Impact of COVID-19 pandemic in the health system of the Federal Capital Territory Abuja (Nigeria): Elucidating strategies to be prepared for upcoming pandemics

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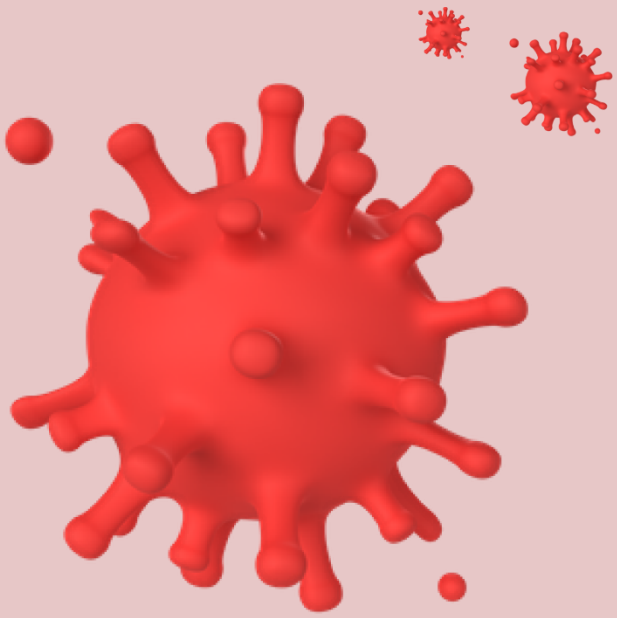

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IMPACT OF COVID-19 PANDEMIC IN THE HEALTH SYSTEM OF THE FEDERAL CAPITAL TERRITORY ABUJA (NIGERIA): *ELUCIDATING STRATEGIES TO BE PREPARED FOR UPCOMING PANDEMICS.*

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DEDICATION

I dedicated this work to Almighty ALLLAH, My Mum Fatima, My Father Abdurrahman, My Wives Safiya & UmmulKhair and My Children Abdurrahman Jr, Baraatu, Muhammad Alamin and Nana Khadija

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SUMMARY

The COVID-19 pandemic, originating in Wuhan, China, rapidly impacted healthcare systems worldwide, including FCT Abuja, Nigeria. This research investigates the impact of the COVID-19 pandemic on FCT Abuja's health system, identifying weaknesses and resilience, and proposing strategies to improve preparedness for future pandemics. A mixed-method approach was used, combining quantitative data analysis and qualitative surveys. This study's results found that the COVID-19 pandemic significantly impacted FCT Abuja's health system, causing shortages of medical supplies, PPE, and critical medications. Healthcare workers faced increased workloads, stress, and disruptions in non-COVID services. Disparities in healthcare access are exposed, with vulnerable populations facing challenges in receiving adequate care. Furthermore, findings from this research reveal significant strains in the health systems of the FCT including, hospital caseloads, shortages of medical supplies, and delays in treatments. More so, vulnerable populations faced greater challenges in accessing healthcare, and limited testing and contact tracing capabilities hindered disease containment. This research also highlighted the challenges and improvement opportunities that the pandemic brought, alongside helping the health systems to elucidate strategies to help prepare for future pandemics. Some of the strategies to enhance preparedness for future pandemics include (i) strengthening healthcare infrastructure by investing in modern equipment, training, and establishing temporary treatment centres (ii) prioritizing training and recruitment to address workforce shortages (iii) stockpiling essential supplies, (iv) diversifying resource allocation, (v) improving testing and contact tracing, (vi) promoting public health education, and (vii) establishing robust communication channels for effective dissemination of critical information during crises amongst others. To improve preparedness, this research suggests strengthening healthcare infrastructure, augmenting the medical workforce, establishing strategic stockpiles, improving testing and contact tracing capabilities, enhancing public health education, effective resource management, and fostering collaboration between healthcare authorities and the public, to mitigate future pandemic effects and safeguard public health.

CHAPTER ONE

BACKGROUND OF THE STUDY

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1.1 Overview of the COVID-19 Pandemic

The coronavirus disease 2019 (COVID-19), a global health emergency has had a significant influence on cultures, economies, and healthcare systems all around the world. It started in Wuhan, China, in late 2019, and spread to almost every region of the world, causing millions of infections and fatalities (WHO, 2023a). The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the cause of COVID-19. When an infected person coughs, sneezes, talks, or breathes deeply, respiratory droplets from that person are essentially how the virus is spread. Additionally, touching contaminated surfaces before contacting your face can spread it (Cevik Bamford and Ho, 2020).

Due to its quick global spread, the World Health Organization (WHO) classified COVID-19 as a pandemic on March 11, 2020 (WHO, 2023a). To stop its spread, governments and health organizations globally employed several measures, such as lockdowns, travel restrictions, social withdrawal, mask requirements, and mass vaccination efforts (Msemburi et al., 2023). The epidemic has significantly strained the healthcare infrastructures, as intensive care beds, ventilators, and personal protective equipment (PPE) were in low supply in hospitals and among medical personnel in several countries (Chen, 2022).

The creation and use of vaccinations have been essential in the battle against COVID-19. Several vaccines, including those created by Pfizer-BioNTech, Moderna, AstraZeneca, Johnson & Johnson, and others, have been approved for use in emergencies. Herd immunity has been the goal of vaccination initiatives, which have also tried to lessen the severity of the illness. Globally, access to and distribution of vaccines have been inconsistent. While low-income countries, such as Nigeria have had difficulty obtaining an appropriate supply, high-income countries, have managed to secure a sizable number of vaccine doses (Msemburi et al., 2023). This discrepancy has exposed the urgent need for international cooperation and vaccination equality (WHO, 2023a).

In Nigeria, wide-ranging social and economic repercussions of COVID-19 include the closedown of businesses, and job loss, while economies suffered due to lockdowns and restrictions (Anjorin, 2020). Global supply chains, trade, and tourism disruptions affected all

economies. Moreso, the pandemic made social inequality already present worse, and has disproportionately afflicted vulnerable groups (Spoorthy, Pratapa, and Mahant, (2020). Understanding the virus, creating medicines, and enhancing public health responses have all benefited greatly from scientific research. Studies are still being conducted to learn more about the virus's origins, its variations, long-term consequences, and the efficacy of vaccinations against new strains (Xiong et al., 2020). Although vaccination programs provide patients with a chance to recover, it is still essential to maintain public health policies, promote equitable vaccine distribution, and build healthcare systems to stop and lessen epidemics in the future (Quaglia and Verdun, 2023).

1.2 Global Epidemiology of COVID-19

The global epidemiology of COVID-19 has been characterized by its rapid spread across countries and continents, resulting in a significant public health challenge (Xu et al., 2020). COVID-19 epidemiology is discussed under the following headings:

WHO Global Overview

As of 18 June 2023, the WHO COVID-19 weekly epidemiological update (Edition 148) published 22 June 2023 showed that globally, over 1.2 million new cases and over 7100 deaths were reported in the last 28 days (22 May to 18 June 2023) (Figure 1, Table 1). The African region has reported a slight increase in deaths but a decrease in cases, while the other five WHO regions have reported decreases in both cases and deaths. As of 18 June 2023, over 768 million confirmed cases and over 6.9 million deaths have been reported globally (WHO, 2023a) (Figure 1; Table 1).

At the regional level, the number of newly reported 28-day cases decreased across all WHO regions: the South-East Asia Region (-78%), the Eastern Mediterranean Region (-71%), the Region of the Americas (-70%), the European Region (-46%), the Western Pacific Region (-33%), and the African Region (-26%). The number of newly reported 28-day deaths decreased across five regions: the Region of the Americas (-73%), the Eastern Mediterranean Region (-70%), the South-East Asia Region (-57%), the European Region (-49%), the Western Pacific Region (-28%); while the number of deaths increased slightly in one WHO Region, the African Region (+5%) (WHO, 2023a) (Figure 1; Table 1).

At the country level, the highest numbers of new 28-day cases were reported from the Republic of Korea (363 382 new cases; -21%), Australia (135 144 new cases; +4%), Brazil (85 987 new cases; -41%), France (71 197 new cases; -42%), and Singapore (54 581 new cases; -44%). The highest numbers of new 28-day deaths were reported from Brazil (978 new deaths; -19%), Spain (729 new deaths; +70%), the Russian Federation (577 new deaths; -13%), Australia (496 new deaths; -6%), and Italy (420 new deaths; -36%) (WHO, 2023a) (Figure 1; Table 1).

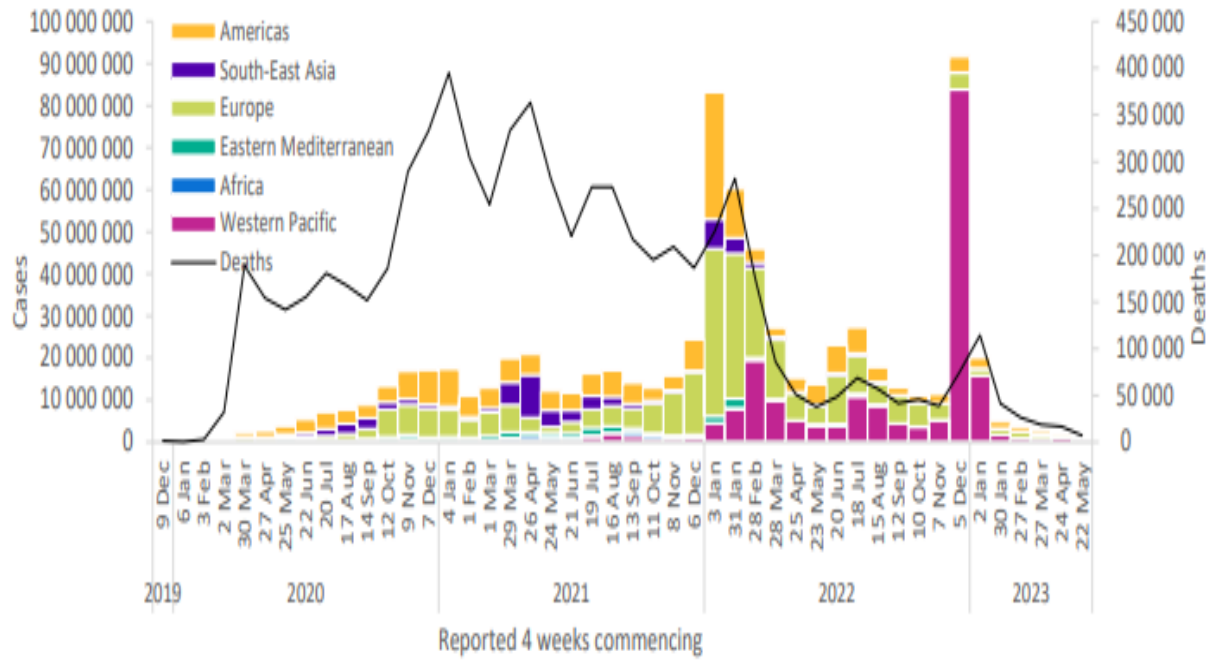

Figure 1: COVID-19 cases reported by WHO Region, and global deaths by 28-day intervals (as of 18 June 2023) (WHO, 2023a)

Table 1: Newly reported and cumulative COVID-19 cases and deaths by WHO Region (as of 18 June 2023) (WHO, 2023a)

WHO Region	New cases in last 28 days (%)	Change in new cases in last 28 days *	Cumulative cases (%)	New deaths in last 28 days (%)	Change in new deaths in last 28 days *	Cumulative deaths (%)
Western Pacific	698 322 (58%)	-33%	**204 340 687 (27%)**	1 154 (16%)	-28%	**413 410 (6%)**
Europe	315 151 (26%)	-46%	**276 536 948 (36%)**	3 523 (49%)	-49%	**2 242 740 (32%)**
Americas	150 857 (12%)	-70%	**193 056 651 (25%)**	1 875 (26%)	-73%	**2 956 210 (43%)**
South-East Asia	32 139 (3%)	-78%	**61 184 736 (8%)**	496 (7%)	-57%	**806 365 (12%)**
Eastern Mediterranean	7 821 (1%)	-71%	**23 382 101 (3%)**	98 (1%)	-70%	**351 329 (5%)**
Africa	6 397 (1%)	-26%	**9 538 444 (1%)**	22 (<1%)	5%	**175 389 (3%)**
Global	**1 210 687 (100%)**	**-48%**	**768 040 331 (100%)**	**7 168 (100%)**	**-58%**	**6 945 456 (100%)**

**Percent change in the number of newly confirmed cases/deaths in the past 28 days, compared to 28 days prior*

WHO (African Region) Overview:

Between 22 May and 18 June 2023, the African Region reported over 6300 new cases, a 26% decrease as compared to the previous 28-day period. Five (10%) of the 50 countries for which data are available reported increases in new cases of 20% or greater, with the highest proportional increases observed in Zambia (1966 vs 192 new cases; +924%), Kenya (392 vs 42 new cases; +833%) and Burundi (274 vs 36 new cases; +661%). The highest numbers of new cases were reported from Mauritius (2355 new cases; 185.2 new cases per 100 000; -59%), Zambia (1966 new cases; 10.7 new cases per 100 000; +924%), and the Democratic Republic of the Congo (519 new cases; <1 new case per 100 000; -37%) (WHO, 2023a) (Figure 2).

The number of new 28-day deaths in the Region increased by 5% as compared to the previous 28-day period, with 22 new deaths reported. The highest numbers of new deaths were reported from Zimbabwe (11 new deaths; <1 new death per 100 000; +83%), Cameroon (two

new deaths; <1 new death per 100 000; +100%), and Mauritius (two new deaths; <1 new death per 100 000; -67%) (WHO, 2023a) (Figure 2).

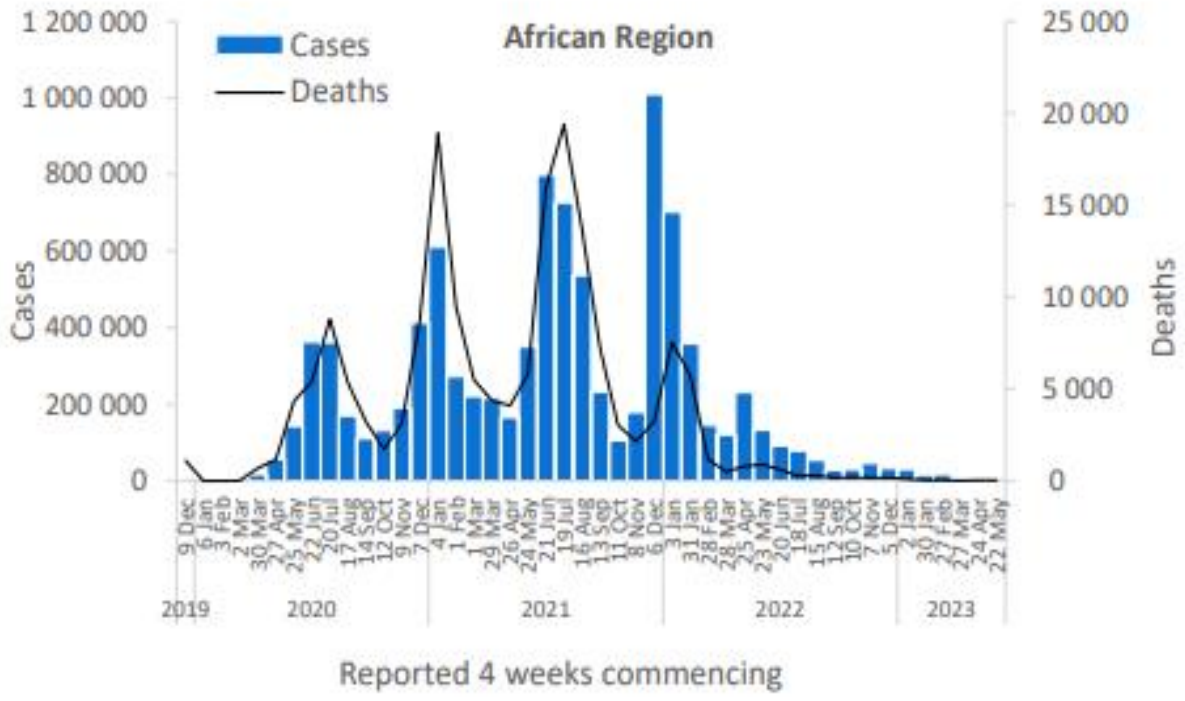

Figure 2: COVID-19 reported cases and deaths by WHO African Region (as of 18 June 2023) (WHO, 2023a)

1.3 Impacts of the COVID-19 Pandemic Worldwide

Globally, the COVID-19 pandemic has had a profound effect on economies, societies, and healthcare systems. The numerous COVID-19 pandemic effects on the world are as follows:

Public Health Impact

The first few years (peak) of the pandemic witnessed high infections and deaths: There were millions of confirmed COVID-19 cases and deaths globally, however, the numbers may have changed significantly since then (Xiong et al., 2020). The rapid spread of the virus has strained and overwhelmed healthcare systems worldwide. Hospitals faced shortages of critical resources such as personal protective equipment, ventilators, and intensive care unit beds (Spoorthy, Pratapa, and Mahant, 2020). Furthermore, some individuals experience long-term

health issues after recovering from COVID-19, commonly known as Long COVID or post-acute sequelae of SARS-CoV-2 infection (PASC). These include persistent symptoms such as fatigue, respiratory problems, and neurological issues (Xiong et al., 2020).

Economic Impact

The pandemic resulted in a severe global recession and economic downturn, with many countries experiencing recessions. Business closures, job losses, disrupted supply chains, and decreased consumer spending contributed to economic contraction (Onyeaka et al., 2021). In addition, the strict global lockdown measures and business closures led to widespread job losses and increased unemployment rates. Certain sectors, such as travel, hospitality, and entertainment, were particularly affected (Nicola et al., 2020).

Social Impact

The pandemic exacerbated existing social and economic inequalities. Vulnerable populations, including low-income individuals and marginalized communities, faced disproportionate economic hardships (Xiong et al., 2020). School closures and remote learning challenges have disrupted education globally. Many students faced difficulties accessing online learning, widening the education gap (Tadesse and Muluye, 2020). Furthermore, the pandemic has taken a toll on mental health, leading to increased rates of anxiety, depression, stress, and post-traumatic stress symptoms. Isolation, fear, and economic stress have led to increased rates of anxiety, depression, and other mental health disorders (Xiong et al., 2020). Physical and social distancing measures, travel restrictions, and lockdowns have significantly altered social interactions and daily routines, impacting social well-being (Onyeaka et al., 2021). These measures and restrictions on gatherings have also resulted in reduced social interactions, impacting relationships, mental well-being, and social cohesion.

Impact on Health and Healthcare Workers

Rapid development and authorization of COVID-19 vaccines have been pivotal in the fight against the pandemic. Vaccines developed by companies such as Pfizer-BioNTech, Moderna, AstraZeneca, and Johnson & Johnson have been authorized for emergency use (Tzenios, Chahine, and Tazanios, 2023). Moreso, global vaccine distribution has faced challenges, including limited supplies, vaccine hesitancy, and inequitable access between high-income and low-income countries. Efforts such as the COVAX initiative aim to ensure

equitable access to vaccines (Tzenios, Chahine, and Tazanios, 2023). Existing health disparities have also been magnified during the pandemic. Vulnerable populations, including racial and ethnic minorities, low-income individuals, and those with underlying health conditions, have experienced a disproportionate burden of infections and severe outcomes. Furthermore, during the pandemic, healthcare workers faced increased workloads, stress, and burnout due to the demands of managing COVID-19 cases, leading to long-term mental health implications (Spoorthy, Pratapa, and Mahant, 2020).

Psychological Impact

The pandemic has led to significant changes in individual and collective behaviours, including increased hand hygiene, mask-wearing, and physical distancing. COVID-19 has been associated with stigma and discrimination, particularly against certain ethnic or racial groups and individuals who have been infected or have recovered from the disease (Onyeaka et al., 2021). In addition, the pandemic has affected genders differently. Women have faced increased caregiving responsibilities, higher rates of job losses in certain sectors, and a rise in domestic violence cases (Spoorthy, Pratapa, and Mahant, 2020).

Educational Impact

School closures and the shift to remote learning have highlighted the digital divide and disparities in access to quality education. Students from disadvantaged backgrounds may have limited access to technology and face challenges in remote learning (Tadesse and Muluye, 2020).

Covid-19 also had negative impacts on children, as school closures had adverse effects on children's learning, mental health, and well-being. Furthermore, the disruptions in routine immunization programs have also raised concerns about other vaccine-preventable diseases.

Impact on Migration and Travels

Travel restrictions, border closures, and economic downturns induced by the pandemic had disrupted global migration patterns, impacting migrant workers, refugees, and displaced populations (Quaglia and Verdun, 2023). The migrants and displaced populations may face barriers in accessing healthcare services, including testing, treatment, and vaccination, exacerbating health inequalities.

1.4 Characteristics of SARS-CoV-2

SARS-CoV-2, the virus responsible for COVID-19 has several distinctive characteristics. The key features of SARS-CoV-2 based on the available scientific knowledge are described below.

Coronaviruses and SARS-CoV-2

SARS-CoV-2 belongs to the family of coronaviruses, which are enveloped RNA viruses. Other notable coronaviruses include SARS-CoV (causing severe acute respiratory syndrome) and MERS-CoV (causing Middle East Respiratory Syndrome) (Chow et al., (2023).

Structure and Genome

The SARS-CoV-2 has spike proteins on its surface that facilitate viral entry into human cells. These spike proteins bind to ACE2 receptors, primarily found in the respiratory tract and other tissues, enabling viral fusion and infection (Perra, 2021). The viral genome of SARS-CoV-2 is a single-stranded RNA molecule with approximately 30,000 nucleotides. The genome encodes various structural and non-structural proteins essential for viral replication and pathogenesis (Perra, 2021).

Transmission and Infectivity

The SARS-CoV-2 primarily spreads through respiratory droplets when an infected person coughs, sneezes, talks, or breathes heavily. It can also be transmitted through close contact with an infected person or by touching contaminated surfaces and then touching the face (Pilkington, Pepperrell, and Hill, 2020). SARS-CoV-2 has demonstrated a high level of human-to-human transmission, contributing to its rapid global spread. The reproductive number (R0), which indicates the average number of people an infected individual can transmit the virus to, has varied during different phases of the pandemic and with the emergence of variants.

Clinical Manifestations

The COVID-19 symptoms vary widely, ranging from mild to severe. Common symptoms include fever, cough, fatigue, shortness of breath, loss of taste or smell, sore throat, and muscle aches. Some individuals may remain asymptomatic (without any symptoms) but

can still transmit the virus (Perra, 2021). COVID-19 can lead to severe respiratory illness, acute respiratory distress syndrome (ARDS), multi-organ dysfunction, and death, especially among older adults and individuals with underlying health conditions.

Variants and Mutations

The SARS-CoV-2 had undergone genetic mutations, resulting in the emergence of new variants. Variants of concern, such as Alpha, Beta, Gamma, and Delta, have shown increased transmissibility, potential immune evasion, or changes in disease severity (Vindegaard, and Benros, 2020). Some COVID-19 variants have shown reduced susceptibility to certain antibodies and treatments, highlighting the need for ongoing surveillance, vaccine development, and updated treatment strategies.

The incubation period refers to the time between viral exposure and the onset of symptoms. For SARS-CoV-2, the average incubation period is estimated to be around 5-6 days, but it can range from 2 to 14 days. During this period, individuals may be contagious even if they do not have symptoms (Vindegaard, and Benros, 2020). The SARS-CoV-2 can be transmitted by asymptomatic individuals (showing no symptoms) or pre-symptomatic (infected but not yet showing symptoms). This makes it challenging to control the spread of the virus, as infected individuals can unknowingly transmit it to others.

Reinfection, Immunity, and Environmental Stability

While most individuals infected with SARS-CoV-2 develop some level of immune response, the duration and level of protection are still being studied. Reinfection with the virus has been reported, but it appears to be relatively rare. Vaccination plays a crucial role in boosting immunity and reducing the severity of the disease (Tzenios, Chahine, and Tazanios, 2023). The SARS-CoV-2 can remain viable on surfaces for varying periods, depending on factors such as temperature, humidity, and surface type. It is susceptible to common disinfectants and hand sanitisers that contain at least 60% alcohol.

Furthermore, the virus has varying impacts on specific age groups. Older adults and individuals with underlying health conditions, such as cardiovascular disease, diabetes, and respiratory conditions, are at higher risk of severe illness and complications from COVID-19 (Msemburi et al., 2023). Children and younger individuals generally experience milder symptoms but can still transmit the virus (Msemburi et al., 2023).

Global Variability and Diagnostic Testing

The impact of SARS-CoV-2 has varied across regions and countries due to factors such as population density, healthcare capacity, public health measures, and socioeconomic factors. The response to the pandemic has been influenced by local circumstances and government interventions (Chen, 2022). Reverse transcription-polymerase chain reaction (RT-PCR) testing is the gold standard for diagnosing COVID-19. Other diagnostic methods, such as antigen tests and antibody tests, are also used to detect current or previous infections and provide information about population-level prevalence.

