**Original Research Article**

# DIPHTHERIA OUTBREAK RESPONSE AND MITIGATION STRATEGIES IN NIGERIA: A CASE STUDY OF THE NIGERIAN RED CROSS SOCIETY (NRCS) AND INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESCENT SOCIETIES (IFRC) INTERVENTION




## ABSTRACT

The diphtheria outbreak in Nigeria, beginning in late 2022, marked a significant public health challenge, with over 16,000 confirmed cases reported by December 2023. The outbreak, concentrated mainly in northern states such as Kano, Yobe, and Katsina, disproportionately affected children and individuals in underserved communities. This study examines the operational response led by the Nigerian Red Cross Society (NRCS), including the IFRC, the Nigeria Centre for Disease Control (NCDC), and the National Primary Health Care Development Agency. It explores the strategic interventions employed to reduce transmission, enhance vaccination coverage, and provide community-level health support. The research focuses on the effectiveness of coordinated response strategies such as active case search, surveillance, immunization campaigns, and community engagement. Additionally, it highlights the operational challenges encountered, including low immunization coverage, poor health infrastructure, and public health messaging gaps. The results revealed the effectiveness of RCCE programs in disseminating critical information and involving communities in the response efforts. The NRCS facilitated improved vaccine coverage through educational campaigns, overcoming cultural and religious barriers to vaccination. Enhanced surveillance measures, including active case search and laboratory confirmation, were implemented in collaboration with the Nigerian Centre for Disease Control (NCDC) and the National Primary Health Care Development Agency (NPHCDA). In conclusion, the NRCS's comprehensive approach to diphtheria response in Nigeria has been instrumental in controlling the outbreak and shows the importance of a multi-faceted strategy. Continuous investment in healthcare infrastructure, training, and public awareness is vital to sustaining progress and preventing future outbreaks. Strengthening surveillance systems, ensuring equitable vaccine access, and fostering community engagement are essential components of an effective emergency response framework; the integration of digital health technology is further recommended in future emergencies, thereby safeguarding public health and preventing the further spread of diphtheria.


**Keywords:** Risk Communication, Community Engagement, Surveillance

**Commented [IMR1]:** 1. Conciseness:
The abstract should be more concise. Consider summarizing key findings more briefly to maintain reader engagement.

2. Structure: Ensure the abstract follows a structured format: Background, Methods, Results, and Conclusion.

3. Clarity: Clarify the significance of the findings, emphasizing their implications for future diphtheria control in Nigeria.

## 1.0 INTRODUCTION

The outbreak, which began in Kano State in December 2022, rapidly spread to neighbouring states, affecting diverse communities and highlighting the critical gaps in vaccination coverage and healthcare infrastructure. With over 16,000 confirmed cases reported by December 2023, the outbreak is considered the worst in over a decade, surpassing previous records from 2011.

Diphtheria is a highly contagious and potentially fatal bacterial infection [1]. It occurs mainly in low-resource countries, especially where poor sanitation and vaccination uptake and coverage are low. The signs and symptoms include fever, sore throat, enlarged lymph nodes, barking cough, difficulty swallowing, and air passage obstruction [2]. The release of toxins capable of damaging organs can lead to severe complications, including respiratory failure, cardiac issues, and even death. As one of the tropical countries, Nigeria has witnessed a surge in diphtheria cases. The diphtheria outbreak in Nigeria primarily affects children aged 0-14, with Kano state being the epicentre of the crisis [3]. This article investigated the emergency response to diphtheria by the Nigerian Red Cross Society (NRCS), highlighting key strategies employed. The Nigerian Red Cross Society (NRCS) was established through an Act of the Parliament in 1960. The Act, referred to as the Nigerian Red Cross Act of 1960, CAP 324 states in Section 5 (1) that 'the Society shall be recognized by the Government of the Federation as a Voluntary Aid Society, auxiliary to the public authorities'. The support from the International Federation of Red Cross and Red Crescent Societies (IFRC) in scaling up its Emergency Appeal expanded the response of the Nigeria Red Cross Society to more states in the country.

