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Prevalence of Malaria among Children 1 – 10 Years Old in Communities in Awka North Local Government Area, Anambra State South East Nigeria

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Abstract

Malaria is a major cause of illness and death especially among children under 5years old and pregnant women. It is estimated than more that more then one million children living in Africa especially in remote areas with poor access to health services die annually from direct and indirect effects of malaria (Fawale and Onadeko, 2001). Fatally affected children often die within less than 72h after developing the symptoms. In Nigeria, malaria consistently ranks among the five most common causes of death in children. As a result of increased mortality and morbidity there is need for proper understanding of the epidemiology of the disease among the most at risk groups. In the study of 1000 children, 1 -10 years old were randomly selected from 20 primary and 31 nursery schools in the four randomly selected

communities in Awka North LGA. Two milliliters venous blood was collected from each of the 1000 pupil (600 primary and 400 nursery) and stored in an anticoagulant specimen bottle. Thick and thin films were prepared, stained and examined for malarial parasite under the microscope using the oil immersion objective. Also both 12h human bait collection and pyrethrum knocked down methods were used for identification of types of mosquitoes found in the study communities. Malaria infection is most prevalent among 1-4 years old, highest being among 3 years old (76.4%), followed by 1 and 4 years old with 71.3 and 71.2% respective, and 62.04% for 2 years old. This decreased as the children get older. There was no significant difference in prevalence among the male and female pupils, with 59. 2 and 57.2%, respectively. The most prominent specie in the community is plasmodium falciparum (51.8%). Forty-three percent of the pupil positive for malaria had low parasitic diversity below 1000, 12.4% between 1000 and 10,000, 2.3% between 10,000 and 100,000 and 0.2% above 100,000. Malaria is a problem among pupil 1-10 years old especially from age 2 yeas when their immunity from mothers start reducing. There is need to ensure that mothers protect their children from mosquito bite by ensuring that they sleep under ITN.

Introduction

Malaria is a major public health problem and cause of suffering and premature death in tropical and subtropical countries (Cheesbrough, 1998). Malaria is, a major cause of illness and death in children. It is estimated that more than one million children living in Africa die yearly from direct and indirect effects of malaria infection (Fawole & Onadeko, 2001). This preventable disease has reached epidemic proportions in many regions of the world and continues to spread unchecked (W.H.O., 1998). African children under five years and pregnant women are most at risk of malaria. Fatally afflicted children often die less than 72 hours after developing symptoms. In those children who survive, malaria drains vital nutrients from them impairing their physical and intellectual development (W.H.O. ,1998). Malaria infections represent substantial social costs due to school absenteeism and reduced economic productivity. Malaria costs Africa up to US $12billion annually. A poor family living in malaria affected area may spend up to 25% or more of its annual income on prevention and treatment of malaria (W.H.O, 2000).

The *Plasmodium* species responsible for malaria infections in Nigeria are *Plasmodium falciparum, Plasmodium malariae and Plasmodium ovale.* Over

80% of malaria infections are caused by *P. falciparum* while up to 15% are caused by *P malariae* and less than 5% are caused by P ovale infections. Mixed infections with P falciparum are common (Federal Ministry of Health 1990, Orajaka, 1996). Mbanugo and Ejims (2000) in a study conducted in three hospitals and a Nursery School in Awka on prevalence of *Plasmodium* infections in children, discovered that out of 400 children, 233(58%) were positive and only *Plasmodium falciparum* were found. Among the positive cases 85.5% were observed in age group 2-3 while 33% was in 0-1 years indicating that the prevalence of *Plasmodium* infections among under 5 children is significantly affected by age. Sex in their findings did not affect prevalence rate. The major vectors of human malaria are *Anopheles gambiae, Anopheles funestus, Anopheles arabiensis and Anopheles melas. A arabiensis* is most dominant in the savannah areas and cities. *A gambiae* are found in highly dense forest areas, *A funestus* has an uneven distribution while A melas is a salt water species (Federal Ministry of Health, 1990). Anopheles mosquitoes can adapt to urban breeding sites over time eg, in India, *Anopheles Stephensi* has developed into urban species and is found in much higher numbers in many cities in India than in the surrounding country side (WHO,1988a). There is evidence that Anopheles mosquitoes are like wise becoming better adapted to the breeding site of Accra (Benneh et al, 1993).

