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ORIGINAL ARTICLE

An Epidemiological Analysis of the Recipients of the First Dose of the First Phase of COVID-19 Vaccination in Oyo State, South-Western Nigeria

Analyse Épidémiologique des Bénéficiaires de la Première Dose de la Première Phase de la Vaccination COVID-19 AstraZeneca dans l'État d'Oyo, dans le Sud-Ouest du Nigeria

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ABSTRACT

BACKGROUND: Millions of people across the globe have been infected with coronavirus disease (COVID-19), and many lives have been lost in the process. As a result, vaccines are being developed to protect people from COVID-19 morbidity and mortality. Therefore, this study was conducted to assess the coverage rate for the COVID-19 vaccine in Oyo State.

METHODS: A descriptive secondary analysis of COVID-19 immunization data was done between March and April 2021. Data were extracted from the original paper format and entered into Excel sheets. Charts and line graphs were plotted to determine the coverage rates.

RESULTS: The overall coverage rate for the State was 81.0%. The highest and lowest coverage rates were 243.0% and 39.0% for Ibadan North and Iseyin Local Government Areas (LGAs), respectively. The proportion of female health workers vaccinated in the State was 64.5%. The proportion of male strategic leaders and male frontline workers was 62.5% and 55.7%, respectively. Akinyele and Egbeda LGAs recorded the same highest number of cases (27) of adverse events following immunization (AEFI).

CONCLUSION: The study highlights the high proportion of vaccinated people in the State, while there was a low proportion of vaccinees in some LGAs. Therefore, effort to scale-up coverage across all the LGAs is recommended. **WAJM 2022; 39(10): 1032–1039.**

Keywords: Epidemiology, COVID-19, vaccine, First phase, Nigeria.

RÉSUMÉ

CONTEXTE: Des millions de personnes dans le monde ont été infectées par le COVID-19 et de nombreuses vies ont été perdues dans ce processus. En conséquence, des vaccins sont en cours de développement pour protéger les personnes contre la morbidité et la mortalité liées au COVID-19. Cette étude a donc été menée pour évaluer le taux de couverture du vaccin COVID-19 dans l'Etat d'Oyo.

MÉTHODES: Une analyse secondaire descriptive des données de vaccination COVID-19 a été réalisée entre mars et avril 2021. Les données ont été extraites du format papier original et saisies dans des feuilles Excel. Des diagrammes et des graphiques linéaires ont été tracés pour déterminer les taux de couverture.

RÉSULTATS: Le taux de couverture global de l'État était de 81,0 %. Les taux de couverture les plus élevés et les plus faibles étaient respectivement de 243,0 % et 39,0 % pour les zones de gouvernement local (LGA) d'Ibadan Nord et d'Iseyin. La proportion d'agents de santé féminins vaccinés dans l'État était de 64,5 %. La proportion d'hommes leaders stratégiques et d'hommes travailleurs de première ligne était respectivement de 62,5 % et 55,7 %. Les LGA d'Akinyele et d'Egbeda ont enregistré le même nombre élevé de cas (27) d'événements indésirables après la vaccination (EIAS).

CONCLUSION: L'étude met en évidence la forte proportion de personnes vaccinées dans l'état, alors qu'il y avait une faible proportion de vaccinés dans certaines zone de gouvernement local. Il est donc recommandé de déployer des efforts pour augmenter la couverture vaccinale dans toutes les AGL. **WAJM 2022; 39(10): 1032–1039.**

Mots clés: Épidémiologie, COVID-19, vaccin, première phase, Nigéria.

