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# Resurgence of diphtheria cases in India: where are we lacking?

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## Abstract

Diphtheria is an acute respiratory tract infection caused by the toxigenic strains of *Corynebacterium diphtheriae.* It has the potential to cause severe morbidity and mortality through its complications such as myocarditis and neuropathies. It continues to be a public health concern since its re-emergence over the last couple of years in various Indian states. Apart from the school going children, recent outbreaks have seen an age shift towards older children, adolescents, and adults. As per the National Health Profile 2022, India has reported 1586 cases and 22 deaths due to diphtheria in the year 2020, and 3677 cases and 47 deaths in 2021. Around 10 Indian states report majority (84%) of the cases. As of 21 June 2024, Orissa has also reported 6 deaths and 21 suspected diphtheria cases. There has been > 90% coverage of diphtheria vaccination in birth cohorts since 2014 but gaps in booster dose coverage are widely prevalent. Plugging of gaps in the routine immunization coupled with inclusion of booster doses in the national data on diphtheria vaccination is the need of the hour.

***Keywords:*** *Diphtheria, immunization, outbreak, resurgence, vaccine*

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## Evidence in Context

- Diphtheria is a vaccine-preventable disease resurging globally, notably in Asia, including India.
- An increasing trend of cases in older children, adolescents, and adults is observed.
- This shift may be due to waning immunity from childhood vaccinations or vaccine hesitancy.
- Global calls to close immunization gaps emphasize the need for adequate booster dose coverage (Td).
- Incorporating booster doses into national diphtheria vaccination data is essential.

To view Article

## Current Situation

Diphtheria is a potentially fatal upper respiratory tract infection caused by the toxigenic strains of gram-positive bacillus *Corynebacterium diphtheriae*. It spreads by droplet infection or close contact with a case or a carrier. In the past few years, there have been numerous reports of a resurgence of this vaccine preventable disease in India and around the world [1]. In October 2023, 3 children lost their lives due to diphtheria in the Nuh and Palwal districts of the Indian state of Haryana [2]. According to the National Health Profile 2022, India has reported 1586 cases and 22 deaths due to diphtheria in the year 2020, and 3677 cases and 47 deaths in 2021 [3]. The Indian states of West Bengal, Kerala, Karnataka, Assam, Rajasthan, Andhra Pradesh, Nagaland, Maharashtra, Haryana, Gujrat, and Delhi account for 84% of the cases (Table 1)[1]. A death case due to diphtheria was reported in January 2024 in Karnataka and in April 2024 in Assam [4,5]. As of 21 June 2024, Orissa has also reported 6 deaths and 21 suspected diphtheria cases (Table 2) [6]. According to the Global Health Observatory data repository (2022), there has been a gradual rise in diphtheria cases around the world with the highest cases being reported from India, Niger, Indonesia, and Pakistan [7]. Figure 1 shows that a lesser number of diphtheria cases are seen in the year 2020 and 2021. This could be due to a possible underreporting during the COVID-19 pandemic as witnessed with the data of other infectious diseases as well. However, the public health authorities soon gathered momentum and since then regular reporting of cases and deaths due to diphtheria has been carried out by the Integrated Disease Surveillance Program (IDSP) and World Health Organization (WHO).

### Possible Causes of Diphtheria Resurgence

Case based surveillance studies in India have shown that areas with greater

Immunization coverage have experienced an age shift of diphtheria cases towards older children and adolescents [8-10]. This is because there has been > 90% coverage in birth cohorts since 2014 but gaps in booster dose coverage are widely prevalent. This has resulted in waning immunity following the primary series of diphtheria vaccinations [11,12]. Lack of awareness among the primary care physicians leading to a delay in clinical diagnosis can also be a possible reason for delayed reporting and management of cases [13]. Studies have reported that national data on coverage of boosters is not routinely collected and people often remain partially immunized [1,14-17]. To add more fuel to the fire, certain faith-based organizations consider vaccines as 'interventions by westerners' to destroy certain communities and taking them would lead to impotence [15,17]. Persistence of these factors undermine the efforts of the government to yield any fruitful results regarding elimination of vaccine preventable diseases.

