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Vaccine inequalities, hesitancy, and media-focused public health interventions in English-speaking West-African Countries

Abideen David Amodu [1, *], Chukwuemeka Oluebube Ochuba [2], Ibrahim Temitope Badirudeen [1] and Kingsley Okwuruoha Ikeokwu [1]

[1] *Federal University Oye-Ekiti, Ekiti State, Nigeria.*
[2] *Federal University of Agriculture, Makurdi, Benue State, Nigeria.*

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Abstract

Background: Vaccine hesitancy poses a significant challenge to public health efforts in English-speaking West-African countries amidst the COVID-19 pandemic. This study aims to examine the multifaceted factors contributing to vaccine hesitancy in the region, including issues of trust, misinformation, cultural beliefs, and access barriers.

Methods: This study reviewed data from three African countries, Nigeria, Ghana, and the Gambia, to analyze attitudes towards vaccination. It also assessed variations in attitudes across these countries and compared them with attitudes in the western world. Qualitative and quantitative methods were employed to gather and analyze data on vaccine hesitancy and related factors.

Results: The study found substantial variation in attitudes towards vaccination across the surveyed countries and compared to the western world. Factors contributing to vaccine hesitancy included historical injustices, misinformation, cultural beliefs, and access barriers such as limited healthcare infrastructure and vaccine supply constraints. Media-focused public health interventions were identified as crucial in addressing vaccine inequalities and enhancing vaccine acceptance.

Conclusion: Overcoming vaccine hesitancy in West Africa requires tailored approaches that acknowledge and address historical injustices and inequities, emphasize culturally appropriate messaging, and utilize existing community infrastructure to deliver accurate information. Targeted communication strategies are essential to combat misinformation and enhance vaccine acceptance. By analyzing the intersection of vaccine hesitancy, media interventions, and public health challenges, this study underscores the need for comprehensive and community-engaged campaigns to promote vaccination and combat the spread of COVID-19 in West Africa.

Keywords: Africa; COVID-19; Ghana; Hesitancy; Nigeria; Public Health; The Gambia; Vaccine

1. Introduction

The virus responsible for causing the COVID-19 illness, formerly known as the '2019-novel coronavirus,' is called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). This virus is an enveloped virus that contains positive-sense single-stranded RNA. The first case was recorded at the Wuhan Jinyintan Hospital in Wuhan, China, and was believed to have arisen from zoonotic transmission (Akande & Akande, 2020; Gorbalenya et al., 2020). The COVID-19 pandemic impacted the narratives of disease prevention and control around the world owing to its huge impacts on global health, communication, politics, and other related affairs (Güner, Hasanoğlu, and Aktas, 2020). With almost 7 million deaths

* Corresponding author: Abideen David Amodu

worldwide and the economic consequences that accompanied the lockdown and travel restrictions that were imposed globally as measures to curtail the spread of the virus, the COVID-19 pandemic has still, however, caused unparalleled worldwide difficulties, leading to rapid and broad measures to alleviate its consequences (van Hoek, 2020). Generally, global efforts were mainly centred on clinical and biomedical controls such as the design and adoption of treatment plans, which resulted in the development of vaccines and other healthcare interventions and the adoption of socio-medical measures such as self-isolation, quarantine, lockdown, and movement and travel restrictions (Excler et al., 2020; Lau et al., 2020; Le et al., 2020).

While extensive studies have highlighted the importance of this intervention in reducing the impacts of the pandemic (Mišík and Nosko, 2023; Nandu et al., 2023), while some countries have advanced well in their post-recovery stages, many African countries are still endeavouring to manage the intricacies of post-pandemic recovery (Czerny, 2021; Kodali, 2023; Yeng et al., 2021), and in these contexts, vaccination appears as a crucial element in restoring public health and adaptability. We approach this study from a public health communication perspective, with a focus on the intersection of healthcare and digital public health interventions in post-pandemic times in Nigeria, Ghana, and the Gambia.

