

investigating the effect of Infodemic on the Perception and Willingness to Take the COVID – 19 Vaccine in Delta State, Nigeria.

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ABSTRACT

Introduction: The rollout of COVID-19 vaccine in response to the COVID-19 pandemic has been accompanied by infodemic. This study ascertained the influence of infodemic on individuals' willingness to be vaccinated for increased vaccine coverage in Delta State.

Methods: In this cross-sectional study, 2500 respondents across the twenty five Local Government Areas in Delta State, with age of at least 15 years were selected using stratified random sampling to provide an appropriate demographic representation. A researcher – made questionnaire including demographic characteristics and questions related to participants' knowledge and attitude regarding COVID-19 vaccine was used. Descriptive Statistics of Frequency (Percentage) was used for data analysis using Microsoft Excel software version 2016.

Results: Demography of respondents showed that secondary education was highest (43%), while 50% of the respondents were urban dwellers. 80.44% of the respondents admitted to the existence of the virus, while 45.84% admitted to its existence in Delta State. 27.68% of the respondents were willing to take the COVID-19 vaccine; while 58.08% declined. 63% of respondents had access to social media; and majority of them (52%) admitted to not verifying health information seen on social media with medical experts. Majority of the respondents willing to take the vaccine were aged 45 to 60 years (42.37%); reside in urban areas, have tertiary education, access to social media; and often verified health information with medical experts. Infodemic about the COVID-19 vaccine and lack of trust in the government were identified as the major debilitating factors to the public acceptance of the vaccine.

Conclusion: Improving COVID-19 vaccine coverage in Delta State requires a holistic approach of combating misinformation about the vaccine,, regulation of health information shared on the social media space, and criminalizing the act of infodemic.

Keywords: Infodemic, COVID-19 vaccine, health information, social media, public health, Delta State.

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Introduction

The word "Infodemic" is a combination of the words "information" and "epidemic". It typically refers to a rapid and far-reaching spread of both accurate and inaccurate information about something, such as a disease (1). Infodemic which was previously used in connection with the global outbreak of Severe Acute Respiratory Syndrome (SARS) in 2003 (2), has seen its renewed usage in recent times following the COVID-19 pandemic (2). According to the World Health Organization (WHO) the novel coronavirus disease (COVID-19) is a highly transmissible human respiratory disease that has infected more than 215 million people and caused approximately 4.5 million deaths worldwide as of 25 August 2021 (3). The United Nations and the World Health Organization began using the term "infodemic" following the waves of misinformation and rumors on the COVID-19 pandemic particularly on various social media platforms, which has interfered with efforts aimed at curtailing the pandemic in the year 2020.

Over the years, the media in its various forms has played a powerful role in the dissemination of information for public health education (4). Its substantial contribution to health awareness and promotion; changing peoples' attitudes and intentions, and influencing health behavior has made it an essential mediator for health communication between governments, health institutions, and the people (5). The phenomenon of spreading misinformation during outbreaks has been known to occur since the Middle Ages (6). However, studies have shown that the emergence and present-day dominance of social media have significantly amplified the dissemination of falsehoods far more than evidence-based information (7,8,9,10,11). Larson (12) predicted that the impact of the next major outbreak would be magnified by emotional contagion that would be digitally enabled. This misinformation has led to an increase in public anxiety about health and chaos in society.

In Nigeria, the media space which has been dominated by various social media platforms such as Twitter, WhatsApp, Instagram, and Facebook

has witnessed its share of the global COVID-19 infodemic, which has increased since the reported first COVID-19 case in Nigeria (27th of February 2020) (13). The COVID-19 infodemic was characterized by distrust of science; misinformation by several experts in science and medicine, religious leaders, and the government. These factors led to the conveyance of misleading information on the disease across the various forms and types of communication media; and the promotion of ineffective precautionary measures. As with the widespread infodemic which accompanied the COVID-19 pandemic; the development of the COVID-19 vaccines and its administration is presently confronted with the same challenge (14,15). The development of COVID-19 vaccines in response to the pandemic has led to investigations on public perceptions of the vaccine, as the effectiveness of a vaccine to protect a population is based on the widespread willingness of individuals to be vaccinated. Recent studies have examined the effect of COVID-19 infodemic on public perceptions of the pandemic (16,17,18), and the willingness to accept a COVID-19 vaccine (19,20). In Africa, a countrywide survey on COVID-19 vaccine perception among fifteen (15) countries including Nigeria, attributed the unwillingness of persons to accept the COVID-19 vaccine to infodemic and conspiracy theories exposure (21).