1.5 COVID-19 Disease

COVID-19 is a respiratory illness caused by the novel coronavirus SARS-CoV-2. While most COVID-19 cases are mild, it can lead to severe respiratory illness and other complications in some individuals (Msemburi et al., 2023). The different aspects of COVID-19 diseases are explained under these headings:

Symptomatic COVID-19

The common symptoms of COVID-19 include fever, cough, shortness of breath, fatigue, muscle aches, sore throat, loss of taste or smell, headache, and gastrointestinal symptoms like nausea and diarrhoea (Msemburi et al., 2023). The COVID-19 disease severity can vary widely, ranging from mild symptoms that resemble a common cold to severe pneumonia and acute respiratory distress syndrome (ARDS). Older age and the presence of underlying health conditions, such as cardiovascular disease, diabetes, chronic respiratory disease, and immunosuppression, are associated with an increased risk of severe illness and worse outcomes (Cevik Bamford and Ho, 2020). Some individuals experience prolonged symptoms and health issues even after recovering from the acute phase of COVID-19. These symptoms may include fatigue, shortness of breath, chest pain, joint pain, cognitive difficulties (brain fog), and mental health problems (Cevik Bamford and Ho, 2020).

Long COVID can significantly impact an individual's ability to carry out daily activities and can have a profound impact on their quality of life. Multisystem inflammatory syndrome in children (MIS-C) is a rare but serious condition that primarily affects children and adolescents, typically occurring weeks after a COVID-19 infection (Chen, 2022). MIS-C is characterized by persistent fever, inflammation, and multiorgan dysfunction, including cardiac

involvement. Other symptoms may include rash, abdominal pain, vomiting, diarrhoea, and respiratory symptoms (Chen, 2022). Early recognition and medical care are crucial in managing MIS-C to prevent complications and provide appropriate treatment.

Respiratory Complications

COVID-19 can lead to viral pneumonia, characterized by inflammation and damage to the lungs. Severe cases may require hospitalization and respiratory support, such as oxygen therapy or mechanical ventilation (Chow et al., 2023). In severe cases, COVID-19 can cause acute respiratory distress syndrome (ARDS), a life-threatening condition where fluid accumulates in the lungs, impairing oxygen exchange. Severe respiratory complications can result in respiratory failure, requiring intensive care and, in some cases, extracorporeal membrane oxygenation (ECMO) to support lung function (Chow et al., 2023).

Cardiovascular Manifestations

COVID-19 has been associated with cardiac complications, including myocardial injury, myocarditis (inflammation of the heart muscle), and arrhythmias. The virus's impact on the vascular system may increase the risk of blood clot formation (thrombosis), leading to conditions like deep vein thrombosis (DVT), pulmonary embolism, and stroke (Xu et al., 2020).

Neurological Effects

COVID-19 can cause neurological symptoms, including encephalopathy (altered mental state), stroke, and other cerebrovascular events (Cevik Bamford and Ho, 2020). In addition, an early and distinct symptom of COVID-19 is anosmia (loss of smell) and dysgeusia (loss of taste), which can persist even after other symptoms resolve.

Gastrointestinal Involvement

COVID-19 can present with gastrointestinal symptoms such as diarrhoea, nausea, vomiting, and abdominal pain (Cevik Bamford and Ho, 2020). Gastrointestinal manifestations may occur with or without respiratory symptoms.

Renal and Kidney Complications

COVID-19 can lead to acute kidney injury (AKI), which is associated with worse outcomes and increased mortality (Cevik Bamford and Ho, 2020). The virus can also affect the kidneys directly, leading to renal impairment and electrolyte imbalances.

Impact on Pregnancy

Pregnant individuals with COVID-19 may be at an increased risk of severe illness, preterm birth, and other adverse pregnancy outcomes. Vertical transmission (transmission from mother to baby during pregnancy) is possible but appears to be rare (Cevik Bamford and Ho, 2020).

1.6 COVID-19 Diagnostics

COVID-19 diagnostic testing plays a crucial role in identifying and controlling the spread of the disease. It's important to note that diagnostic testing guidelines may vary across countries and regions. Timely and accurate testing, along with clinical assessment, is essential for the proper diagnosis and management of COVID-19. The different diagnostic methods for COVID-19 are explained under the following headings:

Nucleic Acid Amplification Tests (NAATs)

The reverse transcription polymerase chain reaction (RT-PCR) is the gold standard diagnostic test for COVID-19. It detects viral RNA in respiratory samples, such as nasopharyngeal or oropharyngeal swabs (Mahalmani et al., 2020). Also, loop-mediated isothermal amplification (LAMP) is an alternative NAAT method that amplifies and detects viral RNA at a constant temperature. It offers advantages such as shorter turnaround time and simplified equipment requirements (Mahalmani et al., 2020).

Antigen Tests

Antigen tests detect specific viral proteins (antigens) in respiratory samples. They are relatively inexpensive, provide quick results (usually within 15-30 minutes), and can be performed at the point of care. However, they may have lower sensitivity compared to RT-PCR, particularly in individuals with a low viral load. BinaxNOW COVID-19 Ag Card and BD Veritor System are examples of authorized rapid antigen tests (Mahalmani et al., 2020).

Antibody Tests

Antibody tests detect the presence of specific antibodies (IgM and IgG) produced in response to SARS-CoV-2 infection. They can help determine past infections and provide information on population-level immunity. However, they are not used for early diagnosis, as it takes time for antibodies to develop (Mahalmani et al., 2020).

Imaging

Imaging techniques, such as chest X-rays and computed tomography (CT) scans, may be used to evaluate the severity and progression of lung involvement in individuals with suspected or confirmed COVID-19. They can help identify characteristic features like ground-glass opacities and consolidations (Perra, 2021).

Saliva and Breath Tests

Saliva-based tests are being developed as an alternative to respiratory swabs. They offer non-invasive sample collection and show promising results in terms of accuracy and ease of use (Pilkington, Pepperrell, and Hill, 2020). Moreso, researchers are exploring the potential for breath-based tests to detect volatile organic compounds or specific metabolic products associated with COVID-19 infection. These tests are still in the early stages of development.

Pool Testing

Pool testing, also known as group testing or pooled testing, involves combining multiple samples and testing them together as a single pool. This approach can help increase testing capacity and reduce costs, particularly in areas with low disease prevalence. If a pool tests positive, individual samples within the pool are retested to identify the positive case(s) (Perra, 2021).

Point-of-Care (POC) Testing

POC tests are designed for rapid and on-site diagnosis, providing results within a short time frame (usually less than an hour). These tests are particularly useful in settings where immediate decisions are required, such as emergency departments and primary care clinics. POC tests can include both antigen and molecular-based tests (Pilkington, Pepperrell, and Hill, 2020). Moreso, home testing kits have been developed to enable individuals to collect samples

at home and send them to a laboratory for analysis or perform the test themselves. These kits may utilize RT-PCR or antigen-based testing methods. They provide convenience and reduce the need for in-person visits to testing centres or healthcare facilities (Vindegaard, and Benros, 2020).

Variants of Concern (VOC) Detection:

As SARS-CoV-2 continues to evolve, identifying and monitoring variants of concern is crucial. Genomic sequencing is performed to detect specific mutations and track the spread of different variants. Whole-genome sequencing and targeted sequencing methods are used to analyze viral genetic material and identify emerging variants (Vindegaard, and Benros, 2020).

1.7 COVID-19 Treatments

COVID-19 treatment strategies have evolved as researchers and healthcare professionals have gained a better understanding of the disease. The different approaches to COVID-19 treatments are discussed below:

Supportive Care

Most COVID-19 cases are mild and can be managed with supportive care measures. These include rest, hydration, fever-reducing medications (e.g., acetaminophen), and over-the-counter cough suppressants. Monitoring vital signs, and oxygen levels, and providing supplemental oxygen therapy when necessary are important aspects of supportive care (Perra, 2021).

Antiviral Therapies

Remdesivir is an antiviral drug that inhibits viral replication. It has shown clinical benefit in reducing the recovery time in hospitalized patients with severe COVID-19 (Beigel et al., 2020a; Beigel et al., 2020b; Grundeis et al., 2023) Furthermore, monoclonal antibodies, such as casirivimab/imdevimab and sotrovimab, can be used for the treatment of mild to moderate COVID-19 in high-risk individuals. These antibodies help neutralize the virus and reduce the risk of disease progression (Pilkington, Pepperrell, and Hill, 2020).

Anti-inflammatory Therapies and Immunomodulatory Drugs

Systemic corticosteroids, such as dexamethasone, have been shown to reduce mortality and the need for mechanical ventilation in hospitalized patients with severe COVID-19 and respiratory distress (Pilkington, Pepperrell, and Hill, 2020). Drugs like tocilizumab and baricitinib, which modulate the immune response, have been used in some cases to control the exaggerated immune response seen in severe COVID-19 (Pilkington, Pepperrell, and Hill, 2020).

Respiratory Support

In severe cases of COVID-19 with respiratory distress or hypoxemia, supplemental oxygen therapy is provided to maintain adequate oxygenation. Mechanical ventilation may be necessary for patients with severe respiratory failure who cannot maintain sufficient oxygen levels. Ventilatory support can range from non-invasive methods (e.g., high-flow nasal cannula) to invasive mechanical ventilation (Perra, 2021).

Blood Thinners

In hospitalized COVID-19 patients at high risk of blood clotting, prophylactic anticoagulation with low molecular weight heparin or other blood thinners may be administered to reduce the risk of thrombotic complications (Perra, 2021).

Extracorporeal Support

Extracorporeal membrane oxygenation (ECMO) is a life-support technique used for patients with severe respiratory failure that does not respond to conventional ventilation. It provides oxygenation and removes carbon dioxide from the blood, allowing the lungs to rest and heal (Pilkington, Pepperrell, and Hill, 2020).

Investigational Therapies

Convalescent plasma therapy involves transfusing plasma from recovered COVID-19 patients, which contains antibodies against the virus, into individuals with severe disease. Its efficacy is still under investigation. Researchers are studying the effectiveness of combining different antiviral drugs, such as remdesivir with other agents, to enhance treatment outcomes.

Therapies Targeting Specific Pathways

Interleukin-6 (IL-6) inhibitors, such as tocilizumab and sarilumab, are used to modulate the immune response in severe cases with excessive inflammation. In addition, Janus Kinase (JAK) inhibitors such as baricitinib, can help regulate the immune response and reduce inflammation (Pilkington, Pepperrell, and Hill, 2020).

Rehabilitation and Post-Acute Care

COVID-19 can cause long-term complications and post-acute sequelae. Rehabilitation programs, including physical therapy, respiratory therapy, and psychological support, are important for individuals recovering from severe disease (Perra, 2021).

1.8 COVID-19 Vaccination

COVID-19 vaccination plays a critical role in preventing COVID-19 infection, reducing severe disease, hospitalizations, and deaths, as well as contributing to the control of the pandemic. The various aspects of COVID-19 vaccination are discussed below:

COVID-19 vaccines have been developed using different technologies, including mRNA-based vaccines (such as Pfizer-BioNTech and Moderna), viral vector vaccines (such as Oxford-AstraZeneca and Johnson & Johnson/Janssen), protein subunit vaccines (such as Novavax), and inactivated vaccines (such as Sinovac and Bharat Biotech). Rigorous testing and evaluation, including large-scale clinical trials, have been conducted to ensure safety and efficacy (Tzenios, Chahine, and Tazanios, 2023). Clinical trials have demonstrated that authorized COVID-19 vaccines are highly effective in preventing symptomatic COVID-19. Vaccinated individuals are also less likely to experience severe disease, hospitalization, or death if they do contract the virus. Real-world studies have confirmed the effectiveness of COVID-19 vaccines in various populations, including different age groups and those with underlying health conditions (Msemburi et al., 2023).

Vaccines are typically administered via intramuscular injection, with most requiring two doses for full effectiveness. The interval between doses varies depending on the vaccine type. COVID-19 vaccines are being distributed through national vaccination campaigns, prioritizing high-risk groups, healthcare workers, and vulnerable populations (WHO, 2022a). COVID-19 vaccines undergo rigorous safety evaluations before authorization or approval.

Large clinical trials assess safety profiles, and regulatory agencies closely monitor adverse events post-vaccination. Reported side effects are generally mild and transient, such as injection site pain, fatigue, headache, and low-grade fever (Quaglia and Verdun, 2023).

The emergence of SARS-CoV-2 variants has raised concerns about vaccine effectiveness. Studies indicate that authorized vaccines still protect against most variants, although efficacy may be slightly reduced. Booster doses or additional vaccine doses may be recommended to enhance and sustain the protection, particularly against new variants or for certain high-risk populations. Guidance on boosters is evolving and varies across countries (Tzenios, Chahine, and Tazanios, 2023). Vaccine hesitancy, influenced by various factors, can impact vaccine uptake. Clear and transparent communication, access to accurate information, addressing concerns, and building trust are crucial to promote vaccine acceptance.

COVID-19 vaccine distribution presents unique challenges, including limited global supply, logistical requirements (e.g., cold chain storage), equitable access, and reaching remote or marginalized populations (Quaglia and Verdun, 2023). Global initiatives, such as COVAX, aim to ensure fair and equitable access to COVID-19 vaccines for all countries, particularly low- and middle-income nations, such as Nigeria. While some COVID-19 variants have shown reduced vaccine effectiveness, authorized vaccines still provide substantial protection against severe disease, hospitalization, and death caused by these variants. Vaccine manufacturers are exploring strategies to modify vaccines or develop variant-specific boosters to enhance protection against emerging variants (Tzenios, Chahine, and Tazanios, 2023).

Vaccine passports or certificates are documents that verify an individual's COVID-19 vaccination status. They may be used for travel, attending events, or accessing certain services. Implementation and requirements for vaccine passports vary among countries and can involve digital apps, paper certificates, or other methods (Quaglia and Verdun, 2023). Achieving global vaccine equity is crucial for controlling the pandemic. Disparities in vaccine access and distribution must be addressed to protect vulnerable populations and prevent ongoing transmission. Various organizations, including the WHO, Gavi, and the Coalition for Epidemic Preparedness Innovations (CEPI), are working to ensure fair and equitable vaccine distribution globally (WHO, 2022b).

Robust systems for monitoring vaccine safety, such as the Vaccine Adverse Event Reporting System (VAERS), are in place to detect and investigate potential adverse events

following immunization. Monitoring programs continually assess the safety profile of COVID-19 vaccines and investigate any reported adverse events to maintain public confidence in vaccine safety (WHO, 2022a). COVID-19 vaccination campaigns involve extensive planning, communication, and coordination across healthcare systems, governments, and communities. Strategies include mass vaccination centres, mobile clinics, outreach programs, and partnerships with community organizations to reach diverse populations (Tzenios, Chahine, and Tazanios, 2023).

1.9 Current Status of the COVID-19 Pandemic

The COVID-19 pandemic continues to have a significant impact globally. The status of the pandemic varies across countries and regions due to differences in vaccination rates, public health measures, healthcare infrastructure, and the emergence of new variants. Globally, most countries had witnessed four different waves during the COVID-19 pandemic, the fourth wave being driven by Omicron Variant. Nevertheless, the COVID-19 pandemic activities were scaled down in June 2022 and remained scaled down as the WHO and countries continue to monitor the global scene. Currently, the WHO has removed the pandemic alert and status of COVID-19, and the virus is now considered an endemic. Precisely on 5 May 2023, the WHO Director General (DG) declared COVID-19 as a global health emergency, but not as a global health threat. This was because of the steady downward trend in COVID-related mortalities, brought about by a weakening virus, growing population immunity and increased vaccination rates.

According to WHO DG, millions of people will continue to live with the debilitating effects of post-COVID-19 conditions. He noted clearly that the virus is here to stay, it is still changing and killing, while the risk remains of new variants emerging that could cause new surges in cases. The WHO DG also warned countries not to dismantle the systems they had built over the years as the disease remains a threat along with multiple other stressors threatening global health and security, including climate change and weak health systems, which could soon lead to yet another pandemic if not forcefully addressed.

The present status of the pandemic is discussed briefly:

The total number of COVID-19 cases and deaths has been continually updated and varies across countries. Some regions have experienced multiple waves of infection, with fluctuations in case rates over time. Variations in testing capacity, reporting systems, and

response measures can impact the accuracy and comparability of case and mortality rates between countries (WHO, 2022a). COVID-19 vaccination campaigns have been initiated in many countries, aiming to immunize populations and reduce the severity of the disease. Vaccination rates differ worldwide due to factors such as vaccine availability, distribution challenges, vaccine hesitancy, and varying national strategies. Some countries have made significant progress in vaccinating their populations, while others are still in the early stages of vaccine rollout (Tzenios, Chahine, and Tazanios, 2023).

Several variants of SARS-CoV-2, the virus that causes COVID-19, have emerged during the pandemic. Some variants, such as the Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), and Delta (B.1.617.2) variants, have shown increased transmissibility or potential resistance to certain treatments (Msemburi et al., 2023). The global spread of variants has implications for public health measures, vaccine effectiveness, and the potential need for updated vaccines or booster shots. Countries have implemented various public health measures to control the spread of the virus, such as physical distancing, face mask requirements, travel restrictions, testing, contact tracing, and lockdowns. The relaxation or tightening of these measures depends on local epidemiological conditions, vaccination rates, and government policies (WHO, 2022a). The pandemic has had far-reaching effects on economies, businesses, education systems, mental health, and social interactions. Government interventions, such as financial support programs and stimulus packages, have been implemented to mitigate the economic impact and assist affected individuals and industries (Quaglia and Verdun, 2023).

1.10 Description of the Health System of the Federal Capital Territory, Abuja

The Federal Capital Territory (FCT) Abuja is the capital city of Nigeria (Figure 3). The health system of FCT Abuja is designed to provide healthcare services to residents and visitors in the region. The FCT consists of six (6) local council areas namely, Abaji, Gwagwalada, Kuje, Bwari, Kwali, and the Abuja Municipal Area Council (AMAC). The following ministries, parastatals, and agencies regulate the health system in the FCT.

Federal Capital Territory Administration (FCTA): The FCTA is the governing body responsible for the administration and provision of various services in the FCT Abuja, including healthcare. Their official website may provide information on the health system infrastructure, hospitals, and services available in the FCT (FCTA, 2023).

FCT Health and Human Services Secretariat (HHSS): The HHSS is responsible for overseeing the healthcare system in FCT Abuja. They may provide information on healthcare policies, programs, and facilities within the FCT. Contacting their office or visiting their official website may provide detailed information on the health system in FCT Abuja (FCT-HHSS, 2023).

FCT Health Insurance Scheme: The FCT Health Insurance Scheme aims to provide affordable healthcare coverage to residents of FCT Abuja. They may provide information on health insurance options, coverage, and benefits within the FCT. Contacting their office or visiting their official website can offer insights into the health insurance system in FCT, Abuja (FCT-HIS, 2023).

Federal Ministry of Health Nigeria: The Federal Ministry of Health Nigeria is responsible for healthcare policies and regulations at the national level. They may provide information on the overall healthcare system in Nigeria, including the FCT Abuja. Their official website may contain relevant resources and publications related to healthcare in the FCT (FMOH, 2023).

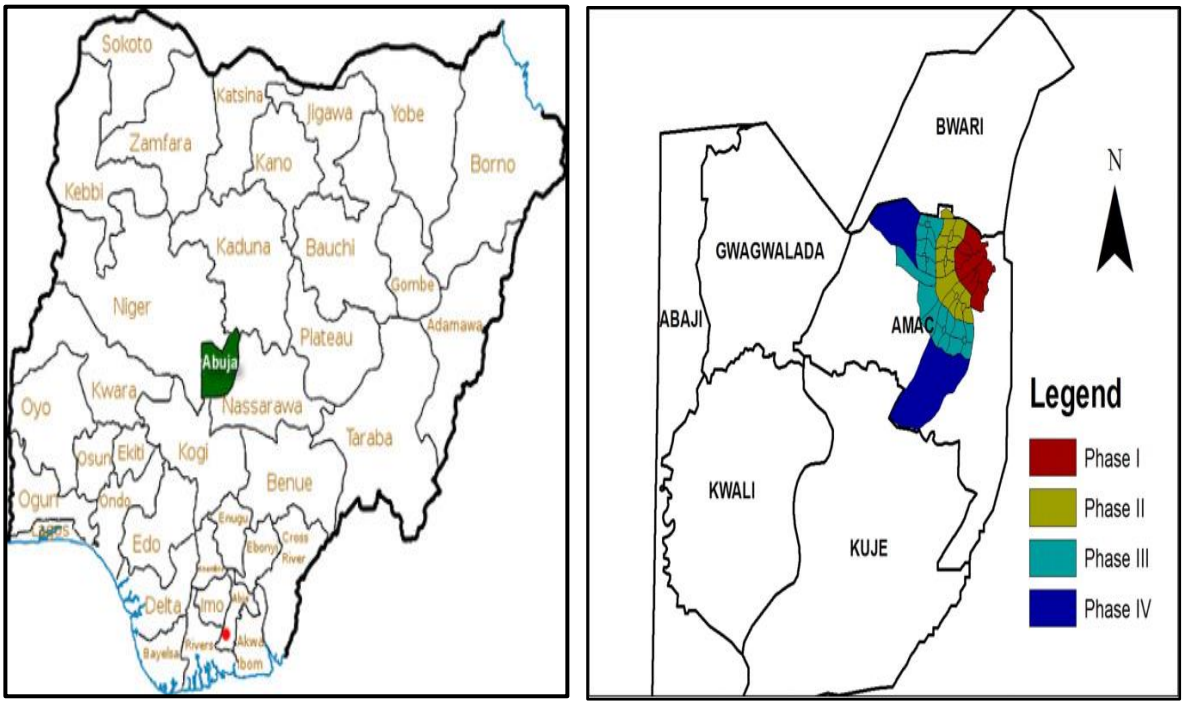

Figure 3: (a) Map of Nigeria showing the Federal Capital Territory (FCT); (b) Map of the Federal Capital Territory (FCT) showing the six local council areas

The health systems of the Federal Capital Territory (FCT) are described under the following headings:

Healthcare Infrastructure: The FCT Abuja has a well-developed healthcare infrastructure that includes hospitals, clinics, and healthcare centres. These facilities are distributed across the territory to ensure access to healthcare services for all residents (FCT-HHSS, 2023; FCTA, 2023).

Public Healthcare Facilities: The FCT Administration operates several public healthcare facilities in Abuja, including tertiary hospitals, general hospitals, and primary healthcare centres. These facilities provide a range of medical services, from primary care to specialized treatments.

Tertiary Hospitals: The FCT has prominent tertiary hospitals that offer advanced medical care, specialized services, and complex treatments. These hospitals are equipped with modern medical equipment and highly skilled healthcare professionals (FCT-HHSS, 2023; FCTA, 2023).

General Hospitals: General hospitals in FCT Abuja provide a wide range of medical services, including emergency care, inpatient treatment, outpatient clinics, diagnostic services, and surgical procedures.

Primary Healthcare Centers: Primary healthcare centres are distributed across various districts and communities in Abuja. These centres focus on providing basic healthcare services, preventive care, health education, immunization, maternal and child health services, and basic laboratory tests (FCT-HHSS, 2023; FCTA, 2023).

Private Healthcare Sector: The private healthcare sector also plays a significant role in the FCT Abuja. Private hospitals, clinics, and specialized healthcare facilities provide additional options for healthcare services, often with a focus on specialized care and premium services.

Health Insurance: The FCT Abuja has implemented a health insurance scheme to improve access to healthcare services for residents. The scheme aims to ensure that individuals and families have financial protection and can access quality healthcare services without facing significant out-of-pocket expenses (FCT-HIS, 2023).

COVID-19 Response: During the COVID-19 pandemic, FCT Abuja, like other regions, implemented various measures to control the spread of the virus. This included setting up dedicated COVID-19 treatment centres, increasing testing capacity, contact tracing, and vaccination campaigns to protect the population.

1.11 COVID-19 Pandemic Impacts in Nigeria

The COVID-19 pandemic has had a significant impact on Nigeria, affecting various aspects of society, including public health, the economy, education, and social interactions. The impact of the COVID-19 pandemic in Nigeria is briefly discussed below:

COVID-19 has strained Nigeria's healthcare system, highlighting challenges such as limited healthcare infrastructure, inadequate testing capacity, and a shortage of medical supplies and personnel. The pandemic has led to an increased burden on healthcare facilities, especially during the peak of infections, resulting in challenges in providing adequate care to patients (NCDC, 2023). More so, Nigeria's economy has been significantly affected by the pandemic due to lockdown measures, travel restrictions, and disruptions in global supply chains. Key sectors such as oil, trade, hospitality, and transportation have experienced declines in revenue and job losses (CBN, 2023).

Schools and educational institutions were closed for a significant period during the pandemic, leading to disruptions in learning and impacting the educational development of students. Virtual learning initiatives were implemented, but access to technology and internet connectivity remains a challenge, particularly in rural areas (FMOE, 2023). In addition, the pandemic has disrupted social interactions, gatherings, and cultural events, leading to changes in societal dynamics and lifestyle. Measures such as physical distancing, face mask mandates, and restrictions on public gatherings have been implemented to mitigate the spread of the virus (NOA, 2023). Nigeria has launched COVID-19 vaccination campaigns to inoculate its population against the virus. However, vaccine supply challenges and vaccine hesitancy pose hurdles to achieving widespread vaccination coverage. The government and health authorities are working to address these challenges and increase vaccine uptake (NPHCDA, 2023).

