# COVID-19 INCIDENCE AND PREVALENCE AMONG UNIVERSITY OF BENIN STUDENTS, NIGERIA

**BY**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF MICROBIOLOGY, FACULTY OF LIFE SCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.Sc) DEGREE IN MICROBIOLOGY**

## CERTIFICATION

This is to certify that this project work was carried out by ALLI-BABA ARAFAT DENNIS with matriculation number LSC1504693 at the Department of Microbiology, Faculty of Life Sciences, University of Benin, in partial fulfilment for the award of Bachelor of Science degree (B.Sc.) in Microbiology.

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DR. K.O. ELIMIAN

Date

(PROJECT SUPERVISOR)

_____ _____

PROF. S.E. OMONIGHO

Date

(HEAD OF DEPARTMENT)

## DEDICATION

I dedicate this work to God Almighty who has been behind my success. Also, to my mum and dad for their support.

# ACKNOWLEDGEMENTS

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## ABSTRACT

COVID-19 (coronavirus disease 2019) is an illness caused by a virus. This virus is a new coronavirus that has spread throughout the world. It is thought to spread mainly through close contact from person to person. This study was carried out to access the incidence and prevalence of COVID-19 among the students in the University of Benin, Nigeria. A cross-sectional survey of eligible study participants was carried out with a view to collecting both outcome variables and covariates at one point in time in the Faculty of Arts, Law and Social Science. However, only participants who test negative to SARS-CoV-2 antibodies (IgG and IgM) by rapid diagnostic test will be eligible for the prospective cohort study, which will involve data collection at baseline (day of registration into the study) and at follow-up (between 14 and 21 days after recruitment into the study). A total of 77 students from the Faculty of Arts, Law and Social Science participated in the study and 54(70.1%) were positive to anti-SARS-CoV-2 IgG. The incidence and prevalence of COVID-19 among the students in the Faculty of Arts, Law and Social Science, University of Benin shows that the SARS-CoV-2 virus is a cause for concern among students.

# CHAPTER ONE

## INTRODUCTION

Coronaviruses are a group of related RNA viruses that cause diseases in mammals and birds. In humans and birds, they cause respiratory tract infections that can range from mild to lethal. Mild illnesses in humans include some cases of the common cold (which is also caused by other viruses, predominantly rhinoviruses), while more lethal varieties can cause SARS, MERS and COVID-19, which is causing an ongoing pandemic. In cows and pigs they cause diarrhoea, while in mice, they cause hepatitis and encephalomyelitis. Coronaviruses constitute the subfamily *Orthocoronavirinae*, in the family *Coronaviridae*, order *Nidovirales* and realm *Riboviria* (Fan *et al.,* 2019). They are enveloped viruses with a positive-sense single-stranded RNA genome and a nucleocapsid of helical symmetry (Cherry *et al.,* 2017). The genome size of coronaviruses ranges from approximately 26 to 32 kilobases, one of the largest among RNA viruses (Woo *et al.,* 2010). They have characteristic club-shaped spikes that project from their surface, which in electron micrographs create an image reminiscent of the solar corona, from which their name derives (Almeida *et al.,* 1968).

The name "coronavirus" is derived from Latin *corona*, meaning "crown" or "wreath", itself a borrowing from Greek κορώνη *korṓnē*, "garland, wreath". The name was coined by June Almeida and David Tyrrell , who first observed and studied human coronaviruses (Tyrrell and Fielder 2002). The name refers to the characteristic appearance of virions (the infective form of the virus) by electron microscopy, which has a fringe of large, bulbous surface projections creating an image reminiscent of the solar corona or halo (Tyrrell and Fielder 2002). The scientific name *Coronavirus* was accepted as a genus name by the International Committee for the Nomenclature of Viruses (later renamed International Committee on

Taxonomy of Viruses) in 1971 (Lalchhandama 2020). As the number of new species increased, the genus was split into four genera, namely *Alphacoronavirus*, *Betacoronavirus*, *Deltacoronavirus*, and *Gammacoronavirus* in 2009 (Carstens 2010). The common name coronavirus is used to refer to any member of the subfamily *Orthocoronavirinae*. As of 2020, 45 species are officially recognised.

The earliest reports of a coronavirus infection in animals occurred in the late 1920s, when an acute respiratory infection of domesticated chickens emerged in North America (Estola 1970). Arthur Schalk and M.C. Hawn in 1931 made the first detailed report which described a new respiratory infection of chickens in North Dakota. The infection of new-born chicks was characterized by gasping and listlessness with high mortality rates of 40–90% (Fabricant 1998). Human coronaviruses were discovered in the 1960s (Kahn and McIntosh, 2005) using two different methods in the United Kingdom and the United States (Monto 1984). E.C. Kendall, Malcolm Bynoe, and David Tyrrell working at the Common Cold Unit of the British Medical Research Council collected a unique common cold virus designated B814 in 1961 (Kendall *et al.,* 1962). The virus could not be cultivated using standard techniques which had successfully cultivated rhinoviruses, adenoviruses and other known common cold viruses. In 1965, Tyrrell and Bynoe successfully cultivated the novel virus by serially passing it through organ culture of human embryonic trachea (Tyrrell and Bynoe 1965). The new cultivating method was introduced to the lab by Bertil Hoorn (Tyrrell and Fielder 2002). The isolated virus when intranasally inoculated into volunteers caused a cold and was inactivated by ether which indicated it had a lipid envelope (Kendall *et al.,* 1962). Scottish virologist June Almeida at St Thomas' Hospital in London, collaborating with Tyrrell, compared the structures of IBV, B814 and 229E in 1967 (Almeida 2008). Using electron microscopy the three viruses were shown to be morphologically related by their general shape and distinctive club-like spikes (Almeida and Tyrrell, 1967). A

research group at the National Institute of Health the same year was able to isolate another member of this new group of viruses using organ culture and named one of the samples OC43 (OC for organ culture) (McIntosh *et al.,* 1967). Like B814, 229E, and IBV, the novel cold virus OC43 had distinctive club-like spikes when observed with the electron microscope (McIntosh *et al.,* 1967).

The IBV-like novel cold viruses were soon shown to be also morphologically related to the mouse hepatitis virus (McIntosh, 1974). This new group of viruses were named coronaviruses after their distinctive morphological appearance (Almeida *et al.,* 1968). Human coronavirus 229E and human coronavirus OC43 continued to be studied in subsequent decades (Myint, 1995). The coronavirus strain B814 was lost. It is not known which present human coronavirus it was (Corman *et al.,* 2014). Other human coronaviruses have since been identified, including SARS-CoV in 2003, HCoV NL63 in 2003, HCoV HKU1 in 2004, MERS-CoV in 2013, and SARS-CoV-2 in 2019 (Zhu *et al.,* 2020).