2. Vaccine Distribution Inequality: African Perspectives

Based on the paradigm that "no one is secure until everyone is secure," public health experts and global leaders urged that vaccines should be fairly and equitably available across the world, making appeals for a COVID-19 vaccine as a global common good (Yunus, Donaldson & Perron, 2020). The World Health Organization (WHO), the Vaccine Alliance, the Coalition for Epidemic Preparedness Innovations (CEPI), and Gavi established the COVID-19 Vaccines Global Access (COVAX) initiative to set up a framework for fair access to COVID-19 vaccines globally. Aligned with pledges to "leave no one behind," COVAX aims to allocate enough doses to support 92 funded low- and middle-income countries (LMICs), including 46 in Africa, to immunise 20% of their population in 2021, focusing on health workers and the most vulnerable groups.

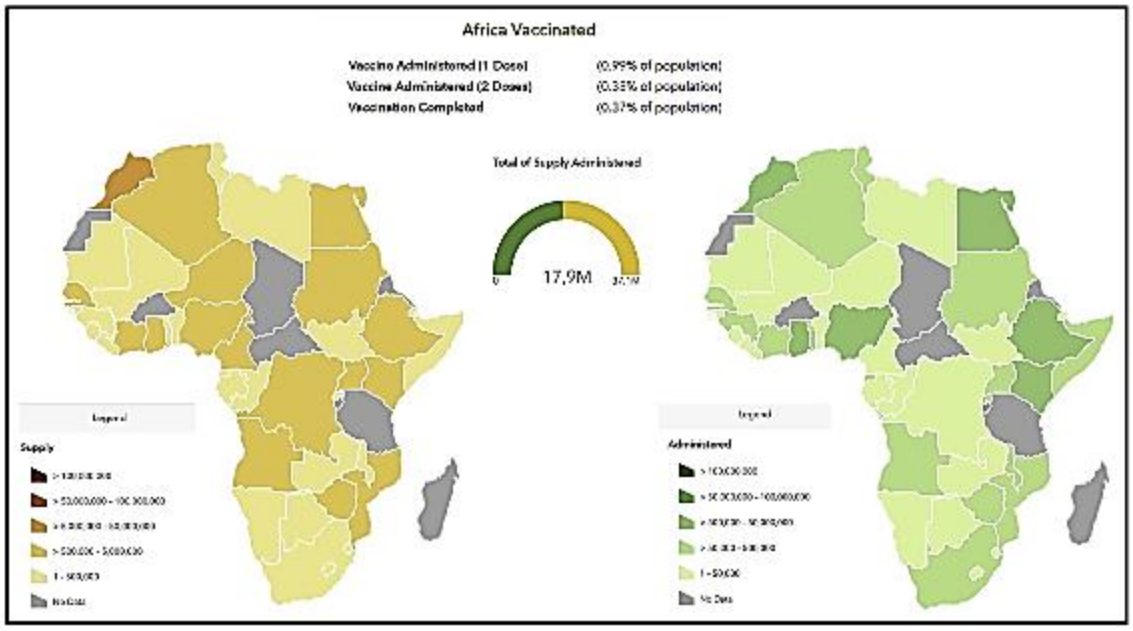

Figure 1 COVID-19 vaccine rollout in Africa: doses supplied and administered by end of April 2021 (Lombe & Nkengasong, 2021)

Despite these pledges for global equity, by the end of April 2021, 3 quarters of the 1 billion COVID-19 vaccine doses administered globally had been given in 10 nations only (Kreier, 2021). African countries had barely administered 18 million COVID-19 vaccine doses out of the 37 million they had available. This represented less than 2% of all doses inoculated globally, corresponding to a coverage of only 1.4% of the continent's population. Vaccine access in Africa today is a case of history repeating itself, with the infamous episodes of inequitable access to HIV therapies or hoarding of the H1N1 vaccine doses by a few during the 2009 outbreak being re-enacted (Nkengasong, Ndembi, Tshangela, Raji, 2020). With a limited pool to choose from, African countries resorted to vaccines donated by the governments of China,