**Commented [IMR2]:** 1. Contextualization: Provide a stronger context for the diphtheria outbreak by including statistics or comparisons to previous outbreaks.

2. Objectives: Clearly state the objectives of the study at the end of the introduction to guide the reader on what to expect.

3. Literature Review: Integrate a brief review of related studies to highlight the uniqueness of this research and its contribution to existing knowledge.

The Nigerian Red Cross Society (NRCS) has been at the forefront of this effort, leveraging its unique position as an auxiliary to public authorities to support the emergency response. The NRCS, in collaboration with the Nigerian Centre for Disease Control (NCDC), the National Primary Health Care Development Agency (NPHCDA), and other partners, has implemented a multi-faceted approach to address the various dimensions of the crisis. This response is made possible by support from the International Federation of Red Cross and Red Crescent Societies (IFRC), enabling the NRCS to expand its reach and impact across multiple states.

The NRCS's approach integrates risk communication, community engagement, vaccination campaigns, and surveillance measures to address the outbreak. Risk communication and community engagement have been critical in dispelling misconceptions and promoting vaccination acceptance among diverse socio-cultural groups. Vaccination efforts have focused on increasing coverage and addressing cultural and religious barriers to immunization. Surveillance measures include active case searching, laboratory confirmation, and data analysis to inform targeted interventions. Standardized protocols and continuous evaluation ensure the quality and effectiveness of the response.

By early 2024, Nigeria had recorded over 28,975 suspected cases of diphtheria, with 16,518 confirmed cases and 839 deaths (case fatality rate of 5.0%). Kano, Yobe, and Katsina were among the states worst hit, accounting for over 96% of the confirmed cases. Many factors, including densely populated living conditions, low vaccination rates, and poor sanitation, contributed to the outbreak's rapid spread. Diphtheria is easily transmissible through respiratory droplets, and communities with limited healthcare access were at heightened risk.

The diphtheria outbreak in Nigeria, which began in late 2022, has exposed significant gaps in vaccination coverage, public health infrastructure, and community trust in immunization. With

over 16,000 confirmed cases by the end of 2023, primarily affecting children in underserved regions, the outbreak showed the urgent need for effective response strategies. This study focuses on the interventions led by the Nigerian Red Cross Society (NRCS), in collaboration with national and international partners, to mitigate the crisis. Key efforts included community-level risk communication, vaccination campaigns, active surveillance, and the use of locally trained volunteers to address cultural and religious barriers to vaccination.

The research provides a comprehensive analysis of the NRCS's multi-faceted approach to outbreak management, evaluating successes such as increased vaccine uptake and community engagement while identifying persistent challenges, including resource limitations and misinformation. It highlights how tailored risk communication strategies helped dispel myths and foster trust among communities, particularly in regions resistant to immunization. Additionally, the use of community-based surveillance by trained volunteers was critical in detecting and managing suspected cases and preventing further spread of the disease.

The findings aim to inform future public health strategies by emphasizing the importance of integrating community participation, robust surveillance systems, and digital health technologies into outbreak responses. Strengthening vaccination programs, enhancing health infrastructure, and ensuring equitable access to healthcare are essential for sustained progress. This study documents the lessons learned from the diphtheria outbreak and serves as a blueprint for improving Nigeria's preparedness and resilience against future health emergencies.



## 2.0 METHODS

### 2.1 Study Design:

**Commented [IMR3]:** 1. Study Design: Specify the study design (e.g., qualitative, quantitative, mixed methods) clearly at the beginning of this section.

2. Sampling Method: Detail the sampling methods used for selecting participants or communities to ensure reproducibility.

3. Data Analysis: Provide more information on the statistical methods or software used for data analysis to strengthen the methodological rigor.

This research utilizes operational reports, situation updates, and the NRCS and IFRC intervention records to assess the response mechanisms employed. Data collection also involved reviewing the community-based surveillance activities, vaccination campaigns, health promotion efforts, and psychosocial support programs executed in the affected regions. Key stakeholders in the diphtheria response include the Nigerian government, NCDC, NRCS, IFRC, WHO, and various local community leaders. Their collaborative efforts form the basis of the intervention strategies examined.

