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Typhoid Conjugate Vaccines indicators

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Burden & epidemiology

Number of new cases per year (last 3-5 years)

Global modelled estimates indicate approximately 6.2 million typhoid illnesses in 2023,[1] compared with 7.2 million illnesses in 2021.[2] A systematic review of blood culture–confirmed incidence (studies 1954–2023) found pooled incidence of 119 per 100,000 person-years (95% CI: 81.9–174.4) in population-based studies and 123 per 100 000 (95% CI: 77.2–196.2) in hybrid-

surveillance studies overall, highest in Asia (206.8 and 259.1 per 100 000 respectively) and lower in Africa (68.9 and 72.5 per 100 000) and Europe (55.6 per 100 000, population-based only).[3] Data were insufficient to generate incidence estimates for the Americas; no Oceania estimates were identified.

Proportion of the population affected by the disease or infected with the antigen

Global pooled age-occurrence estimates indicate that 1.3% of illnesses occur before six months of age, 3.6% before 15 months, 18.7% before five years and 55.5% before 15 years; approximately 36.8% occur between five and 15 years of age.[4] The age distribution varies geographically and between surveillance sites, and population-based estimates remain limited in many endemic countries.[5, 6]

Serogroup or serotype distribution (for serogroup- or serotype-specific vaccines)

Typhoid fever is caused by *Salmonella enterica* serovar Typhi, which expresses somatic O, flagellar H and capsular Vi antigens.[5] The Vi polysaccharide is the antigen used in all currently available typhoid conjugate vaccines (TCVs). Vi is also expressed by *Salmonella* Paratyphi C and, rarely, by other organisms, but is absent from *Salmonella* Paratyphi A and B. TCVs are directed against Vi-expressing *S*. Typhi and are not expected to protect against *S*. Paratyphi A or B infections. A whole-genome-sequencing-based SNP genotyping framework for S. Typhi (GenoTyphi) provides a phylogenetically informative nomenclature for circulating lineages and their antimicrobial resistance (AMR) determinants.[7, 8]

Number of deaths from the disease per year

The Global Burden of Disease Study estimated approximately 72 000 typhoid deaths globally in 2023 (95% UI: 38 000–120 000).[9] The WHO Foodborne Disease Epidemiology Reference Group estimated 94 700 deaths in 2021 (95% UI: 46 900–161 000).[2] Mortality burden is concentrated in South Asia and sub-Saharan Africa, with substantial variation in the countries within these regions. These are modelled estimates rather than vital-registration counts, reflecting incomplete diagnosis, limited blood-culture access and under-ascertainment in many endemic settings.

Case Fatality ratio (number of deaths / number of new cases, in %)

A global systematic review and meta-analysis (reports 1980–2025) estimated an overall pooled case fatality ratio (CFR) of 2.1% (95% CI: 1.7–2.7) among non-surgical typhoid reports; 2.7% (95% CI: 1.8–4.0) among children aged ≤15 years and 1.8% (95% CI: 1.3–2.4) in mixed-age populations.[10]

CFR was higher in facility-based than community-based studies and higher in sub-Saharan Africa than in Asia. Typhoid intestinal perforation occurs in approximately 1–2% of illnesses and carries substantially higher mortality risk than uncomplicated typhoid fever.[11] Case fatality is strongly influenced by timely diagnosis and access to effective antimicrobial and surgical care.

Outbreak, epidemic or pandemic risk

Salmonella Typhi is transmitted through food or water contaminated with faeces from infected people, and outbreaks are facilitated by inadequate water, sanitation, hygiene and food-safety systems.[12] Large and prolonged outbreaks have occurred in endemic settings, including outbreaks involving multidrug-resistant and extensively drug-resistant organisms, notably in Pakistan.[13] TCV has been used in outbreak-response campaigns in Pakistan and Zimbabwe alongside case management and water, sanitation and hygiene interventions.[14, 15, 16] The emergence of resistance to the major antimicrobial classes used to treat typhoid increases the clinical and public-health consequences of outbreaks and may limit treatment options.[17, 18, 19]

Contribution of the vaccine to achievement of the national, regional or global disease goals

There is currently no regional or global disease control or elimination goal for typhoid fever.

