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A study of knowledge, attitude and practices regarding human activities and the breeding of mosquito vectors of human diseases in Ikeduru L.G.A., IMO state, Nigeria

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Abstract
Investigations on knowledge, attitude and practices of the human activities related to the breeding of mosquito vectors in Ikeduru L.G.A, Imo State, Nigeria were carried out. Descriptive survey method was used for the study. The towns were sampled using simple random sampling technique. Questionnaire and interviews were used to generate data. The binomial logistic regression method was applied in testing relationships between parameters. The findings revealed that increasing age was associated with an increased likelihood of having both knowledge and positive attitude associated with human activities on mosquito species. Results further indicated that increase in age was associated with decreased likelihood of participants practicing human activities that contribute to breeding of mosquito species. Findings also revealed that males were 7.026 times more likely to have knowledge associated with human activities on mosquito breeding than their female counterparts. Females were more likely to exhibit positive attitude associated with human activities on mosquito species than male counterpart. Males were more likely to practice the human activities that contribute to breeding of mosquito than females. It was recommended that indiscriminate dumping of refuse should be discouraged. Educating the masses on the activities that favor rapid breeding of mosquitoes in the area should be encouraged. Planting of mosquito repellant herbs near human habitation should be encouraged. Vulcanizers should be enlightened on the dangers of storing water in unused tires. Cassava and Maize Processors should disinfect their environment at least once in two weeks.

Keywords: human activities, breeding, mosquito species, positive attitude, repellant herbs

Introduction
Mosquitoes are obnoxious insect of high economic importance and those that bite humans act as vector for many infectious diseases infecting 214 millions of people per year with malaria parasites, killing approximately 438,000 people each year (WHO, 2006) [22]. Notably, same literature reported that Sub-Saharan Africa records 90% of all malaria deaths worldwide. In Nigeria, several efforts have been geared towards improving malaria situation by distributing long-lasting insecticide-treated nets in various communities of the region through Federal, State, and Local Ministries of Health. Irrespective of control and preventive measures taken against malaria, it has continued to be first amongst the notable prevalent and severe parasitic infections (WHO, 2003; 2006; 2013) [22-23]. The knowledge of mosquito breeding habitat- as it is influenced by human activities and reasons for site preference are indispensable in mosquito control and prevention of disease transmission. Though mosquitoes bred everywhere, human activities and behavior create more and renewed diversity in the occurrence and proliferation of mosquito species and Ikeduru L.G.A., Imo State, Nigeria is not excluded. In spite of mosquito's ubiquitous nature, impact of human activities, behavior and high reproductive potential of the insect vector, there is dearth of information on the knowledge, attitude and practices regarding human activities and the breeding of mosquito vectors of human diseases in the study area.
Mosquito's occurrence and the diseases it transmits, emerging or re-emerging in nature, are consequences of environment-stressed activities whose resultant modification alter the vector's

habitat thereby creating variations that influence the chances of their survival (Nwoke *et al*., 2003) [10]. The management of diseases transmitted by mosquito, become a heavy liability as human population, industrial activities and material consumption expand (WHO, 2013) [23]. Vast socio-economic development activities such as agro-forestry, crop production, hydroelectricity, water resources development, automobiles, house and road construction work which are undertaken by man alter the living ecosystem thereby creating breeding sites and habitats for mosquito and other vectors of parasitic diseases (Nwoke *et al*., 1993; Onyirioha, 2005) [10, 11]. Mosquito has made use of opportunity created due to unplanned urbanization in most tropical countries and the associated poor solid waste collection which yield waste containers to breed in profusion (Hii, 1977; Service, 1980) [7, 17]. Breeding opportunities observed among mosquitoes are often expanded by inadequate piped water supplies in rapidly expanding areas of poor housing as well as the storage of rain water, water from wells and street stand-pipes and a variety of containers for domestic and livestock use (Barrera *et al*., 2006) [1]. Agricultural practices which include irrigation especially during rice cultivation, use of ponds for fish farming; the soaking of cassava in water in uncovered plastic containers are human-based practices which exacerbate mosquito problems. These developments which create conditions that favor the breeding of mosquitoes exist due to the peridomestic environment and many settlements in Imo State, Nigeria. Peterson and Lembercht (1976) [14] observed that traditional water storage in pots in settlements in Anambra South-Eastern Nigeria provided all year round peridomestic breeding site for 18 species of mosquitoes. According to Onyirioha (2005) [11], 19 different mosquito species were identified in Imo State with the prevalence of 45.3% in Owerri zone where Ikeduru L.G.A. is situated, 29.3% in Okigwe zone and 25.4% in Orlu zone. Thus, it is easily discernible that the inhabitants of Ikeduru L.G.A. could be exposed to a great risk of diseases transmitted by mosquito vectors. This study area was selected because previous studies had used Imo State to study mosquitoes associated with human activities and their local controls (Onyirioha, 2005) [11]. During the period of previous studies, there was low human population and the houses were few (this is supported by literature). However, it is important to note that over the last 10 years, the habitat conditions that were prevailing during that period have changed over time. According to Tripis (1971) [19], there was abundance of plants: herbs and trees, the leaf axils of these plants and tree holes were the main breeding habitats of mosquitoes. Today, human activities are significantly contributing to environmental modifications especially in urban areas, thereby increasing mosquitoes breeding habitats. It will be assumed that the current significant increase in human population and associated activities could have led to creation of potential breeding habitants for mosquito. Therefore, it is necessary to carryout studies on the current knowledge, attitude and practices associated with human activities on breeding of mosquitoes. The present paper reports the results of a survey carried out to assess the knowledge, attitude and practices regarding human activities and the breeding of mosquito vectors of human diseases in Ikeduru L.G.A., Imo State, Nigeria with the following hypothesis:

