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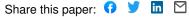
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PREDICTORS OF UPTAKE OF A POTENTIAL COVID-19 VACCINE AMONG NIGERIAN ADULTS

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ABSTRACT

Background: The Coronavirus diseases (COVID-19) pandemic is not abating and there is no approved treatment yet. The development of vaccines is hoped to help in addressing this disease outbreak. However, in the face of anti-vaccines uprise, it is important to understand the factors that may influence the uptake of COVID-19 vaccines as this will influence how successful the fight against COVID-19 will be in the long term.

Methods: A cross-sectional study among 776 adult Nigerians (age ≥18 years) was conducted in the 36 States of Nigeria and the Capital City with online questionnaire. The questionnaire consisted of 5 sections: socio-demographic characteristics of respondents, respondent's knowledge of COVID-19, respondents risk perception of COVID-19, vaccination history of respondents, and willingness to receive COVID-19 vaccine. Descriptive analysis of variables was done and multivariate analysis using logistic regression was carried out to determine the predictors of uptake of a potential COVID-19 vaccine. The level of significance was predetermined at a p-value < 0.05. Data analysis was done with SPSS version 21.

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Results: Most of the respondents were male (58.1%). Most participants were willing to take a potential COVID-19 vaccine (58.2%), while 19.2% would not take it with 22.6% indecisive. 53.5% would prefer a single dose COVID-19 vaccine. For vaccine uptake, being male (p= 0.002) and the perception that "vaccines are good" (p< 0.001) were the positive predictor of uptake of a potential COVID-19 vaccine.

Conclusion: Most Nigerians were willing to take a potential COVID-19 vaccine with the male gender and perception that "vaccines are good" being positive predictors. There is a need for public enlightenment aim at encouraging those that are indecisive or averse to receiving COVID-19 vaccines.

Keywords: COVID-19, COVID-19 Vaccine, Pandemic.

BACKGROUND

Coronavirus disease 2019 (COVID-19), is caused by Severe Acute Respiratory Syndrome Corona virus-2 (SARS-CoV-2).[1] As a result of the widespread occurrence and significant global health risk, the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC) in late January 2020.[2] Nigeria reported its index case on February 27, 2020, from an Italian citizen who tested positive in Lagos State, the commercial capital of the country.[3] By the first week in March 2020, the number of cases had risen to over 100,000 affecting multiple continents, and WHO subsequently declared COVID-19 a global pandemic on March 11, 2020.[4]

As of December 4, 2020, there were over 65 Million cases of COVID-19 across the globe and more than 1.5 million deaths. In Nigeria, data showed over 68,000 cases with about 1200

deaths[5]. Despite the devastating scourge of the disease, there has not been any proven treatment against the SARS-CoV-2. The recommendations of the disease control bodies are focused on disease prevention and control measures to minimize spread and to reduce the burden on the healthcare system.[6-8] Vaccination is an effective preventive measure reducing morbidity and mortality caused by infectious agents. It constitutes the mainstay of prevention of infectious childhood diseases and is of major importance in primary health care.[9] Since the onset of the COVID-19 pandemic, there has been a significant drive to find an effective vaccine with several vaccines at various stages of drug trials and some already being tested in humans across various countries.[10,11] However, the success of this vaccine will be dependent on the acceptance and uptake level and the subsequent development of herd immunity.[9] In recent times, there has been a growing anti-vaccine movement,[11] it is therefore imperative to explore the barriers and drivers of uptake of a potential COVID-19 vaccine to help the government, policymakers, and health care workers mitigate the impact of probable low vaccine uptake.

Vaccine uptake refers to the absolute number of people who receive a specified vaccine dose(s);[12] and low uptake has been increasingly recognized as a challenge to the success of vaccination programs.[11] Uptake of vaccines can be influenced by several factors such as personal risk perception, fear of side effects, access to media, information sources, religious/cultural beliefs, the convenience of getting to a health facility, level of trust for the healthcare system, household wealth, residence, ethnicity, and other demographic variables, as well as other social influences.[13,14] Introduction of a new vaccine to the public may be met with hesitancy due to skepticism about its effectiveness and potential safety.[9] Several studies have been carried out on determinants of uptake of already existent vaccines[14-16] but there is currently a paucity of data on the uptake of a potential COVID-19 vaccine.