Delta State with a population of over 6 million persons is located in the Niger Delta region of Nigeria. The State comprises of 25 Local Government Areas and 12 major urban centers with Asaba as the capital city and Warri as her largest commercial and most populated city in the State (22). The rapid growth of formal education and the rural-urban wage differentials have been identified as the major influences of urbanization in the State (23). The deployment of the COVID-19 vaccine in Nigeria; and the mass vaccination program of individuals in Delta State has necessitated this study to ascertain the influence of infodemic on the willingness of the people to be vaccinated and identify knowledge gaps at the

community level for increased vaccine coverage in Delta State.

Methods

In this cross – sectional study, study population was determined using the Using the Stratified Fisher's Formula (24),

$$n = \frac{Z^2 \times P \times (1 - P)}{d^2}$$

Where n = sample size required

Z = standard normal deviation which was set at 2.58 corresponding to 99% confidence level

P = assumed variability (p = 0.5 which is maximum variability)

d = confidence level interval which was set at ± 5% precision

A population sample size of 2500 individuals comprising of 100 persons from each of the 25 Local Government Areas in Delta State, were selected from January to April 2021 with the age of at least 15 years were selected using stratified random sampling to provide an appropriate demographic representation.

The study utilized the ex-post-facto survey research design to determine the influence of infodemic on the perception and willingness of individuals to take the COVID – 19 vaccine. A structured questionnaire and oral interviews were used as research instruments to collect data and information from respondents. Initially, all study objectives were fully explained to the participants and exclusion criteria were considered as reluctance to participate in the study.

Respondents were asked to complete a researcher - made questionnaire including demographic information as well as knowledge and attitude questions. The survey instrument was validated by 6 experts in biological science and public health studies, and instrument reliability was also confirmed through a pilot study (n = 200)

revealing a Cronbach's alpha index of 0.8. The questionnaire consisted of 9 questions which was split into two sections – The first section (4 items) addressed questions on demographic characteristics, including age, education, occupation and place of residence. The second section comprised of 5 questions pertinent to individuals' knowledge and perception about COVID-19 virus and the COVID-19 vaccines. The questionnaire was administered directly to participants and took about 5 minutes to fill out.

Ethical Statement

Research participants/ respondents for the study consented voluntarily having been assured by the researchers of the non - disclosure of personal information or identifiable data. Also, questions concerning religious beliefs and tribe/ culture were exempted from the survey questionnaire to avoid respondents being stereotyped.

Statistical analysis

Descriptive Statistics of Number frequency of responses and percentages was used for data interpretation. All statistical analysis were computed using Microsoft® Office Excel 2016 version.

Results

The summary of the demographics of respondents is presented in Table 1. The prominent group of respondents was 31 – 45 years (40%). For the highest educational level, secondary education was highest with forty-three percent (43%), while six percent (6%) of the respondents had no basic formal education. Occupation of respondents was evenly stratified among farmers/ traders (20%), civil servants/ employees (20%), self-employed (20%), students (20%) and health practitioners (20%). The majority of the respondents resided in the urban area (50%).

Table 1. Demographics of Study Respondents

	Variables	N	%
Age	15 – 30 years	500	20
	31 – 45 years	1,000	40
	45 – 60 years	500	20
	60 years and above	500	20
Highest Educational Level	Primary	375	15
	Secondary	1,075	43
	Tertiary	900	36
	None	150	06
Occupation	Farmers/ Traders	500	20
	Civil Servants/ Employees	500	20
	Self employed	500	20
	Students	500	20
	Health Practitioners	500	20
Place of Residence	Rural	625	25
	Semi-urban	625	25
	Urban	1,250	50

The responses to questions on the COVID-19 vaccine perception are presented in Table 2. Regarding the reality of the COVID-19 virus, 80.44% of the respondents admitted to the reality and existence of the virus, 8.64% denied its existence, while 10.92% were undecided about the reality and existence of the virus. Concerning the existence of the COVID-19 virus in Delta State, 45.84% admitted to its existence, 43.24% denied

its existence, while 10.92% were undecided about the reality and existence of the virus in the State. On the issue of willingness to take the COVID-19 vaccine; 27.68% of the respondents admitted, 58.08% declined, while 14.24% were undecided. Among respondents, 63% had access to social media; and a majority of the respondents (52%) admitted to not verifying health information seen on social media with medical experts.