Transmission of malaria is intense and stable in Nigeria because the intensity of attack remains constant throughout the year or from year to year. The degree of endemicity of malaria measured is based on the spleen rate in children aged 2-9 years as published by W.H.O. (1951) in their order of severity. Hypoendemic malaria occurs when spleen rate in children is less than 10%. Mesoendemic malaria occurs when spleen rate in children is 11-50%. Hyperendemic malaria occurs when spleen rate is 75% in children and > 25% in adults. Holoendemic malaria occurs when spleen rate is >75% in children but very low in adults.

In Nigeria, malaria is holoendemic in the rural areas and mesoendemic in the urban areas. In the southern part of the country the transmission rate is approximately uniform throughout the year. In the far North there is a marked difference between the high transmission rate in the short wet season and low transmission rate in the long dry season (Lucas & Gilles, 1998).

The main objective of this study was to find out the prevalence of malaria among children of 1 – 10 years old in Awka north Local Government area. The specific objectives include

1. To ascertain the prevalence of malaria parasite infections among children 1 - 10 years in four randomly selected communities in Awka North Local Government area.
2. To determine the predominant *Plasmodium species* causing the infection in the study area.
3. To determine the haematological values of the infected children.

The study was guided by the following research questions:

1. What is the prevalence of malaria among children of ages I to 10 years?
2. What is the prevalence of malaria among children by sex?
3. What is the parasite density in the children (*1 – 10 years old)* studied.?
4. What are the haematological values of the infected children?
5. What types of Plasmodium Species are identified among various age groups?

The following null hypotheses were stated and tested at 0.05 level of significance:

1. The number of male and female children infected by malaria does not differ significantly.
2. There is no significant difference in the prevalence of malaria by age of the children.

Methodology

The study is a descriptive survey aimed at finding out and describing the prevalence of malaria among children of 1 – 10 years old in the study area**.**

The study area is Awka North local government area in Anambra state (See Map Figure 1). The study communities lie within the humid tropical rain forest belt of Southeastern Nigeria. They belong to the Guinea Savanna Vegetation type with Localized clustered growth of deep-rooted tall tree (6 metres or more). They also have under growth of tall grasses mostly elephant grass, awolowo weed and climber trees with durable roots are common. This vegetation provides enough shade for breeding of mosquitoes both during and after the rainy seasons.

The main occupation of the people is subsistence farming. The main crops produced are yams, cassava, maize, rice and vegetables. The people live in scattered compounds surrounded by farmland with economic trees (palm trees, banana, mango, pear, bread fruit tree, e.t.c.). Apart from agriculture, the people engage in trading. Some of their agricultural products are sold for money. They supply food to other surrounding Local Governments Areas around, hence the name "Food Basket of the State". The nature of their occupation (farming) predisposes them to frequent mosquito bites.

Health care facilities: With the exception of Ebenebe, there is no secondary or tertiary health institution in the three remaining study communities. Each community however, has a health centre/post manned by health staff below the professional qualification of a doctor.

A visit was initially made to the palace of the four traditional rulers in each of the four selected study communities. The traditional rulers, after due consultations with their cabinet members, granted the research team permission to carry out the study. The venue of the study was arranged by the research team. Primary schools heads were also communicated prior to the team's visits. The research team also arranged blood samples collection days with the community heads and school heads. This was followed by announcements made through the churches and town criers in the four communities.