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Adults are thought to be the important drivers of SARS-CoV-2 transmission in the community and are also known to be more susceptible than children. Unfortunately, vaccine uptake among adults in Nigeria is already poor.[17,18] There is, therefore, a concern as to the likely picture of uptake of a potential COVID-19 vaccine in the adult population. This study, therefore, aimed to investigate the willingness to receive the COVID-19 vaccine among the Nigerian adult population and the predictors of uptake of the vaccine.

METHODS

This was a cross-sectional study carried out in Nigeria, the most populous nation in Africa with an estimated population of about 200 million and a total land area of 910,770 Km2 (351,650 sq. miles).[19] Nigeria has six geopolitical zones (Southwest, Southeast, Southsouth, Northwest, Northeast, Northcentral) with 36 states. Ethical approval was obtained from the Health Research Ethics Committee of the Federal Medical Centre Gusau, Zamfara State, Nigeria.

The study was conducted online using a pre-tested, semi-structured questionnaire and included Nigerian adults above the age of 18 years who consented to participate in the study. The minimum sample size was determined to be 409 at a confidence level of 95% and based on the proportion of people with good knowledge of 39% in a previous study[20] and a 5% margin of error.

The questionnaire was adapted from several published literature[20-23] and comprised of five sections A-E namely, Socio-demographic characteristics of respondents, respondent's knowledge of COVID-19, respondents risk perception of COVID-19, vaccination history of respondents, and willingness to receive COVID-19 vaccine. The pre-test of the questionnaire was done on 10% of the subjects each at six different states from the six geopolitical zones and was not

included in the study. The pretested questionnaires with participants' information sheets were distributed widely online. The data were collected from June to July 2020.

Data were analyzed using SPSS version 21. The knowledge of COVID-19 among respondents was scored based on the number of correct responses given. The number of correct responses was compared with the average score. Participants whose score equaled or was above the average were categorized as having good knowledge while those who scored below the average were categorized as having poor knowledge. Descriptive statistics (frequency tables and percentages) were calculated for the sample demographic characteristics. The frequency and percentage of willingness to receive the COVID-19 vaccine were also calculated. Chi-square analysis was computed to test for association between sociodemographic characteristics, knowledge of COVID-19 among respondents, vaccination history of the respondent, and willingness to receive a COVID-19 vaccine. Multivariate analysis using logistic regression was carried out to determine the predictors of uptake of a potential COVID-19 vaccine. The level of significance was predetermined at a p-value of less than 0.05 at a 95% confidence level.

RESULTS

A total of 776 participants completed the survey. Most were within the ages of 36-45 years (43.9%), with 58.1% males and 40.9% females. The majority (53.2%) have tertiary education with 7.7% of the respondents being artisans, 8.6% being teachers and 25% being health care workers. Most respondents (26.7%) preferred not to say their annual income with 17.5% earning less than 500,000 Naira /Annum. Zonal representation of respondents (State of origin and place of residence) revealed that most of the respondents were from the southwest zone of the country

(47.4% and 46% respectively). Most respondents' households are made up of 1-4 persons (48.3%) while 5.7% of the respondents have more than 8 persons per household (**Table 1**).

Most of the respondents (58.2%) were willing to receive the vaccine once it is available while 19.2% of the respondents were not willing to receive the vaccine; 22.6% of the respondents were indecisive (**Table 2**). Many of the respondents who were unwilling to take the vaccine were not sure of reasons why they were unwilling to receive the vaccine (**Table 3**). Among the respondents that were willing to take the vaccine, the majority (53.5%) were comfortable with a single dose of the vaccine, while only 8% of the respondents were willing to take more than 4 doses. (**Table 4**) The preferred route of administration among most of the respondents was either oral (58.2%) or Injection (53.8%) with many of the respondents rejecting the administration of the vaccine through the intranasal route (76.1%) (**Table 5**).