## 1.1 Aim and Objectives

The overarching aim of this study is to understand the extent and dynamics of COVID-19 infection in the Universityof Benin, Nigeria. The study will see to address the following specific objectives:

- To determine the seroprevalence of IgG in terms of age, sex and accommodation type of university students in Nigeria.
- To determine the incidence of COVID-19 in terms of age, sex and accommodation type of university students in Nigeria.
- To identify the risk factors for COVID-19 infection and incidence among university students in Nigeria.

# CHAPTER TWO

## Literature Review

The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The novel virus was first identified from an outbreak in the Chinese city of Wuhan in December 2019, and attempts to contain it there failed, allowing it to spread across the globe. The World Health Organization (WHO) declared a Public Health Emergency of International Concern on 30 January 2020 and a pandemic on 11 March 2020. As of 18 January 2022, the pandemic had caused more than 331 million cases and 5.54 million deaths, making it one of the deadliest in history

### 2.1 Etymology

The pandemic is known by several names. It's often referred in news media as the "coronavirus pandemic" despite the existence of other human coronaviruses that have caused epidemics and outbreaks (e.g. SARS).

During the initial outbreak in Wuhan, the virus and disease were commonly referred to as "coronavirus", "Wuhan coronavirus" (McNeil, 2020). "the coronavirus outbreak" and the "Wuhan coronavirus outbreak" (Zhu *et al.,* 2020). with the disease sometimes called "Wuhan pneumonia" (Jiang *et al.,* 2020). In January 2020, the WHO recommended 2019-nCoV and 2019-nCoV acute respiratory disease as interim names for the virus and disease per 2015 international guidelines against using geographical locations (e.g. Wuhan, China), animal species, or groups of people in disease and virus names in part to prevent social stigma. WHO finalized the official names COVID-19 and SARS-CoV-2 on 11 February 2020. Tedros Adhanom explained: CO for corona, VI for the virus, D for disease and 19 for when the

outbreak was first identified (31 December 2019). WHO additionally uses "the COVID-19 virus" and "the virus responsible for COVID-19" in public communications.

WHO names variants of concern and variants of interest using Greek letters. The initial practice of naming them according to where the variants were identified (e.g. Delta began as the "Indian variant") is no longer common. A more systematic naming scheme reflects the variant's PANGO lineage (e.g., Omicron's lineage is B.1.1.529) and is used for other variants (Patel, 2021).

SARS-CoV-2 is a newly discovered virus that is closely related to bat coronaviruses (Perlman, 2020). pangolin coronaviruses (Zhang *et al.,* 2020). and SARS-CoV. The first known outbreak started in Wuhan, Hubei, China, in November 2019. Many early cases were linked to people who had visited the Huanan Seafood Wholesale Market there (Maxmen, 2021). but it is possible that human-to-human transmission began earlier (Graham and Baric, 2020).

The scientific consensus is that the virus is most likely of zoonotic origin, from bats or another closely-related mammal (Hu *et al.,* 2021). Despite this, the subject has generated extensive speculation about alternative origins (Graham and Baric, 2020). The origin controversy heightened geopolitical divisions, notably between the United States and China (Frutos *et al.,* 2021).

The earliest known infected person fell ill on 1 December 2019. That individual did not have a connection with the later wet market cluster (Wang *et al.,* 2020). However, an earlier case may have occurred on 17 November (Ma, 2020). Two-thirds of the initial case cluster were linked with the market (Huang *et al.,* 2020). Molecular clock analysis suggests that the index case is likely to have been infected between mid-October and mid-November 2019 (Pekar *et al.,* 2021).

### 2.2 Signs and symptoms

Symptoms of COVID-19 are variable, ranging from mild symptoms to severe illness (Grant *et al.,* 2020). Common symptoms include headache, loss of smell (anosmia) and taste (ageusia), nasal congestion and runny nose, cough, muscle pain, sore throat, fever, diarrhea, and breathing difficulties. People with the same infection may have different symptoms, and their symptoms may change over time. Three common clusters of symptoms have been identified: one respiratory symptom cluster with cough, sputum, shortness of breath, and fever; a musculoskeletal symptom cluster with muscle and joint pain, headache, and fatigue; a cluster of digestive symptoms with abdominal pain, vomiting, and diarrhea. In people without prior ear, nose, and throat disorders, loss of taste combined with loss of smell is associated with COVID-19 and is reported in as many as 88% of cases (Paderno *et al.,* 2020).

Of people who show symptoms, 81% develop only mild to moderate symptoms (up to mild pneumonia), while 14% develop severe symptoms (dyspnea, hypoxia, or more than 50% lung involvement on imaging) and 5% of patients suffer critical symptoms (respiratory failure, shock, or multiorgan dysfunction). At least a third of the people who are infected with the virus do not develop noticeable symptoms at any point in time (Gao *et al.,* 2021). These asymptomatic carriers tend not to get tested and can spread the disease (Gao *et al.,* 2021). Other infected people will develop symptoms later, called "pre-symptomatic", or have very mild symptoms and can also spread the virus (Furukawa *et al.,* 2020)

As is common with infections, there is a delay between the moment a person first becomes infected and the appearance of the first symptoms. The median delay for COVID-19 is four to five days (Gandhi *et al.,* 2020). Most symptomatic people experience symptoms within two to seven days after exposure, and almost all will experience at least one symptom within 12 days (Gandhi *et al.,* 2020).

## 2.3 Cause

COVID-19 is caused by infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus strain (Hu *et al.,* 2021).

### 2.3.1 Transmission

COVID-19 is mainly transmitted when people breathe in air contaminated by droplets and small airborne particles containing the virus. Infected people exhale those particles as they breathe, talk, cough, sneeze, or sing (Greenhalgh *et al.,* 2021). Transmission is more likely when people are physically close. However, infection can occur over longer distances, particularly indoors (Wang *et al.,* 2021).

Infectivity can occur 1-3 days before the onset of symptoms. Infected persons can spread the disease even if they are pre-symptomatic or asymptomatic. Most commonly, the peak viral load in upper respiratory tract samples occurs close to the time of symptom onset and declines after the first week after symptoms begin. Current evidence suggests a duration of viral shedding and the period of infectiousness of up to 10 days following symptom onset for persons with mild to moderate COVID-19, and a up to 20 days for persons with severe COVID-19, including immunocompromised persons.

### 2.3.2 Virology

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a novel severe acute respiratory syndrome coronavirus. It was first isolated from three people with pneumonia connected to the cluster of acute respiratory illness cases in Wuhan. All structural features of the novel SARS-CoV-2 virus particle occur in related coronaviruses in nature (Andersen *et al.,* 2020).

