Predicting the impact of typhoid conjugate vaccines on antimicrobial resistance

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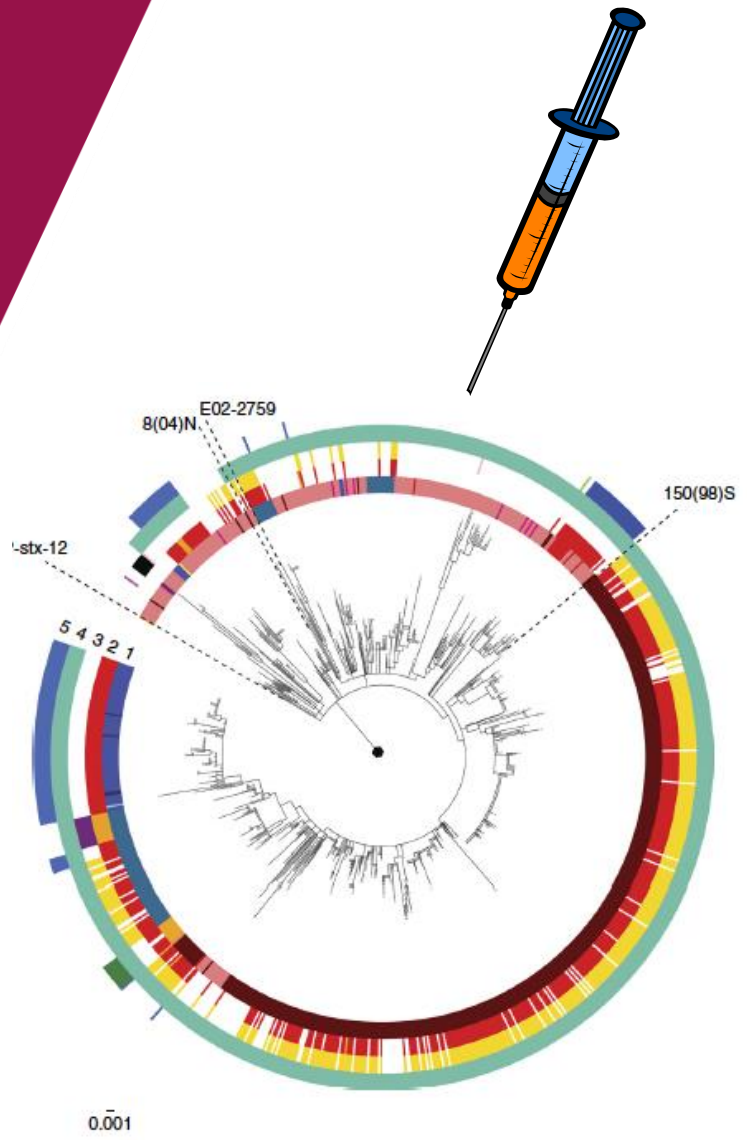