i. There is no significant relationship between the socio-demographic characteristics of participants and knowledge associated with human activities on mosquito species.
ii. There is no significant relationship between the socio-demographic characteristics of participants and attitude associated with human activities on mosquito species.
iii. There is no significant relationship between the socio-demographic characteristics of participants and practices associated with human activities on mosquito species.

Materials and Methods

Area of Study

Ikeduru is geographically located between latitude 5^0 45'N and 6^0 58' E and longitude 5^0 34' N and 7^0 4' E in the western part of Imo State, in South-East Nigeria, West Africa. According to the data of 2006 census, the cosmopolitan city has a population of 175,720 people. It has eight months of rainfall (April to November) and four months of dry season (November to March). There are instances of rain in the dry period of year. The mean annual rainfall is 2000 mm while the mean daily temperature varies from 23.5 ^{0}C in the rainy season to 31.1 ^{0}C in the dry season. It shares boundary with Mbaitoli (Ogwa to Orodo), Isiala Mbano (Atta to Ibeme) and Ahiazu Mbaise (Ugiri to Obohia). The inhabitants of Ikeduru are predominantly farmers, traders, civil servants and merchants who are typically Igbos and few Immigrants. The study sites are characterized by man-made polluting sources such as plastic cans, shallow ground pools, discarded household materials, indiscriminate dumping of tires and refuse and gardens of plantain and pineapple.

