COVID-19 VACCINE HESITANCY AMONG STAFF OF UNIVERSITY OF BENIN, UGBOWO CAMPUS, BENIN CITY

BY

UWUMAROGIE UYI JOE

PHA1506022

DEPARTMENT OF CLINICAL PHARMACY AND PHARMACY PRACTICE

FACULTY OF PHARMACY

UNIVERSITY OF BENIN

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BEING A DISSERTATION SUBMITTED TO THE DEPARTMENT OF CLINICAL PHARMACY AND PHARMACY PRACTICE, FACULTY OF PHARMACY, UNIVERSITY OF BENIN, BENIN CITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DOCTOR OF PHARMACY (PHARMD) DEGREE

JANUARY, 2023

CERTIFICATION

This is to certify that this project was carried out by Uwumarogie Uyi Joe in the department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, University of Benin, in partial fulfillment of the requirement for the award of Doctor of Pharmacy (PharmD) degree

Uwumarogie Uyi Joe (Student)	DATE
Dr. M.I Osarenmwinda (Project supervisor)	DATE
Dr. (Mrs.) S.F Usifoh (Head of Department)	DATE

DEDICATION

I dedicate this work to my late beloved mother and siblings for their endless supports and prayers.

ACKNOWLEDGEMENT

My profound gratitude goes to God almighty, the giver of life and good health.

I extend my deep- seated appreciation to my supervisor in the person of Dr M.I Osarenmwinda for his kind corrections, counsels and mentorship. I am grateful and highly treasured the time spent working under you.

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I also acknowledge my friends in the department for their assistance and supports.

It is my humble request that God almighty keep, bless and protect us all through all life's endeavors.

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LIST OF ABBREVIATIONS

ACE-2	Angiotensin Converting Enzyme-2
ARDS	Acute Respiratory Disease Syndrome
CDC	Center for Disease Control
COVID-19	Coronavirus Disease 2019
CRS	Congressional Research Service
EMA	European Medicines Agency
FDA	Food and Drug Association
NAFDAC	National Agency for Food and Drug Administration and Control
NCDC	Nigeria Centre for Disease Control and Prevention
PCR	Polymerase Chain Reaction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus-2
TGA	Therapeutic Goods Administration
WHO	World Health Organization

ABSTRACT

Background: Vaccines remain one of the most successful and cost-effective measures for combating COVID-19. However, vaccine hesitancy which refers to delay in acceptance of vaccination despite availability of vaccination services (MacDonald NE and SAGE working group, 2015), could pose a serious problem for COVID-19 prevention and control.

Objectives: The objective of this study was to estimate the level of COVID-19 vaccine hesitancy among staff of the institution and factors associated with it.

Methods: The study design was a cross sectional retrospective study. Data was collected using a self-administered questionnaire. The questionnaire was shared to the staff in their various offices. The outcome measures were participants' demographics, participants' knowledge of the disease, and of course the proportion of participants already vaccinated; vaccine hesitancy rates and reasons for this hesitancy. Data were analyzed using SPSS version 23 and Minitab version 19. Bivariate analysis was performed by the chi-square test, and statistical significance was accepted when p-value is < 0.05.

Results: Only 140 of the study responses were analyzed. Results showed that only 42, representing just 30% of the surveyed participants have been vaccinated; whereas, 98 participants representing 70% of the study respondents have not been vaccinated/ hesitant to get vaccinated. Vaccine safety concerns (31.4%), vaccine effectiveness (27.1%) and availability (15.7%) major of their hesitancy towards getting vaccinated.

Nature of job (whether academic or non-academic) with p=0.032, years of experience with p=0.004, and educational level with p=0.002 may have significantly influence participants decisions towards the vaccine.

Conclusion: COVID-19 vaccine hesitancy is high among staff of the University of Benin and this is attributable to concerns surrounding the vaccine safety, effectiveness and availability.

Keywords: Corona virus, vaccine, hesitancy

CHAPTER ONE

LITERATURE REVIEW

1.0 Background

In December 2019, an outbreak of the novel coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was initially detected in Wuhan city, Hubei province, China. Subsequently, on March 11, 2020, the WHO declared COVID-19 as a pandemic due to the alarming levels of spread and severity of the infection (WHO, 2020)ss. SARS-COV-2 infection has been associated with a wide spectrum of illness that ranges from asymptomatic, mild to severe, or fatal. Common clinical symptoms of COVID-19 include fever, fatigue, dry cough, and shortness of breath, pneumonia, ageusia, and anosmia. (CDC, 2021), with less common ones including headaches, nasal congestion and runny nose, muscle pain, sore throat, diarrhea, eye irritation (Pardhan, et al; 2020) and toes swelling or turning purple, and in moderate to severe cases, breathing difficulties. (ECDC, 2020)

The first confirm case in Nigeria was announced on 27 February, when an Italian national tested positive for the virus (NCDC, 2020).

As of December 2021, the COVID-19 pandemic had caused almost unthinkable damage to many nations' health and economy. According to an early COVID-19 modeling report, Nigeria has a high coronavirus importation risk, high susceptibility, and moderate capacity to contain the outbreak. Overall, more than 661 million COVID cases and 6 million deaths have been recorded worldwide (Worldometers, 2022). Nigeria has experienced the highest COVID-19 burden of any country in Africa to date, with over 260,000 cases and over 3,000 deaths (NCDC, 2022). Universities have certain characteristics that can increase the risk of COVID-19 spread

throughout campuses, such as a large population, high population density, and regular interactions between students and staffs. This risky combination calls for protective measures to curb the spread of the virus on campuses.

Vaccines are one of the most successful and cost-effective COVID-19 protective measures. Several prophylactic vaccines against COVID-19 have already been developed in various countries, including vaccines produced by AstraZeneca, Pfizer–BioNTech, Moderna, and Johnson & Johnson (Janssen). These vaccines have been distributed to various countries. In Nigeria, however, Moderna, astrazeneca, and Janssen COVID-19 vaccine has been rolled out for public use (NAFDAC, 2021). With this vaccination underway, it is critical to investigate the acceptability of a COVID-19 vaccine, particularly given people's varying perception of vaccines worldwide. Moreover, the best vaccine would be ineffective if it is not used. Although little progress has been made in vaccination among the general public in Nigeria, there are still important challenges about complete immunization against COVID-19 in universities, one of which is the uncertainty about the students' and staffs' acceptance of COVID-19 vaccination amidst the many fake news and conflicting information on social media that could deter acceptance.

Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services (MacDonald NE and SAGE working group, 2015). The "3 Cs" model of vaccine hesitancy, namely Complacency, Convenience, and Confidence, was first proposed to the WHO EURO Vaccine Communications Working Group in 2011(WHO, 2014). Complacency denotes the low perception of the disease risk; hence, vaccination was deemed unnecessary. Confidence refers to the trust in vaccination safety, effectiveness, besides the competence of the

healthcare systems. Convenience entails the availability, affordability and delivery of vaccines in a comfortable context.

The complex nature of motives behind vaccine hesitancy can be analyzed using the epidemiologic triad of environmental, agent and host factors.(Kumar *et al.,* 2016) Environmental factors include public health policies, social factors and the messages spread by the media(Daley *et al*., 2016). The agent (vaccine and disease) factors involve the perception of vaccine safety and effectiveness, besides the perceived susceptibility to the disease (Arede et al., 2018) (Dube *et al*., 2015) Host factors are dependent on knowledge, previous experience, educational and income levels (Kumar *et al*., 2016) (Olson *et al*., 2020)

Previous research has demonstrated that vaccination reluctance is a widespread occurrence around the world, with variation in the reported reasons for vaccine rejection. (Lane *et al*., 2018) (Wagner *et al*., 2019) The most common reasons included: perceived dangers versus advantages, specific religious views, and a lack of knowledge and awareness. (Karafillakis *et al*., 2017) (Pelcic *et al.,* 2017) The aforementioned factors can be used to explain COVID-19 vaccine reluctance, as demonstrated by recent publications that found a strong correlation between intent to receive coronavirus vaccines and its perceived safety (Karlsson *et al*., 2021), a link between a negative attitude toward receiving COVID-19 vaccines and refusal to receive the vaccines (Paul *et al*., 2021), and a link between religiosity and lower intention to receive COVID-19 vaccines. (Olagoke *et al*, 2020)

There is regional variation in how people perceive the safety and efficacy of vaccination, according to other studies that evaluated attitudes regarding vaccination. (Wagner, *et al*., 2019) (Wellcome Global Monitor, 2020) (Larson, *et al.,* 2016) Higher income regions were the least certain regarding vaccine safety with 72%–73% of people in Northern America and Northern

Europe who agreed that vaccines are safe. This rate was even lower in Western Europe (59%), and in Eastern Europe (50%), despite the presence of a substantial variability in Eastern European countries (from 32% in Ukraine, 48% in Russia, to 77% in Slovakia). However, the majority of people in lower-income areas agreed that vaccines are safe, with the highest proportions seen in South Asia (95%) and in Eastern Africa. (92%) (Wellcome Global Monitor, 2020) A similar pattern was observed regarding vaccine effectiveness, with Eastern Europe as the region where people are the least likely to agree that vaccines are effective, as opposed to South Asia and Eastern Africa (Wellcome Global Monitor, 2020). The assessment of such regional differences can be invaluable in addressing and fighting public health threats posed by vaccine hesitancy.

The global efforts to lessen the effects of the pandemic, and to reduce its health and socio-economic impact, rely to a large extent on the preventive efforts (Nicola *et al*., 2020) (Calina *et al*., 2020). Thus, huge efforts by the scientific community and pharmaceutical industry backed by governments' support were directed towards developing efficacious and safe vaccines for SARS-CoV-2 (Conte *et al.,* 2020). These efforts were manifested by the approval of several vaccines for emergency use, in addition to more than 60 vaccine candidates in clinical trials. Moreover, more than 170 COVID-19 vaccine candidates are in the pre-clinical phase (WHO, 2020).

Despite the huge efforts made to achieve successful COVID-19 vaccines, a major hindrance can be related to vaccine hesitancy towards the approved and prospective COVID-19 vaccination (Harrison and Wu 2020)

1.1 Coronavirus disease 2019(COVID-19)

Coronavirus disease 2019(COVID-19) is an infectious disease caused by acute respiratory syndrome coronavirus-2. It was first identified in December 2019 in Wuhan, Hubei, China, and has resulted in an ongoing pandemic (Mayo Clinic, 2020). Subsequently, on March 11, 2020, the WHO declared COVID-19 as a pandemic due to its alarming levels of spread and severity (WHO, 2020).