Furthermore, the pandemic has prompted efforts to strengthen Nigeria's healthcare system, including investments in infrastructure, medical equipment, and training of healthcare workers. The government has initiated programs to improve healthcare capacity and emergency response systems in preparation for future outbreaks (WHO, 2022b). The pandemic

has exacerbated existing socio-economic disparities in Nigeria, with vulnerable populations such as the poor, informal workers, and internally displaced persons facing significant challenges. Measures to mitigate the impact on vulnerable populations include social protection programs and targeted interventions (UNDP, 2023). The pandemic has taken a toll on mental health in Nigeria, with increased stress, anxiety, and depression reported among individuals. Mental health services have been scaled up to address the growing demand and awareness campaigns have been launched to reduce stigma and promote mental well-being (MHF, 2023).

The pandemic has disrupted the provision of essential services such as routine immunization, antenatal care, and treatment for other diseases like malaria and HIV/AIDS. Efforts are being made to mitigate these disruptions and ensure the continuity of essential services through innovative approaches such as telemedicine and community outreach (UNICEF, 2023). The pandemic has spurred research and development activities in Nigeria, including clinical trials, epidemiological studies, and the development of diagnostic tools and treatment protocols. Collaboration between local and international research institutions has been strengthened to enhance Nigeria's capacity to respond to future health crises (NIMR, 2023).

1.12 Important Strategies to Prepare for Upcoming Pandemics

Preparing for upcoming pandemics requires a comprehensive and proactive approach to strengthen healthcare systems, enhance surveillance and response capabilities, and ensure effective communication. These strategies form a foundation for pandemic preparedness and response. By implementing these measures, countries can be better equipped to detect, mitigate, and control future pandemics. Some important strategies to prepare for future pandemics are discussed below:

Strengthening Healthcare Systems: Investing in healthcare infrastructure, including hospitals, clinics, and laboratories, to enhance capacity and response capabilities. Increasing the availability and accessibility of healthcare services, including primary care, vaccination programs, and emergency response systems (WHO, 2022b)

Enhancing Surveillance and Early Warning Systems: Establishing robust surveillance systems to detect and monitor infectious diseases, including novel pathogens. Strengthening laboratory networks for timely and accurate diagnosis of diseases (WHO, 2022b).

Building Capacity for Rapid Response: Developing and regularly updating preparedness and response plans at national, regional, and local levels. Conducting regular training and simulations to ensure readiness to respond to pandemics (WHO, 2022a).

Investing in Research and Development: Supporting research and development efforts to understand emerging infectious diseases and develop diagnostics, therapeutics, and vaccines. Encouraging collaboration between scientists, institutions, and governments to share data and knowledge (NIMR, 2023).

Strengthening Global Cooperation: Promoting international collaboration and partnerships to share resources, expertise, and best practices. Supporting global health organizations, such as WHO, to coordinate responses and provide guidance during pandemics (WHO, 2022a).

Risk Communication and Community Engagement: Ensuring transparent and timely communication with the public, providing accurate information, and addressing misinformation. Engaging communities in preparedness efforts, including risk awareness, hygiene practices, and adherence to public health measures (WHO, 2022a).

Strengthening Supply Chains: Ensuring a robust supply chain for essential medical equipment, personal protective equipment (PPE), medications, and vaccines. Diversifying suppliers and building stockpiles of critical supplies to mitigate disruptions during pandemics (WHO, 2022a).

Improving Data Sharing and Collaboration: Encouraging information sharing and collaboration between countries, public health agencies, research institutions, and international organizations. Establishing mechanisms for real-time data sharing to facilitate early detection and response to emerging infectious diseases (WHO, 2022a).

Strengthening One Health Approach: Implementing a "One Health" approach that integrates human health, animal health, and environmental factors to detect and respond to zoonotic diseases. Enhancing collaboration between human health, veterinary, and environmental sectors for early detection and prevention (WHO, 2022a).

Investing in Vaccine Development and Manufacturing: Supporting research and development of vaccines for emerging infectious diseases. Encouraging local vaccine production capabilities to ensure timely access to vaccines during pandemics (WHO, 2022a).

Enhancing Community-Based Surveillance: Implementing community-based surveillance systems to detect early signs of disease outbreaks at the grassroots level. Training and empowering community health workers to play an active role in surveillance and reporting (WHO, 2022a).

Strengthening Legal and Policy Frameworks: Developing and implementing legal and policy frameworks that support pandemic preparedness, response, and coordination. Ensuring clear roles, responsibilities, and authority for different stakeholders involved in pandemic management (WHO, 2022a).

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CHAPTER TWO

JUSTIFICATION AND OBJECTIVES

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2.1 Justification of the Study

The COVID-19 pandemic has had a profound impact on health systems worldwide, highlighting vulnerabilities and opportunities for improvement. These include placing significant strain on healthcare infrastructure, particularly in regions with high infection rates; the disruption of routine healthcare services; posing several challenges for the healthcare workforce, such as increased workloads, longer shifts, and higher risks of exposure to the virus, and staff shortages. The global pandemic disrupted supply chains for medical equipment, personal protective equipment (PPE), and essential medications causing shortages and delays in their production and distribution.

The pandemic also had significant mental health implications, such as increased rates of anxiety, depression, and other mental health disorders. More so, the pandemic caused financial strains on health systems, exposed, and exacerbated existing health inequalities, while disparities in access to healthcare and resources further widened the gaps in health outcomes. The pandemic forced healthcare systems to adapt rapidly leading to an unprecedented global effort to develop and distribute vaccines. While the development and deployment of vaccines have been remarkable, challenges in production, distribution, and vaccine hesitancy have impacted equitable access to vaccines worldwide.

Hence, conducting this present study which aims to assess the impact of COVID-19 in the health system of the Federal Capital Territory of Abuja, Nigeria, is justified to inform strategies for future pandemic preparedness. The findings of this present study would have local relevance while also contributing to global knowledge and enhancing the resilience of the health system in Abuja and beyond. Understanding the specific challenges faced, the effectiveness of existing strategies, and areas that require improvement can help inform future preparedness plans. More so, this study would provide valuable insights into the strengths and weaknesses of the health system's response to the COVID-19 pandemic in Abuja.

Abuja, as the capital city of Nigeria, represents a significant hub for political, economic, and social activities. Thus, examining the impact of the pandemic on its health system would provide a localized understanding of the challenges faced and the strategies needed to enhance

preparedness. By analyzing the impact of COVID-19 on Abuja's health system, this study can identify areas that require strengthening. This could include improvements in healthcare infrastructure, resource allocation, workforce capacity, supply chain management, and coordination mechanisms. Implementing strategies based on these findings would enhance the overall resilience of the health system and its ability to respond to future pandemics.

Furthermore, this study would aim to identify specific strategies and interventions that can be implemented to enhance preparedness for future pandemics. This could involve evaluating the effectiveness of early warning systems, surveillance mechanisms, communication strategies, community engagement initiatives, and the integration of technology in healthcare delivery. By elucidating these strategies, policymakers and healthcare providers can develop robust plans to mitigate the impact of future pandemics. This study could shed light on the differential impact of the pandemic on vulnerable populations within Abuja. By examining factors such as socioeconomic disparities, access to healthcare, and health outcomes among different groups, the study can help identify strategies to address health inequities and ensure a more equitable pandemic response.

The findings of the study would provide evidence-based recommendations for policymakers and healthcare authorities in Abuja. This would aid in the development of policies, guidelines, and frameworks to strengthen the health system's capacity to respond to pandemics effectively. It would also facilitate informed decision-making regarding resource allocation, healthcare infrastructure development, and workforce planning. The insights gained from studying the impact of COVID-19 on Abuja's health system can contribute to the global understanding of pandemic preparedness and response. Sharing best practices and lessons learned can help other regions and countries improve their health systems and better prepare for future pandemics.

2.2 Objectives of the Study

This study aims to evaluate the impact of the COVID-19 pandemic on the health system of the Federal Capital Territory (FCT), Abuja, Nigeria, and elucidate strategies to be prepared for upcoming pandemics.

The objectives of the study are as follows:

(i) To evaluate the dimensions of the COVID-19 pandemic in the FCT, Abuja, Nigeria

(ii) To evaluate the infection prevention and control practices experienced in public and private health facilities in FCT, Abuja during the COVID-19 pandemic.

(iii) To evaluate the diagnostic performance of COVID-19 serological assays with SARS-COV-2 in health care settings of FCT, Abuja

(iv) To evaluate the knowledge, perceived risk, and willingness for COVID-19 vaccine uptake among primary healthcare workers in Abuja, Nigeria

(v) To evaluate the influence of vaccine hesitancy amongst healthcare workers and COVID-19 vaccine distribution in Abuja Municipal Area Council (AMAC), FCT, Nigeria

(vi) To evaluate the impact of end-to-end quality strategy to improve performance in COVID-19 pandemic responses in FCT, Abuja, Nigeria

CHAPTER THREE

DIMENSIONS OF THE COVID-19 PANDEMIC IN THE FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA

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ABSTRACT

Background: Coronavirus disease (COVID-19) has become a global pandemic. Gender and health refer to the socially constructed differences and the power relations between women and men, as a determinant of health. Disease outbreaks aggravate gender inequalities for women and men. Women play important roles in curbing the current COVID-19 outbreak that put them at increased risk of exposure including working as frontline healthcare workers, caregivers at home, and as mobilizers in their communities. Other gender barriers that put women at risk include limited access to information, lack of Personal Protective Equipment (PPE) such as masks, and other sociocultural practices. Treating women and men equally is the right and smart thing to do, is entrenched in human rights and is in keeping with the United Nations System-Wide Action Plan for Gender Equality and the Empowerment of Women.

Objective: The objective of this study is to highlight the significance and implications of COVID-19 gender analysis and sex-disaggregated data in the Federal Capital Territory (FCT), Abuja.

Materials and Methods: We retrospectively reviewed the COVID-19 database in the Public Health Department of the Federal Capital Territory (FCT), Abuja with a particular focus on the confirmed COVID-19 cases between the start of the outbreak on March 20, to May 31, 2020. We analyzed the data by age, sex, location, travel history and outcome.

Results: The number of suspected and confirmed COVID-19 cases during the study period was 8,722 and 660, respectively. Of the 660 confirmed cases, 204 were females and 456 were males. The number of deaths was 10 out of which 9 were males. The mean age of all the confirmed COVID-19 cases was 35 years with a range of 6 months to 87 years. All the confirmed cases came from five (Municipal, Bwari, Abaji, Gwagwalada and Kuje) out of the six area councils of the FCT. A total of 70 of the confirmed cases had prior international travel history to areas affected by the COVID-19 outbreak. Of these 70 with travel history, 44 were women.

Conclusion: Men and women have the same COVID-19 prevalence, but men are more at risk of severe form of the disease including dying from it.

KEYWORDS: COVID-19, Gender, Outbreak, Federal Capital Territory, Abuja, Nigeria

INTRODUCTION

Coronavirus disease (COVID-19) started in Wuhan, the capital of Central China's Hubei province in late December 2019 and by 30 January 2020, the disease was declared a Public Health Emergency of International Concern (PHEIC) by the World Health Organization and subsequently a global pandemic[1,2]. COVID-19 is the sixth disease to be declared as a PHEIC since 2005 when the new International Health Regulation (IHR) came into force[3]. According to the IHR(2005), SARS, Smallpox, wild-type poliomyelitis, and any new subtype of human influenza are automatically PHEICs and thus do not require an IHR decision to declare them as such[4].

Gender and health refer to the socially constructed differences and the power relations between women and men, as a determinant of health[5]. The health of both sexes is influenced by biological factors as well as other socio-cultural factors which determine risk factors, access and utilization of health care services and products as well as interaction with healthcare providers. In addition, health problems in men and women are also influenced by socio-economic status, ethnicity and geolocation[6,7]. All these factors intertwine to influence the course of the disease and its outcome. In gender inequality, one group is systematically empowered over another leading to inequities between men and women in health status and the provision of appropriate health services. Communities with high gender inequality are unhealthy for both men and women[8].

Disease outbreaks aggravate gender inequalities for women and men. Women play important roles in curbing the current COVID-19 outbreak that put them at increased risk of exposure including working as frontline healthcare workers, caregivers at home, and as mobilizers in their communities[9]. Other gender barriers that put women at risk include limited access to information, lack of Personal Protective Equipment (PPE) such as masks; and other socio-cultural practices[10]. Treating women and men equally is the right and smart thing to do, is entrenched in human rights and is in keeping with the United Nations System-Wide Action Plan for Gender Equality and the Empowerment of Women[11].

METHODS

Study area and population

The Federal Capital Territory (FCT), Abuja is the Capital of Nigeria and lies between latitudes 8.25 and 9.20 north of the equator and longitude 6.45 and 7.39 east of Greenwich Meridian. It is geographically located in the centre of the country. The FCT is bordered by the states of Niger to the West and North, Kaduna to the northeast, Nasarawa to the east and south and Kogi to the southwest. The total population is close to five million and is subdivided into 6 Area Councils (Abaji, Bwari, Gwagwalada, Kuje, Kwali and Municipal) which are equivalent to Local Government Areas (LGAs) in other states of Nigeria. The Municipal Area Council is the largest of all the area councils in the FCT accounting for over 55% of the total population. In addition, there are 62 political wards and 2,652 settlements.

Brief Description of COVID-19 Surveillance Including Community Active Surveillance in FCT, Abuja

At the start of the COVID-19 outbreak in the FCT, the initial strategy of detecting suspected cases was through receipt of alerts/calls from suspected cases or their proxies (e.g. relations, neighbours or clinicians) by designated members of the EOC who in turn verified that the suspected case satisfied the COVID-19 case definition before arranging for sample collection either in the homes of suspected cases or in a designated area near the International Conference Centre (ICC), Abuja. An additional strategy, the community active surveillance was added on the 13th of April 2020. This strategy entailed advocacy to traditional leaders, community mobilization in high-risk areas and provision of sample collection centres in these high-risk communities. Through these combined strategies, a total of 8,722 samples were collected from all the area councils as of 31st May 2020. Samples were tested at the National

Reference Laboratory, Gaduwa, Abuja. Confirmed COVID-19 cases were isolated in designated health facilities by the FCT administration.

Data Collection and Analysis

Data sources for analysis were from the COVID-19 Excel database of the Public Health Department of the FCT as well as the master list of FCT settlements at the WHO office in the FCT. We abstracted data from the start of the outbreak on March 20 to May 31, 2020. We conducted gender analysis based on sex-disaggregated data using Microsoft Office Excel 2010.

RESULTS

The total number of samples collected as of May 31, 2020 was 8,722 (Table 1) out of which 660(7.6%) were confirmed. Of the 8,722 samples collected, 5,899(68%) and 2,823(32%) were collected from men and women, respectively. The total number of COVID-19-positive cases among men and women was 456(69%) and 204(31%) respectively. The Municipal area council accounted for 7,054(81%) of all samples collected and 604(92%) of all the COVID-19-positive cases. The mean age of the COVID-19 cases was 35 years (range: 6 months to 87 years). The number of COVID-19 cases that died was 10 out of which 9(90%) deaths were among men. The number of deaths with comorbidity was 6(60%). The mean age of those that died of the disease was 50 years (range: 32 to 68 years). Of the 660 COVID-19-positive cases, a total of 70(10.6%) had a history of international travel to countries affected by the pandemic. The number of confirmed men and women with international travel history was 26(37%) and 44(63%) respectively. A total of 68(97%) of those with a history of international travel came from the Municipal council.

DISCUSSION

Initially, as with every region of the world, the first COVID-19 cases in the country and indeed the FCT came from exposure to international contacts—travel, trade, tourism, or business. These initial cases were mostly clustered in the Municipal area council and so was the community active surveillance. Of the 70 confirmed cases with international travel history, 40(57%) came back from Saudi Arabia and 14(20%) from the United Kingdom. These countries had their first COVID-19 cases before Nigeria and are among the most frequented countries by Nigerians. The rising new COVID-19 cases where there is no recent history of

travel to infected areas or recent contact with confirmed cases were strongly suggestive of community transmission.

Table 1: Distribution of COVID-19 tests conducted and confirmed cases by Area Councils in the FCT, Abuja, March-May 2020

	No (%) tested		No (%) positive		Total	
Area Council	**Male**	**Female**	**Male**	**Female**	**No (%) tested**	**No (%) positive**
Municipal	4847(56)	2207(25)	434(66)	170(26)	7054(81)	604(92)
Bwari	634(7)	319(4)	11(2)	15(2)	953(11)	26(4)
Abaji	195(2)	114(1)	6(1)	9(1)	309(3)	15(2)
Kuje	110(1)	87(1)	3(0)	4(1)	197(2)	7(1)
Kwali	57(1)	78(1)	0(0)	0(0)	135(2)	0(0)
Gwagwalada	56(1)	18(0)	2(0)	6(1)	74(1)	8(1)
Total	**5899(68)**	**2823(32)**	**456(69)**	**204(31)**	**8722(100)**	**660(100)**

Table 2: Age/Sex distribution of confirmed COVID-19 cases in the FCT, March-May 2020

	Male		Female		Total	
Age group	**No.**	**%**	**No.**	**%**	**No.**	**%**
<15 years	14	2	15	2	29	4
15-34 years	206	31	115	18	321	49
35-54 years	186	28	65	10	251	38
55-74 years	48	7	9	1	57	9
75+ years	2	1	0	0	2	0
Total	**456**	**69**	**204**	**31**	**660**	**100**

The FCT had one of the highest number of samples taken per million of population (>2,500) in the country. This was due to the intensive community active surveillance instituted to improve access to COVID-19 testing to populations with poor knowledge of COVID-19 in addition to digitally marginalized populations who do not have access to COVID-19 testing information, do not have phones or credit in their phones due to poverty. There was more than twice the number (5,899) of men tested as women (2,823). This sex difference may be artificial, especially in our society where female movements in some communities are restricted due to cultural practices and hence their access to COVID-19 testing is limited[12]. Indeed, Women have been shown to utilize screening tests more than their male counterparts by a large margin in primary care and the greater use of additional diagnostic procedures[13]. The sex difference in testing may also have accounted for the difference in the confirmed cases among men (456) and women (204) by almost the same margin.

The FCT has a relatively younger age group of COVID-19 cases. The most affected age group was 15-34 with a mean age of 35 years. This may have contributed to the observed relatively low case fatality (1.5%), but the economic impact may be significant considering the productivity of this age group. Six (60%) of the 10 confirmed COVID-19 cases that died in the FCT were over 50 years and had comorbidities (mostly hypertension and diabetes). The older population (>50 years) are more vulnerable to the disease and more likely to have the severe form of the disease given that they tend to have weaker immune system and are likely to have underlying chronic illnesses[14-16].

Of the 10 COVID-19 cases that died in the FCT, 9(90%) were males. While men and women may have the same prevalence, it is almost unanimous that men with COVID-19 are more at risk for worse outcomes including need of intensive care and death independent of age[17]. Although the mean age of all the COVID-19 cases was 35 years, the mean age of those that died was 50 years. Many postulates tried to explain this observation as caused by the genes, hormones, the immune system, high-risk behaviour (e.g. smoking) and prevalence of chronic diseases (e.g. heart disease, diabetes and cancer)[18]. This gender role in mortality has also been observed in SARS patients where the percentage of males who died was higher than in women (P =0.015)19.

While the disease itself may be subtle on women, especially in terms of case fatality, its larger extended impact on women and girls is enormous. Many women were trapped at home during lockdowns with their abusers while being cut off from normal support services20.

Spikes in domestic violence, rape and teen pregnancies were reported21,22. The death of men breadwinners and lockdowns with attendant loss of jobs and earnings meant additional economic hardship to women and girls in a family. In addition, meagre family resources may be redirected to cater for the needs of boys over girls.

We conclude that Men and women have the same COVID-19 prevalence, but men are more at risk of severe form of the disease including dying from it. We also recommend that COVID-19 gender analysis and sex-disaggregated data at all levels be available to guide policies and actions. The current COVID-19 palliatives being distributed by the Governments should prioritize women and girls. Key health services for women and girls in the health facilities, such as reproductive and sexual health services should be preserved. Investment in girl child education should be made to prevent dropout.

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CHAPTER FOUR

INFECTION PREVENTION AND CONTROL PRACTICES OF PUBLIC AND PRIVATE HEALTH FACILITIES IN FEDERAL CAPITAL TERRITORY ABUJA, EXPERIENCE DURING COVID-19 PANDEMIC

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ABSTRACT

Background

Adherence to Infection prevention and control standard practice protocol is critical in minimizing the risk of contracting COVID-19 infection among healthcare workers in healthcare settings. With the increasing trend of nosocomial transmission of COVID-19 among healthcare workers during the pandemic in Nigeria, we assessed the status of IPC in facilities in the Federal Capital Territory (FCT), Abuja during the COVID-19 pandemic.

Methods

A cross-sectional study design was conducted from March to April 2020 in the Federal Capital Territory (FCT), Abuja. A semi-structured interviewer-administered checklist adapted from the World Health Organization (WHO) IPC scorecard for health facilities was used. IPC focal persons for each health facility visited were interviewed on the twelve core IPC domains. Data was analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 26. A $p < 0.05$ was considered statistically significant for all statistical tests.

Results

Most of the facilities were public/government owned 320(69.9%) with more than half 31.5 (68.8%) being secondary health facilities. IPC status in health facilities was good in 408(89.0%) of the health facilities. However, there was a significant statistical difference in the IPC practices among private and public facilities in most of the IPC domains; Functional IPC Committee ($p<0.001$), facility triaging ($p<0.001$), temporary holding area, (THA)

(P<0.001), PPE (P<0.001), Waste disposal (p=0.023), hospital sterilization (p=0.008), and Hospital decontamination (p=0.004).

Conclusion

The study found a satisfactory IPC protocol operationalization status in health facilities in the Federal Capital Territory (FCT), Abuja. Nevertheless, there is a need for interventions targeting mostly private health facilities to address the disparity and gaps identified in IPC practices.

Keywords: Infection Prevention and Control, COVID-19, Healthcare workers, Federal Capital Territory, Abuja

INTRODUCTION

Infection prevention and control (IPC) practices in healthcare facilities during COVID-19werepoised with increasing challenges of ensuring optimal practices due to the increased number of patients presenting with COVID-19 and patients with routine care needs. [1] The absence of an adequate workforce to maintain a functional local response and patient care during the pandemic was responsible for a high rate of infection among Health Care Workers (HCWs).[2] In Federal Capital Territory (FCT), Abuja a total of seven hundred and fifty-six (756) healthcare workers have been infected with COVID-19 in the course of duty between the 20th of March 2020 to the 31st of March 2021.[3]Health Care Workers (HCWs) are generally at risk of emerging viral diseases SARS-COV-2, due to novel nature of the disease and poor IPC practices.[2,4,5]

In Nigeria, studies reported the prevalence of nosocomial infection ranging between 14% - 49%.[6-8]In Wuhan, China, during the early phase of the COVID-19 epidemic about 29% of patients with SARS-CoV-2 were health-care workers and were assumed to have acquired the infection in hospital.[9]Deaths among health-care workers infected with SARS-CoV-2 were mostly among aged 50 and above.[10] With an increasing understanding of COVID-19, the proportion of healthcare workers contracting COVID-19 infection in hospital settings has decreased, but stringent IPC measures and continued vigilance are needed. Facility-based infection prevention and control (IPC) measures are fundamental to addressing this challenge while public health measures target community transmission.[11]

Infection prevention and control is a proven solution that can mitigate the incalculable suffering and costs to both healthcare workers and the health system.[12] Compelling evidence shows that up to 70% of hospital-acquired infections (HAIs) can be prevented by scaling up an array of effective IPC interventions. Investing in IPC is one of the most cost-effective

interventions available. In particular, hand hygiene and environmental hygiene in healthcare facilities were found to halve the risk of death due to infections with AMR pathogens and decrease the associated long-term complications and health burden by at least 40%. Improving hand hygiene in healthcare settings could save about US$ 16.50 and reduce healthcare expenditure while generating substantial net saving across countries worldwide.[13]During the first six months of the COVID-19 pandemic, access to appropriate personal protective equipment combined with rapid IPC training would have had the potential to avert SARS-CoV-2 infections and related deaths among health care workers globally.[13]

IPC measures are extensive in hospitals managing patients infected with SARS-CoV-2 and include rigorous cleaning and disinfection to reduce environmental contamination, use of personal protective equipment (PPE), isolation, and isolation.[14] COVID-19 has stretched IPC practice in facilities both in terms of the human capacity to ensure the practice and increased demand for IPC materials.[2]

The COVID-19 pandemic and other recent large disease outbreaks have highlighted the extent to which healthcare settings can contribute to the spread of infections, patients, health workers and visitors, are at risk of contracting nosocomial infections if little attention is paid to IPC. Good hand hygiene and other cost-effective practices can prevent up to 70% of such infections.[13] The COVID-19 pandemic has exposed many exciting challenges encountered in the implementation of IPC in all regions and countries, including those with the most advanced IPC programmes. It has also provided an unprecedented opportunity to take stock of the situation, rapidly scale up disease outbreak readiness and response through proper implementation of IPC practices, as well as strengthening IPC programmes across the health system.[13]The aim of the study is to determine the status of IPC in facilities during the COVID 19 pandemic.