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INTRODUCTION

The recent COVID-19 pandemic, which started in the industrial city of Wuhan, China among people linked to a local seafood market ('wet market'), has generated much scholarly concern in different parts of the world, especially in the areas of healthcare delivery, economy, and socio-political activities.[1–5] The clarity of the extent of the pandemic is obstructed by the poorly analyzed data,[6] and this further aggravated the already heightened anxiety. There is currently no cure for COVID-19 and, in view of this, researchers have continued to preoccupy the public health space with renewed interests in the search for the definitive management of COVID-19 cases. However, such renewed interests had not produced the desired results, as much of the interventions are still based on non-pharmacologic measures such as city lockdowns to reduce virus spread.[7]

Public health professionals attribute much of these problems to the pathogenic variability exhibited by the virus.[8] While evidence-based researches are still ongoing, a lot of measures have been put in place in different countries of the world to contain the spread of this virus with a view to reducing the societal impact.[2–5] The use of face masks, maintaining social and physical distance, the practice of regular hand washing, the use of alcohol-based sanitizers,[9] seeking medical intervention early, cleaning and disinfecting frequently touched surfaces, and following advice given by healthcare providers,[10] have all been scientifically observed as potent and cost-effective ways of controlling the virus.

While the aforementioned strategies were put in place to battle the first wave of the pandemic, regrettably, due to the lowering of the guards by the populace, the emergence of mutant variants, and the politicisation of the pandemic, among others, the virus escaped these globally accepted interventions and meta-morphosed countries into the second and third waves with more atrocious impacts.[6,11] The protracted pandemic has adversely affected the basic healthcare delivery activities, including routine medical services, immunization, and surveillance exercises for other diseases. Several parts of the world are now in the grip of a second wave of the pandemic. For example, India recorded an average daily increase of 35,000 and 89,000 new cases of COVID-19 during the first and second waves, respectively[11] while in Nigeria, 8,000 and 18,000 new cases per month were documented in the first and second wave respectively.[6] In Africa, about 4.3 million COVID-19 cases have been reported so far, causing 114, 000 deaths.[12] In the last eight weeks, the region has witnessed a plateau of around 74, 000 new cases per week.[13]

In some countries, the emergence of the fourth wave is inevitable as the previously controlled transmission is now resurfacing with attendant higher morbidity and mortality.[14] The resurgence of the subsequent waves did not put the efficacy of the proven strategies in doubt but relied mostly on the non-compliance and poor practices observed while carrying out these strategies.[15] The dilemma of striking a balance between a fresh lockdown and the imperative of uninterrupted economic activity is another impediment towards a virus-free society. These uncertainties once again re-ignited the interest of the researchers towards COVID-19 vaccine production with a view to improving the herd immunity of the community.

At the center of the occurrence of these secondary waves is the culpability of the resistant variants of the virus. The COVID-19 vaccines are expected to provide at least some protection against new virus variants and are effective at preventing serious illness and death.[16] That is because these vaccines create a broad immune response and any viral changes or mutations should not make vaccines completely ineffective.[9] In African countries, access to the COVID-19 vaccine is limited as the countries of production have proved not to be self-sufficient, especially during the more dreaded secondary waves. In view of this insufficiency, there is a global scarcity of vaccines and many countries that have already exhausted their initial supplies will need to wait, as manufacturers are having supply problems.[17]

While other countries are still battling with the second wave of the pandemic, Kenya is experiencing the third wave, and the epidemic is showing an upward trend in fourteen African countries, including Ethiopia, Eritrea, Mali, Rwanda, and Tunisia.[13] Such an upward trend could not be unconnected with the low vaccination coverage, limited stocks, and supply bottlenecks that characterized vaccination processes in the African region, as less than 2% of the 690 million COVID-19 vaccines administered globally were delivered to Africa.[13] In all, 13 million out of the 31.6 million doses delivered so far have been utilized.[13] In view of this, Africa is now seen to embark on a COVID-19 vaccination catch-up, and the gap is still widening.[13] Though there is an unprecedented global demand for vaccines, inequality was found to worsen the existing gaps. Expectedly, more than a billion Africans remain on the margins of this historic march to overcome the pandemic,[13] which can only be achieved when the issues around vaccine nationalism are addressed.