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Benefits of the intervention

Serogroup or serotype coverage by vaccines considered (for serogroup- or serotype-specific vaccines)

TCVs conjugate the Vi capsular polysaccharide to a carrier protein (tetanus toxoid, CRM197 or diphtheria toxoid); product differences relate mainly to carrier protein, presentation, licensed age range and manufacturer rather than antigenic breadth (see indicator 1.3 for antigen/serovar coverage). Rare Vi-negative *S*. Typhi variants were first described among patients with typhoid fever in the Faisalabad region of Pakistan.[20] These variants are clinically indistinguishable from Vi-positive infection and would not be targeted by current TCVs. Available genomic surveillance has not demonstrated vaccine-driven selection for Vi loss, although continued surveillance after national introduction is recommended.[21] Effectiveness also appears preserved against antimicrobial-resistant strains: in Hyderabad, Pakistan, effectiveness was 97% (95% CI: 95–98) against XDR *S*. Typhi specifically, comparable to 95% (95% CI: 93–96) against culture-confirmed *S*. Typhi overall in the same cohort.[15] Current studies are not powered to compare effectiveness by genotype, and there is no evidence as yet that vaccine-induced pressure is changing circulating bacterial populations.

Efficacy and effectiveness estimates (e.g. against infection, disease, hospitalization, death), including in different populations

Three randomized controlled trials of Vi-TT in children nine months–16 years of age reported 79% efficacy in Nepal (95% CI: 61.9–88.5), 83.7% in Malawi in the per-protocol analysis (95% CI: 68.1–91.6) and 85% total protection (97.5% CI: 76–91) in the Bangladesh cluster-randomized trial against blood culture-confirmed typhoid over 18–24 months.[22, 23, 24, 25] The Bangladesh trial also estimated overall cluster-level protection of 57%; indirect protection among unvaccinated residents was imprecise and not statistically significant.[24] Observational studies following campaigns or programme introduction in India, Pakistan and Zimbabwe generally reported effectiveness of approximately 70% to >90% against culture-confirmed disease.[14, 16, 26, 27] Effectiveness was also high against extensively drug-resistant *S.* Typhi in Pakistan.[15]

Duration of protection and waning of immunity in general and risk groups

Extended follow-up indicates that protection after a single TCV dose persists for several years, but the pattern of waning differs across settings.

In Malawi, cumulative efficacy was 83.4% at one year, 80.7% at two years, 80.1% at three years, 77.1% at four years and 78.3% through a maximum follow-up of 4.6 years; interval-specific analyses found no statistically significant decline, although later estimates were imprecise.[28] Over the full 4.61 year follow-up period, efficacy was 70.6% among children vaccinated before two years of age, 79.6% among those vaccinated at two to four years and 79.3% among those vaccinated at five to 12 years of age.[28]

Preliminary extended follow-up in Nepal found protection of 77% at one to five years among more recently vaccinated children and 53% at four to eight years among earlier vaccinees, with greater decline among children vaccinated at younger ages.[29]

Preliminary findings from Bangladesh suggested a decline from 91% in year one and 86% in year two to 50% in year five; estimates in years 6–7 were imprecise, and waning was most pronounced among children vaccinated before two years of age.[30]

Collectively, these findings suggest more evident waning in the very-high-incidence Nepal and Bangladesh settings than in Malawi, potentially reflecting differences in transmission intensity, age at vaccination, study design and follow-up.

