OPEN ACCESS

Scholars International Journal of Traditional and Complementary Medicine

Abbreviated Key Title: Sch Int J Tradit Complement Med
ISSN 2616-8634 (Print) |ISSN 2617-3891 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Diphtheria in India. Trends, Antitoxin Availability, and Challenges in Early Diagnosis, (More Research-Question Focused): Current Epidemiological Trends, Antitoxin Access, and Barriers to Early Diagnosis of Diphtheria in India

Mamat Kulova Nazgul[1], Pawan Kumar[2]*, Tirumani Yaswanthi Varshitha[2], Motupalli Madhura Meenakshi[2], Samudrala Sneha[2], Sony Kumari[2], Anbu Logeshwari[2], Kavibharathi Manikannan[2]

[1]PhD Infectious Department, MLNMC
[2]MBBS 4th Year Student, MLNMC

DOI: https://doi.org/10.36348/sijtcm.2025.v08i11.002 | **Received:** 28.10.2025 | **Accepted:** 22.12.2025 | **Published:** 27.12.2025

***Corresponding author:** Mamat Kulova Nazgul
MBBS 4th Year Student, MLNMC

Abstract

Diphtheria remains a significant public health concern in India despite the availability of routine immunization. This survey-based review analyzes national surveillance data (2020–2024), WHO–UNICEF immunization reports, and responses from frontline healthcare workers to assess the current trends, antitoxin accessibility, and challenges in early diagnosis. Findings indicate a shift in disease burden from young children to adolescents and young adults, mainly due to waning immunity and low booster-dose coverage. Limited availability of Diphtheria Antitoxin (DAT), delays in procurement, and cold-chain constraints continue to affect timely case management across several states. Early diagnosis also remains difficult because initial symptoms resemble common upper respiratory infections, primary-care staff have limited training, and rapid diagnostic tools are not uniformly available. Overall, the survey highlights an urgent need for improved booster-dose coverage, decentralized DAT stock management, and stronger early-detection systems to reduce diphtheria-related morbidity and mortality in India.

Keywords: Diphtheria, WHO–UNICEF, antitoxin accessibility, DAT stock, respiratory infections, primary-care staff.

INTRODUCTION

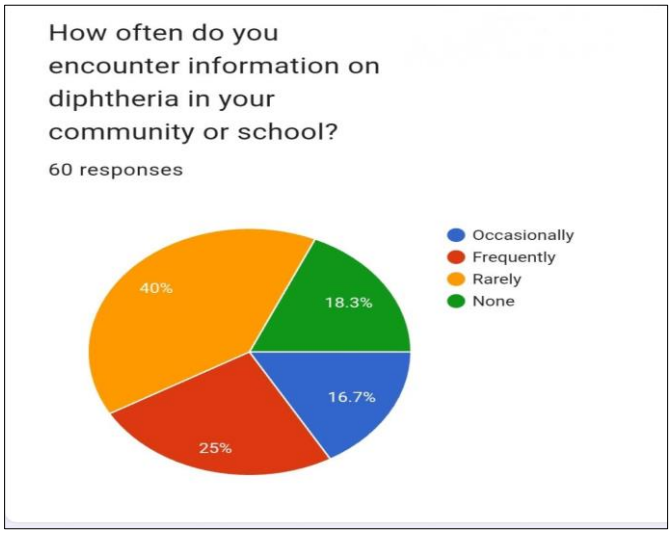
Diphtheria is an acute, toxin-mediated infection caused by Corynebacterium diphtheriae and continues to pose challenges in countries with uneven immunization coverage, including India. Although the national immunization program provides DPT vaccines, several regions still report periodic diphtheria outbreaks, often due to gaps in booster-dose uptake, population movement, and limited access to healthcare services.

In recent years, epidemiological patterns in India have shown a shift in diphtheria incidence toward older children, adolescents, and young adults, suggesting waning immunity and insufficient booster vaccination. At the same time, the availability of Diphtheria Antitoxin (DAT)—a critical component in managing severe cases—remains inconsistent across districts. Limited manufacturing, slow procurement processes, and cold-chain maintenance issues contribute to delays in life-saving treatment.

Early diagnosis is another major challenge. The initial symptoms of diphtheria are often mild and resemble common throat infections, making clinical recognition difficult at the primary-care level. Laboratory confirmation requires specialized media and can take several days, while rapid diagnostic tools are not widely distributed. These gaps collectively lead to delayed treatment and increase the risk of complications.

