Science Discovery Medicine
2026, Vol. 1, No. 1, pp. 1–6
https://doi.org/10.11648/j.sdmed.20260101.11

Research Article

Risk Factors Associated with Diphtheria Outbreak Among Patients Under 5 Years Attending de Martino Hospital Mogadishu, Somalia

Saciid Abdullahi Abshir[1, *], Ibrahim Mohamed Mahamud[1], Faduma Ahmed Mahamuud[1], Mohamed Gedi Sheikhow[1, 2]

[1]School of Medicine and Surgery, University of Somalia, Mogadishu, Somalia
[2]School of Medicine and Surgery, Somaville University, Mogadishu, Somalia

Abstract

Background: In areas with poor vaccination rates, diphtheria, a dangerous acute infectious disease brought on by Corynebacterium diphtheria, remains a threat. Due to low vaccination uptake and undeveloped immunity, children under five are especially at risk. *Objective:* risk factors and describing the clinical characteristics of diphtheria in children under five who were enrolled in De Martino Hospital in Mogadishu were the objectives of this study. *Methods:* Eighty confirmed cases of diphtheria participated in a descriptive cross-sectional investigation. Structured questionnaires and a review of medical records were used to gather data. Age, gender, immunization status, clinical characteristics, complications, and results were among the variables evaluated. *Findings:* Of the 80 children, 43.8% were younger than two years old, and 35.0% were between three and four years old. With 50.0% of the population being female and 48.8% being male, the gender distribution was almost equal. Only 15.0% of people were fully vaccinated, 21.3% were partially vaccinated, and 63.8% were not immunized. The two most common symptoms were fever (100%) and sore throat (100%). The following conditions were also quite common: dysphagia (93.8%), respiratory distress (98.8%), cervical lymphadenopathy (96.3%), and pseudo membrane development (98.8%). 25% of patients had myocarditis, and 75% of patients experienced respiratory problems. Residence of the patients (45.0%) resided in Yaqshid, followed by 16.3% from Karaan and 8.8% from Shibis. Smaller proportions of patients came from Dharkenley (6.3%), Celasha Biyaha (5.0%), Deynile (3.8%), Hodan (3.8%), and other areas including Kaxda, Hilwa, Sh. Dhexe, Hirshabele, Balcad, and Tabelaha, each contributing 2.5% to 1.3% of cases. This distribution indicates that Yaqshiid and Karaan were the most affected areas, suggesting a potential geographic clustering of cases., 76.3% recovered from the disease, while 23.8% did not. 77.5% was survived, while 22.5% was died, children who were not vaccinated having a higher death rate. Conclusion: diphtheria is still a serious public health issue in Somalia affecting children under five. The most frequent clinical symptoms were fever, sore throat, and pseudo membrane formation, while the main risk factors were found to be incomplete immunization, malnutrition, and delayed healthcare-seeking behavior. Improved immunization campaigns, early diagnosis, and prompt treatment treatments are critically needed, as highlighted by the high case fatality rate.

Keywords

Diphtheria, Outbreak, Risk Factors, Children Under Five, Demertinho, Mogadishu, Somalia

*Correspondence: Saciid Abdullahi Abshir (Luckycade33@gmail.com)

Received: 20 September 2025; **Accepted:** 2 February 2026; **Published:** 25 February 2026