No clinical efficacy or effectiveness data are available for a booster dose; current evidence is limited to immunogenicity studies showing a boosting response, with longer intervals generally producing stronger responses.[31, 25]

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Safety of the intervention

Type, including severity, consequences and frequency of short- and long-term adverse events following vaccination

Evidence from randomized trials, systematic reviews and post-licensure surveillance indicates a favourable TCV safety profile.[5, 25, 32] Common reactions are generally mild and transient and include injection-site pain, fever, headache and malaise.[5, 25, 32] A 2025 Cochrane review of 19 studies involving 394 790 participants found little to no difference in overall adverse events between TCV and comparator vaccines or placebo (RR 0.91, 95% CI: 0.76–1.09), and no increase in serious adverse events among TCV recipients (RR 0.83, 95% CI: 0.71–0.97), although some comparisons included few events.[33]

WHO safety reviews and pharmacovigilance data have not identified a new safety signal; passive reporting cannot establish causality. Repeat or booster dosing has also been well tolerated, with no observed vaccine-related serious adverse events, although booster studies were not powered to detect rare events.[5, 25, 32]

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Values and preferences

Perception of the target population on the risk of disease

The SAGE Evidence-to-Recommendation assessment concluded that community understanding and perception of typhoid as a public-health issue varies by setting. In higher-burden settings, stakeholders raised concern about leaving young children unprotected if primary vaccination were delayed, suggesting that early-life disease risk is salient in some contexts. However, these findings are indirect and are based primarily on programme and expert perspectives rather than representative studies of the target population.[32]

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Acceptability to stakeholders

Acceptability of the vaccine and of vaccination against the disease

Programme experience indicates that TCV campaigns can achieve substantial uptake, although reported coverage varied considerably across the settings reviewed. Facilitators included school-based delivery, community outreach, government leadership, partner coordination and engagement of trusted local influencers. Reported barriers included limited awareness, access constraints, fear of adverse effects, rumours and personal or philosophical objections. In the SAGE Evidence-to-Recommendation assessment, TCV-specific hesitancy and public resistance were rarely identified as major barriers; stakeholder concerns focused more strongly on financing, competing immunization priorities, programme fit and the strength of disease-burden evidence. Acceptability of a booster dose has not been systematically assessed.[34], [35], [31]

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Financing & funding

Estimated financial cost of materials per vaccine dose (syringes, needles, safety box) (in USD)

Price for one auto-disable (AD) syringe and needle

- As of October 2025, the UNICEF procurement price for 2026 ranges from US$ 0.023 to US$ 0.046 depending on supplier and product.[36]
- The 2026 PAHO Revolving Fund for Access to Vaccines price ranges from US$ 0.03 to US$ 0.04, depending on supplier and product.[37]

Price for one 5-litre safety box

- The UNICEF procurement price for 2026 ranges from US$ 0.375 to US$ 0.860, depending on supplier and product.[38]
- The 2026 PAHO Revolving Fund for Access to Vaccines price ranges from US$ 0.41 to US$ 0.47, depending on supplier and product.[37]

Each 5-litre safety box can hold around 100 syringes.

Estimated vaccine financial cost per dose (in USD)

As of April 2026, the UNICEF price per dose for the 5-dose TCV presentations for countries eligible for Gavi pricing ranges from US$ 0.99 (BBIL) to US$ 1.34 (Biological E), depending on the supplier.[39]

For Middle-Income Countries (MICs), the UNICEF price per dose ranges from US$ 1.25 (Zydus) to US$ 1.50 (Biological E), depending on the supplier.[39]

UNICEF prices are subject to change. The latest TCV vaccine price information is available from UNICEF Supply Division. Users are encouraged to confirm current prices by contacting UNICEF Supply Division.

The 2026 PAHO Revolving Fund for Access to Vaccines pricelist reports a price per dose of US$ 1.25 for the 5-dose TCV presentation.[40]

Among self-procuring MICs, country-reported prices for 2025 per dose range from US$ 1.66 to US$ 7.50 for the 5-dose TCV presentation.[41]

Estimated financial cost per person vaccinated (in USD)

The cost of delivering TCV varies according to delivery strategy, scale and setting.