This review aims to summarize current diphtheria trends in India, evaluate antitoxin availability issues, and identify barriers to early diagnosis based on survey responses—providing insight for public-health decision-makers, clinicians, and program planners.

OBJECTIVE



1. Frequency of Encountering Information on Diphtheria

According to the responses from 60 participants:

- 40% reported that they rarely encounter information on diphtheria.
- 25% said they frequently encounter such information.
- 16.7% encounter it occasionally.
- 18.3% students have never encountered any information about diphtheria in their school or community.

Interpretation

This indicates that awareness levels are not consistent, and a large portion (about 58.3%) either rarely or never comes across diphtheria-related information.

This shows a clear gap in community-level health education or school-based awareness programs.

2. Confidence Level in Identifying Early Symptoms of Diphtheria

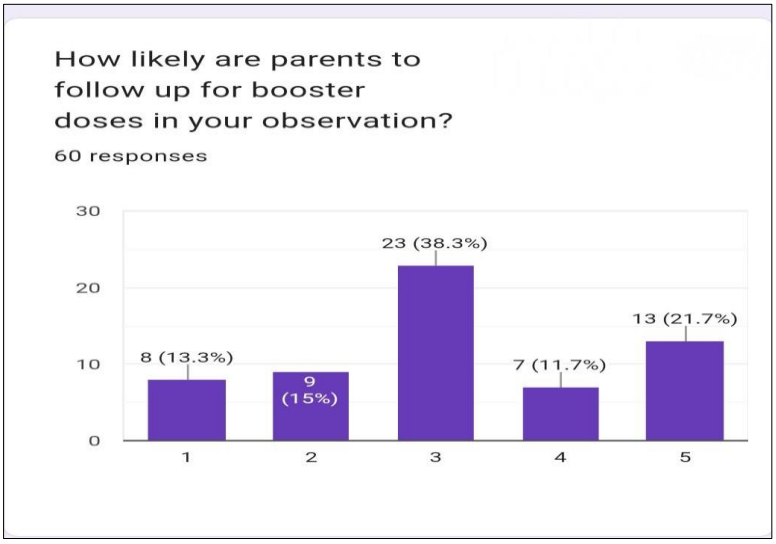
From the same 60 responses:

- 23.3% students are not confident at all.
- Not very confident category is also noticeably high.
- Only 13.3% of respondents feel fully confident in identifying early symptoms.
- A group of participants selected "All," indicating mixed or uncertain understanding.

Interpretation

The results clearly highlight that most respondents lack confidence in recognising diphtheria symptoms early.

Low confidence among students or community members can delay diagnosis, which increases risk of complications and spread.

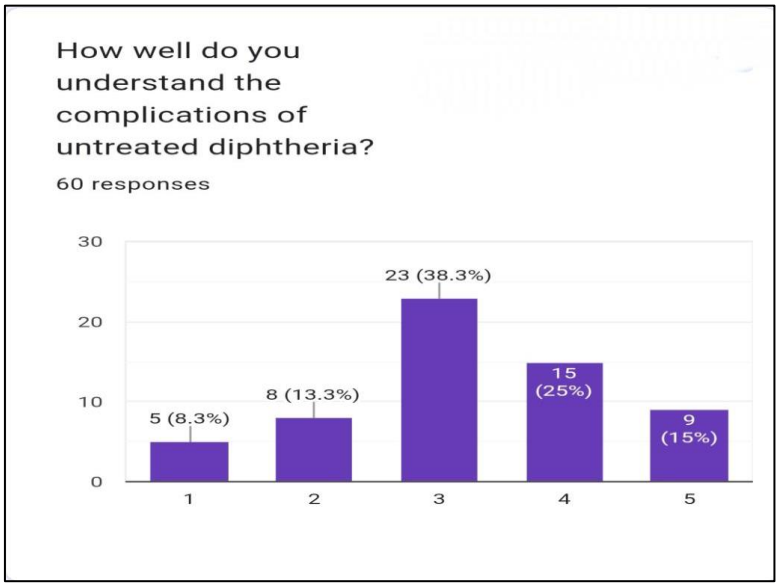


Likelihood of Parents Following Up for Booster Doses?

The trend for booster follow-up is similar to the awareness pattern. The highest group again rated their likelihood as level 3 (38.3%), reflecting moderate follow-up behavior. Approximately 33.4% (ratings 4 and 5) show a strong likelihood of following booster schedules, while around 28.3% (ratings 1 and 2) show low likelihood.