Outside the human body, the virus is destroyed by household soap, which bursts its protective bubble (Gibbens, 2020).

SARS-CoV-2 is closely related to the original SARS-CoV (Zhu *et al.,* 2020). It is thought to have an animal (zoonotic) origin. Genetic analysis has revealed that the coronavirus genetically clusters with the genus Betacoronavirus in subgenus Sarbecovirus (lineage B) together with two bat-derived strains. It is 96% identical at the whole genome level to other bat coronavirus samples (BatCov RaTG13) (Rathore and Ghosh, 2020). The structural proteins of SARS-CoV-2 include membrane glycoprotein (M), an envelope protein (E), nucleocapsid protein (N), and the spike protein (S). The M protein of SARS-CoV-2 is about 98% similar to the M protein of bat SARS-CoV, maintains around 98% homology with pangolin SARS-CoV, and has 90% homology with the M protein of SARS-CoV; whereas the similarity is only around 38% with the M protein of MERS-CoV.

### 2.3.3 SARS-CoV-2 variants

The many thousands of SARS-CoV-2 variants are grouped into either clades or lineages (Koyama *et al.,* 2020). The WHO, in collaboration with partners, expert networks, national authorities, institutions and researchers, have established nomenclature systems for naming and tracking SARS-CoV-2 genetic lineages by GISAID, Nextstrain and Pango. At present, the expert group convened by WHO has recommended the labelling of variants using letters of the Greek Alphabet, for example, Alpha, Beta, Delta, and Gamma, giving the justification that they "will be easier and more practical to discussed by non-scientific audiences." Nextstrain divides the variants into five clades (19A, 19B, 20A, 20B, and 20C), while GISAID divides them into seven (L, O, V, S, G, GH, and GR) (Alm *et al.,* 2020). The Pango

tool groups variants into lineages, with many circulating lineages being classed under the B.1 lineage (Rambaut *et al.,* 2020).

As of December 2021, there are five dominant variants of SARS-CoV-2 spreading among global populations: the Alpha variant (B.1.1.7, formerly called the UK variant), first found in London and Kent, the Beta variant (B.1.351, formerly called the South Africa variant), the Gamma variant (P.1, formerly called the Brazil variant), the Delta variant (B.1.617.2, formerly called the India variant), and the Omicron variant (B.1.1.529), which had spread to 57 countries as of 7 December.

### 2.4 Pathophysiology

The SARS-CoV-2 virus can infect a wide range of cells and systems of the body. COVID-19 is most known for affecting the upper respiratory tract (sinuses, nose, and throat) and the lower respiratory tract (windpipe and lungs) (Harrison *et al.,* 2020). The lungs are the organs most affected by COVID-19 because the virus accesses host cells via the receptor for the enzyme angiotensin-converting enzyme 2 (ACE2), which is most abundant on the surface of type II alveolar cells of the lungs (Verdecchia *et al.,* 2020). The virus uses a special surface glycoprotein called a "spike" to connect to the ACE2 receptor and enter the host cell (Letko *et al.,* 2020).

#### 2.4.1 Respiratory tract

Following viral entry, COVID-19 infects the ciliated epithelium of the nasopharynx and upper airways (Marik *et al.,* 2021).

#### 2.4.2 Nervous system

One common symptom, loss of smell, results from infection of the support cells of the olfactory epithelium, with subsequent damage to the olfactory neurons (Meunier *et al.,* 2020). The involvement of both the central and peripheral nervous systems in COVID-19 has been reported in many medical publications (Juan *et al.,* 2021). It is clear that many people with COVID-19 exhibit neurological or mental health issues. The virus is not detected in the CNS of most COVID-19 patients with neurological issues. However, SARS-CoV-2 has been detected at low levels in the brains of those who have died from COVID-19, but these results need to be confirmed (Pezziniand and Padovani, 2020). While the virus has been detected in the cerebrospinal fluid of autopsies, the exact mechanism by which it invades the CNS remains unclear and may first involve the invasion of peripheral nerves given the low levels of ACE2 in the brain (Li et al., 2020). The virus may also enter the bloodstream from the lungs and cross the blood-brain barrier to access the CNS, possibly within an infected white blood cell (Pezziniand and Padovani, 2020).

### 2.4.3 Gastrointestinal tract

The virus also affects gastrointestinal organs as ACE2 is abundantly expressed in the glandular cells of gastric, duodenal and rectal epithelium (Gu et al., 2020). as well as endothelial cells and enterocytes of the small intestine (Mönkemüller *et al.,* 2020).

### 2.4.4 Cardiovascular system

The virus can cause acute myocardial injury and chronic damage to the cardiovascular system (Zheng *et al.,* 2020). An acute cardiac injury was found in 12% of infected people admitted to the hospital in Wuhan, China (Huang *et al.,* 2020). and is more frequent in severe diseases. Rates of cardiovascular symptoms are high, owing to the systemic inflammatory response and immune system disorders during disease progression. However, acute myocardial injuries may also be related to ACE2 receptors in the heart (Zheng *et al.,* 2020). ACE2 receptors are

highly expressed in the heart and are involved in heart function (Zheng *et al.,* 2020). A high incidence of thrombosis and venous thromboembolism have been found in people transferred to Intensive care units (ICU) with COVID-19 infections and may be related to poor prognosis (Abou-Ismail *et al.,* 2020). Blood vessel dysfunction and clot formation (as suggested by high D-dimer levels caused by blood clots) are thought to play a significant role in mortality, incidences of clots leading to pulmonary embolisms, and ischaemic events within the brain have been noted as complications leading to death in people infected with SARS-CoV-2. Infection appears to set off a chain of vasoconstrictive responses within the body; constriction of blood vessels within the pulmonary circulation has also been posited as a mechanism in which oxygenation decreases alongside the presentation of viral pneumonia (Wadman, 2020). Furthermore, microvascular (arterioles and capillaries) blood vessel damage has been reported in a small number of tissue samples of the brains – without detected SARS-CoV-2 – and the olfactory bulbs from those who have died from COVID-19 (Lee *et al.,* 2021). COVID-19 was also found to cause substantial – including morphological and mechanical – changes to blood cells – such as increased sizes – sometimes persisting for months after hospital discharge (Kubánková *et al.,* 2021).

### 2.4.5 Other organs

Another common cause of death is complications related to the kidneys (Wadman, 2020). Early reports show that up to 30% of shospitalised patients in China and New York have experienced some injury to their kidneys, including some persons with no previous kidney problems.

Autopsies of people who died of COVID-19 have found diffuse alveolar damage and lymphocyte-containing inflammatory infiltrates within the lung (Eketunde *et al.,* 2020).