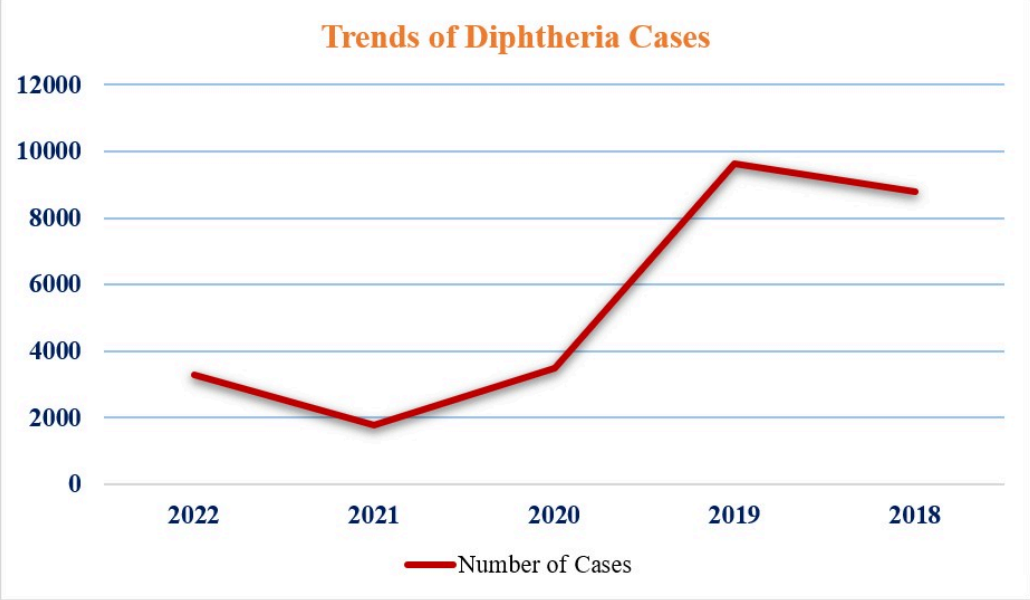


**Figure 1: Showing graphical representation of diphtheria cases over the last few years as reported by Global Health Observatory Data Repository, WHO [7]**

Experts around the world have continuously warned regarding the growing number of antimicrobial genes in this bacterium making it resistant to a number of antibiotics [18]. Disrupted childhood vaccination schedules due to the COVID-19 pandemic have made the situation worse. Studies around the world have shown a resurgence of diphtheria cases post the pandemic in countries such as India, Peru, Pakistan, and Nigeria [19].

The 2016 Kerala outbreak in India showed that about 79% of the cases occurred in persons more than 10 years of age. As evidenced by the diphtheria epidemics in South America and Eastern Europe, immunity is attenuated after a few years of the primary series of childhood vaccinations. These regions eventually shifted to Td (tetanus and adult diphtheria) vaccinations for older children, adolescents, and pregnant women which resulted in a marked decrease in diphtheria cases [20].

**Table 1: Showing data on Indian states exhibiting maximum cases and deaths due to diphtheria in the past few years [1]**

| States/ UT | Year | Male | | Female | | Total | |
|---|---|---|---|---|---|---|---|
| Cases | Deaths | Cases | Deaths | Cases | Deaths | Cases | Deaths |
| West Bengal | 2021 | 1548 | 0 | 679 | 0 | 2227 | 0 |
| Telangana | 2021 | 43 | 0 | 62 | 47 | 105 | 47 |
| Delhi | 2020 | 72 | 8 | 64 | 7 | 136 | 15 |
| Telangana | 2020 | 125 | 0 | 129 | 0 | 254 | 0 |
| Gujrat | 2019 | 219 | 0 | 223 | 0 | 442 | 0 |
| Delhi | 2019 | 232 | 25 | 170 | 16 | 402 | 41 |

**Current Recommendations for Diphtheria Prophylaxis**

WHO in its deliberations of the Strategic Advisory Group of Experts (SAGE) in 2002 and 2016 along with its tetanus vaccine position paper of 2017, has time and again emphasized the replacement of TT (tetanus toxoid) with Td. This was taken up by the National Technical Advisory Group on Immunization (NTAGI), Ministry of Health and Family Welfare, Government of India, which led to the introduction of the Td vaccine in India's immunization program of all age groups including pregnant women [20].