MATERIALS AND METHODS

Study Settings, Design, and Sample Size

A cross-sectional study was carried out from March 2020 to April 2020 in the Federal Capital Territory (FCT), Abuja. The Federal Capital Territory is a cosmopolitan city and the political capital of Nigeria which experiences a high influx of diverse people with a wide diurnal nocturnal ratio. The estimated total population of the FCT is about 5,338,550 with a landmass of 1769 km^2. There are 6 Area Councils (AC) and 62 political wards in the FCT.[13][14]

FCT operates a 3-tier health system of primary, secondary, and tertiary levels of care that spread over rural and urban areas. There are 754 accredited health facilities made up of

500 private health facilities and 254 public health facilities. The 254 public health facilities are disaggregated into 237 primary health facilities, 14 secondary health facilities, and 3 tertiary hospitals namely; National Hospital, Federal Medical Centre and University of Abuja Teaching Hospital located in Gwagwalada Area Council. The three tertiary hospitals are owned and funded by the Federal Government, while the secondary facilities are managed by the Hospitals Management Board (HMB), and the PHC facilities are managed by the FCT Primary Health Care Board (PHCB). The private health facilities consist of hospitals, maternity homes, faith-based hospitals and clinics, diagnostic centres, and pharmacies. The private sector provides healthcare for a substantial proportion of the population.[14]

The minimum sample size was calculated using the formula for a cross-sectional study. The significant level was placed at a 95% confidence interval, a power of 80% using prevalence from a similar previous study.

Study Population and Sampling Techniques

The IPC scorecard adapted from the World Health Organization (WHO) was administered to IPC focal persons in the facilities.[15] All the public tertiary and secondary health facilities were selected. The study population consisted of consenting Primary Healthcare workers 18 years and above, residing and working in the FCT for at least six months. The list of all the private and public primary healthcare facilities was obtained to form the sampling frame. A proportion-to-size sampling technique was used to select the number of primary health facilities in the 6 Area Councils. Twenty-two HCWs, twelve nurses and ten Community Health Officers (CHOs) were recruited and trained for two days as research assistants. Written informed consent was sought and obtained from each eligible participant, and a semi-structured interviewer-administered questionnaire was used to collect information from all facilities.

Study Instrument and Data Collection

A semi-structured interviewer-administered checklist adapted from the WHO core component and facilities scorecard for IPC was utilised. [15] IPC was assessed in twelve domains in all facilities. IPC committee or hygiene committee in place, Triage area in place, identification of a temporary holding area, Hand hygiene, availability and usage of PPE, waste collection and segregation, waste disposal, staff training, intra-hospital alert, sterilization, decontamination of the environment and risk assessment of healthcare worker exposed. Each domain has a set of questions, and the responses are scored as 1 for a yes response and 0 for a no response. Each domain score was graded as good (75%-100%), fair (50%-74%) and poor

(1%-49%). The checklist was pretested among 10% of the total sample size in PHC facilities in Karu LGA.

Measurement of Variables

The dependent variables were the IPC status categorised as good, fair and poor while the twelve domains were independent.

Data Analysis

All the data generated was entered and analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 26. A $p < 0.05$ was considered statistically significant for all statistical tests. The data analysis was stratified by facility ownership. Mean scores and standard deviations were used to summarise the quantitative variables. A chi-square test was done to describe associations between IPC domains and facility ownership.

Ethical Consideration

Ethical approval for the study was obtained from the FCTA Health and Research Ethics Committee (FHERC). Written informed consent was obtained from each study participant. Respondents were free to withdraw anytime during the study if they so desired. The participants were assured of the confidentiality of their information. All methods were carried out following relevant guidelines and regulations.

RESULTS

Table 1: Characteristics of Health Facilities Assessed for IPC in Federal Capital Territory Abuja

Characteristic	Frequency (n)	Percentage (%)
Facility ownership		
Private	138	30.1
Public	320	69.9
Facility type		
Primary	83	18.1
Secondary	315	68.8
Tertiary	60	13.1

Most of the facilities were public government-owned 320(69.9%) and the majority were secondary health facilities (Table 1).

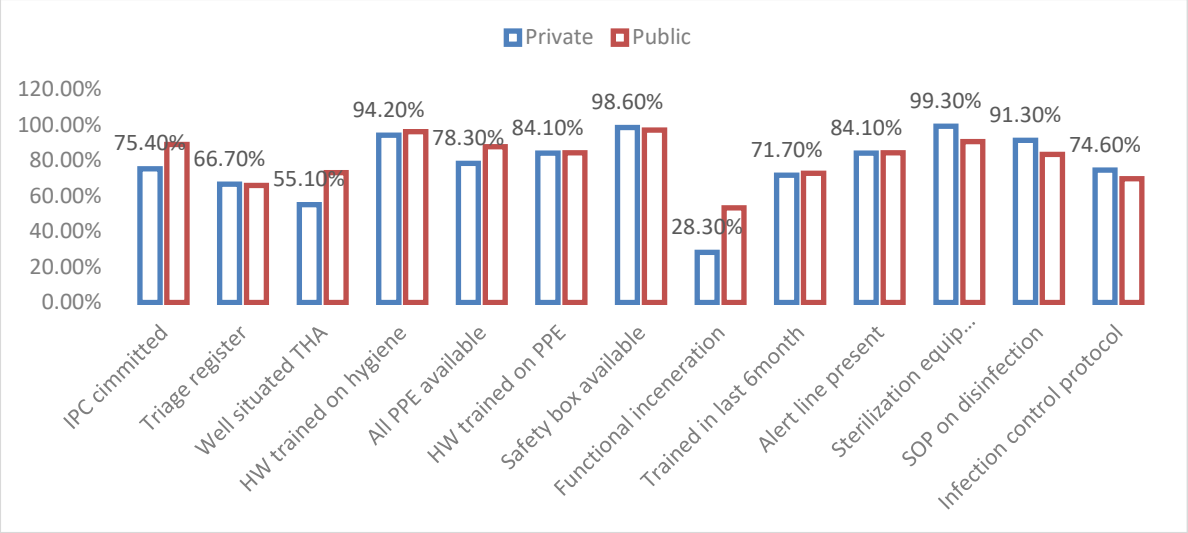

Figure 1: Respondents' responses on the IPC Practices in facilities in Federal Capital Territory

Most public facilities show better IPC practice compared to private facilities except for the availability of sterilization equipment, SOP on disinfection and the presence of infection control protocol. Only about two-thirds of the facilities have a protocol for IPC available. Functional incineration is only available in Less than 30% of private facilities and about 50% of public facilities.

Table 2: Assessment of IPC Domain in Health Facilities in Federal Capital Territory Abuja

IPC Domain	Frequency (n)	Percentage (%)
Functional IPC committee		
Good	361	78.8
Fair	25	5.5
Poor	72	15.7
Facility triaging		
Good	293	64
Fair	133	29
Poor	32	7
THA		
Good	241	52.6
Fair	49	10.7
Poor	168	36.7
Hand hygiene		

Good	436	95.2
Fair	5	1.1
Poor	17	3.7
Personal Protective Equipment		
Good	305	66.6
Fair	106	23.1
Poor	47	10.3
Waste collection		
Good	399	87.1
Fair	41	9.0
Poor	18	3.9
Waste disposal		
Good	90	19.7
Fair	324	70.7
Poor	44	9.6
Health worker training on IPC		
Good	223	48.7
Fair	101	22.0
Poor	134	29.3
Hospital IPC alert		
Good	381	83.2
Fair	37	8.1
Poor	40	8.7
Hospital sterilization		
Good	359	78.4
Fair	64	14.0
Poor	35	7.6
Hospital decontamination		
Good	379	82.8
Fair	71	15.5
Poor	8	1.7
Hospital health worker risk assessment		
Good	180	39.3
Fair	131	28.6
Poor	147	32.1

Table 2: The functional IPC committee was categorised as good in only about 25(5.5%). Most facilities had good triaging place 293(64.0%). Half of the Health facilities have a good temporary holding area of 241(52.6%). Hand washing and hygiene were optimal in most of the facilities 436(95.2%). PPES was available in two third of the facilities 305(66.6%). Waste collection was good 399(87.1%) with only 90(19.7%) having good disposal methods. Less than half 223(48.7%) of the health care workers reported having good training on IPC. Most of the hospitals 359(78.4%) had good sterilization methods in the facilities and most of the facilities do hospital decontamination 379(82.8%). Hospital health workers' risk assessment was good in only 180(39.3%).

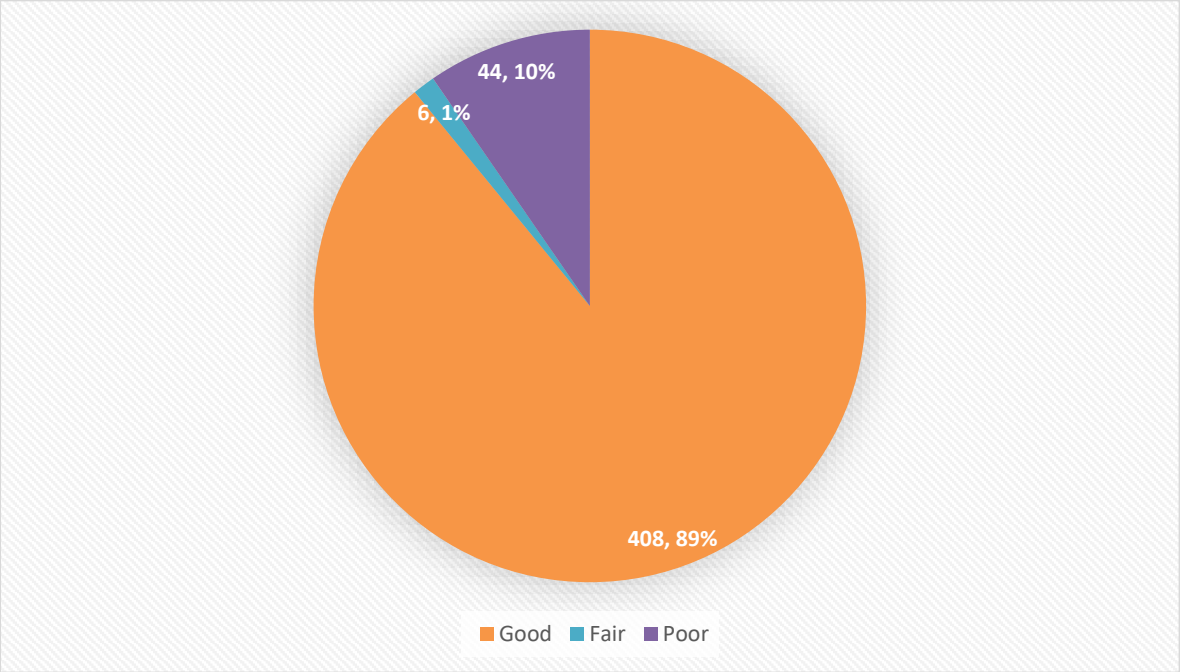

Figure 2: Overall IPC status in Health Facilities in Federal Capital Territory Abuja

Overall IPC status in health facilities was good 408(89.0%) and this was poor in only 44(10.0%)

Table 3: IPC Status in Public and Private Health Facilities in Federal Capital Territory Abuja

	Facility ownership				
IPC Domain	**Private Freq.(%) n=138**	**Public Freq.(%) n=320**	**V= χ^2**	**df**	**p-value**
Functional IPC committee					
Good	92(25.5)	269(74.5)	21.284	2	**<0.001**
Fair	8(32.0)	17(68.0)			
Poor	38(52.8)	34(47.2)			
Facility triaging					
Good	32(24.1)	101(75.9)	6.710	2	**<0.001**
Fair	91(31.1)	202(68.9)			
Poor	15(46.9)	17(53.1)			
THA					
Good	42(17.4)	199(82.6)	42.540	2	**<0.001**
Fair	27(55.1)	22(44.9)			
Poor	69(41.1)	99(58.9)			

Hand hygiene					
Good	129(29.6)	307(70.4)	1.212	2	0.546*
Fair	2(40.0)	3(60.0)			
Poor	7(41.2)	10(58.8)			
PPE					
Good	100(32.8)	205(67.2)	15.749	2	**<0.001**
Fair	17(16.0)	89(84.0)			
Poor	21(44.7)	26(55.3)			
Waste collection					
Good	115(28.8)	284(71.2)	2.914	2	0.233
Fair	17(41.5)	24(58.5)			
Poor	6(33.3)	12(66.7)			
Waste disposal					
Good	20(22.2)	70(77.8)	7.584	2	**0.023**
Fair	98(30.2)	226(69.8)			
Poor	20(45.5)	24(54.5)			
Health worker training on IPC					
Good	58(26.0)	165(74.0)	3.665	2	0.160
Fair	33(32.7)	68(67.3)			
Poor	47(35.1)	87(64.9)			
Hospital IPC alert					
Good	110(28.9)	271(71.1)	1.781	2	0.410
Fair	14(37.8)	23(62.2)			
Poor	14(35.0)	26(65.0)			
Hospital sterilization					
Good	120(33.4)	239(66.6)	9.739	2	**0.008**
Fair	14(21.9)	50(78.1)			
Poor	4(11.4)	31(88.6)			
Hospital decontamination					
Good	126(33.2)	253(66.8)	11.297	2	**0.004***
Fair	11(15.5)	60(84.5)			
Poor	1(12.5)	7(87.5)			
Hospital health worker risk assessment					
Good	45(25.0)	87(66.4)	3.711	2	0.156
Fair	44(33.6)	135(75.0)			
Poor	49(33.3)	98(66.7)			

There was a significant statistical difference in the IPC practices among private and public facilities in most of the IPC domains Functional IPC Committee (p<0.001), facility triaging (p<0.001), THA (P<0.001), PPE (P<0.001), Waste disposal (p=0.023), hospital sterilization (p=0.008), and Hospital decontamination (p=0.004). No statistical difference was observed in

hand hygiene (p=0.546), waste collection (p=0.233), health workers training on IPC (p=0.160) and hospital health workers risk assessment (0.156).

Table 4: Comparison of overall IPC status in Public and Private Health Facilities in Federal Capital Territory Abuja

	Facility ownership				
IPC Domain	**Private Freq.(%) n=138**	**Public Freq.(%) n=320**	χ^2	**df**	**p-value**
Overall IPC status					
Good	116(84.0)	292(91.3)	4.934	2	**0.085**
Fair	6(4.4)	3(0.9)			
Poor	16(11.6)	25(7.8)			
Total	138(100.0)	320(100.0)			

There was no significant statistical difference in good IPC practice between private and public facilities (p = 0.085), however, most facilities in the public facilities had good IPC practice 292(91.3%) compared to private 116(84.0%).

DISCUSSION

The COVID-19 pandemic has tested the strength of the health systems globally and has impacted the health system, including human resource and training needs, monitoring and provision of resources. This has led to improvement in Health Care Workers' (HCWs) IPC capacity and behaviours.[11] Thus, efforts to improve IPC activities need to continue beyond acute response efforts. IPC implementation at the national level needs to be comprehensive and well-funded to protect HCWs, the patients they serve, community and ultimately to contribute to safe health services delivery.[13]

In this study, an assessment of IPC implementation and practice was carried out in private and public healthcare facilities in FCT using the twelve components of the WHO infection prevention and control assessment tool. This study found no significant difference in the overall IPC practice of private and public-owned facilities.[15] This is above the average of 80% required for the control of epidemic diseases.[16,17] Similar findings were reported in a study conducted in Tanzania after an IPC intervention.[15] This finding was also corroborated in done

in Kenya, which shows a weak association between private and public facility ownership.[18] The high proportion of good IPC in this study may be due to the effect of intervention activities in both the private and public facilities, facilities now have a better understanding of IPC, in what combination, and in what context, implementation strategies should be best utilized to ensure their safety and that of their patients.[19]

However, we found 11.6% of private and 7.8% of public facilities with poor IPC is similar to a finding in a study done in Ghana that reported 12.5% and 19.2% in Kenya.[20-22] This implies that HCWs working in those facilities are more likely to be exposed to nosocomial infections and are at more risk of COVID-19 infection.[21] There is a need to strengthen governance and leadership at health facilities to promote adherence to IPC policy and SOPs, which will mitigate the risk of the spread of infections and promote hygiene.

In this, study more than two-thirds of the facilities in both private and public facilities had functional IPC committees. This finding was in congruence with studies carried out in River and Ghana[21,24] where there was an IPC program in greater than fifty percent of facilities. The World Health Organization reiterates that establishing IPC programmes are vital for limiting the spread of infectious diseases in the hospital setting.[25] When there are no clearly stated goals for programme implementation activities, achieving the programme goals becomes difficult. The finding indicates that further improvement is expedient to ultimately achieve quality IPC practice.[21]

We found that most of the healthcare facilities had a copy of the IPC protocol, but adherence to the implementation of IPC activities was insufficient. It was reported that evidence-based guidelines on IPC practices and procedures can effectively reduce hospital-acquired and antimicrobial resistance especially when combined with healthcare workers' education and training.[24] A local adjustment and application of the IPC protocol can warrant and sustain good IPC practices in healthcare facilities.[26]

We also found that most healthcare workers in both private and public facilities had training on IPC in the last 6 months. Disparity in IPC training and education among health workers on infection prevention and control has been reported.[27] Training of the health workforce should be supported through the inclusion of IPC in training curricula at all levels, rather than within individual disease-specific programmes.[15]There is a need to develop

integrative nationwide training and similar learning strategies among health workers to allow for uniformity in IPC knowledge and practice.[24]

In this study, more than two third the number of facilities assessed had IPC protocols without clearly stated objectives and plan of activities. A similar result was observed in a study conducted in Ghana [22] where more than fifty percent of the health facilities had IPC programs but without clearly defined objectives. We observed that most Health facilities both private and public had most health workers trained in hand hygiene. This is important in ensuring the monitoring of adherence to the implementation of IPC activities and the adaption of the IPC in the local context to guarantee sustainable good IPC practice. This observation indicates the need for awareness creation, information, education and periodic training of healthcare workers on infection prevention and control.[24]

We found that less than one-third of facilities had good waste disposal methods and less than half had incineration to treat waste. Most facilities used mixed methods of waste disposal including a combination of incineration, open burning, disposal at a general dumpsite and burying.

This is important in the prevention of infection of health workers, patients and members of the community. A variety of safe waste disposal methods were recommended by World Health Organization in health facilities and resource-poor settings, such as thermal, chemical and containment processes.[24]

CONCLUSION

The COVID-19 pandemic has caused significant disruption in health systems, stressing the importance of effective IPC programmes. The importance of monitoring and supervision in contributing to improved IPC practices at healthcare facilities cannot be overemphasize.[29] and improved IPC practices play a key role in the reduction in the proportion of HCW infections.[27] There is a need for training and education of HCWs on IPC as this was shown to decrease the risk of SARS-CoV-1 and MERS-CoV infection among HCWs.[30]All the health facilities in this study are supported by NGOs for the implementation of IPC, therefore, the findings cannot be generalised for the nation as this support is in selected facilities and states.

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CHAPTER FIVE

EVALUATING THE DIAGNOSTIC PERFORMANCE OF COVID-19 SEROLOGICAL ASSAYS WITH SARS-COV-2 IN A HEALTHCARE SETTING IN THE FEDERAL CAPITAL TERRITORY ABUJA, NIGERIA

CHAPTER FIVE

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ABSTRACT

COVID-19 is one of the most lethal infections, causing a global pandemic. An alternative serological test was developed in response to the increased demand for COVID-19 diagnosis. This study compared the diagnostic performance of Saytul and Global Access to the gold standard (Sars-COV-2) in Abuja, Nigeria. The diagnostic performance of COVID-19 serological assays was determined in a cross-sectional study (Saytul and Global Access). All three tertiary health facilities in the FCT, as well as the Zankli Research Center, were purposefully chosen as COVID-19 referral laboratories, and all of the institutions were selected to provide medical student training. Quota sampling was used in the study. The data was analyzed using SPSS version 23.0, with statistical significance set at $p<0.005$. Eight hundred and six respondents participated in the study. Most of the respondents (71%) were aged 16-30 years. The positivity rate is higher in SarCov2 compared to Saytul and Global Access. Saytul shows a sensitivity of 47.2% and specificity of 98.0% while Global Access shows a sensitivity of 43.8% and specificity of 98.0%. There was a statistically significant difference in the results between SarCOV 2 PCR and Saytul ($p=0.001$) and Global Access ($p=0.001$). We discovered that the serological tests have low sensitivity but high specificity. Low sensitivity has implications for missing cases, which could lead to further infection spread. With improved technology and understanding of the virus, highly accurate and effective tests to help prevent coronavirus infection can be made available.

Keywords: Serological test, COVID-19, Sensitivity, Specificity

INTRODUCTION

Late 2019 saw the emergence of coronavirus disease 2019 (COVID-19), one of the deadliest infections which was first discovered in Wuhan, China and later declared a pandemic following its alarming severity and spread across the world.[1,2][3] Known to be very contagious, infected persons present mainly with respiratory symptoms but the disease may affect other parts of the body. Most infected people develop mild symptoms with a few having severe symptoms which has caused the death of millions of people globally since its onset.[4][5]

The symptoms of COVID-19 include fever, cough, tiredness, and loss of taste or smell. sore throat, headache, aches and pains, diarrhoea, rashes on the skin, discolouration of fingers or toes and red or irritated eyes.[6][7][8] In severe cases SARS-CoV-2 infection leads to severe pneumonia, organ failure and even death.[9] The coronavirus family has α CoV and βCoV, genera as the species that infect mammals. Currently, seven members of the coronavirus family are pathogenic to human beings.[10] Three are highly pathogenic coronaviruses (SARS-CoV, MERS-CoV, and SARS-CoV-2), the other four human coronaviruses (HCoV-229E, HCoV-OC43, HCoV-NL63, and HCoV-HKU1) usually cause mild-to-moderate upper respiratory diseases in people.[11]

Definitive diagnosis is by the reverse transcription polymerase chain reaction (RT-PCR) test where the viral gene is detected and this test has been recognized as the gold standard for detecting COVID-19.[12] With several measures put in place to contain the pandemic, the place of increased testing cannot be overemphasized.[13] The increased demand for tests and diagnosis necessitated the development of alternative tests to detect COVID-19 many of which got Emergency Use Authorization (EUA).[14] Among the tests used are antigen-based rapid diagnostic tests (Ag RDTs) and host antibody detection rapid diagnostic tests. These tests can be used in screening people without symptoms of COVID-19 which is important in efforts to control the disease.[15,16] Many antigen-based and antibody-based tests are available for use under the EUA, however, caution is recommended in their use, so that people will not be wrongly categorized after a test.[15] Therefore, their use is recommended mainly in research settings but may be used in a population after validation in such populations and settings. This necessitated validation of two RDTs in Abuja, Nigeria where their use has been wide spread owing to the unavailability, cost and delay in getting results associated with RT-PCR.

This study, therefore, aimed to determine the diagnostic performance of Saytul and Global Access and compare their performance with the gold standard (Sars-COV) in Federal Capital Territory (FCT) Abuja, Nigeria.

METHODS

Study Settings and Area

This was a cross-sectional study carried out from September 2021 to December 2021 in Federal Capital Territory. Federal capital territory (FCT), being the seat of the government of an emerging national economy, experiences an influx of people from diverse backgrounds. The estimated total population is 5,338,550 with a landmass of 1769 km^2. It has 6 Area Councils (AC) and 62 political wards.[17]

FCT operates a 3-tier health system, comprising primary, secondary, and tertiary levels of care that spread over rural and urban areas. There are 254 public health facilities which are disaggregated into 237 primary health facilities, 14 secondary health facilities, and 3 tertiary hospitals. The three tertiary hospitals are owned and funded by the Federal Government of Nigeria, while the FCT's Hospitals Management Board (HMB) manages the secondary facilities, and its Primary Health Care Board (PHCB) manages the PHC facilities. The private health facilities consist of hospitals, maternity homes, faith-based hospitals and clinics, diagnostic centres, and pharmacies. The private sector provides healthcare for a substantial proportion of the population.[18]

Study Design

A cross-sectional study to evaluate the diagnostic performance of COVID-19 serological assays (Saytul and Global Access). The tests are rapid chromatographic immunoassays for qualitative detection of specific SARS-Cov-2 antigens present in the human nasal cavity.

Sample Size and Sampling Technique

The minimum sample size was calculated using the formula for a cross-sectional study. The confidence interval was placed at 95%, and a power of 80% using prevalence from a similar previous study. The sample collected was well above the estimated sample size to increase the power of the study.[19] All three tertiary health facilities in FCT, Abuja and Zankli Research Center selected purposively being of the COVID-19 referral laboratory and all of the

selected institutions provide training for medical students. A purposive sampling technique was utilized to recruit symptomatic and asymptomatic individuals in the study.

The study population consisted of individuals with symptom(s) of COVID-19, attending health facilities and residing in the FCT for at least six months who consented to the study. The asymptomatic participants were persons attending the health facilities who reported no symptom(s) of COVID-19 were recruited. Those who declined consent for the study were excluded.

Sample Collection and Analysis

The sample was collected from individuals with symptoms of suspected COVID-19 (fever, cough, tiredness, loss of taste or smell. sore throat, headache, aches and pains, diarrhoea, a rash on the skin, or discolouration of fingers or toes and red or irritated eyes) for symptomatic individuals.[14] Those without the symptoms were classified as asymptomatic.

PCR Assay: we used three types of automatic extractors to obtain viral RNA from clinical samples, i.e. MagCore HF16 (RBC bioscience, Taipei, Taiwan), Nimbus MicrolabSeegene (Hamilton Company, Bonaduz, Switzerland) and m2000 system (Abbott Molecular Inc. Des Plaines, IL). RNA amplification was made using two real-time PCR platforms, i.e. qCOVID-19 (Genomica, Madrid, Spain) and Allplex 2019-nCoV assay (Seegene, Seoul, South Korea) and we used the CFX96™ (Bio-Rad) real-time detection system. PCR did not have a human extraction control gene target. The extraction control gen target was a phage. These kits were used according to the manufacturer´s instructions for both the handling and the interpretation of the results.