### 2.2 Study Area

The study was conducted across 13 Nigerian states where diphtheria outbreaks were reported: Kano, Osun, Borno, Yobe, Kaduna, Jigawa, Lagos, FCT, Kastina, Taraba, Jos, Gombe, and Zamfara. These states were selected based on the severity of the outbreak.

## 3.0 Document and Case Analysis of the NRCS Approach:

Internal reports, response plans, and evaluation documents from the NRCS, IFRC, the Nigerian Centre for Disease Control and Prevention (NCDC), the National Primary Health Care Development Agency (NPHCDA) and relevant resource documents from the World Health organization were analyzed. These documents provided valuable insights into the operational aspects of the response.

### 3.1 Risk Communication and Community Engagement:

Effective risk communication and community engagement are crucial components of emergency response efforts, especially in the case of a diphtheria outbreak. In Nigeria, the Nigerian Red Cross Society (NRCS), the Nigerian Centre for Disease Control (NCDC), and the National Primary Health Care Development Agency (NPHCDA) play critical roles in mitigating the diphtheria crisis through the RCCE programme. Risk communication involves a real-time exchange of information

and the dissemination of warnings, advice, and instructions between experts or officials and people who face a threat (hazard) to their survival, health, or economic or social well-being [4]. It is a vital tool for maintaining public awareness, building trust, and fostering collaboration between response organizations and communities. In Nigeria's context of a diphtheria outbreak, risk communication helps inform the population about the disease, its transmission, symptoms, and prevention methods. Moreover, it assists in dispelling rumours and misconceptions about diphtheria, promoting appropriate healthcare-seeking behaviour among affected communities. By incorporating information from scientific literature, risk communication efforts can effectively communicate the outbreak's severity, the importance of preventive measures, and the efficacy of available treatments. This information empowers individuals to make informed decisions about their health and encourages them to seek timely medical assistance. Engaging Communities in Emergency Response to effectively respond to the diphtheria outbreak in Nigeria community engagement is crucial. Involving community members in all stages of emergency response helps ensure a more comprehensive and culturally appropriate approach. By actively engaging the community, response organizations can better understand local beliefs, practices, and concerns related to diphtheria. This knowledge allows for the development of targeted strategies that resonate with the community and encourage active participation. Engaging communities by incorporating their voices and concerns into response strategies fosters trust and drives wider community participation. In any emergency response, effective risk communication and community engagement are crucial. The affected communities need to be well-informed about the nature of diphtheria, its prevention, and the available treatment options. Developing targeted communication strategies that resonate with diverse socio-cultural contexts within these states is vital. This was done by the community volunteers trained by the NCDC and the NPHCDA, who

also worked with health professionals, community leaders, religious leaders, and other key influencers. Through this effort, the community was actively participating in preventing and controlling the spread of the disease

- Community Awareness and Education: The RCCE strategies implemented by the NRCS and its partners were instrumental in raising awareness about diphtheria, its symptoms, and prevention methods. The dissemination of accurate information helped dispel myths and misconceptions, which are often barriers to effective disease management in communities.
- Engagement with Community Leaders: By involving community leaders, religious figures, and influencers, the NRCS was able to foster trust and ensure the cultural relevance of its messages. This engagement proved crucial in areas where cultural and religious beliefs influenced vaccine hesitancy.
- Use of Local Volunteers: The deployment of trained community volunteers to conduct door-to-door visits and organize community meetings allowed for direct interaction with residents, facilitating personalized communication and fostering a sense of community ownership over health initiatives.
- Feedback Mechanisms: Establishing channels for community feedback through the CEA component enabled the NRCS to tailor its communication strategies to better meet the population's needs and concerns. This two-way communication approach enhanced the community's trust and empowered individuals to take proactive steps in disease prevention.

Effective RCCE requires a deep understanding of a community's cultural and social dynamics. Tailoring messages to align with local values and beliefs is essential for gaining community trust and cooperation.

Sustained community engagement is vital for building resilience against future outbreaks. Continuous dialogue with communities helps maintain awareness and preparedness even after an outbreak has been controlled.