### 2.5 Diagnosis

COVID-19 can provisionally be diagnosed based on symptoms and confirmed using reverse transcription-polymerase chain reaction (RT-PCR) or another nucleic acid testing of infected secretions (Li *et al.,* 2020). Along with laboratory testing, chest CT scans may be helpful in diagnosing COVID-19 in individuals with a high clinical suspicion of infection (Salehi *et al.,* 2020). Detection of a past infection is possible with serological tests, which detect antibodies produced by the body in response to the infection (Li *et al.,* 2020).

#### 2.5.1 Viral testing

The standard testing methods for the presence of SARS-CoV-2 are nucleic acid tests (Li *et al.,* 2020). which detects the presence of viral RNA fragments. As these tests detect RNA but not an infectious viruses, their "ability to determine the duration of infectivity of patients is limited." (Bullard, 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. Results are generally available within hours (Li *et al.,* 2020). The WHO has published several testing protocols for the disease.

Several laboratories and companies have developed serological tests, which detect antibodies produced by the body in response to infection. Several have been evaluated by Public Health England and approved for use in the UK.

The University of Oxford's CEBM has pointed to mounting evidence (Heneghan and Jefferson, 2020). that "a good proportion of 'new' mild cases and people re-testing positives after quarantine or discharge from hospital are not infectious, but are simply clearing harmless virus particles which their immune system has efficiently dealt with" and have called for "an international effort to sstandardise and periodically calibrate testing" (Spencer *et al.,* 2020). On 7 September, the UK government issued "guidance for procedures to be

implemented in laboratories to assure positive SARS-CoV-2 RNA results during periods of low prevalence, when there is a reduction in the predictive value of positive test results".

### 2.5.2 Coding

In late 2019, the WHO assigned emergency ICD-10 disease codes U07.1 for deaths from lab-confirmed SARS-CoV-2 infection and U07.2 for deaths from clinically or epidemiologically diagnosed COVID-19 without lab-confirmed SARS-CoV-2 infection.

### 2.5.3 Pathology

The main pathological findings at autopsy are:

- Macroscopy: pericarditis, lung consolidation and pulmonary oedema (Eketunde *et al.,* 2020).
- Lung findings:
    - minor serous exudation, minor fibrin exudation (Eketunde *et al.,* 2020).
    - pulmonary oedema, pneumocyte hyperplasia, large atypical pneumocytes, interstitial inflammation with lymphocytic infiltration and multinucleated giant cell formation (Eketunde *et al.,* 2020).
    - diffuse alveolar damage (DAD) with diffuse alveolar exudates. DAD is the cause of acute respiratory distress syndrome (ARDS) and severe hypoxemia (Eketunde *et al.,* 2020)
    - organisation of exudates in alveolar cavities and pulmonary interstitial fibrosis (Eketunde *et al.,* 2020).
    - plasmacytosis in BAL (Giani *et al.,* 2020).
- Blood and vessels: disseminated intravascular coagulation (DIC) (Lillicrap, 2020); leukoerythroblastic reaction (Mitra *et al.,* 2020).; endotheliitis (Satturwar *et al.,* 2021). hemophagocytosis (Satturwar *et al.,* 2021).

- Heart: cardiac muscle cell necrosis (Satturwar *et al.,* 2021).
- Liver: microvesicular steatosis (Eketunde *et al.,* 2020).
- Nose: shedding of the olfactory epithelium (Meunier *et al.,* 2020).
- Brain: infarction (Satturwar *et al.,* 2021).
- Kidneys: acute tubular damage (Satturwar *et al.,* 2021).
- Spleen: white pulp depletion (Satturwar *et al.,* 2021).

**2.6 Prevention**

Preventive measures to reduce the chances of infection include getting vaccinated, staying at home, wearing a mask in public, avoiding crowded places, keeping distance from others, ventilating indoor spaces, managing potential exposure durations, washing hands with soap and water often and for at least twenty seconds, practising good respiratory hygiene, and avoiding touching the eyes, nose, or mouth with unwashed hands.

The CDC advises those diagnosed with COVID-19 or who believe they may be infected to stay home except to get medical care, call ahead before visiting a healthcare provider, wear a face mask before entering the 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.

The first COVID-19 vaccine was granted regulatory approval on 2 December 2020 by the UK medicines regulator MHRA. It was evaluated for emergency use sauthorisation (EUA) status by the US FDA and in several other countries (Mueller, 2020). Initially, the US National Institutes of Health guidelines do not recommend any medication for the prevention of COVID-19, before or after exposure to the SARS-CoV-2 virus, outside the setting of a clinical trial (Sanders *et al.,* 2020). Without a vaccine, other prophylactic measures, or effective treatments, a criticalcrucial part of managing COVID-19 is  decreasing and delay

the epidemic peak, known as "flattening the curve" (Anderson *et al.,* 2020). This is done by slowing the infection rate to decrease the risk of health services being overwhelmed, allowing for better treatment of active cases, and delaying additional cases until effective treatments or a vaccine become available (Anderson *et al.,* 2020).

### 2.6.1 Vaccine

A COVID-19 vaccine is intended to provide acquired immunity against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), 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 the Middle East respiratory syndrome (MERS). This knowledge accelerated the development of various vaccine platforms in 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 19 March, the global pharmaceutical industry announced a significant commitment to addressing COVID-19 (Padilla, 2021).

The COVID-19 vaccines are widely credited for reducing the severity and death caused by COVID-19 (Vergano, 2021). Many countries have implemented phased distribution plans that prioritise those at the highest risk of complications, such as the elderly, and those at high risk of exposure and transmission, such as healthcare workers (Beaumont, 2020).

As of 17 January 2022, 9.68 billion doses of COVID-19 vaccines have been administered worldwide based on official reports from national public health agencies (Richie *et al.,* 2021). By December 2020, more than 10 billion vaccine doses had been preordered by countries

(Mullard, 2020). with about half of the doses purchased by high-income countries comprising 14% of the world's population (So and Woo, 2020).

### 2.6.2 Face masks and respiratory hygiene

The WHO and the US CDC recommend that individuals wear non-medical face coverings in public settings with an increased risk of transmission and where social distancing measures are challenging to maintain. This recommendation is meant to reduce the spread of the disease by asymptomatic and pre-symptomatic individuals and is complementary to established preventive measures such as social distancing. Face coverings limit the volume and travel distance of expiratory droplets dispersed when talking, breathing, and coughing. A face covering without vents or holes will also filter out particles containing the virus from inhaled and exhaled air, reducing the chances of infection. However, if the mask includes an exhalation valve, a wearer that is infected (maybe without having noticed that and asymptomatic) would transmit the virus outwards through it, despite any certification they can have. So the masks with exhalation valves are not for the infected wearers and are not reliable for stopping the pandemic on a large scale. Many countries and local jurisdictions encourage or mandate the use of face masks or cloth face coverings by public members to limit the spread of the virus (Greenhalgh *et al.,* 2020).

