



## 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

### 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



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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.

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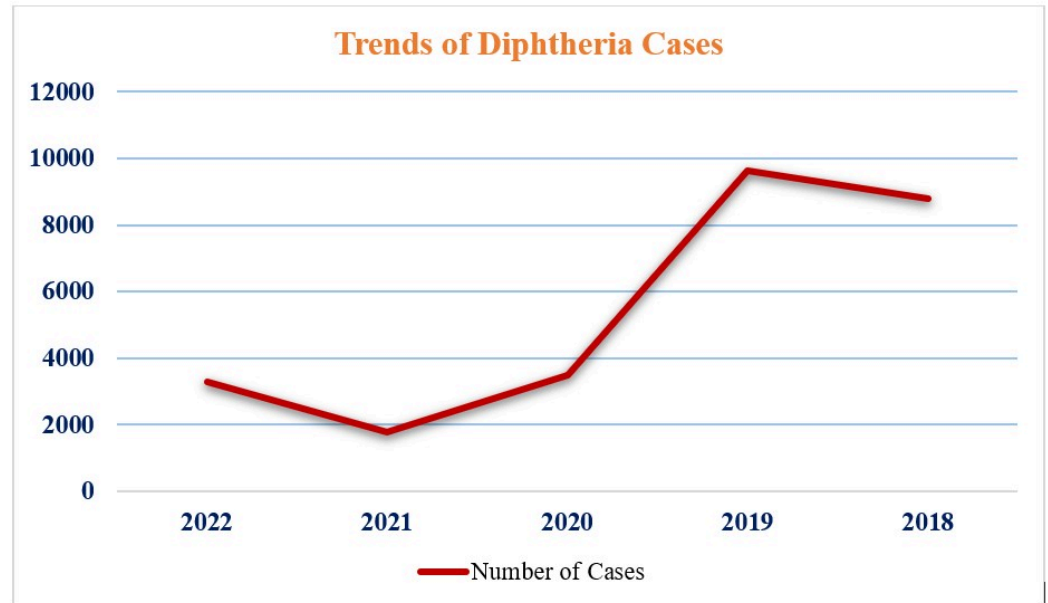


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## Sagar D (2024): Resurgence of diphtheria

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].



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

**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
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

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.

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 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

## 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].

## 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.

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None

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