The research team consisted of, a Medical Doctor, three laboratory technicians, a researcher and one attendant. The Medical Doctor conducted physical examination on the children. This included watching out for any enlarged spleen on the children through simple palpation technique. The three experienced laboratory technicians assisted the researcher in the collection of blood samples. The attendant was engaged in maintenance of order.

Gifts of biscuit and candies were offered to the children after blood collection. The teachers in each of the schools visited helped in controlling the children. Consent was received from the parents before involving their children, hence, they co-operated.

The target population for this study consist of all children aged between 1 and 10 years in the four randomly selected communities out of ten communities that make up Awka North Local Government Area. A register containing names of all pupils who registered in all the nursery and primary

schools in all the communities in Awka North Local Government Area in 2002 academic year was collected and used for building the sampling frame.

A sample of 1000 children was made for the study. Based on a sample size of 1000 pupil, 60% of the total was allocated to the primary School pupil and 40% to nursery School pupil.

A two-stage cluster sampling was adopted for selection of target population. In the first stage, from ten communities with 7227 pupils 1 – 10 years old identified in (83 primary & 40 nursery schools) only four were sampled. The selected communities are Amanuke, Awba-Ofemili, Ebenebe and Mgbakwu.

To achieve the second stage in the selection of the target group from the selected communities, equal allocation technique was used in allocating the sample size to be selected in each school. This is to allow each school a chance to be equally represented in the study sample. In the four communities selected, there were a total of twenty primary schools, 30 pupils were then chosen at random from each school, ten from primary one, ten from primary two and ten from primary three. Also, there were 31 nursery schools in the selected communities and an average of 13 pupils was selected from each nursery school. Thus a total of 1000 pupils were selected and examined from the four communities.

Parasitological method

Collection of blood samples: 2ml Venous blood collection from each child was carried out on scheduled days using a tubing tourniquet tied to the upper arm of each of the children, after cleaning blood samples were collected and emptied into anticoagulant specimen bottles, already labelled with children's name and mixed gently.

This anticoagulant (EDTA) is used for haematological test. The chemicals therein, prevent blood from clotting by removing calcium (Cheesbrough 2000).

Preparation of blood film: The laboratory method employed for staining and identification of malaria parasites in collected blood samples was as described by (Cheesbrough (2000). Both thick and thin films were prepared. The thick film was prepared first because concentration of parasites is ensured by this type of blood film.

Examination of blood films: Both thick and thin smears prepared were examined microscopically under oil immersion. The immersion oil was

spread to cover about 10mm in diameter in the areas of the film. With the (X100) objective the stained slides were examined for malaria parasites.

Identification of malarial species: During the examination of stained films, if only one or two rings were found, it would be practically impossible to decide which species it was. However, small rings were found in large numbers and no other forms were present, it was almost certainly it is the malignant tertian parasite, P. falciparum. If large trophozoites were seen, this excluded malignant tertian except in moribund cases, and the identification rested between tertian and quartan malaria. If Schuffner's dots were present the differentiation between P.vivax and P.ovale depended on the appearance of the red cells and the character of the contained parasites.

If Schuffner's dots were not present, the parasite was probably P.malaria (Lock and Well, 1977). In all the slides examined during this work except three samples, ring forms were seen in large numbers with double chromatin dot. The schizonts were not seen but the gametocytes were clearly seen as crescent shaped or banana shaped. The host cells contained several parasites.

The gametocytes were small and round in shape with yellow – brown pigment. The schizonts were small with neatly arranged merozoites. The trophozoites seen appeared as "bird eye" ring. These features suggested that the three blood films were Plasmodium malariae.

Haemoglobin estimation using Cyanmethaemoglobin method was used for estimates.

Packed cell volume (P.C.V.): The packed cell volume also called haematocrit is used to screen for anaemia. It is suitable for screening large clinic populations (Cheesbrough, 2000). The principle behind packed cell volume was to have whole blood centrifuged for maximum red blood cell packing. The space occupied by the red blood cell was measured and expressed as a percent of the whole blood volume.