Common symptoms include fever, cough, fatigue, shortness of breath, loss of smell and taste. While majority of cases result in mild symptoms, some progress to acute respiratory distress syndrome (ARDS); possibly precipitated by cytokine storm, multi organ failure, septic shock and blood clots. The time from exposure to onset of symptoms is typically around five days, but may range from two to fourteen days (CDC, 2020).

1.1.1 Signs and symptoms

Symptoms of COVID-19 are variable, but usually include fever and a cough. People with the same infection may have different symptoms, and their symptoms may change over time. For example, one person may have a high fever, a cough and fatigue, and another person may have a low fever at the start of the disease and develop difficulty in breathing a week later. All the symptoms of covid-19 are non-specific, which means they can be seen in other diseases. Nevertheless, on the 13th of August 2020, scientists at the University of Southern California reported the “likely “order or initial symptoms of the COVID-19 disease as ; fever, cough, muscle pain, and then nausea, and/or vomiting and diarrhea (Larsen *et el*, 2020).

Other typical symptoms include fatigue, shortness of breath, muscles and joint pains. Some symptoms such as difficulty in breathing, are more common in patients who need hospital care.

Shortness of breath tends to develop later in the illness. About 40% of people temporarily lose their sense of smell(anosmia), experience changes in how foods tastes(dyspepsia), or have other disturbances to those normal abilities to taste or smell. (CDC, 2020)

Other symptoms are less common among people with covid-19. Some people experience gastrointestinal symptoms such as loss of appetite, diarrhea or nausea. Some persons have sore throat, headache, vertigo and other symptoms.

1.1.2 Cause

Covid-19 is caused by infection with severe acute respiratory syndrome coronavirus-2 (SARS-COV-2) virus strain.

1.1.3 Transmission

Covid-19 is a new disease, and many of the details of its spread are still investigation (WHO, 2020). It spread easily between people-more easily than influenza, but not as easily as measles (U.S CDC, 2020). People are most infectious when they show symptoms (even mild or non-specific), but may be infectious for up to two days before symptoms appear (pre-symptomatic transmission). They remain infectious for an estimated seven to twelve days in moderate cases and an average of two weeks in severe cases. People can also transmit the virus without showing any symptom (asymptomatic transmission), but it is unclear how often this happens. A June 2020 review found that 40-45% of infected people are asymptomatic (Oran and Topel, 2020).

Covid-19 spreads primarily when people are in close contact and one person inhales small droplets produced by an infected person (symptomatic or not), coughing, sneezing, talking or singing. The WHO recommends 1 meter (3ft) of social distance (WHO, 2020), the US Centre for Disease control and Prevention (CDC) recommends 2 meters (6ft) (U.S CDC, 2020).

Transmission may also occur through aerosols, smaller droplets that are able to stay suspended in the air for longer periods of time. Experimental results show the virus can survive in aerosol for up to three hours (Gehanno *et al*., 2020). Some outbreaks have also been reported in crowded and inadequately ventilated indoor locations where infected persons spend long periods of time (such as restaurants and nightclubs). Aerosol transmission in such locations has not ruled out. Some medical procedures performed on covid-19 patients in health facilities can generate those smaller droplets, and results in the virus being transmitted more easily than normal (WHO, 2020).

Less commonly, when the contaminated droplets fall on floors or surfaces they can remain infectious if people touch contaminated surfaces and then their eyes nose or mouth with unwashed hands (WHO, 2020). On surfaces, the amount of viable active virus decrease over time until it can no longer cause infection, and surfaces are thought not be the mason way the virus spreads (US CDC, 2020). The level of contamination required to transmit infection via surfaces is unknown, but virus can be detected for up to four hours in copper, up to one day on cardboard, and up to three days on plastic and stainless steel (AISI 304). Surfaces are easily decontaminated with household disinfectants which destroy the virus outside the human body or on the hands. Disinfectants or bleach are not treatment for COVID-19, and cause health problems when used properly, such as when inside the human body (CDC, 2020)

Sputum and saliva carry large amounts of the virus. Although covid-19 is not a sexually transmitted infection, direct contact such as kissing, intimate contact, and fecal-oral routes are suspected to transmit the virus. The virus may occur in breast milk, but whether it is transmitted to the baby us unknown (Bingmann, 2020)

1.1.4 Pathophysiology

COVID-19 can affect the upper respiratory tract (sinuses, nose, and throat) and the lower respiratory tract (windpipe and lungs). The lungs are the organs most affected by covid-19 because the virus accessed host cells via the enzyme angiotensin-converting enzyme 2(ACE2), which is most abundant in type ii alveolar cells of the lungs. The virus uses a special surface glycoprotein called a "spike" (peplomer) to connect to ACES and enter the host cell (Letiko *et al*, 2020). The density of ACE2 in each tissue correlates with the severity of the disease in that tissue and some have suggested decreasing ACE2 activity using angiotensin II receptor blocker medication could be protective. As the alveolar disease progresses, respiratory failure might develop and death may follow (Xu *et al*, 2020)

SARS-CoV-2 may also cause respiratory failure through affecting the brainstem as other coronaviruses have been found to invade the central nervous system (CNS). While virus has been detected in cerebrospinal fluid of autopsies, the exact mechanism by which it invades the CNS remains unclear and may first involve invasion of peripheral nerves given the low levels of ACE2 in the brain (Li *et al*., 2020).

1.1.5 Diagnosis

The WHO has published several testing protocols for the disease. The standard method of testing is real time reverse transcription polymerase chain reaction (rRT-PCR) (2019 Novel Coronavirus (2019-nCoV) situation summary, 2020). The test is typically done on respiratory samples obtained by a nasopharyngeal swab; however, a nasal swab or sputum sample may also be used (Real-time RT-PCR Panel for Detection 2019-nCoV, 2020). Results are generally available

within a few hours to two days. Blood tests can be used, but these require two blood samples taken two weeks apart, and the results have little immediate value.

Chinese scientists were able to isolate a strain of the virus and publish the genetic sequence so laboratories across the world could independently develop polymerase chain reaction (PCR) tests to detect infection by the virus (Hui, 2020). As at 4th April 2020, antibody tests (which detect active infections and whether a person had been infected in the past) were in development but not yet widely used (Petherick, 2020).

Antibody tests may be most accurate 2-3 weeks after a person's symptoms starts. The Chinese experience with testing has shown the accuracy of only 60-70%. The US Food and Drug Administrators (FDA) approved the first point-of-care test on 21 March 2020 for use at the end of that month. The absence or presence of COVID-19 signs and symptoms alone is not reliable enough for an accurate diagnosis (Struyf *et al.,* 2020).

1.1.6 Comorbidities

Most of those who die of covid-19 have pre-existing (underlying) conditions including hypertension, diabetes mellitus, and cardiovascular diseases. The instituto Superiore de Sanita reported that, out of 8.8% of deaths where medical charts were available, 97% of people had at least comorbidity, with the average person having 2.7 diseases (Palmer *et al*., 2020). According to the same report, the median time between the onset of symptoms and death was ten days, with five being spent hospitalized. However, people transferred to an ICU had a median time of seven days between hospitalization and death (Palmer *et al.,* 2020).

In a study of early cases, the median time from exhibiting symptoms to death was 14 days, with a full range of six to 41 days (Wang *et al.,* 2020). In a study by the National Health Commission

(NHC) of China, men had a death rate of 2.8% while women had a death rate of 1.7%. In 11.8% of the deaths reported by the National Health Commission of China, heart damage was noted by elevated levels of cardiac arrest. According to March data from the United States, 89% of those hospitalized had pre-existing conditions (Garg *et al*., 2020).

1.1.7 Prevention

Preventive measures to reduce the spread and chances of infection include staying at home, wearing a face mask in public, avoiding crowded places, keeping distance from others, washing hands with soap and water often and for at least, 20 seconds, practicing good respiratory hygiene, and avoiding the eyes, nose or mouth with unwashed hands(CDC, 2020).

Those diagnosed with COVID-19 or who believe they may be infected are advised by the CDC to stay at hint except to get medical care, call ahead before visiting a Healthcare provider, wear a face mask before entering a healthcare provider's office and when in any room or vehicle with another person, cover coughs and sneezes with a tissue, regularly wash hands with soap and water and avoid sharing personal household items (CDC, 2020).

Sanitizing of frequently touched surfaces is also recommended or required by regulation for businesses and public facilities.

1.1.8 Management

People are managed with supportive care, which may include fluid therapy, oxygen support, and supporting other organs. The CDC recommends those who suspect they carry the virus to wear a simple face mask. Extracorporeal membrane oxygenation (ECMO) has been used to address the issues of respiratory failure, but its benefits are still under consideration. Personal hygiene and a

healthy lifestyle and diet have been recommended to improve immunity. Supportive treatments may be used in those with mild symptoms at the early stage of infection. (Wang *et al*, 2020)

1.2 COVID-19 Vaccines

A COVID19 vaccine is one intended to provide acquired immunity against severe acute respiratory syndrome coronavirus 2 (SARSCoV2), the virus that causes coronavirus disease 2019 (COVID-19).