### 3.2 Vaccination Coverage:

Vaccination Coverage According to the United Nations Children Fund 2019, Immunization is one of public health's most successful and cost-effective interventions [5]. The Nigerian Red Cross Society has played a critical role in supporting the coverage of diphtheria vaccines nationwide. Vaccination is the most effective way to prevent the spread of diphtheria, and the Nigerian Red Cross Society has worked tirelessly to ensure that as many people as possible have access to this life-saving vaccine. Primarily, there are barriers to vaccination; in certain parts of the country, especially the Northern region, there are some cultural and religious beliefs against taking vaccines, with resultant low acceptance and uptake of immunization, including diphtheria-toxoid-containing pentavalent vaccine [6]. Due to the Nigerian Red Cross Society's diligence, dedication, and support from the International Federation of the Red Cross and Red Crescent Societies, the country has made significant strides in improving diphtheria vaccine coverage. By focusing on education, advocacy, and community outreach, they have raised awareness about the importance of vaccination and addressed common misconceptions. This has resulted in an increase in vaccine acceptance among Nigerians, ultimately contributing to a reduction in diphtheria cases.

One key initiative the Nigerian Red Cross Society has undertaken is education. They have conducted numerous information campaigns to educate the public about the risks of diphtheria and the benefits of vaccination. Through workshops, seminars, and community meetings, they have provided accurate information and addressed concerns or doubts that individuals may have had.

The Nigerian Red Cross Society has also been actively engaged in advocacy efforts with the government and other stakeholders. To reach even the most remote areas, they have partnered with local healthcare organizations, government institutions, and international agencies to ensure the seamless delivery of vaccines. They have been champions of policies and initiatives that aim to improve vaccine accessibility and affordability, ensuring that more Nigerians can receive the diphtheria vaccine. Furthermore, the society has carried out extensive community outreach programs. Volunteers and health workers go door-to-door, conducting vaccination drives and providing information about diphtheria and other preventable diseases. These efforts have helped to reach underserved populations and improve vaccine coverage in remote areas. Not only does high vaccine coverage prevent individual cases of diphtheria, but it also helps to establish herd immunity within communities. This means that even those unable to receive the vaccine, such as infants or individuals with certain medical conditions, are protected from the disease because most of the population is vaccinated. Achieving and maintaining high diphtheria vaccine coverage is, therefore, crucial for the overall health and well-being of the Nigerian population.

### 3.3 Surveillance measure:

In terms of disease control, surveillance refers to the systematic collection, analysis, and interpretation of health data for preventive action. Poor surveillance and lack of capacity for diagnosis have led to the underreporting of the burden of diphtheria in Nigeria [7]. This informed the Nigerian Red Cross Society to support the NCDC in its Surveillance pillar. The surveillance measures implemented in Nigeria's emergency diphtheria response follow a well-structured framework. This framework includes Active case Search, laboratory confirmation, Contact tracing, reporting, data collection, analysis, and dissemination of findings. Each step is critical in

providing a wholesome picture of the disease's prevalence and guiding response strategies. The first surveillance measure involves Active case Search, NRCS-trained community volunteers with the Disease Surveillance and Notification Officers (DSNOs) supported by NCDC, and NPHCDA, actively search for suspected cases of diphtheria through house-to-house visits, health facilities, and community outreach programs. Early identification of cases is essential to prevent the disease from spreading further, saving lives. Once suspected cases are identified, laboratory confirmation becomes imperative. This involves collecting clinical samples, such as throat swabs, from suspected cases and sending them to designated laboratories for testing. In collaboration with other partners, NCDC ensures that these laboratories are equipped with the necessary reagents and trained personnel to conduct accurate and timely diagnostic tests. Following laboratory confirmation, cases are promptly reported to the central surveillance system, and contact tracing is initiated with a 10-day follow-up. As the coordinating body, the NCDC collates all relevant information to track the outbreak's magnitude and geographical spread. This enables decision-makers to understand the current situation better and allocate resources accordingly. Additionally, data collection is an integral component of surveillance measures. Community volunteers diligently collect epidemiological information from each identified case, recording vital demographic details such as age, sex, immunization status, and geographic location. This data is then directly entered into an electronic database called SORMAS, establishing a reliable source of information for future analysis. Data analysis is the next crucial step in surveillance. Epidemiologists and statisticians use specialized software and statistical techniques to examine the collected data, identifying trends, patterns, and risk factors associated with the diphtheria outbreak. These findings help guide response strategies, such as targeted vaccination campaigns in high-risk areas, and inform policy decisions to minimize the disease's impact. Finally, the dissemination of