Socio-demographic variables such as gender and religion of the respondents showed a statistically significant association with willingness to receive the vaccine (**Table 6a and 6b**). 'Perception that vaccines are good or bad', previous history of vaccination, and knowledge of COVID-19 were also shown to have a statistically significant association with willingness to receive the vaccine. However, there was no statistically significant association between risk perception of COVID-19 and willingness to receive COVID-19 vaccine (Table 6b). Male gender and 'perception that vaccines generally are good' were found to be significant predictors of uptake of a potential COVID-19 vaccine. Males were one and a half times more likely to receive the vaccine than females and those with a 'perception that vaccines are generally good' were

seven times more likely to receive the vaccine than those who have a 'perception that vaccines are generally bad' (**Table 7).**

Table 1: Socio-demographic characteristics of Respondents

Variables	Frequency (*n = 776)*	%
Age group (years)		
18 – 25	93	12.0
26 – 35	241	31.1
36 – 45	341	43.9
46 – 55	73	9.4
> 55	28	3.6
Gender		
Male	451	58.1
Female	317	40.9
Prefer not to say	8	1.0
Marital Status		
Single	214	27.6
Married	489	63.0
Separated/ Divorced	15	1.9
Widowed/ Widower	7	0.9
In a relationship	45	5.8
Undisclosed	6	0.8
Religion		
None	9	1.2
Christianity	616	79.4
Islam	147	18.9
Others	4	0.5
Level of Education		
Secondary school or less	36	4.6
Tertiary	413	53.2
Postgraduate	327	42.1
Occupation		
Unemployed	60	7.7
Trader	22	2.8
Teacher	67	8.6
Artisan	17	2.2
Healthcare worker	194	25.0
Information technology	43	5.5
Financial services	45	5.8
Security agent	12	1.5
Agricultural services	19	2.4

Others	297	38.3
Estimated Income of Caregiver Per Annum (Naira)		
< 500,000	136	17.5
500,000 -1 million	120	15.5
1 – 2 million	117	15.1
2 – 3 million	54	7.0
3 – 4 million	37	4.8
> 4 million	105	13.5
I prefer not to say	207	26.7
State Origin (Zone)		
North-Central	90	11.6
North-East	46	5.9
North-West	49	6.3
South-East	119	15.3
South-South	94	12.1
South-West	368	47.4
Prefer not to say	10	1.3
Place of residence (Zone)		
North-Central	174	22.4
North-East	24	3.1
North-West	103	13.3
South-East	32	4.1
South-South	40	5.2
South-West	357	46.0
Prefer not to say	46	5.9
No person in a household		
1 – 4	375	48.3
5 – 8	357	46.0
> 8	44	5.7

Table 2: Respondents willingness to take potential COVID-19 Vaccine

Willingness to take potential COVID 19 Vaccine	Frequency (*n = 776*)	Percent (%)
Yes	452	58.2
No	149	19.2
Maybe	175	22.6

Table 3: Respondents reasons for refusing to take a Potential COVID-19 Vaccine

	Yes	No	Maybe	Don't

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Determinants	n (%)	n (%)	n (%)	know n (%)
The potential vaccine is a mark of the beast	4 (2.7)	29 (19.5)	9 (6.0)	107 (71.8)
The potential vaccine is to reduce the world population	4 (2.7)	20 (13.4)	20 (13.4)	105 (70.5)
The potential vaccine can make one sick	7 (4.7)	10 (6.7)	25 (16.8)	107 (71.8)
I might not be able to afford the vaccine	9 (6.0)	21 (14.1)	15 (10.1)	104 (69.8)
I don't have time to take any vaccine	3 (2.0)	35 (23.5)	8 (5.4)	103 (69.1)
My religion does not allow vaccination	0 (0.0)	45 (30.2)	4 (2.7)	100 (67.1)
I will take it if I get paid for it	5 (3.4)	30 (20.1)	15 (10.1)	99 (66.4)
I have other medical condition that would not allow me to take it	3 (2.0)	38 (25.5)	7 (4.7)	101 (67.8)
The vaccines we are taking are already too much	8 (5.4)	26 (17.4)	11 (7.4)	104 (69.8)
Vaccines are only for children	0 (0.0)	44 (29.5)	5 (3.4)	100 (67.1)
The vaccine is not needed because the infection is harmless	0 (0.0)	40 (26.8)	8 (5.4)	101 (67.8)