Russia, and India to initiate their national COVID-19 immunisation campaigns, a geopolitical phenomenon dubbed "vaccine diplomacy," often ahead of their inclusion on the WHO Emergency Use Listing (EUL) with only limited efficacy and safety data publicly available. These vaccines included the BBIBP-CorV vaccine by Sinopharm, China (used in 20 countries), the Coronavirus vaccine by Sinovac, China (used in 4 countries), the Sputnik V vaccine by Gamaleya Institute, Russia (used in 6 countries), and the Covaxin vaccine by Bharat Biotech, India (2 countries). It is important to note that there are inequalities at the regional level in the COVID-19 vaccine rollout in Africa. At both extremes, 8 countries were yet to receive any supply and initiate immunisation (Burkina Faso, Burundi, Chad, the Central African Republic, Eritrea, Madagascar, Tanzania, and the Saharawi Republic), whereas the Seychelles, with close to 60% of its population fully vaccinated, is ranked second globally, only behind Gibraltar.

3. Inequality in COVID-19 Vaccine Distribution in Africa: Causes and Effects

Significant disparities have existed in the distribution of vaccines throughout Africa, both between and within populations. Limited vaccine production capacity has led to prioritisation strategies where high-risk groups and healthcare personnel are often given precedence. Despite these efforts, disparities still exist as a result of factors like race, ethnicity, and socioeconomic status. WHO advocates for vaccine equity, emphasising its potential to hasten the end of the pandemic. Achieving WHO's vaccine equity targets will enhance global population immunity, protect health systems, revive economies, and mitigate the emergence of new variants.

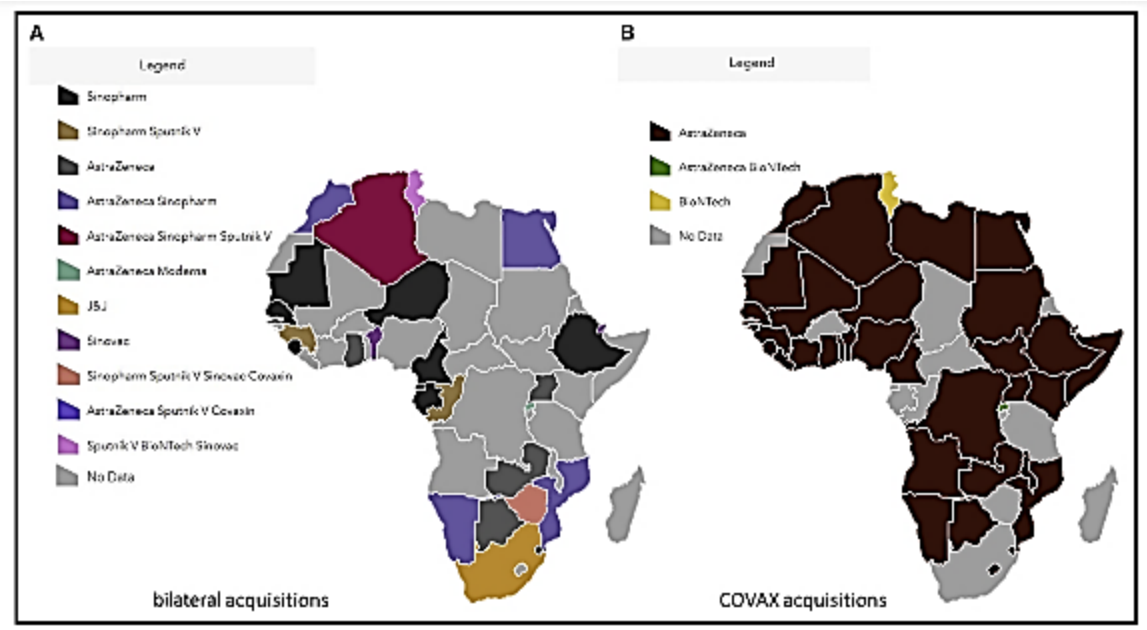

Figure 2 COVID-19 vaccine rollout in Africa: doses obtained via multilateral (COVAX) or bilateral procurement mechanisms (Lombe & Nkengasong, 2021)