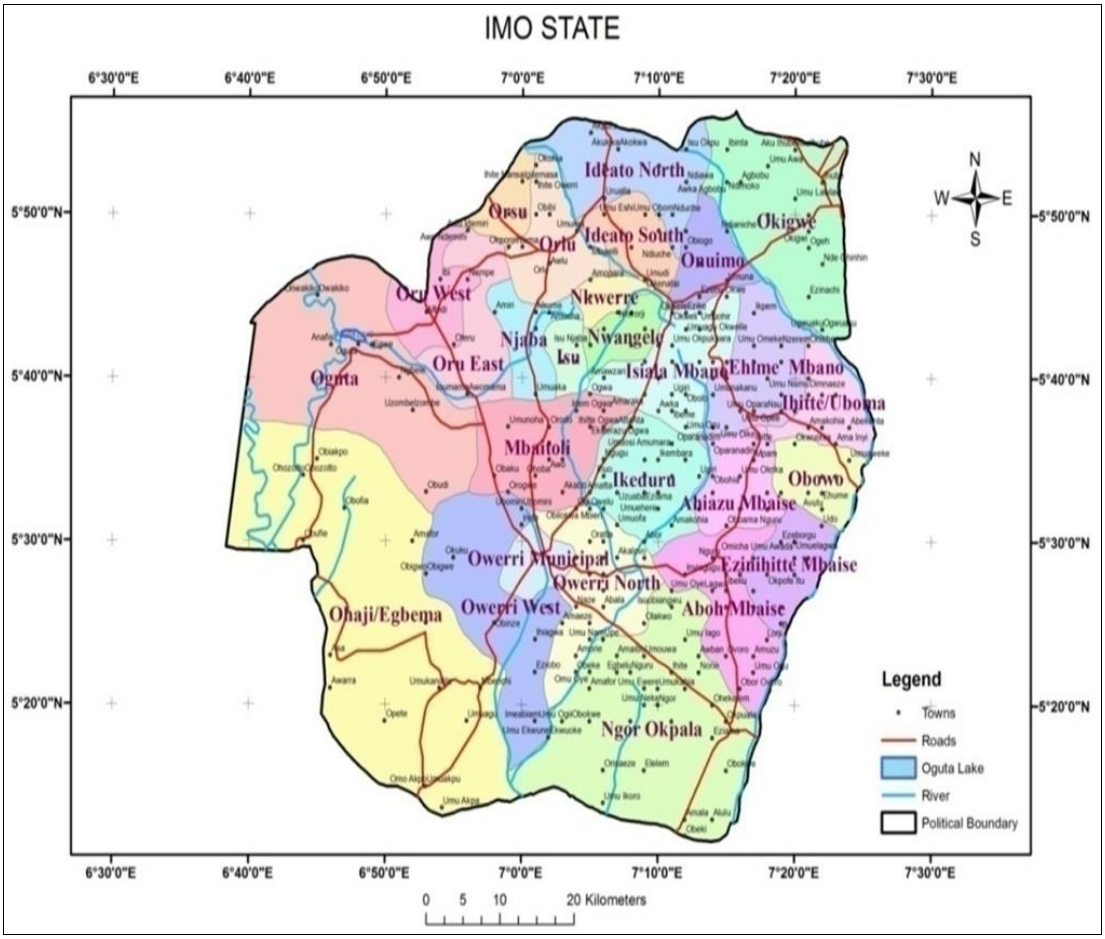

Fig 1: Map Representing Imo State and the Neighbor Towns

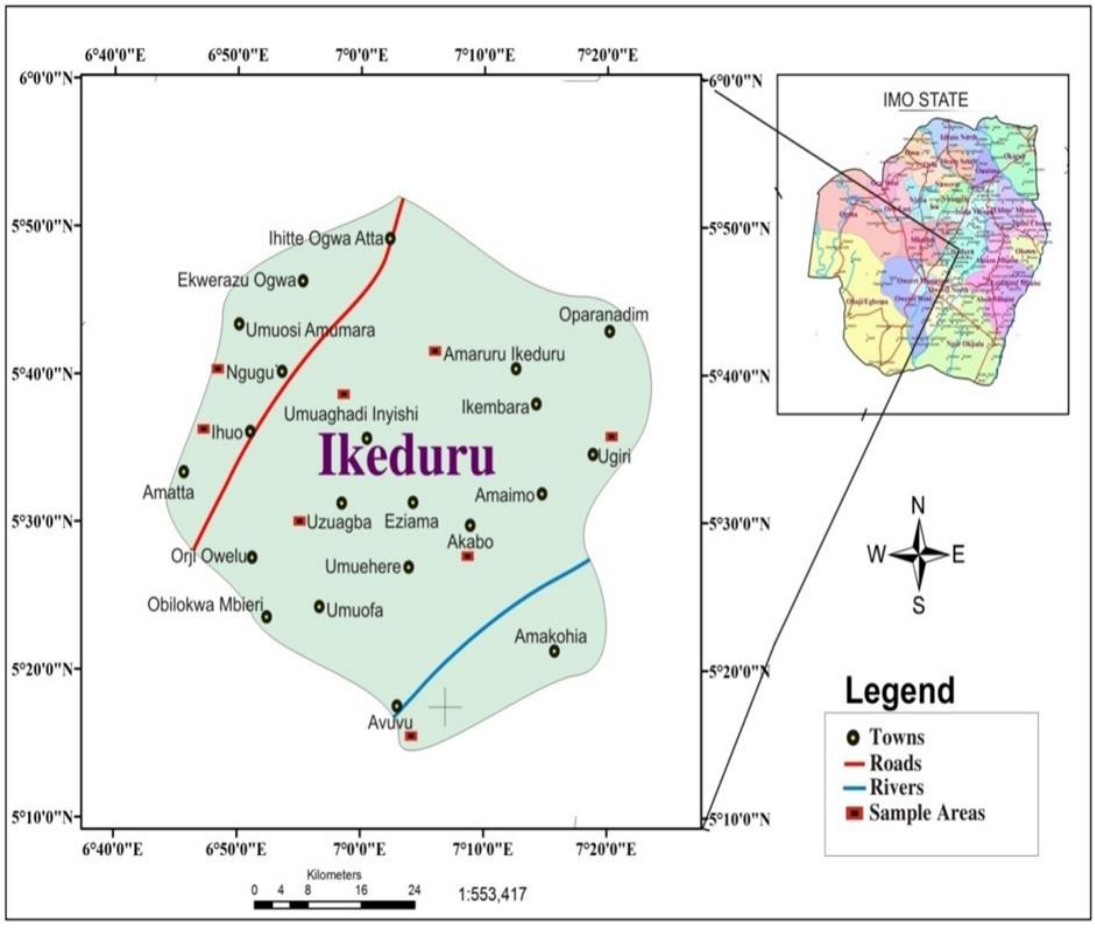

Fig 2: Map Representing Ikeduru L.G.A. and the Sampled Locations

Preliminary Survey

Prior to field investigations, the study area (Ikeduru, Imo State, Nigeria) was visited. The focus of the preliminary interactions was to establish best community liaison, gain insight into the people's culture, have deeper access to live experiences of human activities that encourage the breeding of mosquitoes in the area and conduct a pilot test using the structured questionnaire.

