



## Case Study

# Diphtheria in an Under-immunized Child in Rivers State, Nigeria: A Case Report

<sup>1</sup>Hope Owhondaa Avundaa, <sup>2</sup>Eziyi Iche Kalu, <sup>3</sup>Ugo Uwadiako Enebeli, Agwu Nkwa Amadi

<sup>1</sup>Department of Community Medicine, University of Port Harcourt Teaching Hospital, Nigeria

<sup>2</sup>Department of Medical Microbiology Gregory University, Amaokwe Achara, Uturu, Abia State, Nigeria

<sup>3</sup>Department of Community Medicine, Rhema University, Aba, Abia State, Nigeria

<sup>4</sup>Department of Public Health, Federal University of Technology, Owerri, Nigeria

**Corresponding author:** Ugo Uwadiako Enebeli, Department of Community Medicine Rhema University, 153 Aba Owerri Road, Aba, Abia State, Nigeria. ugoenebeli@rhemauniversity.edu.ng: +2348033382361

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## Abstract

**Background:** Diphtheria is a potentially fatal, vaccine-preventable disease, with a recent resurgence from systematic challenges, particularly in resource-limited settings like Nigeria. This is a case report of the index case of diphtheria in the recent outbreak in Rivers State, in the Southern region of Nigeria.

**Case summary:** A 3-year-old under-immunized girl presented with a seven-day history of fever and neck swelling at the children's emergency unit of a tertiary health facility. Clinical evaluation, throat swab microscopy/culture, and PCR confirmed *Corynebacterium diphtheriae* infection. The patient's management included antibiotics, diphtheria antitoxin, and respiratory support. Her condition rapidly deteriorated, and she died within a few days of presentation.

**Discussion:** The fatal outcome of the index case highlights the critical role of vaccination in preventing diphtheria. Under-immunization, as in this case, underscores systemic challenges such as vaccine hesitancy, inadequate healthcare infrastructure, and limited public awareness, which contribute to the resurgence of vaccine-preventable diseases like diphtheria in Nigeria.

**Conclusion:** Diphtheria is a life-threatening disease. Strengthening immunization programs, enhancing healthcare access, and implementing targeted public health campaigns are essential to address these gaps and prevent future outbreaks. This case serves as a reminder of the need for sustained efforts to improve vaccine coverage and public health education.

**Keywords:** Diphtheria, under-immunization, Nigeria, *Corynebacterium diphtheriae*, vaccine-preventable disease



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## INTRODUCTION

Diphtheria is caused by the *Corynebacterium diphtheriae* bacteria and is a vaccine-preventable disease that remains endemic in regions with low immunization coverage. It is a highly contagious illness transmitted through respiratory droplets or contact with infected lesions and is frequently recorded among children below 15 years of age. Widespread vaccination is the primary method for controlling and preventing diphtheria.<sup>1</sup>

Despite global efforts, outbreaks persist in sub-Saharan Africa, where incomplete vaccination and poor healthcare access contribute to high mortality.<sup>2</sup> Mortality from diphtheria is frequently from diphtheritic myocarditis and respiratory failure.<sup>3,4</sup> Diphtheria vaccination is one of the pentavalent vaccines on the Nigerian childhood immunisation schedule. However, the COVID-19 pandemic further impacted vaccine uptake by creating barriers to accessing vaccination services and decreasing immunisation demand and uptake among caregivers. Movement restrictions and lockdowns also resulted in decreased general healthcare service delivery, increased transportation costs, fewer engagements to promote vaccine uptake, and the discontinuation of mobile vaccination campaigns that targeted hard-to-reach communities. Thus, the vaccine's suboptimal coverage at 56% has contributed to the recent resurgence and re-emergence of diphtheria in Nigeria.<sup>4</sup>

The ongoing diphtheria outbreak in Nigeria started from the notification to the Nigeria Centre for Disease Control (NCDC) on December 1, 2022, of suspected diphtheria outbreaks, which were confirmed on January 20, 2023.<sup>4</sup> This was worsened by population growth and climate-related declines in hygiene due to water shortages, but the main driver of the outbreak was a historical gap in vaccine coverage, as most of the confirmed cases of diphtheria in the country were unvaccinated against diphtheria. The hardest hit were six Northern States, accounting for 95.8% of confirmed diphtheria cases in Nigeria in 2023.<sup>5</sup>

Recent epidemics underscore the need for renewed efforts to better understand diphtheria and enhance epidemic preparedness.<sup>6</sup> This case report describes the index confirmed case of diphtheria in Rivers State. Rivers State is one of the states in South-South of Nigeria, where cases were initially scarce. This fatal diphtheria case in an under-immunized child highlights

the urgent need for improved immunization strategies, early disease recognition, and prompt treatment.

### Case Presentation

In May 2025, a three-year-old girl was brought to the children's emergency unit by her mother with a seven-day history of high-grade fever and a three-day history of neck swelling. The neck swelling was insidious in onset, first noticed on the left side, gradually increased in size, and eventually became bilateral (Figure 1). Oropharynx examination revealed bilateral haemorrhagic exudates on the tonsils and foul-smelling oral discharge. She was in respiratory distress.