surveillance findings is of utmost importance. In collaboration with other stakeholders, NCDC shares regular updates on the outbreak's progress, including the number of cases, deaths, and areas affected. This information is available to healthcare professionals, government agencies, and the public. It increases awareness and empowers individuals to take appropriate preventive measures and seek early medical attention. The comprehensive surveillance measures implemented by NRCS, NCDC, and NPHCDA in response to the diphtheria outbreak in Nigeria have proven to be highly effective. The collaborative efforts of these organizations, along with the support of other partners, have enabled the prompt detection, confirmation, reporting, and analysis of cases. This has facilitated evidence-based decision-making and the implementation of targeted interventions. However, it is crucial to acknowledge the challenges that surveillance teams face while executing these measures. The vastness of Nigeria's geography and security situations make access to some communities challenging, hindering the timely detection and reporting of cases. Moreover, the limited availability of trained personnel and laboratory capacity further strain the surveillance system. Addressing these challenges requires continued investment in infrastructure, human resources, and training programs. In conclusion, the surveillance measures implemented as part of the emergency diphtheria response in Nigeria have played a vital role in curbing the spread of this disease. Case detection, laboratory confirmation, reporting, data collection, analysis, and dissemination of findings form a well-structured framework that enables effective response strategies. However, ongoing efforts to strengthen the surveillance system are crucial to ensure the timely identification and control of future disease outbreaks. The emergency diphtheria response in Nigeria has required a coordinated and multi-faceted approach. The support provided by the NRCS, NCDC, and NPHCDA in resource allocation and capacity building has been crucial in controlling the outbreak. Through their collaborative efforts, these organizations have ensured the

availability and distribution of essential resources and the training of healthcare workers. The efforts and remarkable progress towards the containment of the diphtheria outbreak in Nigeria prove the effectiveness of these collaborative efforts. However, sustaining these efforts and strengthening the healthcare system to prevent future outbreaks and protect the population from infectious diseases is essential.

### 3.4 Standardization and Evaluation:

Standardization and evaluation play a vital role in ensuring the quality and effectiveness of emergency diphtheria response. Developing standardized guidelines and protocols will promote consistency in diagnosis, treatment, and infection control measures across the affected states. Regular evaluation of response activities helps identify improvement areas, validate interventions' effectiveness, and ensure accountability. This requires the establishment of monitoring and evaluation systems and the integration of feedback from both healthcare professionals and affected communities. The NRCS, NCDC, NPHCDA and other partners worked together to establish standardized protocols and guidelines for various aspects of the response. These include case definition, laboratory testing, treatment protocols, contact tracing, and surveillance. By standardizing these processes, the organizations have ensured that healthcare workers across different regions follow uniform procedures, improving accuracy in diagnosis, treatment, and reporting of diphtheria cases. Standardization has also facilitated effective coordination and communication among the organizations involved in the response. The NRCS has played a significant role in standardizing community-based interventions. They have developed guidelines for health education campaigns, vaccination strategies, and contact tracing protocols. These guidelines have been disseminated to NRCS volunteers and other healthcare workers involved in

the response, ensuring a consistent approach to delivering essential services to affected communities. The NCDC has contributed to standardization by providing technical expertise and guidance in developing national diphtheria surveillance, laboratory testing, and case management guidelines. These guidelines have been widely adopted by healthcare facilities nationwide, promoting uniformity in the response. Evaluation Evaluation is essential to assess the effectiveness of emergency response and identify areas for improvement. The NRCS, NCDC, and NPHCDA have recognized the importance of evaluation and have implemented various mechanisms to monitor and evaluate the diphtheria response in Nigeria. These organizations have established surveillance systems to track the number of diphtheria cases, identify trends, and monitor the impact of interventions. Through these surveillance systems, they can assess the effectiveness of vaccination campaigns, contact tracing efforts, and treatment protocols.