Masks are also strongly recommended for those who have been infected and those taking care of someone who may have the disease. When not wearing a mask, the CDC recommends covering the mouth and nose with a tissue when coughing or sneezing and recommends using the inside of the elbow if no tissue is available. Proper hand hygiene after any cough or sneeze is encouraged. Healthcare professionals interacting directly with people who have COVID-19 are advised to use respirators at least as protective as NIOSH-certified N95 or equivalent, in addition to other personal protective equipment.

### 2.6.3 Hand-washing and hygiene

Thorough hand hygiene after any cough or sneeze is required. The WHO also recommends that individuals wash hands often with soap and water for at least twenty seconds, especially after going to the toilet or when hands are visibly dirty, before eating and blowing one's nose. When soap and water are not available, the CDC recommends using an alcohol-based hand sanitiser with at least 60% alcohol. For areas where commercial hand sanitisers are not readily available, the WHO provides two formulations for local production. In these formulations, the antimicrobial activity arises from ethanol or isopropanol. Hydrogen peroxide is used to help eliminate bacterial spores in the alcohol; it is "not an active substance for hand antisepsis." Glycerol is added as a humectant.

### 2.6.4 Social distancing

Social distancing (also known as physical distancing) includes infection control actions intended to slow the spread of the disease by minimising close contact between individuals. Methods include quarantines; travel restrictions; and the closing schools, workplaces, stadiums, theatres, or shopping centres. Individuals may apply social distancing methods by staying at home, limiting travel, avoiding crowded areas, using no-contact greetings, and physically distancing themselves from others (Nussbaumer-Streit *et al.,* 2020). Many governments are now mandating or recommending social distancing in regions affected by the outbreak (Qian and Jiang, 2020).

Outbreaks have occurred in prisons due to crowding and an inability to enforce adequate social distancing (Hawks *et al.,* 2020). In the United States the prisoner population is ageing, and many of them are at high risk for poor outcomes from COVID-19 due to high rates of coexisting heart and lung disease and poor access to high-quality healthcare (Hawks *et al.,* 2020).

### 2.6.5 Self-isolation

Self-isolation at home has been recommended for those diagnosed with COVID-19 and those who suspect they have been infected. Health agencies have issued detailed instructions for proper self-isolation (Patiño-Lugo *et al.,* 2020). Many governments have mandated or recommended self-quarantine for entire populations. The most robust self-quarantine instructions have been issued to those in high-risk groups. Those who may have been exposed to someone with COVID-19 and those who have recently travelled to a country or region with the widespread transmission have been advised to self-quarantine for 14 days from the last possible exposure.

## 2.7 Treatment

There is no specific, effective treatment or cure for coronavirus disease 2019 (COVID-19), the disease caused by the SARS-CoV-2 virus (Siemieniuk *et al.,* 2020). One year into the pandemic, highly effective vaccines have now been introduced and are beginning to slow the spread of SARS-CoV-2; however, for those awaiting vaccination, as well as for the estimated millions of immunocompromised persons who are unlikely to respond robustly to vaccination, treatment remains important (Tao *et al.,* 2021). Thus, the lack of progress in developing effective treatments means that the cornerstone of management of COVID-19 has been supportive care, which includes treatment to relieve symptoms, fluid therapy, oxygen support and prone positioning as needed, and medications or devices to support other affected vital organs ( Fisher and Heymann, 2020).

Most cases of COVID-19 are mild. In these, supportive care includes medication such as paracetamol or NSAIDs to relieve symptoms (fever, body aches, cough), proper intake of

fluids, rest, and nasal breathing (Wang *et al.,* 2020). Good personal hygiene and a healthy diet are also recommended (Wang *et al.,* 2020). The U.S. Centers for Disease Control and Prevention (CDC) recommend that those who suspect they are carrying the virus isolate themselves at home and wear a face mask.

People with more severe cases may need treatment in hospitals. In those with low oxygen levels, the use of the glucocorticoid dexamethasone is strongly recommended, as it can reduce the risk of death. Noninvasive ventilation and, ultimately, admission to an intensive care unit for mechanical ventilation may be required to support breathing. Extracorporeal membrane oxygenation (ECMO) has been used to address the issue of respiratory failure, but its benefits are still under consideration (Guan *et al.,* 2020). Some the cases of severe disease course are caused by systemic hyper-inflammation, the so-called cytokine storm (Kim *et al.,* 2021). Several experimental treatments are being actively studied in clinical trials (Siemieniuk *et al.,* 2020). These include fluvoxamine, a cheap and widely available antidepressant (May and Saima, 2021).; and the antivirals molnupiravir (developed by Merck) (Aripaka and Pushkala, 2021)., and nirmatrelvir/ritonavir (developed by Pfizer) (Beasley and Deena, 2021). Others were thought to be promising early in the pandemic, such as hydroxychloroquine and lopinavir/ritonavir, but later research found them ineffective or even harmful (Siemieniuk *et al.,* 2020). Despite ongoing research, there is still not enough high-quality evidence to recommend so-called early treatment (Kim *et al.,* 2020). Nevertheless, in the United States, two monoclonal antibody-based therapies are available for early use in cases thought to be at high risk of progression to severe disease. The antiviral remdesivir is available in the U.S., Canada, Australia, and several other countries, with varying restrictions; however, it is not recommended for people needing mechanical ventilation and is discouraged altogether by the World Health Organization (WHO) (Hsu, 2020)., due to limited evidence of its efficacy (Siemieniuk *et al.,* 2020). In November 2021, the UK

approved the use of molnupiravir as a COVID treatment for vulnerable patients recently diagnosed with the disease.

### 2.8 Impact of the COVID-19 pandemic on education

The COVID-19 pandemic has affected educational systems worldwide, leading to close closures of schools, early childhood education and care (ECEC) services, universities and colleges.

Most governments decided to temporarily close educational institutions to reduce the spread of COVID-19 (Skulmowski and Ray, 2020). As of 12 January 2021, approximately 825 million learners are currently affected due to school closures in response to the pandemic. According to UNICEF monitoring, 23 countries are currently implementing nationwide closures, and 40 are implementing local closures, impacting about 47 per cent of the world's student population. One hundred twelve countries' schools are currently open.