The Universal Immunization Program (UIP) offers diphtheria vaccine at 6, 10, and 14 weeks of age as a pentavalent vaccine. This is followed by DPT (diphtheria, pertussis and tetanus) boosters at 16-24 months and 5-6 years of age. Then it is given as a Td booster at 10 years and 16 years to tackle the waning immunity. During pregnancy, Td is given in two doses 1 month apart in primigravida and a single booster shot in multigravida if previous doses were taken within the last 3 years [21].

**Table 2: Showing the summary of diphtheria cases and deaths in the year 2024**

| S. No | State | Month | Cases | Deaths |
|---|---|---|---|---|
| 1 | Orissa | June | 21 (suspected) | 6 |
| 2 | Assam | April | 1 | 1 |
| 3 | Karnataka | January | 1 | 1 |

**Future Perspectives and the Road Ahead**

Researchers from India, Russia, and the UK have used genomics for mapping diphtheria and have included a subset from India, which was home to half of the globally reported cases in the year 2018. They built a phylogenetic tree by combining 61 bacteria isolated from cases with 441 publicly available genomes that were collected from around the world in 122 years. The presence of antimicrobial resistance genes, mode of spread, and toxin variation were assessed [22].

Plugging the bottlenecks in the routine delivery of immunization especially in marginalised and underserved strata of the population is essential to prevent outbreaks of vaccine preventable diseases. There is a dire need to raise awareness amongst primary care physicians to keep a high index of clinical suspicion when managing membranous tonsillitis cases. Opportunities to provide diphtheria vaccination in adolescents and adults should be encouraged. Targeted interventions for increasing vaccine acceptance in certain religions with high vaccine hesitancy should be encouraged. The involvement of religious leaders, community influencers, and educational institutions can be beneficial. A study on the Kerala outbreaks of 2016, also highlighted the need for strengthening laboratory supported vaccine preventable diseases' (VPD) surveillance [8].

It is crucial to monitor diphtheria closely, or we risk a major epidemic in a more adapted and modified form. Routine immunization with an emphasis on coverage of booster doses continues to be the most effective way of preventing resurgence of diphtheria. Strengthening of the health systems at the grassroot levels is the need of the hour.

**Abbreviations**

IDSP: Integrated Disease Surveillance Program

NTAGI: National Technical Advisory Group on Immunization

SAGE: Strategic Advisory Group of Experts

UIP: Universal Immunization Program

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# References

1. Mohanty A, Bhatia M, Gupta P, Varshney S, Malhotra M, Omar BJ. Diphtheria: The patch still remains—A case report from the state of Uttarakhand. J Pharm Bioall Sci. 2019; 11:190-3. *[Crossref][PubMed][Google Scholar]*

2. Pati I. Diphtheria cases on rise in Palwal and Nuh, 3 kids die. The Times of India. [cited 2023 Oct 23]. *Available from: [Article][Crossref][PubMed][Google Scholar]*

3. National Health Profile 2022. Central Bureau of Health Intelligence. Ministry of Health and Family Welfare, Government of India. [cited 2024 Mar 12]. *Available from: [Article][Crossref][PubMed] [Google Scholar]*

4. Weekly Outbreak Report. District wise disease alerts/outbreaks reported in the 5th week 2024 Integrated Disease Surveillance Program. [Internet]. [cited 2024 Mar 25]. *Available from: [Article] [Crossref][PubMed][Google Scholar]*