Figure 1. 'Bull neck' appearance of the child

### Past Medical History

The child had only received birth doses (BCG, OPV, and Hepatitis B) vaccines within two days of birth and missed the rest of the vaccines. In essence, the child never received the diphtheria-containing pentavalent vaccines due to parental indecision. Prior to her presentation at the hospital, the patient had received Diclofenac in combination with herbal mixtures for the high-grade fever and neck swelling, administered twice daily for three days, with worsening of symptoms.

### Family and Social History

She is the first child of the mother in a polygamous family setting, and the 15-month-old younger sibling was completely unimmunized. There is a history of similar

illness in her two stepsiblings, living within the same compound, aged six and nine years, who died within 12 and 7 days prior to the presentation of the index case. The family migrated from Northern Nigeria, and all stay in a self-contained (one-room) housing unit.

### Investigations

Upon arrival at the tertiary hospital, diphtheria was suspected due to the classical symptoms. The child was promptly admitted to the isolation ward of the children's emergency unit, where samples were collected for a throat swab MCS, PCR for diphtheria, full blood count and differential, serum electrolyte, urea and creatinine. The PCR for diphtheria returned positive after 72 hours.

### Management

The patient was promptly commenced on IV Ceftriaxone 800mg daily, Paracetamol 250mg 8 hourly, Dexamethasone 2.4mg 6 hourly, Guttae tobramycin 8 hourly, 5% Dextrose saline 1300mls/24hrs at 18 drops per minute, and Metronidazole 130mg 8 hourly. There was oral cleansing with TCP, and a strict input and output were maintained for fluids. Vital signs were monitored closely. DAT was administered.

### Outcome

She deteriorated rapidly, and on the third day of admission, went into respiratory failure and rapidly passed amidst cardiopulmonary massage with IPPV and IV hydrocortisone administration.

### DISCUSSION

The receipt of three doses of diphtheria toxoid vaccine is 87% effective against symptomatic disease, reduces transmission by 60%, and vaccination alone interrupts transmission in 28% of outbreak settings, making isolation and antibiotics essential,<sup>6</sup> as was carried out in this study. Also, antibiotics reduce the duration of infection and must be paired with diphtheria antitoxin to limit morbidity,<sup>6</sup> as in this case report. Despite appropriate management, the mortality record of this index case points to the interconnectedness of contributory factors to diphtheria mortality.

Un- and under-immunization, as observed in this case, underscores systemic challenges such as vaccine hesitancy, inadequate healthcare infrastructure, and limited public awareness, which contribute to the resurgence of vaccine-preventable diseases like

diphtheria in Nigeria. The rapid deterioration of the patient's condition emphasizes the importance of early presentation and prompt diagnosis, as delays can lead to fatal complications due to the aggressive nature of *Corynebacterium diphtheriae*. Strengthening immunization programs, enhancing healthcare access, and implementing targeted public health campaigns are essential to address these gaps and prevent future outbreaks. This case serves as a reminder of the need for sustained efforts to improve vaccine coverage and public health education in vulnerable populations.

Additionally, there was a delayed presentation to the healthcare facility as the parents initially administered analgesics and herbal treatment for days, delaying critical hospital care. It is worth noting that the iceberg of disease was demonstrated with clarity in this case, as two prior deaths in the same compound suggest an otherwise undetected propagated outbreak, necessitating contact tracing and mass vaccination.

The public health implications of this case also include the need for community interventions and improving access to healthcare services.<sup>7,8</sup> The child's presentation and prompt diagnosis and management at a tertiary healthcare center with specialists and specialists-in-training also emphasize the need for research engagement,<sup>9</sup> personnel welfare and avoidance of burnout,<sup>10-12</sup> in order to avoid missed diagnoses.<sup>13</sup> To maintain sustainable control of diphtheria epidemics and safeguard public health worldwide, long-term policies should be implemented,<sup>14</sup> including boosting funding for immunization programs, improving disease surveillance, and building collaborations. Furthermore, there is also a need for exploring the development of new vaccines that provide longer-lasting immunity.<sup>15</sup>

### CONCLUSION

Diphtheria is a preventable yet deadly disease in under-immunized populations. Strengthening routine immunization, community education, and healthcare infrastructure is vital to curbing outbreaks in Nigeria. This report contributes to the understanding of the drivers of new diphtheria outbreaks.

### DECLARATIONS

**Ethics Statement:** Ethical clearance was obtained from the University of Port Harcourt Teaching Hospital. Informed consent was obtained from the parents for case publication and use of pictures.



**Conflict of Interest:** The authors declare no conflict of interest.

**Data Availability Statement:** All relevant data are included in the manuscript. Any further de-identified case details are available upon request from the corresponding author.

#### Abbreviations:

BCG	Bacillus Calmette–Guérin
DAT	Diphtheria antitoxin
IV	Intravenous
MCS	Microscopy, Culture, and Sensitivity
OPV	Oral Polio Vaccine
PCR	Polymerase Chain Reaction

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