Research Design, Sampling Size and Sampling Technique

A descriptive survey research design was adopted. The study was conducted between June and September 2019. Eighty (80) households were sampled (10 from each town sampled) employing a systematic sampling method. Six vector collecting sites were randomly selected from each town in the study area for the "knowledge, attitude and practices" study. Households located within a 50 m radius from each site were listed by doing a social mapping. Five adult members were selected from each household sampled. Taro Yamani sampling method was used in calculating the sampling size from the population of the Local Government Area as follows.

$$n = \frac{N}{1 + N(e)^2}$$

n = sample size; N= population; e= 0.05.

Healthy individuals aged 15 years and above were considered. Fresh inhabitants and those who migrated from other districts and countries within the past six months were excluded. Individual members of household (either the Head or the family members) were the study participants.

Instrument for Data Collection and Validation

The instrument used for data collection was a well-structured questionnaire. The questionnaire consisted of (i) socio-economic information such as age, gender, marital status and occupation, (ii) knowledge of association of human activities on breeding of mosquitoes (iii) attitude towards association of human activities on breeding of mosquito species (iv) practices towards association of human activities on breeding of mosquito species. The Knowledge Attitude and Practice questionnaire used was validated both for face and contents validity by experts in the Departments of Sociology and Measurement and Evaluation of Alvan Ikoku Federal College of Education, Owerri, Nigeria.

Reliability Test

The questionnaire was pre-tested on the members of the Community in Ikeduru L.G.A., Imo State, Nigeria. The pre-test result was not included in the final analysis. Cronbach's Alpha Coefficient (Cronbach, 1951) [2] was used to assess the reliability coefficient which is a measure of the internal consistency of questionnaire.

Statistical Analysis

Data obtained in the study were analyzed using simple percentage, frequency table and chart. The hypotheses were subjected to Binomial logistic regression using SPSS (Statistical Package for the Social Sciences) version 21. A probability level of 0.05 was considered for all statistical inference.

Results

Response Rate on Knowledge, Attitude and Practices of the People

A total of 400 questionnaire copies were distributed and collected so as to address and ascertain the level of knowledge, attitude and practices associated with human activities on mosquitoes species in Ikeduru L.G.A. After sorting and coding, the results of socio-economic information showed that 393 questionnaires were usable while 7 were found to be unusable; this gave a response rate of 98.25%. The results of socio-economic information were analyzed using Figures 3 to 6 and Tables 1 to 12.

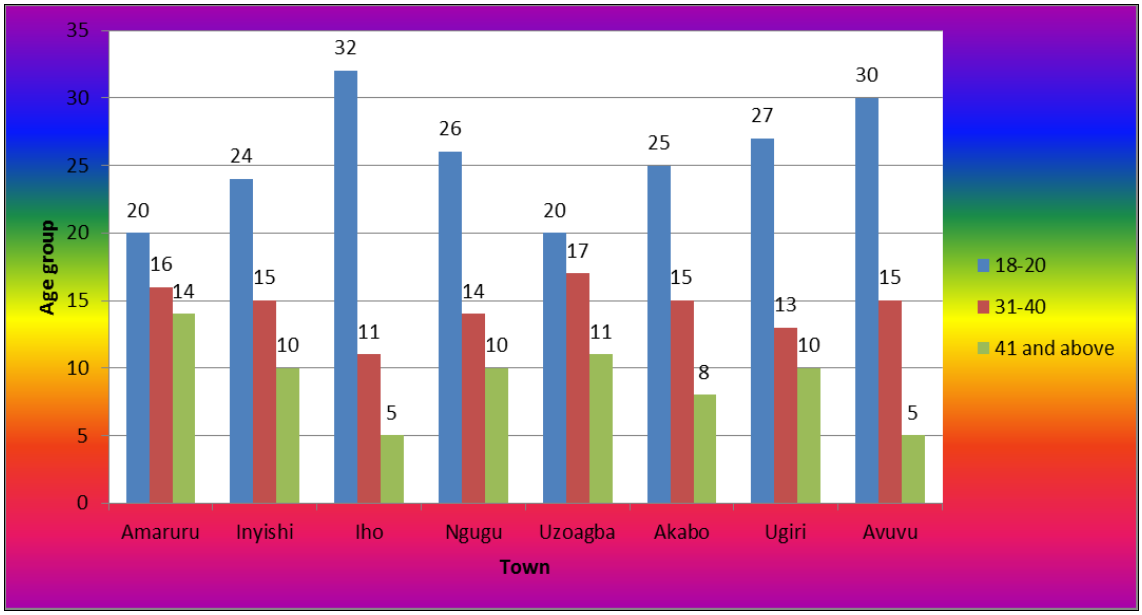

Fig 3: Different age responses in the sampled towns in Ikeduru, Imo State, Nigeria