The researchers used the procedure of allowing well mixed anticoagulated blood to enter into the special capillary tube until approximately ¾ filled with blood. -the end of the haematocrit tube was sealed with plasticine. The filled capillary tube was placed in the grooves of the haematocrit centrifuge head. The sealed end was placed away from the centre of the centrifuge. The centrifuge was covered by screwing up the lid adequately and centrifuged for 5 minutes. The haematocrit tubes were removed as soon as the centrifuge has

stopped spinning – the tubes were read on the haematocrit tube reader. In this way, the PCV of each of the child was obtained.

$$\text{PCV \%} = \frac{\text{Length of red cell column (mm)}}{\text{Length of total column (mm)}} \times 100$$

Results

The total prevalence of malaria among the 1000 children examined was 582(58.2%). As shown in Table 1, malaria infection is most prevalent in children 3yrs old (76.40%,) followed by children of one year (71.30%), having the highest level of infection 4 year (71.20%,) 2 year old (64.42%), 5 year old 55.60%, 8 year old 54.50%, 7 year old 54.40%, 9 year old 50.50% and 10 year old 50.20% while children 6 year old are less infected (46.70%)

Table 2 shows that 296 (59.20%) out of the 500 male children examined had malaria parasites as against 286 or 57.20 percent of the 500 female children examined. In effect, Malaria is more prevalence among male children but it is not statistically significant.

Table 3 shows that generally 268 children (1-5yrs) old and 311 children (6-10yrs old) totalling 579 (57.9%) of the children sampled were infected with P. falciparium. Among those 6-10yrs, 3 children (0.5%) had P. malariae.

P. vivax and P. ovale were not identified in any of the group examined.

About 43.3 percent of the children positive for malaria had low parasite density below 1000. Also as shown in table 4 above 124 of the 582 infected children (12.4%) have a parasite density of between 1000 to 10,000 cmm.

Furthermore 23 children (2.3%) of the infected children had parasite density of between 10,000 and 100,000 cmm. Finally only 2 infected children (0.2%) have the very high parasite density of between 100,000 cmm and above.

As shown in table 5 the Hb value for the children 1–5 years infected with malaria parasites stood at 8.20g/dl with a PCV value of 24.84% while the Hb value for the same age group who are not infected stood at 10.89g/dl with PCV of 32.71%.

Also the Hb value of children 6 – 10 years infected with malaria stood at 11.24g/dl with PCV of 33.80%. While the Hb value of children 6 – 10 years not infected with malaria parasites stood at 12.18g/dl with PCV of 36.53%.

This shows that generally, infected children in the locality have low haematological values. This may be due to the presence of malaria parasites in their blood.

As shown in table 6, at 5 percent significant level and 9 degree of freedom, the calculated X^2 201.79 is greater than the critical X^2 value 16.90. Therefore the $H0_2$ is rejected and the alternative accepted. Then the researcher concludes that there is significant difference in the prevalence of malaria infection among children aged (1 – 10 years).

Discussion

Results show that 582 (58.2%) out of 1000 children involve in the study were positive for malaria parasites in their blood while children 1 - 3 years old have high infection prevalence of (76.40%). This agrees with the findings of Mbanugo and Ejim (2000), who reported that 0 -1 year olds had low prevalence for plasmodium infection. They attributed this to maternal derived antibodies. The markedly increase level of parasitaemia in children 2 -3 years old according to Mbanugo and Ejim (2000) could be attributed to the gradual loss of these maternally derived antibodies. Mbanugo and Ejim worked in urban area where children are more protected from mosquito bites. Children in the rural area where the present study was carried out are less protected and are more prone to mosquito bite.

Although it has been established that residual immunity derived from mothers could be very effective in younger children but environmental condition and inability of children of this age in the study area to ward-off environmental induced mosquito attack predisposed them to malaria attack than the better protected urban children.