In Navi Mumbai, India, the average financial delivery cost (excluding vaccine and supply costs) of a preventive catch-up campaign in 11 urban health posts was US$ 0.38 per dose, and the average economic cost was US$ 1.49 per dose (2018 US$).[42]

During a 2019 outbreak-response campaign in Harare, Zimbabwe, the financial operational cost was US$ 0.79 per dose, excluding vaccine and vaccination supplies.[43]

A nationwide TCV introduction campaign in Burkina Faso reported financial and economic delivery costs of US$ 0.47 and US$ 2.16 per dose, respectively (2024 US$), excluding vaccine and injection supplies.[44]

Cost-effectiveness ratio

Multi-model transmission-dynamic and economic modelling commissioned to inform the 2026 WHO TCV recommendations indicated that the cost-effectiveness of different TCV introduction strategies depends on incidence setting, case-fatality rate and cost assumptions.[6]

Under higher CFR/cost assumptions: in medium-incidence settings (approximately 50 cases per 100 000 person-years) TCV may be cost-effective above approximately US$ 1250 per DALY averted (with routine vaccination optimally delayed to two or five years); in high-incidence settings (approximately 200 cases per 100 000 person-years) routine vaccination at nine months is likely cost-effective across most willingness-to-pay (WTP) thresholds; in very-high-incidence settings (approximately 1500 cases per 100 000 person-years) TCV is cost-saving, and adding a booster dose is very likely cost-effective.[45]

Under lower CFR/cost assumptions: medium-incidence vaccination is not cost-effective, high-incidence vaccination may be cost-effective (favouring vaccination at two years), and very-high-incidence vaccination remains cost-saving, with delay to two years or a booster considered at WTP ≥ US$ 1800 per DALY averted.[45]***Cost–effectiveness varies considerably by several factors, including, the burden of disease, vaccination coverage, vaccine price, delivery costs, delivery approaches, and schedules. Caution is recommended when comparing estimates of cost-effectiveness for different interventions evaluated by different methods and in different contexts (e.g., with different concurrent health interventions and standards of care).***

Is there a Gavi programme to support the introduction of this vaccine? If a Gavi programme is available, what support is available to

countries?

TCV is supported by the Gavi discretionary vaccine budget.[46]

Gavi supports WHO-prequalified single-dose injectable TCV products for use in both routine immunization and one-off campaigns where there is documented typhoid burden.

- Routine immunization: single dose between nine months and < 5 years of age, as per WHO guidance section above.
- One-off campaign: targeting children aged nine months to up to <15 years old in high-burden areas, as assessed using the Typhoid Burden and Risk Assessment Tool (BRAT) and surveillance data (S. Typhi burden of disease, age distribution and antimicrobial patterns), with consideration given to subnational targeting.

In the context of limited fiscal space, countries may choose to introduce TCV in routine immunization in the first instance while mobilising resources for the catch-up campaign, which can be implemented at a later stage. Countries are encouraged to establish functioning routine surveillance for typhoid and monitoring vaccine impact.[46]

Specific requirements for funding request: Countries are required to provide all available country-specific data on S. Typhi burden. This may include: (i) S. Typhi laboratory confirmation by blood culture and molecular testing (ii) Typhoid intestinal perforation (TIP) data, (iii) confirmed typhoid outbreaks and (iv) antimicrobial resistance patterns. Data should be disaggregated by age group if available. Countries may consider using the BRAT to review and collate their data on typhoid burden.[47]

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Market (feasibility)

Available vaccines, licensing status, prequalification status, presentation, formulation, dosage and route of administration

Five TCV products are currently WHO prequalified: Typbar-TCV, manufactured by Bharat Biotech; TYPHIBEV, manufactured by Biological E. Limited; SKYTyphoid Multi Inj., manufactured by SK Bioscience; and ZyVac TCV, manufactured by Zydus Lifesciences, and EuTYPH-C Inj. manufactured by EuBiologics Co., Ltd. [48, 49]

Three more vaccines are available only in their country of origin: PedaTyph from Biomed in India, Typhocon from Incepta in Bangladesh and Bio-TCV from PT Biofarma Persero in Indonesia.

