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Formal Education Related Pattern of Awareness and Basic Knowledge on Zika Virus Disease, among Women Visiting Children Immunization Unit in a Tertiary Hospital, Southeast Nigeria

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Abstract

Zika virus is transmitted through the bite of infected *Aedesa egypti*, or *Aedes albopictus* mosquito, and re-emerged as a disease of global public health importance in March/April 2015 in Brazil. The objective of this study is to assess the formal education related pattern of awareness, and basic knowledge on Zika virus disease, among women visiting children immunization unit in a tertiary hospital, in Nigeria. Study was conducted in 2016/2017 with 256 randomly selected respondents. Semi-structured questionnaire was used in the cross-sectional study. Findings including 77.8% of respondents with postgraduate educational qualification were aware that there is a disease known as Zika Virus Disease (ZVD), 62.0% for tertiary education qualification, 53.8% for secondary education level, 20.0% for primary education level, while none of the three respondents that had no formal education were aware of ZVD. The level of awareness increased with increasing educational qualification. These findings were analyzed using the Likelihood Ratio which was calculated to be 28.329, with *P*-value of <0.001. Television was the commonest source of first ZVD information. Overall mean percentage knowledge level of the different educational groups revealed as followed; no formal education 22.2%, primary level 12.0%, secondary level 46.1%, tertiary level 54.4%, and postgraduate level was 51.5%. The mean for the stated scores was 37.2%. Students' T-Test at 95.0% confidence interval was 0.012, showing that the difference in the mean percentage scores between the groups was significant. Respondents with tertiary and postgraduate education qualifications recorded overall mean score above 50.0% each, while secondary, primary, and no for-

mal education groups recorded overall mean percentage scores below 50.0%. Stepping up ZVD health education and awareness activities, especially among women with educational qualification below tertiary level will greatly improve the awareness and knowledge on ZVD among this study population.

Keywords

Education, Awareness, Knowledge, Zika Virus

1. Introduction

Zika Virus Disease (ZVD) is arthropod-borne infection that is caused by a flavivirus known as Zika virus, and transmitted mainly through the bite of infected *Aedesa egypti*, or *Aedes albopictus* mosquito [1]. These species of mosquito vector also transmit Yellow fever, Dengue fever, and Chikungunya virus diseases [2]. This virus was first isolated in rhesus monkey in the Zika forest of Uganda in 1947. The transmission to the monkey was through the bite of infected Aedes Africanus mosquito [3]. Though infection in man was detected in Nigeria in 1952, and reported in 1954 [4]; and also in Uganda and the United Republic of Tanzania in the same 1952 [5]. Up, until 2007 when the first major outbreak of ZVD occurred in Yap Island (Micronesia), only about 14 cases of the infection in man had been documented [6]. This outbreak in Yap Island had about 73% of the residents older than 3 years getting infected [7]. The next recorded cases of ZVD outbreak were recorded in French Polynesia in 2013 where about 30,000 cases were reported [8].

Over the years, some cases of ZVD were reported in some endemic parts of Africa, and also in Southeast Asia, Americas and Caribbean [9] [10]. The infection re-emerged as a disease of global public health importance in March/April 2015 in Brazil [11] [12]. In the distant past, ZVD was known to present with non-specific symptoms such as fever, joint pains, conjunctivitis, and malaise, with about 80% of the cases being asymptomatic [5]. However, since the outbreak of the infection in French Polynesia in 2013, significant neurological problems such as birth defects associated with microcephaly and Guillain-Barre syndrome were beginning to be recorded [13]. The magnitude of these neurological problems associated with ZVD outbreak of 2015 was so worrisome that the World Health Organization (WHO) in February 1, 2016 declared the outbreak a "PUBLIC HEALTH EMERGENCY OF INTERNATIONAL CONCERN", and activated an Emergency Incident Management System to handle international response to the outbreak [14]. The spread of this infection to countries where it was previously unknown was so alarming that in January 2017, mosquito-borne transmission of the infection had been reported in 75 countries across the globe, with 46 of these countries being in the Latin American and Caribbean zones [15] [16].

In addition to the transmission of Zika virus infection through the bite of

mosquito, the infection could also be transmitted from an infected person to another through contaminated blood, infected mother to unborn child, sexual intercourse, and breast feeding [17] [18] [19] [20]. Zika virus disease is the only disease transmitted through the bite of mosquito, which can also be transmitted through sexual intercourse and can cause birth defects [21]. Though the disease has not been recorded in Nigeria as causing any public health concern, it is possible that some cases of microcephaly and other neurological congenital malformation could have arisen from Zika virus infection [22]. Detection of antibodies to Zika virus in Nigerian populations and the presence of the mosquito vector that transmit this disease further suggest that the infection may be going on in Nigeria undiagnosed [23] [24]. It is therefore very crucial that the emphasis of WHO on the need to provide education to communities on Zika virus generally [25], be complied with.