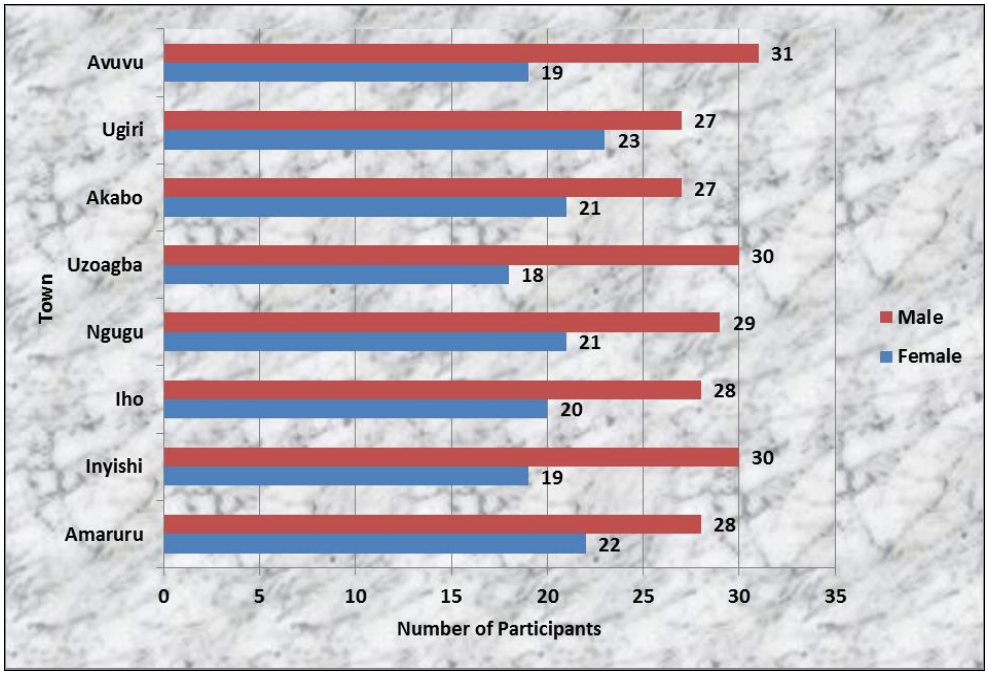

Fig 4: Different sex responses in the sampled towns in Ikeduru, Imo State, Nigeria

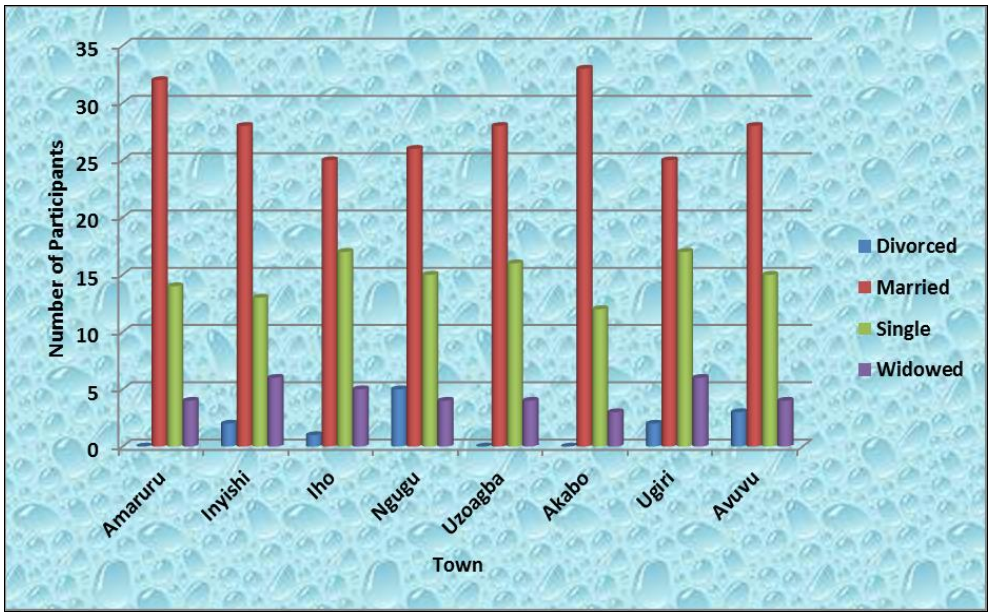

Fig 5: Different marital status responses in the sampled towns in Ikeduru, Imo State, Nigeria