The prevalence of malaria is lower among children above 5 years, this could be attributed to the fact that children of this age have developed immunity against plasmodium parasite (Brown, 1980).

Infection prevalence among the males and females showed that out of five hundred male children examined 296 (59.20%) of males were positive for malaria while out of five hundred(500) female children examined, 286 (57.20%) were positive for malaria. It appeared that malaria is more prevalent among male children, but at 5% level of significance the difference is not statistically significant. This also agrees with the finding of Mbanugo and Ejim (2000) who reported that sex did not affect the prevalence among

children. Displaced persons and refugees including children are very vulnerable to malaria. Malaria in refugee camps has been a major problem in the 1990's.

On the involvement of different species of *Plasmodium* in malaria parasitaemia of children 1 – 10 years, the study revealed that *Plasmodium falciparium* is the predominant specie found in the blood of children with malaria from 1 – 10 years old. Out of 400 blood sample from children 1 – 5 years old examined, 268 (67%) were positive for *Plasmodium falciparium* infections. Among 6 -10 years old out of 600 children examined, 311 or 51.8% were positive for *Plasmodium falciparium* infection while 3 (0.5%) had *Plasmodium malariae* infection. None of the children were positive for *Plasmodium vivax* and *Plasmodium ovale* infections.

These findings were in agreement with the previous studies carried out by Lucas & Gilles, (1998), Cheesbrough, (1998) and Coluzzi, (1997). All reported that *Plasmodium falciparum* is the main specie found in Tropical and Subtropical Africa and parts of Central America and South America. The study also showed that majority of the infected children had low parasite densities. For example, 433 out of 582 children have low parasite density. This represents 43.3 percent of the entire sample, while 124 of the 582 infected children have a parasite density of between 1000 to 10,000/cmm representing 12.4% of the entire sample studied.

Furthermore, 23 children, out of 582 infected children have the parasite density of between 10,000 and 100,000/cmm. Only two children out of the 582 infected cases have very high parasite density of between 100,000/cmm and above.

The low densities of parasitaemia seen in these children could be attributed to immunity derived from persistent attacks due to malaria. This agrees with the findings of Brown (1980) who stated that in hyperendemic areas, the disease is mild and asymptomatic in older children. Age and nutritional status of the host might represent natural or acquired resistance and can play a role in the severity of the disease produced.

With reference to haematological values of the infected children, low haemoglobin and packed cell volume were observed among infected children as shown in the analysis. The mean haemoglobin value (Hb) of the infected children 1 – 5 years is 8.20g/dl with mean packed cell volume (PCV) of 24.84% while the mean Hb value for the same age group of the non-infected

children is 10.89 g/dl with the mean PCV of 32.71%. Also, the mean Hb value of infected children in the age range of 6 – 10 years is 11.24g/dl with PCV of 33.80% while the Hb of children not infected with malaria in the same age range is 12.18g/dl with PCV of 36.53% This shows that infected children have lower haematological values than the non- infected children.

These findings agree with the findings of Okafor et al (2001), Cheesbrough (1998), Ukoli (1990) and Lucas & Gilles (1990) who reported that anemia as the commonest complication of malaria. among 1 -5 age groups.

Conclusion and recommendations

The study clearly showed that malaria is still possing problems in Awka North Local Government Area of Anambra State. The prevalent rate is still high among the younger age group (1 – 5 years.). The low haemoglobin and packed cell volume observed in the infected children showed that malaria plays an important role in causing anaemia in children.

For these reasons, the following recommendations were made:-

1. Public health education campaign for mothers and health care givers to create awareness that may lead to reduction of vectors of malaria infection and control of the disease especially in young children.
2. Free or subsidised insecticide treated bed nets(ITN) should be made available to mothers so that the infection of malaria could be controlled in children.
1. Mothers and other caregivers need to be empowered to treat malaria infection at home.