Prior to the COVID-19 pandemic, an established body of knowledge existed about the structure and function of coronaviruses causing diseases like severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). This knowledge accelerated the development of various vaccine platforms during early 2020(Li *et al.,* 2020). The initial focus of SARS-CoV-2 vaccines was on preventing symptomatic, often severe illness. (Subbarao, 2021) On 10 January 2020, the SARS-CoV-2 genetic sequence data was shared through GISAID, and by March, the global pharmaceutical industry announced a major commitment to address COVID19. (Padilla TB, 2021) In 2020, the first COVID- 19 vaccines were developed and made available to the public through emergency authorizations (Rogers K, 2022) and conditional approvals. The COVID-19 vaccines are widely credited for their role in reducing the severity and death caused by COVID19. (Rogers K, 2022)

At least nine different technology platforms are under research and development to create an effective vaccine against COVID19.(Le TT, 2020) (London school of Hygiene and Tropical medicine, 2021) Most of the platforms of vaccine candidates in clinical trials are focused on the coronavirus spike protein (S protein) and its variants as the primary antigen of COVID-19 infection,(Le TT, 2020) since the S protein triggers strong B-cell and T-cell immune

responses.(Arbeitman *et al*., 2021) (Grifoni *et al*., 2020) However, other coronavirus proteins are also being investigated for vaccine development, like the nucleocapsid, because they also induce a robust T-cell response and their genes are more conserved and recombine less frequently (compared to Spike).(Grifoni *et al*., 2020) (Dutta *et al*, 2020) (Nikolaidis *et al*., 2021)

Platforms developed in 2020 involved nucleic acid technologies (nucleoside-modified messenger RNA and DNA), non-replicating viral vectors, peptides, recombinant proteins, live attenuated viruses, and inactivated viruses.(Gates B, 2020) (Le *et al*., 2020) (Thanh *et al*., 2020) (Diamond MS and Pierson TC, 2020)

Over eight vaccines have been approved for emergency or full use by at least one stringent regulatory authority recognized by the World Health Organization (WHO): Pfizer–BioNTech, Oxford–AstraZeneca, Sinopharm BIBP, Moderna, Janssen, CoronaVac, Covaxin and Novavax. Five others are under assessment by the WHO: Sputnik V, Sinopharm WIBP, Convidecia, Sanofi–GSK and SCB-2019. (WHO)

Specific versions of five vaccines have been authorized by the European Medicines Agency (EMA): Pfizer–BioNTech, Janssen, Novavax, Moderna and Oxford–AstraZeneca. (EMA) Specific versions of another four vaccines are under evaluation by the EMA: Sputnik V, CoronaVac, Sanofi–GSK and Valneva. (EMA)

Note that in some countries, vaccines may be authorized solely for travel purposes. They may not be approved for the general population. For example, the CoronaVac, Covishield, BBIBP-CorV and Covaxin vaccines are not part of Australia's national vaccination program; however, they are recognised for the purpose of travel to Australia. (Therapeutic Goods Administration, 2022) (Department of Home Affairs, Australia, 2022)

1.2.1 oxford-Astrazeneca vaccine

The Oxford–AstraZeneca COVID-19 vaccine, codenamed AZD1222, and sold under the brand names COVI SHIELD and VAXZEVRIA among others, is a viral vector vaccine for prevention of COVID-19. Developed in the United Kingdom by the Oxford University and British-Swedish Company AstraZeneca, using as a vector the modified chimpanzee adenovirus ChAdOx1, the vaccine is given by intramuscular injection.

The vaccine is given to adults aged 18 and above. The medicine is administered by two 0.5 ml (0.017 US fl oz) doses given by intramuscular injection into the deltoid muscle (upper arm). The initial course consists of two doses with an interval of 4 to 12 weeks between doses. The World Health Organization (WHO) recommends an interval of 8 to 12 weeks between doses for optimal efficacy. (WHO, 2021)

The vaccine is stable at refrigerator temperatures and has a good safety profile, with side effects including injection-site pain, headache, and nausea, all generally resolving within a few days.(Belluz J, 2020) More rarely, anaphylaxis may occur; the UK Medicines and Healthcare products Regulatory Agency (MHRA) has 268 reports out of some 21.2 million vaccinations as of 14 April 2021.(MHRA) In very rare cases (around 1 in 100,000 people) the vaccine has been associated with an increased risk of blood clots when in combination with low levels of blood platelets.(EMA, 2021) According to the European Medicines Agency as of 4 April 2021, a total of 222 cases of extremely rare blood clots had been recorded among 34 million people who had been vaccinated in the European Economic Area (a percentage of 0.0007%).(EMA, 2021)

1.2.2 Moderna vaccine

The Moderna COVID19 vaccine, sold under the brand name Spikevax, is a COVID-19 vaccine developed by American company Moderna, the United States National Institute of Allergy and Infectious Diseases (NIAID), and the Biomedical Advanced Research and Development Authority (BARDA). Depending on the jurisdiction, it is authorized for use in people aged six months, (Mandavilli, A, 2022) twelve years, or eighteen years and older. It provides protection against COVID-19 which is caused by infection by the SARS-CoV-2 virus (DailyMed, 2020) (Health Canada, 2022) (Therapeutic Goods Administration, 2021)

It is designed to be administered as two or three 0.5 mL doses given by intramuscular injection at an interval of at least 28 days apart.(U.S. CDC, 2021)(U.S. FDA, 2021)

The most common adverse events are pain at the injection site, fatigue, headache, myalgia (muscle pain), and arthralgia (joint pain). (WHO, 2021)

The US Centers for Disease Control and Prevention (CDC) has reported anaphylaxis (a severe allergic reaction) in 2.5 cases per million doses administered and has recommended a 15-minute observation period after injection. (U.S. CDC, 2021)

1.2.3 The Janssen COVID-19 vaccine

The Janssen COVID-19 vaccine, or Johnson and Johnson COVID-19 vaccine, is a COVID-19 vaccine that was developed by Janssen Vaccines in Leiden, Netherlands, and its Belgian parent company Janssen Pharmaceuticals, a subsidiary of American company Johnson and Johnson.

It is a viral vector vaccine based on a human adenovirus that has been modified to contain the gene for making the spike protein of the SARS-CoV-2 virus that causes COVID-19. (EMA, 2021)

The body's immune system responds to this spike protein to produce antibodies. (Malcolm K, 2021) The vaccine requires only one dose and does not need to be stored frozen. (U.S. CDC, 2021)

The vaccine is given to adults aged 18 years and above. (DailyMed, 2021) The vaccine is given by intramuscular injection into the deltoid muscle. The initial course consists of a single dose. (WHO, 2021)

The most common side effects are pain at the injection site, headache, tiredness, muscle pain, and nausea, affecting more than 1 in 10 people. Coughing, joint pain, fever, chills, redness, and swelling at the injection site occurred in less than 1 in 10 people. Sneezing, tremor, throat pain, rash, sweating, muscle weakness, pain in the arms and legs, backache, weakness, and feeling generally unwell occurred in less than 1 in 100 people. Rare side effects (that occurred in less than 1 in 1,000 people) are hypersensitivity (allergy) and itchy rash. (EMA, 2021)

An increased risk of the rare and potentially fatal thrombosis with thrombocytopenia syndrome (TTS) has been associated with mainly younger female recipients of the vaccine.(Cines DB and Bussel JB., 2021) Allergic reactions, including anaphylaxis, can occur in rare cases within a few minutes to one hour after receiving a dose.

1.2.4 Sputnik V vaccine

Sputnik V or Gam-COVID-Vac is an adenovirus viral vaccine for COVID-19 developed by the Gamaleya Research Institute of Epidemiology and Microbiology in Russia. It is the world's first registered combination vector vaccine for the prevention of COVID-19, having been registered on 11 August 2020 by the Russian Ministry of Health. (Callaway E, 2020) (Cohen J, 2020)

The vaccine can be formulated in two ways: as a ready-to-use solution in water that is frozen at the common home-freezer storage temperature of −18 °C or 0 °F or lower, and as a freeze-dried (lyophilized) powder, "Gam-COVID-Vac-Lyo", which can be stored at 2–8 °C or 36–46 °F. The freeze-dried powder must be reconstituted with sterile water before use. (Rinat S and Ivanova P, 2020) The lyophilized formulation of Gam-COVID-Vac is similar to the smallpox vaccine, circumventing the need for continuous "colder chain" or cold-chain storage – as required for the Pfizer–BioNTech and Moderna vaccines – and allowing transportation to remote locations with reduced risk of vaccine spoilage.(Balaskhrishnan VS, 2020) (Irfan U, 2020)

The first dose (based on Ad26) is administered on the first day, and the second dose (based on Ad5) is administered on the 21st day to boost immune response. (Sokolov, A, 2020) (Russian Ministry of Health, 2020) Both doses are administered into the deltoid muscle.

Side effects are mostly mild and similar to other adenovirus vector vaccines such as the Oxford-AstraZeneca and the Janssen vaccines. However, unlike the Oxford-AstraZeneca and Janssen vaccines, evidence does not suggest a risk of vaccine-induced immune thrombotic thrombocytopenia. (Nogrady B, 2021)

1.2.5 Pfizer-BioNTech vaccine

The Pfizer–BioNTech COVID-19 vaccine (INN: tozinameran), sold under the brand name Comirnaty, (EMA, 2021) (U.S. FDA, 2021) is an mRNA-based COVID-19 vaccine developed by the German biotechnology company BioNTech and for its development collaborated with American company Pfizer, for support with clinical trials, logistics, and manufacturing. (Browne R, 2020) (Thomas *et al*., 2020) It is authorized for use in people aged five years and older in some jurisdictions, (U.S.CDC, 2020) twelve years and older in some jurisdictions, and for people

sixteen years and older in other jurisdictions, (EMA, 2021) (Health Canada, 2021) (DailyMed, 2021) to provide protection against COVID-19, caused by infection with the SARS-CoV-2 virus. The vaccine is given by intramuscular injection. It is composed of nucleoside-modified rna (modRNA) encoding a mutated form of the full-length spike protein of SARS-CoV-2, which is encapsulated in lipid nanoparticles.(Walsh *et al*., 2020) Initial advice indicated that vaccination required two doses given 21 days apart,(U.S.CDC,2020) (Palca J, 2020) (Herper M, 2020) but the interval was later extended to up to 42 days in the US, (U.S.CDC,2021) (Ellis R, 2021) (ABC News, 2021) and up to four months in Canada. (ABC News, 2021) (Health Canada, 2012)

The vaccine is supplied in a multidose vial as "a white to off-white, sterile, preservative-free, frozen suspension for intramuscular injection". (DailyMEd, 2021) (U.S. FDA, 2021) It must be thawed to room temperature and diluted with normal saline before administration. (U.S. FDA, 2020)

The initial course consists of two doses. The World Health Organization (WHO) recommends an interval of three to four weeks between doses. By delaying the second dose by up to twelve weeks can increases immunogenicity, even in older adults, against all variants of concern. (The Guardian, 2021)

Most side effects of the Pfizer–BioNTech COVID19 vaccine are mild to moderate in severity and are gone within a few days. (U.S. CDC, 2021) They are similar to other adult vaccines and are normal signs that the body is building protection to the virus. During clinical trials, the common side effects affecting more than 1 in 10 people are (in order of frequency): pain and swelling at the injection site, tiredness, headache, muscle aches, chills, joint pain, and fever. (EMA, 2020) Fever is more common after the second dose.

1.2.6 Sinopharm vaccine

The Sinopharm BIBP COVID-19 vaccine, also known as BBIBP-CorV (Xia, *et al;* 2021), the Sinopharm COVID-19 vaccine, or BIBP vaccine, (WHO, 2020) (Lahiri*, et al*., 2021) is one of two inactivated virus COVID-19 vaccines developed by Sinopharm's Beijing Institute of Biological Products (sometimes written as Beijing Bio-Institute of Biological Products, resulting in the two different acronyms BBIBP and BIBP for the same vaccine).