Globally, about 150 doses of the vaccine have been administered per 1,000 people. Unfortunately, in sub-Saharan Africa, there are about eight doses per 1,000 people. Interestingly, about 16.6 million vaccine doses, mainly AstraZeneca, have been delivered to African countries,[13]of which 3.94 million doses were supplied to Nigeria.[18] Oyo State received 3.2% of the national stock.[18] According to the World Health Organisation (WHO), nine countries have administered less than a quarter of the doses they obtained, while 15 countries have given less than half.[17] The slow rate of vaccination is caused partly by issues around vaccine distribution, such as the lack of health infrastructure and staff. Additionally, there are concerns that vaccine hesitancy and skepticism resulting from issues around blood clots following vaccination could play a major role in recording low coverage.[19] Consequent to these concerns, the study assessed the trends and coverage rates of AstraZeneca vaccination among target population of the first phase of vaccination in Oyo State, South-Western Nigeria.

MATERIALS AND METHODS

Study Area

Oyo State is one of the 36 states of the federation and is located in the

Southwestern part of Nigeria. It is in the tropical rainforest. The mean monthly temperature is in the range of 25°C to 31°C. The average annual percentage of humidity is 81.0%. The state has a projected 2019 population of 8,635,793 using an annual growth rate of 3.4% and a 2006 population figure as the baseline.[20] The State has a total of 733 health facilities offering routine immunization services distributed across 33 local government areas (LGAs). Routine immunization (RI) services are offered at least once a week in all the health facilities and are managed by the routine immunization (RI) focal persons.

As of June 16th, 2021, the total number of confirmed cases was 167,095 of which 2,117 deaths were reported, while Oyo State recorded 4.1% and 5.9% of the country's confirmed cases and deaths, respectively.[21]

Target Population for Phase One:

Nigeria received about 4 million doses of AstraZeneca vaccines, and these were grossly inadequate for the estimated population of about 200 million. As a result of this inadequacy, the National Primary Health Care Development Agency (NPHCDA) planned a four-phased prioritization vaccination exercise. The target population for the first phase includes:

- Healthcare workers,
- Frontline workers, including support staff such as cleaners, security staff, body handlers, drivers, waste managers, etc.,
- Ports of entry (air, land, and seaports),
- Military,
- COVID-19 rapid response team (RRT),
- Laboratory network,
- Policemen and petrol station workers.

Delivery Strategies for the COVID-19 Vaccination

In order to ensure adequate coverage and to leave none of the eligible people unvaccinated, the following vaccination strategies were employed by the Federal Government of Nigeria (FGN):

- *Fixed Post:* These were domiciled in the primary health care (PHC) facilities. Vaccination sites are PHCs that offer routine immunization and have cold chain equipment (CCE) for storage of COVID-19 vaccines. There was one vaccination team per designated fixed post, and in large secondary and tertiary health facilities, there were two teams based on their micro plans.
- *Temporary Fixed Post*: Temporary fixed post (TFP) is dependent on the phase of vaccination. There were fewer numbers of TFP in Phase 1 and there could be more TFP in Phase 2 and 3.
- *Special Teams*: Special or mobile teams are dependent on the phase. There were fewer special teams in Phase 1, and these will be increased in the other phases because of the higher proportion of the target population.

Team Composition for COVID-19 Vaccination

The team composition for the fixed and temporary posts includes six (6) personnel; one supervisor per site, one vaccinator – must be a health worker licensed to give an injection; one recorder; one community mobilizer/ crowd controller, one town announcer and one security personnel. Only the special team has five personnel, which does not include the town announcer.

COVID-19 Vaccine Administration

A dose of the AstraZeneca vaccine is 0.5 ml. The route of administration is intramuscular (IM) and is given in the deltoid muscle (left upper arm). For better protection, two doses are given in 6–12 weeks apart.

Study Design

We carried out a secondary analysis of COVID-19 immunization data for Oyo State for the period between March and April, 2022.

Data Source

Data on AstraZeneca vaccination from all the 33 LGHAs in Oyo State from March to April, 2022 were obtained from the Monitoring and Evaluation Unit of the Oyo State Primary Health Care Board (OYSPHCB).