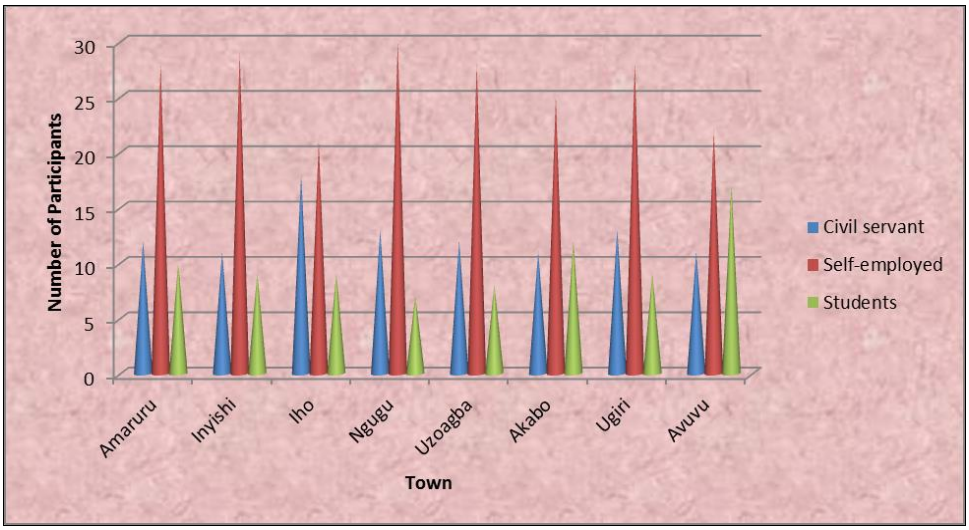

Fig 6: Occupational response in the sampled towns in IKeduru, Imo State, Nigeria

Table 1: Model summary for the relationship between social demographic characteristics and knowledge

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	35.893[a]	.451	.904

Source: SPSS Output

From Table 1, three models were outputted from the SPSS carried out; however Nagelkerke R square was applied because it is the most recent model. The result showed a Nagelkerke R square-value of 90.4%, which indicates the strength of association between the variables.

Table 2: Classification table on knowledge of the people with respect to breeding of mosquitoes

			Predicted		
	Observed		Knowledge		Percentage Correct
			No	Yes	
Step 1	Knowledge	No	36	7	83.7
		Yes	0	350	100.0
	Overall Percentage				98.2
a. The cut value is .500					

Source: SPSS Output

Table 2 shows that it was predicted that 36 respondents would say NO which was also observed to be NO, while 7 respondents that were predicted to say YES was observed to have indicated NO, which is 83.7% correct. It was also predicted that 350 respondents would say YES, which was also observed to be YES, which is 100% correct. This gave an overall percentage classification of 98.2%. This was a significant observation.

Table 3: Chi Square value of the whole model

		Chi-square	Df	Sig.
Step 1	Step	235.505	4	.000
	Block	235.505	4	.000
	Model	235.505	4	.000

Source: SPSS Output

Table 3 shows the Chi-square value of the whole model, which indicated a significant relationship; X^2=235.505 at df = 4; $p < 0.05$.

Table 4: Variables in the equation

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Age	17.984	4410.512	9.132	1	.007	1.089	1.030	1.151.
	gender(1)	38.204	6402.301	2.134	1	.003	7.026	1.348	36.625
	Marital status	20.974	2885.224	.065	1	.394	1.006	.962	1.051.
	occupation	15.572	4440.544	4.266	1	.022	.906	.824	.995.
	Constant	81.839	7635.517	.253	1	.615	.187		
a. Variable(s) entered on step 1: age, gender, marital status, occupation.									

$$Knowledge = 17.984age + 38.204gender + 20.974marital_{status} + 15.572occupation + 81.84$$

A binomial logistic regression was performed to ascertain the effects of age, sex, marital status and occupation on the likelihood that participants have knowledge associated with human activities on breeding of mosquitoes. The logistic regression model was found to be statistically significant, $\chi 2(4) = 235.505, p < 0.05$. The model explained 90.4% (Nagelkerke R^2) of the variance in knowledge associated with human activities on mosquito breeding and correctly classified 98.2% of cases. Increasing age was associated with an increased likelihood of having knowledge associated with human activities on mosquito breeding (Wald = 9.132, $p < 0.05$). Males were 7.026 times more likely to have knowledge associated with human activities on mosquito breeding than their female counterpart (Wald = 2.134, odd ratio = 7.026, $p < 0.05$). A significant relationship was found to exist between occupation and knowledge (Wald = 4.266, $p < 0.05$), however, no statistically significant relationship was found to exist between marital status and knowledge associated with human activities on mosquito breeding (Wald = 0.65, $p > 0.05$). Therefore, the null hypothesis which asserted that there was no significant relationship between the socio-demographic characteristics of respondents and knowledge associated with human activities on mosquito breeding is hereby rejected and alternate hypothesis accepted.

Table 5: Model summary for the relationship between social demographic characteristics and attitude of the people

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	9.195[a]	.605	.985

From Table 5, three models were outputted from the SPSS; however Nagelkerke R square was used and it is the most recent model. Nagelkerke R square-value of 98.5% was recorded and this implies considerable strength of association between the variables.