The vaccine is given by intramuscular injection into the deltoid muscle. The initial course consists of two doses, and there is no evidence that a third booster dose is needed. The World Health Organization (WHO) recommends an interval of 3 to 4 weeks between doses. ((Guidance) WHO, 2021)

As of 28 January 2022, 10 billion doses of COVID19 vaccines have been administered worldwide based on official reports from national public health agencies. (Ritchie H, 2022)

1.3 COVID-19 vaccination in Nigeria

COVID-19 vaccination in Nigeria is an ongoing immunization campaign against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), in response to the ongoing pandemic in the country. Vaccination began on 5 March 2021. As of 28 February 2022, 17,914,944 people have received their first dose a COVID-19 vaccine, and 8,197,832 have received their second dose. (National Primary Health Care Development Agency, 2022)

NADFAC has approved a total of seven vaccines for use in Nigeria (COVID-19 vaccine tracker, 2022) but only three are currently being deployed. The three currently deployed include, Moderna vaccine, Oxford/Astrazeneca vaccine and Johnson and Johnson vaccine.

1.3.1 Covid-19 vaccination Time-line

March 2021

On 2 March, the first shipment of four million Oxford–AstraZeneca COVID-19 vaccine doses from the COVAX initiative arrived at Nnamdi Azikiwe International Airport. (Al Jazeera, 2021)

Cyprian Ngong, a doctor at National Hospital, Abuja, became the first person in Nigeria to receive a COVID-19 vaccine on 5 March. (BBC news pidgin, 2021)

President Muhammadu Buhari received his first COVID-19 vaccine dose on 6 March. (Reuters, 2021)

On 21 March, Nigeria received an additional 300,000 doses of Oxford–AstraZeneca COVID-19 vaccines from MTN. (Premium Times, 2021)

By the end of March, 0.7 million vaccine doses had been administered.

April 2021

On 6 April, Nigeria received 100,000 doses of Oxford–AstraZeneca COVID-19 vaccines from the Government of India. (Premium Times, 2021)

By the end of April, 1.2 million vaccine doses had been administered.

May 2021

By the end of May, 1.6 million vaccine doses had been administered.

June 2021

By the end of June, 3.4 million vaccine doses had been administered.

July 2021

The vaccination campaign in Nigeria was paused on 9 July due to exhaustion of the first COVAX shipment that arrived in March. (Health Policy watch, 2021) (Reuters, 2021)

By the end of July, 3.9 million vaccine doses had been administered.

August 2021

On 1 August, Nigeria received four million doses of Moderna COVID-19 vaccines from the United States. (Africanews, 2021)

The second phase of the vaccination rollout began on 16 August. (Vanguard, 2021)

By the end of August, 4.2 million vaccine doses had been administered.

September 2021

By the end of September, 6.9 million vaccine doses had been administered.

October 2021

On 8 October, Nigeria received 500,000 doses of Oxford–AstraZeneca COVID-19 vaccines from the Government of France. (Premium Times, 2021)

By the end of October, 8.6 million vaccine doses had been administered. 4% of the target population had been fully vaccinated by the end of the month.

November 2021

By the end of November, 9.8 million vaccine doses had been administered. 4% of the target population had been fully vaccinated by the end of the month.

December 2021

Up to a million doses of the Oxford-AstraZeneca vaccine were destroyed by Nigeria due to their short expiry-dates. (Vanguard news, 2021)

By the end of December, 14.8 million vaccine doses had been administered. 5% of the target population had been fully vaccinated by the end of the month.

1.4 A concise systematic review of COVID-19 vaccine acceptance rates, worldwide

A systematic search of the peer-reviewed English survey literature indexed in PubMed was done on December 25, 2020. Results from 31 peer-reviewed published studies met the inclusion criteria and formed the basis for the final COVID-19 vaccine acceptance estimates. Survey studies on COVID-19 vaccine acceptance rates were found from 33 different countries. Among adults representing the general public, the highest COVID-19 vaccine acceptance rates were found in Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%) and China (91.3%). However, the lowest COVID-19 vaccine acceptance rates were found in Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), US (56.9%), and France (58.9%). Only eight surveys among healthcare workers (doctors and nurses) were found, with vaccine acceptance rates ranging from 27.7% in the Democratic Republic of the Congo to 78.1% in Israel. In the majority of survey studies among the general public stratified per country (29/47, 62%), the acceptance of COVID-19 vaccination showed a level of ≥ 70%. Low rates of COVID-19 vaccine acceptance were reported in the Middle East, Russia, Africa and several European countries. This could represent a major problem in the global efforts to control the current COVID-19 pandemic.

For the three studies conducted among parents/guardians, the vaccine acceptance rates were more than 70%. For the two studies among University students, the vaccine acceptance rate was 57.3% in Malta (excluding university staff), and 86.1% in Italy.

Male sex was associated with significantly higher rates of COVID-19 vaccine in 15 countries/studies, while the age was a significant factor in 11 studies/countries.

1.5 COVID-19 vaccine hesitancy

The phrase "vaccine hesitancy" is used to indicate "delay in acceptance or refusal of vaccination notwithstanding availability of vaccination services," according to the Strategic Advisory Group of Experts on Immunization (SAGE). (McDonald, N.E, 2015) Complacency, Convenience, and Confidence—the "3 Cs" model of vaccination hesitancy—were initially put forth to the WHO EURO Vaccine Communications Working Group in 2011. (WHO, 2014) Complacency refers to the low perception of the danger posed by the disease, thus, vaccination deemed unnecessary. Confidence is defined as having faith in the safety, efficacy of the vaccines, and aside competency of the healthcare systems. The availability, affordability, and distribution of vaccines in a convenient setting are all aspects of convenience.

The epidemiologic trio of environmental, agent, and host factors can be used to assess the complicated nature of reasons for vaccine reluctance. (Kumar *et al.,* 2016) Environmental influences include societal issues, public health regulations, and media messaging (Daley *et al*., 2016). The perception of vaccine effectiveness and safety, in addition to the perceived vulnerability to the disease, are agent (vaccine and disease) factors (Arede *et al*., 2018) (Dube *et al*., 2015) Knowledge, prior experience, educational attainment, and financial levels all affect host variables (Kumar *et al*., 2016) (Olson *et al*., 2020)

The London School of Hygiene & Tropical Medicine (LSHTM) and the Africa Center for Disease Control and Prevention (Africa CDC) performed a study that revealed a significant majority (79% average) of respondents in Africa would receive the COVID-19 vaccination if it was judged safe and effective. (Africa CDC, 2020)

Between August and December 2020, more than 15,000 adults, 18 years of age and older, were interviewed for the study in 15 different African nations, including Burkina Faso, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gabon, Kenya, Malawi, Morocco, Niger, Nigeria, Senegal, South Africa, Sudan, Tunisia, and Uganda.

Data from the survey reveals notable differences in willingness between nations and among the five regions of the continent, with Ethiopia and Niger having the highest willingness (94% and 93%, respectively), and Senegal and the Democratic Republic of the Congo having the lowest willingness (55% and 59%, respectively).(Africa CDC, 2020)

In general, perceptions of the importance, safety, and efficacy of the COVID-19 vaccination as well as trust in vaccines played a major role in people's desire to receive it or not. Safety was of the biggest importance; on average, 18% of respondents thought vaccines weren't usually safe, and 25% said a COVID-19 vaccine wouldn't be safe. Some responders voiced mistrust for vaccinations in general, while others did so specifically for the COVID-19 vaccine. (Africa CDC, 2020)

Health workers in Ethiopia, Zimbabwe, Ghana, South Africa, Kenya, and Sudan have reported having concerns about efficacy, side effects, and safety. Similar outcomes have been recorded in Uganda, Sierra Leone, Rwanda, Mozambique, Burkina Faso, Cameroon, and South Africa.

According to the Africa CDC study, respondents thought the COVID-19 vaccination was less safe and effective than other vaccines. (Worldbank, 2021)

Confidence in COVID-19 vaccination was impacted by the suspension of AstraZeneca's rollout in some European countries, the South African statistics on its effectiveness, and the temporary suspension of the Johnson & Johnson vaccine in the United States to assess reports of blood clotting. Ultimately, several African nations rejected AstraZeneca's vaccine. (Worldbank, 2021)

Social media accessibility has made it easier for false information and conspiracy theories to proliferate. People with high levels of hesitation were more likely to use social media and be exposed to misinformation, according to the Africa CDC study. In South Africa, half of those polled thought the virus was related to 5G technology. In a different South African study, around a third of those who would reject the vaccination saw social media as their main information source. According to a tiny study conducted in Addis Ababa, social media users were 3.6 times more hesitant than those who listened to the radio and watched television. (Worldbank, 2021)

Trust in one's government influences vaccination uptake. In West Africa, Afrobarometer reported high levels of mistrust in governments' ability to provide a safe vaccine. Those who did not trust their government were five to 10 times less likely to want to be vaccinated. In Ghana, 40% of those who are unwilling to be vaccinated cited mistrust of the government while in South Africa, those who believed the president was doing a good job were more likely to be vaccinated. (Worldbank, 2021)

Religious beliefs also inform vaccine acceptance. Close to 90% of individuals surveyed in Niger and Liberia said that prayer was more effective than the vaccine. A recent Geopoll survey in six

African countries showed religious beliefs as key determinants of hesitancy. (GeoPoll report, 2021) (Worldbank, 2021)

Behavior can also be influenced by perceptions of the severity of the threat posed by COVID-19 and the risk of contracting it. People who did not think COVID-19 existed in the DRC and Côte d'Ivoire were less likely to get vaccinated. People who knew someone who had previously contracted COVID-19 had a 13% greater rate of being vaccinated than those who did not. However, even when respondents were aware of a COVID-19 infection, they continued to downplay the severity of the disease. (Worldbank, 2021)

Africans have long harbored mistrust of vaccines created in industrialized nations. It has its roots in the continent's history of unethical Western medical practices, when early attempts to treat disease eroded confidence in Western medicine and resulted in underuse of healthcare services. A little over 43% of respondents to the 15-country Africa CDC research thought that Africans were being used as test subjects for vaccines. Similar results were observed in the DRC, and a poll conducted in Addis Ababa in 2021 revealed that hesitation was linked to the idea that the vaccination was a biological weapon used by industrialized nations to limit population growth. (Worldbank, 2021)

However, perceptions of COVID-19 vaccines are not constant, thus it is important to repeatedly gather data using qualitative and quantitative approaches to track changes over time. The GeoPoll study noted increases in hesitation in Nigeria, Kenya, South Africa, Côte d'Ivoire, and the DRC between November 2020 and April 2021. Hesitancy increased in Mozambique in the early part of 2021 after declining in late 2020. In Ghana, vaccination hesitancy dropped from 38% in August 2020, before to vaccine approval, to 17% in April 2021, following the delivery of the first batch of vaccines. (Worldbank, 2021)