Detailed information on the available products can be found in the vaccine comparison table, including licensing, presentation, formulation, dosage and route of administration.[50]

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Service delivery (feasibility)

Number of doses and timing of administrations

WHO recommends the use of TCV for routine immunization programmes in typhoid-endemic countries. In settings with high or very-high incidence, a high CFR, or a high burden of antimicrobial-resistant S. Typhi, the first dose is recommended at 9–24 months of age. In medium-incidence settings, TCV introduction may be considered, particularly where disease is associated with a high CFR or a high burden of antimicrobial resistance; in such settings, the first dose may be administered at ≥2 years of age and may be delayed up to 5 years of age on the basis of local epidemiology and feasibility.[5]

WHO recommends catch-up vaccination with TCV at the time of vaccine introduction. The age range should be guided by local epidemiology and programmatic feasibility; children aged <15

years are often targeted.[5]

Countries with very-high typhoid incidence should consider a booster dose at around 5 years of age for children who received a primary TCV dose at 9–24 months of age. In high-incidence settings, a booster dose around 5 years of age may be considered if there is evidence of waning protection. In other settings where the primary dose was administered before 24 months of age, a booster may also be considered if waning protection is observed. National decisions should take into account typhoid incidence, CFR, antimicrobial resistance patterns, cost-effectiveness and programmatic feasibility. WHO recommends maintaining a minimum interval of one year between primary vaccination and the booster dose. In medium- or high-incidence settings, or where limited waning is observed, a booster may not be needed, particularly if the primary dose is administered at ≥2 years of age. If administering a booster dose is a significant barrier, this should not preclude the introduction and use of TCV without a booster.[5]

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Logistics (feasibility)

Cold chain volume required per vaccine dose (in cm3)

Cold-chain volume varies by product and presentation. In secondary packaging, volumes are 14.45 cm^3/dose for the Typbar-TCV single-dose vial and 2.9 cm^3/dose for its 5-dose vial; 14.7 cm^3/dose for the TYPHIBEV single-dose vial and 2.9 cm^3/dose for its 5-dose vial; 2.62 cm^3/dose for ZyVac TCV; and 3.05 cm^3/dose for SKYTyphoid Multi Inj.[51]

For specific product characteristics, see the comparison table.[52]

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Sources

1.
GBD 2023 Causes of Death Collaborators (2025). Global burden of 292 causes of death in 204 countries and territories and 660 subnational locations, 1990–2023: a systematic analysis for the

Global Burden of Disease Study 2023. Lancet. 406:1811–72. doi:/10.1016/S0140-6736(25)01917-8.

2.
Majowicz SE, Scallan WE, Pires SM, Minato Y, Founou L et al. (2026). WHO estimates of the global, regional, and national burden of eight foodborne non-diarrhoeal enteric disease hazards, 2000–21: an updated data synthesis. Lancet Glob Health. Published online 16 June 2026. doi:/10.1016/j.langlo.2026.103981.

3.
Murthy S, Hagedoorn NN, Faigan S, Rathan MD, Sharples KJ et al (2025). Global typhoid fever incidence: an updated systematic review with meta-analysis. Lancet Infect Dis. 25(12):1347–62. doi:/10.1016/S1473-3099(25)00359-7.

4.
Batool R, Gamble C, Murthy S, Aung T, Akinlabi OS et al. (2026). Age distribution of typhoid fever, paratyphoid fever, and non-typhoidal Salmonella invasive disease: a secondary analysis of global epidemiologic data [version 1]. VeriXiv.3:213. doi:/10.12688/verixiv.3426.1.

5.
World Health Organization. WHO position paper on typhoid vaccines, August 2026. Wkly Epidemiol Rec. 2026;101:166–180 (https://www.who.int/publications/i/item/who-wer10132-166-180, accessed 22 September 2026).

6.
World Health Organization (2026). SAGE Background Document – Typhoid vaccines. SAGE meeting, 9–11 March 2026. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 22 July 2026).

7.
Wong VK, Baker S, Pickard DJ, Parkhill J, Farrar JJ et al. (2016). An extended genotyping framework for *Salmonella enterica* serovar Typhi, the cause of human typhoid. Nat Commun. 7:12827.

8.

Dyson ZA, Holt KE (2021). Five years of GenoTyphi: updates to the global *Salmonella* Typhi genotyping framework. J Infect Dis. 224(Suppl 7):S775–S780.