Data Management

Data were sorted, cleaned, and relevant variables were extracted using Microsoft Excel 2010. The following variables were used in the final analysis: gender, vaccination days, coverage rate, number of children vaccinated, occupation, LGA, and State. Descriptive statistics, including line graphs, were plotted to compare the trends of the coverage rates across the LGAs in the State.

Ethical Consideration

Ethical approval for the study was obtained from the Oyo State Ministry of Health. We maintained the confidentiality of subjects by excluding all identifying information such as names and addresses from the analysis. Data were stored in a password-protected file on a computer only accessible to the principal investigator.

RESULTS

Oyo State Vaccination: Vaccine used vs. People Vaccinated

Oyo State's target population for the first phase of COVID-19 vaccination was 78, 214, of which 63,191 eligible people under the first phase were vaccinated with 61,180 doses. (Figure 1).

Vaccination Trend, Target Population, and Coverage Rate by LGAs in Oyo State, Nigeria – 2021

The highest coverage rate (243.0%) was recorded for Ibadan North LGA, followed by Ibadan South West (122.0%) while the least coverage rate (39.0%) was documented for Iseyin LGA, followed by Ibarapa North LGA (55.0%). In Ibadan North, Ibadan North West, and Ibadan South West LGAs, the administrative coverage rates exceeded 100.0%, that is, the number of vaccinated children surpassed the target population (Figure 2).

Vaccination Coverage Rates in State and LGAs of Oyo State, Nigeria – 2021

The overall coverage rate for the State was 81.0%. Ibadan North, Ibadan North West, Ibadan South West, Ido, and Oluyole LGAs were LGAs with the coverage rates above the state coverage rate (Figure 3).

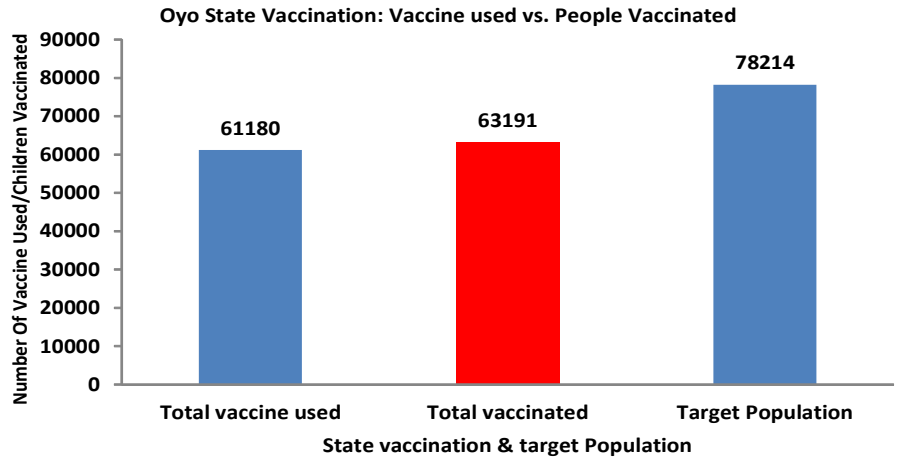

Fig. 1: Oyo State Vaccination: Vaccine Used vs. People Vaccinated.

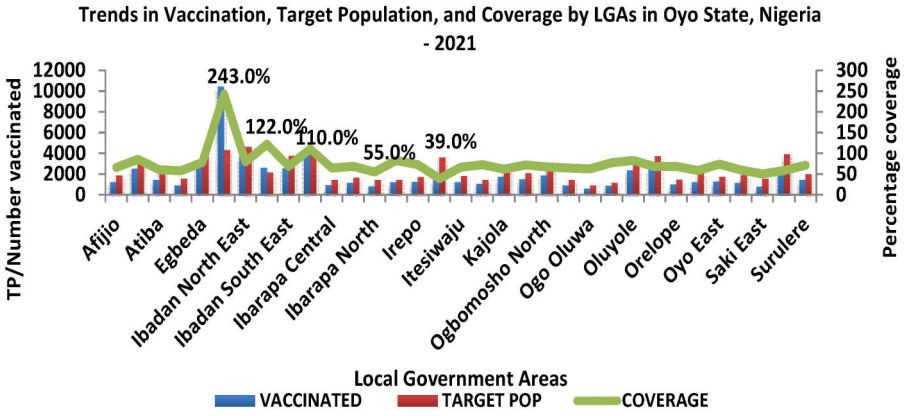

Fig. 2: Vaccination Trends, Target Population, and Coverage Rate by LGAs in Oyo State, Nigeria – 2021.