Rapid Diagnostic Test: The SARS-CoV-2 antibody test (lateral flow method) is an immunochromatographic assay used for rapid qualitative detection of IgM/IgG in human whole blood serum or plasma samples against SARS-CoV2 infection. All index test results are for research purposes and were not used for patient care. The diagnostic tests are easy to perform for preliminary or emergency medical screening of SARS-CoV-2 within 20 minutes. The test was performed according to the leaflet manufacturers-protocol provided by the manufacturer in the test kit packet.

Table 1: Product information

Manufacturer Name	Global Access Diagnostics Ltd	Institut Pasteur de Dakar
Test name	Covios®Ag kits (COVID-19 rapid antigen test kits)	SAYTU COVID-19 Ag TEST (DAITROPIX)
Device batch No:	CA25K-130-1	19O1DO22S
Pack size(s)	25 tests per kit	25 tests per kit
Content of kit	Covid-19 lateral flow device, swab extraction buffer tube, specimen collection swab, instructions for use	Test device, extraction buffer bottle, tube, nozzle cap, nasal swab, paper stand, instructions for use
Product storage (temperature range)	2-30^{o}C / 36-86^{o}F	2-30^{o}C / 36-86^{o}F
Product expiry (months, year)	October 2022	24 months
Manufacturing site (country)	Bedford Technology Park Thurleigh, Bedfordshire, United Kingdom	Institut Pasteur de Dakar – Senegal

Measurement of Variables

The dependent variable was the presence of sars-cov-2 while the independent variables were sociodemographic characteristics and the diagnostic used.

Data Analysis

All the data generated were entered and analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 23. A $p < 0.05$ was considered significant for all statistical tests. Mean and standard deviations were used to appropriately summarize the quantitative variables. Chi-square was done to describe associations between sociodemographic Sarscov-2

Ethical Consideration

Ethical approval for the study was obtained from the FCTA Health and Research Ethics Committee (FCTHERC). Written informed consent was obtained from each study participant. Respondents were free to withdraw anytime during the study if they so desired. The participants were assured of the confidentiality of their information. All methods were carried out following relevant guidelines and regulations.

RESULTS

Table 2: Sociodemographic Characteristics of Participants

Parameter	Frequency	Percentage
Age group		
< 16	24	3.0
16-30	572	71.0
31-45	154	19.1
46-60	49	6.1
>69	7	0.9
Sex		
Male	383	47.5
Female	423	52.5
Highest Educational Level		
None/No formal	26	3.2
Primary	28	3.5
Secondary	570	70.7
Tertiary	182	22.6
Marital Status		
Single	577	71.6
Married	226	28.0
Widow	3	0.4
Religion		
Christianity	749	92.9
Islam	56	6.9
Others	1	0.2
Occupation		
Employed	304	37.7
Unemployed	502	62.3

Five hundred and seventy-two (71%) of the respondents were within the age range of 16-30 years with 7 (0.9%) being over 60 years. Males constituted 47.5% (383) while females were 52.5% (423) of the respondents. Two hundred and twenty-six (28.0%) were married.

Table 3: Test Results by Different Test Methods

Variable	Frequency	Percentage
SarCOV		
Negative	717	89.0
Positive	89	11.0
Saytul		
Negative	750	93.1
Positive	56	6.9
Global Access		
Negative	753	93.4
Positive	53	6.6

Table 3 shows 89 (11.0%), 56 (6.9%) and 53 (6.6%) positive results for SarCOV, Saytul and Global Access tests respectively.

Table 4: Comparison of serological assays with the Gold Standard SarCOV 2 PCR

	SARCoV-2 PCR				
	Negative Freq (%)	**Positive Freq (%)**	**OR (95% CI)**	**χ^2**	**p-value**
Saytul					
Negative	703 (98.0)	47 (52.8)	44.87 (22.89-87.96)	250.617	0.001
Positive	14 (2.0)	42 (47.2)			
Global Access					
Negative	703 (98.0)	50 (56.2)	39.17 (19.95-76.90)	225.907	0.001
Positive	14 (2.0)	39 (43.8)			

Table 4 shows a sensitivity of 47.2% and a specificity of 98.0% for Saytul. It also shows a sensitivity of 43.8% and a specificity of 98.0% for Global Access. There was a statistically significant difference in the results between SarCOV 2 PCR and Saytul (p=0.001) and Global Access (p=0.001).

Table 5: Sociodemographic factors associated with SarCOV Test Result

Variable	SarCOV			
	Negative	**Positive**		
Age group	**Freq (%)**	**Freq (%)**	χ^2	**p-value**
< 16	20 (83.3)	4 (16.7)	19.109	**0.002**
16-30	526 (91.3)	46 (8.7)		
31-45	125 (76.8)	29 (23.2)		
46-60	41 (80.5)	8 (19.5)		
>60	5 (71.4)	2 (28.6)		
Sex				
Male	341 (89.0)	42 (11.0)	0.004	1.000
Female	376 (88.9)	47 (11.1)		
Highest Educational Level				
None/No formal	25 (96.2)	1 (3.8)	3.737*	0.288
Primary	23 (92.1)	5 (17.9)		
Secondary	510 (89.6.)	59 (10.4)		
Tertiary	158 (86.8)	24 (13.2)		
Marital Status				
Single	529 (91.7)	48 (8.3)	15.734*	**0.002**
Married	186 (82.3)	40 (17.7)		
Widow	2 (66.7)	1 (33.3)		
Religion				
Christianity	673 (89.9)	76 (10.1)	8.543	**0.010**
Islam	43 (76.6)	13 (23.2)		
Others	1 (100.0)	0 (0.0)		

Table 5 shows that age was statistically associated with sarcov-2 (p=0.002). Higher positivity to SARCoV-2 was found among respondents over 30 years and was highest among age groups greater than 60 years. Marital status (p=0.002) and religion (p=0.010) was found to be associated with SARCoV-2.

DISCUSSION

This study showed both Saytul and Global Access to have positive rates lower than SarCOV. There was a statistically significant difference in the diagnostic performance of Saytul and Global Access compared to the gold standard. Both Saytul and Global Access had sensitivity lower than average. This is unlike that reported in a study in California where above-average figures were reported for the sensitivity of rapid antigen detection tests.[19] This disparity may be explained by differences in the sociodemographic characteristics of the study

populations and also, peculiarities of the test strips may explain the difference. Specificity for both tests was almost a hundred percent when compared to SARCOV-2.

There is a possibility that these tests are not able to detect minute quantities of the viral antigen in test specimens and this is an indication the two tests have tendencies to miss out on picking people that have the disease. Missing out positive cases constitutes a threat to public health, and it compromises efforts at controlling the diseases as people will be given false hope thereby spreading more of the diseases. In as much as time is of the essence, where a highly contagious and sometimes fatal disease is being considered for control, the sensitivity and specificity of rapid tests should not be compromised. The low sensitivity recorded is a wake-up call to healthcare providers to consider confirmatory tests using SARCOV-2 to avoid giving false positive results to people which in turn defeats the efforts at containing COVID-19.

In this study, we found that age group was statistically significantly associated with sars-cov-2 infection. The age group less than 30 years had a lower positivity rate compared to the age group over 30 years. The SARCOV-2 positive rate was highest among the age group greater than 60 years. This finding supports the report that the risk of COVID-19 was higher among the elderly compared to the young and the mortality rate among the age group greater than 55 years was 8.1 times higher and 62 times higher among those ages 65 or older.[20]

There were no gender differences among the responders. Also, we discovered that SARCOV-2 and married status were both statistically associated.[20] A study with married women revealed a similar finding, saying that married women cope better because stable couples understand one another.[21] The study recommended greater policies on residents' education and sustainable living since it connected unequal socioeconomic distributions to a variety of COVID-19 transmission in the area.

In a pandemic situation associated with severe morbidity and mortality such as the world is witnessing with COVID-19, desperate measures need to be taken to contain the situation. These include correct identification of cases, made possible by tests with high sensitivity and specificity. More effort needs to be put in place to ensure that, especially when developing newer ways of testing to prevent the misclassification of cases with its attendant consequences on the individuals, families, and the healthcare system.

CONCLUSION

We found that the RTKs have low sensitivity, though with high specificity. Low sensitivity of the RTKs implies the identification of coronavirus infection including missing cases and gives individuals false hope of being free from the infection and this could lead to more spread of the infection. The need to enhance diagnostic accuracy for RTKs is necessary. With improved technology and understanding of the virus, highly accurate and effective RTKs can be made available to help prevent coronavirus infection.

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CHAPTER SIX

KNOWLEDGE, PERCEIVED RISK, AND WILLINGNESS FOR VACCINE UPTAKE OF COVID-19 AMONG PRIMARY HEALTH CARE WORKERS IN ABUJA, NIGERIA

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ABSTRACT

Background

COVID-19 is a highly infectious disease, and healthcare workers have increased vulnerability. The novel virus caused significant morbidity and mortality and has continued to cause ravaging epidemics in different countries of the world, especially among the unvaccinated population. The study aimed to assess knowledge, risk perception, and willingness to vaccine uptake of COVID-19 among health workers.

Methods

This study utilized a cross-sectional design carried out among Primary Health Care Workers in the Federal Capital Territory (FCT) Abuja. A two-stage sampling technique was used to recruit 284 participants for the study. We adopted the Extended Parallel Process Model questionnaire to determine respondents' knowledge, risk perception, and willingness to COVID-19 vaccine uptake. Data were analysed using SPSS version 23, and statistical significance was set at $p<0.005$.

Results

The mean age of the study respondents was 36.05 years. The study shows that slightly more than half (58.8%) of respondents have good knowledge of COVID-19. The majority of the health workers perceived themselves as not likely to become sick with coronavirus 158(55.6%). Most of the respondents were aware of the coronavirus vaccine 260 (91.5%), and

the majority of the respondents 234(82.4%) were willing to take the coronavirus vaccine if it is available in the community. The majority of the respondents reported a lack of trust in government 140 (49.3%) and religion 33 (11.6%) as a reason for vaccine hesitancy.

Conclusions

Our study found that knowledge of COVID-19 was sub-optimal, and risk perception was low among HCWs. Though willingness for vaccine uptake was high, lack of trust in the government was the main reason for vaccine hesitancy. These findings underscored the need for government to build the trust of HCWs through continued engagement and highlighted the need to improve the knowledge of HWCs on COVID-19 and implement strategies that consider their belief system and perception in developing control measures.

Keywords: Risk perception, COVID-19, vaccine uptake, HCWs

INTRODUCTION

Novel Coronavirus or COVID-19 is a new strain of viruses that is highly infectious and can infect humans causing life-threatening diseases.[1][2] COVID-19 is a public health emergency that has caused significant morbidity and mortality globally.[3][4][5] As of September 2021, an estimated 218 million cases of COVID-19 have been confirmed with more than 4.5 million deaths.[4] The African region is the least affected by the virus with an estimated 5.6 million confirmed cases.[4] This may be due to unclear epidemiological differences. COVID-19 has significantly interrupted both preventive and curative services, has contributed to a global economic recession with a looming food crisis, and has adversely affected the mental health and well-being of individuals and communities, especially in developing countries.[6] It has continued to cause devastating epidemics in different countries of the world, especially among the unvaccinated population. Several efforts were put in place to prevent the spread of the virus. This includes the non-pharmaceutical measures of hand washing, or hand sanitizing with alcohol-based sanitisers, correct cough etiquette, avoidance of handshaking, wearing of facemask, and observing social distancing. These countermeasures were remarkable and their effectiveness and success depend on knowledge and the risk perception of COVID-19.[7][8]

Healthcare workers (HCWs) clearly show increased vulnerability as they respond to patients during this COVID-19 global pandemic. HCWs had increased exposure to COVID-19 viral pathogens, long working hours, psychological distress, fatigue, occupational burnout and stigma, and physical violence.[9] There has been increasing tension among healthcare workers proportional to the rise in figures of COVID-19 cases and mortality.[10] Frontline healthcare workers having more direct contact with disease patients in departments like the emergency department, intensive care unit, and infectious disease were found in a study to be at higher risk of covid-19 infection than administrative staff. These were found to show greater levels of fear, anxiety, depression, and psychological disorder than administrative staff.[11]

The protection measures such as non-pharmaceutical protocols and lockdowns taken by governments to contain the spread of the disease, although deemed necessary, have not significantly improved control of the pandemic.[6] Safe and effective vaccines are a critical tool to control the COVID-19 pandemic, and these vaccines have resulted in control of the epidemic, especially in developing countries where the coverage is significant, especially for the vulnerable population. Estimated over 5 billion doses of the vaccine have been administered worldwide.[7]

To introduce and install effective control measures, knowing basic hygiene principles and modes of disease transmission, and vaccination is important. To achieve ultimate success against the ongoing encounter against COVID-19, the uptake of the COVID-19 vaccines must be given priority, Therefore, understanding the knowledge, risk perception, and willingness for vaccine uptake of COVID-19 among health workers is vital to achieving success.[12]

MATERIALS AND METHODS

Study Settings, Design, and Sample Size

This was a cross-sectional study carried out from March 2020 to April 2020 in Federal Capital Territory. Federal capital territory (FCT), being the seat of the government of an emerging national economy, experiences an influx of people from diverse backgrounds. The estimated total population is 5,338,550 with a landmass of 1769 km^2. It has 6 Area Councils (AC) and 62 political wards.[13]

The indigenes are mainly subsistence farmers and the major food crops include yam, maize, guinea corn, beans, and millet. Fishing activities are also prominent among the Bassa people and villagers along the rivers of Usma, Jabi, and Gurara. Pottery, wood, and craftwork are also notable occupations of the people of the territory, especially the Gbagyis.[14]

FCT operates a 3-tier health system of primary, secondary, and tertiary levels of care that spread over rural and urban areas. There are 754 accredited health facilities made up of 500 private health facilities and 254 public health facilities. The 254 public health facilities are disaggregated into 237 primary health facilities, 14 secondary health facilities, and 3 tertiary hospitals which are the National Hospital located in the Central Business Area of Abuja Municipal Area Council, Federal Medical Centre (formerly Federal Staff Hospital) located at Airport Road and University of Abuja Teaching Hospital located in Gwagwalada Area Council. The three tertiary hospitals are owned and funded by the Federal Government, while the secondary facilities are managed by the Hospitals Management Board (HMB), and the PHC facilities are managed by the FCT Primary Health Care Board (PHCB). The private health facilities consist of hospitals, maternity homes, faith-based hospitals and clinics, diagnostic centres, and pharmacies. The private sector provides healthcare for a substantial proportion of the population.[14]

The minimum sample size was calculated using the formula for a cross-sectional study. The significant level was placed at a 95% confidence interval, a power of 80% using prevalence from a similar previous study.[15]

Study Population and Sampling Techniques

The study population consisted of consenting Primary Healthcare workers 18 years and above, residing and working in the FCT for at least six months were recruited into the study. A two-stage sampling technique was used to select the study population. Two area councils were selected out of the six area councils in the FCT using the simple random sampling technique. The list of all the facilities and the health workers in each of the facilities was obtained as a frame for the two area councils. A proportion-to-size sampling technique was used to select the number of respondents in each facility.

Four staff of the primary health care board, two doctors, and four nurses from the facilities had 3 hours of daily training sessions for two days as research assistants on the study protocol and questionnaire conducted by the principal researcher. Written informed consent

was sought and obtained from each eligible participant, and a semi-structured interviewer-administered questionnaire was used to collect information from all participants that fulfilled the inclusion criteria and gave consent.

Study Instrument and Data Collection

A semi-structured interviewer-administered questionnaire adapted from the Extended Parallel Process Model based on risk perception assessments of other infectious diseases was used.[16][17] The questionnaire was pretested among 10% of the total sample size in a PHC facility in Karu LGA Information was collected on sociodemographics, knowledge of COVID-19, Sources of information on COVID-19, and vaccine acceptability.

Knowledge of cervical cancer was assessed using 31- a point knowledge score. The respondents were asked a total of 31 questions on the knowledge that carried a total of 31 correct responses. Each correct response was given a score of 1 and the wrong response a score of 0. The points (questionnaires) included symptoms, prevention, early detection, and treatment of the disease. Participants with a summary score greater than or equal to the mean value were categorized as having "good knowledge" and those with a score less than the mean were categorized as having "poor knowledge".

Measurement of Variables

The dependent variables were knowledge and risk perception while social, and demographic characteristics were independent.

Data Analysis

All the data generated was entered and analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 23. A $p < 0.05$ was considered statistically significant for all statistical tests. Mean scores and standard deviations were used to summarise the quantitative variables. Chi-square was done to describe associations between sociodemographic features and the knowledge of participants on COVID-19. Risk perception and source of information were presented in proportions and graphs.

Ethical Consideration

Ethical approval for the study was obtained from the FCDA Health and Research Ethics Committee. Written informed consent was obtained from each study participant. Respondents were free to withdraw anytime during the study if they so desired. The participants were assured of the confidentiality of their information. All methods were carried out following relevant guidelines and regulations.

RESULTS

Table 1: Sociodemographic Characteristics of Respondents

Variable	Frequency	Percentage
Age group		
15-24	31	10.9
25-34	91	32.0
35-44	107	37.7
45-54	47	16.5
>55	8	2.8
Sex		
Male	169	59.5
Female	115	40.5
Highest level of education		
Primary	9	3.2
Secondary	33	11.6
Tertiary	195	68.7
Postgraduate	47	16.5
Marital status		
Single	55	19.4
Married	228	80.3
Divorce	1	0.4

The mean age of the study respondents was 36.05 years. The age of the respondents was from 18 to 63 years old and it was distributed into 5 categories as follows; 15-24 years old 31(10.9%), 25 to 34 years 91(32.0%), 35 to 44 years 107(37.7%), 45 to 54 years 47(16.5%) and ≥55 years 8(2.8%). More than half of the respondents were males 169(59.5%), while 115(40.5%) were females. The majority of the respondents were having tertiary education. Most of the respondents were married 228(80.3%).

Table 2: Knowledge of coronavirus disease among respondents

Variable	Frequency	Percentage
Knowledge		
Good	I67	58.8
Poor	117	41.2

The mean knowledge score of respondents was 14.40 ± 4.40. Table 2 demonstrated that slightly greater than half of the study respondents 167(58.8) had good knowledge of coronavirus disease.

Table 3: Factors associated with knowledge of Coronavirus disease among healthcare workers

	Knowledge of COVID 19			
Variable	**Good Freq (%)**	**Poor Freq (%)**	**X^2**	**p-value**
Age group (years)			2.022	0.738
15-24	15(48.4)	16(51.6)		
25-34	57(62.6)	34(37.4)		
35-44	63(58.9)	44(41.1)		
45-54	27(57.4)	20(42.6)		
>55	5(62.5)	3(37.5)		
Sex			6.495	0.014
Male	89(52.7)	80(47.3)		
Female	78(67.8)	37(32.2)		
Highest level of education			1.002	0.807
Primary	6(66.7)	3(33.3)		
Secondary	17(51.5)	16(48.5)		
Tertiary	116(59.5)	79(40.5)		
Postgraduate	28(59.6)	19(40.4)		
Marital status			1.570	0.480
Single	34(61.8)	21(38.2)		
Married	133(58.3)	95(41.7)		
Divorce	0(0.0)	1(100.0)		

There was no significant difference in the knowledge of coronavirus disease between the different age groups (p > 0.738). However, more than half of the respondents in the different age groups had good knowledge of coronavirus disease except those in the younger age group15 - 24 years. There was a statistically significant association between sex and knowledge of coronavirus disease (p = 0.014). There was no significant association between the level of education and knowledge of coronavirus disease. There was no significant difference (p = 0.480) between single, married, and divorced.

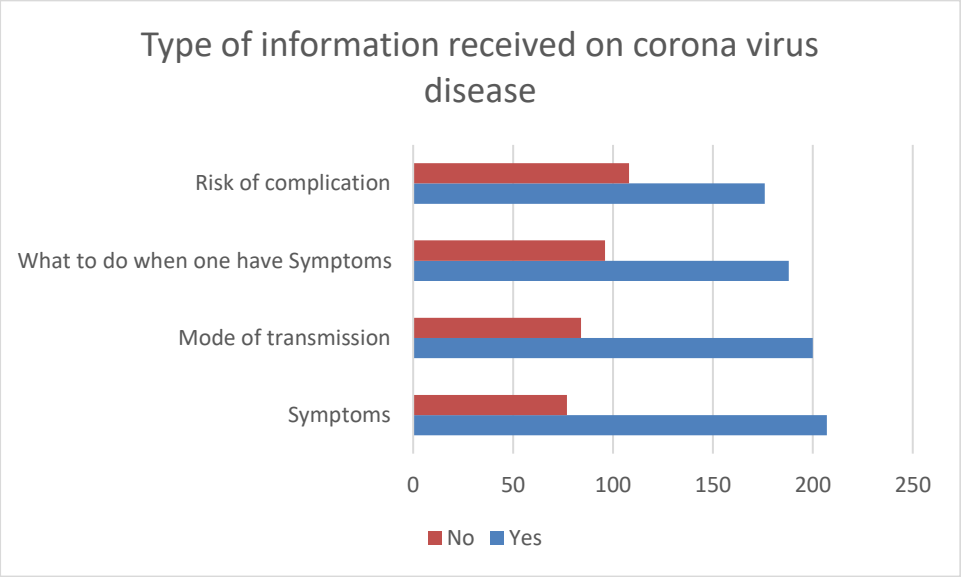

Figure 1: Different information received on coronavirus disease

From Figure 1, most of the respondents reported that the most frequent information they received was on how to protect themselves 258(90.8), this was followed by information on the disease symptoms 207(72.9), Mode of transmission 200(70.4), what to do when one has the disease 188(66.2) and risk of complication of the disease 176(62.0).

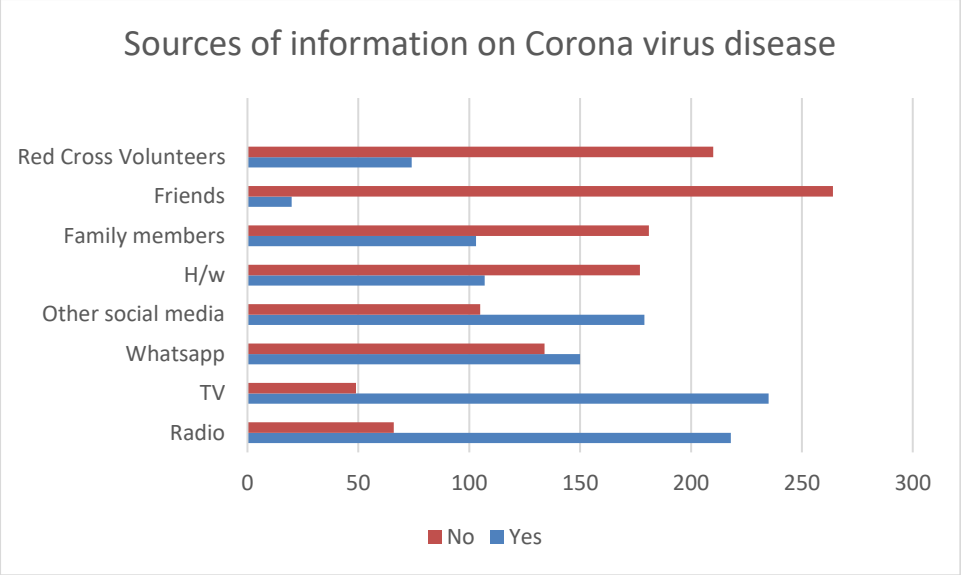

Figure 2: Sources of information on coronavirus disease

Figure 2: Respondent's source of information on coronavirus disease was the television 235(82.7%), radio 218(76.8%), and WhatsApp 150(52.2%). The least source of information was through friends 107(37.7%). Only about half of the respondents got their information from health workers.

Table 4: Risk perception of coronavirus disease among health workers

Variable	**Frequency**	**Percentages**
I think am likely to become sick with the new virus		
Yes	126	44.4
No	158	55.6
I think the coronavirus is		
Dangerous	25	8.8
Very Dangerous	259	91.2

Table 4: Most of the health workers perceived themselves as not likely to become sick with coronavirus 158(55.6%). Most of the health healthcare workers believe that the

coronavirus disease was very dangerous 259(91.2%) and 25(8.8%) believe that the disease was dangerous but none of the respondents reported that coronavirus disease was not dangerous.

Table 5: Awareness and willingness for COVID-19 vaccine uptake among health workers

Variable	Frequency	Percentages
I am aware of the vaccines against coronavirus		
Yes	260	91.5
No	24	8.5
I will receive the vaccine if it is made in my community		
Yes	234	82.4
No	47	16.5
I think the coronavirus is generating stigmatization of infected people		
Yes	265	93.3
No	14	4.9
I don't know	5	1.8

Table 5: Most of the health workers were aware of the coronavirus vaccine 260(91.5%) with a majority of the respondents 234(82.4%) willing to take the coronavirus vaccine if it is made available in the community.