Increased demand for vaccines in India, faced with a devastating surge in COVID-19 cases, and the government decision to redirect locally produced doses towards the domestic market have had repercussions around the globe (Kuppalli et al., 2021). As a consequence, the chief supplier for COVAX postponed delivery of the 90 million vaccine doses expected in March and April 2021. Extra constraints following production failures along the vaccine supply chain in Europe led to further delays in the delivery of AstraZeneca doses. The African countries that have been most efficient in administering doses received as part of their initial allocation, such as Rwanda and Ghana, needed to decide whether to reserve doses to vaccinate the most people fully or to provide partial immunity to the most people while running the risk that many will miss their second dose.

4. Intrinsic factors limiting local access in Africa

The fact that Africa is lagging behind the rest of the world in access to vaccines reflects the paucity of sustainable national investments in domestic vaccine research and development (R&D) programmes and industry. Though vaccines are clearly acknowledged as a cornerstone of the COVID-19 pandemic response, domestic production has not been a priority for national outbreak preparedness. On the positive side of vaccine R&D, capacity for vaccine manufacturing is mostly

lacking. Africa, home to a population of 1.3 billion and faced with a high prevalence of infectious diseases, only produces 1% of the doses it uses, despite a high need for vaccines to ensure health security (Abiodun et al., 2021). Around 10 local companies operate at some stage of the vaccine manufacturing value chain on the whole continent, from production of the vaccine ingredients to the "fill and finish" process. The Pasteur Institute in Dakar, Senegal, is the only institution that produces a prequalified WHO vaccine (for yellow fever). Additionally, external donors like GAVI or UNICEF provide the majority of the vaccines in Africa. Having outsourced the procurement process and faced with patent access issues, African nations have had few incentives to support a local vaccine industry.

According to the WHO landscape of COVID-19 vaccines, a total of 277 candidates were under development at the end of April 2021. Africa had contributed a mere five, with four candidates being tested at the Egypt National Research Centre, another one at a Nigeria-based private firm, and none having yet progressed past the pre-clinical evaluation phase. In the later phase of human clinical trials, there has been an initial reluctance to join global efforts to assess new COVID-19 candidate vaccines, even though the continent hosts a number of research sites with pre-established expertise for trials (Nkengasong et al., 2020). Public opinion related suspicions that Africa was being used as a testing ground by western researchers to assess unsafe vaccines (Samarasekera, 2021). One notable exception has been South Africa, where several COVID-19 clinical trials have been undertaken. This underdeveloped R&D ecosystem and over-reliance on external financial influxes for supplying vaccines may explain why most African countries, especially those with small populations, have remained minor players in the race to secure advanced market commitments.

Each nation is responsible for the regulation of medical products within its borders. However, with few regulatory entities up to international standards, African countries mostly rely on external, stringent regulatory agencies. They act as surrogate decision-makers for reviewing trial data and granting approval for new therapeutics and vaccines. Countries then use accelerated approval mechanisms. These processes cause delays and limit the utilisation of national rolling reviews of trial data to expedite approval.