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Table 1: Prevalence of malaria by Age among Children 1 – 10 Years old

Age	Examined	Number No. Positive	Percentages of positive
1	87	62	71.30
2	108	67	62.04
3	123	94	76.40
4	59	42	71.20
5	36	20	55.60
6	90	42	46.70
7	46	25	54.40
8	77	42	54.50
9	93	47	50.50
10	281	141	50.20
	1000	**582**	**(58.2%)**

Table 2: Prevalence of Malaria by Sex

Source of Variation	**No. Examined**	**No. Positive**	**%**	**No Negative**	**%**
Male	500	296	59.20	204	40.80
Female	500	286	57.20	214	42.80
Total	1000	582	58.2	418	41.80

Table 3: Types of Plasmodium species involved in Malaria parasitaemia among Children 1-10 years.

Source of Variation	1-5yrs	N = 400	6–10yrs	N = 600
Species of Plasmodium	No Positive	%	No Positive	% No Positive
P. falciparium	268	67%	311	51.8
P. malaria	0	0	3	0.5
P. vivax	0	0	0	0
P. ovale	0	0	0	0
	268	67.0%	314	52.3%
Examined No.	400		600	

Table 4: The Parasite Density in 582 out of 1000 children who were positive for Malaria infection as shown in table 4

Source of Variation Parasite Density	**Range of Parasite per C.M.M.**	**No. Positive**	**%**	**Remark**
+ (1-10)parasite per 100 high power field)	Below 1,000	433	43.3	
++(11-100 parasite per 100 high power field)	1000-10,000	124	12.4	*
+++(1-10parasite in every high power field)	10,000-100,000	23	2.3	*
++++(more than 10 parasites in every high power field)	Over 100,000	02	0.2	
□□□□□□□□□		**582**	**58.2%**	

Sample Size – 1000 No. Negative = 418 or 41.8%.

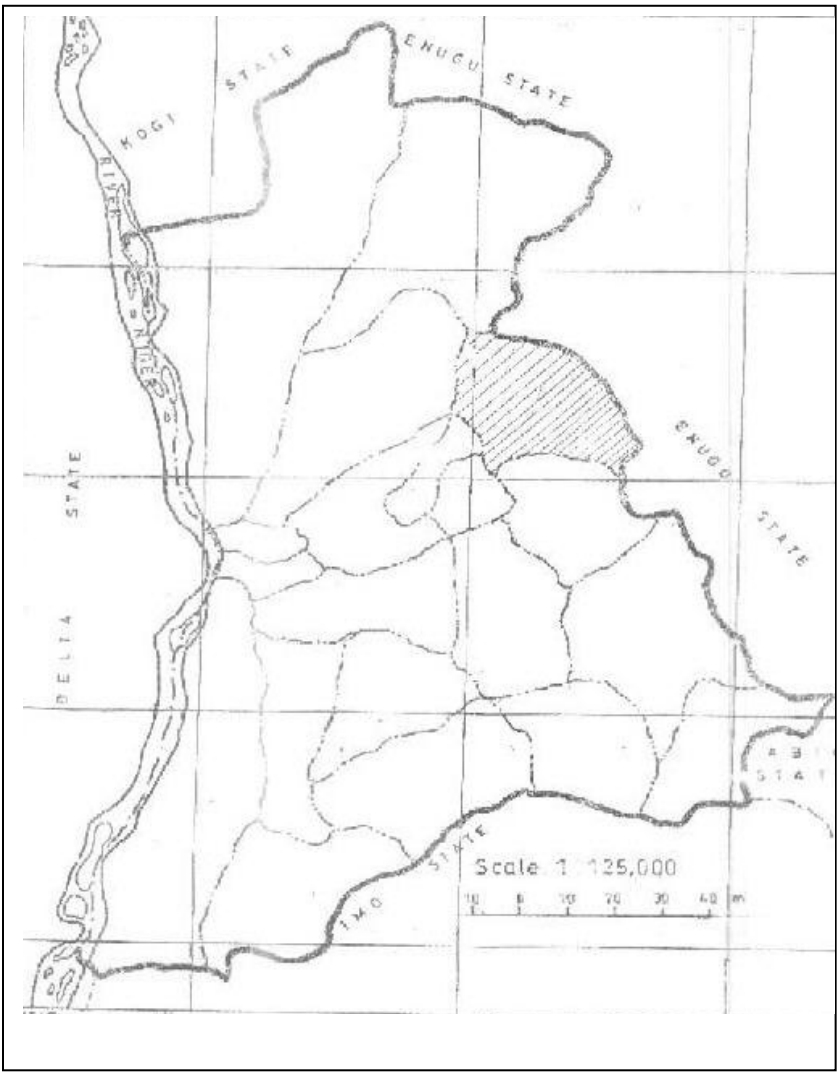
Table 5: Haematological Values of the Infected Children

