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COMMENTARY

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The re-emergence of diphtheria in Nigeria: Descriptive assessment of the post-COVID-19 crisis management

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1 | INTRODUCTION

Diphtheria is an extremely infectious disease caused by toxigenic *Corynebacteria* species, which are, species of *Corynebacterium diphtheriae* and infrequently *Corynebacterium ulcerans*, and *Corynebacterium pseudotuberculosis*.[1,2] It presents with fever, sore throat, enlarged lymph nodes, barking cough, difficulty swallowing, and obstruction of air passage.[3] The release of toxin capable of harming the organs cause severe complications such as respiratory failure, heart problems, and even death.[4,5] The prevention and treatment of diphtheria globally requires early detection, and administration of diphtheria antitoxin and antibiotics.[6] The introduction of diphtheria antitoxin in 1950, has resulted in a significant decline in diphtheria cases with more than 1 million cases in the pre-vaccination era to an average of 6582 cases between 2013 and 2017.[7] Vaccination against diphtheria is included in the National Program on Immunization (NPI) schedule and presented as the DTP (diphtheria, tetanus, and pertussis) vaccine which is given to neonates at Weeks 6, 10, and 14 of life.[3] The incidence of diphtheria outbreaks in Nigeria revealed the insufficient coverage of national childhood immunization programs.[8] Ibrahim et al.[7] observed an average of 5–6 cases of diphtheria for each month, between July and December 2020. The number of cases surpasses the current reports from Nigeria.[9,10] This paper discusses the challenges, effort made to address the re-emergence of diphtheria in Nigeria and possible recommendations

2 | DIPHTHERIA CHALLENGES

In 2023, the first diphtheria outbreak was formally declared on the 20th of January, 2023, and an aggregate of 253 suspected cases were reported, and 111 (42.1%) of the suspected cases were (8 lab-confirmed and 103 clinically diagnosed). Most of the cases confirmed (91.9%) affected children aged 2–14 years old. Furthermore, among confirmed cases, an aggregate of 22 deceases (CFR = 19.8%) were noted.[11] Out of 111 confirmed cases, only 12 (10.8%) received diphtheria antitoxin (DAT) in its entirety. This showed that the majority of diphtheria patients were not fully protected by the DAT vaccine. An aggregate of suspected and confirmed cases of diphtheria was reported to be 2,006 and 672 confirmed cases, respectively, with 73 deceases (CFR 10.9) between May 2022 and May 2023 across 23 states in Nigeria. This indicates the threat posed by the diphtheria outbreak (Figure 1).[12]

2.1 | Negative impact of the COVID-19 pandemic

The pandemic upset Nigeria's health care services. Routine immunization has a substantial influence on childhood health, especially in areas with low immunization exposure.[13] In a study conducted between July and December 2020 in Katsina, an average of 5–6 cases per month, was reported. The number of cases exceeds the

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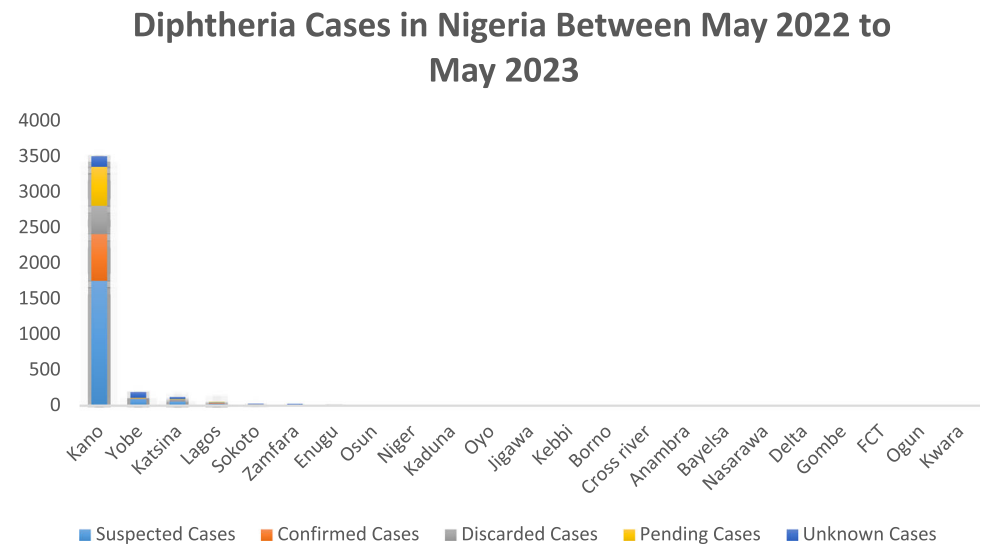