Women that usually bring children for immunization are mostly mothers who recently were delivered of their babies. As a consequence of microcephaly and other congenital abnormalities associated with Zika virus infection on pregnant women, they may be seen as a group that ought to be targeted for Zika virus infection prevention interventions [26]. Some studies documented the positive effect of formal education on the awareness and knowledge on Zika virus among the populace [26] [27] [28] [29]. It is important to assess the effect of formal education on the awareness and knowledge on ZVD among women who recently were delivered of their babies, with a view to identifying gaps that could be addressed through structured interventions aimed at ensuring improved ZVD awareness and knowledge. The objective of this study is to assess the formal education related pattern of awareness, and basic knowledge on Zika virus disease, among women visiting children immunization unit in a tertiary hospital, in Nigeria.

2. Materials and Methods

Nigeria is divided into thirty six states and one capital territory, which are the political and administrative units. The states are further split into a total of seven hundred and seventy four local government areas. Enugu state is one of the five states in the Southeast geopolitical zone. There are six geopolitical zones in Nigeria, but they are however not administrative entities. Enugu state is made up of seventeen Local Government Areas (LGAs), comprising five urban, and twelve rural LGAs. This study was conducted in the state owned Teaching hospital located in Enugu North LGA, one of the three LGAs that constitute the state capital territory. Residents of Enugu metropolis are predominantly of Igbo tribe extraction, with some persons from other Nigerian tribes and few foreigners living very peacefully together. There are four public tertiary health facilities in the state, among which is this study site, the only one owned by the state government. The rest belong to the Federal government [30]. The study was of observational, descriptive, and cross-sectional design. Women who brought their

children for immunizationin the teaching hospital were the study population. This implied that most of these women were delivered of a baby in the recent past. All women that brought a child for immunization in the study tertiary hospital were included in the study, while all visitors and health workers of any cadre in the hospital were excluded from the study.

The hospital provides immunization services to the populace three days of the week namely Mondays, Wednesdays and Fridays. The average weekly immunization coverage is two hundred and sixty three (263) children. The study was conducted for nine weeks between November 2016, and February 2017; with 10 randomly selected women interviewed on each immunization day by a trained junior resident doctor in the department of Community Medicine, giving a total of 30 respondents in a week, while only 16 respondents were interviewed on the last week for data collection. This summed up to 256 respondents that participated in the study. Semi-structured questionnaire was pre-tested at the Federal government owned Teaching hospital in the state, and used for collecting information from respondents. The information elicited were analyzed using Statistical Package for Social Sciences (SPSS) version 20, and the outcome variables were determined in terms of the percentage of respondents in different levels of formal education who are aware of ZVD, and those with correct basic knowledge of ZVD. Students T-Test was done to ascertain if the difference in the mean basic knowledge of ZVD among the no formal education, primary education, secondary education, tertiary education, and postgraduate education levels was significant.

Ethical clearance for this study was obtained from the Ethical Research Committee of the Enugu State University Teaching Hospital. The main objective of the study was explained to the respondents who freely gave their consent before the questionnaire was administered. The difference in number of respondents between the educational level groups was very wide. Only three persons with no formal education at all (1.2% of total respondents) participated, while one hundred and twenty nine of persons with tertiary education (50.4% of total respondents) participated in the study. This clearly makes comparing data recorded for the different groups probably not completely reliable. The margin of error for the group with few respondents could be high. This obviously is a limitation for this study.

3. Results

3.1. Socio-Demographic Characteristics

Significant majority of the respondents (86%) fall between 20 to 39 years age range, are of Igbo tribe (92.2%), married (89.5%), and of the Christian religious faith (94.9%). About half of the respondents are graduates (tertiary level), while only 1.2% had no formal education, and 2% were formally educated up to primary school level. Slightly less than half of the respondents were Civil servants (48.4%). This was followed by Petty traders (15.2%), Students (11.3%), and

Teachers (8.2%). Very few numbers of the respondents were unemployed (2%).

3.2. Awareness of Zika Virus Disease

Over 70% of respondents with postgraduate educational qualification (77.8%) are aware that there is a disease known as Zika Virus Disease. Respondents with tertiary education qualification recorded 62%, secondary education level 53.8%, primary level 20%, while none of the three respondents that had no formal education were aware that there was a disease called Zika virus disease. Generally the level of awareness increased with increasing educational qualification, with the postgraduate level group recording the highest awareness on ZVD, while respondents with no formal education scored the least on ZVD awareness. These findings were analyzed using the Likelihood Ratio which was calculated to be 28.329, with P-value of <0.001.

3.3. Source of Information on Zika Virus Disease

The source of ZVD information for 37.3% of all respondents that heard about ZVD was through television (TV). This was followed by radio (25.3%), newspapers (13.3%), friends (8.2%), hospital (5.7%), internet (3.2%), relations (3.1%), school (1.9%), church (1.3%), and lastly market (0.6%).

