

## Trend in Malaria Incidence Rates (2006-2013) in Edo State, Nigeria

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### Authors' contributions

This work was carried out in collaboration among all authors. Author AE coordinated data collection. Author AOO did the literature search. Author SNO designed the study produced the first draft. Author MAEN did literature search and edited the draft manuscript. All authors read and approved the final manuscript.

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### ABSTRACT

**Background:** Detailed information on the severity of malaria and other diseases across operational areas is a prerequisite to the judicious utilization of limited effective tools for the control in Africa.

**Methods:** Records of Patients, from the 18 Local Government Areas (LGAs), who visited Health Centres across Edo State, 2006-2013, and stored in the Ministry of Health database in Benin City were analysed. Patients were placed in 3 groups (out-patients, In-patients, Pregnant Women).

Human population data, in the 18 LGAs over the period were obtained from the National Population Commission. Malaria incidence rates were estimated. The proportions of patients in the 3 categories annually across LGAs were determined.

**Results:** Malaria Incidence rates increased 2-13 folds over the period in all LGAs, except in Esan West where there was a significant reduction in 2011. The highest rates were recorded at Esan

Central (13.66%) and Uhunmwonde (11.50%). The highest increases in the proportions of patients with severe malaria were at Uhunmwonde, Igueben and Orhionmwon LGAs. In contrast, reductions in the proportions of severe malaria were in Esan Northeast and Owan West. The highest increases in the proportions of pregnant women patients were in Esan central and Esan West; in contrast, major reductions were observed at Oredo and Igueben.

**Conclusion:** The multi-faceted Federal and State Governments Intervention Policies and Strategies have apparently not been effective in the State. There is an urgent need for the intensification of efforts, including increase in the number of ITNs and upgrading of facilities at the Primary Health Care Centres for holistic diagnosis.

*Keywords: Trend; malaria incidence; Edo State; Nigeria.*

## 1. INTRODUCTION

Several highly effective tools are now available to control malaria [1]. These include the use of Insecticide-treated bednets (ITNs), intermittent presumptive treatment (IPT) for pregnant women and Artemisin-based combination therapy [2,3,4]. Among the anti-vector measures, pyrethroid-treated nets have emerged in recent years as the most promising tool for reducing malaria mortality and morbidity, especially in children less than five years of age in disease endemic areas in Africa [2,5].

Studies on malaria rates in Edo State have yielded significantly divergent results. Most have been localized, either in the State Capital, Benin City [6,7] or a selected Local Government Area (LGA) [8]. These have recorded incidence rates of 78.9% [6], 41.4-58.5% [7] and 50% [8]. The only accessible State-wide, incidence study yielded low rates of 2.8-6.2% [9]. The method of malaria diagnosis in the aforementioned studies was by blood smears.

Barat [1] established that two of the four key factors that contributed to the reduction of the malaria burden in four countries (Brazil, Eritrea, India, Vietman) were a targeted, technical approach using a package of effective tools and data-driven decision making. Intervention policies and strategies against malaria in Nigeria include the use of ITNs, Indoor Residual Spray (IRS), larval control, IPT and Artemisinin-based drugs. It is therefore imperative that in the distribution of the limited number of ITNs and other tools in any future exercise or utilisation of any other effective tool among the Local Government Areas (LGAs) in the State, information changes in malaria cases was important. A critical analysis of trends in malaria incidence rates in these areas must be utilised. Consequently, an analysis of the trend in the number of new cases annually over a 7-year period (2006-2013) was undertaken to obtain reliable baseline data.