The widespread resistance to the COVID-19 immunization displayed by the majority of Nigerians, including both medical experts and ordinary citizens, might be attributed to a number of concerns regarding the disease's origin and the motivation behind this widespread campaign. (New Telegraph, 2021)

Since the manufacturers of these vaccines issued a warning and dissociated themselves from any unanticipated outcomes linked to administration and deployment of the vaccine for immunization, many people believe there is something evil about the vaccines. (New telegraph, 2021)

Legal Issues in COVID-19 Vaccine Development states that specific regulations under the Public Readiness and Emergency Preparedness (PREP) Act govern legal liability for injuries brought on by a COVID-19 vaccine, shielding the manufacturer from claims of bodily harm or death brought on by the vaccine (s).(CRS Reports, 2020)

The 25th Secretary of the Department of Health and Human Services (HHS), Xavier Becerra, declared COVID-19 a public health emergency and invoked the PREP Act for COVID-19 countermeasures.(new telegraph, 2021) (CRS reports, 2020) (New telegraph, 2021)

In accordance with HHS's declaration, individuals who administer a COVID-19 vaccine, such as developers, manufacturers, distributors, and medical professionals, are generally exempt from legal responsibility for damages resulting from the administration or use of an FDA-approved COVID-19 vaccine, with the exception of willful misconduct that results in death or serious physical harm. (US Department of Health and Human Services, or HHS,) (CRS Reports, 2020) (New telegraph, 2021)

Indeed, this disclaimer brought about a deafening hush, particularly among top medical professionals and those who covertly counseled their colleagues not to participate in the experiment.

However, there are valid reasons and scientifically supported grounds for which many Nigerians are cautious about the vaccination, in addition to the variety of myths and misconceptions connected with this immunization. (New telegraph, 2021)

According to the feedback Sunday Telegraph received from the populace, some Nigerians feel that a national vaccination policy is unnecessary for a virus that can be readily eradicated by hand washing with regular soap. (New telegraph, 2021)

Others countered that since the body's immune system can effectively combat the virus; there is no need for a vaccine that does not protect those receiving it from catching it. For this reason, people were recommended to continue bolstering their immune systems by taking vitamin C. (New telegraph, 2021)

Many of them argued that adopting a vaccine program is unwise for a virus that frequently mutates since the variant you see today may not be the one you treat tomorrow, as is the case with the virus's present lethal and highly contagious Delta version. (New telegraph, 2021)

Sunday Telegraph also reported that, some people who consented to the vaccination did so against their will because of laws and regulations that prevent them from exercising their inherent rights, such as traveling to specific locations and nations, unless they are fully immunized. (New telegraph, 2021)

Edo State is a clear example of a state where people were being coerced into doing so to enable them to gain access to certain offices and places, without which, no one will gain access to the

Government House or certain ministries in the state, going by the policy of flying one's evidence of vaccination as a pass, though a court later ruled otherwise. (New telegraph, 2021)

For many others, they did not show up for the vaccine out of genuine conviction, but rather out of hypocrisy, doing it on the premise 'to be seen to have done so' other than preventive measures. (New telegraph, 2021)

Many experts believed that the vaccines are trial ones as they have not gone through the necessary clinical trials before being recommended for a mass administration which is why the manufacturers declines any responsibility in the possibility of unexpected outcomes. (New telegraph, 2021)

They noted that the permission or licenses that the manufacturers have received for administering the vaccines to masses are also most appropriately called 'Emergency' Licenses, drug trial types of experimental. (New telegraph, 2021)

This supported the claims made by certain professors of medicine, immunologists and professors in solid sciences that what was being paraded as vaccines are, indeed, not vaccines going by what inoculation is known for. Many even argued that what is being currently offered are not vaccines rather Genetically Modified Organisms (GMOs). (New telegraph, 2021

1.6 Tackling covid-19 vaccine hesitancy

Given the risks stemming from COVID-19 vaccine hesitancy, it is pivotal to outline solutions to build up vaccine confidence.

In tackling COVID-19 vaccine hesitancy, a multi-pronged framework tailored to socio-political contexts, specific social groups, and even individuals can provide the best results. Policymakers,

public health officials, vaccine developers, healthcare workers, researchers, advocates, communicators, media, and others need to collaborate to sustain public confidence in COVID-19 vaccines. (Africa CDC, 2020) (Lazarus *et al*., 2020) (Kochhar *et al.,* 2020)

Good policies are pivotal. Transparent management of vaccine approval and purchase are streamlined to logistics and equal access to a network of adequately equipped network of vaccination centers that can increase public trust. This will thereby host frequent briefings about ongoing clinical trials and making decision making open, following the example of the FDA and EMA can help the public to be on the same page with scientists and policymakers. (Ogundele *et al.*, 2020) (Wilson and Wiysonge, 2020) This way, the management of vaccination hesitancy can set an example of transparency, accountability, democratic, and participatory engagement applicable to other facets of policymaking.

Furthermore, clinical trial protocols and appropriate results must be communicated in accessible formats to both scientists and the public. The medical knowledge about vaccines, how it works, including its adverse effects has impact on its increases acceptance and confidence of the public. (Sharpe, *et al.,* 2020) (Lazarus, *et al* 2020)

Also, a pledge to vaccine safety is a crucial strategy. The public can get easily suspicious over pharmaceutical companies denying accountability for vaccines' side effects. Although, ensuring that no adverse event will occur is not pragmatic, letting the public realize the shared commitment of researchers, policymakers and the industry to safety can be a game changer. Nine vaccine manufacturers recently pledged not to submit vaccines for approval in the US until proven safe in large clinical trials to assuage fears around political pressure to speed up development.(Kwok, *et al.,* 2020) (Ogundele*, et al*., 2020) This could be adapted by including different stakeholder groups to add an additional layer of reassurance for the public.

Another key strategy is creative communication and honest dialogue to mitigate misinformation or false information around vaccines and vaccination. A study published recently in the BMJ reported that misleading content from abroad could easily penetrate national communities in social media increasing vaccine hesitancy.(Bhopa and Niekem, 2021) (Wilson and Wiysonge, 2020) Innovative and compelling communications methods, particularly storytelling (e.g. personal stories to which people can relate), emotion, appeals to empathy and altruism, and memes to convey essential information in engaging ways can flood social media in an effort to counteract misleading information.(Bhopa and Niekem, 2021) (Africa CDC, 2020)

Effective communication requires context-specific and evidence-informed assessment to identify communication preferences and language needs. Accessible material can help people make sense of things in the inherently uncertain and tense time like this COVID era. Furthermore, engaging both online and offline platforms, including social media, for clear communication about the types of vaccines and the process of deploying them.

Use all languages spoken and visual imagery from the platforms people trust; and build on local terminologies and understandings of vitality, strength, and immunity in communications about vaccination. Working together with trusted influencers in and beyond public health from national and international celebrities, to online 'influencers', to locally trusted alternative health providers and community leaders to convey information and facilitate dialogue in compelling ways. Asking local healers and religious leaders, whose say weighs heavily in the conscience of most people in Africa, can also turn the tide in favor of vaccines. (Kochhar *et al.,* 2020) (Ogundele *et al*., 2020) (Wilson and Winysonge, 2020)

Another major strategy is to co-design and discuss vaccination strategies with citizens, including how to prioritize access once vaccines are available. Prioritization may be done geographically

(e.g. where there is higher transmission or risk), by occupational group (e.g. prioritizing frontline personnel), by age or medical status (e.g. the elderly, people with pre-existing conditions). This will be important for building and maintaining public trust and confidence, especially where vaccine confidence is already low. Citizens' juries are a useful model used in past epidemics to achieve the best results. (Bhopa and Niekem, 2021) (Dube *et al.*, 2014)

At the same time, it is pivotal to work with frontline healthcare workers, including non-biomedical health providers, to address vaccine hesitancy among them. Not only the wellbeing of this group is essential, but also, they can set an example for hesitant. This is quite relevant given the high number of hesitant among healthcare workers worldwide, and particularly in Africa, where the number of qualified healthcare professionals is small about the population.(Sharpe *et al.,* 2020) (Kochhar *et al*., 2020)(Ogundele *et al*., 2020)

The logistics of vaccination pose an additional challenge to tackle. It is important to manage expectations of likely vaccine effectiveness, populace priority, and that life may not go 'back to normal' immediately after vaccine deployment.(Lazarus *et al.,* 2020) (Kochhar *et al.,* 2020) (Wilson and Wiysonge, 2020) Vaccines should be administered without coercion by trusted actors such as local healthcare providers, including non-biomedical practitioners, where appropriate. The use of existing infrastructures such as routine vaccine drives may inspires greater trust and confidence. (Kochhar *et al*., 2020) (Wilson and Wiysonge, 2020)

Finally widely used telecommunication services, such as social media chats or short text messages (SMS) can also be employed to inform individuals about their rendezvous in vaccination centers. Finally, surveillance systems for adverse medical events, which may be caused or perceived to be caused by vaccines, must be in place. There is a need to engage

independent monitoring bodies at national and regional levels and establish clear communication protocols for communicating with the public about adverse events. (Ogundele, *et al*., 2020)

1.7 Rational/justification of the study

The COVID-19 pandemic has brought about huge negative consequences on business, education, health, and tourism globally. During the first wave, the primary, secondary and tertiary institutions in Nigeria were closed and these seriously affected millions of students in tertiary institutions who have their semesters canceled or suspended due to the pandemic. While many other countries switched to virtual learning, many tertiary institutions within Nigeria lack the various online educational platforms or facilities for such method of teaching, which have worsened the situation for students in the country. (Adebowale *et al.,* 2021)

University of Benin (UNIBEN) is a public research university located in Benin City, Edo State, Nigeria (Ministry of education (Nigeria), 2011). It is among the universities owned by the Federal Government of Nigeria and was founded in 1970(The Nation, Nigeria, 2018). The School currently has two campuses with fifteen faculties including a central library called the John Harris Library. In addition to the two campuses, the school also boasts of primary and secondary Demonstration high schools.

Given the strategic location and popularity of the university, there is large population of stakeholders who come in the school frequently. More so, the university is located in a State where the COVID-19 protocols appear to be largely ignored by residents as can be seen in marketplaces, churches and funeral ceremonies. Based on the foregoing, there was an urgent need to interrogate the perception of COVID-19 vaccination exercise among staffs of University of Benin. This might help determine the level of COVID-19 vaccine acceptance and hesitancy in

the university amid the vaccine roll-out. The study was also expected to reveal the reasons for hesitancy towards the vaccine.