Table 4: Respondents preferred maximum dose(s) of potential COVID-19 vaccine

Number of willing Permissible Dose	Frequency (n = 452)	Percent (%)
1	242	53.5
2	116	25.7
3	50	11.1
≥ 4	36	8.0
Indecisive	8	1.8

Table 5: Respondents preferred route for potential COVID-19 vaccine

The preferred route of administration	Yes n (%)	No n (%)	Maybe n (%)
Oral	263 (58.2)	170 (37.6)	19 (4.2)
Intranasal	62 (13.7)	344 (76.1)	46 (10.2)
Injection	243 (53.8)	174 (38.5)	35 (7.7)
Any Route	58 (12.8)	336 (74.3)	58 (12.8)

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Table 6a: Willingness to be vaccinated by Respondents characteristics

| | Willingness to take a potential vaccine for COVID-19 | | | | | |
| | Yes | Maybe | No | Total | χ^2 | *p-value* |
Characteristics	n (%)	n (%)	n (%)	N (%)		
Age (years)						
18 – 25	56 (60.2)	19 (20.4)	18 (19.4)	93	7.941	0.439
26 – 35	141 (58.5)	50 (20.7)	50 (20.7)	241		
36 – 45	205 (60.1)	62 (18.2)	74 (21.7)	341		
46 – 55	37 (50.7)	13 (17.8)	23 (31.5)	73		
> 55	13 (46.4)	5 (17.9)	10 (35.7)	28		
Gender						
Male	282(62.5)	79 (17.5)	90 (20.0)	451	7.010	**0.030***
Female	168 (53.0)	68 (21.5)	81 (25.6)	317		
Level education						
Secondary school or less	17 (47.2)	11 (30.6)	8 (22.2)	36	4.202	0.379
Tertiary	239 (57.9)	82 (19.9)	92 (22.3)	413		
Postgraduate	196 (59.9)	56 (17.1)	75 (22.9)	327		
Marital status						
Single	133(62.1)	34 (15.9)	47 (22.0)	214	13.581 F	0.093
Married	279 (57.1)	95 (19.4)	115 (23.5)	489		
Separated/ Divorced	6 (40.0)	3 (20.0)	6 (40.0)	15		
Widowed/ Widower	2 (28.6)	3 (42.9)	2 (28.6)	7		
In a relationship	29 (64.4)	12 (26.7)	4 (8.9)	45		
Number person in a household						
1 – 4	231 (61.6)	75 (20.0)	69 (18.4)	375	7.625	0.106
5 – 8	195 (54.6)	66 (18.5)	96 (26.9)	357		
> 8	26 (59.1)	8 (18.2)	10 (22.7)	44		
State origin zone						
North-Central	59 (65.6)	12 (13.3)	19 (21.1)	90	14.819	0.139
North-East	27 (58.7)	6 (13.0)	13 (28.3)	46		
North-West	30 (61.2)	10 (20.4)	9 (18.4)	49		
South-East	56 (47.1)	25 (21.0)	38 (31.9)	119		
South-South	53 (56.4)	19 (20.2)	22 (23.4)	94		
South-West	223 (60.6)	75 (20.4)	70 (19.0)	368		
Place of residence						
North-Central	106 (60.9)	34 (19.5)	34 (19.5)	174	2.339	0.993
North-East	14 (58.3)	4 (16.7)	6 (25.0)	24		
North-West	63 (61.2)	19 (18.4)	21 (20.4)	103		

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South-East	18 (56.2)	6 (18.8)	8 (25.0)	32		
South-South	25 (62.5)	7 (17.5)	8 (20.0)	40		
South-West	201 (56.3)	72 (20.2)	84 (23.5)	357		
Religion						
None	5 (55.6)	1 (11.1)	3 (33.3)	9	14.465 F	**0.025***
Christianity	346 (56.2)	128 (20.8)	142 (23.1)	616		
Islam	100 (68.0)	20 (13.6)	27 (18.4)	147		
Others	1 (25.0)	0 (0.0)	3 (75.0)	4		

