



Review Article

Evolving Strategies in Typhoid Prevention and Control: Recent Advancements and Future Directions

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A B S T R A C T

Typhoid fever remains a significant global health challenge, especially in regions lacking access to clean water and sanitation. Recent advancements in prevention and control strategies, notably the introduction of the Typhoid Conjugate Vaccine (TCV), have spurred renewed efforts to combat this infectious disease. This comprehensive review explores key insights, including recommendations, hurdles, cross-country experiences and emerging trends, with a focus on India's experience amid the COVID-19 pandemic. Strategies encompass a multifaceted approach, ranging from vaccination initiatives guided by the National Technical Advisory Group on Immunisation (NTAGI) to enhanced surveillance methodologies and targeted interventions. Despite challenges such as vaccine hesitancy and resistance to antibiotics, the integration of TCV holds promise in reducing the burden of typhoid and improving public health outcomes. As India adapts to post-pandemic dynamics, proactive measures aimed at strengthening healthcare infrastructure and refining disease control strategies are essential in shaping a resilient response to infectious diseases like typhoid.

Keywords: Typhoid Fever, Typhoid Conjugate Vaccine, Prevention, Control, India, NTAGI, Antimicrobial Resistance, COVID-19, Public Health

Introduction

Typhoid fever, an infectious disease caused by *Salmonella* Typhi bacteria, continues to pose a significant global health challenge, particularly in areas with inadequate access to clean water and sanitation facilities. Recent years have witnessed heightened efforts to strengthen typhoid prevention and control approaches, with a specific focus on the incorporation of the Typhoid Conjugate Vaccine (TCV).¹ Across regions in India, the incidence of typhoid fever ranged from 12 to 1622 per 1 lakh population among those aged less than 15 years and ranged from 108 to 970

per 1 lakh population.² As per the recent reports, in 2022 there were 10 lakh cases of typhoid that were reported. Isolated studies have found that the efficacy of TCV can be 45% to 59% in a single dose with efficacy in the second year at 83%, while the efficacy following two doses can be 91% after two years.³

To prevent typhoid, necessary measures such as sanitation facilities, access to safe water, better hygiene and better access to patient care. The treatment is by use of antimicrobials and probiotics, but antimicrobial usage involves an increased risk of antimicrobial resistance.



The best strategies for typhoid prevention are sanitation measures and typhoid vaccination, which is a better choice as it is suitable for all age groups and also provides a longer duration of protection.

While typhoid vaccination is not included in the National Immunisation Schedule, the protection offered and an overall decrease in incidence can reduce resultant morbidity and mortality, with an observed reduction of Disability Adjusted Life Years (DALYs) of 15% to 60%.⁴ This comprehensive review delves into key insights encompassing recommendations, obstacles, cross-country experiences, and emerging trends in the realm of typhoid prevention and control, encompassing the evolving impact of the COVID-19 pandemic.

Guidelines from the National Technical Advisory Group on Immunisation

The National Technical Advisory Group on Immunisation (NTAGI) in India has emerged as a critical entity shaping strategies to thwart the menace of typhoid. The 40th and 41st STSC meetings have steered the introduction of TCV into the Universal Immunisation Program (UIP) via a phased approach. The proposed vaccination strategies encompass routine inoculation, targeted school-centric campaigns, and age-specific prioritisation, all aimed at curbing the prevalence of typhoid and tackling antimicrobial resistance head-on.⁵

The control of typhoid is becoming more complex due to the surging antimicrobial resistance to various drugs, thus leading to the emergence of drug resistance *S. typhi*. International trade and travel make it more difficult to halt this AMR spread globally. Here, the role of the introduction of vaccination is crucial, as it would help in decreasing the burden of AMR. A multi-centric study conducted by the Global Alliance for Vaccination and Immunisation (GAVI) showed that a reduction of 16% in drug-resistant typhoid can be predicted in the case of vaccination.⁶ The impact of vaccination is attention-grabbing as the spread of infection can be curbed by vaccination and also by limiting the transmission to unvaccinated individuals. Thus vaccination can reduce the emergence of novel drug resistance.⁷

The various vaccination strategies can be dealt with in two categories i.e. Vaccination disease control and vaccination delivery. The vaccination disease control strategy would mainly focus on the preemptive or reactive strategy, which includes targeting the high-risk group or geographical areas in order to prevent, or as a response to an outbreak respectively. The vaccination delivery strategies deal with community-based routine immunisation or mass campaigns, which would be provided as a routine or supplemental activity. It also focuses on a more specific approach such as school-based vaccination offered to school children.⁸

Navigating Challenges and Crafting Inoculation Approaches

The journey toward TCV integration within India's healthcare framework has been riddled with challenges, including limited blood culture capabilities, misuse of antibiotics, vaccine hesitancy, and logistical hurdles. Evident successes from countries that spearheaded early TCV introductions have underscored the significance of meticulous situational analyses, engagement with stakeholders, and meticulous communication strategies. These experiences offer invaluable insights to inform India's vaccination endeavors.^{1,9}

Influencing India's Immunisation Endeavours

The debut of TCV holds immense potential to mitigate the burden of typhoid in India, a country plagued by high endemicity and antibiotic resistance issues. Its integration into routine childhood immunisation initiatives, coupled with its suitability for infants below the age of 2, positions it as a pivotal tool to combat the disease's spread. Enhanced efficacy and the convenience of a single-dose injectable formula render TCV superior to conventional polysaccharide vaccines, thereby amplifying its impact on India's immunisation landscape.

Unpacking the Burden of Typhoid and Morbidity

The unsettling incidence, morbidity, and mortality rates of typhoid, particularly in the pediatric age bracket, underscore the urgency for efficacious preventive tactics. Rigorous surveillance efforts have exposed the varying disease burdens across different age clusters and geographic regions, thereby illuminating avenues that warrant targeted interventions. Strategic methodologies such as environmental surveillance and collaborative partnerships with surgical units promise a comprehensive comprehension of typhoid's repercussions.^{2,10} Through Environmental Surveillance (ES), the detection of *S. typhi* in environmental samples can be used to investigate the community transmission dynamics as well as the risk factors that are associated with typhoid fever. ES can also be used to do a retrospective analysis of the samples, to find out the scale and the likely source of infection.¹¹

Post-COVID-19 Dynamics and Implications

The aftermath of the COVID-19 pandemic has ushered in transformative shifts in the epidemiological realm, reverberating across typhoid prevention and control in India. Escalated emphasis on bolstering public health infrastructure, refining disease surveillance methodologies, heightening vaccination coverage, harnessing digital health technologies, advancing research and modelling, and reforming healthcare-seeking behaviours are poised to redefine India's approach to combating infectious ailments. These adaptations hold the promise of expedited disease detection and intervention.¹²

Conclusion

Recent recommendations, challenges, cross-country lessons, and emergent trends in typhoid prevention and control spotlight a dynamic landscape marked by concerted endeavours to combat this preventable yet significant ailment. The assimilation of TCV, synergised with comprehensive surveillance practices and robust healthcare infrastructures, fosters optimism regarding curtailed typhoid burdens and ameliorates public health outcomes. As India navigates the uncharted territory of a post-pandemic era, these strategies are pivotal in shaping a proactive response to the management of infectious diseases.

Conflict of Interest: None

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