## 2. MATERIALS AND METHODS

### 2.1 Study Areas

There are three eco-vegetational zones (Derived Savanna, Lowland rainforest, Freshwater Swamp forest) and two seasons: rainy (May-October) and dry (November-April). There are 18 Local Government Areas (LGAs): Akoko-Edo, Etsako East, Etsako Central, Etsako West, Owan West, Esan North-East, Esan Central, Esan South-east are in the Derived Savanna; Ovia South-West, Ovia North-East, Igueben, Egor, Uhunmwonde, Oredo, Ikpoba-Okha, Orhionmwon are in the lowland rainforest, four LGAs (Ovia South-West, Oredo, Ikpoba-Okha, Orhionmwon) extend into the Freshwater Swamp Forest in the South of the State (Fig. 1). The major urban centres are Benin City, State Capital (Oredo LGA), Igarra (Akoko-Edo LGA), Agenebode (Etsako East LGA), Sakponba (Orhionmwon LGA) and Ehor (Uhunmwonde LGA). Edo State is in the South-South Geopolitical zone, where the 2012 Malaria Indicator Survey (MIS) showed that the malaria incidence rates in the zone, for children 6-59 months were 31-40%, while the ITN ownership in the zone was 43.8% [10].

### 2.2 Methods

Ethical clearance was obtained from the State Ministry of Health. Human population data over the period, 2006-2013 were obtained from the 2006 Census figures [11]. The estimated populations for subsequent years utilized the 2.7% Annual Growth Rate of the National Population Commission (Table 1). There is a 3-tier health care referral system in Nigeria. Primary healthcare is at the Primary Health Centres in the Local Government Headquarters. Facilities are limited; laboratories and supporting technical personnel are non-existent. There is an improvement in facilities at the State Government-run hospitals for secondary healthcare. Facilities and trained personnel are

optimal at the University Teaching and Specialist hospitals for tertiary healthcare. Numbers of patients for malaria treatment at LGA Health Centres were obtained from the database of the Malaria Control Section, State Ministry of Health, Benin City, Edo State. Incidence rates were subsequently calculated as

$$\frac{\text{No of malaria cases}}{\text{Human Population}} \times \frac{100}{1}$$

Patients were placed in three groups: Out-patient, in-patient and Pregnant Women. Diagnosis at the Primary Health Care (PHC) centres was presumptive, because of inadequate facilities. The misdiagnosis that may result from presumptive treatment has been highlighted by several authors [12,13]. Hommel and Gilles [14] (1998) reported that the commonest misdiagnoses in non-immune individuals are influenza, viral hepatitis, viral encephalitis, meningitis, psychosis and viral haemorrhagic fever. However, it should be stressed that experienced medical practitioners, conversant with the disease are usually accurate in their diagnoses. Furthermore, some of the diseases mentioned by Hommel and Gilles [14] are non-existent in Edo State. Out-patients were treated and released. Those with severe symptoms were admitted and if there was minimal improvement, were subsequently referred to Secondary Health Care (SHC) State hospitals. Severity was based on the classical symptoms of severe malaria, which may occur singly or more commonly in combination in the same patient: impaired consciousness (including unrousable coma); Prostration (i.e- generalized weakness so that the patient is unable to sit, stand or walk without assistance; Multiple convulsions more than 2 episodes in 24 h; deep breathing and respiration distress (acidotic breathing); acute pulmonary oedema and acute respiratory distress syndrome; circulatory collapse or shock, systolic blood pressure <80 mmHg in adults and 50 mmHg in Children; acute kidney injury; clinical jaundice plus evidence of other vital organ dysfunction; and, abnormal bleeding as contained in WHO [15].

### 3. RESULTS

Highest populations were in Oredo, Ikpoba-Okha, Egor LGAs and least in Igueben, Etsako Central and Owan LGAs (Table 1). Incidence rates increased steadily over the period in all LGAs. However, there was a significant drop in 2011 at Esan West. Highest incidence rates were

recorded in 2012/2013 at Uhunmwonde (10.4512-11.4959%) and Esan Central (13.5873-13.6548%) LGAs and lowest rates (0.9691-2.3828) at Akoko Edo LGA (Table 2). The proportions of out-patient, in-patient and pregnant women cases in all LGAs over the 7-year period appear in Table 3.