Table 2. Summary of Respondents Perception of COVID-19 and COVID-19 Vaccine.

	Variables	N	%
Do you believe COVID-19 is real?	Yes	2,011	80.44
	No	216	8.64
	Undecided	273	10.92
Do you believe COVID-19 exist in Delta State?	Yes	1,146	45.84
	No	1,081	43.24
	Undecided	273	10.92
Are you willing to take the COVID-19 Vaccine?	Yes	692	27.68
	No	1,452	58.08
	Undecided	356	14.24
Do you have access to social media?	Yes	1,673	66.92
	No	827	33.08
Do you verify health information seen on social media with an expert?	Yes	439	26.24
	No	893	53.38
	Sometimes	341	20.38

Table 3. Perception of COVID-19 vaccine in relation to age group of respondents.

	Variables	Yes (%)	No (%)	Undecided (%)
Are you willing to take the COVID-19 Vaccine?	15 – 30 years	99 (14.31)	326 (22.45)	75 (21.07)
	31 – 45 years	150 (21.68)	736 (50.69)	114 (32.02)
	45 – 60 years	307 (44.36)	135 (9.30)	58 (16.29)
	60 years and above	136 (19.65)	255 (17.56)	109 (30.62)
Do you have access to social media?	15 – 30 years	328 (19.61)	172 (20.80)	-
	31 – 45 years	847 (50.63)	153 (18.50)	-
	45 – 60 years	384 (22.95)	116 (14.03)	-
	60 years and above	114 (6.81)	386 (46.68)	-
Do you verify health information seen on social media with an expert?		Yes (%)	No (%)	Sometimes (%)
	15 – 30 years	63 (14.35)	196 (21.94)	69 (20.24)
	31 – 45 years	112 (25.51)	557 (62.37)	178 (52.20)
	45 – 60 years	186 (42.37)	127 (14.22)	71 (20.82)
	60 years and above	78 (11.93)	13 (1.46)	23 (6.75)

Table 4. Perception of COVID-19 vaccine in relation to respondents' place of residence.

	Variables	Yes (%)	No (%)	Undecided (%)
Are you willing to take the COVID-19 Vaccine?	Rural	57 (8.24)	495 (34.09)	73 (20.51)
	Semi-Urban	192 (27.75)	339 (23.35)	94 (26.41)
	Urban	443 (64.02)	618 (42.56)	189 (53.09)
Do you have access to social media?	Rural	206 (12.31)	419 (50.67)	-
	Semi-Urban	493 (29.47)	132 (15.96)	-
	Urban	974 (58.22)	276 (33.37)	-
Do you verify health information seen on social media with an expert?		Yes (%)	No (%)	Sometimes (%)
	Rural	19 (4.33)	152 (17.02)	35 (10.26)
	Semi-Urban	113 (25.74)	277 (31.02)	103 (30.21)
	Urban	307 (70.39)	464 (51.96)	203 (59.53)

Table 5. Perception of COVID-19 vaccine in relation to respondents' educational qualification.

	Variables	Yes (%)	No (%)	Undecided (%)
Are you willing to take the COVID-19 Vaccine?	Primary	86 (12.43)	203 (13.98)	86 (24.16)
	Secondary	194 (28.04)	749 (51.58)	132 (37.08)
	Tertiary	401 (57.95)	395 (27.20)	104 (29.21)
	None	11 (1.59)	105 (7.23)	34 (9.55)
Do you have access to social media?	Primary	138 (8.25)	237 (33.01)	-
	Secondary	782 (46.74)	293 (35.43)	-
	Tertiary	715 (42.74)	185 (22.37)	-
	None	38 (2.71)	112 (13.54)	-
Do you verify health information seen on social media with an expert?		Yes (%)	No (%)	Sometimes (%)
	Primary	23 (5.24)	79 (8.85)	36 (10.56)
	Secondary	128 (29.16)	523 (58.57)	131 (38.42)
	Tertiary	283 (64.47)	269 (30.12)	163 (47.80)
	None	5 (1.34)	23 (2.56)	11 (3.23)