χ^2: **Chi-Square test; F: Fisher's exact test; *: *p*-value**

Table 6b: Willingness to be vaccinated by Respondents characteristics

	Readiness to take a potential vaccine for COVID-19					
	Yes	**Maybe**	**No**	**Total**	χ^2	**p-value**
Characteristics	**n (%)**	**n (%)**	**n (%)**	**N (%)**		
Occupation						
Unemployed	35 (58.3)	16 (26.7)	9 (15.0)	60	28.694	**0.050**
Trader	17 (77.3)	2 (9.1)	3 (13.6)	22		
Teacher	30 (44.8)	17 (25.4)	20 (29.9)	67		
Artisan	13 (76.5)	0 (0.0)	4 (23.5)	17		
Healthcare worker	124 (63.9)	31(16.0)	39 (20.1)	194		
Information technology	19 (44.2)	9 (20.9)	15 (34.9)	43		
Financial services	24 (53.3)	10 (22.2)	11 (24.4)	45		
Security agent	9 (75.0)	1 (8.3)	2 (16.7)	12		
Agricultural services	14 (73.7)	4 (21.1)	1 (5.3)	19		
Others	167 (56.2)	59 (19.9)	71 (23.9)	297		
Average income						
< 500,000	85 (62.5)	21(15.4)	30 (22.1)	136	9.780	0.460
500,000 -1 million	62 (51.7)	25(20.8)	33 (27.5)	120		
1 – 2 million	73 (62.4)	20 (17.1)	24 (20.5)	117		
2 – 3 million	37 (68.5)	9 (16.7)	8 (14.8)	54		
3 – 4 million	24 (64.9)	9 (24.3)	4 (10.8)	37		
> 4 million	61 (58.1)	19 (18.1)	25 (23.8)	105		
Vaccines (immunization) are good						
Yes	419 (68.1)	98 (15.9)	98 (15.9)	615	123.715	**<0.001***
No	33 (20.5)	51(31.7)	77 (47.8)	11		
Ever received any vaccine before						
Yes	415 (59.5)	136 (19.5)	147 (21.1)	698	8.879	**0.012***
No	37 (47.4)	13 (16.7)	28 (35.9)	78		

Risk perception for COVID-19						
Good	289 (59.0)	93 (19.0)	108 (22.0)	490	0.310	0.856
Poor	163 (57.0)	56 (19.6)	67 (23.4)	286		
Knowledge of COVID-19						
Good	419 (59.8)	135 (19.3)	147 (21.0)	701	10.950	**<0.001***
Poor	33 (44.0)	14 (18.7)	28 (37.3)	75		

χ^2: **Chi square test; *: *p* value <0.05**

Table 7: Predictors of uptake of a potential COVID-19 vaccine

Social Demographics and other Uptake Variables of Respondents	B	*p*-value	OR (95% CI)	95% CI Lower	Upper
Gender					
Male	0.484	**0.002***	1.622	1.189	2.214
Female REF			1		
Religion					
None REF			1		
Christianity	-0.056	0.935	0.945	0.244	3.662
Islam	-0.666	0.351	0.514	0.127	2.084
Others	-2.279	0.099	0.102	0.007	1.532
Occupation					
Unemployed REF			1		
Trader	-0.656	0.267	0.519	0.163	1.654
Teacher	0.506	0.163	1.658	0.815	3.374
Artisan	-1.019	0.173	0.361	0.083	1.561
Healthcare worker	0.492	0.117	1.635	0.884	3.024
Information technology	0.841	0.093	2.318	1.043	5.153
Financial services	0.434	0.286	1.543	0.695	3.425
Security agent	-0.152	0.847	0.859	0.184	4.018
Agricultural services	-0.917	0.147	0.400	0.116	1.380
Others	0.458	0.119	1.581	0.889	2.813
Vaccines (immunization) are good					
Yes	1.891	**<0.001***	6.623	4.549	9.642
No REF			1		
Ever received any vaccine before					
Yes	0.310	0.242	1.364	0.811	2.295
No REF			1		
Knowledge of COVID-19					
Good	0.175	0.497	1.191	0.719	1.972
Poor REF			1		