Table 6: Classification table on attitude of the people with respect to breeding of mosquitoes

			Predicted		
	Observed		Attitude		Percentage Correct
			No	Yes	
Step 1	Attitude	No	72	0	100.0
		Yes	1	320	99.7
	Overall Percentage				99.7
a. The cut value is .500					

As shown in Table 6, it was predicted that 72 respondents would say NO and the observation was NO. Zero respondent was predicted to say YES was observed to have indicated NO. It was predicted that 320 respondents would say YES and it was observed to be YES. It was predicted that 1 respondent will indicate NO but was observed to have said YES which is 99.7% correct. This gave an overall percentage classification of 99.7%.

Table 7: Omnibus tests of model coefficients

		Chi-square	Df	Sig.
Step 1	Step	365.115	4	.000
	Block	365.115	4	.000
	Model	365.115	4	.000

Table 7 shows that the chi-square value of the whole model indicated a significant relationship. X^2=365.115 at df = 4 p < 0.05.

Table 8: Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1[a]	Age	22.944	.465	4.123	1	.006	1.233	1.102	1.567
	gender(1)	38.093	.926	5.132	1	.015	0.121	1.981	2.415
	Marital status	15.909	.340	1.231	1	.003	1.091	.998	1.213
	Occupation	-.618	.670	7.218	1	0.011	0.941	.670	1.323
	Constant	76.736	3.888	.219	1	.712	0.129		
a. Variable(s) entered on step 1: age, gender, marital status, occupation.									

$$Attitude = 22.944age + 38.093gender + 15.909marital_{status} - 0.618occupati + 76.74$$

A binomial logistic regression was performed to ascertain the effects of age, sex, marital status and occupation on the likelihood that participants in the area have positive attitude towards factors associated with breeding of mosquito species. The logistic regression model was found to be statistically significant, $\chi 2(4) = 365.115$, $p < 0.05$. The model explained 98.5% (Nagelkerke R^2) of the variance in positive attitude associated with human activities on mosquito species and correctly classified 99.7% of cases. Increasing age was associated with an increased likelihood of having positive attitude associated with human activities on mosquito species (Wald = 4.123, $p < .05$). Females were found to be more likely to have positive attitude associated with human activities on mosquito species than their male counterpart (Wald = 5.132, odd ratio = 0.121, $p < .05$). A significant negative relationship was found to exist between occupation and attitude (Wald = 7.218, $p < 0.05$). Similarly, statistically significant relationship was found to exist between marital status and attitude associated with human activities on breeding of mosquito species (Wald = 0.03, $p < 0.05$). Therefore, the null hypothesis which states that there is no significant relationship between the socio-demographic characteristics of participants and attitude associated with human activities on mosquito species is hereby rejected and alternate hypothesis accepted.

Table 9: Model summary for the relationship between social demographic characteristics and practice

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	47.973[a]	.519	.904

In Table 9, three models were outputted from the SPSS; however Nagelkerke R square, the most recent model was applied. The result showed a Nagelkerke R square-value of 90.4%, which reflects the strength of association between the variables.

Table 10: Classification table on practice of the people with respect to breeding of mosquitoes

	Observed		Predicted		
			Practice		Percentage Correct
			No	Yes	
Step 1	Practice	No	60	0	100.0
		Yes	13	320	96.1
	Overall Percentage				96.7
a. The cut value is .500					

Table 10 shows that it was predicted that 60 respondents would say NO which was accordingly observed to be NO. Zero respondent that was predicted to say YES was observed to have indicated NO. It was predicted that 320 respondents would say YES and they did. It was predicted that 13 respondents would indicate NO but was observed to have said YES which is 96.1% correct. This gave an overall percentage classification of 96.7%.

Table 11: Omnibus tests of model coefficients

		Chi-square	Df	Sig.
Step 1	Step	287.897	4	.000
	Block	287.897	4	.000
	Model	287.897	4	.000

Table 11 shows the chi-square value of the whole model, which indicated a significant relationship. $X^2 = 287.897$ at df = 4 $p < 0.05$.

Table 12: Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Age	-.043	.145	3.192	1	.002	3.121	1.006	3.567.
	gender(1)	.026	.891	3.331	1	.001	1.232	2.081	2.415.
	Marital status	.920	.033	2.121	1	.004	1.211	.906	1.321
	Occupation	.594	.072	2.344	1	.012	2.338	.670	3.193.
	Constant	-1.833	3.213	.211	1	.029	.789		
a. Variable(s) entered on step 1: age, gender, marital status, occupation.									

$$Practice = -0.43age + 0.026gender + 0.920marital_{status} + 0.594occupation - 1.833$$

A binomial logistic regression was performed to ascertain the effects of age, sex, marital status and occupation on the likelihood that participants practice the human activities that contribute to breeding of mosquito species. The logistic regression model was found to be statistically significant, $\chi 2(4) = 287.897, p < 0.05$. The model explained 90.4% (Nagelkerke R^2) of the variance in positive attitude associated with human activities on mosquito species and correctly classified 96.7% of cases. Increasing age was associated with a decreased likelihood of participants practicing the human activities that contribute to breeding of mosquito species (Wald = 3.121, $p < 0.05$). Males were found to be more likely to practice the human activities that contribute to breeding of mosquito species than their female counterpart (Wald = 3.331, odd ratio = 2.081, $p < 0.05$). A significant relationship was found to exist between occupation and practice (Wald = 2.344, $p < 0.05$). Significant relationship was found to exist between marital status and practice associated with human activities on breeding of mosquito species (Wald = 2.121, $p < 0.05$). Therefore the null hypothesis which says there is no significant relationship between the socio-demographic characteristics of participants and practices associated with human activities on mosquito species is hereby rejected and alternate hypothesis accepted.