3.4. Basic Knowledge on Zika Virus Infection

Overall, 61.3% of all respondents knew that ZVD symptoms could be similar to malaria infection. Persons with tertiary level educational qualification recorded the highest percentage score (69.8%) on ZVD and malaria symptoms being similar. They were followed by the postgraduate qualification group with 61.1% score, while the secondary level group had 50.8% of them knowing that SVD and malaria symptoms could be similar. None of the respondents with no formal education had this knowledge, while only one person (20%) out of the five that had only primary level education had the knowledge. More than 70% of respondents in each group that had above secondary level of education knew that Zika virus is a micro-organism that cannot be seen with the naked eye (secondary level = 78.5%, tertiary level = 77.5%, postgraduate level = 72.2%). Respondents without formal education recorded 33.3%, while those with only primary level qualification recorded 40.0%. Overall, 75.4% respondents had the correct knowledge. None of the respondents with primary level educational qualification knew that Zika virus can infect monkeys, while only one out of the three (33.3%) with no formal education had the correct knowledge on this. Less than half (45.7%) of those with tertiary education knew about possible monkey infection with Zika virus, 35.2% of those with postgraduate qualification, and 32.3% of those with secondary education also share the same knowledge. Overall, 39.1% of respondents knew that Zika virus could infect monkeys.

The highest percentage knowledge score on Zika virus being transmitted through mosquito bite was recorded by respondents with postgraduate qualifica-

tion (77.8%), followed by those with tertiary qualification (66.7%), and those with secondary education (56.9%). Only one respondent (20%) from the primary group, out of five persons in that group; and two (66.7%) out of three, among those without any formal education had the correct knowledge that mosquito bite could cause Zika virus infection. The overall knowledge of respondents on the transmission of Zika virus through mosquito bite was 65.5%. None of the five persons with primary level education knew that Zika virus infection can be transmitted through sexual intercourse, while only one (33.3%), out of the three that had no formal education knew that the infection can be transmitted through sexual intercourse. Knowledge on sexual transmission of Zika virus was highest among respondents with tertiary level of education qualification (48.8%), and was followed by secondary education (40.0%), and then postgraduate education level (37.0%). The recorded overall knowledge level on sexual transmission of Zika virus was 43.0%. The highest knowledge score on the possibility of Zika virus transmission through blood transfusion was recorded by tertiary education level participants (53.5%), followed by postgraduate level (48.1%), and secondary level (40.0%) in that order. None of the 5 primary education level participants had this knowledge, while 1 person (33.3%) among those that had no formal education, knew that Zika virus could be transmitted through blood transfusion. None of the 3 respondents that had no formal education knew that Zika virus cannot be transmitted through rat bite. Only 1 (20%) respondent among the 5 with primary level education had the correct knowledge about inability to transmit Zika virus through rat bite, while 44.6%, 48.8%, and 48.1% of those with secondary, tertiary, and postgraduate educational qualifications respectively; knew that Zika virus cannot be transmitted through rat bite. Overall, 46.5% of respondents had the correct knowledge that Zika virus infection cannot be transmitted through rat bite.

Respondents with postgraduate educational qualification demonstrated highest level of knowledge (64.8%) among the rest, on Zika virus infection not being transmitted through handshake. They were followed by those with tertiary educational qualification (55%), secondary education (50%), and primary education (40%). No respondent without formal education knew that Zika virus infection is not transmitted through handshake. On Zika virus infection not being transmitted through sharing meal with an infected person, respondents with postgraduate educational qualification recorded the highest knowledge level of 66.7%. They were followed by those with tertiary education qualification (58.1%), and those with secondary education (49.2%). Only one person (33.3%) out of the three with no formal education, and also one (20%) out of the five with primary education had correct knowledge on this. Respondents with tertiary educational qualification had the highest score of 62.8% on the correct knowledge that Zika virus can infect a pregnant woman, leading to the delivery of baby with malformed brain. Those with postgraduate level scored 61.1%, while those with secondary education qualification recorded 58.5%. None of the five respondents with primary level education knew that Zika virus infection in a

pregnant woman, could lead to malformation of the brain in the child, while only one (33.3%) out of three of those with no formal education had the correct knowledge. More than half of the respondents with tertiary educational qualification (54.3%) knew that Zika virus infection in pregnant women does not lead to the delivery of very big babies by the women. Those with postgraduate education recorded 48.1%, and those with secondary education had 46.2%. Those with no formal education had one person (33.3%) with this knowledge, while no person, out the five with primary education had the knowledge.

Respondents with tertiary educational level qualification recorded the highest score (51.2%) on knowledge of Zika virus infection leading to delivery of baby with small head (microcephaly). They were followed by those with postgraduate education qualification (46.3%), and secondary education level (36.9%). No respondent in the primary level, and no formal education groups had the correct knowledge on Zika virus infection causing microcephaly in the babies. Total knowledge scored on this was 44.9%. None of the groups of respondents scored above 40% on the knowledge that Zika virus infection can cause paralysis in grown-up persons. Respondents with tertiary education qualification scored 39.5%, secondary education qualification 35.4%, postgraduate education 35.2%. None of the respondents with primary education had the correct knowledge on this, while only one person (33.3%) out of three with no formal education had the correct knowledge. Overall knowledge score on this was 36.7%. Again, respondents with tertiary education level had the highest knowledge score (40.3%) on Zika virus infection not leading to shrinking of the head in grown-up persons. Respondents with postgraduate qualification recorded 37%, secondary education 36.9%, and primary education 20%. None of the respondents with no formal education had the correct knowledge on this. Overall knowledge score was 37.9%. The highest score of 43.4% on Zika virus infection not having a vaccine was recorded by respondents with tertiary education level qualification, while the next highest score of 33.8% was recorded by those with secondary level education, and 33.3% was scored by respondents with postgraduate education. Those with primary level education and no formal education scored zero. The overall knowledge score on this was 37.5%.