5. Weekly Outbreak Report. District wise disease alerts/outbreaks reported in the 15th week 2024 Integrated Disease Surveillance Program. [Internet]. [cited 2024 Jun 26]. *Available from: [Article] [Crossref][PubMed][Google Scholar]*

6. Pradhan H, Mohanty H. One more kid dies, diphtheria toll rises to six. The Time of India. [cited 2024 Jun 28]. *Available from: [Article][Crossref][PubMed][Google Scholar]*

7. World Health Organization. Global Health Observatory (GH)O): By category: Diphtheria - Reported cases by country. [Internet]. [cited 2024 Mar 10]. *Available from: [Article][Crossref] [PubMed][Google Scholar]*

8. Sangal L, Joshi S, Anandan S, et al. Resurgence of Diphtheria in North Kerala, India, 2016: Laboratory Supported Case-Based Surveillance Outcomes. Front Public Health. 2017;5:218. *[Crossref][PubMed][Google Scholar]*

9. Maramraj KK, Latha MK, Reddy R, et al. Addressing reemergence of diphtheria among adolescents through program integration in India. Emerg Infect Dis. 2021; 27(3): 953. *[Crossref] [PubMed][Google Scholar]*

10. Clarke KEN, MacNeil A, Hadler S, et al. Global epidemiology of diphtheria, 2000–2017. Emerg Infect Dis. 2019;25:1834–42. *[Crossref][PubMed][Google Scholar]*

11. World Health Organization. Diphtheria vaccine: WHO position paper, August 2017—recommendations. Vaccine. 2018;36:199–201. *[Crossref][PubMed][Google Scholar]*

12. Tiwari T, Wharton M. Diphtheria toxoid In: Plotkin SA, Orenstein WA, Offit PA, editors Vaccines, 6th ed Edinburgh: Elsevier Saunders. 2013:153–66. *[Crossref][PubMed][Google Scholar]*

13. Gupta A, Gujral M, Singh A, Chawla K. Diphtheria resurgence in India: A case study from south Karnataka. J Family Med Prim Care. 2020;9:5776-8. *[Crossref][PubMed][Google Scholar]*

14. Murhekar MV, Bitragunta S. Persistence of diphtheria in India. Indian J Community Med. 2011;36:164-5. *[Crossref][PubMed][Google Scholar]*

15. Patil S, Vedpathak M, Dharmshale S, Shaikh N. Diphtheria: A case series from West Maharashtra, India. J Med Sci Health. 2022;8:93-96. *[Crossref][PubMed][Google Scholar]*

16. Murhekar M. Epidemiology of Diphtheria in India, 1996–2016: Implications for Prevention and Control. Am J Trop Med Hyg. 2017;97:313–318. *[Crossref][PubMed][Google Scholar]*

17. Shaffi M, Nayar KR, Lal SS. Diphtheria Deaths in Kerala: Signs of an Impending Crisis. Economic and political weekly. 2015;50(43). *[Crossref][PubMed][Google Scholar]*

18. Gavi The Vaccine Alliance. Emerging threats. [Internet]. [cited 2024 Mar 7]. *Available from: [Article][Crossref][PubMed][Google Scholar]*

19. Fauzi IS, Nuraini N, Sari AM, et al. Assessing the impact of booster vaccination on diphtheria transmission: Mathematical modelling and risk zone mapping. Infect Dis Model. 2024;9(1):245-62. *[Crossref][PubMed][Google Scholar]*

20. Tetanus and adult diphtheria (Td) operational guidelines. Ministry of Health and Family Welfare,Government of India. [Internet]. [cited 2024 Mar 10]. *Available from: [Article][Crossref] [PubMed][Google Scholar]*

21. Universal Immunization Program. Ministry of Health and Family Welfare, Government of India. [Internet]. [cited 2024 Mar 6]. *Available from: [Article][Crossref][PubMed][Google Scholar]*

22. India Science Wire. Study warns diphtheria could become a major global threat Down to Earth. [Internet]. [cited 2024 Mar 7]. *Available from: [Article][Crossref][PubMed][Google Scholar]*