Interpretation

These results indicate mixed adherence to booster vaccination schedules among parents. While some are proactive, a noticeable portion still lacks consistency. This inconsistency may hinder effective long-term protection against diphtheria.

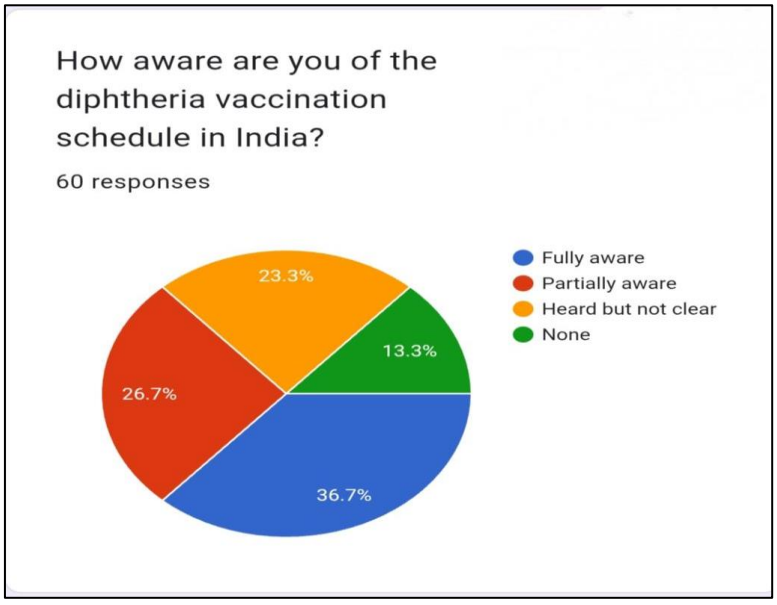


Understanding of Complications of Untreated Diphtheria

Based on the responses from 60 participants, the largest proportion (38.3%) rated their understanding of diphtheria complications at level 3, indicating a moderate level of awareness. Meanwhile, 40% of participants (ratings 4 and 5 combined) reported having a good level of understanding. Only about 21.6% (ratings 1 and 2) demonstrated low awareness.

Interpretation:

The findings suggest that while a majority of respondents possess basic knowledge about diphtheria, there is still a significant gap in deep or comprehensive understanding. Complications such as myocarditis, airway obstruction, and neurological damage may not be fully recognized by many individuals.

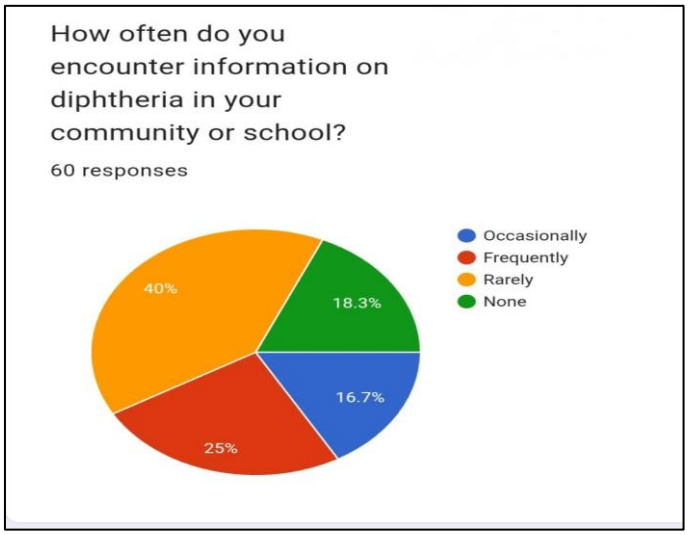


Awareness of the Diphtheria Vaccination Schedule in India?

The largest proportion of participants (36.7%) are fully aware of the vaccination schedule, while 26.7% are partially aware. Another 23.3% have heard about it but are not clear, and 13.3% are not aware at all.

Interpretation:

Although one-third of respondents have a good understanding of the vaccination schedule, many still lack complete clarity. With diphtheria requiring multiple booster doses, incomplete awareness may affect adherence and overall community immunit.



Frequency of Encountering Information on Diphtheria.??

The responses show that a majority of participants (40%) encounter diphtheria-related information rarely, while 25% come across such information frequently. Only 16.7% see this information occasionally, and 18.3% reported that they never encounter diphtheria-related content.