1. Introduction

Even if vaccination campaigns have been effective in lowering the global incidence of diphtheria, it continues to be a health issue, particularly in Asia. The World Health Organization estimates that there were 4,680 cases of diphtheria in 2013, with the majority of cases occurring in Asia, including With 3,313 cases, India, 775 cases, Indonesia, 190 cases, Iran, 183 cases, Pakistan, and 103 cases, Nepal. The second most cases of diphtheria may be found in Indonesia, with 775 cases. [1] Hippocrates was the first to identify diphtheria, which is derived from the Greek word "Diphtera," which means leather hide before the fourth century BC. Although this illness primarily affects children under the age of five, it is now also seen in adults and in children aged five to nineteen. [2] Several studies have shown that low vaccination coverage, crowding and migration, or a combination of host, agent, and environmental factors, can influence the incidence of diphtheria. [3]. Despite the success of vaccination campaigns in lowering the global incidence of diphtheria, it continues to be a public health issue, particularly in the Asian continent. According to the World Health Organization, there were 4,680 instances of diphtheria in 2013, which were geographically diverse but mostly found in Asia. including Nepal (103 cases), Pakistan (183 cases), Iran (190 cases), Indonesia (775 cases), and India (3,313 cases). With 775 cases 1, 2, Indonesia has the second highest number of diphtheria cases in the world. [4]. Since then, there have been a few more diphtheria outbreaks in addition, several developing happening in other regions of the globe who turned out to be over varied time periods has a higher mortality rate. A 27% outbreak, In the south, the case fatality rate (CFR) was recorded 2015 Africa, [5]. The incidence of diphtheria was successfully reduced throughout the 1980s in both rich and poor nations. [6]. a toxin called the diphtheria exotoxin, which causes diphtheria Strong 62-kd polypeptide prevents the production of protein, resulting in necrosis of the tissue in the area [7]. The functioning of widespread Vaccination programs are a top priority in public health. Necessary, Vaccinations include those for diphtheria and tetanus [8]. Diphtheria is a dangerous disease that spreads quickly, a dangerous illness brought on by bacteria [9]. Health is one of the most significant issues, in addition to the socioeconomic and political aspects of this phenomenon in connection with the 'migrant crisis' [10]. The incidence of diphtheria at the moment The second-highest is in Indonesia the world following India (WHO, 2015). Research at the newly independent states (NIS) forecasted a number of risk variables for the in particular, the diphtheria epidemics of 19901996 underlying illness of the patient, carriers, low immunization coverage, economic crisis, militarization, mass human mobilization, and personal cleanliness [11]. Diphtheria is a severe illness brought on by toxin-producing Corynebacterium diphtheriae primarily affects strains the upper respiratory system (tonsils, pharynx, larynx, nose and etc [12]. Despite the introduction of the diphtheria vaccine in the national expanded immunization program in Indonesia, the country is still experiencing outbreaks of the disease, Since the introduction of the expanded program on immunization (EPI) in 1977, cases have been reported sporadically from a number of provinces. Since 2006, the Ministry of Health of the Republic of Indonesia has reported a rise in cases [13] We now plead with national and local governments to develop thorough initiatives to improve vaccine acceptance and public perceptions about immunization. It is widely accepted that vaccination-related decision-making procedures are complicated and multifaceted; as a result, they are designed. Programs should be able to reduce mistrust and perceived, religious constraints, reduce particular obstacles to vaccination such as raise expectations and confidence in the effectiveness of the vaccine and as dread of adverse effects. [14]. Despite being a country with recent diphtheria outbreaks, Nigeria has seen The VPD is a clear sign that the full diphtheria preventative strategy has failed the nation's immunization coverage program. This is not The fact that the COVID-19 epidemic has caused havoc makes this even more unexpected programs for health around the world [15].

Toxigenic strains of Corynebacterium diphtheria are the source of the vaccine-preventable bacterial infection known as diphtheria. The illness is mainly transmitted by respiratory droplets and can lead to serious side effects as neuropathy, myocarditis, and airway blockage. Even though widespread vaccination has reduced the frequency worldwide, diphtheria is still resurfacing in areas with inadequate health systems and low vaccination rates. Malnutrition, a lack of access to healthcare, and low DTP3 vaccine coverage make diphtheria a chronic health concern in Somalia. Youngsters under five are especially vulnerable to illness and serious consequences. This study examines the clinical characteristics and risk factors of diphtheria cases in children under five who are treated at De Martino Hospital, one of Mogadishu's primary referral hospitals.

2. Methods

This study utilized a descriptive cross-sectional study design to analyze risk factors of Diptheria among children at De Martino Hospital, Mogadishu.

The study population include eighty children under five with laboratory confirmed and epidemiological link diphtheria Outbreak made up the research population.

Structured questionnaires given to careers and a review of medical records were used to collect data. Age, sex, immunization status, clinical presentation, complications, and results were among the variables.

The data were imported into IBM SPSS version 24.0 statistical software for analysis. Descriptive statistics were used to summarize demographic characteristics, Vaccination status,

symptoms, laboratory results, and outcomes.

Our study were approved by University of Somalia Ethical committee, and De Martino hospital ethical committee before it started. Since it was contacted as primary data from caregivers we asked consent every participants and requested according to the ethical guidelines. All data were anonym zed and handled with strict confidentiality to ensure privacy was protected.