B: Coefficient of Ordinal logistic regression; OR: Odds ratio; 95% CI: 95% Confidence Interval; *: *p* value <0.05

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DISCUSSION

This study reveals that only a simple majority (58.2%) were willing to take a COVID 19 vaccine when available. This is short of the findings from a study by Abdelhafiz A. et.al[24] where about 73% of the respondents were willing to take a potential COVID-19 vaccine. Malik A.[25] in his study in the United States (US) also found that 67% of participants would be willing to accept the vaccine. About one-fifth of the respondents in this study were indecisive; a finding similar to the one reported among healthcare workers from a study conducted by Fu C. et.al.[26] Strikingly, there was an aversion to multiple vaccine doses among those willing to take the vaccine with most preferring the oral and the injection routes over other potential routes of administration This information is important for policymakers to improve uptake and compliance, especially if multiple route options become available. About one-fifth of the respondents were unwilling to receive a potential vaccine which appears to stem from skepticism about the safety of the potential vaccine. For instance, in this study, the majority were unsure if the potential vaccine is 'a mark of the beast' or if the motive is 'to reduce the world population'. This is comparable to the findings in the study by Thunstrom L. et.al[9] where it was reported that 20% of the US population would decline the vaccine. They noted that distrust of vaccine safety and vaccine novelty are among the most important obstacles to vaccination.

Five factors namely, gender, religion, occupation, knowledge of COVID-19, 'perception that vaccines generally are good', and previous vaccination(s) were shown to have a statistically significant association with 'willingness to take vaccine'. However, male gender and 'perception that vaccines generally are good' were found to be the only independent significant predictors of uptake of a potential COVID 19 vaccine. Like this, Wang J.[27] in his study in China found that being male increased the probability of accepting the vaccine. Contrary to this Padhi[28] in his

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study in Saudi Arabia reported no association between gender and willingness to take a COVID-19 vaccine while Lazarus J [29] also reported that gender differences were small in his study across 19 Countries.

While gender (male), and 'perception that vaccines generally are good' predicted the positive uptake of a potential COVID-19 vaccine as hypothesized, surprisingly, knowledge and risk perception of the disease did not, despite reported good knowledge and positive risk perception. This suggests there are still other factors influencing the uptake of a potential vaccine; of note is the range of misconceptions bordering on the skepticism about the safety of a potential vaccine identified in this study, which seems to agree with the study by Thunstrom L. et.al.[9] While it is recognized that hypothetical choices may not always reflect real-life behaviour/decision, it is imperative for stakeholders (for example government agencies/policymakers, non-governmental organizations, and health care workers) to still do more in terms of health education and promotion especially in addressing these misconceptions about a potential COVID-19 vaccine. This may go a long way in improving probable low vaccine uptake.

Limitations

Findings may be influenced by selection bias because respondents needed access to a smartphone or computer. This may have excluded the poor, elderly who are most vulnerable to COVID-19 this may limit external validity and may have distorted estimation of those willing to take the vaccine.

CONCLUSION

Our study showed that 58.2%of our sample from across Nigeria would be willing to take a COVID-19 vaccine. Male gender was the most significant independent predictor of vaccine

uptake, this is particularly important in Nigeria where the patriarchal system is dominant. Most respondents who were not willing to receive vaccines could not give a reason for their stance. Policymakers and Stakeholders will need to focus attention on Health education campaigns targeted at both males and females in the community to improve the acceptance and uptake of the vaccine.

DECLARATIONS

Ethics approval

Ethical approval was obtained from the Health Research Ethics Committee of Federal Medical Center, Gusau, Zamfara State, Nigeria

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests

Funding

No funding was received for this research

Authors` Contributions

Conception/design of the study-COO, VKS, OBF, AOO; data collection-UOA, CMI, JCO, OFA, KWO; data analysis and interpretation-EEA, GOP, AOA, OEA; article drafting- BFU, YBA, OFA, AOO; Critical revision of the article- COO, BFU, VKS; final approval of the version to be published-all authors

Acknowledgment

Ruth Oluwafunmike Olomofe is appreciated for proof-reading the final manuscript.

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