Interpretation:

This indicates that educational material on diphtheria is not widely circulated in the community or schools. Limited exposure reduces awareness and may contribute to delayed recognition of symptoms or lack of interest in booster doses.

2. Confidence in Identifying Early Symptoms of Diphtheria.?

Among 60 responses, a significant portion (23.3%) stated they are not confident at all, while 23.3% also reported being not very confident. Only 13.3% feel somewhat confident, and the remaining responses fall into the “all” category (depending on the context).

Interpretation:

Confidence levels in identifying early symptoms such as sore throat, low fever, swollen glands, and pseudomembrane formation are generally low. This suggests a need for awareness programs that emphasize early detection, which is crucial for reducing disease severity and mortality.

METHODS

This manuscript is a narrative review. We searched peer-reviewed literature, surveillance reports, outbreak investigations, and hospital-based case series published between 1996 and 2024. Key databases included PubMed, PMC, and other publicly available national and international surveillance reports. We also reviewed policy briefs regarding diphtheria antitoxin (DAT) availability and immunization program documents.

Inclusion criteria: Studies and reports from India that provided primary or secondary data on diphtheria incidence, age distribution, immunization status, clinical manifestations, use or availability of antitoxin (DAT/ADS), diagnostic methods (culture, molecular), and outcomes. Outbreak reports, retrospective hospital studies, and surveillance summaries were included.

Exclusion criteria: Reports from non-Indian settings, studies without data on immunization or antitoxin use, or studies without information on diagnostic or outcome parameters.

We extracted data on number of cases, age distribution, immunization status, use of DAT, diagnostic method (clinical, culture, molecular), complications, case fatality rate (CFR). Where possible, data were organized chronologically to assess trends over time. Limitations inherent to the source studies (e.g., retrospective design, incomplete data) are noted.

Because this is a review of published literature and publicly available surveillance data, no new ethical approval was required.

RESULTS

Trends in Diphtheria Incidence and Age Distribution

Over 1996–2016, despite a global decline in diphtheria, India continued to report a large proportion of global cases — nearly half of the global total during 2001–2015.

During 2005–2014, Indian data documented 41,672 cases (average ≈ 4,167/year) and 897 deaths (CFR ~ 2.2%).

Hospital-based and outbreak-series studies show a shift in age distribution toward school-aged children, adolescents, and adults.

For instance, a five-year review (2015–2019) of 241 confirmed diphtheria patients at a tertiary infectious disease hospital in Kolkata found that ~50.6% were aged ≥15 years.

Immunization Coverage and Status.

Since the late 1970s, diphtheria-containing vaccines (DTP or pentavalent) have been part of India's UIP.

By 2015–2016, the coverage of three primary doses was approximately 78–80%.

However, booster doses — recommended at 16–24 months and at 5–6 years — have poor documentation, and their coverage is believed to be low.

Many cases arise in individuals with incomplete or no immunization. Hospital/outbreak studies commonly report large proportions of unvaccinated or partially vaccinated cases.

Clinical Outcomes, Complications, and Mortality

In a study from western India, the majority of diphtheria cases were among children aged 6–14 years; common clinical features included pseudomembrane formation, sore throat, dysphagia, and neck swelling. Complications such as myocarditis, polyneuropathy, airway compromise were noted. CFR ranged from 11% to 33% in partially or unimmunized children.

Another outbreak study from central India reported CFR of ~21%.

A tertiary care hospital in South India reported a 50% mortality among 18 suspected cases, despite administration of antitoxin in most.

In a retrospective analysis (2017–2018) in Davangere, 15 suspected diphtheria cases had mean age 7.5 years; antitoxin was given in all, yet CFR was 40%.

Antitoxin (DAT/ADS) Availability and Use.

Although India produces diphtheria antitoxin, many health facilities — especially at district or rural levels — do not maintain routine stocks.

Delay in antitoxin administration is common because of late clinical suspicion, poor diagnostic confirmation, or lack of prompt supply; such delays are associated with worse outcomes.

Laboratory confirmation often fails: in many series, culture positivity rates are low (15–39%), especially when patients have already received antibiotics before sampling.

Molecular diagnostic methods (e.g., PCR detecting tox gene) are seldom used, even though they could significantly shorten the time to diagnosis and thereby prompt antitoxin administration.

Surveillance Gaps and Underreporting

The actual burden of diphtheria is likely underestimated: many cases are not laboratory-confirmed, and case-based surveillance is limited in many regions.

