Cost-effectiveness analysis of typhoid conjugate vaccine in Gavi-eligible countries

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Introduction

Typhoid fever remains endemic in low- and middle-income countries, causing between 9.9 and 24.2 million cases per year. Programmatic use of existing vaccines is limited, but upcoming typhoid conjugate vaccines (TCVs) could warrant wider use. We evaluated the cost-effectiveness of five TCV delivery strategies in three urban areas (Delhi and Kolkata, India and Nairobi, Kenya) and two rural settings (Lwak, Kenya and Dong Thap, Vietnam) as case studies, and then extended our analysis to all Gavi-eligible countries.

Data and Methods

We evaluated routine infant vaccination with and without catch- up campaigns among older individuals in five representative settings within Gavi-eligible countries: Kolkata and Delhi in India, Nairobi and Lwak in Kenya, and Dong Thap Province in Vietnam.

We used a dynamic model of typhoid transmission coupled to a treatment model to simulate cases, hospitalizations, deaths, disability-adjusted life-years (DALY) lost, treatment and intervention costs. We estimated cost-effectiveness (in terms of costs per DALY averted over 10 years) from the healthcare provider perspective. We assessed how cost-effectiveness was influenced by uncertain model parameters using a random forest analysis.

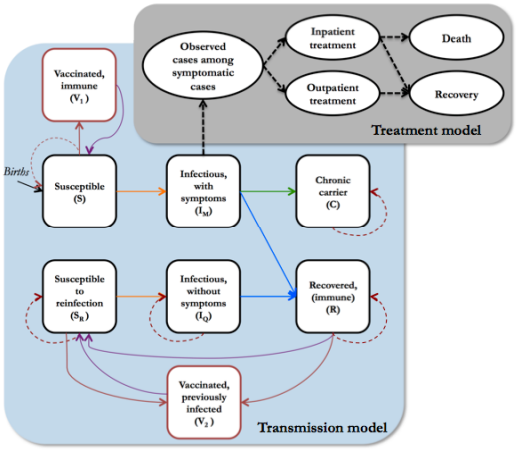

Figure 1: Typhoid fever transmission and treatment model.

We expanded the cost-effectiveness analysis to all Gavi-eligible countries, calculating the transmission rate according to the incidence rate as reported in the Global Burden of Disease Study [1]. We simulated vaccination impact assuming coverage rates estimated by Gavi, a vaccine efficacy of 87.5%, and a 20-year duration of vaccine protection [2,3,4]. Treatment and vaccination costs were informed by the literature and WHO unit costs.

Results

- Compared to no vaccination, routine infant vaccination at $1/dose was cost-saving in Delhi and Dong Thap, "very cost-effective" in Kolkata and Nairobi, and "cost-effective" in Lwak.
- Routine vaccination was not likely to be the optimal strategy compared to strategies that included a catch-up campaign.
- The number of doses necessary for full protection and the hospitalization rate were the primary sources of uncertainty within representative settings.
- Across all Gavi-eligible countries, adding a campaign alongside routine vaccination is generally the preferred strategy.
- Uncertainty in incidence, mortality, and prevalence of antimicrobial resistance contributed prominently to uncertainty in cost-effectiveness results across all Gavi-eligible countries.

Conclusion

Routine vaccination with TCV would be cost-effective in some settings, and additional one-time catch-up campaigns would also be economically justified at $1/dose.

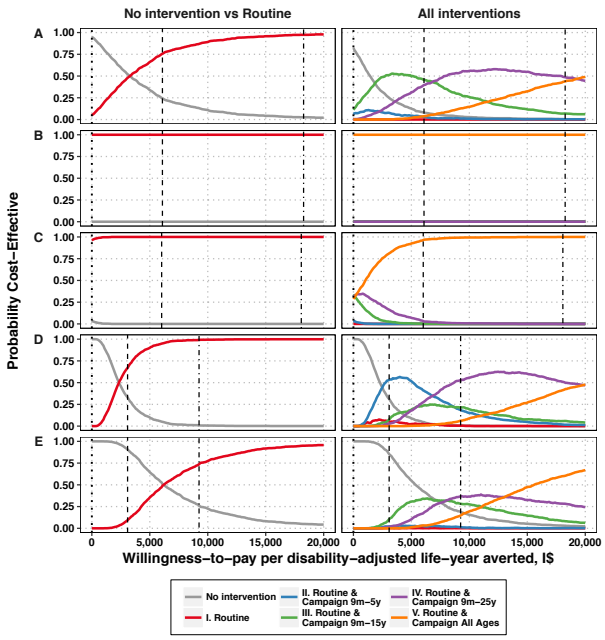

Figure 2: Cost-effectiveness acceptability curves for routine vaccination at 9 months of age (left) and for all five delivery strategies under consideration (right) versus no intervention for (A) Kolkata, (B) Delhi, (C) Dong Thap, (D) Nairobi, and (E) Lwak.

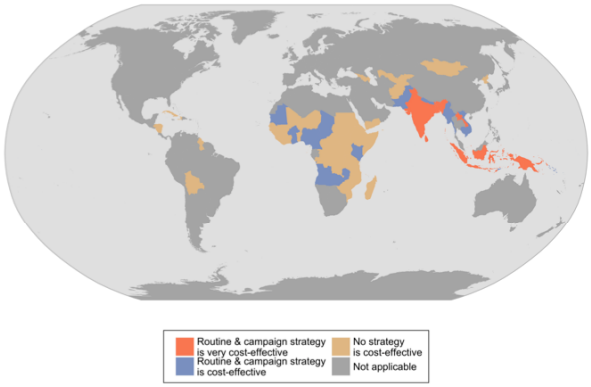

Figure 3: Preliminary cost-effectiveness analysis of strategies employing TCVs in Gavi-eligible countries. **Very cost-effective interventions** consist of strategies for which the cost of averting one disability-adjusted life-year (DALY) is less than the GDP per capita of that country and **cost-effective interventions** are strategies where one DALY averted costs less than three times the GDP per capita of that country.

Acknowledgments

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