Source of Variation cases	**Positive cases**			**Negative**		
	N	**Hb+X g/dl**	**PCV+X %**	**N**	**Hb-X g/dl**	**PCV-X %**
1-5 years children	268	8.20	24.84	132	10.89	32.71
6 – 10 years	314	11.24	33.80	286	12.18	36.53
Total	**582**			**418**		

Table 6: Summary of X^2 on the Ages of the Children Infected by Malaria

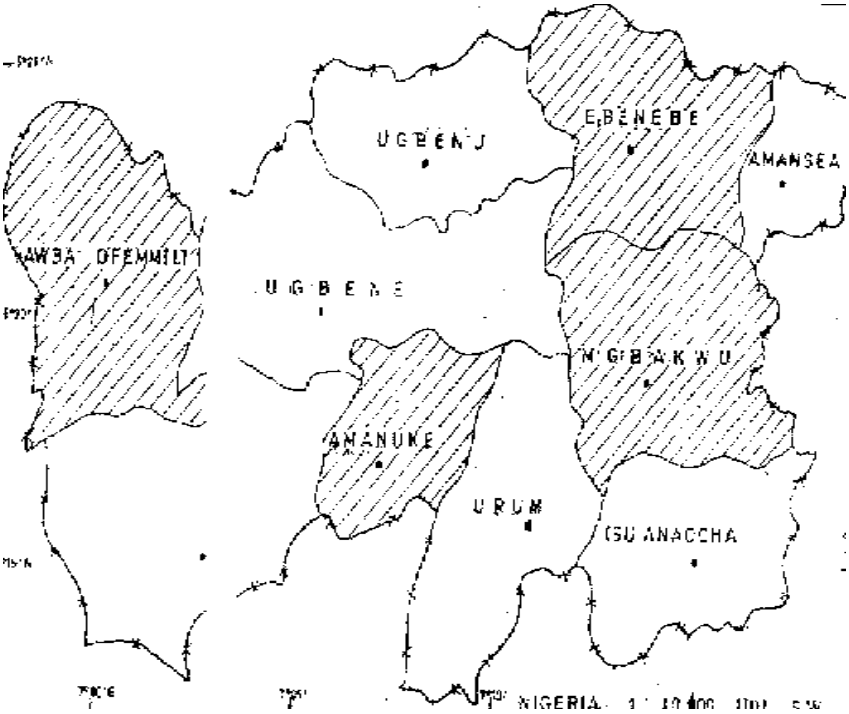
Source of Variation	No. Infected	df	Cal X^2	Crit X^2	P > 0.05
1-year-old	**62**				
2 years	**67**				
3 years	**94**				
4 years	**25**				
5 years	**20**				
6 years	**42**				
7 years	**42**				
8 years	**42**				
9 years	**47**				
10 years	**141**				
	582	**9**	**201.79**	**16.9**	**0.05**

* 0.05 = Significant



MAPS AND FIGURES

Fig: Map of Anambra Stae showing Awka North Local Government Area (the study communities



Map of Awka North L.G.A showing the four study communities

Source: National Population Commission