### 3.5 Learning and Adaptation:

The diphtheria outbreak in Nigeria has highlighted several key lessons and areas for improvement. First, Strengthening Surveillance Systems. The outbreak revealed gaps in the surveillance systems for detecting and responding to infectious diseases. Enhancing these systems is crucial for early identification and containment of outbreaks. This is based on the observation made by the researchers at the epicentre of the disease in Ungogo LGA, Kano State, Nigeria. More responders need to employ surveillance mechanisms during similar outbreaks.

Effective data management systems are crucial at all stages of an outbreak for accurately identifying and recording cases. Precise data collection allows health officials to track the spread of diphtheria, identify hotspots, and implement targeted interventions. Timely data collection ensures current and actionable information, enabling rapid decision-making and resource

allocation. For instance, the early identification of cases in Lagos State facilitated swift action and containment efforts. Robust data management systems enhance surveillance capabilities, allowing for continuous outbreak monitoring. By maintaining comprehensive records, community health officials can detect trends, monitor the effectiveness of interventions, and adjust strategies as needed. Enhanced surveillance during the diphtheria outbreak enabled health workers to track the spread of the disease, identify areas with low vaccine coverage, and prioritize these regions for vaccination campaigns.

In addition, there was a shortfall in vaccine coverage, particularly in underserved communities. Some health facilities do not have an adequate supply of vaccines. Ensuring widespread and equitable access to vaccines is vital in preventing future outbreaks. Also, misinformation and lack of awareness about diphtheria and the importance of vaccination were evident. Public health campaigns are necessary to educate communities on the benefits of vaccines and the dangers of vaccine-preventable diseases. The community-based volunteers of the NRCS were deployed in major affected communities. They incorporated risk communication and community engagement activities, forming the bulk of the public awareness. Such education needs strengthening as a means of preparedness. Engaging local communities in outbreak response efforts is crucial. Community leaders and influencers can significantly promote vaccination and adherence to public health guidelines as CBVs of NRCS and NCDC staff cascade this information in various communities.

Moreover, on Health Infrastructure The outbreak strained Nigeria's health infrastructure, highlighting the need for improved healthcare facilities, especially in rural and hard-to-reach areas in states like Kano, Osun, Borno, Yobe, Kaduna, Jigawa, Lagos, Zamfara, Katsina, etc. Investment in health infrastructure is essential for effective disease management and response. This is a call

for the government to invest more in health infrastructure. It is also commendable that some states, like Kano, had about three isolation and case management centres. Rapid Response and Coordination problem is another lesson to learn from the outbreak. The outbreak emphasized the need for a coordinated and rapid response from national and international health bodies. Establishing and maintaining strong partnerships and communication channels is key to managing public health emergencies. Also, there is a need for continuous training and capacity building for healthcare workers to ensure they are well-prepared to handle outbreaks. This includes training on the latest diagnosis, treatment, and vaccination protocols. Some facilities visited by the NDRTs of NRCS revealed the need for continuous capacity building of the primary health care worker towards managing outbreaks. Good Policy and adequate funding are key factors to take out from the diphtheria outbreak. The outbreak underscored the importance of robust policies and adequate funding for infectious disease prevention and control. Sustainable funding mechanisms are essential for maintaining public health initiatives and emergency preparedness at facility and community levels. Finally, research and development are very important, as they ensure that findings and outcomes are properly documented for further studies. Investing in research to better understand the epidemiology of diphtheria and other infectious diseases can inform more effective prevention and control strategies. This includes studying vaccine efficacy and the potential emergence of new strains.

## 4.0. Results

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Community-Based Surveillance:

**Commented [IMR4]:** 1. Data Presentation: Use tables or graphs to present key data, such as vaccination rates or case numbers, for clarity and visual impact.