Result of Reliability Test

The result showed that Cronbach's Alpha Coefficient of knowledge, attitude and practice domain was 0.7. This shows that the questionnaire was reliable.

Discussion

After a decade, with reported cases followed by a series of outbreaks of mosquito-borne diseases there were no studies on knowledge, attitude and practices of human activities and their associations with breeding of mosquitoes in the country except research work-based studies which are not on knowledge, attitude and practice (Gratz, 2004; Pandey *et al*., 2004; Malla, 2008; Gautam *et al*., 2009, Pun, 2011; Sedhain *et al*., 2011; Gautam, 2012, Dumre *et al*., 2013) [6, 12, 8, 4-5, 16, 3]. The findings of this study suggest that increasing age was associated with an increased likelihood of having knowledge associated with human activities on mosquito breeding. Males were 7.026 times more likely to have knowledge associated with human activities on mosquito breeding than their female counterpart. The results revealed that occupation and knowledge were significantly related whereas; marital status and knowledge were not, in terms of their association with human activities on mosquito breeding. The level of knowledge of human activities associated with the breeding of mosquitoes are comparable to findings of similar studies in India, Pakistan, Thailand and Jamaica (Van Benthen *et al*., 2002; Shuaib *et al*., 2010; Mayxay *et al*., 2013) [20, 18, 9]. The higher knowledge level among study participants in the Ikeduru L.G.A. may be due to relatively frequent mosquito-borne disease outbreaks in the recent years and occasional awareness programmes at the time of outbreaks (Malla *et al*., 2008; Pandey *et al*., 2008; Dumre *et al*., 2013) [8, 13, 3]. Increasing age was associated with an increased likelihood of having positive attitude associated with human activities on mosquito breeding. Females were likely to have positive attitude associated with human activities on mosquito breeding than their male counterpart. The results further revealed a significant inverse relationship between occupation and attitude; also marital status and attitude were related in terms of association with human activities on breeding of mosquito species. The higher positive attitude associated with human activities on mosquito breeding found among female individuals is in agreement with information in literature. These authors noted the major role of women in domestic assignments which invariably have relationships with rapid breeding of mosquito species.

Increasing age was associated with a decreased likelihood of participants practicing the human activities that contributed to breeding of mosquito species. Practices of the human activities that contribute to breeding of mosquitoes favored males. It was also revealed that occupation and practice are strongly linked; same with marital status and practice as they are associated with human activities on breeding of mosquito species.

Furthermore, as the age increases the people had a higher probability of good attitude and decreased likelihood of participants practicing the human activities that contribute to breeding of mosquito species. This underscores how important age is for changing the attitude and practice levels of people's prediction that age will make people more aware of the human activities that contribute to breeding of mosquito species. Findings showed that occupation, knowledge and practice were significantly and directly connected whereas; occupation and attitude were negatively related. Precisely, the correlation between occupation and knowledge only was higher compared to occupation and attitude and occupation and practice. These notable observations are supported by literature.

Conclusion and Recommendations

From the results of this study, it can be concluded that the elimination of the human activities that contribute to breeding of mosquito species and their allied diseases is quite difficult to be achieved. This is because the people are aware of the factors that encourage the breeding of mosquito vector but

because of poor economic conditions, they cannot stop such human activities which include local processing of cassava and maize, crude vulcanizing workshops, planting of plantains and ornamental plants near human habitation; indiscriminate dumping of refuse and indiscriminate disposal of discarded household materials. In other words, people of the area have compromised environmental sanitation to favor rapid breeding of mosquito species because their poor financial status would not permit total compliance to standards that will significantly limit the proliferation of mosquitoes in the area (inferred from questionnaire). Therefore, enlightening the masses on the effect of the practices that encourage the breeding of these vectors (detrimental to their health) is recommended. Planting of mosquito-repellant herbs around the houses, as ornamental plants such as lemon grass, rosemary and a host of others should be considered. Vulcanizers should be enlightened on the dangers of stored waters in the unused tires in their workshop which they see as one of the factors that attract customers to their shop. Cassava and Maize Processors should apply insecticides in their environment at least once in two weeks. These measures will help to check rapid breeding of mosquito species in Ikeduru, Imo State, Nigeria.

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