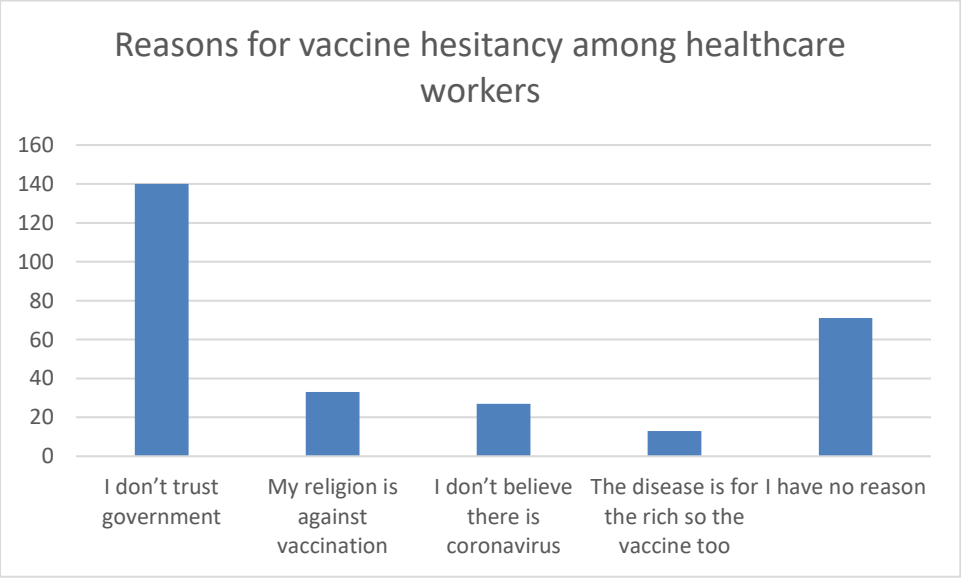

Figure 3: Reason for vaccine hesitancy among healthcare workers

Figure 3: Most of the respondents reported the reason for vaccine hesitancy to be a lack of trust in the government 140(49.3%). Other reasons for the vaccine hesitancy were religion 33(11.6%), don't believe in the existence of coronavirus 27(9.5%), and the disease is mainly for the rich 13(4.6%). Others 71(25.0%) did not give any reason for hesitancy but may not avail themselves to receive the vaccine.

DISCUSSION

This study shows that more than of the respondents have good knowledge of coronavirus diseases. This was higher than the finding of a study done among the general population in Kebbi state where only about a third had good knowledge about control of COVID-19.[8] A study done amount University students in Japan reported good knowledge scores in most of the studied population compared to our study.[7] This may be because the pandemic impeded directly their daily lives and academic activities compared to other adults and may have compelled them to acquire some knowledge about the disease. In addition, the provision of guidelines and protocols for proper conduct during the pandemic may have influenced their knowledge. Another study was done among the Iranian population and also revealed that the majority have good knowledge of COVID-19.[12] The finding in this study may reflect increased exposure to information on COVID-19 from governments and media. Almost half of the respondents in this study had poor knowledge of the disease. This was worrisome as this study was carried out among healthcare workers who are expected to have adequate and correct knowledge of the virus and also serve as a source of information for the general population, this had great implications for COVID-19 control.

Our study did not find a significant association between knowledge of coronavirus disease and age groups. In contrast, other studies reported an association between good knowledge and age greater than 30 years.[8],[1][18] This may be because the older persons are mostly those that are married and are quick to take actions that will protect them and their families. In addition, at this age, many of the respondents are already involved in COVID-19 campaigns about either prevention or treatment of the infected people. In this study, we found that the male gender was associated with good knowledge of coronavirus disease. However, this was inconsistent with the finding of a study carried out in Japan that females had more basic knowledge and explained the information more correctly than males, which agrees with previous studies in other countries showing that females have higher knowledge about COVID-19 and a proper attitude.[7] Another study done in Northern Nigeria reported no significant

association between gender and knowledge of coronavirus disease.[8] Based on these findings, to improve health education support programs regarding the knowledge about COVID-19, more targeted approaches for certain demographic characteristics such as gender is required.

In this study, level of education was not associated with knowledge of coronavirus disease. This was not consistent with a study done in Syria that revealed that a tertiary level of education was associated with knowledge of coronavirus disease.[12],[7] The finding in this study was that the majority of the respondents have a higher level of education and are healthcare workers. Differences in methodology and study population may have also contributed to the disparity. We find that the most frequent information received by health workers was on the symptoms of COVID-19 and the mode of transmission of the virus. The least information received by the HCWs was at risk of complication. This was because COVID-19 was not fully understood and information on the complication was evolving. The major source of information on coronavirus disease reported was the television and radio. A similar finding was reported in a study carried out among HCWs in Makerere.[18] This suggests that these channels of communication should be utilized in planning and implementing health promotion and risk communication in the population.

Less than half of the respondents perceived themselves as likely to be sick with the virus and all respondents believe that the coronavirus was dangerous or very dangerous. This was similar to findings reported in studies done in Ethiopia and Iran where most of the respondents have a high-risk perception.[2][19] Other studies carried out in India and Gondar City reported lower risk perception[20][21] This might be due to the differences in the study population, methodology, data, and level of spread of the virus across countries and communities. It may also be accounted for by the level of access to information, level of knowledge, and risk communication of the local authorities Also, risk perceptions can influence health-related behaviours and can play a substantial role in disease control as individuals are likely to adhere to preventive measures.

In this study, a majority (>90%) of the HCWs were aware of the vaccine against coronavirus and most of the respondents were willing to receive the vaccine if it is made available. The finding was consistent with a study conducted in seven European countries from Denmark, France, Germany, Italy, Portugal, the Netherlands, and the UK stating that they would be willing to get vaccinated against COVID-19 if a vaccine would be available.[22] A study done in Australia reported less proportion of participants willing to receive the

vaccine.[23] Getting HCWs vaccinated is a critical preventive measure in light of the increased COVID-19 risk of HCWs. Most of the HCWs reported a lack of trust in the government and religion as the reason for vaccine hesitancy. This has implications for the COVID vaccine uptake since the HCWs at the community level are an integral part of the strategy to achieve coverage needed for herd immunity. This was challenging against the backdrop of poor vaccine compliance and coverage in Nigeria.

Limitation

Our study considers only HCWs at the primary health care facilities and this may not reflect the knowledge of HCWs in the FCT. The close-ended question on vaccine hesitancy may have limited individuals' responses. There is a need for a community-based study with a qualitative component to explore willingness for COVID-19 vaccine uptake in the context of the community.

CONCLUSION

The study highlighted that knowledge of COVID-19 was sub-optimal among HCWs. The main source of information on COVID-19 was news media such as television and radio. Risk perception among HCWs was low. However, the willingness for COVID-19 vaccine uptake was high. There is a need to continue to improve the knowledge of HWCs on COVID-19 and implement strategies that consider their belief system and perception in developing control measures.

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CHAPTER SEVEN

EVIDENCE-BASED DECISION MAKING OF COVID-19 VACCINE DISTRIBUTION IN ABUJA MUNICIPAL AREA COUNCIL, FCT NIGERIA: STUDY ON INFLUENCE OF VACCINE HESITANCY AMONGST HEALTHCARE WORKERS

CHAPTER SEVEN

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ABSTRACT

Background

COVID-19 vaccine hesitancy is a growing concern worldwide, especially among healthcare workers who are at the forefront of the fight against the pandemic. Healthcare workers' vaccine hesitancy may be attributed to several factors, including a lack of trust in the vaccine's safety and efficacy, lack of knowledge about the vaccine, fear of side effects and misinformation. Conducting a study on COVID-19 vaccine hesitancy amongst healthcare workers in AMAC could provide valuable insights into the factors that influence vaccine hesitancy in the region. This could inform public health policies and strategies to increase vaccine uptake amongst healthcare workers, which in turn could improve the overall vaccination rate and help control the spread of the pandemic.

Materials and Methods

The study covered all twelve wards of the Abuja Municipal Area Council, with 375 Healthcare workers as the respondents. An online semi-structured Questionnaire was adapted from the WHO clinical care form.

Results

A total of 375 healthcare workers in AMAC were the respondents for this study. 60% of them reported to have been vaccinated against COVID-19 and only 24.5% which represents 92 respondents have completed their COVID-19 vaccine doses. The doubt of the COVID-19 Vaccine may cause damage to internal organs in the nearest future, could be attributed to fear as (51.5%) agreed and (48.5%) of the respondents did not agree. This could also be attributed to a lack of information on how the vaccine was developed and tested. From the results, it shows that 225 Healthcare workers agreed COVID-19 vaccine is a means of controlling population growth (60.0%), and only 40.0% did not agree, representing 150 Healthcare workers respectively.

Conclusion

The study findings provide valuable insights into factors influencing vaccine hesitancy and highlight the need for evidence-based interventions to promote vaccine uptake.

Keywords: COVID-19, Vaccination, Hesitancy, Healthcare Workers, Abuja Municipal Area Council.

INTRODUCTION

The World Health Organization (WHO) characterized COVID-19 as a pandemic on the 11th of March 2020. The COVID-19 Pandemic has posed unprecedented challenges to Health care systems globally. As of May (2023), there have been 766,895,075 confirmed cases of COVID-19, including 6,935,889 deaths, reported to WHO globally. Also, to have been reported on 16th May (2023) a total of 13,352,935,288 COVID-19 vaccine doses have been administered worldwide (World Health Organization Coronavirus report). Nigeria has recorded 266,675 confirmed cases with 259,953 cases discharged and 3,155 deaths (ncdc.gov.ng report April 2023). All 36 states have been affected including FCT. In the FCT, there have been 29,535 confirmed cases with 249 deaths. (www.ncdc.gov.ng). The federal government of Nigeria has introduced measures to contain the spread of the virus, including the vaccination of priority groups, such as Healthcare workers. However, vaccine hesitancy remains a significant obstacle to achieving herd immunity and controlling the pandemic.

The success in the fight against COVID-19 rests largely on successful global vaccination coverage, as it has affected all aspects of human endeavours like education, business, economy, religious activities, social life etc. According to the weekly epidemiological update as of 22 May (2022), almost one billion people in lower-income countries remain unvaccinated and only 57 countries have vaccinated 70% of their population- almost all of them are high-income countries. There is a need to continue to support all countries to reach 70% vaccination coverage as soon as possible, including 100% of the healthcare workforce and 100% of those with underlying morbidities.

Widespread acceptance of COVID-19 vaccines is crucial for achieving vaccination coverage to end the global pandemic. Hence, Healthcare workers are critical stakeholders in the vaccination rollout against the COVID-19 pandemic. They have the power to accelerate vaccine uptake among communities. However, unvaccinated healthcare workers may pose a risk in the vaccination drive. It is necessary to study reasons which prevent health workers from getting vaccinated. This is an important study to provide evidence to drive decision-making for large-scale vaccination, which is yet to begin, as most healthcare workers are yet to be vaccinated in Abuja Municipal Area Council (AMAC), Nigeria.

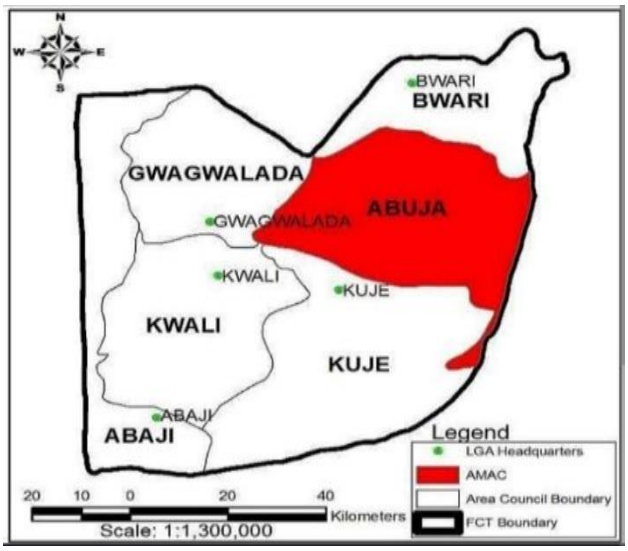
According to data from FCT Primary Health Care Board (PHCB). Abuja Municipal Area Council is the 3rd least vaccinated Area Council in FCT. The reasons projected are attributed to urbanization, high level of education, and geographical largesse. A recent study has been limited as to why there is low vaccination uptake in Africa looking at the data from John Hopkins University or WHO website.

METHODOLOGY

Materials & Methods: The study was conducted in all the twelve wards of Abuja Municipal Area Council, Federal Capital Territory. Politically the wards are divided into twelve namely: City Centre, Garki, Gui, Gwagwa, Gwarinpa, Jiwa, Kabusa, Karshi, Karu, Nyanya, Orozo and Wuse. Using a semi-structured online Questionnaire which was adapted from WHO COVID-19 clinical care form.

***Study Area*:** The Abuja Municipal Area Council was created in October 1984. It is located on the eastern wing of the Federal Capital Territory. AMAC Is the most developed of all the area councils. The bulk of Federal Institutions, Ministries, Departments, Agencies, Embassies, Multinationals, and Businesses, including the Presidential Villa, the National

Assembly and the Supreme Court of Nigeria are located within the precinct of the area council. The current metro area population of Abuja in 2023 is 3,840,000, a 5.15% increase from 2022. The metro area population of Abuja in 2022 was 3, 652,000, a 5.43% increase from 2021. 55% of the population resides in Abuja Municipal Area Council (AMAC). The major Occupation of the inhabitant of AMAC is civil service and trading, and only a few people are engaged in farming. Most of the inhabitants come from different parts of the country, but the indigenous inhabitants are Gwari, Gbagi and Nupe who are predominantly farmers.



FCT map showing the location of AMAC.

Method of Data Collection

375 Healthcare workers in AMAC were the respondents for this study. The following responses were collected for Yes or No questions.

1. Do you believe COVID-19 is real?
2. Have you ever been tested for COVID-19?
3. Have you ever been managed for any chronic disease?
4. Do you think you are at high risk of getting COVID-19?
5. Have you been vaccinated against COVID-19?
6. Has an eligible member of your family received their COVID-19 vaccine?
7. Would you recommend the COVID-19 vaccine to others?
8. Did you have any side effects after receiving the vaccine?

9. Do you believe that the COVID-19 vaccine is a means of controlling population growth?
10. Do you believe COVID-19 goes along with religion?
11. Do you believe the COVID-19 vaccine can cause damage to internal organs?

***Data Analysis*:** Data collected for the above information was subjected to single population proportion formula, using SPSS/Excel 2021.

RESULTS

Procedure: Assuming a 58.1% proportion of healthcare workers in AMAC from previous data in Primary Health Care Board (PHCB)

Therefore, n =p (1-p) (ZE) 2

n= sample size

Z is the confidence level (Z=1.96 for 95%)

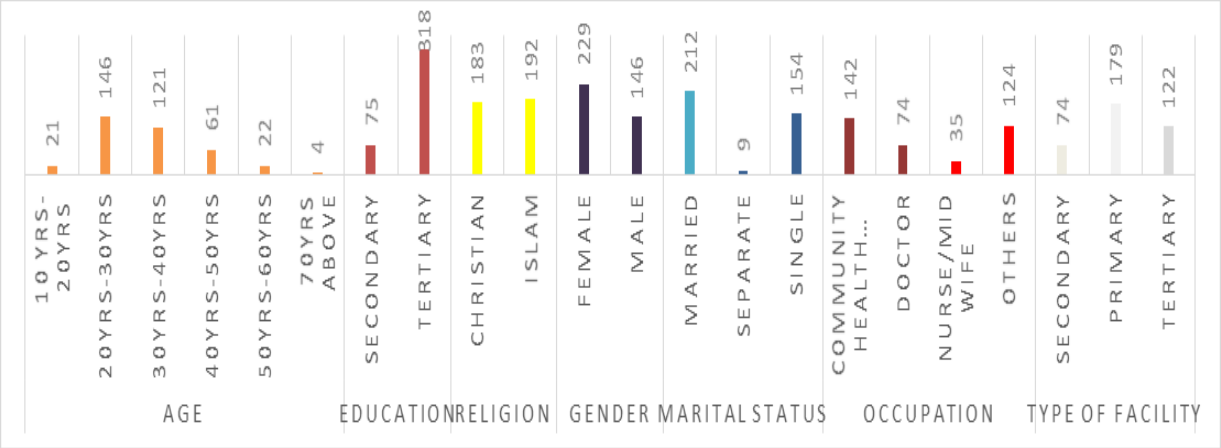
E is the desired margin of error (0.05)

P=proportion of AMAC population from the previous study =58.1%=0.581

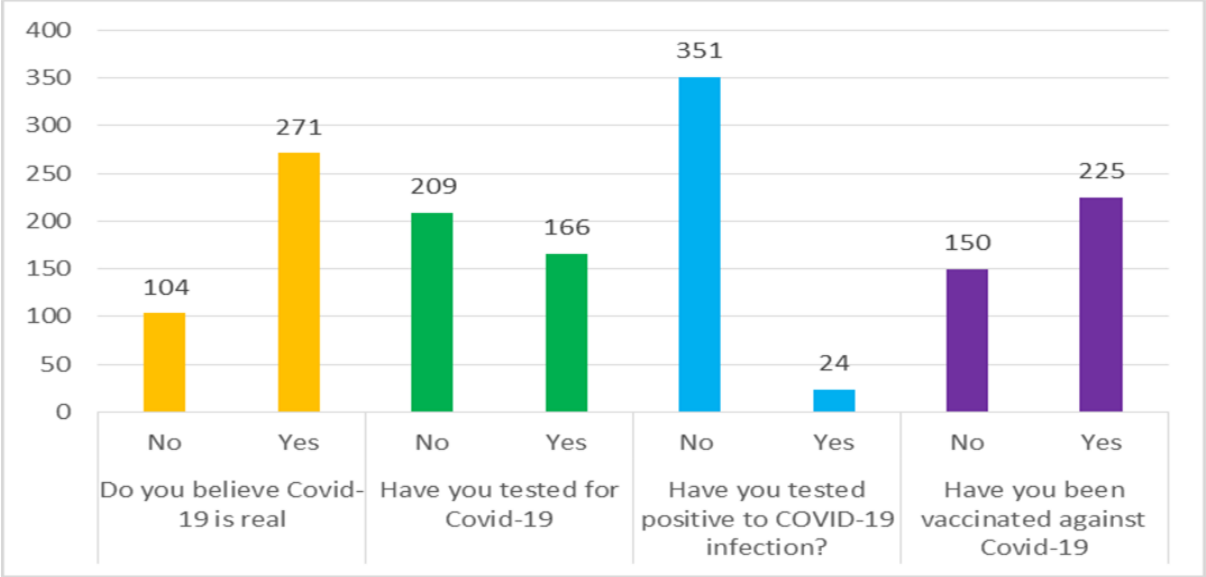
n= 0.581(1-0.581) (1.960.05)2

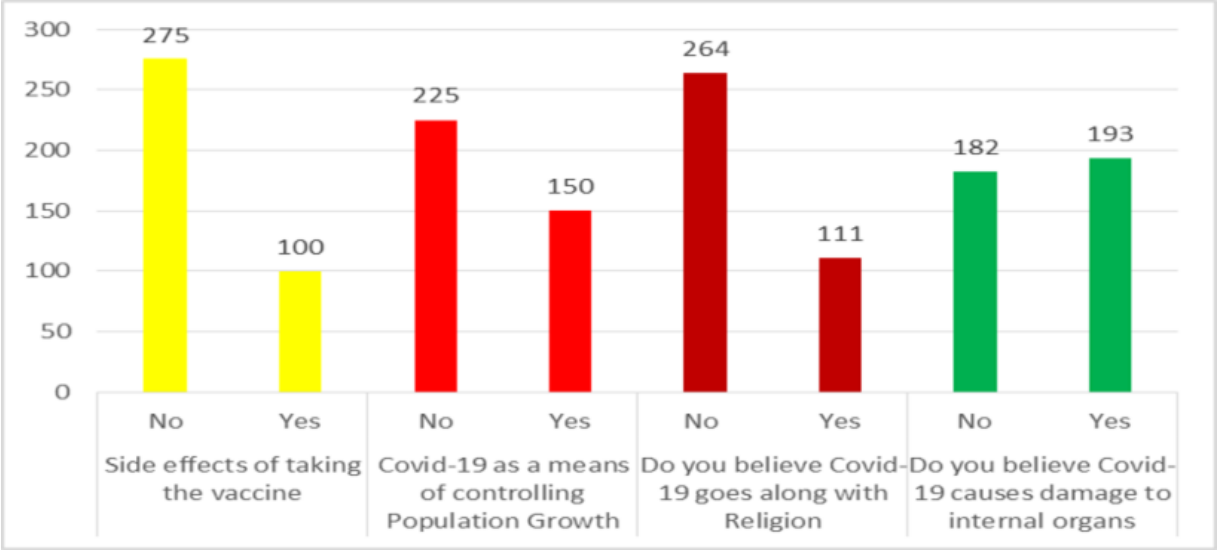
n= 375

The following table and charts below show the answers to each question answered in percentage.



Demographics of COVID-19 Vaccine Distribution in Abuja Municipal Area Council (n=375)


400
350
300
250
200
150
100
50
0
104
271
209
166
351
24
150
225
No
Yes
No
Yes
No
Yes
No
Yes
Do you believe Covid-19 is real
Have you tested for Covid-19
Have you tested positive to COVID-19 infection?
Have you been vaccinated against Covid-19


300
250
200
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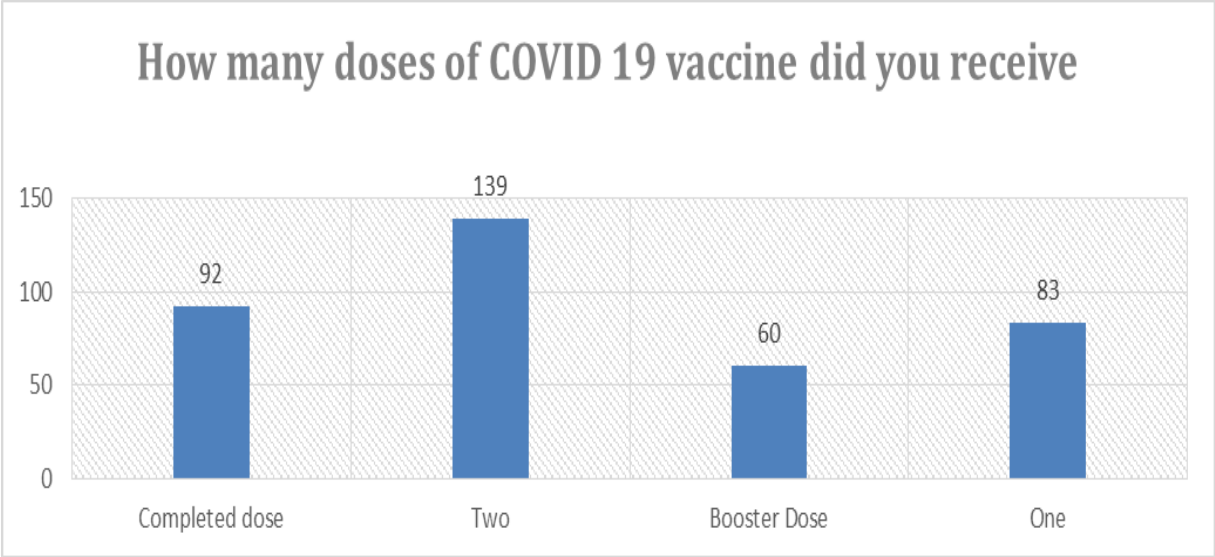
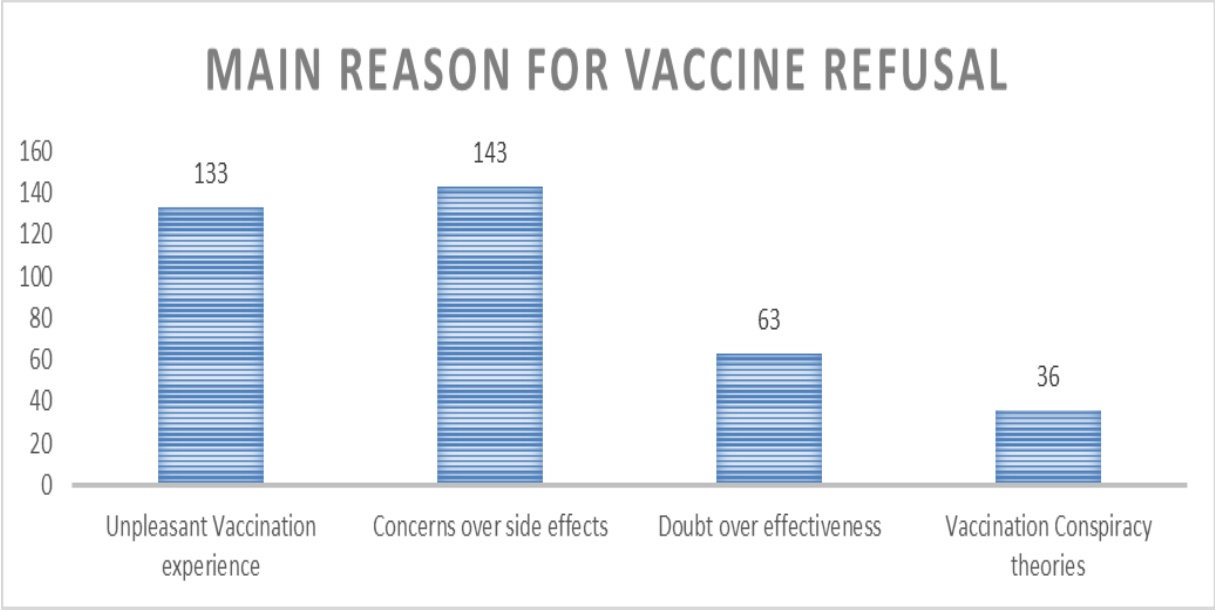
100
50
0
275
100
225
150
264
111
182
193
No
Yes
No
Yes
No
Yes
No
Yes
Side effects of taking the vaccine
Covid-19 as a means of controlling Population Growth
Do you believe Covid-19 goes along with Religion
Do you believe Covid-19 causes damage to internal organs





DISCUSSION

The study utilized a prospective cohort study. An electronic questionnaire was administered to a total number of 375 Healthcare workers, in Abuja Municipal Area Council (AMAC). Data were entered and analysed using Excel/SPSS. The majority of the respondents were between the ages of 20-30 years (38.9%). Over a tenth (72%) of the respondents (Healthcare workers) reported to COVID-19 is real. While only 44.3% agreed to have tested for COVID-19. Furthermore, only 5.6% had tested positive for the virus. Although 60% of the

respondents agreed to have been vaccinated against COVID-19 and only 24.5% which represents 92 respondents have completed their COVID-19 vaccine doses. 139 Healthcare workers which represent 37.3% have taken the first and second doses. This could be attributed to everyone out of the 375 participants having been vaccinated with at least one injection (dose).