The fragility of African healthcare systems further impedes the deployment of COVID-19 vaccines at scale and speed. A World Bank assessment estimated that most low- and middle-income countries (LMICs) were adequately prepared to manage small initial vaccine consignments delivered through COVAX. This readiness included developing national deployment and vaccination plans, defining priority target populations, establishing cold chain logistics, safety surveillance procedures, adverse effect monitoring, and training vaccination teams. However, after the first vaccine tranche arrived, countries realised that addressing the last mile to administer doses faced additional operational challenges. This notably involved mobilising communities for vaccine uptake and managing nationwide delivery logistics. By the end of April, only Morocco (with 9.5 million doses administered) and a few other countries (such as Nigeria, Ethiopia, Egypt, Ghana, and Kenya) were nearing or surpassing the 1 million doses administered mark.

5. Vaccination Hesitancy

An earlier survey conducted by the Africa CDC and the London School of Hygiene & Tropical Medicine indicated an initial willingness to undergo COVID-19 immunisation with a safe and efficient vaccine, as demonstrated by an average acceptability rate of 79% in respondents across 15 countries (Samarasekera, 2021). The situation, however, had negative repercussions on vaccine uptake: the Democratic Republic of Congo (DRC) postponed deployment of the vaccine for close to a month, whereas Chad forfeited its COVAX allocation altogether. (Loembé &. Nkengasong, 2021) Furthermore, as wealthier nations are now turning away from AstraZeneca in favour of mRNA vaccines while offering excess doses to COVAX for redistribution, there is a perception that second best options are being relegated to African countries, which could further contribute to building mistrust on the continent (Loembé &. Nkengasong, 2021).

These setbacks have been exacerbated by a backdrop of insufficient readiness to go the last mile to deliver vaccine doses into the arms of an adult population not usually reached by routine immunisation programmes. It became clear that the COVAX model, based on philanthropy and the good will of wealthier nations, did not lead to equitable and fair vaccine access soon enough in the face of urgency. The market dominance of a few nations sustainably undermined the multilateral initiative (Loembé &. Nkengasong, 2021).

6. Scepticism Towards COVID-19 Vaccines

Misinformation fuels scepticism, which is a major factor in vaccine hesitancy. The COVID-19 infodemic, marked by conspiracy theories and false information on social media, poses a significant challenge (Enders et al., 2020). Content on social media platforms, often lacking editorial oversight, contributes to the spread of anti-vaccine sentiments. Studies highlight the prevalence of anti-vaccine content on platforms like YouTube, Twitter, and Instagram. Addressing

scepticism and misinformation is crucial for overcoming barriers to COVID-19 vaccine acceptance (Shahi, Dirkson & Majchrzak, 2021)

Furthermore, the Health Belief Model provides a framework for understanding vaccine hesitancy, emphasising the role of perceived benefits, self-efficacy, and perceived barriers (Champion & Skinner, 2008). Effective communication strategies, including message framing, media type, and addressing scepticism, are essential for promoting COVID-19 vaccine acceptance. Combating misinformation on social media and leveraging the credibility of traditional media sources are critical components of successful communication campaigns (Amodu & Otesile, 2023; Shahi, Dirkson & Majchrzak, 2021). Public health efforts must consider these factors to create targeted and persuasive communication strategies that encourage widespread COVID-19 vaccine uptake.

7. Nigeria

In the outbreak of any pandemic or epidemic, efforts to develop vaccines usually follow to mitigate the effect and maintain a healthy population (Amodu & Otesile, 2023; Brisse et al., 2020; Gebre et al., 2021; Oyston & Robinson, 2012). However, studies have shown that religious affiliation, cultural views on health and wellness, socioeconomic status, and other factors significantly affect how well people receive vaccines across nations (Fisk, 2021; Gatwood et al., 2021; Salmon et al., 2021; Seddig et al., 2022; Umakanthan et al., 2022). However, studies on COVID-19 vaccination have also shown that health authorities in countries invest in vaccine communication to elicit positive attitudes towards vaccine acceptance and significantly reduce hesitancy and rejection (Gerretsen et al., 2021; Khubchandani et al., 2021; Majid et al., 2022; Seddig et al., 2022; Wang & Liu, 2022).