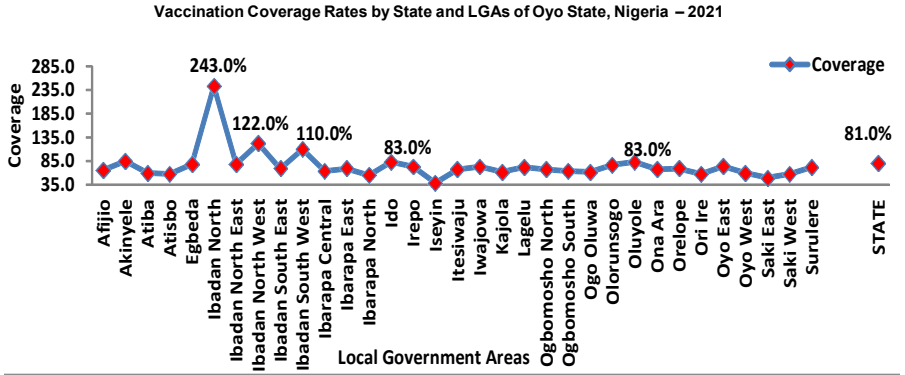

Fig. 3: Vaccination Coverage Rates by State and LGAs of Oyo State, Nigeria –2021.

Vaccination by Gender among Health Workers in the LGAs, Oyo State, Nigeria – 2021

Across the LGAs, the highest proportion of vaccination was recorded among female health workers (87.3%) in Ona-Ara LGA, while Oriire LGA recorded the highest proportion of male health workers vaccinated with the COVID-19 vaccine. Overall, the proportion of female health workers vaccinated in the State was 64.5% (Figure 4).

Vaccination by Gender among Strategic Leaders in the LGAs, Oyo State, Nigeria – 2021

In Oyo State, 62.5% of male strategic leaders were vaccinated. In Iseyin LGA, 100.0% of female strategic leaders were vaccinated, while 100.0% of male strategic leaders were vaccinated with the AstraZeneca vaccine in Ona-Ara LGA. (Figure 5).

Vaccination by Gender among Frontline Workers in the LGAs, Oyo State, Nigeria – 2021

The overall proportion of AstraZeneca vaccination among male strategic leaders in Oyo State was 55.7%. A higher proportion of vaccination among female supportive staff was reported in Ogbomoso North (55.2%), Ibadan North (52.0%), Ibadan South East (51.7%), Oluyole (51.9%), and Oyo West (50.4%) LGAs. (Figure 6).

Vaccination Trend by Implementation Days in Oyo State, Nigeria – 2021

A sinusoidal pattern was observed which peaked at days 5 (n = 7180), 7 (n = 7370) and 10 (n = 5310). Most of the vaccinations were captured during the first 12 days. The least vaccination (n=70) was recorded on day eight (8) of the mop-up.

Trend of Serious and non-Serious Cases of AEFI by LGAs in Oyo State, Nigeria – 2021

A wavelike pattern of non-serious AEFI cases was also observed across the LGAs in Oyo State. The peaks of the waves were seen at cases 27, 27, 22, 23, 17, 18, 9, 16, 17, and 7 and these were recorded for Akinyele, Egbeda, Ibadan North East, Ibarapa East, Iseyin, Itesiwaju, Kajola, Olorunsogo, Oyo East, and Saki West, respectively. No single case of serious AEFI was reported.