1.8 Specific objective

The main objective of this study was to estimate the level of COVID-19 vaccine hesitancy among staff of the institution and factors associated with it.

General objectives

To assess participants';

1. General knowledge of COVID-19.
2. knowledge of symptoms, transmission and prevention of the disease
3. Knowledge of COVID-19 vaccine.
4. Reasons for being hesitant to getting vaccinated.

CHAPTER TWO

METHODS

2.1 Setting

The study was conducted at the University of Benin, Ugbowo campus. University of Benin (UNIBEN) is a public research university located in Ovia north east local Government area, Benin City, Edo State, Nigeria (Ministry of education (Nigeria), 2011). It is among the universities owned by the Federal Government of Nigeria and was founded in 1970(The Nation, Nigeria, 2018). The School currently has two campuses with fifteen faculties including a central library called the John Harris Library. In addition to the two campuses, the school also boasts of primary and secondary Demonstration high schools. The faculties offer both postgraduate and undergraduate courses. With a student population of over forty-five thousand and staff strength of about eight thousand personnel, the University of Benin has provided exemplary leadership in the educational Development of the immediate region and Nigeria in general.

2.2 Study design

The study design was a cross sectional retrospective study. A cross-sectional (also known as a cross sectional analysis, transverse study, prevalence study) is a type of observational study that analyzes data from a population, or a representative subset (sample), at a specific point in time. It is retrospective since it assesses participants' histories of exposures and outcomes over a given time.

2.3 Study population

The study population was staff of the institution, Ugbowo campus. Participants were drawn from all the different departments of the school. The participants were drawn within a specified period of time.

2.4 Sample size

The sample size was calculated using Cochran equation;

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:

- n is sample size
- e is the desired level of precision (i.e. the margin of error),
- p is the (estimated) proportion of the population which has the attribute in question,
- q is 1 – p
- the value of Z is found in the statistical tables which contain the area under normal curve e.g. Z =1.96 for 95% level of confidence

150 participants were selected for the study.

2.5 Inclusion and exclusion criteria

Being a staff of the university was the only criterion for being part for the study.

However, any staff that was not around as at the time of the study was excluded from the study

2.6 Administrative approval

A letter of request of approval was written to the appropriate authority (Dean of student). The request for approval was granted. Approval was therefore obtained to carry out this research in the school.

2.7 Data collection

Data was collected with the aid of a pre-tested, self-administered data collection form (questionnaire). The questionnaire was shared to the staff of the university in their various offices. Both qualitative and quantitative data were collected. Open-ended questions in the questionnaire were used to collect the qualitative data with which the perceptions of study participants on COVID-19 vaccination were uncovered

The outcome measures were participants' demographics, participants' knowledge of the diseases, participants' source of information regarding COVID-19, and proportion of participants already vaccinated, proportion of participants unwilling to get vaccinated and reasons behind their hesitancy

2.8 Data analysis

Quantitative data were entered into Microsoft excel window 10, double checked, cleaned and thereafter transported to the Statistical Package for the Social Science version 20(SPSS 20) for analysis.

Qualitative data were analyzed thematically and the perceptions of respondents on COVID-19 vaccination were then organized into key themes. To stay true to the participants' words and experiences, two independent coders read each filled questionnaires and used grounded theory coding techniques to gather all emerging categories from the text. The grounded theory coding

started with a line-by-line review of the text, creating open codes that captured pieces of text relevant to the research questions. The open codes were then gathered into focused codes to capture major coding themes emerging from the participants. Finally, these categories were reorganized and revised to reach a broader understanding. The researchers translated the focused codes into broader themes and subthemes to best represent study participants' perceptions of COVID-19 vaccine and capture any phenomenon.

Relevant percentage frequencies and the chi-square test were obtained. Statistical significance was accepted when p-value was less than 0.005.

CHAPTER THREE

RESULTS

3.1 Socio-demographic Characteristics of Study Respondents (*N*=140)

Table 3.1 presents the demographic characteristics of study participants. A total of 140 participants took part in the study. 42.1% of the participants fell within the age range of 36-45 years. Majority of respondents (81.4%) were married. The nonacademic staff (72.1%) form bulk of the study participants. Majority of the participants were either bachelor decree holders (40.7%) or masters/PhD holders (41.4). More than half of the respondents (74.3%) said they had no underlining health conditions (comorbidities). Only about 8.6% had over 250000 as their monthly salary.

Table 3.1: Socio-demographic Characteristics of Study Respondents (N=140)

Variables	Frequency	Percentage (%)
Age group (years)		
26-35	23	16.4
36-45	59	42.1
46-55	35	25.0
56-65	23	16.4
Gender		
Male	76	54.3
Female	64	45.7
Marital Status		
Single	21	15.0
Married	114	81.4
Divorced	5	3.6
Educational Level		
Secondary	5	3.6
Diploma	20	14.3
Bachelor's degree	57	40.7
Post graduate/PhD	58	41.4
Nature of Job		
Academic	39	27.9
Non-Academic	101	72.1
Experience		
<5 years	7	5.0
5-10 years	59	42.1
10-20 years	42	30.0
>20 years	32	22.9
Monthly income		
<50,000	5	3.6
50000-70000	15	10.7
70000-100000	40	28.6
100000-250000	68	48.6
>250000	12	8.6
Disease Condition		
Diabetes	17	12.1
Cardiovascular disease	4	2.9
Rheumatoid arthritis	15	10.7
No condition	104	74.3

3.2 Prophylactic measures against COVID-19 by study participants

The different prophylactic measures put in place by study participants are presented in bar chart 3.1. Wearing of face mask (22.2%), regular hand washing (24.7%), use of hand sanitizer (24.3%), and social distancing (17.2%) were the main prophylactic measures put in place by study respondents. It was safe to say that participants have good knowledge and maintained good measures to prevent the disease.

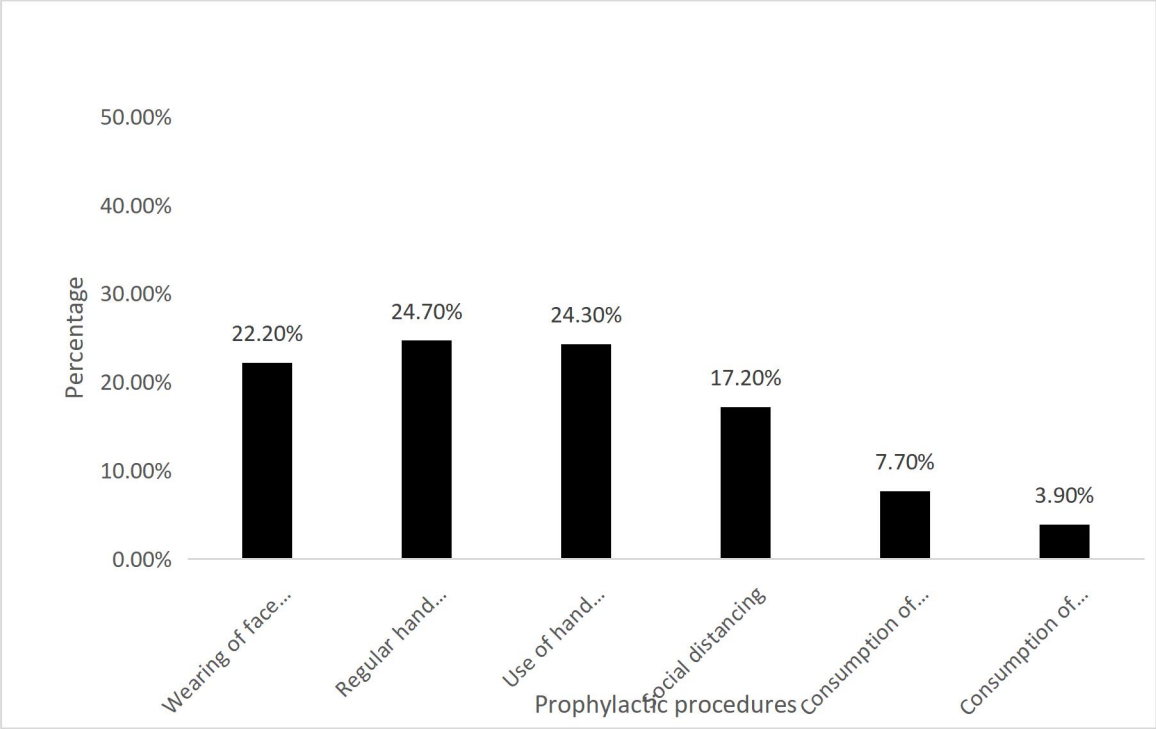

Figure 3.1: Prophylactic procedures to avoid COVID- 19 by Study Participants

3.3 Participants' source of information

Majority of study respondents had news from national TV/radio (97%), social media (93%) and news from their health care providers (75%) as their main source of information regarding COVID-19.

Considerable amount of participants (66%) also got their information from government agencies. Discussion among friends and family members (55%) also served as source of information.