The data results showed that HCWs in AMAC are vaccine compliant, this could be related to the fact that the study was done after all the doses have been launched in Nigeria and the targets set by the National Primary Health Care Board to reach 70% coverage in 2022. The level of vaccine hesitancy in this study is low. Healthcare workers who participated in this study are most likely to accept the COVID-19 vaccine as the findings are similar to a study in the US (Shaw 2021, COVID-19 vaccination in a large University Health Care system). HCW perceived that the chances of contracting COVID-19 are high as evidenced by a study which reported that HCW had a seven-fold higher Risk of severe COVID-19 cases (Mutambudzi 2021, Occupation and Risk of severe COVID-19: prospective cohort study of 120 UK Biobank participants). Healthcare workers feel the moral obligation not to harm their patients; they feel compelled to protect the sick and vulnerable patients by vaccinating themselves with at least the first and second doses as reported in the study.

The major reason for COVID-19 vaccine Hesitancy in this study, highlighted by healthcare workers were concern about vaccine side effects (38.2%), Unpleasant Vaccination experience (35.4%), Doubt over effectiveness (16.8%) and Vaccination Conspiracy theories (9.5%). The doubt of the COVID-19 Vaccine may cause damage to internal organs in the nearest future, could be attributed to fear as (51.5%) agreed, representing 193 respondents among healthcare workers. While 48.5% of the respondents did not agree. This could also be attributed to a lack of information on how the vaccine was developed and tested. From the results, it shows that 225 respondents among healthcare workers agreed COVID-19 vaccine is a means of controlling population growth (60.0%), and only 40.0% did not agree, representing 150 Healthcare workers respectively. Also, 70.4% of the respondents disagreed that the COVID-19 vaccine goes along with Religion, and only 28.5% agreed.

The vaccination rate of Community Health workers is higher than that of doctors, nurses and other HCWs. Previous studies have shown that doctors are more willing to receive the COVID-19 vaccine than nurses and Community Health Workers, but the reverse is the case here in AMAC, which could be related to the fact that vaccine of any type is mostly handled

by the Primary Health Care Centres at the different Community level, which harbours mostly community health workers and volunteers, including Students on practical's from various Health institutions. Though looking at the results from the data collected, all the categories of HCWs had a significantly positive attitude towards vaccination.

The results indicate that Healthcare workers in AMAC believe that COVID-19 is real, and more than half of the respondents (60%) have been vaccinated against the virus. While about 24% have taken the first, second and booster doses. These findings are consistent with other African studies from the Democratic Republic of Congo 56% (Ditekemena et al). The similarities in findings may be due to the resemblance in the methodology used as well as the socio-economic and political settings in DRC. Though looking at a recent South African survey, it is pertinent to note that South African HCWs are most likely to accept the vaccine because of their high cases of COVID-19 and its co-morbidities just like Nigeria, particularly states like FCT and Lagos recorded a high number of cases. Moreover, the surveys from DRC were conducted before the vaccine was rolled out and different conspiracies on the vaccine were on the high side. Thus, the researchers predict an increase in vaccine acceptance as more advocacies on vaccine hesitancy were done. This will penetrate the populace and will make more people be vaccinated.

CONCLUSION

The study highlights some evidence that has been known to influence vaccine hesitancy amongst healthcare workers in AMAC. Religion and population control have been known as one of the myths surrounding vaccine hesitancy among healthcare workers. Even though the results, show respondents have more than average knowledge about the COVID-19 vaccine when it comes to religion and population control. All the twelve wards in AMAC were involved, though some were more represented than others. The study received a good response rate as data collection was completed in 22 days, (a reminder message was sent by the researchers to 2 platforms in the 2nd week) as no incentives were given to respondents to cover internet connection fees. Four (4) different WhatsApp platforms were used as proxies for distributing the data collection tool. Since the advent of the COVID-19 vaccine in the FCT, to my knowledge, this is one of the first studies on Vaccine Hesitancy amongst HCWs, particularly in the most urbanized Area Council in the FCT which is AMAC despite the relatively large sample size.

However, these results can be used to guide future health activities to improve COVID-19 vaccine uptake till the last dose. Also, Health promotion campaigns are required to make the vaccine more acceptable irrespective of being a Healthcare worker or not. Even though HCWs in AMAC have a strong willingness to receive the Covid-19 vaccine and have a high level of vaccine knowledge looking at the percentage of the respondents who have been vaccinated (60%) and ranging from different levels of doses uptake. The high vaccine acceptance amongst HCWs was also because most people will consult healthcare workers before deciding whether to be vaccinated or not.

This can be a good foundation to launch a successful COVID-19 vaccine awareness event amongst entire residents of Abuja Municipal Area Council in the Federal Capital Territory. Though, HCWs are like every normal human with the same emotions and dilemmas that all members of the general population experience when it comes to vaccination. Thus, despite their professional titles, discussions about HCW vaccination are likely to continue. Further studies should continue to examine effective interventions for not only increasing vaccination rates but changing fundamental attitudes leading to vaccine hesitancy.

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affirm Improvement in Infection Prevention and Control.

CHAPTER EIGHT

IMPACT OF END-TO-END QUALITY STRATEGY TO IMPROVE PERFORMANCE IN COVID-19 PANDEMIC RESPONSES IN FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA

CHAPTER EIGHT

IMPACT OF END-TO-END QUALITY STRATEGY TO IMPROVE PERFORMANCE IN COVID-19 PANDEMIC RESPONSES IN FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA

Submitted to: Pan African Medical Journal, PAMJ Headquarters

Nairobi, Kenya

ABSTRACT

Background: The Coronavirus disease 2019 (COVID-19) outbreak was declared a Pandemic on the 11th of March 2020. In Nigeria, Federal Capital Territory (FCT) Abuja, has the second largest cases of Covid-19, accounting for about 11% of total confirmed cases. Resolve to Save Lives (RTSL) supported Federal Capital Territory Emergency Operation Centre (FCTEOC) to improve critical response activities of the covid-19 response to prevent, promptly detect and isolate cases. The end-to-end quality improvement strategy was used to identify key bottlenecks in the response activities to use as a performance milestone to improve the covid-19 response in FCT.

Methods: A cross-sectional after-action review of the supported FCTEOC COVID-19 response activities using end-to-end quality improvement milestones to improve performance in the pandemic response activities. Data was extracted retrospectively from the Surveillance outbreak response management and analysis system (SORMAS) database of the Public Health Department, FCT.

Results: During the three months of support to improve the performance of COVID-19 response activities in FCT, cases investigated increased to 438,802, about 47.1% with 23, 125 confirmed COVID-19 cases (Figure 2). The case fatality rate was 0.9% with 13, 715 contacts listed. Although there was a remarkable increase in the proportion of the cases investigated and confirmed, it was not statistically significant with a chi-square of 2.68 and p-value = 0.26 at $p<0.05$.

Conclusion: The end-to-end quality improvement strategy helped the FCTEOC COVID-19 pandemic response activities to be more responsive to the FCT populace and enhanced programmatic care.

Key Words: *End to End quality strategy, improve performance in COVID-19 pandemic response*

INTRODUCTION

The Coronavirus disease 2019 (COVID-19) outbreak was declared a Public Health Emergency of International Concern (PHEIC) on the 30th of January 2020 and the Pandemic on the 11th of March 2020.[1] Since the outbreak, all facets of society, including health, Security, Political, Economic and Social life continue to be negatively impacted by the Pandemic.[1] In the health sector, the pre-existing fragile health systems especially in resource-poor countries were over-whelmed with the surge in cases at the peak of the second wave around June 2020.[1] Several countries in the African region implemented early comprehensive and strict Public Health and Social measures at the onset of the Covid-19 pandemic. However, public health interventions to the resurgences have lagged in many countries and have had less impact on reducing transmission, due largely to low compliance to public health protocols and inconsistent application of control measures.[1] Countries continue to report challenges with National and sub-National capacities for covid-19 response while maintaining resources for the continuity of essential health services. These challenges continue to be exacerbated in fragile, low-resource settings and countries.[1], [2]

World Health Organization has advised that countries should continue to take all necessary public health and social measures to slow the spread of SARS.COV2 to prevent infections, especially in people vulnerable to severe disease or death and avoid having the health systems overwhelmed.[2],[3] Enhanced surveillance, intensive testing and robust risk communication and community engagement are critical to effectively breaking the chain of transmission of the disease, guided by proper implementation of control measures and quality of services, which are necessary for outbreak response. Quality improvement is the action of every person working to implement iterative, measurable changes to make health services more effective, safe and people-centred.[4] It is also about giving the people quality care, the time, permission, skills and resources they need to solve them.[5] It involves a systematic and

coordinated approach to solving a problem using specific methods and tools with the intent to bring about a measurable outcome.

In Nigeria, the Federal Capital Territory (FCT) has the second largest cases of Covid-19, accounting for about 11% of total confirmed cases in the country.[6] As a result, Resolve to Save Lives (RTSL) partnered with the Federal Capital Territory Emergency Operation Centre (FCTEOC) to improve critical response activities of the covid-19 response in FCT to promptly identify and isolate cases, improve case investigation, improve call-in and turn-around time for covid 19 results as well as quarantine of contacts. There were barriers to the effective implementation of these response activities due to the continued community spread of covid-19, changing variants of the disease, and many cases and contacts. Effective follow-up and quarantine efforts including identifying asymptomatic cases for effective monitoring were hampered. The aim was to use an end-to-end quality improvement strategy to identify key bottlenecks in the FCT covid-19 pandemic response activities to improve performance milestones of the covid-19 response implementations in FCT.

METHODOLOGY

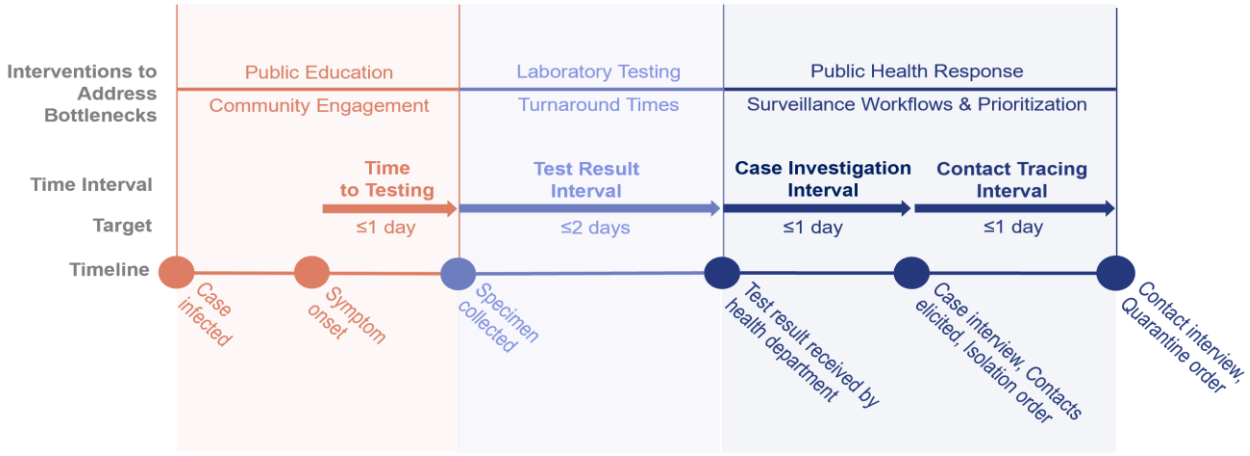
Description of the Study Area

Federal Capital Territory is in the Centre of Nigeria with a land mass of 7.315 km^2. It lies between latitude 8.25 and 9.20 north of the equator and longitude 6.45 and 7.39 east of the Greenwich meridian. The FCT is bordered by the states of *Niger* to the West and North, Kaduna to the Northeast, Nasarawa to the East and South and Kogi to the Southwest. The total population is close to five million and is subdivided into 6 Area Councils (Abaji, Bwari, Gwagwalada, Kuje, Kwali and Municipal) which are equivalent to Local Government Areas (LGA) in other states of Nigeria. The FCT confirmed its cases of covid-19 on the 20th of March, 2020 and a Multi-Sectoral Covid-19 Emergency Operation Centre (FCTEOC) was activated on the 23rd of March, 2020 to coordinate covid-19 response activities in the FCT.

Description of the End-to-End Quality Improvement Milestone.

The end-to-end quality improvement milestone has interventions to address bottlenecks at activity levels. Before the introduction of the end-to-end quality improvement strategy, there were recognized delays in the case investigation and time to testing, delays in the turn-around

time of results with a subsequent link to health care services leading to apathy among the populace.



The Resolve to Save Lives (RTSL) supported the FCTEOC Covid-19 response activities using end-to-end quality improvement milestones to improve performance in the pandemic response activities.

Public Health Surveillance is pivotal to the prevention, detection, and isolation of covid-19 cases to break the chain of transmission in the community. In addition, during the outbreak, risk communication and community engagement help to educate and inform the community about the risk posed by the disease to the populace and how to mitigate such risks and stop transmission. Laboratory services help to identify those with the disease for isolation and treatment. There should be proper coordination of these response activities during disease outbreaks for effective and efficient use of scarce resources in response to the pandemic.

The bottleneck analysis was used to determine the standard of covid-19 response activities and the challenges inherent to FCT covid-19 response activities in terms of surveillance, Risk communication and community engagement, laboratory services and coordination of response activities to the pandemic. In surveillance, the activities were to set up and popularize the state call centre to respond to queries and alerts on covid 19 including testing requests from the public and health facilities. Establish linkage with the surveillance team and rapid response team. To conduct training for the call centre volunteers. Engage officers to retrieve results from the SORMAS and communicate timely with the patients and case managers and support the surveillance data team.

Risk communication and community engagement were supported to manage rumours and misinformation through weekly radio discussions and phone programs in addition to grass-root sensitization. The laboratory was supported to conduct training on the use of rapid diagnostic kids to improve the turn-around time of results and transition to electronic case investigation forms.

Areas of FCT COVID-19 Support

RESPONSE PILLAR	ACTIVITIES
SURVEILLANCE	Set-up and popularize State call centre to respond to queries and alerts on COVID-19 including testing requests from the public and health facilities. Establish linkage with surveillance team/RRT
	Conduct a one-day training for call center volunteers
	Engage 8 officers to retrieve results and communicate timely to patients and case managers
	Support for the State Surveillance data team including engagement of data officers
RISK COMMUNICATION AND COMMUNITY ENGAGEMENT	Support mechanism to manage rumors and misinformation through weekly Radio discussions and phone-in program
	Activate and use Ward/facility development committee for grassroot community sensitization 62 wards: Sensitization/training/ Meetings
LABORATORY	COVID-19 Rapid Diagnostic Testing (RDT) 2-day Training for selected 12 HFs across 6 area councils
	Payment of 3 months allowance for 20 volunteer sample collectors
	Electronic case investigation form (e-CIF) training for Private laboratories Disease Surveillance and Notification Officers (DSNOs) and data clerks
COORDINATION	Recruitment of Data Manager

Data Collection and Analysis

Data was extracted retrospectively from the Surveillance outbreak response management and analysis system (SORMAS) database of the Public Health Department, FCT. The data was from the start of the outbreak in FCT on the 20th of March 2020 to the 31st of June 2021 before the three months of support from RSTL. Data for the three months of technical support, July, August, and September 2021 were also retrospectively extracted. The result was compared with the previous response activities over the same period.

Analysis was done using Microsoft office excel 2021 to highlight the timeliness of sample collection from symptom on set among symptomatic cases, the time between specimen collection and the arrival of the laboratory test report to the public health department (Turn-around time of results) and the completeness of cases of Covid 19 quarantine. Proportions and percentage of the outcome measures were done, and the Chi-square test was used to compare

covid 19 cases investigated and confirmed using Winpepi version 11.30 at p< 0.05 and 95% confidence interval. For improved performance, 80% was the landmark acceptable for the response activities during the three months of support.

RESULTS

The total number of cases investigated as of June 2021 was 232,339 with 20,951 confirmed cases of Covid 19. The case fatality rate was 0.8% and the contact listed was 12,395 (Figure 1). During the three months of support using an end-to-end quality strategy to improve the performance of covid 19 response activities in FCT, cases investigated increased to 438,802, about 47.1% with 23, 125 confirmed covid 19 cases (Figure 2). The case fatality rate was 0.9% with 13, 715 contacts listed. Although there was a remarkable increase in the proportion of the cases investigated and confirmed, it was not statistically significant with a chi-square of 2.68 and p-value = 0.26 at p<0.05.

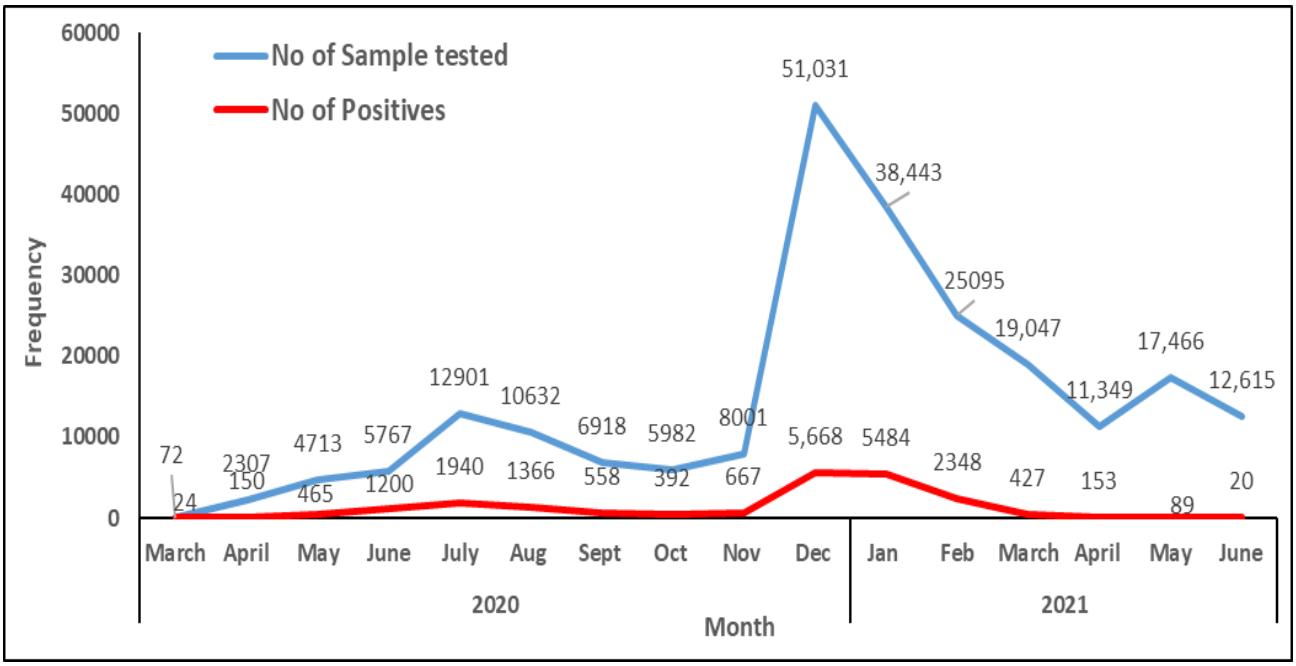


Figure 1: Monthly samples collected and confirmed cases from March 2020 to June 2021

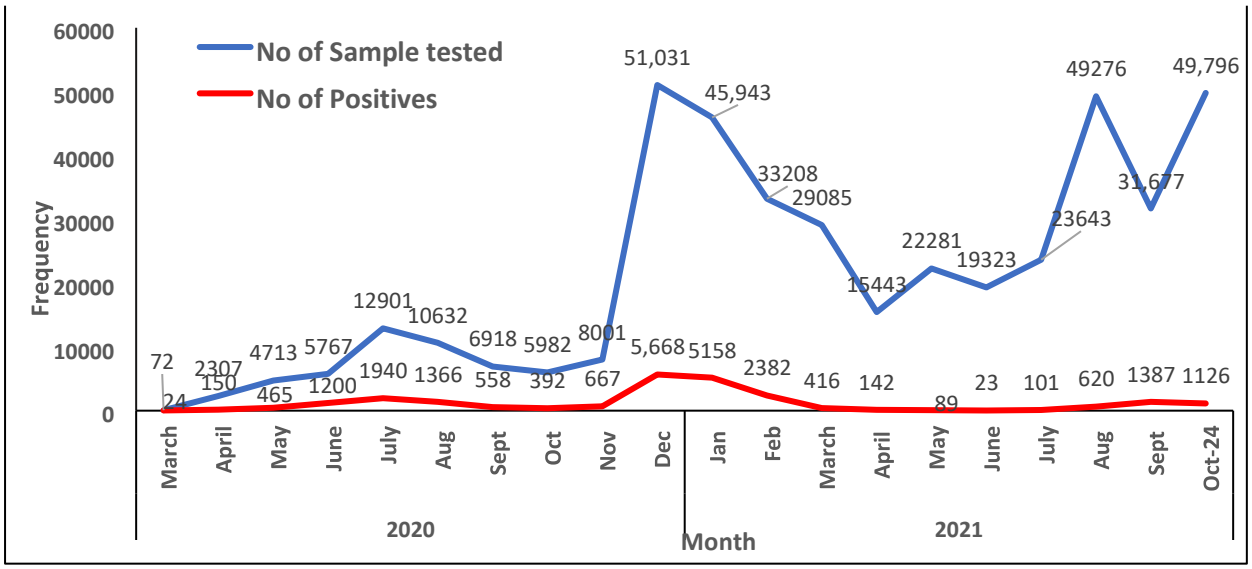


Figure 2: Monthly samples collected and confirmed cases from March 2020 to September 2021

There was improved timeliness in the specimen collection and report of results to the Department of public health for decision-making (Tables 1 and 2). Also, the completeness of isolation of cases of covid 19 to reduce the spread in the populace was seen in addition to the other metrics of measurement of the covid 19 response in the said period for evidence decision-making in the FCTEOC (Tables 3 and 4).

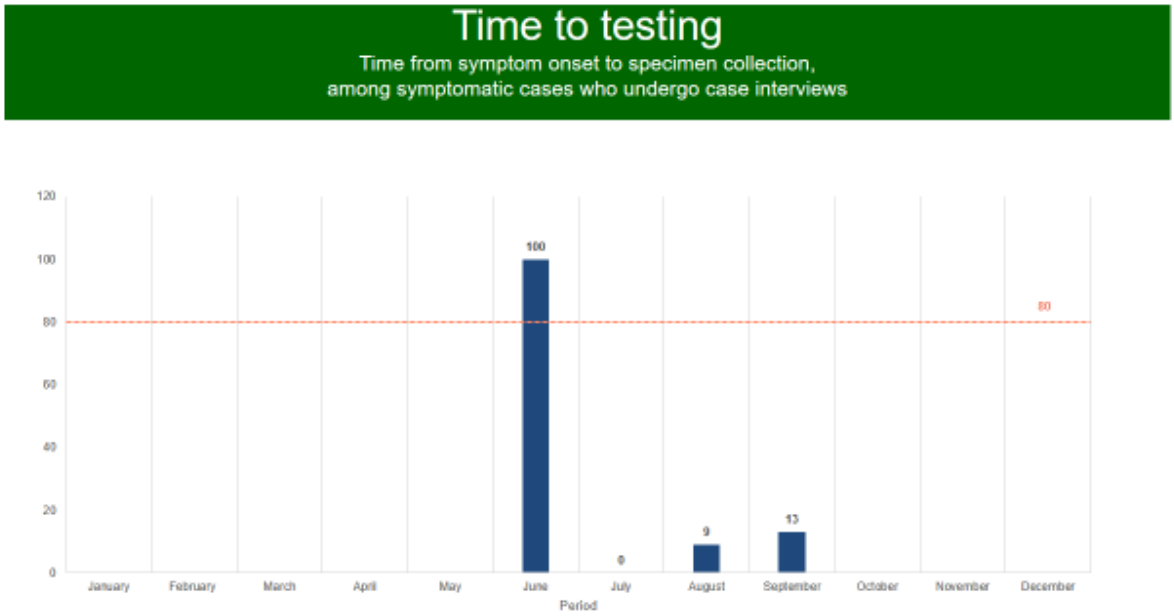


Table 1: Time to Testing before the end-to-end strategy.