Having fewer education options has globally impacted people with less money, while people with more money have found education. New online programs have shifted the labour of education from schools to families and individuals. Consequently, people everywhere who relied on schools rather than computers and home life have had more difficulty accessing their education. Early childhood education and care (ECEC), as well as school closures impact not only students, teachers, and families (Bao *et al.,* 2020). but have far-reaching economic and societal consequences (Aristovnik *et al.,* 2020). School closures in response to the pandemic have shed light on various social and economic issues, including student debt (Jamerson and Mitchell, 2020)., digital learning (Aristovnik *et al.,* 2020)., food insecurity, homelessness, as well as access to childcare, health care, housing, internet, and disability services. The impact was more severe for disadvantaged children and their families, causing

interrupted learning, compromised nutrition, childcare problems, and consequent economic cost to families who could not work.

In response to school closures, UNESCO recommended using distance learning programmes and open educational applications and platforms that schools and teachers can use to reach learners remotely and limit the disruption of education.

# CHAPTER THREE

# MATERIALS AND METHODOLOGY

## 3.0 STUDY SETTINGS

The study will be conducted in the University of Benin in Edo State, Faculty of Arts, Law and Social Sciences.

## 3.1 STUDY DESIGN

The study will use a combination of cross-sectional and prospective cohort epidemiological designs. A cross-sectional survey of eligible study participants will be carried out with a view to collecting both outcome variables and covariates at one point in time. However, only participants who test negative to SARS-CoV-2 antibodies (IgG and IgM) by rapid diagnostic test will be eligible for the prospective cohort study, which will involve data collection at baseline (day of registration into the study) and at follow-up (between 14 and 21 days after recruitment into the study).

## 3.2 SAMPLING APPROACH

We conducted a multiple randomised sampling, with the systemtic sampling approach. The first stage comprising of randomly different locations within the university and then selecting the nth students we came across (n=3). Ekosodin backgate, anatomy back gate, June 12, hall

of residents bus stop and the university main gate were the locations selected for the study. All participants in the study were student (undergraduates and post graduates).

### 3.3 STUDY PARTICIPANTS AND INCLUSION CRITERIA

Students who are willing to sign an informed consent form and aged 18 years or older in the selected faculties/departments will be eligible to participate in the study, irrespective of whether or not they had prior confirmed COVID-19 or COVID-19 related symptoms. To minimise potential selection bias in the recruitment process, we will make available study invitation posters around the faculties and departments selected for the study. Students with a contraindication to specimen collection, experiencing difficulty in providing specimens, or vaccinated within 14 days of symptom onset will however be ineligible for the study.

### 3.4 SAMPLE SIZE ESTIMATION

Overall 591 students were recuited for the study but only 78 (13.2%) was from the Faculty of Arts, Law and Social Sciences.

### 3.5 DATA COLLECTION

Prior to data collection, research assistants with medical background will be trained by the research team using a combination of physical and online platforms. The trainings will focus the principles of data collection, the study protocol procedures and relevant standard operating procedures and ethics. For the cross-sectional study, trained data collectors will contact each student in the departmental register who meet the study predefined inclusion criteria for recruitment. Following consent completion, the study participants will be required to provide the following data:

(1) Sociodemographic (age, sex, state of residence, ethnicity, religion, accommodation type, hostel type and size, sharing facilities (with 3 or fewer students, with 4–7 students, with 8 or more students), medical background (medical-related courses vs non-medical-related courses), parental occupation, commonly used transportation etc.) and

(2) clinical profile (signs and symptoms of COVID-19, pre-existing conditions, whether they were aware of confirmed cases within their accommodation etc.).

Data will be collected using Open Data Kit (ODK) App to allow real-time transmission of data and monitoring of data quality.

Following questionnaire completion, a phlebotomist will collect about 400 μL of capillary blood from participating students in line with standard procedures. The blood sample is expected to be collected within 5 min while the blood-filled tube is then capped and sent to a designated health centre at the university of Benin teaching hospital. For instance, the primary healthcare centre at the University of Benin is equipped with all the required facilities to store, centrifuge and test the sera for SARS-CoV-2 antibodies using any rapid diagnostic test kit currently supplied by the Nigeria Centre for Disease Control to health facilities across the country. One of such commonly used product is the Abbott Architect SARS-CoV-2 IgG (nucleoprotein assay), which is highly specific (99.9%, 95% CI: 99.4–100; cut 0.8) and sensitive (92.7%,95% CI: 90.2–94.8), especially within the first three months after infection. Results of the antibody testing will be reported back to individual participants as quickly as possible; however, participating students with positive antigen and IgM results will be referred to a designated health centre (e.g. university health centre) as an active case where COVID-19 management protocol will be applied.

For the prospective cohort study, the WHO First Few X (FFX) protocol will be adapted. This will be such that similar sociodemographic and clinical data will be collected from

consenting SARS-CoV-2-negative (i.e. both IgG and IgM negative) students using Form A1 at baseline (just after a positive diagnosis) and Form A2 at follow-up (14-21 days after completion of Form A1). Unlike the cross-sectional study, however, either rapid diagnostic test kit targeting SARS-CoV-2 antigen or reverse transcription polymerase chain reaction (RT-PCR) will be used to confirm active COVID-19 infection. Furthermore, students in the cohort study will be required to complete a symptom diary, recording the presence or absence of COVID-19 signs or symptoms, for a minimum of 14 days after the administration of Form A1.

All data collection activities will be conducted in English language, using a combination of face-to-face or telephone interviews, self-reporting (symptom diary), interview of health care providers and/or review of medical records in the case of hospitalised participants.

### 3.6 STUDY DURATION

At a minimum, enrolled students will complete data and specimen collection at enrolment and 14-21 days later. However, the study will continue until the estimated sample size for each university is attained.

### 3.7 DATA MANAGEMENT

Data management will be performed using both MS Excel and Stata version 16 (College Station, TX: StataCorp LLC). A student in the cross-sectional study will be classified seropositive if they are IgM+/IgG-, IgM-/IgG+, or IgM+/IgG+; whereas, a student in the cohort study who tests negative to all SARS-CoV-2 antibodies at baseline will be classified as COVID-19 positive if they test positive to SARS-CoV-2 by rapid diagnostic test targeting antigen and/or by RT-PCR at follow-up (14-21 days of post-recruitment into the study).

### 3.8 STATISTICAL ANALYSIS

Similar to data management, statistical analyses will be performed using Stata version 16. Descriptive statistics will be used to summarize baseline and demography data; e.g., using frequencies and percentages to describe binary/categorical variables, mean (SD) for normally distributed continuous variables and Median (IQR) for non-normally distributed continuous variables. Data will be analysed to estimate the seroprevalence of IgM/IgG antibodies against SARS-CoV-2 with 95% CI. We will also calculate seroprevalence of COVID-19 by age group, sex, university, accommodation type, (campus vs off-campus) and hostel type (self-contained vs shared), where data are available, with the aim of exploring the effects of demographic and geographic characteristics on SARS-CoV-2 antibody/antigen seropositivity.