### 4. DISCUSSION

There were 5-6 fold increases in incidence rates from 2006-2013 at Etsako West, Oredo and Ovia southwest LGAs. There were 3-fold increases in incidence rates over the 7-year period at Esan Northeast, Etsako Central and Ovia Northeast LGAs. Two-fold increases in incidence rates were recorded over the same period at Akoko-Edo, Egor Esan Central, Ikpoba-Okha and Orhionmwon LGAs. The proportion of severe (in-patient) cases in relation to all cases increased 30-fold at Ovia Northeast; 4-5-fold at Esan Central and Ovia Southwest LGAs. In contrast, there were 110, 130 and 150-fold reductions respectively at Uhunmwonde, Igueben and Orhionmwon LGAs respectively; 7, 14-fold reductions in Esan Northeast and Owan East respectively; 2-fold reductions in Esan West, Etsako Central, Etsako East and Ikpoba-Okha LGAs respectively. The proportion of pregnant women in relation to all recorded malaria cases increased 3 and 4-folds at Esan Central and Esan West LGAs; 2-fold increases in Egor and Ikpoba-Okha LGAs. In contrast, there were 4-fold reductions in Igueben and Oredo LGAs.

Incidence rates rose steeply in both the derived savanna (Etsako West) and lowland rainforest (Oredo, Ovia Southwest). These rates also rose markedly in rural (Ovia Southwest) and urban (Oredo) where the State capital Benin City dominates the LGA. The increase in incidence rates was corroborated by significant increasing trends in the proportions of in-patients and pregnant women cases recorded in many LGAs.

The country-wide reductions in malaria admissions in 2010 and 2011 [10] were observed in the severe and pregnancy categories in some LGAs: Etsako central, Igueben, Orhionmwon, Owan East, Uhionmwonde. A positive note was the reduction in the proportion of pregnant women reporting for treatment in Oredo (urban) and Igueben (rural) LGAs. Access to IPT<sub>p</sub> by pregnant women might have been a contributory factor to the decrease. Incidence rates obtained in these studies were significantly lower than those of other workers [6,7,8].

**Table 1. Edo State population (growth rate=2.7%) (National Population Commission)**

LGAs	2006	2007	2008	2009	2010	2011	2012	2013
Akoko-Edo	262110	269187	276455	283919	291585	299458	307543	315847
Egor	339899	349076	358501	368181	378122	388331	398816	409584
Esan Central	105310	108153	111074	114072	117152	120316	123564	126900
Esan North East	119346	122568	125878	129276	132767	136352	140033	143814
Esan South East	167721	172249	176900	181677	186582	191619	196793	202107
Esan West	125842	129240	132729	136313	139993	143773	147655	151642
Etsako Central	94575	97129	99751	102444	105210	108051	110968	113964
Etsako East	145996	149938	153986	158144	162414	166799	171302	175928
Etsako West	197609	202944	208424	214051	219831	225766	231862	238122
Igubeen	69639	71519	73450	75433	77470	79562	81710	83916
Ikpoba-Okha	371106	381126	391416	401984	412838	423985	435432	447189
Oredo	374671	384787	395176	405846	416804	428058	439615	451485
Orhionmwon	182717	187650	192717	197920	203264	208752	214389	220177
Ovia North East	153849	158003	162269	166650	171150	175771	180517	185391
Ovia South West	135356	139011	142764	146619	150577	154643	158818	163106
Owan East	154385	158553	162834	167231	171746	176383	181146	186037
Owan West	97388	100017	102718	105491	108340	111265	114269	117354
Uhunmwonde	120813	124075	127425	130865	134399	138028	141754	145582
	3218332	3305227	3394468	3486119	3580244	3676911	3776187	3878144