3.5. Overall Mean Percentage Knowledge Level of the Educational Groups

Overall mean percentage knowledge level of the different educational groups revealed as follows; No formal education was 22.2%, primary level 12.0%, secondary level 46.1%, tertiary level 54.4%, and postgraduate level was 51.5%. The mean for the stated scores was 37.2%. Students T-Test at 95.0% confidence interval was 0.012, showing that the difference in the mean percentage score between the groups was significant.

4. Discussion

The declaration of Zika virus disease on February 1, 2016 as a Public Health

Emergency of International Concern (PHEIC) by WHO was a significant occurrence that highlighted the need to put in more efforts towards controlling this disease. A study conducted in Brazil, Puerto Rico, and El Salvador revealed that Zika virus infection occurs more among women than men, with the highest rate being recorded among women aged 20 to 49 years [7] [31] [32]. Majority of the respondents in this study are women within this ages range (94.2%) (**Table 1**). This further justified this study, since the findings could reliably guide the development of strategies that could improve the awareness and knowledge of ZVD among this most susceptible group.

The percentage of respondents who had ever heard about Zika virus revealed that the pattern of awareness was related to the level of education, with those with postgraduate education scoring highest (77.8%) out of the 158 (61.7% of the total respondents) persons who had ever heard about Zika virus, while those with no formal education scored zero (**Table 2**). The overall level of awareness on Zika virus among women who brought their children for immunization at the Enugu State Teaching hospital immunization unit was reasonably less than what was found among pregnant women attending Gynaecology clinic in July 2016, in Greece (77.4%) [28]; but a bit comparable to the 68.97% awareness level found among reproductive-age women attending a general outpatient clinic in Northern Nigeria [33]. The 77.8% awareness level among women in this study who possessed postgraduate qualifications is comparable to that finding in the cited Greece study. This could be as a result of Greece being a developed country, and having higher literacy level than Nigeria. Majority of the respondents in this study got their first information on Zika Virus from the television or radio (66.2%), with those with postgraduate education qualification recording the highest (75.5%). The finding on the cited Greece study of 2016 also showed that television or radio were the highest source of awareness on Zika virus (75.3%). This could be a pointer to the likelihood of women of child being age usually watching television or listening to radio, for information, education and entertainment; as against reading newspapers or using the internet. The market (0.6%), church (1.3%), and school (1.9%) were reported as the lowest sources of Zika virus information (**Table 3**). These social institutions actually could serve as very efficient and effective platforms for disseminating Zika virus information if proper strategies are developed for this purpose. In some other studies among students who belong to the younger age group, the finding was that Internet and the social media were the highest reported sources of Zika virus awareness [27] [34].

Obviously the younger age group makes more use of the internet and social media generally. It is essential that these diverse sources of Zika virus information for women of child bearing age and those in different levels of education be taken into consideration when planning any intervention that would create awareness on Zika virus among this group.

Zika virus disease may be asymptomatic in about 80% of cases, and in some

instances where symptoms occur, it might be non-specific, thus making it difficult to arrive at a diagnosis without laboratory investigations [5]. This implies that ZVD could be presumptively diagnosed as malaria in this study environment where malaria is endemic. Respondents with tertiary level education qualification (graduates) recorded the highest percentage knowledge on this aspect of non-specific symptoms of ZVD (69.8%). They were followed by the postgraduate level (61.1%), secondary level (50.8%), and primary level (20%). No respondent without formal education had this knowledge. One would have expected respondents with postgraduate qualification to have demonstrated the highest level knowledge in all the aspects investigated, but this is not the case. The educational system in Nigeria is such that undergraduate students are usually given didactic lectures in addition to other forms of training in their chosen fields, while didactic lectures are usually not employed in training postgraduate students. Hence respondents who recently graduated from tertiary academic institutions could have been exposed more to information on Zika virus through formal lectures or informally during discussions while gathered for a didactic lecture; since ZVD was topical globally around the time of this study. This thinking however requires scientific research, to make it authentic.

Respondents with secondary education recording the highest score (78.5%) on the knowledge about Zika virus being a micro-organism that cannot be seen with the naked eyes is a bit curious, since ordinarily one would have expected tertiary and postgraduate respondents to have exhibited higher level of knowledge on this (**Table 4**). Could it be that they still possess a reasonable level of secondary school knowledge of Biology, while tertiary and postgraduate level respondents would have lost a great deal of that knowledge over the years? Zika virus being detected first in monkeys [3] is a vital information that should be disseminated as much as is possible, since infection could be acquired through contact with infected monkeys. The overall knowledge on this was 39.1%, with tertiary level education respondents (45%), being the only group that recorded score above 40%. Though the overall level of knowledge on ZVD being transmitted through mosquito bite can be said to be good (65.5%) (**Table 4**) since it was above 50%, it was still a far cry from findings on similar studies elsewhere. In the year 2016, 90.5% of pregnant women attending a Gynaecologist clinic in Greece knew that ZVD is transmitted through mosquito bite; while 94% of women that participated in a survey in the United States of America in 2016 had the knowledge [28] [35]. In Malaysia, in 2016, a survey among Selangor residents revealed that 85.8% of those that participated in the survey knew that ZVD is transmitted through mosquito bite [36]. The higher level of knowledge demonstrated in these three countries could be because they are more developed than Nigeria, and probably had more established systems of disseminating health information.