9.
GBD 2023 Causes of Death Collaborators (2025). Global burden of 292 causes of death in 204 countries and territories and 660 subnational locations, 1990–2023: a systematic analysis for the Global Burden of Disease Study 2023. Lancet. 406:1811–72. doi:/10.1016/S0140-6736(25)01917-8.

10.
Murthy S, Hagedoorn NN, Faigan S, Rathan MD, Marchello CS et al (2026). Complications and mortality of typhoid fever: an updated global systematic review and meta-analysis. Lancet Infect Dis. 26:270–83. doi:/10.1016/S1473-3099(25)00551-1.

11.
Hagedoorn NN, Birkhold M, Murthy S, Rathan MD, Faigan S et al. (2024). Mortality, morbidity, and post-operative complications of typhoid intestinal perforations: global systematic review and meta-analysis. medRxiv [preprint]. 2024.06.28.24309663. doi:/10.1101/2024.06.28.24309663.

12.
Crump JA, Sjolund-Karlsson M, Gordon MA, Parry CM (2015). Epidemiology, Clinical Presentation, Laboratory Diagnosis, Antimicrobial Resistance, and Antimicrobial Management of Invasive Salmonella Infections. Clin Microbiol Rev. 28(4):901–937.

13.
Andrews JR, Qamar FN, Charles RC, Ryan ET (2018). Extensively Drug-Resistant Typhoid - Are Conjugate Vaccines Arriving Just in Time? N Engl J Med. 379(16):1493–1495.

14.
Batool R, Yousafzai MT, Qureshi S, Ali M, Sadaf T et al. (2021). Effectiveness of typhoid conjugate vaccine against culture-confirmed typhoid in a peri-urban setting in Karachi: a case-control study. Vaccine. 39(40):5858–5865.

15.

Yousafzai MT, Karim S, Qureshi S, Kazi M, Memon H et al. (2021). Effectiveness of typhoid conjugate vaccine against culture-confirmed Salmonella enterica serotype Typhi in an extensively drug-resistant outbreak setting of Hyderabad, Pakistan: a cohort study. Lancet Glob Health. 9(8):e1154–e1162.

16.

Lightowler MS, Manangazira P, Nackers F, Van Herp M, Phiri I et al. (2022). Effectiveness of typhoid conjugate vaccine in Zimbabwe used in response to an outbreak among children and young adults: a matched case control study. Vaccine. 40:4199–4210.

17.

Hooda Y, Tanmoy AM, Nath SD, Jul AB, Amin A et al. (2025). Outbreak of Ceftriaxone-resistant Salmonella enterica serovar Typhi, Bangladesh, 2024. Emerg Infect Dis. 31(7):1460–1465.

18.

Nizamuddin S, Khan EA, Chattaway MA, Godbole G (2023). Case of Carbapenem-resistant Salmonella Typhi Infection, Pakistan, 2022. Emerg Infect Dis. 29(11).

19.

Carey ME, Dyson ZA, Ingle DJ, Amir A, Aworh MK et al. (2023). Global diversity and antimicrobial resistance of typhoid fever pathogens: insights from a meta-analysis of 13 000 Salmonella Typhi genomes. eLife. 12:e85867. doi:/10.7554/eLife.85867.

20.

[1] Baker S, Sarwar Y, Aziz H, Haque A, Ali A et al. (2005). Detection of Vi-negative Salmonella enterica serovar Typhi in the peripheral blood of patients with typhoid fever in the Faisalabad region of Pakistan. J Clin Microbiol. 43(9):4418–4425.

21.

Kutambe BM, Patel PD, Chizani K, Silungwe N, Kukacha C et al (2026). Genomic analysis of Salmonella Typhi from a typhoid conjugate vaccine trial. Microbial Genomics. 12(5):001721. doi:/10.1099/mgen.0.001721.

22.

Patel PD, Patel P, Liang Y, Meiring JE, Misiri T et al. (2021). Safety and efficacy of a typhoid conjugate vaccine in Malawian children. N Engl J Med. 385(12):1104–1115.