Possible risk factors for COVID-19 infections will be determined using logistic regression models. The association between possible risk factors and COVID-19 infection will be assessed by using bivariate logistic regression models. Factors with P-value <0.05 will be selected for inclusion in a multivariate model, which will be constructed using a backwards elimination procedure that retain only factors with a P-value <0.05. Significance of association will be assessed using Wald tests for binary or continuous variables, and likelihood ratio tests for categorical variables. Findings in the adjusted model will be presented as odds ratios with 95% Confidence Intervals (CIs). The incidence of COVID-19 during the study period will be presented as incidence rate per 1,000 students; the risk factors for COVID-19 incidence will be presented in terms of incidence rate ratios and 95% CIs after fitting Poisson regression models.

### 3.9 DETECTION OF SARS-COV-2 ANTIBODIES (IgM/IgG)

STANDARD$^{TM}$ Q COVID 19 IgG/IgM combo test (SD Biosensor) was used. This is a lateral flow immunoassay intended for the qualitative detection and differentiation of IgM and IgG antibodies against SARS-CoV-2 in serum, plasma, or whole blood specimens, producing results in 15–20 min. The manufacturer reports a sensitivity and specificity of 96.94% (95/98, 95% CI, 91.31% -99.36%) after 14 days after symptoms onset and after 14 days after symptoms onset and a standard specificity of 95.74% (225/235, 95% CI: 92.31–97.94%). STANDARD$^{TM}$ Q COVID 19 IgG/IgM combo test has three precoated lines, “C” control lines, “G” and “M” test lines forn the device on the surface of the nutricellulose membrane.

# CHAPTER FOUR

# RESULT

From the randomized sample at te University of Benin Ugbowo, 591 participants were examined from the randomized sample. 77 subjects were from the faculty of Arts, Law and Social Science.

In total, the study was carried out between Febuary 16th , 2022 and stopped March 15th , 2022 due to the emergence of ASUU (Academic Staff Union of Universities) strike that lasted for about eight months. The study was then continued following the resumption of schools due to the suspension of ASUU strike in November 2nd 2022 to November 15th 2022. The cross-sectional study sample consisted of 16 subjects, and the participant took a knowledge and aptitude test. The survey's response rate was 100%(591/591). The male students made up 315(53.3%) of the participants who responded to the questionnaire, while 276(46.6%) of the participants were females.

Of the study population, 290 (49.1%) live permanently in Edo State and 127(21.5%) live permanently in Lagos State. In the faculty of Arts, Law and Social Science, IgG positivity was detected in 22(40.7%) male students and 32(59.3%) female students. However, 11 (47.8%) of the female students and 12 (52.2%) of the male students who took the IgG test were negative. The mean age of the students in the study was 21.5 years old (±2.6) (Table 1)

Table 2 shows the distribution of SARS-CoV-2 (IgG) in students of the faculty of Arts, Law and Social Science. 55.8% of the 77 students in the faculty of Arts, Law and Social Science were reported to be female, while 44.2% were male. The majority (59.3%) of the students wo tested positive for SAR-CoV-2 IgG were female, while the remainder students (40.7%) were male. However, a p-value of 0.355 indicates that there was not a statistically significant correlation between student sex and SARS-CoV-2 IgG positivity.

Of the 77 students in the faculty of Arts, Law and Social Science, 40 (52.0%) of the study population were between the ages of 18-21 years, followed by those between the ages of 22-25 years with 29 (37.7%). The remaining proportion 8 (10.4%) with ages greater than or equals to 26 years. As regards to SARS-CoV-2 IgG positivity, the majority 28 (51.9%) who

Table 1: Baseline characteristics of the study population (N=591)

| Characteristics | Frequency (%) |
|---|---|

tested positive reported to be within the ages of 18-21 years, after which students within the ages of 22-25 years, 20 (37.0%) tested positive. The association between students age and SARS-CoV-2 IgG positivity was not statistically significant as indicated by a p-value of 0.947 as shown in Table 2.

The majority 48 (62.3%) of the 77 students in the faculty of Arts, Law and Social Science claimed that they did not feel comfortable wearing facemasks, whereas the remaining 29(37.7%) students disagreed. 34 (63.0%) of the students who tested positive for SARS-CoV-2 IgG did not feel comfortable using a facemask. The 20 (37.0%) of students who tested positive for SARS-CoV-2 were at ease wearing facemasks. A p-value of 0.862 indicates that there was no statistically significant correlation between students' comfort wearing facemasks nd SARS-CoV-2 IgG positivity as shown in Table 2.

Table 2 shows that 64.9% of the 77 students in the faculty of Arts, Law and Social Science said they shared bathrooms, while 35.1% said they didn't. the majority of students who tested positive for SARS-CoV-2 IgG reported sharing facilities in their housing (68.5%), compared to the 31.5%of students who tested negative for the IgG, who reported not sharing any facilities. However, as shown by a p-value of 0.313, there was statistically significant link between students sharing amenities in their housing and SARS-CoV-2 IgG positivity

| | |
|---|---|
| Mean age (SD) | 21.5 (2.6) |
| [Min-Max] | [18-43] |
| **Sex** | |
| Female | 276 (46.6) |
| Male | 315 (53.2) |
| Missing | 1 (0.2) |
| **Faculty** | |
| Life Sciences | 126 (21.3) |
| Arts, Law and Social Sciences | 78 (13.2) |
| Agricultural Sciences | 78 (13.2) |
| Education | 108 (18.3) |
| Engineering | 73 (12.4) |
| Physical Sciences | 44 (7.5) |
| Management Sciences | 41 (6.9) |
| Medicine, Pharmacy, Basic Med. Sciences and Dentistry | 34 (5.8) |
| Entrepreneurial Development and Environmental Science | 9 (1.5) |
| **Ethnicity** | |
| Bini | 138 (23.3) |
| Igbo | 138 (23.3) |
| Yoruba | 62 (10.5) |
| Afemai | 10 (1.7) |
| Ishan | 46 (7.8) |
| Hausa | 5 (0.8) |
| Others | 193 (32.6) |