2. Narrative Clarity: Ensure that the narrative clearly correlates with the data presented. Avoid redundancy and focus on the most relevant findings.

3. Highlight Key Findings: Emphasize the most significant results that directly relate to the study's objectives.

**Commented [IMR5]:** Discussion:
Interpretation: Provide a more in-depth interpretation of the results, discussing how they compare to findings from other studies.

Limitations: Explicitly state the limitations of the study, including potential biases and how they were mitigated.

Future Directions: Suggest specific areas for future research based on the findings, enhancing the manuscript's contribution to the field.

Over 1300 volunteers were trained in active case search and contact tracing. These efforts led to the identification of 6,972 suspected cases of diphtheria, many of which were later confirmed by health authorities. The volunteers were critical in ensuring that individuals with symptoms were rapidly identified, reported, and referred for treatment Sources [8]

Vaccination Campaigns:

Routine immunization was intensified, particularly in Kano, Katsina, and Osun states. A total of 120 vaccination teams were deployed, reaching thousands of children and zero-dose individuals. Despite these efforts, vaccination coverage remained low, with only 42% of children under 15 years fully immunized. However, the NRCS's mobilization of parents and caregivers contributed to improved access to vaccines in hard-to-reach communities [8]

Increased Vaccine Uptake: The NRCS successfully improved vaccination coverage by addressing cultural and religious barriers through targeted education campaigns. These efforts increased vaccine acceptance and uptake, particularly in regions where skepticism was prevalent.

Accessibility to Vaccines: Collaboration with local healthcare providers, NPHCDA, and international organizations ensured the widespread distribution of vaccines, reaching even remote areas. This strategic partnership facilitated logistical support, including cold chain management and vaccine transportation.

Focus on Vulnerable Populations: Efforts were made to prioritize high-risk groups, such as children aged 0-14, who were most affected by the outbreak. Special vaccination drives and clinics were set up to cater to these populations, thereby increasing their access to immunization.

Data-Driven Strategies: Data from the RCCE exercise that answers the vaccination status of community members were complemented with data from the NPHCDA to identify areas with low

vaccination rates, allowed for targeted interventions, optimizing resource allocation and maximizing the impact of vaccination campaigns.

Risk Communication and Community Engagement (RCCE):

The NRCS executed robust public health messaging campaigns, including radio shows, market storms, and roadshows. These campaigns aimed to educate the public on diphtheria symptoms, prevention measures, and the importance of vaccination. Over 4 million people were reached through these RCCE activities [8]

Infection Prevention and Control (IPC):

Volunteers were trained in IPC measures to minimize transmission during surveillance and vaccination activities. Hygiene kits were distributed to households in Kano, Katsina, Kaduna, and Osun states. However, challenges persisted in securing adequate supplies of personal protective equipment (PPE) for frontline workers [8]

Mental Health and Psychosocial Support (MHPSS):

Psychosocial support services were integrated into the intervention, targeting families affected by the outbreak, particularly those who had lost loved ones. Volunteers provided community-based psychosocial first aid to mitigate the mental health impact of the crisis

## 5.0 Policy Recommendations and Future Directions

One key recommendation is to equip healthcare workers with mobile devices or their devices, which should be loaded with mHealth apps that enable real-time data collection and reporting of

diphtheria cases. These apps can be designed to capture clinical symptoms, patient demographics, and geolocation, allowing for immediate case reporting to a central database (SORMAS) managed by the Nigeria Centre for Disease Control (NCDC).

Strengthening surveillance systems for early detection and reporting of cases is crucial. This can be achieved by establishing a robust national disease reporting network, where healthcare facilities promptly notify the NCDC of suspected cases. Additionally, training healthcare workers on the clinical diagnosis of Diphtheria and improving laboratory capacity for accurate and timely diagnosis are key components of an effective surveillance system.

Another policy recommendation is the implementation of a comprehensive vaccination program. A digital vaccination records that allow individuals to store and access their vaccination history through mobile devices. This can help ensure that individuals receive complete immunization schedules and avoid missed doses. Vaccines have proven highly effective in preventing Diphtheria, and ensuring high vaccination coverage is crucial in controlling outbreaks.