**Table 2. Malaria incidence rates (%) in Igas, Edo State 2006-2013**

LGAs study/period	2006	2008	2009	2010	2011	2012	2013
Akoko-Edo	0.9691	1.1608	1.5959	1.8060	2.3736	1.9916	2.3828
Egor	0.9167	5.4915	4.4008	5.8473	6.5045	3.9484	2.8275
Esan Central	7.0800	6.9170	10.0313	9.1897	8.9057	13.5873	13.6548
Esan North East	2.8237	5.7159	6.7104	5.5217	9.1183	8.9179	7.3275
Esan South East	2.1214	1.9096	2.6338	2.9799	4.5183	2.9518	3.4036
Esan West	3.1261	3.3293	4.0341	3.2302	1.6526	5.1688	5.1246
Etsako Central	2.9331	3.5599	4.2120	3.9264	5.8546	3.8488	6.0993
Etsako East	1.9877	2.0859	2.4244	4.2823	6.0216	3.1272	2.9421
Etsako West	1.4038	2.5419	2.6961	3.1661	2.4906	3.1320	6.8587
Igubeen	3.2496	4.4479	5.8767	6.6064	6.1424	4.6690	4.3091
Ikpoba-Okha	1.8278	2.0602	1.9648	3.1753	3.3383	1.8889	2.4158
Oredo	0.8229	2.8734	4.3780	7.1321	8.0982	6.2916	5.7933
Orhionmwon	1.1137	1.5966	2.1701	3.5333	3.6311	2.9904	2.8123
Ovia North East	2.7169	3.6033	2.9343	2.8344	5.3928	5.4488	7.0489
Ovia South West	1.3032	3.7741	4.5308	4.3393	4.4664	4.2753	6.6049
Owan East	2.6440	1.6569	1.9398	3.0196	4.0049	3.7097	3.2714
Owan West	3.0096	2.5195	2.5130	3.9625	4.5648	4.1035	2.7123
Uhunmwonde	5.4597	6.3426	6.8131	4.3542	8.5273	11.4959	10.4512

Studies by Wagbatsone and Omoike [8] and Okafor and Oko-Ose [7] targeted pregnant women, while Oladeinde et al. [6] examined school children exclusively.

Furthermore, these studies were restricted to either Igubeen or Oredo LGAs. The 2007/2008

incidence rates in the present study were lower than those obtained across LGAs in 2007/2008 by the use of the thick smear method [9]. Although the incidence rates obtained in the present study were lower than those obtained by the thick blood smear method in other studies in the State, indicating minimal misdiagnosis, there

is an urgent need for the improvement of facilities at the Primary Health Centres so that diagnoses are comprehensive, based on clinical symptoms and results of thick blood smears.”

Nigeria’s intervention policies and strategies at Federal and State levels include: use of ITNs, IRS, larval control, IPT<sub>p</sub> of pregnant women, free diagnosis and ACT [10]. Edo State is in the South-south geopolitical zone where ITN ownership, based on a 2010 Malaria Indicator Survey is indicated at 43.8% [10]. The increasing malaria incidence rates across most LGAs in Edo

State indicate that the National and State strategies and policies were apparently not effective in the State. Other factors might have also contributed. These include: an estimated 65% of Nigerians living in poverty, which is a major factor in malaria prevention and treatment; the increasing rate of malaria vector resistance to pyrethroids in sub-Saharan Africa and treatment of over 70% of children by Chloroquine or Sulphadoxin – Pyrimethanine (SP), although the National policy is the use of ACT as the first-line treatment [10,13,16].