23.
2021 Lancet Global Health final 2-year analysis: Shakya M, Voysey M, Theiss-Nyland K, Colin-Jones R, Pant D et al. (2021). Efficacy of typhoid conjugate vaccine in Nepal: final results of a phase 3, randomised, controlled trial. Lancet Glob Health. 9(11):e1561–e1568.

24.
Qadri F, Khanam F, Liu X, Theiss-Nyland K, Biswas PK et al. (2021). Protection by vaccination of children against typhoid fever with a Vi-tetanus toxoid conjugate vaccine in urban Bangladesh: a cluster-randomised trial. Lancet. 398:675–684.

25.
Gloeck NR, Leong TD, Mthethwa M, Iwu-Jaja CJ, Katoto PDMC et al. (2025). Typhoid conjugate vaccines for preventing typhoid fever (enteric fever). Cochrane Database Syst Rev. (5):CD015746. doi:/10.1002/14651858.CD015746.pub2.

26.
Hoffman SA, LeBoa C, Date K, Haldar P, Harvey P et al. (2023). Programmatic effectiveness of a pediatric typhoid conjugate vaccine campaign in Navi Mumbai, India. Clin Infect Dis. 77:138–144.

27.
Tamrakar D, Shahi SB, Jung E, Naga SR, Shrestha B et al. (2025). Effectiveness of the TYPHIBEV® (Vi-CRM197 conjugate) vaccine introduction in Nepal: a test-negative, case-control study. medRxiv [preprint]. doi:/10.1101/2025.11.20.25340644.

28.
Patel PD, Liang Y, Meiring JE, Chasweka N, Patel P et al. (2024). Efficacy of typhoid conjugate vaccine: final analysis of a 4-year, phase 3, randomised controlled trial in Malawian children. Lancet. 403(10425):459–468. doi:/10.1016/S0140-6736(23)02031-7.

29.
Pant D, Zhang Y, Basile FW, Shakya M, Kelly S et al. (2026). Eight-year vaccine protection following a single dose of Vi-tetanus toxoid conjugate vaccine in Nepali children: extended follow-

up of the TyVAC Nepal randomised controlled trial. SSRN [preprint]. doi:/10.2139/ssrn.6327745.

30.
World Health Organization (2026). SAGE Background Document – Typhoid vaccines. SAGE meeting, 9–11 March 2026. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 26 July 2026).

31.
World Health Organization (2026). SAGE Evidence-to-Recommendation Framework TCV – Part II. In: SAGE Yellow Book, March 2026, section 4.4. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 26 July 2026).

32.
World Health Organization (2026). SAGE Background Document – Typhoid vaccines. SAGE meeting, 9–11 March 2026. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 26 July 2026)

33.
Gloeck NR, Leong TD, Mthethwa M, Iwu-Jaja CJ, Katoto PDMC et al. (2025). Typhoid conjugate vaccines for preventing typhoid fever (enteric fever). Cochrane Database Syst Rev. (5):CD015746. doi:/10.1002/14651858.CD015746.pub2.

34.
World Health Organization (2026). Survey findings on feasibility, acceptability, equity and implementation considerations associated with TCV schedule adaptations. In: SAGE Yellow Book, March 2026, section 4.8. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 26 July 2026).

35.
World Health Organization (2026). SAGE Evidence-to-Recommendation Framework TCV – Part I. In: SAGE Yellow Book, March 2026, section 4.3. (https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_March26.pdf, accessed 26 July 2026).

36.

UNICEF Supply Division (2025). Auto-disable (AD) syringe price data. (https://www.unicef.org/supply/media/24391/file/Auto-Disable-AD-syringes-pricing-data-2011-2027.pdf, accessed 24 June 2026).

37.
Pan American Health Organization (2026). Revolving fund: Syringe and Safety Boxes – Price List for the Calendar Year 2026. (https://www.paho.org/en/documents/syringes-and-safety-boxes-2026-prices, accessed 29 September 2026).