DISCUSSION

Today, the developing world is struggling to have enough vaccines to vaccinate its citizens against COVID-19. This is almost self-inflicting as many African countries were caught in the web

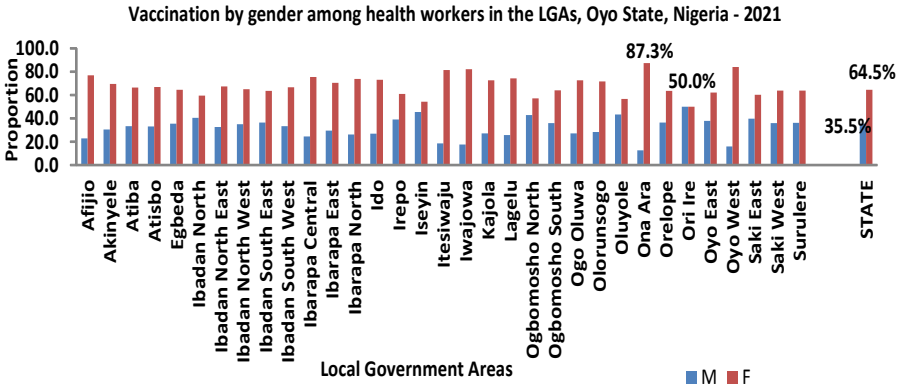

Fig. 4: Vaccination by Gender among Health Workers in the LGAs, Oyo State, Nigeria – 2021

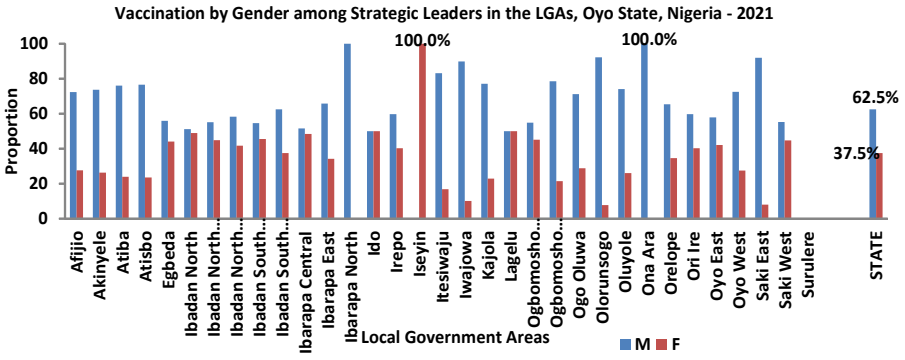

Fig. 5: Vaccination by Gender among Strategic Leaders in the LGAs, Oyo State, Nigeria – 2021

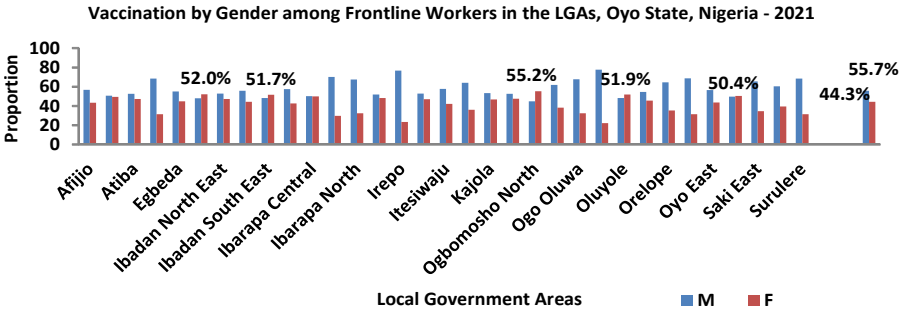

Fig. 6: Vaccination by Gender among Frontline Workers in the LGAs, Oyo State, Nigeria – 2021

of inadequate planning, ineffective management of resources, misplaced priorities, politicization of the pandemic, poor budgetary provisions for the health sector, and lack of pre-engagement with the potential manufacturers of the COVID-19 vaccines. All these factors have been seen to have characterized the planet of Africa and, as such, have made the accessibility to enough vaccines become more herculean.[23,24]