In addition to strengthening surveillance and vaccination efforts, it is essential to prioritize public awareness and education. Many Nigerians may not be familiar with the signs and symptoms of Diphtheria or the importance of vaccination. Implementing comprehensive public awareness campaigns through various media outlets can help disseminate accurate information about the disease, its prevention, and treatment. Additionally, community engagement programs can be organized to address misconceptions and generate support for vaccination efforts.

Future interventions should include using mHealth apps to enable online appointment scheduling for vaccinations. Automated reminders can be sent via SMS or app notifications to remind individuals of upcoming vaccination appointments, reducing missed visits.

Furthermore, improving healthcare infrastructure and access to quality healthcare services should be a priority. Many remote and underserved areas in Nigeria lack proper healthcare facilities, making it challenging to provide timely and adequate Diphtheria treatment. Investing in healthcare infrastructure, especially in rural areas, Health Technologies and training healthcare providers in Diphtheria management can significantly enhance the emergency response capacity. Looking ahead, it is crucial to establish a long-term plan for sustained Diphtheria control in Nigeria. This can be achieved by integrating Diphtheria surveillance and control activities into routine public health programs. Regular monitoring, evaluation, and research should be conducted to assess the impact of implemented strategies and identify areas for improvement. Collaboration with international organizations and partners can also provide valuable support and resources for long-term Diphtheria control efforts.

In all, addressing the emergency Diphtheria response in Nigeria requires a multi-faceted approach that involves embracing digital health, strengthening surveillance systems, implementing a comprehensive vaccination program, prioritizing public awareness and education, improving healthcare infrastructure, and establishing a long-term plan for sustained control. The NRCS, NCDC, and NPHCDA, in collaboration with relevant stakeholders, must work together to effectively combat this deadly disease and protect the health and well-being of the Nigerian population. By implementing these policy recommendations and focusing on future directions, Nigeria can significantly reduce the burden of Diphtheria and prevent future outbreaks.



## Conclusion

The emergency diphtheria response in Nigeria has highlighted the critical need for a comprehensive and coordinated approach to tackling infectious disease outbreaks. The efforts led

**Commented [IMR6]:** 1. Relevance: Reinforce the practical implications of the findings for public health policy and future outbreak preparedness.

2. Call to Action: Consider including a call to action, urging stakeholders to implement the recommendations derived from the study.

3. Summary of Findings: Conclude with a brief summary of the key findings and their significance in the context of public health in Nigeria.

by the Nigerian Red Cross Society (NRCS), in collaboration with the Nigeria Centre for Disease Control (NCDC) and the National Primary Health Care Development Agency (NPHCDA), have demonstrated the importance of integrating risk communication, community engagement, vaccination coverage, and robust surveillance measures. The response teams have made significant strides in controlling the diphtheria outbreak across the affected regions by employing a multi-faceted strategy that emphasises standardisation, evaluation, and adaptation.

The success of these initiatives revealed the value of strong partnerships between national and international organizations, effective resource allocation, and capacity building. These efforts have curtailed the spread of diphtheria and strengthened the overall healthcare infrastructure, making it more resilient to future outbreaks. The lessons learned from this response serve as a roadmap for enhancing Nigeria's public health preparedness and response mechanisms.

Moving forward, it is imperative to sustain these efforts by continuously strengthening surveillance systems, expanding vaccination programs, and prioritizing public awareness campaigns. By embracing technological advancements, such as mobile health applications and digital vaccination records, Nigeria can further improve its ability to detect, respond to, and prevent infectious diseases. Moreover, investing in healthcare infrastructure, especially in underserved areas, will ensure equitable access to quality healthcare services.

In conclusion, addressing the diphtheria outbreak in Nigeria requires a sustained commitment to public health initiatives, policy reforms, and collaborative efforts. By building on the progress made and implementing the recommended strategies, Nigeria can effectively mitigate the impact of diphtheria and other infectious diseases, safeguarding the health and well-being of its population

**COMPETING INTERESTS DISCLAIMER:Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.**

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