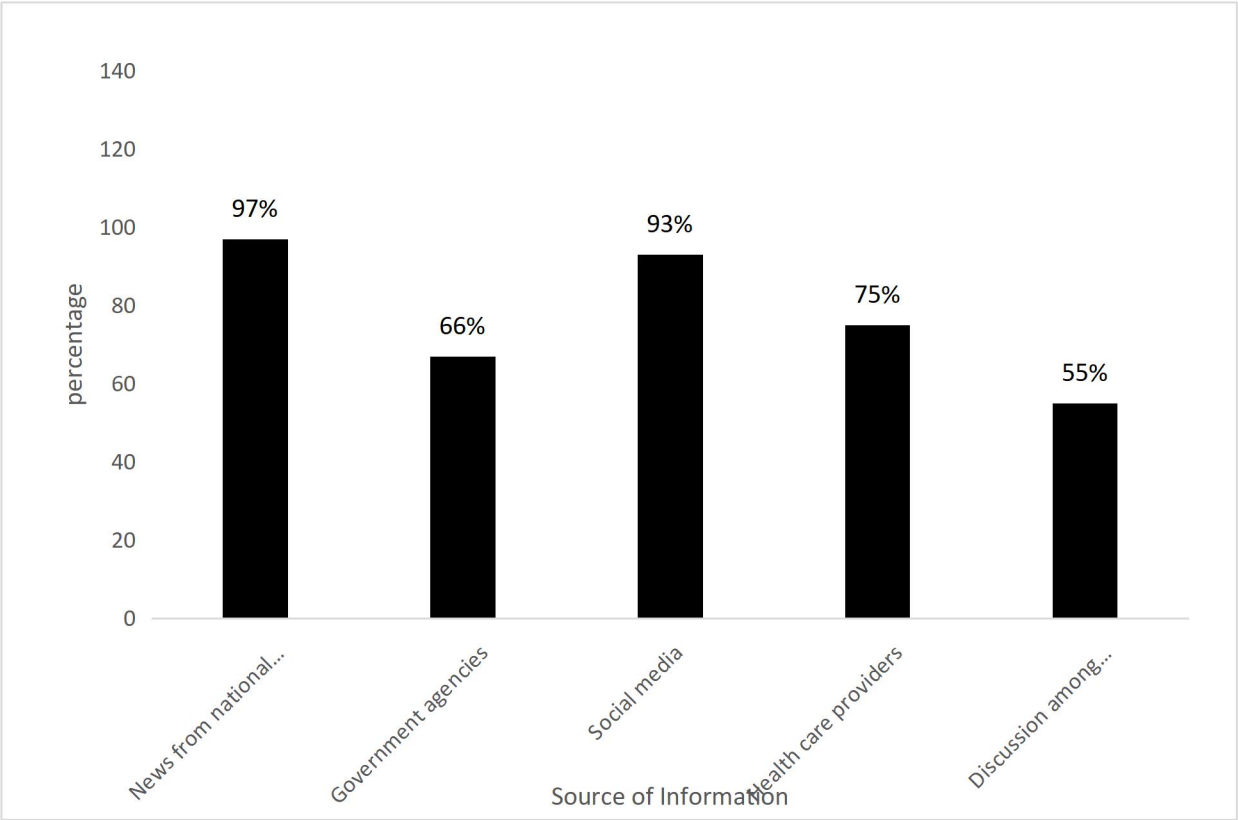

Figure 3.2: Source of information about COVID-19 vaccine

3.4 Knowledge of COVID-19

Table 3.2 provides information regarding participants' knowledge of the disease, its symptoms and mode of transmission. A set of ten questions were used to test participants' knowledge of the disease. Participant that has a score of seven and above was said to have good knowledge of the disease. In total, 74.3% of participants were said to have good knowledge of the disease. More than half (51.4%) of participants do not, however trust that the government was doing enough or making decisions in their best interest with respect to COVID-19 vaccine.

Table 3.2: Knowledge of COVID-19 and its Symptoms and Transmission

Questionnaire item	Yes	No	Maybe
1. Have you ever been infected by COVID-19	4 (2.9)	122 (87.1)	14 (10.0)
2. Do you know anyone who has been infected by COVID-19	40 (28.6)	79 (56.4)	21 (15.0)
3. The main symptoms of an individual infected with COVID-19 includes fever, feeling of tiredness, dry cough and body aches	128 (91.4)	12 (8.6)	0 (0.0)
4. There is currently no cure for COVID-19 but early detection and supportive treatment can help most patients recover from the infection	101 (72.1)	3 (2.1)	36 (25.7)
5. Not everyone with COVID 19 develops symptoms	76 (54.3)	27 (19.3)	37 (26.4)
6. People with COVID-19 cannot transfer the virus to others if they do not have a fever	56 (40.0)	56 (40.0)	28 (20.0)
7. Isolation and treatment of people with COVID-19 is an effective way to reduce the spread of the virus	122 (87.1)	5 (3.6)	13 (9.3)
8. People who come in contact with someone infected with COVID-19 must be immediately isolated in a particular place	129 (92.1)	2 (1.4)	9 (6.4)
9. Do you trust that your government is making decisions in your best interest with respect to COVID-19 vaccine	42 (30.0)	72 (51.4)	26 (18.6)

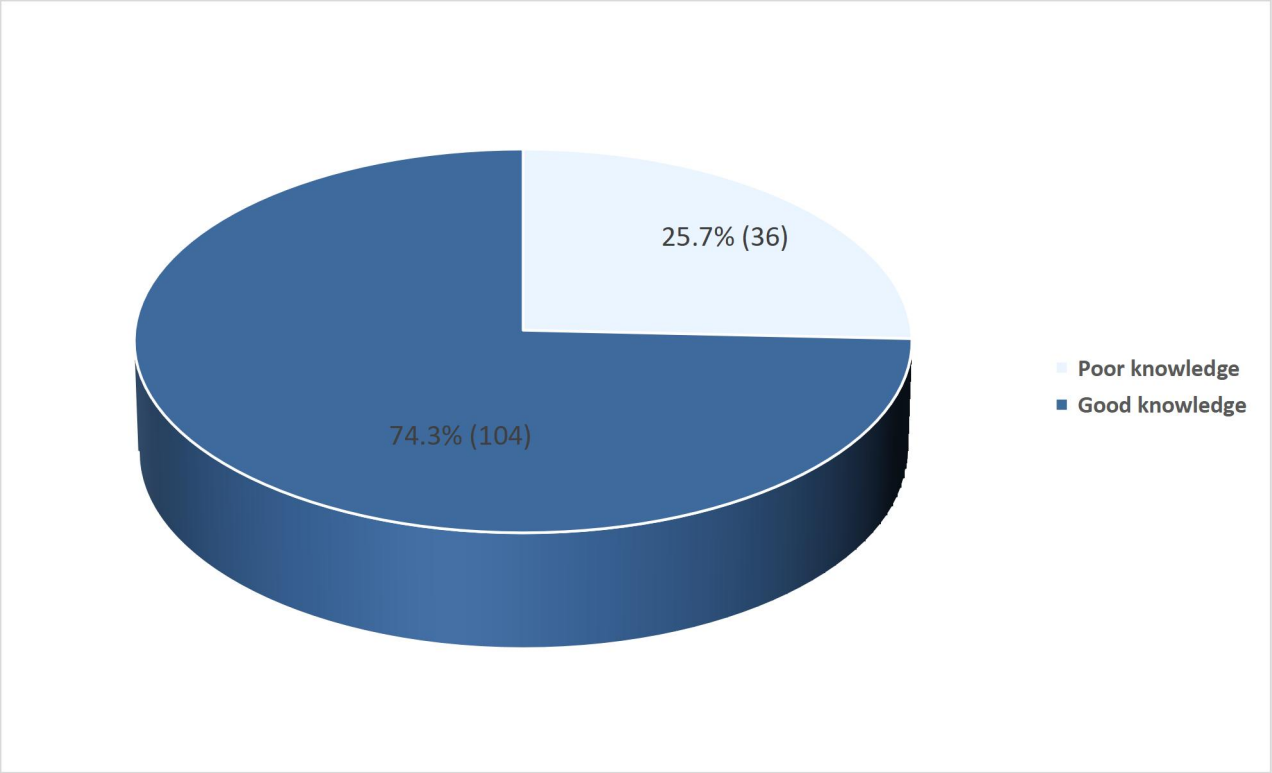

Figure 3.3: Knowledge of Participants on COVID-19

3.5 Hesitancy toward covid-19 vaccine

70% of study participants were/ have not been vaccinated against the disease. They gave different reasons why they were reluctant to get the COVID-19 vaccine. Majority of participants (31.4%) cited safety concerns as the reason for their hesitancy. Another 27.1% said the vaccine was not effective, hence their reluctance to getting vaccinated. Unavailability of the vaccine also discouraged some participants (15.7%).

Most of the study respondents (72.1%) did agree that the COVID-19 vaccine should not be made compulsory.

Table 3.3: Hesitancy towards-19 Vaccine

Questionnaire item	Yes	No	Maybe
1. Have you taken the COVID-19 vaccine	42 (30.0)	98 (70.0)	0 (0.0)
2. Do your religion /cultural beliefs forbid you from being vaccinated	12 (8.6)	128 (91.4)	0 (0.0)
3. I have taken the COVID-19 vaccine and can gladly recommend it for my friends and family	32 (22.9)	8 (5.7)	5 (3.6)
4. (No response: 95(67.9%))			
5. Do you think the COVID-19 vaccine should be made compulsory	17 (12.1)	101 (72.1)	22 (15.7)

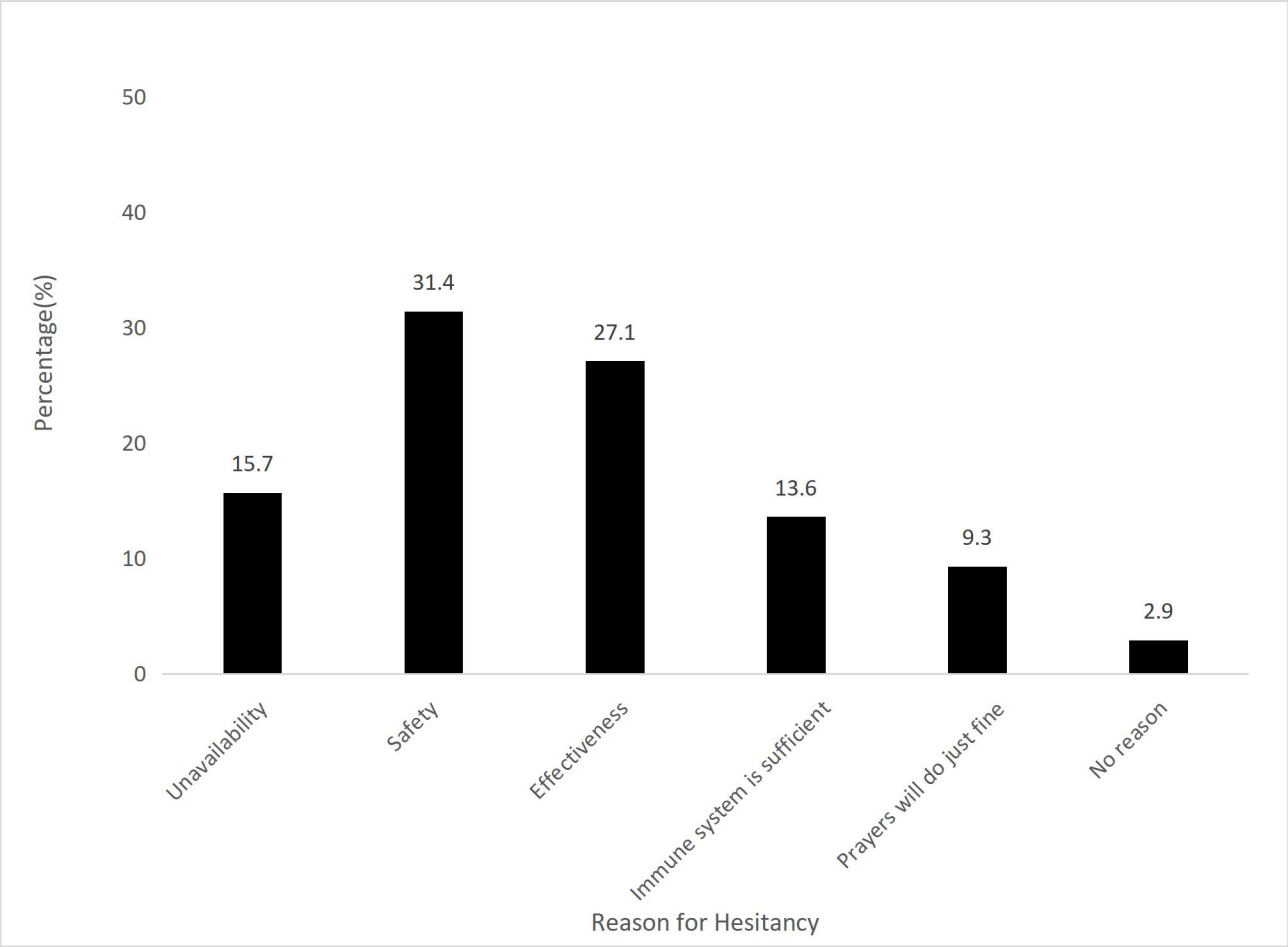

Figure 3.4: Reasons for hesitancy towards COVID-19 vaccination by respondents

3.6 Relationship between socio-demographics and knowledge of COVID-19

Table 3.4 shows the relationship between the different demographic variables and knowledge about COVID-19, and by extension, attitudes toward the vaccine.