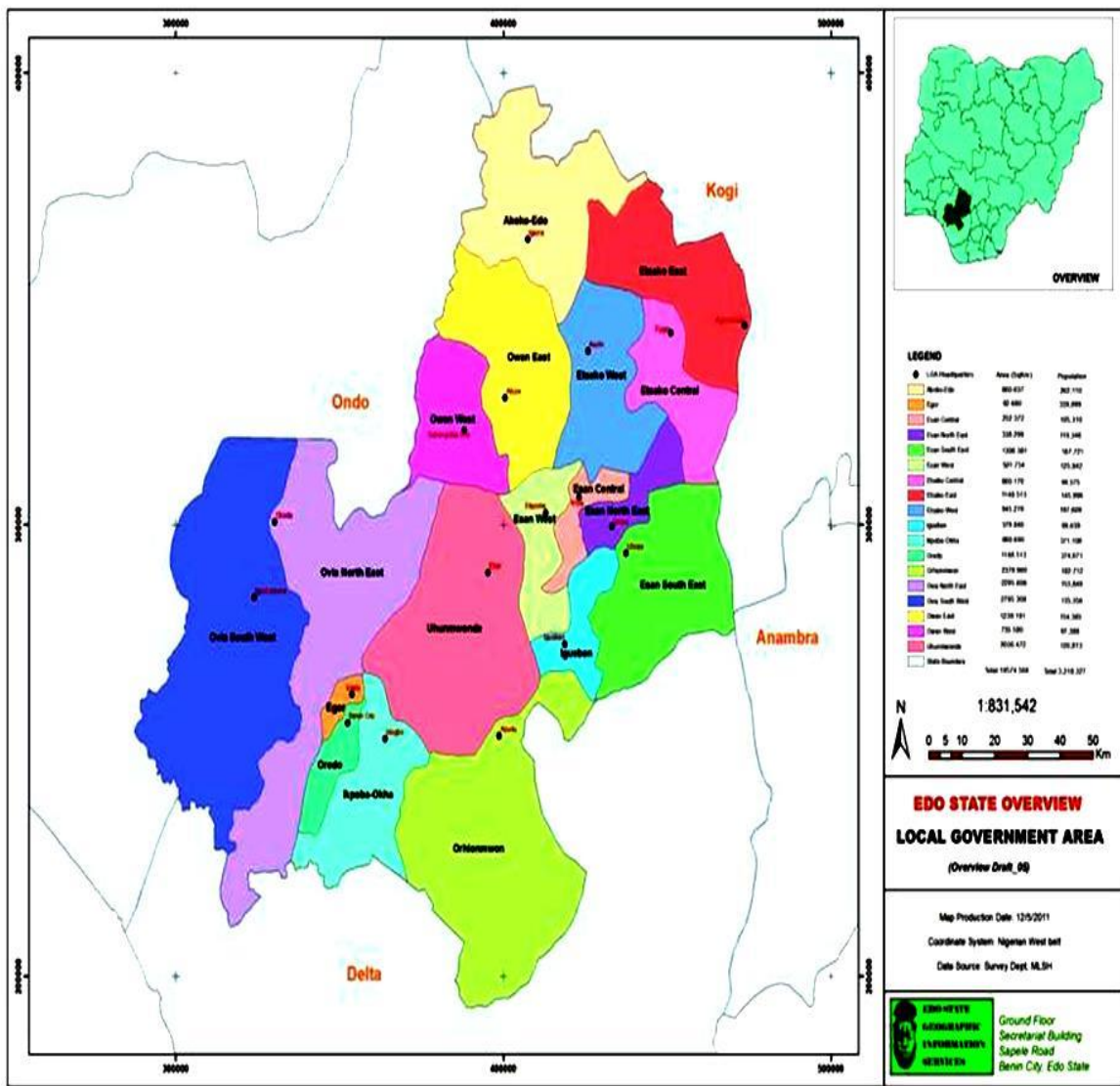


Fig. 1. Local government areas in Edo State

**Table 3. Malaria cases in Edo State (no/%) (2006-2013)**

	<b>Severity</b>	<b>2006</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Akoko-Edo	M <sub>1</sub>	2105(82.87)	2446(76.22)	3406(75.17)	3889(73.85)	5682(79.94)	4974(81.21)	5767(76.63)
	M <sub>2</sub>	269(10.59)	599(18.67)	915(20.19)	1069(20.30)	1178(16.57)	854(13.94)	1404(18.66)
	M <sub>3</sub>	166(6.54)	164(5.11)	210(4.63)	308(5.85)	248(3.49)	297(4.85)	355(4.72)
Egor	M <sub>1</sub>	2653(85.14)	17234(87.54)	12346(76.20)	17202(77.80)	19786(78.33)	10135(64.36)	7840(67.70)
	M <sub>2</sub>	301(9.66)	1938(9.84)	2798(17.27)	3488(15.78)	3815(15.10)	4535(28.80)	2451(21.16)
	M <sub>3</sub>	162(5.20)	515(2.62)	1059(6.54)	1420(6.42)	1658(6.56)	1077(6.84)	1290(11.14)
Esan Central	M <sub>1</sub>	6830(91.60)	7138(92.91)	10585(92.50)	9914(92.09)	9660(90.15)	13681(81.49)	12137(70.04)
	M <sub>2</sub>	450(6.04)	244(3.18)	283(2.47)	245(2.28)	429(4.00)	2306(13.74)	3958(22.84)
	M <sub>3</sub>	176(2.36)	301(3.92)	575(5.02)	607(5.64)	626(5.84)	802(4.78)	1233(7.12)
Esan North East	M <sub>1</sub>	2610(77.45)	5802(80.64)	6724(77.51)	6625(90.37)	11411(91.78)	11456(91.74)	9836(93.34)
	M <sub>2</sub>	495(14.69)	793(11.02)	1321(15.23)	283(3.86)	233(1.87)	257(2.06)	191(1.81)
	M <sub>3</sub>	265(7.86)	600(8.34)	630(7.26)	423(5.77)	789(6.35)	775(6.21)	511(4.85)
