5 Economic impact of malaria on the subjects

On the economic impact of malaria, the participants are not satisfied with the treatment received and poor health care delivery was implicated (318, 79.5%) as the major reason for the dissatisfaction. This if followed by the ineffectiveness of the drugs received (69, 17.3%). On the cost of treatment, greater preponderance of the study participants responded that it was moderate (297, 74.4%) (Table 5).

Table 5: Economic impact of malaria on the subjects

Variables	Rank	Communities Frequency (%)					Total
		Eha-Amufu	Ikem	Mbu	Neke	Umualor	
Non-satisfaction	Ineffective drugs	(n=144)	(n=76)	(n=72)	(n=64)	(n=44)	(n=400)
		19 (13.2)	16 (21.1)	10 (13.9)	10 (15.6)	14 (31.8)	69 (17.3)
with treatment	Side effects	1 (0.7)	2 (2.6)	0 (0.0)	4 (6.3)	6 (13.6)	13 (3.2)
	Poor health care	124 (86.1)	58 (76.3)	62 (86.1)	50 (78.1)	24 (54.5)	318 (79.5)
Cost of treatment	Low	10 (6.9)	7 (9.2)	0 (0.0)	0 (0.0)	0 (0.0)	17 (4.2)
	Moderate	100 (69.4)	57 (75.0)	48 (66.7)	56 (87.5)	36 (81.8)	297 (74.3)
	High	34 (23.6)	12 (15.8)	24 (33.3)	8 (12.5)	8 (18.2)	86 (21.5)

4. Discussion

Malaria is preventable when people are educated on the factors that predispose them to it. The burden of malaria perpetuates poverty. Consequently, those at high risk need to be educated on management strategies.

Majority of our respondents were susceptible to malaria due to their occupation (farming) and low educational status that could limit their knowledge on management of malaria [6].

Our findings on awareness and predisposing factors for malaria revealed that the media and health workers are making impact on malaria programme awareness in our study area. However, for the fact majority of the participants first heard of malaria at adulthood implies that children and teenagers are not been captured in the malaria awareness programmes in agrarian settlements. Therefore strategies should be mapped out on how to reach these groups. Strategies such as creating health clubs (at communities and schools) that will focus on educating children and teenagers on tropical diseases especially malaria. The trained ones will be considered as peer health educators. We also observed that poor housing quality (with regards to walls, roofs, doors, and window materials), nearness of households and villages to bushes, forest and water sources were among major factors that predispose our respondents to malaria. These findings consonant with [2]. The observed presence of overgrown bushes around residences implies that residents do not have the fund to employ manual labourers. This supports the fact that low income earners and the poor are at high risk of malaria [6]. Staying late night outdoors for cool relaxation is a life style of agrarian settlers and it predispose them to malaria. Agrarian settlers need proper education on the need to curb this life style.

The monthly and quarterly persistent episodes of malaria symptoms could be as a result of high malaria prevalence and confirms the high predisposition factors reported in this study. Similarly, negative effect of malaria on productivity could be as a result of delay in farming activities and absenteeism of the malaria infected persons in the labour force. The money spent on treatment of malaria negatively affects the socio-economic status of the families. Lower preponderance on cerebral complication, still birth, postnatal death and disability suggests low severe malaria cases among the populace. These results consonant with [7].

The inhabitants may have preferred local herbs because it cost them nothing to procure and not that it is more effective than drugs recommended at the hospitals. Consequently, the continued use of herbs in malaria treatment could have contributed to the high prevalence of malaria in the area because some of them admitted that they only seek for malaria treatment at the health centers when malaria persists after taking herbs. The use of local herbs in malaria treatment and use of plant extracts as insecticides have been reported [8-

[12]. The least number of participants used the combination of insecticide sprays, nets and drugs. This result agrees with [13]. Consequently, there is an urgent need to sensitize agrarian settlers on the need to adopt the three ways of treating and managing malaria - drugs, insecticides and treated nets. The unsatisfactory response of the participants on treatment given to them at their health facilities was as a result of poor health care delivery and this paints a true picture of the state of health facilities in agrarian settlements.

Most importantly, the high monthly prevalence of malaria burden in Isi-Uzo could be favoured by conditions suitable for malaria parasite transmission (coincidence of precipitation accumulation greater than 80 mm, mean temperature between 18 ^{0}C and 32 ^{0}C and relative humidity greater than 60%) [14]. The climatic conditions of Isi-Uzo fits in the above described conditions.

5. Conclusion

Agrarian populace (especially in our study area) suffer high malaria predisposition, high burden of malaria and poor health care delivery.

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7. Conflict of interest: The authors declare that they have no conflict of interest.

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