Discussion

The global COVID-19 pandemic has seen a mixed reaction and response on the existence of the virus from the public. On the existence of the COVID-19 virus, the majority of the respondents admitted to its existence because of the

information and knowledge about the virus they have received from the media which they confirmed with health officials and relatives resident in developed nations where pandemic was severe. The respondents who doubted the existence of the COVID-19 virus were found to be majorly

residing in the rural areas, lacked access to social media, unavailability of infected persons within their neighborhood, and belief in conspiracy theories. A similar scenario was observed with the existence of the COVID-19 virus in Delta State, a majority of the respondents who admitted to the existence of the virus in the State were majorly resident in the urban areas, had access to social media and authenticated information from health professionals. However, the majority of the respondents believe that the threat from the COVID-19 virus is exaggerated and does not pose a major health risk to the public. This corroborates with the CDC Africa (21) opinion report on Nigerians (67%) apathy of the COVID-19 virus on public health, and consistent with research on risk perception and behavior - as those with less favorable attitudes towards the COVID-19 vaccine also perceived the virus to be less threatening (36).

The public perception of the COVID-19 vaccine is premised on the accuracy of the information they have received from media sources that they see as reliable. Although there are several contributing factors to the public acceptance of vaccines, infodemic has increased the public apprehension concerning the safety and efficacy of the COVID-19 vaccine. As recent studies have identified the relevance of the social media in shaping personal or parental opinion about vaccination (42,43,44).. This is evident in this study by the divergent attitude of responses from individuals who questioned the need and efficacy of the COVID-19 vaccine; yet agreed to general vaccinations to protect against other diseases for public health.

Individuals' perceptions and attitudes to receiving vaccines have been shown to be influenced by a variety of socio-demographic factors such as age (36), ethnic background (37), socioeconomic status – place of residence and type of work (38) and level of education (39). In this study, a small percentage of the total respondents (27.68%) were willing to take the vaccine as they saw the COVID-19 vaccine-like every other human vaccine such as polio and meningitis needed for wellbeing. Majority of the respondents

willing to take the COVID-19 vaccine were aged 45 to 60 years (42.37%); had access to social media; and often verified health information with medical experts (Table 3).

The place of residence have been shown to influence the decision making process and behavior of residents (25). As regarding the influence of place of residence on the willingness to take the vaccine, respondents in the urban areas showed a mixed trend as they recorded the highest positive response (64.02%), highest negative response (42.56%) and the highest undecided (53.09%) in willingness to take the COVID-19 vaccine. The urban respondents' perception toward the vaccine was found to be influenced by their access and high usage of the social media (58.22%), which exposed them to a lot of infodemic about the vaccine (Table 4). Also, majority of the respondents' resident in the rural areas that had access to social media admitted to the non-verification of health information on social media as they lacked access to health professionals and therefore rely on third party information. This corroborates with the findings of Ekoko (28) which reported that the majority of the rural women and residents in Delta State consult traditional healers and relatives for information regarding their health.

Regarding the influence of educational status of respondents on their perception and willingness to take the COVID-19 vaccine (Table 5); it was observed that majority of respondents willing to take the vaccine (57.95%) and do verify health information with medical experts (64.47%) had tertiary education; while majority of respondents unwilling to take the vaccine (51.59%) and do not verify health information with medical experts (58.57%) had secondary school education. Also, it was observed that educational status and exposure to social media influenced the perception of the COVID-19 vaccine, as respondents with secondary education recorded highest usage of social media (46.74%) and uncertainty about taking the vaccine (37.08%). The unwillingness by a majority of the respondents (76.04%) to take the COVID-19 vaccine were based on reasons such as conspiracy theories, discrepancies of opinions among

developed nations and international health organization about the vaccine; information on speculated human reaction to the vaccine, and self-opinion of not infested with the virus. In Africa, the unwillingness to accept the COVID-19 vaccine was high (78%) among those exposed to infodemic and conspiracy theories, with Nigeria grouped into the bottom half of countries in terms of willingness to take COVID-19 vaccine (21). This study has shown the high level of respondents' exposure to infodemic through access to social media. These findings corroborate with reported studies on the decline in public confidence in vaccines (26,27). The study observed an existing distrust among citizens with the Nigerian government authorities at the National and State levels that was further heightened as a result of the poor management of citizens' welfare during the COVID-19 pandemic lockdown in 2020. This level of distrust negatively influenced the citizens' trust in the integrity of the vaccines and the willingness to be vaccinated. An outcome that led to the spread of popular Pidgin English slogan messages such as "Na People wen chop palliative go take a vaccine, as e no good to take injection without Food" on various social media platforms.