Nigeria, like every other country, also experienced the importation of COVID-19 by an Italian citizen on February 27, 2020, marking the first case of the virus in the country. Subsequently, many cases have been reported in different states, including the Federal Capital Territory (FCT), Abuja (Worgu et al., 2023). Following the record of the first COVID-19 case in Nigeria, healthcare workers in Nigeria were therefore saddled with the responsibility of attending to suspected and confirmed individuals with the disease, which puts them at risk of being infected. To mitigate this, the Nigerian government introduced preventive measures such as lockdowns, the use of face masks, social distancing, contact tracing, and vaccine campaigns, and with the collaboration of the Nigerian Centre for Disease Control (NCDC), actively created awareness and educated Nigerians through media illustrations on the need to adhere to COVID-19 preventive measures (Amodu & Otesile, 2023; Olu-Abiodun, Abiodun, & Okafor, 2022; Worgu et al., 2023). After the vaccine was developed and sent to Nigeria, there were doubts surrounding the efficacy and safety of the COVID-19 vaccine, and there was widespread hesitancy and resistance towards its acceptance (Aliyu, Murtala, & Gora, 2023).

As of November 19, 2021, nearly six million Nigerians had received their initial COVID-19 vaccine dose, with only 3,369,628 completing the two-dose regimen (NCDC, 2021). This leaves over two hundred million people unvaccinated, which constitutes 97.15% of the total population. Despite the urgent need for COVID-19 vaccination in the country, the country still experienced hesitancy and apathy towards receiving the vaccine. Aliyu, Murtala, & Gora (2023) also posit that only 29.1% of Nigeria's population, consisting of 31,901,816 individuals, were vaccinated as of September 15th, 2022, with most individuals only accepting the vaccine when travelling overseas or when it is made mandatory for public figures and healthcare workers (Chizaram Nnaemeka et al., 2023).

However, scepticism regarding the pandemic, concerns regarding the unforeseen effects of the vaccines, a preference for natural immunity, and a general mistrust of vaccine benefits, among others, were negative perceptions that affected the acceptance of the COVID-19 vaccine in Nigeria (Sadiq, Croucher, & Dutta, 2023). Additionally, concerns about commercial profiteering further heightened these negative attitudes, which are also of general global concern around vaccination and post-pandemic efforts.

Furthermore, Sadiq, Croucher, and Dutta (2023) posit that despite the projection of a 70% vaccination rate by the end of 2022, only 33.86% of the Nigerian population was fully vaccinated. They attribute this to misinformation about COVID-19, particularly on social media platforms like YouTube, where Nigerians believed that taking the vaccine posed a greater threat to their lives than being infected with the virus. Additionally, studies have confirmed that the dissemination of fake news in Nigeria at the time, along with the absence of openness and accountability in the COVID-19 pandemic response, further heightened the erosion of public trust (Abayomi, 2022).

The demonstration of religious beliefs and biotechnology-related conspiracies that dominated users' discussions about COVID-19 vaccines was responsible for the vaccination hesitancy (Sadiq, Croucher, & Dutta, 2023). For example, while some believe in the story of "Take the vaccine, you die or lose your fertility," others suggest that "it's mRNA technology," and most shockingly, some say "Jesus is my vaccine" or that the vaccine is a "mark of the beast." The aforementioned

misinformation and conspiracy theories were responsible for the low rate of acceptance of the vaccine (Sadiq, Croucher, & Dutta, 2023). In Makurdi, Nigeria, for instance, vaccine hesitancy persisted due to beliefs about Jewish expectations of the anti-Christ, such as the mark of the beast, being chained to hell, acting immorally, and having animalistic inclinations, among others (Uroko & Okuosa, 2022). It is also necessary to note that healthcare workers who were supposed to be on the front lines combating the pandemic demonstrated hesitancy to the vaccination (Chizaram Nnaemeka et al., 2023).