Zika virus can be transmitted through sexual intercourse, even if the infected partner is asymptomatic [37]. The probability of Zika virus transmission

Table 1. Socio-Demographic characteristics.

Variable	N	%
(256) (100)		
Age Range (yrs)		
Below 19	9	3.5
20 - 29	108	42.2
30 - 39	112	43.8
40 - 49	21	8.2
50 - 59	3	1.2
60 - 69	2	0.8
70 and above	1	0.4
Tribe		
Igbo	236	92.2
Efik	1	0.4
Yoruba	6	2.3
Hausa	8	3.1
Igala	1	0.4
Cross Rivers	1	0.4
Benue	2	0.8
West Country	1	0.4
Marital Status		
Married	229	89.5
Single	26	10.2
Divorced/Separated	1	0.4
Religion/Denomination		
Christian	243	94.9
Muslim	8	3.1
Traditional Religion	5	2.0
Educational Level		
No Formal Education	3	1.2
Primary Level	5	2.0
Secondary Level	65	25.4
Tertiary Level	129	50.4
Postgraduate Level	54	21.1
Occupation		
Nothing	5	2.0
Farmer	6	2.3
Teacher	21	8.2
Petty Trader	39	15.2
Civil Servant	124	48.4
Public Servant	7	2.7
Student	29	11.3
National Youth Service Corps	2	0.8
Business	7	2.7
Hair Dressing	1	0.4
Engineer	2	0.8
Tailoring/Fashion Designer	3	1.2
Banking	1	0.4
Optometrist	1	0.4
Private Organisation	7	2.7
Nursing	1	0.4

Table 2. Respondents that ever heard about Zika Virus.

Educational Status	Yes	No	Not Sure	Total	Likelihood Ratio	P-value
No formal education	0 (0.0%)	1 (33.3%)	2 (66.7%)	**3 (100%)**	28.329	<0.001
Primary level	1 (20.0%)	1 (20.0%)	3 (60.0%)	**5 (100%)**		
Secondary level	35 (53.8%)	25 (38.5%)	5 (7.7%)	**65 (100%)**		
Tertiary level	80 (62.0%)	43 (18.5%)	6 (4.7%)	**129 (100%)**		
Postgraduate level	42 (77.8%)	10 (18.5%)	2 (3.7%)	**54 (100%)**		
Total	**158 (61.7%)**	**80 (31.3%)**	**18 (7.0%)**	**256 (100%)**		

Table 3. Source of information on Zika Virus disease.

Educational Status	Radio	TV	Newspaper	Relations	Friends	Church	School	Market	Internet	Hospital	Total
No formal education	1 (33.3%)	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100%)
Primary level	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (100%)
Secondary level	11 (28.9%)	16 (42.1%)	5 (13.2%)	2 (5.3%)	0 (0.0%)	1 (2.6%)	0 (0.0%)	1 (2.6%)	0 (0.0%)	2 (5.3%)	38 (100%)
Tertiary level	16 (21.1%)	26 (34.2%)	13 (17.1%)	1 (1.3%)	9 (11.8%)	1 (1.3%)	3 (3.9%)	0 (0.0%)	3 (3.9%)	4 (5.3%)	76 (100%)
Postgraduate level	11 (28.2%)	16 (41.0%)	2 (5.1%)	1 (2.6%)	4 (10.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (5.1%)	3 (7.6%)	39 (100%)
Total	40 (25.3%)	59 (37.3%)	21 (13.3%)	5 (3.1%)	13 (8.2%)	2 (1.3%)	3 (1.9%)	1 (0.6%)	5 (3.2%)	9 (5.7%)	158 (100.0%)

Table 4. Basic knowledge on Zika virus infection.

Question	Level of Education	Correct Response
Zika virus Disease symptoms can be similar to those for malaria?	No formal education	0 (0.0%)
	Primary	1 (20.0%)
	Secondary	33 (50.8%)
	Tertiary	90 (69.8%)
	Postgraduate	33 (61.1%)
	Total	157 (61.3%)
Zika virus is micro-organism that you cannot see with the naked eyes?	No formal education	1 (33.3%)
	Primary	2 (40.0%)
	Secondary	51 (78.5%)
	Tertiary	100 (77.5%)
	Postgraduate	39 (72.2%)
	Total	193 (75.4%)
Zika virus can infect monkeys?	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	21 (32.3%)
	Tertiary	59 (45.7%)