Infodemic thrives on the spreading of unverified medical information, with the digital space offered by social media platforms such as Facebook and Twitter serving as fertile grounds for the dissemination to a vast audience (40,41). It was observed that a small percentage (26.24%) of the respondents verify medical information seen on social media with health professionals. This corroborates with the report of Nigerians are more likely to trust the radio (69%) and social media (36%) and less willing to trust government sources (8%) and health care authorities (14%) for public health information (21). This is a serious concern in the effort to mitigate the spread of the COVID-19 pandemic and increase the willingness of citizens to get vaccinated. A probable futuristic fallout of the influence of infodemics on the COVID-19 vaccine is the decline in the number of children and adults willing to take routine vaccination especially in developing nations such as Nigeria.

As communities previously harboring "myths and misconceptions" about vaccines and vaccination will resist vaccination as a result of exuberating fear and anxiety leading to declining community protection against vaccine-preventable diseases (29,44,46,47,48). Similar studies in UK and the USA to quantify how exposure to online misinformation around COVID-19 vaccines affects successful vaccination campaigns, showed that scientific-sounding misinformation was more strongly associated with declines in vaccination intent among participants in the study (49). The reluctance to receive recommended vaccination because of concerns and doubts about vaccines have been identified by the World Health Organization as one of the top 10 threats to global health (45). The Global Alliance for Vaccines and Immunization (GAVI) identified the anti-vaccine movement as one of the challenges to achieving mass vaccination in Nigeria (30). This is a cause of concern for public health in Nigeria, which is committed to achieving 100 percent immunization coverage.

As with other epidemics in the past such as SARS and Ebola, the knowledge, attitudes, precautionary behaviors, and active social participation of citizens had positive effects on the control of the epidemics (31,32,33). Having examined the perception of people in Delta State towards the COVID-19 vaccine, it is evident that infodemic conveys misleading messages on the disease and the vaccine which has negatively impacted their willingness to take the vaccine. Therefore, there is a need to counter the spread of infodemic in the public information domain for improved vaccination coverage.

Recommendations

As facts, rumors, and fears about the COVID-19 vaccine get mixed up and disseminated to the public, it becomes difficult for the public to learn essential information about the issue. Increasing the vaccination coverage of the population in Delta State is contingent on the willingness of the citizens to be vaccinated. To achieve the set national target of seventy percent (70%) population

COVID-19 vaccination, the following are recommended:

1. Public Health Education: The need to increase public health education on the safety of the COVID-19 vaccines especially in the suburban and rural areas. Having identified the reliance of the public on radio and social media for health information; increased dissemination of science-based information through these channels and other identified communication channels at the rural level will help in improving the perception and willingness to take the COVID-19 vaccine. Also, there is need for Government and relevant agencies to improve the communication strategy in the digital space by engaging identified social media influencers in the support and dissemination of scientific knowledge on the safety of the COVID-19 vaccine (44,48).

2. Legislation: There is a need to strengthen the regulation of health information shared on the Nigerian social media space. Governments should develop and direct public health policies to address the role of media portals in propagating health information. This will greatly assist in combating the ills of infodemic, safeguard public health, and criminalize misinformation.

3. Civil society organizations: Civil society organizations (CSOs) have been identified as potential frontline community players in delivering key messages related to COVID-19 and the emerging risk of vaccine-preventable diseases (VPDs) in communities (33). The services of registered CSOs particularly those working with rural communities should be engaged in the fight against infodemic and rebuilding public trust in the COVID-19 vaccine. The Government through the provision of appropriate institutional support can leverage the already built partnership trust between CSOs and communities to improve on the COVID-

19 vaccination coverage. As these CSOs have demonstrated great power in advocacy, community mobilization, and creating awareness on several social and political concerns in the country.

Conclusion

The impact of infodemic in the interference of the COVID-19 pandemic mitigation and the willingness of individuals to take the COVID-19 vaccine threatens the inoculation of the public against the disease is a serious concern to public health. This study has identified the spread of misinformation about the COVID-19 vaccine and the lack of trust in the government at the national and state levels as the major debilitating factors to the public acceptance of the vaccine. Improving the COVID-19 vaccine coverage in Delta State requires a holistic approach of combating misinformation about the vaccine in the public domain with science-based authenticated information by government agencies/ health organizations; regulation of health information shared on the social media space and criminalizing the act of infodemic.

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Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Authors' Contributions

Egun, N. K. conceptualized and designed the study. All authors contributed to the review of literature, data/ information collection and analysis, and preparation of the manuscript.

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