While many African countries are still battling with the reality of the pandemic, many developed countries have for a long time entered into pre-purchase agreements with COVID-19 vaccine manufacturers, a development that has come to be known as vaccine nationalism. The advance agreement has made the initial few vaccines unaffordable and accessible to everyone apart from the rich countries in a world of roughly 8 billion people.[25]

To bring about equitable distribution and access, the WHO, the Coalition for Epidemic Preparedness Innovations (CEPI), and GAVI came up with an initiative known as the "COVID-19 Vaccines Global Access" (COVAX). The COVAX facility is a global risk-sharing mechanism for pooled procurement and equitable distribution of COVD-19 vaccines. The facility was able to procure at least two billion doses of COVID-19 vaccines for deployment and distribution mainly in low- and middle-income countries.[25,26] Of all these doses, Nigeria was able to procure about 4 million doses,[27] out of which 1% of the population that comprised the health workers and others were vaccinated during the first phase.[28]

This study was undertaken to ascertain the coverage of the vaccine within the context of global scarcity and to understand the resources to be pooled together to address the gaps identified. The overall coverage rate for the first dose vaccination was 81.0%, with the highest (243.0%) and lowest (39.0%) rates recorded for Ibadan North and Iseyin LGAs, respectively. Our finding was in agreement with 89.0% that was documented in a study among health workers in the United Kingdom.[30] The study equally revealed the use of 61, 180 doses to vaccinate 63, 191 people. The discrepancy noticed was in the number vaccinated per vial. The supplied vial of AstraZeneca vaccine contains 10 doses, but in reality, an average of 12 people were vaccinated with a vial even after factoring in the wastage rate. Hence, the justification for the observed gap.

The study showed that 64.5% of the vaccinated health workers were females, and this pattern was also observed across all the LGAs. The female preponderance corroborated studies of health workers on COVID-19 vaccine acceptability in Ghana and the United States that documented the female proportions of 63.2% and 75.0%, respectively.[31,32] In Nigeria, nursing schools and schools of health technologies that majorly produce the bulk of health workers in hospitals are female-dominated institutions. Hence, the higher proportion of female health

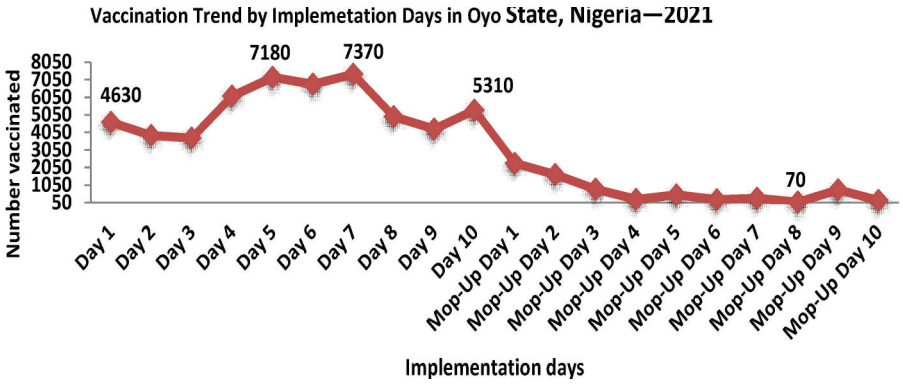

Fig. 7: Vaccination Trend by Implementation Days in Oyo State, Nigeria – 2021.