Continued

	Postgraduate	19 (35.2%)
	Total	100 (39.1%)
Zika virus can be transmitted through mosquito bite?	No formal education	2 (66.7%)
	Primary	1 (20.0%)
	Secondary	37 (56.9%)
	Tertiary	86 (66.7%)
	Postgraduate	42 (77.8%)
	Total	168 (65.5%)
Zika virus can be transmitted through sexual intercourse?	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	26 (40.0%)
	Tertiary	63 (48.8%)
	Postgraduate	20 (37.0%)
	Total	110 (43.0%)
Zika virus can be transmitted through blood transfusion?	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	26 (40.0%)
	Tertiary	69 (53.5%)
	Postgraduate	26 (48.1%)
	Total	122 (47.7%)
Zika virus can be transmitted through rat bite?	No formal education	0 (0.0%)
	Primary	1 (20.0%)
	Secondary	29 (44.6%)
	Tertiary	63 (48.8%)
	Postgraduate	26 (48.1%)
	Total	119 (46.5%)
Zika virus can be transmitted through shaking hands with infected persons?	No formal education	0 (0.0%)
	Primary	2 (40.0%)
	Secondary	33 (50.8%)
	Tertiary	71 (55.0%)
	Postgraduate	35 (64.8%)
	Total	141 (55.1%)
Zika virus can be transmitted through sharing meal with an infected person?	No formal education	1 (33.3%)
	Primary	1 (20.0%)
	Secondary	32 (49.2%)
	Tertiary	75 (58.1%)
	Postgraduate	36 (66.7%)

Continued

Zika virus can infect a pregnant woman leading to the delivery of a baby with malformed brain?	Total	145 (56.6%)
	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	38 (58.5%)
	Tertiary	81 (62.8%)
	Postgraduate	33 (61.1%)
Zika virus can infect a pregnant woman leading to the delivery of a very big baby?	Total	153 (59.8%)
	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	30 (46.2%)
	Tertiary	70 (54.3%)
	Postgraduate	26 (48.1%)
Zika virus can infect a pregnant woman leading to the delivery of a baby with small head (Microcephaly)?	Total	127 (49.6%)
	No formal education	0 (0.0%)
	Primary	0 (0.0%)
	Secondary	24 (36.9%)
	Tertiary	66 (51.2%)
	Postgraduate	25 (46.3%)
Zika virus can infect a grown-up person, leading to paralysis?	Total	115 (44.9%)
	No formal education	1 (33.3%)
	Primary	0 (0.0%)
	Secondary	23 (35.4%)
	Tertiary	51 (39.5%)
	Postgraduate	19 (35.2%)
Zika virus can infect a grown-up person, leading to shrinking of the head?	Total	94 (36.7%)
	No formal education	0 (0.0%)
	Primary	1 (20.0%)
	Secondary	24 (36.9%)
	Tertiary	52 (40.3%)
	Postgraduate	20 (37.0%)
Zika virus has a vaccine for the prevention of infection	Total	97 (37.9%)
	No formal education	0 (0.0%)
	Primary	0 (0.0%)
	Secondary	22 (33.8%)
	Tertiary	56 (43.4%)
	Postgraduate	18 (33.3%)
	Total	96 (37.5%)

through sexual intercourse was first suggested in a study conducted in the United States of America and published in 2011 [38]. The virus was eventually identified in the semen of a Tahitian man during ZVD outbreak in French Polynesia in 2013 [39]. This information on the possibility of Zika virus transmission through sexual intercourse is vital in planning for prevention, yet only 43% of respondents in this study knew about this. Respondents with tertiary education qualification recorded the highest knowledge level (48.8%), followed by those with secondary education level (40%) and then those with postgraduate qualification (37%) (**Table 4**). Surprisingly, a study that was conducted in the United States of America and published this year 2018, recorded a similar finding where only 42% of women respondents had the knowledge [35]. Respondents in this study also exhibited better knowledge on this, than what was found in Greece in 2016 (36.7%) [28]. A more worrisome finding on this (17.1%) was recorded in Saudi Arabia among medical students in 2017 [34]. One would have expected medical students to be more knowledgeable on Zika virus than the general public. This curious finding in Saudi Arabia could be because the study was conducted among first year medical students, who could even be said to be equivalent to secondary education level respondents. A study is however required to authenticate this thinking. Some factors could have been at play in those areas that recorded lower findings on the knowledge of sexual transmission of ZVD. Ordinarily one would have expected developed countries to record higher knowledge scores.

A more encouraging finding of 56.8% was made in Malaysia in 2016 [36]. It has been documented that Zika virus Ribonucleic Acid (RNA) can be detected in semen 188 days after the onset of symptoms [40].

The overall knowledge reported in this study on Zika virus transmission through blood is poor (47.7%) (**Table 4**). Only respondents with tertiary education qualification recorded a good score (53.5%), while the rest scored below 50%. Surprisingly, this score is better than scores recorded in similar studies in some more developed countries such as Qatar (22.9%), and Saudi Arabia (30.3%) [27] [34]. It is important that women, and the general public are equipped with the knowledge that Zika virus can be transmitted through blood transfusion, so that they request for Zika virus blood screening before transfusion, in times of outbreak. None of the educational group of respondents in this study had good knowledge on Zika virus not being transmitted through rat bite. All the groups scored less than 50%, with tertiary level education respondents again recording the highest score of 48.8% (**Table 4**). There was an outbreak of Lassa fever infection in the neighbouring Ebonyi State at the time of this study, and there was a lot of awareness campaign highlighting the role of multimamate rat in the transmission of Lassa fever. Many of the respondents in this study could have confused Zika virus with Lassa fever, hence believed that Zika virus could be transmitted through rat bite. The gap in knowledge on this aspect of Zika virus not being transmitted through rat bite becomes more obvious when