8. Ghana

Ghana, with a population exceeding 30 million, recorded its first two confirmed cases of COVID-19 on March 12, 2020 (Odikro et al., 2020). Individuals who had just returned from Turkey and Norway imported it. This marked the beginning of Ghana's battle against the pandemic, setting up preventive measures such as lockdowns, social distancing, contact tracing, and vaccination campaigns (Kenu, Frimpong, & Koram, 2020). Ghana is the first country within the West African sub-region to receive the shipment of the COVAX facility of 600,000 Oxford AstraZeneca vaccines on February 24, 2021 (WHO, 2021). It was deployed on March 2, 2021, with the President, along with political figures, traditional leaders, and religious leaders, publicly receiving vaccination shots to build trust and confidence in the vaccine among the population (Keledzi, 2021).

However, fear, religious affiliations, and safety concerns, compounded by the spread of anti-vaccine conspiracy theories, have hindered the COVID-19 vaccination campaign (Alhassan et al., 2021; Brackstone et al., 2022; Pertwee et al., 2022), thereby contributing to an overall decline in acceptance and willingness to receive the vaccine among certain populations. Studies have also identified a lack of adequate information on the vaccine development process and its importance as a major contributing factor to vaccine hesitancy in rural populations (Botwe et al., 2022; Udoh, Eshun, & Tampah-Naah, 2023). This includes myths or having non-scientific knowledge of how the vaccine works or about the rigorous phases of trials (phases one, two, and three) that assess immunogenicity, safety, and efficacy (Meng et al., 2021). The rapid development of the COVID-19 vaccine, setting an all-time record for vaccine development, has also fuelled scepticism and uncertainty among the public (Trogen, Oshinsky & Caplan, 2020). This hesitancy is evident not only in Ghana but also in many other parts of the world (University of Southampton, 2021).

According to the Ghana Health Service, Ghana had administered over 19.8 million doses of the coronavirus (COVID-19) vaccine as of August 10, 2022. This success has been attributed to Ghana's existing health policies for handling polio eradication and other past immunisation projects (Lohiniva et al., 2022, 2023). Amponsah-Tabi et al. (2023) highlights the influence of social media on vaccination acceptance. The study found that social media awareness had a significant impact on people with prior knowledge of vaccination. Social factors like family beliefs and religious leaders' perceptions strongly influence vaccine acceptance (Vepachedu et al., 2024). The use of accurate information dissemination to address misconceptions and promote vaccine acceptance. Though the elderly exhibit lower vaccine hesitancy, males tend to be more indecisive about vaccination compared to females (Acheampong et al., 2021). These findings suggest that leveraging social media platforms for vaccine campaigns enhances vaccine uptake in Ghana by combating misinformation and building trust among hesitant populations (Forkuo, Osarfo, & Ampofo, 2022).

9. The Gambia

The Gambia is a small country with a population of over 2 million people. The first case of COVID-19 in the country was recorded on March 17, 2020 (Bittaye et al., 2023). A Gambian individual who had been residing in England returned to their homeland, utilizing the country's only airport as their point of entry. In response to the global pandemic, the Gambian Government, like many others worldwide, implemented various measures to combat its spread. These measures included implementing total or partial lockdowns, isolation protocols, enforcing social distancing guidelines, and promoting the use of hand sanitizers and face masks as preventive measures (Lowe et al., 2021). While the confirmed patient was quarantined, treated, and discharged on March 31st, 2020 (Omotosho et al., 2020), the Gambian Health Ministry traced and isolated all passengers who boarded the flight with her (Darboe, 2020).

The Gambian President launched the national COVID-19 vaccination campaign on March 10, 2020, after receiving a shipment of 36,000 COVID-19 vaccines (UNICEG Gambia, 2021). He publicly took the first dose of the vaccine to encourage Gambians and showcase its efficiency (OCED, 2021). The media were engaged to educate the public about the risks posed by the virus and how to mitigate the factors that contribute to the spread of COVID-19 within a community (United Nations - The Gambia, 2021). They were further equipped to tackle fake news like "COVID-19 is over," especially from the community it is coming from, as such can undermine adherence to safety measures and hinder

efforts to control the pandemic (Delegation of the European Union to The Gambia, 2021; World Health Organization - Gambia, 2021).