FIGURE 1 A chart showing the spread of diphtheria cases across the states in Nigeria between May 2022 and May 2023.

most current reports from Nigeria.[9,10] The increased number of cases over the 6 months has been because routine immunization could not be performed in many vaccination centers during the period of lockdown, which brings a gap in vaccination exposure.[14]

2.2 | Socio-economic status

Eight of the cases (88.8%) out of 9 cases transferred to the National Ear Care Centre, Kaduna had not been previously immunized against diphtheria, and they were of low socio-economic status. The northern part of Nigeria is known to have reduced exposure to immunization in the world with immunization exposure of 6%. Due to this, many children fall off diseases prevented with vaccines. The reasons could be due to misunderstandings about immunizations, religious impact, vaccine failure owing to deprived cold chain, scarcity of vaccines, and materials for immunization.[15]

2.3 | Challenges associated with bureaucratic rule

The bureaucratic rule in Nigeria poses a challenge to the re-emergence of diphtheria, where state epidemiologist after getting the report of suspected or confirmed cases, notifies the Ministry of Health responsible for requesting antitoxin from the CDC. It takes time to get a producer to supply the antitoxin within the expiry date (even if it is available), and also the time it takes for the shipment, makes the supply too late to save a patient's life.[16]

2.4 | Low coverage of immunization program

The tenacity of diphtheria in Nigeria has been associated with low vaccination rates, inadequate vaccine storage, and transportation,[4] absence of immunization, partial immunization, waning immunity (which happens over time), lack of booster doses, reduction in herd immunity, low socio-economic class, an unsatisfactory healthcare system, and overcrowding, among other variables.[17,18]

2.5 | Inadequate healthcare facility

Delays in diagnosis and treatment are aggravated owing to diminished access to medical services, particularly in rural areas. Additionally, the ineffective detection and response to outbreaks are hampered by a lack of expertise in disease surveillance, laboratory surveillance, and response systems caused by a shortage of resources, staff, and collaboration between government agencies.[4] Diminished vaccination rates and restricted access to medical facilities have made it more difficult to control the incidence of diphtheria in Nigeria. According to the National Immunization Coverage Survey (NICS), 3.1 million (14%) children had no or missed vaccinations. Additionally, 49% of these children only received the primary dose of the PENTA vaccine, and only 33% received the entire three doses of the PENTA valent vaccine.[19] Additionally, 40% of these kids received no vaccinations from the healthcare system.[4]

3 | EFFORTS

3.1 | Immediate response

In the re-emergence of diphtheria infection, the support of the government of Kano state, international organizations, affected families, and doctors suppress the re-emergence. In Kano, many affected children are brought by their families for treatment. In Lagos, officers in charge of disease Surveillance and Notification are posted in several areas to trail and report any alleged cases.[20]

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3.2 | Decreasing the threat of outbreak

The NCDC recently released about 100 vials of diphtheria antitoxin for treatment to Lagos state to combat the outbreak in the city of a large population. "The NCDC advised health facilities in Nigeria to intensify alertness, and detection levels while also publishing a public health advisory on its website." NCDC provides guides to Nigerians, to decrease the threat of diphtheria. Parents should ensure the complete vaccination of their children against diphtheria with three (3) doses of the pentavalent vaccine as endorsed in the childhood immunization program.[20] High suspicion for diphtheria infection should be done by healthcare workers. Individuals should isolate themselves if show signs, and symptoms indicative of diphtheria, as well as alert the local government area, state disease surveillance officer (DSNO), or the NCDC via a cost-free line (6232). Moreover, the NCDC recommends individuals in contact with a confirmed case individual must be monitored closely, administering antibiotics as prophylaxis, then placed on diphtheria antitoxin when directed. Also, advise all healthcare personnel with greater contact with cases of diphtheria to receive vaccine against diphtheria.[20]