the overall score of 46.5% of those with the correct knowledge is compared with 4.6% of reproductive-age women attending general outpatient clinic in Northern Nigeria, in 2017; believing that ZVD can be transmitted through rat bite. Only 46.5% of respondents in this study having the correct knowledge on this implies that about 53.5% might not have the correct knowledge; thus we are comparing 53.5% of those with incorrect knowledge with 4.6% of those with incorrect knowledge in a similar study in Northern Nigeria. Investigating the factors that contributed to the impressive knowledge recorded in Northern Nigeria, with the aim of using the findings to address the huge gap recorded in this Southeastern part of Nigeria will be beneficial.

The overall correct knowledge of 55.1%, on Zika virus not being transmitted through handshake is good; but more health education activities among women of childbearing age could improve this knowledge level. Having the correct knowledge on this, would contribute to ZVD patients not being stigmatized. The pattern of percentage of those with correct knowledge on this, among the different educational level respondents revealed that it increased with increasing educational qualification. Postgraduate respondents scored 64.8%, tertiary education level 55%, secondary education level 50.8%, primary education level 40%, and none of those with no formal education had the correct knowledge (**Table 4**). Again the overall knowledge level of 56.6% that ZVD is not transmitted through meal is good, and increased with increasing level of education up to the secondary level. The total number that believed that ZVD is transmitted throw meals or are indifferent to the question was 43.4% (**Table 4**). This is reasonably higher than the 26.5% recorded in a similar study conducted in Greece two years ago, where the pregnant women strongly agreed, agreed, or said yes to Zika virus being transmitted through the consumption of contaminated food [28]. The knowledge gap on ZVD not being transmitted through meals however is more glaring when compared to the finding of only 5.7% of female respondents in a study conducted in Qatar two years ago, who believed that ZVD can be transmitted through contaminated food [27]. The impressive finding in the Qatar study could be as a result of the study being conducted in an Education city with many students and academic staff. This group is usually expected to be better informed in issues such this one.

The effects of Zika virus infection on the unborn children of pregnant women are some of the key effects of this infection that made it to be declared "A public health emergency of international concern" by WHO on February 1, 2016. These effects are neurological disorders and microcephaly [41]. These are the reasons pregnant women are considered most at risk for this disease, and prevention strategies are focused on them [26]. Good number of tertiary education level respondents in this study (62.8%) knew that ZVD could cause brain damage in the unborn child, while 61.1% of those with Postgraduate education had the same knowledge. Overall, majority of the respondents (59.8%) had this knowledge which is good (**Table 4**). This is however slightly lower than the 65.77%

found in a similar study conducted in the northern part of the same country, in the same year [33]. However, a much smaller percentage of the total respondents (44.9%) knew that Zika virus infection can cause microcephaly in the unborn child in the womb. Again respondents with tertiary education level recorded the highest knowledge of 51.2%, followed by those with postgraduate education (46.3%), and secondary education (36.9%). None of those with no formal education or primary education had the knowledge (**Table 4**). As high as 80.77% of respondents in that same similar study in Northern Nigeria had the knowledge that ZVD in the pregnant women could cause microcephaly in the unborn baby [33]. Further research work on the interventions/factors that enhanced ZVD knowledge among the group in the northern part of Nigeria, and also factors that contributed to the knowledge level on some key aspects of ZVD in our study population, could be useful in developing programmes that will enhance the knowledge level among our study population.

It is not clear why only slightly less than half (49.6%) of the respondents had the correct knowledge on ZVD not causing the delivery of big babies in infected pregnant women. The pattern of this knowledge with respect to the respondent's level of education revealed that those with tertiary level education had the highest knowledge, followed by those with postgraduate education (**Table 4**). It is possible that respondents were confusing this with diabetes mellitus as a cause of delivery of big babies. They were frequently given this information during the health education sessions on Ante-natal visits. This thinking however requires further research work. The respondents generally exhibited poor knowledge on the paralyzing health effect of ZVD on the adult population. Only 36.7% of all respondents knew that ZVD in the adult could lead to paralysis, and respondents with tertiary education again demonstrated the highest level of knowledge (**Table 4**). This in a way supports the thinking that many people believe that health effect of ZVD only manifests in pregnant women and the unborn babies. It did appear as if majority of the respondents believed that ZVD causing microcephaly in the unborn baby could also apply to adults. Less than 40% (37.9%) of the overall respondents knew that ZVD in adults does not cause shrinking of the head. Respondents with tertiary education level recorded the highest knowledge on this (40.3%) (**Table 4**). In planning ZVD awareness activity, it is important that efforts are made to place emphasis on Zika virus infection in pregnant women being the cause of microcephaly in the child inside the womb, and that this infection does not cause shrinking of the head in the adult. The finding in this study that majority of the respondents believed that there is a vaccine for Zika virus infection is worrisome. Only 37.5% of the total respondents that participated in this study knew that Zika virus does not have any preventive vaccine (**Table 4**). This could make them adopt risky attitudes towards Zika virus infection prevention practices; believing that they could get a preventive vaccine when desired. As high as 65.0% of female respondents in a ZVD study done in Qatar in 2016 had the correct knowledge that there is no Zika virus prevention

vaccine [27]. The Qatar study was conducted among people residing in an education city that had a lot of tertiary institutions. Presumably, the average education level for respondents in that study could have been significantly higher than the average level for respondents in this study. The finding in the Qatar study however is similar to 64.0% of respondents that knew that Zika virus did not have a vaccine, in another ZVD study conducted in Selangor, Malaysia in 2016 [36].