Results: Of the 1266 suspected Diphtheria cases 6.3% were confirmed as Diptheria positive. Those 80 children, 43.8% were younger than two years old, and 35.0% were between three and four years old. With 50.0% of the population being female and 48.8% being male, the gender distribution was almost equal. Only 15.0% of people were fully vaccinated, 21.3% were partially vaccinated, and 63.8% were not immunized. The two most common symptoms were fever (100%) and sore throat (100%). The following conditions were also quite common: dysphagia (93.8%), respiratory distress (98.8%), cervical lymphadenopathy (96.3%), and pseudo membrane development (98.8%). 25% of patients had myocarditis, and 75% of patients experienced respiratory problems. Residence of the patients (45.0%) resided in Yaqshid, followed by 16.3% from Karaan and 8.8% from Shibis. Smaller proportions of patients came from Dharkenley (6.3%), Celasha Biyaha (5.0%), Deynile (3.8%), Hodan (3.8%), and other areas including Kaxda, Hilwa, Sh. Dhexe, Hirshabele, Balcad, and Tabelaha, each contributing 2.5% to 1.3% of cases. This distribution indicates that Yaqshiid and Karaan were the most affected areas, suggesting a potential geographic clustering of cases. 76.3% recovered from the disease, while 23.8% did not. 77.5% was survived, while 22.5% was died, children who were not vaccinated having a higher death rate.

Table 1. *Clinical presentation of Diphtheria patients.*

Clinical presentation of Diphtheria patients		Frequency	Percentages %
fever of the patient	yes	80	100.0%
	no	0	0.0%
sore throat of the patient	yes	80	100.0%
	no	0	0.0%
pseudo membranous formation of the patient	yes	79	98.8%
	no	1	1.3%
cervical lymphadenopathy of the patient	yes	77	96.3%
	no	3	3.8%
difficult breathing of the patient	yes	79	98.8%
	no	1	1.3%
dysphagia of the patient	yes	75	93.8%
	no	5	6.3%

Table 2. *Risk factors of Diphtheria of Diphtheria.*

Risk factors of Diphtheria of Diphtheria		Frequency	Percentages %
Patient vaccine status	Unvaccinated	51	63.7%
	Partial vaccinated	17	21.3%
	Fully vaccinated	12	15.0%
Travel history	No	16	20.0%
	Yes	64	80.0%
Contact history	No	26	32.5%
	Yes	54	67.5%

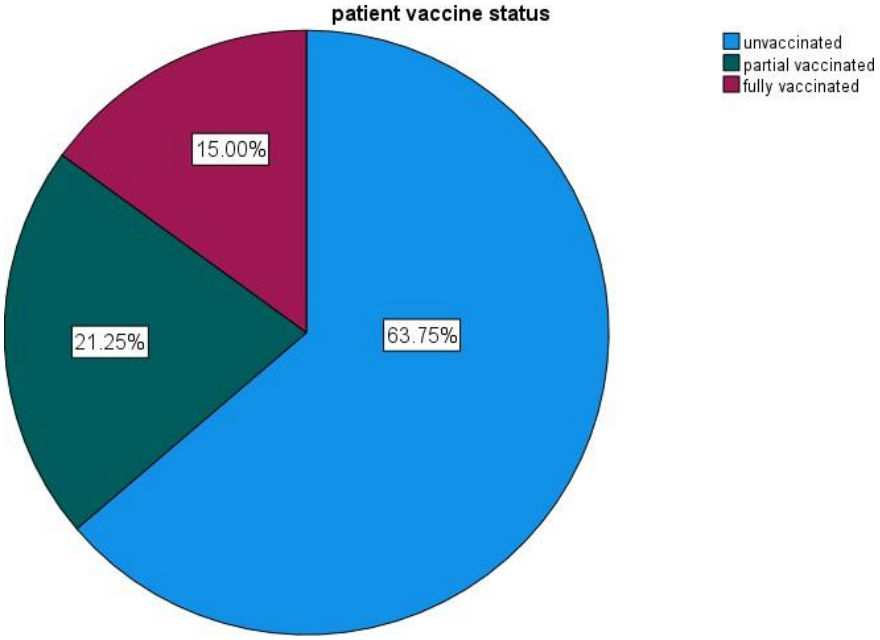

Figure 1. *Patient vaccine status.*

3. Discussion

This highlights a serious epidemic that disproportionately impacts young children, with 43.8% of the 1,266 suspected cases being under the age of two. Of these, 6.3% (n=80) were confirmed to be diphtheria. This distribution of ages is consistent with global studies that demonstrate young children are especially vulnerable to infection by Corynebacterium diphtheriae during the period of incomplete first vaccination and waning maternal antibodies [16]. That biological sex is not a risk factor is further supported by the virtually equal gender split (50.0% female, 48.8% male). Unvaccinated or partially vaccinated communities are particularly susceptible, and the large number of infections among very young infants reveals serious deficiencies in the maternal immunization protocol and the early baby vaccination schedule, leaving this demographic characteristics. The vaccination status of the verified cases indicates a serious weakness in the local immunization program. Although just 15.0% of the population was fully immunized, the data reveal that a startling 63.8% of the children had not received any immunizations. This poor coverage rate immediately explains the high attack rate and severity of the epidemic, considering that the diphtheria toxoid vaccine 2. The finding that children who were only partially vaccinated were implicated in 21.3% of instances lends credence to evidence that incomplete immunization provides protection. Instead of completely preventing the sickness, it may only lessen its intensity and offers subpar protection [3, 16]. Systemic problems in the Expanded Programme on Immunization (EPI) are evident in this vaccination profile, which may be caused by logistical challenges, vaccine mistrust in health care access.