Esan South East	M <sub>1</sub>	3175(89.24)	2566(75.96)	3907(81.65)	4775(85.88)	7786(89.93)	5396(92.89)	6174(89.75)
	M <sub>2</sub>	141(3.96)	552(16.34)	431(9.01)	297(5.34)	214(2.47)	170(2.93)	357(5.19)
	M <sub>3</sub>	242(6.80)	260(7.70)	447(9.34)	488(8.78)	658(7.60)	243(4.18)	348(5.06)
Esan West	M <sub>1</sub>	3178(80.78)	2435(55.10)	3010(54.74)	2578(57.01)	1406(59.18)	5987(78.45)	5866(75.49)
	M <sub>2</sub>	610(15.51)	1699(38.45)	2155(39.19)	1365(30.19)	659(27.74)	274(3.59)	551(7.09)
	M <sub>3</sub>	146(3.71)	285(6.45)	334(6.07)	579(12.80)	311(13.09)	1371(17.96)	1354(17.42)
Etsako Central	M <sub>1</sub>	2197(79.20)	3225(90.82)	3736(86.58)	3472(84.05)	5723(90.47)	3899(91.29)	6123(88.09)
	M <sub>2</sub>	403(14.53)	62(1.75)	66(1.53)	179(4.33)	85(1.34)	15(0.35)	529(7.61)
	M <sub>3</sub>	174(6.27)	264(7.43)	513(11.89)	480(11.62)	518(8.19)	357(8.36)	299(4.30)
Etsako East	M <sub>1</sub>	2632(90.70)	2843(88.51)	3605(94.03)	6377(91.69)	9177(91.37)	4552(84.97)	4834(93.39)
	M <sub>2</sub>	149(5.13)	149(4.64)	37(0.97)	150(2.16)	162(1.61)	514(9.59)	169(3.27)
	M <sub>3</sub>	121(4.17)	220(6.85)	192(5.01)	428(6.15)	705(7.02)	291(5.43)	173(3.34)
Etsako West	M <sub>1</sub>	2368(85.36)	4248(80.18)	4794(83.07)	4810(69.11)	5080(90.34)	6068(83.56)	11566(70.82)
	M <sub>2</sub>	230(8.29)	599(11.31)	738(12.79)	1325(19.04)	239(4.25)	706(9.72)	3071(18.80)
	M <sub>3</sub>	176(6.34)	451(8.51)	239(4.14)	825(11.85)	304(5.41)	488(6.72)	1695(10.38)