Recommendations

The media has influenced almost every aspect of healthcare intervention, which supports the effectiveness of media-oriented interventions in achieving positive health outcomes in a population. Our study reconfirms that while it may seem that COVID-19 has declined, there is a need for government health agencies to collaborate with other stakeholders in the health promotion industry to ensure that more people, especially those in rural areas, understand the usefulness of vaccination. Additionally, in West Africa, where countries are mostly low- and middle-income, it is crucial to extend the vaccination campaign to reach the population.

Moreover, it is essential to address the underlying factors contributing to vaccine hesitancy, particularly the impact of religious and sociocultural beliefs. Across Africa, there is pervasive adherence to health misconceptions, which, coupled with ingrained religious and sociocultural norms, pose challenges in accessing and embracing comprehensive healthcare services. These beliefs often intersect with perceptions of modern medicine, creating barriers to vaccination campaigns and public health interventions. We recommend that to effectively address this issue, interventions must be culturally sensitive and community-driven, engaging local leaders and influencers to dispel myths and misconceptions while promoting evidence-based information about the safety and efficacy of vaccines.

The diverse socioeconomic landscapes across African nations, characterised by varying income levels and literacy rates, underscore the need for tailored approaches to address vaccine hesitancy and broader health disparities. While leveraging social media platforms for awareness campaigns is effective in urban areas with high technological penetration and literacy rates, it neglects rural populations with limited access to modern technologies. Therefore, complementary strategies utilising traditional mass media should be implemented to ensure comprehensive outreach and promote vaccine acceptance among underserved communities. Hence, incorporating culturally significant elements such as indigenous languages, historical narratives, and environmental contexts can enhance engagement and foster trust in health promotion efforts.

10. Conclusion

Vaccination stands as a critical pillar of public health, playing a pivotal role in safeguarding communities against infectious diseases. However, it is crucial to adopt more nuanced approaches to healthcare delivery as the world's population diversifies, reflecting a variety of socio-cultural backgrounds, religious convictions, and moral philosophies. This entails recognising and addressing the unique needs of underserved groups, including those who may face barriers to accessing healthcare services due to social, economic, or cultural factors. By tailoring healthcare delivery methods to suit the specific needs of diverse communities, we can work towards achieving health equity and ensuring that no one is left behind in the pursuit of good health. To effectively address the disparities in healthcare access and uptake of vaccination, it is crucial to implement targeted interventions that actively engage with marginalised populations. This involves going beyond traditional healthcare delivery models and reaching out to communities through culturally sensitive and community-led initiatives. By partnering with local leaders, religious figures, and community organisations, we can build trust and rapport within these communities, facilitating open dialogue and addressing concerns surrounding vaccination. Moreover, investing in health literacy programmes and public health campaigns that debunk prevalent myths and misconceptions about vaccines is essential to fostering quality health and lifestyle adoption

Compliance with ethical standards

Authors' Contributions

- **Conceptualization**: AMODU, A.D
- **Formal Analysis:** AMODU, A.D; BADIRUDEEN, I.T, OCHUBA, C.O; and IKEOKWU, K.O
- **Writing-Original Draft:** AMODU, A.D; BADIRUDEEN, I.T, OCHUBA, C.O; and IKEOKWU, K.O
- **Writing-Review and Editing**: AMODU, A.D; BADIRUDEEN, I.T, OCHUBA, C.O; and IKEOKWU, K.O

Disclosure of conflict of interest

The authors declare that they have no competing interests.

Statement of ethical approval

This study used freely accessible and downloadable data in the public domain. Therefore, institutional review board approval was not required.

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