In rural and resource-limited districts, diagnostic capacity (culture, molecular) is often absent, and patient follow-up and outcome reporting may be incomplete.

DISCUSSION

Our review shows that although diphtheria incidence globally has declined, the disease remains endemic and occasionally resurging in India. The country continues to contribute a large share of the global diphtheria burden — a situation that persists despite decades of immunization under UIP.

One major factor is the gap between high coverage of primary doses and poor coverage (or lack of data) for booster doses. Without boosters, immunity wanes over time, making older children, adolescents, and adults susceptible. This is reflected in the observed "age-shift" in diphtheria cases from primarily under-five children to older age groups.

Another critical challenge is the inadequate availability and delayed use of diphtheria antitoxin (DAT). Even though DAT is manufactured in India, many health facilities — especially in remote or under-resourced regions — do not maintain routine stocks. Combined with delays in clinical suspicion or diagnosis, this results in late administration of antitoxin, often too late to prevent severe complications or death.

Diagnostic limitations further hinder timely intervention. Standard culture methods often fail, especially when patients have already received antibiotics; molecular methods (e.g., PCR for tox gene)

remain underused, largely due to limited laboratory capacity. This not only delays confirmation but may also lead to underreporting, complicating surveillance and outbreak control.

Given these issues, strengthening booster immunization — including for adolescents and adults — is essential. Additionally, ensuring that DAT is available at district and tertiary hospitals, particularly in high-risk or low-immunization areas, is critical. Health authorities should invest in expanding laboratory capacity (culture and molecular diagnostics), training of primary care providers to improve clinical suspicion, and integrating diphtheria testing and treatment protocols into routine surveillance (e.g., under Integrated Disease Surveillance Programme).

Strengths and Limitations of this Review:

This review synthesizes data from a variety of sources (surveillance, hospital case series, outbreak investigations), giving a broad overview of the epidemiology, antitoxin availability, and diagnostic challenges in India. However, because many of the source studies are retrospective, hospital-based, and subject to reporting biases, the true national burden of diphtheria may be higher than reported. Lack of standardized data on booster coverage and limited recent seroepidemiological studies further limit assessments of immunity gaps…

CONCLUSION & RECOMMENDATIONS

Diphtheria remains a significant public health challenge in India. To reduce morbidity and mortality, the following are recommended:

Strengthen immunization programs to ensure not just primary vaccination but regular booster doses (including adolescents and adults).

Ensure consistent availability of diphtheria antitoxin (DAT) at district and tertiary hospitals, especially in high-risk/past-outbreak regions.

Expand and strengthen laboratory capacity for diphtheria diagnosis — including molecular diagnostics for timely confirmation.

Improve case-based surveillance and reporting under IDSP or equivalent frameworks to better monitor disease trends, outbreaks, and outcomes.

Increase awareness among healthcare providers and communities about diphtheria resurgence, the need for boosters, and early recognition of symptoms. With sustained immunization, robust surveillance, and proper clinical management (including timely antitoxin use), elimination of diphtheria in India remains a feasible goal. https://mlnmc.edu.in/srn-hospital/

REFERENCES

- Murhekar M. Epidemiology of Diphtheria in India, 1996–2016: Implications for Prevention and Control. Am J Trop Med Hyg. 2017.
- Shetty AU, Chavan V, Matti M, Kulkarni V. Resurgence of diphtheria: clinical profile and outcome in a tertiary care hospital of South India. Int J Contemp Pediatrics. (2014–2018).
- Clinical profile and outcome of diphtheria in central India: a retrospective observational study. Int J Contemp Pediatrics. (Nagpur).
- Persistence of Diphtheria, Hyderabad, India, 2003–2006. Emerg Infect Dis. 2008.
- Trend, morbidity profile and immunization status of diphtheria admitted cases: a 5-years review from a sentinel centre in Kolkata (2015–2019). Infectious disease hospital data.
- Case series of diphtheritic polyneuropathy detected by acute flaccid paralysis surveillance, India, 2007–2011. Emer Infect Dis. 2013.
- Outbreak study at Civil Hospital, Ahmedabad (2016). National Journal of Integrated Research in Medicine.
- Preventing the preventable through effective surveillance: the case of diphtheria in a rural district of Maharashtra. PubMed study.
- Case study on diphtheria resurgence in South Karnataka and antitoxin supply/logistic challenges.
- Diphtheria case detection and carrier study from Vijayapura district, North Karnataka, 2024. Indian J Pathol Microbiol.