38.
UNICEF Supply Division (2025). Safety boxes price data. (https://www.unicef.org/supply/media/24401/file/Safety-Boxes-SB-pricing-data-2011-2027.pdf, accessed 24 June 2026).

39.
UNICEF Supply Division (2026). Typhoid conjugate vaccine (TCV) price data. April 2026 (https://www.unicef.org/supply/documents/typhoid-conjugate-vaccine-tcv-price-data, accessed 26 July 2026).

40.
Pan American Health Organization (2026). Vaccine prices list for the Calendar Year 2026. (https://www.paho.org/en/documents/vaccine-prices-revolving-fund-2026, accessed 26 July 2026).

41.
World Health Organization (2026). Interim 2025 MI4A public vaccine purchase dataset. Geneva: WHO September 2026 (https://www.who.int/teams/immunization-vaccines-and-biologicals/vaccine-access/mi4a/mi4a-vaccine-purchase-data, accessed 29 September 2026)

42.
Song D, Pallas SW, Shimpi R, Ramaswamy N, Haldar P et al. Delivery cost of the first public sector introduction of typhoid conjugate vaccine in Navi Mumbai, India. PLOS Glob Public Health. 2023 Jan 4;3(1):e0001396. doi: 10.1371/journal.pgph.0001396.

43.

Poncin M, Marembo J, Chitando P, Sreenivasan N, Makwara I et al. Implementation of an outbreak response vaccination campaign with typhoid conjugate vaccine - Harare, Zimbabwe, 2019. Vaccine X. 2022 Aug 2;12:100201. doi: 10.1016/j.jvacx.2022.100201.

44.
Koulidiati J-L, Zoma RL, Nebié EI, Yameogo S, Neya Ouedraogo C et al. (2026). Cost analysis of a nationwide typhoid conjugate vaccine campaign in Burkina Faso. PLoS One 21(6): e0351148. doi:/10.1371/journal.pone.0351148

45.
Wenger CGC, Grantz KH, Menkir TF, Muellenmeister AM, Pithawala Z et al. (2026). Evaluating the impact and cost-effectiveness of typhoid conjugate vaccine schedules across diverse settings: a multi-model comparison. medRxiv [preprint]. doi:/10.64898/2026.03.09.26346651.

46.
Gavi, the Vaccine Alliance (2026). Gavi 6.0 Funding Guidelines v1.0 April 2026 (https://www.gavi.org/sites/default/files/support/guidelines-2026/gavi-60-funding-guidelines-annexes.pdf, accessed 24 July 2026)

47.
Gavi, the Vaccine Alliance (2019). Typhoid Data Guidance for Gavi Applications 1. (https://www.gavi.org/sites/default/files/document/support/

Typhoid%20data%20guidance%20for%20Gavi%20application.pdf, accessed 24 July 2026)

48.
World Health Organization (2026) Full vaccine product list (https://www.who.int/teams/immunization-vaccines-and-biologicals/vaccine-access/mi4a/mi4a-vaccine-purchase-data

accessed 24 July 2026)

49.
World Health Organization (2026) Prequalified Vaccines (https://extranet.who.int/prequal/vaccines/prequalified-vaccines, accessed 29 September 2026)

50.

For specific product characteristics, see the comparison table.

51.

World Health Organization (2026). WHO Prequalification of Medical Products: Typbar-TCV (single-dose and 5-dose presentations), TYPHIBEV® (single-dose and 5-dose presentations), ZyVac® TCV and SKYTyphoid Multi Inj. (https://extranet.who.int/prequal/vaccines/p/typbar-tcv; https://extranet.who.int/prequal/vaccines/p/typbar-tcv-0; https://extranet.who.int/prequal/vaccines/p/typhibevr; https://extranet.who.int/prequal/vaccines/p/typhibevr-0; https://extranet.who.int/prequal/vaccines/p/zyvacr-tcv; https://extranet.who.int/prequal/vaccines/p/skytyphoid-multi-inj,https://extranet.who.int/prequal/vaccines/p/eutyph-c-inj-multi-dose, accessed 26 September 2026).

52.

For specific product characteristics, see the comparison table.