Respiratory diphtheria had a severe and usual clinical appearance. The prevalence of respiratory distress (98.8%) and pseudo-membrane development (98.8%) was incredibly high, in addition to the typical symptoms of fever and sore throat (100%). As primary indicators of tissue damage brought on by toxins, these findings are pathognomonic for the disease and have been extensively described in the literature (4). 25% of patients experienced myocarditis, and 75% of patients had respiratory problems, which was a worryingly high proportion of sequelae. The ferocity of the infection in this mostly unvaccinated community is highlighted by the fact that myocarditis, a direct consequence of the effect of diphtheria toxin on the heart muscle, is a recognized predictor of mortality and chronic morbidity [17].

A non-uniform distribution of the cases is revealed by geospatial analysis, with 16.3% of patients residing in Karaan and 45.0% of patients in Yaqshid. The clustering suggests localized epidemics, which could be brought on by factors including inadequate herd immunity in certain sub-districts, population density, and socioeconomic factors affecting healthcare access. Geographic clustering of vaccine-preventable diseases can be a crucial indicator for guiding public health efforts [18]. A targeted response, including extensive vaccination campaigns and heightened monitoring in Yaqshid and Karaan, is required to stop the disease epidemic and restrict its geographic spread because of the large number of cases in these areas. The case outcome statistics provide the strongest evidence of the vaccine's ability to save lives. In total, 22.5 percent of the population perished, but this burden was excessive. carried by children who were not immunized, who had a significantly higher death rate. This outcome confirms widely recognized research showing that immunization status is the The fact that 76.3% of cases have recovered, demonstrating the effectiveness of

case management, including the use of antitoxin, is the most important predictor of diphtheria [19]. Without prompt administration of antibiotics and diphtheria antitoxin, the significant fatality rate among unvaccinated individuals may be avoided. These findings clearly show that the most important public health goals to stop future outbreaks and deaths from this completely vaccine-preventable disease are increasing routine immunization coverage, guaranteeing full vaccination, and addressing geographic areas of poor immunity.

4. Conclusion

For Somali children under five, diphtheria remains a major concern. Malnutrition, incomplete immunization, and delayed arrival at medical facilities were found to be major risk factors. While respiratory issues and myocarditis were common consequences, fever, sore throat, and pseudomembrane development were the most common clinical symptoms. In order to stop future outbreaks, the high fatality rate highlights the urgent need to boost public health awareness, improve hospital readiness, and improve immunization.

What is already now about topic. In developing countries, and hard to reach areas, Low coverage of PENTA vaccine, due to Diphtheria outbreak.

The vaccination coverage is still below the target which is 80%, What this study adds.

This study highlighted the Socio-demographic clinical and vaccination history characteristics with likelihood of Diphtheria outbreak, especially lack of vaccination history contributed, and high severity of cases those were unvaccinated.

Abbreviations

WHO	World Health Organization
CFR	Case Fatality Rate
EPI	Expanded Programme on Immunization
VPD	Vaccine-Preventable Disease
SPSS	Statistical Package for the Social Sciences
PENTA	Pentavalent Vaccine
DTP3	Diphtheria-Tetanus-Pertussis Vaccine (3rd Dose)
NIS	Newly Independent States
SAM	Severe Acute Malnutrition

Author Contributions

Saciid Abdullahi Abshir: Conceptualization, Methodology, Writing – Original Draft, Investigation.

Ibrahim Mohamed Mahamud: Formal analysis, Data Curation, Validation.

Faduma Ahmed Mahamuud: Resources, Visualization, Writing – original draft.

Mohamed Gedi Sheikhow: Supervision, Writing – review & editing.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Centers for Disease Control and Prevention. (2024). Diphtheria. https://www.cdc.gov/diphtheria

[2] World Health Organization. (2024). Diphtheria fact sheet. https://www.who.int/news-room/fact-sheets/detail/diphtheria

[3] Brown, K., & Lee, T. (2022). Clinical features of diphtheria in pediatric patients. Pediatric Infectious Disease Journal, 41(4), 312–318.