Overall mean percentage basic knowledge level of 37.2%, on Zika virus disease, among women visiting children immunization unit in a tertiary hospital, southeast Nigeria is poor. The pattern of this knowledge among the different educational level of respondents revealed that those with tertiary education qualification demonstrated the highest mean percentage score of 54.4%; while the more educationally qualified group of postgraduate respondents recorded a lower score of 51.5%. This was followed by respondents with secondary educational qualification with 46.1%, and curiously respondents with no formal education had higher mean percentage score (22.2%) than those with primary level educational qualification with 12.0% score (**Figure 1**). Very few respondents from both the primary level (5 respondents) and no formal education (3 respondents) groups participating in this study, could render findings in both groups unreliable. One would have expected the postgraduate respondents to have higher mean percentage knowledge level than those with Bachelor's degree (tertiary level), but this was not the case. Could the group with tertiary education qualification scoring higher than those with postgraduate education qualification imply that the positive effect of formal education on ZVD knowledge is optimum at tertiary education level? Finding from another ZVD study among dental practitioners in Tricityarea of India in 2016 however did not support this thinking. In that study, it was found that postgraduate qualification was significantly associated with higher knowledge on Zika virus [29]. Could environment and

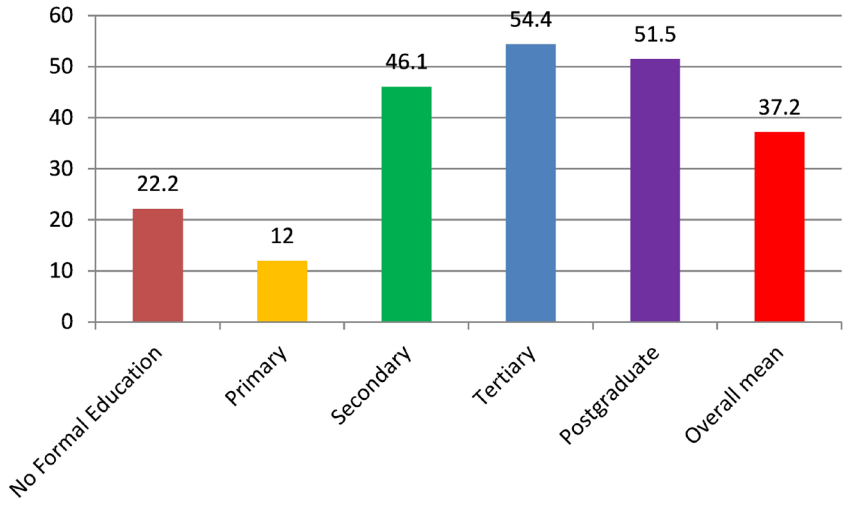

Figure 1. Overall mean Percentage knowledge level of the different educational groups. P = 0.012.

some other factors such as pattern and accessibility to Health awareness activities influence ZVD knowledge among women? It is also curious that respondents with secondary education qualification scored slightly higher than those with postgraduate education qualification on Zika virus being transmitted through sexual intercourse, potential of Zika virus to cause paralysis in the adults, and ZVD not having any vaccine. More research work to further elucidate the factors that enhance or inhibit the positive effects of formal education on ZVD knowledge will help in throwing more light on the findings in this study. P-value of Students T-Test done to check the level of significance of the mean knowledge scores of the five different groups was 0.012 at 95.0% confidence interval. This implies that the level of formal education among women, probably could affect the level of knowledge on ZVD that they have.

5. Conclusion

The awareness of the respondents on Zika virus was found to increase with increasing educational qualification. Their knowledge however did not strictly follow this pattern. Respondents with tertiary educational qualification demonstrated the highest level of overall knowledge on ZVD, followed by those with postgraduate education qualification, secondary education qualification, primary education qualification, and lastly those without any formal education in that order. It is surprising that respondents with secondary education qualification exhibited higher knowledge on three of the fifteen knowledge items studied. The overall awareness on ZVD of 61.7% was good, but respondents with primary level education qualification recorded very poor awareness score of 20.0%, while no one among those without any formal education was aware of ZVD. The overall mean percentage knowledge level of 37.2% is poor. Respondents with tertiary and postgraduate education qualifications however recorded overall mean score above 50.0% each, while secondary, primary, and no formal education groups recorded overall mean percentage scores below 50.0%. Stepping up ZVD health education and awareness activities, especially among women with educational qualification below tertiary level will greatly improve the awareness and knowledge on ZVD among this study population.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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