3.3 | Surveillance of diphtheria outbreak

To improve surveillance and diphtheria outbreak response, the NCDC is partnering with state health departments and other organizations. The NCDC has been collaborating with stakeholders to raise alertness of the illness, but regrettably, the number of cases is still rising.[12] To organize the efforts at all levels, the National Technical Working Group's multi-partner, multi-sector Emergency Operations Center (EOC) was initiated.[20] Through the weekly meetings of the Diphtheria National Technical Working Group, the Nigeria Centre for Disease Control and Prevention (NCDC) is in charge of making sure that coordination and oversight of the country's diphtheria surveillance and response efforts are ongoing. Additionally, Rapid Response Teams (RRTs) have been sent to some states including Katsina, Osun, and Yobe, and then sent back to Kano and Lagos States to boost response efforts in response to the diphtheria outbreak. One of the crucial actions taken to contain the diphtheria outbreak is the harmonization of surveillance and laboratory data across states, which has started.[21] This will boost the ability for rapid case detection. In states where RRTs were deployed, clinical and surveillance personnel have received training on how to present, prevent, and monitor diphtheria. Additionally, procurement processes for reagents, sample collection, transportation materials, and media have also been started. For the isolation of confirmed cases across the states, NCDC NRL offers drug sensitivity testing after the laboratory analysis is completed.[21]

3.4 | Vaccination against diphtheria outbreak

To stop the disease from spreading further, the NCDC advises Nigerians to get vaccinated against diphtheria. National Primary Health Care Development Agency (NPHCDA), a disease prevention and immunization agency, collaborates with the NCDC to ensure a quick rise in vaccination coverage.[22]

The availability of the DAT is essential for controlling the outbreak; as a result, distribution of the DAT to the affected states has been going on since December 2022, and nationwide routine immunization programs are being strengthened.[23] With the worrying trend, the government requested National States' assistance in scaling up immunizations.[12]

4 | CONCLUSION

Nigeria is currently facing the re-emergence of vaccine-preventable disease as a result of low vaccine coverage and a problem with vaccine supply and stocking. This has caused the current reported cases of diphtheria in the country. The support provided by Nigeria's government, the Nigeria Centre for Disease Control, International Organizations, and Doctors has helped in making an effective response to the outbreak. The National Primary Health Care Development Agency (NPHCDA) collaborates with the NCDC to ensure a quick rise in vaccination coverage. The paper recommended addressing the country's vaccination program, vaccine supply, and stocking and training of cold chain officers through telehealth and community-based education.

5 | RECOMMENDATION

The recent outbreak of diphtheria in Nigeria has called for the reviewing of the National Immunization Schedule in Nigeria.

- Nigeria's Immunization Program should be improved through collaboration between the government, health workers, and also support from non-governmental organizations that will promote the coverage of vaccination across the country.
- Immunization coverage survey should be implemented to easily detect areas with low vaccination rates and then offer a possible solution to the low coverage.
- The introduction of telehealth can help address vaccine hesitancy through communication and answering critical questions regarding online vaccine uptake by individuals.
- Implementation of telehealth service can also bring vaccines close to hard-to-reach areas through online booking of appointments.
- Nigeria's health sector should be equipped with the capacity to produce vaccines to reduce long trends of shipping vaccines to Nigeria and also to provide quick access to vaccination by individuals. This will not only benefit the Nigeria health sector but also contribute towards the attainment of the New Public Health Order for African.
- The decrease in vaccination uptake can be properly improved through community-based health education which will offer information on sound and accurate education to improve vaccine uptake.
- The surveillance system of Nigeria should be strengthened more so that they can easily identify cases of diphtheria in the country. The

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introduction of telehealth as a surveillance tool in detecting new cases can also be used to improve the Nigeria surveillance system.

- The supply of vaccines and the country's cold chain system should be looked into, and the personnel in charge of the cold chain should undergo training on how to effectively store the vaccine.

AUTHOR CONTRIBUTIONS

Tolulope Joseph Ogunniyi: Conceptualization; validation; writing—original draft; writing—review & editing. **Mustapha Abdulrazaq**: Conceptualization; validation; writing—original draft; writing—review & editing. **Fortune Benjamin Effiong**: Writing—review & editing. **Roseline D. Dine**: Writing—review & editing.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no data sets were generated or analyzed during the current study.

TRANSPARENCY STATEMENT

The lead author Roseline Dzekem Dine affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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