[4] Mohamed, A., & Hassan, M. (2025). Childhood diphtheria in Somalia: Challenges and solutions. Somalia Medical Journal, 12(1), 45–53.

[5] Susanti R, Ifroh RH, Noviasty R, Muhamad Ramdan I, Susanti R, Ifroh RH, et al. Risk factors for diphtheria outbreak in children aged 1-10 years in East Kalimantan Province, Indonesia [version 1; peer review: 2 approved] Iwan Muhamad Ramdan. F1000 Research. 2019; 7(0): 1–10. Available from: https://www.cdc.gov/diphtheria/about/diagnosis-treatment.html

[6] Murhekar M V., Bitragunta S. Persistence of diphtheria in India. Indian J Community Med. 2011; 36(2): 164–5.

[7] Bisgard KM, Rhodes P, Hardy IRB, Litkina IL, Filatov NN, Monisov AA, et al. Diphtheria Toxoid Vaccine Effectiveness: A Case-Control Study in Russia. J Infect Dis. 2000 Feb 1; 181(Supplement_1): S184–7. Available from: https://doi.org/10.1086/315562

[8] Ramdan IM, Susanti R, Ifroh RH, Noviasty R. Risk factors for diphtheria outbreak in children aged 1-10 years in East Kalimantan Province, Indonesia. F1000 Research. 2018; 7(May): 1–10.

[9] Rintani A, Mintarsih T, Rbm YM, Siregar JS, Widodo AP, Biasa L, et al. Risk Factors Associated To Diphtheria Outbreak in Developing Countries Faktor-Faktor Risiko Yang Berhubungan Dengan Kejadian. 2018; 9(2): 83–95.

[10] Garib Z, Danovaro-Holliday MC, Tavarez Y, Leal I, Pedreira C. Diphtheria in the Dominican Republic: reduction of cases following a large outbreak. Rev Panam Salud Publica. 2015 Oct; 38(4): 292–9.

[11] Sadoh A, Sadoh W. Diphtheria mortality in Nigeria: the need to stock diphtheria antitoxin. African J Clin Exp Microbiol. 2011; 12(2): 82–5.

[12] Gowin E, Wysocki J, Kaluzna E, Swiatek-Koscielna B, Wysocka-Leszczynska J, Michalak M, et al. Does vaccination ensure protection? Assessing diphtheria and tetanus antibody levels in a population of healthy children: A cross-sectional study. Med (United States). 2016; 95(49): e5571.

[13] Patil N, Gawade N, Gaidhane A, Syed Z. Investigating diphtheria outbreak: A qualitative study in rural area. Int J Med Sci Public Heal. 2014; 3(4): 513.

[14] Castelli F, Sulis G. Migration and infectious diseases. Clin Microbiol Infect [Internet]. 2017; 23(5): 283–9. Available from: http://dx.doi.org/10.1016/j.cmi.2017.03.012

[15] Husada D, Primayani D, Marbun K, Kartina L, Puspitasari D, Tirthaningsih NW, et al. Risk factors of diphtheria carriers in Indonesian children. Southeast Asian J Trop Med Public Health. 2018; 49(4): 660–9.

[16] Shedaiwah S, Alsharabi H, Anam L, Al Amad MA. Risk factors of diphtheria outbreak in damt district of Al Dhalea Governorate, 2023 -Yemen: a case–control study. BMC Infect Dis. 2024; 24(1). Available from: https://doi.org/10.1186/s12879-024-09932-7

[17] Arguni E, Karyanti MR, Satari HI, Hadinegoro SR. Diphtheria outbreak in Jakarta and Tangerang, Indonesia: Epidemiological and clinical predictor factors for death. PLoS One. 2021; 16(2 February): 1–11. Available from: http://dx.doi.org/10.1371/journal.pone.0246301

[18] Harapan H, Anwar S, Dimiati H, Hayati Z, Mudatsir M. Diphtheria outbreak in Indonesia, 2017: An outbreak of an ancient and vaccine-preventable disease in the third millennium. Clin Epidemiol Glob Heal. 2019; 7(2): 261–2. Available from: https://doi.org/10.1016/j.cegh.2018.03.007

[19] Oduoye MO, Musa ZM, Tunde AM, Nazir A, Cakwira H, Abdulkareem L, et al. The recent outbreak of diphtheria in Nigeria is a public health concern for all. Int J Surg Glob Heal. 2023; 6(5).