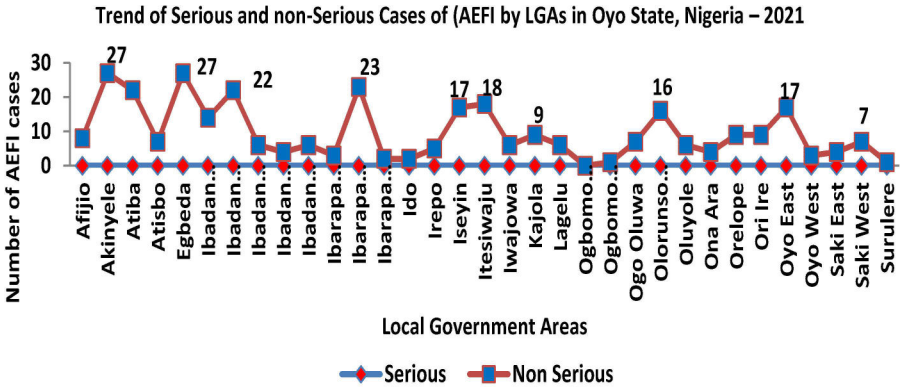

Fig. 8: Trend of Serious and non-Serious Cases of AEFI by LGAs in Oyo State, Nigeria – 2021.

workers in the study. The male-gender gap that exists should be closed by recruiting more male health workers, especially for deployment to the hard-to-reach areas, which are more difficult for women because of the issues relating to rape and other social vices.

Strategic leaders were incorporated into the first phase of vaccination with the aim that their vaccination would increase vaccine acceptability and mitigate the effects of myths and rumours surrounding vaccination. In all, about two-thirds of male strategic leaders were vaccinated in Oyo State. This is not unexpected as males are culturally considered as opinion and religious leaders, especially in South-Western Nigeria. Many African communities consider female leadership to be taboo, and as a result, they disregard any authority that comes with it. The culturally acceptable male-driven leadership was not demonstrated in Iseyin LGA, where all the vaccinated strategic leaders were females. As a consequence of this, monitoring of this LGA for the second dose and subsequent phases of vaccination must be intensified so as to forestall the perceived negative effects that may likely come up with female leadership on future vaccine acceptability in this LGA. Whereas in Ibadan North and Ona-Ara LGAs, all the vaccinated strategic leaders were males, and this seemed not to be socially acceptable, especially in these female-dominated LGAs.[20] Therefore, efforts must be harnessed to ensure fair representation of female leaders with a view to influencing the majority who see them as role models.

The trend of vaccination revealed an initial hesitancy followed by an improved period of acceptance, which thereafter, went down to an unacceptable value. This trend is reinforced by the growing evidence of vaccine delays or refusals due to a lack of trust in the importance, safety, and effectiveness of vaccines, alongside persistent access issues.[33] Throughout the twenty-day period of exercise, the highest number of vaccinated was recorded on day 7, followed by a period of abysmally low coverage. This could be inferred from the fact that many people probably awaited the effects of the vaccines on earlier vaccinees before making their own decisions.

In this regard, community trust is key to ensure vaccine uptake and buy-in. To build trust, it is important to understand how communities perceive the disease and their main questions, doubts, and fears around vaccines, generally, and towards COVID-19 vaccines specifically. Previous experience of epidemics and communities' risk perceptions about the disease can also influence vaccine uptake. Lack of trust in service providers, past negative experience with vaccination, and poor quality of services may also affect the decision to accept a new vaccine in certain contexts. In this instance, the Federal Government of Nigeria (FGN) and other stakeholders should scale-up activities to build community trust through programmes that will increase their knowledge of COVID-19 vaccines. The study further revealed the cases of AEFI and these were prominently noticed among two rural LGAs. Though these cases were non-serious AEFI, efforts must be geared towards reducing the incidence as this may constitute barriers for future vaccine acceptability, especially during the second dose of the first phase and other phases. It is also instructive that those in the rural areas probably need more training on effective vaccination strategies, as they were reporting more cases than their urban counterparts. On the other hand, the reporting of AEFI cases must be prioritized in urban LGAs, as low prevalence of AEFIs might be due to low reporting.

CONCLUSION

The study highlights the high proportion of vaccinated people in the state. However, about 19.0% were yet to be covered and this might constitute an epidemiological risk for other co-workers, which could later become the agents of transmission in the communities. As the wave of the global scarcity of the COVID-

19 vaccine is radiating more terribly to encircle the developing nations, especially Nigeria, efforts must therefore be geared towards ensuring judicious use of the limited vaccines to ensure better coverage.

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Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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