Nature of job (whether academic or non-academic) with p=0.032, years of experience with p=0.004, and educational level with p=0.002 may have significantly influence participants decisions towards the vaccine.

Table 3.4: Relationship between socio-demographics and knowledge of COVID-19

Variables	Good knowledge	Poor knowledge	X^2	p value
Age group (years)				
26-35	19 (82.6)	4 (17.4)	7.289	0.063
36-45	46 (78.0)	13 (22.0)		
46-55	27 (77.1)	8 (22.9)		
56-65	12 (52.2)	11 (47.8)		
Gender				
Male	57 (75.0)	19 (25.0)	0.044	0.833
Female	47 (73.4)	17 (26.6)		
Marital Status				
Single	15 (71.4)	6 (28.6)	3.413	0.182
Married	87 (76.3)	27 (23.7)		
Divorced	2 (40.0)	3 (60.0)		
Educational Level				
Secondary	2 (40.0)	3 (60.0)	15.071	0.002
Diploma	10 (50.0)	10 (50.0)		
Bachelor's degree	41 (71.9)	16 (28.1)		
Post graduate/PhD	51 (87.9)	7 (12.1)		
Nature of Job				
Academic	34 (87.2)	5 (12.8)	4.705	0.032
Non-Academic	70 (69.3)	31 (30.7)		
Experience				
<5 years	5 (71.4)	2 (28.6)	13.26	0.004
5-10 years	49 (83.1)	10 (16.9)		
10-20 years	34 (81.0)	8 (19.0)		
>20 years	16 (50.0)	16 (50.0)		
Monthly income				
<50,000	4 (80.0)	1 (20.0)	6.429	0.169
50000-70000	11 (73.3)	4 (26.7)		
70000-100000	24 (60.0)	16 (40.0)		
100000-250000	55 (80.9)	13 (19.1)		

CHAPTER FOUR

DISCUSSION

This study was conducted to estimate the proportion of the University of Benin staff, Ugbowo campus that are hesitant to get vaccinated against COVID-19 and factors that are responsible for this.

This research work was important because University staff can serve as reliable source of health information, and their willingness or unwillingness toward the vaccine can influence the general population perception and uptake of the vaccine.

One interesting part of this study was that, even though participants have good knowledge of the disease, this, however, did not translate to accepting the vaccine.

Top of the reason for the high hesitancy toward vaccination was concerns surrounding safety of the vaccine. Majority of respondents cited this fear. Safety concerns could revolved around lack of trust in the vaccines, vaccine developers, donors and the Nigeria government; vaccine development within one year, lack of rigorous testing , several conspiracy theories, possibility of receiving a fake vaccine, fears of adverse effects and events , among others.

Nigerians, just like most Africans have long harbored mistrust for vaccines created in industrialized nations. It has its roots in the continent's history of unethical Western medical practices, when early attempts to treat disease eroded confidence in Western medicine and resulted in underuse of healthcare services. A little over 43% of respondents of the 15-country Africa CDC research thought that Africans were being used as test subjects for vaccines. Similar results were observed in the DRC, and a poll conducted in Addis Ababa in 2021 revealed that

hesitation was linked to the idea that the vaccination was a biological weapon used by industrialized nations to limit population growth. (Worldbank, 2021)

Still on the issue of safety and lack of confidence in the vaccine, many believed that since the manufacturers of these vaccines issued a warning and dissociated themselves from any unanticipated outcomes linked to administration and deployment of the vaccine for immunization, many people believe there is something sinister about the vaccines. (New telegraph, 2021)

Legal Issues in COVID-19 Vaccine Development states that specific regulations under the Public Readiness and Emergency Preparedness (PREP) Act govern legal liability for injuries brought on by a COVID-19 vaccine, shielding the manufacturer from claims of bodily harm or death brought on by the vaccine (s).(CRS Reports, 2020). The 25th Secretary of the Department of Health and Human Services (HHS), Xavier Becerra, declared COVID-19 a public health emergency and invoked the PREP Act for COVID-19 countermeasures.(new telegraph, 2021) (CRS reports, 2020) (New telegraph, 2021).In accordance with HHS's declaration, individuals who administer a COVID-19 vaccine, such as developers, manufacturers, distributors, and medical professionals, are generally exempt from legal responsibility for damages resulting from the administration or use of an FDA-approved COVID-19 vaccine, with the exception of willful misconduct that results in death or serious physical harm. (US Department of Health and Human Services, or HHS) (CRS Reports, 2020) (New telegraph, 2021)

Indeed, this disclaimer brought about a deafening hush, particularly among top medical professionals and those who covertly counseled their colleagues not to participate in the exercise.

Trust in one's government was another factor known to influence vaccination uptake. In this study, over more than half of study participants maintained that they do not trust that the government was making decisions in their best interest with respect to COVID-19 vaccine. This finding corroborated with other studies. For example, In West Africa, Afrobarometer reported high levels of mistrust in governments' ability to provide a safe vaccine. Those who did not trust their government were five to 10 times less likely to want to be vaccinated. In Ghana, 40% of those who are unwilling to be vaccinated cited mistrust of the government while in South Africa, those who believed the president was doing a good job were more likely to be vaccinated. (Worldbank, 2021)

Uncertainty about the vaccine efficacy was another concern expressed by respondents. Many of them argued that adopting a vaccination program was unwise for a virus that frequently mutates since the variant you see today may not be the one you treat tomorrow, as is the case with the virus's present lethal and highly contagious Delta version. (New telegraph, 2021)

Others countered that since the body's immune system can effectively combat the virus; there is no need for a vaccine that does not protect those receiving it from catching it. For this reason, people were recommended to continue bolstering their immune systems by taking vitamin C. (New telegraph, 2021)

Many believed that the vaccines are trial ones as they have not gone through the necessary clinical trials before being recommended for a mass administration which is why the manufacturers declines any responsibility in the possibility of unexpected outcomes. (New telegraph, 2021)

Many even argued that what is being currently offered are not vaccines rather Genetically Modified Organisms (GMOs). (New telegraph, 2021)

Availability of vaccine was also a factor. This was particularly true at the early stages of the vaccination exercises. The vaccination campaign in Nigeria was paused on 9 July due to exhaustion of the first COVAX shipment that arrived in March. (Health Policy watch, 2021) (Reuters, 2021) This brief pause coupled with long queues in some centers may have discouraged some persons from getting the vaccine.

The role of social media in all of these cannot be over emphasized. Social media make it easier for false information and conspiracy theories to proliferate. It can also serve as source of genuine information. Most study participants said they make use of social media to source information. According to the Africa CDC study, people with high levels of hesitation were more likely to use social media and be exposed to misinformation. In South Africa, half of those polled thought the virus was related to 5G technology. In a different South African study, around a third of those who would reject the vaccination saw social media as their main information source. According to a tiny study conducted in Addis Ababa, social media users were 3.6 times more hesitant than those who listened to the radio and watched television. (Worldbank, 2021)

Even though most of the study participants did agree that their religion/cultural beliefs do not forbade them from being vaccinated, a considerable amount of participants maintained that a vaccine was unnecessary and that prayers would provide the needed protection against the disease. In one study conducted, close to 90% of individuals surveyed in Niger and Liberia said that prayers were more effective than the vaccine. A recent Geopoll survey in six African countries showed religious beliefs as key determinants of hesitancy. (Geopoll report, 2021) (Worldbank, 2021)

Three demographic variables, namely; Nature of job (whether academic or non-academic), years of experience, and educational level may have significantly influence participants decisions towards the vaccine. Having a higher educational decree, being an academic staff and having longer years of experience may mean that a participant has access to certain information that can in turn influence decisions regarding the vaccine.

Other reasons for hesitancy may include disbelief in the existence of COVID-19, down-playing the severity of the disease, belief that the tropical climate would render the virus less dangerous, among others.

LIMITATIONS

The study has limitations. First it was a single-center retrospective study and as such the findings are limited to the population used. There could be bias due to the nature of analysis employed in the study. The unavailability and lack of easy access of academic staff mean they were poorly represented and findings may not be a true reflection of the larger academic staff population.

CHAPTER FIVE

CONCLUSION AND RECOMMENDTIONS

This study clearly showed that COVID-19 vaccine hesitancy is high among staff of the institution and this was due to concerns surrounding safety of the vaccine, its efficacy, and availability.

In tackling vaccine hesitancy, a pledge to vaccine safety is a crucial strategy. The public can get easily suspicious over pharmaceutical companies denying accountability for vaccines' side effects. Although, ensuring that no adverse event will occur is not pragmatic, letting the public realize the shared commitment of researchers, policymakers and the industry to safety can be a game changer.

Furthermore, clinical trial protocols and appropriate results must be communicated in accessible formats to both scientists and the public. The medical knowledge about vaccines, how it works, including its adverse effects has impact on its increases acceptance and confidence of the public.

Another key strategy is creative communication and honest dialogue to mitigate misinformation or false information around vaccines and vaccination. Innovative and compelling communications methods, particularly storytelling (e.g. personal stories to which people can relate), emotion, appeals to empathy and altruism, and memes to convey essential information in engaging ways can flood social media in an effort to counteract misleading information.

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