Table 1 contd: Baseline characteristics of the study population (N=591)

| | |
|---|---|
| **Religion** | |

| | |
|---|---|
| Christianity | 577 (97.5) |
| Islam | 9 (1.5) |
| Other | 6 (1.0) |
| **Mode of study** | |
| Full-time | 587 (99.2) |
| Part-time | 5 (0.8) |
| **Year of study** | |
| 1st year | 101 (17.1) |
| 2nd year | 153 (25.8) |
| 3rd year | 163 (27.5) |
| 4th year | 150 (25.3) |
| 5th year | 19 (3.2) |
| 6th year | 4 (0.7) |
| 7th year | 2 (0.3) |
| **State of residence when not in school** | |
| Abia | 3 (0.5) |
| Adamawa | 1 (0.2) |
| Akwa-Ibom | 3 (0.5) |
| Anambra | 13 (2.2) |
| Bayelsa | 1 (0.2) |
| Benue | 1 (0.2) |
| Cross-River | 4 (0.7) |
| Delta | 78 (13.2) |
| Edo | 290 (49.1) |
| Ekiti | 2 (0.3) |
| Enugu | 1 (0.2) |
| FCT | 14 (2.4) |
| Imo | 1 (0.2) |
| Kaduna | 2 (0.3) |
| Lagos | 127 (21.5) |
| Ogun | 21 (3.6) |
| Ondo | 14 (2.4) |
| Osun | 1 (0.2) |
| Oyo | 7 (1.2) |
| Rivers | 7 (1.2) |

Table 1 contd: Baseline characteristics of the study population (N=591)

| | |
|---|---|
| **Setting of residence when not in school** | |

| | |
|---|---|
| Urban | 524 (88.5) |
| Rural | 44 (7.4) |
| Don't know | 24 (4.1) |
| **BMI** | |
| Underweight | 71 (12.1) |
| Healthy weight | 384 (65.5) |
| Overweight | 88 (15.0) |
| Obese | 43 (7.3) |
| **Accommodation situation in school** | |
| On-campus | 119 (20.1) |
| Off-campus (alone) | 454 (76.8) |
| Off-campus (living with parents/relatives) | 18 (3.1) |
| **How many people do you share facilities (bathroom/toilet) with?** | |
| ≤3 | 214 (36.2) |
| 4  7 | 63 (10.6) |
| ≥8 | 81 (13.7) |
| Missing | 234 (39.5) |
| **Covid-19 test and vaccination** | |
| IgG (only for 586 students) | |
| Negative | 131 (22.4) |
| Positive | 455 (77.6) |
| IgM test (only for 586 students) | |
| Negative | 493 (84.1) |
| Positive | 93 (15.9) |
| **Covid-19-like symptoms in the past 7 days** | |
| No | 283 (48.2) |
| Yes | 304 (51.8) |
| **Self-reported previous Covid-19 test (by PCR)** | |
| No | 540 (91.4) |
| Yes | 51 (8.6) |
| **Previous Covid-19 test among those previously tested (n=51)** | |
| Negative | 47 (92.2) |
| Positive | 4 (7.8) |
| **Covid-19 vaccine status** | |
| Unvaccinated | 539 (91.2) |
| Vaccinated | 52 (8.8) |
| Abbreviations | |
| BMI=Body mass index | |
| FCT=Federal Capital Territory | |
| SD=Standard Deviation | |

Table 2:  Sero prevalence of SARS-CoV-2 Among Students in the  Faculty of Arts, Law and Social Sciences, University of Benin, Edo State, Nigeria

| Characteristic | IgG negative (n=23) | IgG Positive (n=54) | Total (N=77) | P-value |
|---|---|---|---|---|
| **Sex** | | | | |
| Female | 11(47.8) | 32(59.3) | 43(55.8) | 0.355 |
| Male | 12(52.2) | 22(40.7) | 34(44.2) | |
| **Age group, year** | | | | |
| 18-21 | 12(52.2) | 28(51.9) | 40(52.0) | 0.947 |
| 22-25 | 9 (39.1) | 20(37.0) | 29(37.7) | |
| ≥26 | 2 (8.7) | 6 (11.1) | 8 (10.4) | |
| **Feel comfortable wearing facemask** | | | | |
| No | 14(60.9) | 34(63.0) | 48(62.3) | 0.862 |
| Yes | 9 (39.1) | 20(37.0) | 29(37.7) | |
| **Share facilities in accommodation** | | | | |
| No | 10(43.5) | 17(31.5) | 27(35.1) | 0.313 |
| Yes | 13(56.5) | 37(68.5) | 50(64.9) | |
| Pearson chi-squared p-value | | | | |

## CHAPTER FIVE

# DISCUSSION AND CONCLUSION

## 4.1 Discussion

In the study, 8.6% reported having undergone PCR test for SARS-CoV-2 and of these four were positive. Among all positive case to IgG, 77.6% (455/586) had symptoms. This findings is important in a university campus, if large numbers of the population are asymptomatic or ave mildly symptomatic infections, seroprevalence estimation studies may under represent the prior incidence of the disease.

Out of the 591 students that participated in the study, only 8.8% of them were vaccinated and the remaining 92.2% were not. When asked if they had plans on taking the vaccine if made available, the response varied from each participant. Most were not inclined in taking the vaccine, might be as a cause of rumours ( in which people said the vaccine causes harm) or parental influence; wherein parents stops their children from taking the vaccine.

In the study, the prevalence of IgG antibodies against SARS-CoV-2 from February 16$^{th}$ 2022 to March 15$^{th}$ 2022 and November 2$^{nd}$ to November 15$^{th}$ 2022, in a randomized samle of students in the faculty of Arts, Law and Social Science of the University of Benin was 70%. The findings assessed the situation with the resumption of school after the COVID-19 outbreak.

Approximately 38% of the participant in the faculty of Arts, Law and Social Science declared following proper preventive methods against the spread of the virus, such as wearing facemask. It should be noted tat 59.3% of participants from the faculty of Arts, Law and Social Science that tested positive were females. This could infer that females are slightly at risk in contacting the SARS-CoV-2 virus.

We could point out some difficulties in the process of the study. The emergence of ASUU strike caused a delay in getting students for the study. Also students when having been briefed about what the study was all about and the procedures necessary were wary to participate. The major cause of this was the phlebotomy (drawing of blood) procedure. Even after explaining to them that it wasn't harmful, the fear of needle was prominent and it made it difficult to get students for the study.

## 4.2 Conclusion

The incidence and prevalence of COVID-19 among the students in the faculty of Arts, Law and Social Science, University of Benin shows that the SARS-CoV-2 virus is a cause for concern in students as out of the 77 students tested from the faculty of Arts, Law and Social Science 54 (70.1%) were positive. Care and necessary procedures must be taken.

Vaccines against COVID-19 are a reality. On December 27, 2020, a symbolic day to underline unity of action and coincident with the announcement of te first cases of the disease a year earlier, te 27 members of the European Union started immunizing.