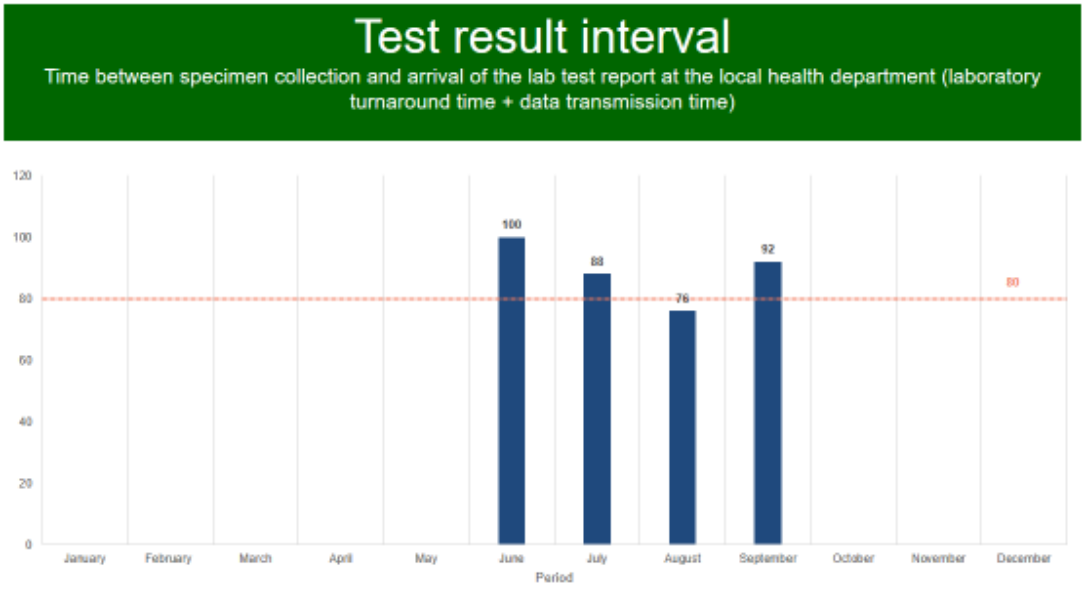


Table 2: Time to Testing during the end-to-end strategy.

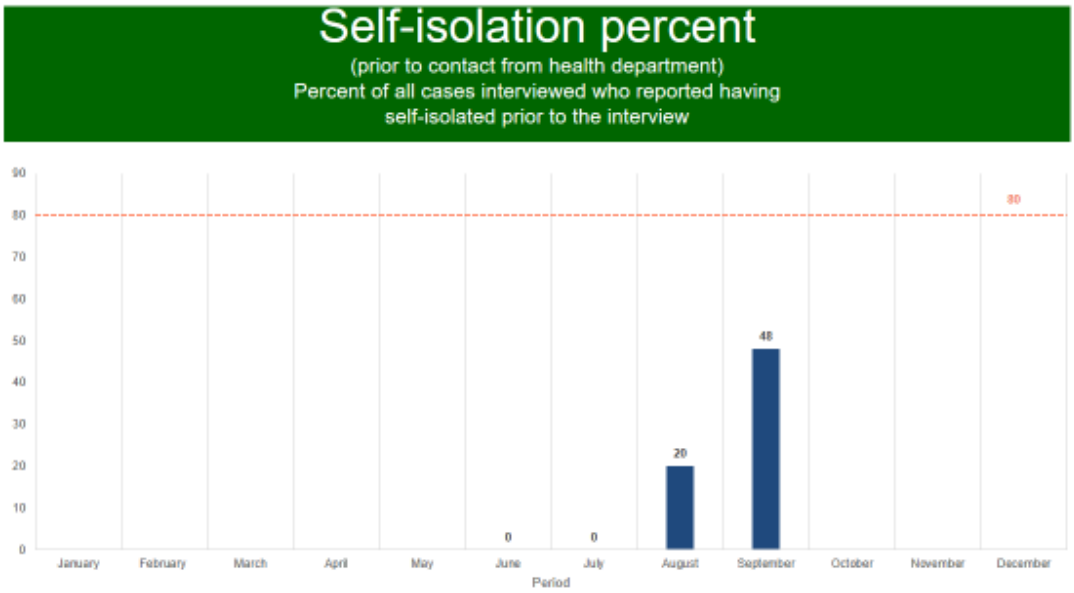


Table 3: Self-isolation before the end-to-end strategy.

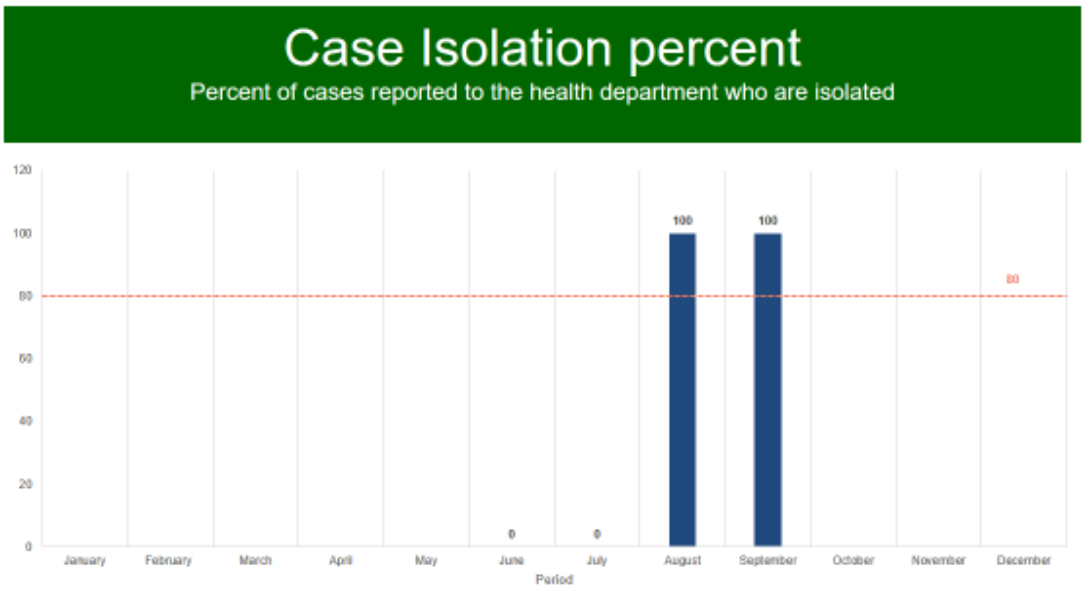


Table 4: Self-isolation during the end-to-end strategy

DISCUSSION

The bottleneck analysis using an end-to-end strategy helped in the identification of the gaps in covid 19 pandemic response activities in the FCT. The main aim of covid 19 response was to prevent, detect, isolate, and send appropriately treat cases of covid 19 to reduce morbidity and mortality resulting from Covid 19 infection among the populace in FCT. The decline in the covid 19 case investigation and detection necessitated the bottleneck analysis of the response activities using an end-to-end strategy to identify the root cause of the gaps and ways to mitigate them through metrics of indicators to measure the outcome of response activities after three months.

During the period of the end-to-end strategy to improve performance in covid 19 response in FCT (July – September 2021), a total of (438,802 against 232,339) 206,493 samples were collected showing a 47.1% increase from what it was in June 2021 with 2,174 confirmed cases in FCT in same period. This approach was similar to what was done in FCT Abuja, Nigeria where community active case search contributed to the community surveillance for covid 19 which revealed community transmission of covid 19 in the early phase of covid 19 in Nigeria.[7] Improvement in the quality of health care is a pivotal entry point for health system strengthening. Quality improvement approaches play a pivotal role in improving the quality of health services and response activities delivered across the various levels of the health system[4] and in the case of pandemic response, levels of response activities.

The timeliness in testing and reporting also increased from 9% in August 2020 and 13% in September 2020 to 76% and 92% respectively in 2021, within and above the 80% mark for all response activities during the end-to-end strategy to improve performance in covid 19 response. The FCT covid 19 response activities became more responsive to the populace. This is in tandem with global practice and calls that there is a need to look beyond service coverage and financial protection and emphasize more improvements in the quality-of-service delivery, which should be at the core of the country's action. This is because the quality of health services, coupled with services coverage will play a critical role in strengthening the national health system and improving health outcomes [4].

CONCLUSION

Improvement in the quality of health care and outbreak response is a pivotal entry point for health systems strengthening. The end-to-end quality strategy to improve performance has

provided the catalytic impetus in the response activities to covid 19 pandemic in FCT and this has been integrated into other program activities to improve performance.

Limitation

The limitation of the review was incomplete data entry, especially during the case investigation.

Strength of the Study

An end-to-end quality strategy to improve performance using bottleneck analysis was used for the first time in our response to covid 19 pandemic response activities to improve response in FCT, Nigeria.

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CHAPTER NINE

GENERAL DISCUSSION

CHAPTER NINE

GENERAL DISCUSSION

The overall aim of this research project is to evaluate the impact of the COVID-19 pandemic on the health system of the Federal Capital Territory (FCT), Abuja, Nigeria, and elucidate strategies to be prepared for upcoming pandemics. This project was achieved by conducting six individual studies, which involves specific objectives. The results and findings from these separate studies will be discussed in detail to help answer the research questions and justify the central aim of this research project.

The first study evaluated the dimensions of the COVID-19 pandemic in the FCT, Abuja, Nigeria. This study revealed that the first COVID-19 cases in Nigeria and the FCT originated from international contacts, with most clustered in the Municipal area council. Of the 70 confirmed cases, 57% came from Saudi Arabia and 20% from the UK, which had its first COVID-19 cases before Nigeria (Jian-Min et al., 2020). Rising new cases without recent travel or contact indicate community transmission. The FCT had the highest number of samples taken per million population in the country, mainly due to community active surveillance and digitally marginalized populations. Women had over twice the number of tests (5,899) as men (2,823), possibly due to cultural practices restricting female movements and limited access to testing. This sex difference may account for the difference in confirmed cases between men (456) and women (204) by almost the same margin.

The FCT has a younger age group of COVID-19 cases, with the most affected being 15-34 years old. This may contribute to a low fatality rate but also have significant economic impacts (Jennifer et al., 2020). 60% of confirmed cases were over 50 years old, with comorbidities like hypertension and diabetes. Our study showed that ninety-five percent (95%) of COVID-19 cases died in the FCT, with men being more at risk for worse outcomes. The mean age of those who died was 50 years, with factors like genes, hormones, immune system, high-risk behaviour, and chronic diseases contributing to this gender role. In addition, the disease significantly impacts women and girls, causing lockdowns, domestic violence, rape, and teen pregnancies. Men's deaths and lockdowns result in economic hardship, redistributing resources and causing increased domestic violence and rape.

The second study evaluated the infection prevention and control (IPC) practices experienced in public and private health facilities in FCT, Abuja during the COVID-19

pandemic. This study revealed that the COVID-19 pandemic has impacted global health systems, affecting human resource and training needs. Improvement in IPC capacity and behaviours among healthcare workers is crucial. Nationally comprehensive, well-funded implementation is needed to protect healthcare workers, patients, and communities (Erick et al., 2020).

The study also assessed IPC implementation in private and public healthcare facilities in FCT using WHO's infection prevention and control assessment tool. Results showed no significant difference in overall IPC practice, above the average of 80% required for epidemic disease control. The high proportion of good IPC may be due to intervention activities in both facilities, allowing facilities to better understand IPC and the best implementation strategies for their safety and patients' well-being. More so, our findings revealed that 11.6% of private and 7.8% of public facilities have poor IPC, similar to 12.5% and 19.2% in Ghana (Philip et al., 2021), and Kenya (Bedoya et al., 2017). This increases HCWs' exposure to nosocomial infections and COVID-19 infection risk. Strengthening governance and leadership at health facilities is crucial for adherence to IPC policies and SOPs.

Furthermore, our study found that over two-thirds of facilities in both private and public settings had functional IPC committees, similar to River and Ghana's IPC programs (Philip et al., 2021). Establishing IPC programs is crucial for limiting infectious disease spread, but achieving goals is difficult without clear implementation goals. Further improvement is needed for quality IPC practice. Most healthcare facilities have IPC protocols, but adherence is insufficient. Evidence-based guidelines can reduce hospital-acquired and antimicrobial resistance, with local adjustments sustaining good practices. Most healthcare workers have received IPC training in the last six months, but there is a disparity in education. To ensure uniformity, IPC should be included in training curricula at all levels and integrated nationwide (Oppong et al., 2020).

Furthermore, the study found that over two-thirds of facilities had an infection prevention and control protocol without clearly stated objectives or activities. In Ghana, over fifty percent had an IPC program without defined objectives (Philip et al., 2021). Most facilities had trained health workers on hand hygiene, highlighting the need for awareness creation, information, education, and periodic training for infection prevention and control. In addition, less than one-third of facilities have good waste disposal methods, and less than half use incineration. Most use mixed methods, including incineration, open burning, general dumpsite,

and burying, to prevent infection. The World Health Organization recommends safe waste disposal methods like thermal, chemical, and containment processes.

The third study evaluated the diagnostic performance of COVID-19 serological assays with SARS-COV-2 in health care settings of FCT, Abuja. This study found Saytul and Global Access had lower positive rates than SARS-COV, with a significant difference in diagnostic performance compared to the gold standard (Bedoya et al., 2017). Their sensitivity was lower than average, possibly due to differences in study populations and test strip peculiarities. Findings from this study also showed that rapid tests may not detect viral antigens accurately, potentially missing out on people with the disease. This poses a threat to public health and compromises disease control efforts. Healthcare providers should consider confirmatory tests for SarCOV-2 to avoid false positives and defeat efforts to contain COVID-19 (Lawal et al., 2022).

In addition, our study found age significantly associated with SARS-COV-2 infection, with lower positivity rates in those under 30 years and the highest rates in those over 60 years. This suggests higher COVID-19 risk among elderly individuals and higher mortality rates in those over 55 years old. No gender differences exist among participants, and SAR-COV 2 and married status were statistically associated. Married women cope better, and policies on education and sustainable living were recommended due to unequal socioeconomic distributions. Thus, these findings showed that the COVID-19 pandemic demands urgent measures to contain severe morbidity and mortality, including correct identification of cases using high-sensitivity and specificity tests. More effort is needed to prevent misclassification and its consequences on individuals, families, and healthcare systems (Dowd et al., 2020).

The fourth study evaluated the knowledge, perceived risk, and willingness for COVID-19 vaccine uptake among primary healthcare workers in Abuja, Nigeria. This study revealed that over half of respondents have good knowledge of coronavirus diseases, higher than a third in Kebbi state (Habib et al., 2021). This may be due to the pandemic's impact on daily life and academic activities, as well as guidelines and protocols for proper conduct. A study among the Iranian population found that most have good knowledge of COVID-19, possibly due to increased exposure to information from governments and media (Erfani et al., 2020). However, nearly half had poor knowledge, concerning healthcare workers who are expected to have accurate knowledge and serve as a source of information for the general population.

The study found no significant association between knowledge of coronavirus disease and age groups but found that the male gender was associated with good knowledge. Older individuals, mostly married, are quick to act and are involved in COVID-19 campaigns. In addition, it reported that a study in Japan found females have higher knowledge and correct explanations of COVID-19 information than males (Hatabu et al., 2020). However, a study in Northern Nigeria found no significant association between gender and COVID-19 knowledge (Habib et al., 2021). Targeted approaches for specific demographic characteristics are needed to improve health education support programs. Our study also found no association between education level and knowledge of coronavirus disease, unlike a previous study in Syria. Most respondents were healthcare workers, possibly due to differences in methodology and study population.

Furthermore, our study also revealed that health workers frequently receive information on COVID-19 symptoms and transmission mode, but their knowledge is at risk of complications due to evolving information. Television and radio are the primary sources of information on COVID-19, suggesting the use of these channels for health promotion and risk communication. Less than half of respondents believe they are likely to be sick with the coronavirus, with most believing it is dangerous or very dangerous. This is similar to Ethiopia (Kabito et al., 2020), and Iran (Erfani et al., 2020), where most respondents have a high-risk perception. Factors such as study population, methodology, data, and virus spread may also influence risk perceptions. In addition, our study found that 90% of healthcare workers (HCWs) were aware of the coronavirus vaccine and willing to receive it if it was available. This is consistent with studies in seven European countries (Neumann-Böhme et al., 2020). However, a lack of trust in government and religion is a reason for vaccine hesitancy, which affects COVID vaccine uptake. This challenge is particularly significant in Nigeria, where poor vaccine compliance and coverage are hindering herd immunity efforts.

The fifth study evaluated the influence of vaccine hesitancy amongst healthcare workers on COVID-19 vaccine distribution in Abuja Municipal Area Council (AMAC), FCT, Nigeria. This study revealed that the prospective cohort study of 375 healthcare workers in Abuja Municipal Area Council used an electronic questionnaire. The majority were aged 20-30, with 72% reporting COVID-19 as real, while 44.3% agreed to test, and 5.6% positive. In addition, 60% of respondents have been vaccinated against COVID-19, but only 24.5% have completed their doses, with 37.3% of healthcare workers taking the first and second doses.

More so, our study found that healthcare workers in AMAC are vaccine compliant, likely due to the launch of new doses and the National Primary Health Care Board's 70% coverage target in 2022. The study found low vaccine hesitancy, and HCWs perceived high risk of contracting COVID-19. They feel a moral obligation to protect vulnerable patients and vaccinate themselves with at least the first and second doses (Obafemi et al., 2021).

Our study also found that healthcare workers are hesitant about the COVID-19 vaccine due to concerns about side effects, unpleasant experiences, doubt over effectiveness, and conspiracy theories. Fear of potential organ damage and lack of information about vaccine development contributed to this hesitancy. Most respondents agreed that the COVID-19 vaccine is a means of controlling population growth, while only 40.0% disagreed. Community health workers have a higher vaccination rate than doctors, nurses, and other healthcare workers (Leask, Wallaby, and Kaufman, 2014). This may be due to primary healthcare centres handling vaccines, which mostly involve community health workers and volunteers. All categories of HCWs have a positive attitude towards vaccination.

Furthermore, healthcare workers in AMAC believe COVID-19 is real, with 60% of respondents having been vaccinated. 24% have taken the first, second, and booster doses. This is consistent with African studies from the Democratic Republic of Congo (56%). South African healthcare workers are likely to accept the vaccine due to high COVID-19 cases and co-morbidities. The DRC surveys were conducted before the vaccine was rolled out, suggesting an increase in vaccine acceptance as more advocacies on vaccine hesitancy are addressed.

The sixth study evaluated the impact of end-to-end quality strategy to improve performance in COVID-19 pandemic responses in FCT, Abuja, Nigeria. This study indicated that the bottleneck analysis using an end-to-end strategy identified gaps in COVID-19 pandemic response activities in the FCT. The main aim of this study was to prevent, detect, isolate, and treat cases to reduce morbidity and mortality. The decline in case investigation and detection led to a need for a bottleneck analysis to identify root causes and mitigate them using indicators (WHO, 2018). The end-to-end strategy for improving COVID-19 response in FCT (July-September 2021) collected 438,802 samples, a 47.1% increase from June 2021, with 2,174 confirmed cases.

This end-to-end approach is similar to FCT Abuja, Nigeria, where community active case search contributed to early COVID-19 transmission (Abdullahi et al., (2020). Quality

improvement approaches are crucial for strengthening health systems and improving response activities. The FCT's testing and reporting timeliness increased from 9% in 2020 to 76% and 92% in 2021, achieving 80% performance in COVID-19 response activities (Jana et al., 2021). This aligns with global practice, emphasizing quality service delivery and financial protection as core actions for strengthening national health systems and improving health outcomes.

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CHAPTER TEN

RECOMMENDATIONS

CHAPTER TEN

RECOMMENDATIONS

These recommendations, grounded in the study's findings, aim to bolster the preparedness of the healthcare system in the Federal Capital Territory, Abuja for potential future pandemics. By focusing on infrastructure enhancement, preparedness planning, and technological integration, the region can better safeguard public health and mitigate the impact of future health crises.

1. Enhance Healthcare Infrastructure and Resource Allocation:

The study findings emphasize the importance of strengthening the healthcare infrastructure and resource allocation in the Federal Capital Territory, Abuja. Recommendations include increasing the number of healthcare facilities, beds, medical equipment, and personnel to ensure that the healthcare system can handle a surge in patient numbers during future pandemics. This also involves strategic planning to identify potential makeshift hospitals or treatment centres and establish effective supply chains for medical resources.

2. Develop Comprehensive Pandemic Preparedness Plans:

The research projects highlight the necessity for comprehensive pandemic preparedness plans tailored to the local context. Recommendations involve creating well-defined protocols for disease surveillance, rapid testing, contact tracing, and quarantining. These plans should outline the roles and responsibilities of various government agencies, healthcare institutions, and community organizations in the Federal Capital Territory, Abuja. Regular drills and simulations can be conducted to ensure the readiness of all stakeholders to respond swiftly and effectively to future pandemics.

3. Invest in Telemedicine and Digital Health Solutions:

The study underscores the role of technology in maintaining healthcare services during a pandemic. Recommendations include promoting and investing in telemedicine platforms and digital health solutions that allow remote consultations, prescription refills, and medical advice. Establishing a robust telehealth infrastructure can help reduce the burden on physical

healthcare facilities in the Federal Capital Territory, Abuja, and provide a means of delivering medical care while minimizing the risk of transmission during pandemics.

CHAPTER ELEVEN

CONCLUSIONS

CHAPTER ELEVEN

CONCLUSIONS

A summary of the conclusions from the six separate studies will form the basis of the conclusion of this research project, which will in turn answer the research questions and justifies the central aim of the research project. This present research investigated the impact of the COVID-19 pandemic on FCT Abuja's health system, identifying weaknesses and resilience, and proposing strategies to improve preparedness for future pandemics. The first study which evaluated the dimensions of the COVID-19 pandemic in the FCT, Abuja, Nigeria concluded that men and women have the same COVID-19 prevalence, but men are at higher risk of severe disease and death. Thus, gender analysis and sex-disaggregated data should guide policies and actions, as prioritizing women and girls in COVID-19 palliatives, preserving reproductive and sexual health services, and investing in girl child education can prevent dropout.

The second study which evaluated the infection prevention and control practices experienced in public and private health facilities in FCT, Abuja during the COVID-19 pandemic, concluded the COVID-19 pandemic has emphasized the importance of effective infection control (IPC) programs, with monitoring and supervision crucial for improved practices. Thus, training and education for healthcare workers on IPC can reduce infection risk. The third study which evaluated the diagnostic performance of COVID-19 serological assays with SARS-COV-2 in health care settings of FCT, Abuja, concluded that RTKs have low sensitivity but high specificity, impacting coronavirus infection identification and spreading. Hence, enhancing diagnostic accuracy is crucial for preventing infection and improving technology and understanding of the virus.

The fourth study which evaluated the knowledge, perceived risk, and willingness for COVID-19 vaccine uptake among primary healthcare workers in Abuja, Nigeria, found sub-optimal COVID-19 knowledge among healthcare workers, with news media being the primary source. Hence, low-risk perception and high vaccine uptake suggest further improvement and consider belief systems in control measures. The fifth study which evaluated the influence of vaccine hesitancy amongst healthcare workers and COVID-19 vaccine distribution in Abuja Municipal Area Council (AMAC), FCT, Nigeria, concluded that respondents have more than average knowledge about COVID-19 vaccines, with some wards more represented. Hence,

successful COVID-19 vaccine awareness can be achieved among Abuja residents, as healthcare workers (HCWs) share similar emotions and dilemmas as the general population. The sixth study which evaluated the impact of end-to-end quality strategy to improve performance in COVID-19 pandemic responses in FCT, Abuja, Nigeria, concluded that enhancing healthcare quality and outbreak response is crucial for strengthening health systems, and end-to-end quality strategies have catalyzed response activities during the COVID-19 pandemic.

ANNEXES

ANNEXES

RESEARCH PUBLICATIONS FOR PhD BOOK

ARTICLE 1: Dimensions of the COVID-19 pandemic in the FCT, Abuja, Nigeria

- ***Published in*** *"African Journal of Biology and Medical Research. 2020."*

ARTICLE 2: Infection prevention and control practices in public and private health facilities in Federal Capital Territory, Abuja experienced during the COVID-19 pandemic

- ***Published in*** *"Journal of Community Medicine and Public Health. 2023."*

ARTICLE 3: Evaluating the diagnostic performance of COVID-19 Serological Assays with SARS-COV-2 in Health Care Settings of Federal Capital Territory, Abuja

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ARTICLE 4: Knowledge, perceived risk, and willingness for COVID-19 vaccine uptake among Primary Healthcare Workers in Abuja, Nigeria

- ***Published in*** *"Journal of Case Reports and Medical History. 2023."*

ARTICLE 5: Evidence-Based Decision Making Of COVID-19 Vaccine Distribution in Abuja Municipal Area Council, FCT Nigeria: Study On Influence of Vaccine Hesitancy Amongst Healthcare Workers.

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ARTICLE 6: Impact of end-to-end quality strategy to improve performance in COVID-19 pandemic responses in federal capital territory, Abuja, Nigeria

- ***Submitted to*** *"Pan African Medical Journal"*

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