Igueben	M <sub>1</sub>	1746(77.15)	2742(83.93)	3698(83.42)	4723(92.28)	4734(96.87)	3760(98.56)	3509(97.04)
	M <sub>2</sub>	301(13.30)	298(9.12)	488(11.01)	246(4.81)	59(1.21)	12(0.31)	4(0.11)
	M <sub>3</sub>	216(9.54)	227(6.95)	247(5.57)	149(2.91)	94(1.92)	43(1.13)	103(2.85)
Ikpoba-Okha	M <sub>1</sub>	5936(87.51)	6265(77.69)	6171(78.13)	8651(65.99)	10689(75.52)	6193(75.29)	8324(77.05)
	M <sub>2</sub>	468(6.90)	1129(14.00)	1088(13.78)	3271(24.95)	2139(15.11)	1188(14.44)	1195(11.06)
	M <sub>3</sub>	379(5.59)	670(8.31)	639(8.09)	1187(9.05)	1326(9.37)	844(10.26)	1284(11.89)
Oredo	M <sub>1</sub>	2595(84.17)	9668(85.14)	11750(66.13)	26831(90.26)	32643(94.17)	24173(87.40)	24178(92.44)
	M <sub>2</sub>	229(7.43)	513(4.52)	4647(26.15)	1946(6.55)	1395(4.02)	2569(9.29)	1535(5.87)
	M <sub>3</sub>	259(8.40)	1174(10.34)	1371(7.72)	950(3.20)	627(1.81)	917(3.32)	443(1.69)
Orhionmwon	M <sub>1</sub>	1628(80.00)	2125(69.06)	3269(76.11)	6529(90.91)	7039(92.86)	6223(97.07)	6063(97.92)
	M <sub>2</sub>	320(15.72)	436(14.17)	182(4.24)	144(2.01)	11(0.15)	18(0.28)	5(0.08)
	M <sub>3</sub>	87(4.28)	516(16.77)	844(19.65)	509(7.09)	530(6.99)	170(2.65)	124(2.00)
Ovia North East	M <sub>1</sub>	3784(90.53)	4712(80.59)	4451(91.02)	4588(94.58)	7609(80.27)	7117(72.36)	8895(68.07)
	M <sub>2</sub>	21(0.50)	838(14.33)	263(5.38)	211(4.35)	882(9.30)	1398(14.21)	2076(15.89)
	M <sub>3</sub>	375(8.97)	297(5.08)	176(3.60)	52(1.07)	988(10.42)	1321(13.43)	2097(16.05)
Ovia South West	M <sub>1</sub>	1737(98.47)	5268(97.77)	6416(96.58)	6074(92.96)	6306(91.30)	6217(91.56)	9957(92.43)
	M <sub>2</sub>	6(0.34)	28(0.52)	14(0.21)	128(1.96)	195(2.82)	225(3.31)	175(1.62)
	M <sub>3</sub>	21(1.19)	92(1.71)	213(3.21)	332(5.08)	406(5.88)	348(5.13)	641(5.95)
Owan East	M <sub>1</sub>	2743(67.20)	2019(74.83)	2470(76.14)	4168(80.37)	6064(85.84)	5995(89.21)	5438(89.35)
	M <sub>2</sub>	1165(28.54)	572(21.20)	527(16.25)	626(12.07)	280(3.96)	68(1.01)	143(2.35)
	M <sub>3</sub>	174(4.26)	107(3.97)	247(7.61)	392(7.56)	720(10.19)	657(9.78)	505(8.30)
Owan West	M <sub>1</sub>	1806(61.62)	1565(60.47)	1744(65.79)	2645(61.61)	2834(55.80)	2122(45.25)	1955(61.42)
	M <sub>2</sub>	823(28.08)	785(30.33)	625(23.58)	1143(26.62)	1712(33.71)	2259(48.18)	1084(34.06)
	M <sub>3</sub>	302(10.30)	238(9.20)	282(10.64)	505(11.76)	533(10.49)	308(6.57)	144(4.52)
Uhunmwonde	M <sub>1</sub>	4692(71.13)	5139(63.59)	6150(68.98)	4088(69.86)	11290(95.92)	15386(94.42)	14552(95.64)
	M <sub>2</sub>	779(11.81)	1058(13.09)	563(6.31)	343(5.86)	20(0.17)	0(0.00)	5(0.03)
	M <sub>3</sub>	1125(17.06)	1885(23.32)	2203(24.71)	1421(24.28)	460(3.91)	910(5.58)	658(4.32)

Key: M<sub>1</sub> – out-patient malaria cases, M<sub>2</sub> – in-patient malaria cases, M<sub>3</sub> – malaria cases in pregnant women

## 5. CONCLUSION

The increase in malaria incidence rates was widespread (derived Savanna and lowland rainforest; Urban and rural LGAs). This was corroborated by the rising proportions of in-patients and pregnant women recorded. Although these indicate that the National and State control strategies were apparently not very effective, there were signs of progress such as the reductions in the proportions of pregnant women reporting for treatment in two LGAs: Oredo, Igueben.

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## CONSENT

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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