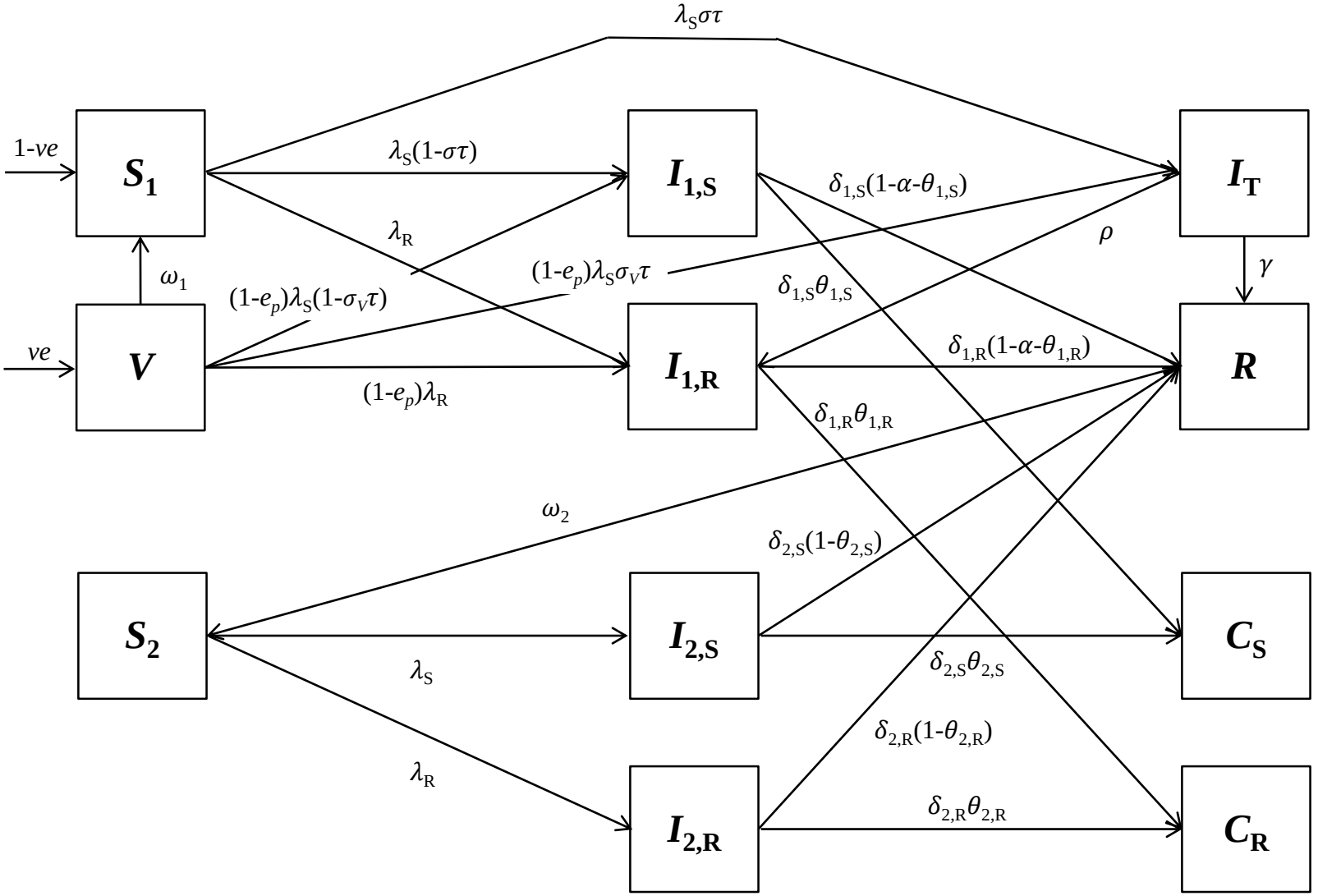
TyVAC Typhoid Vaccine Acceleration Consortium

Modeling the impact of typhoid conjugate vaccines (TCVs) on antimicrobial resistance

HYPOTHESIS:
By decreasing the incidence of typhoid fever, and thereby decreasing the number of individuals being treated with antimicrobials, vaccination can decrease selection pressure for transmitted resistance

This will lead to a synergistic benefit by reducing both the **incidence** and **prevalence** of resistant strains

Model structure



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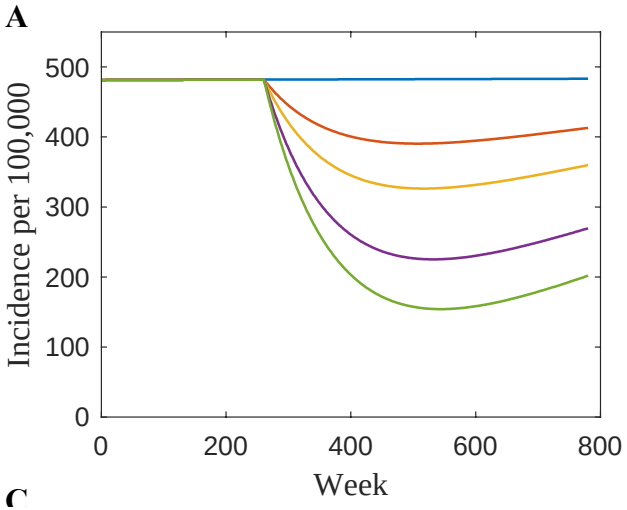
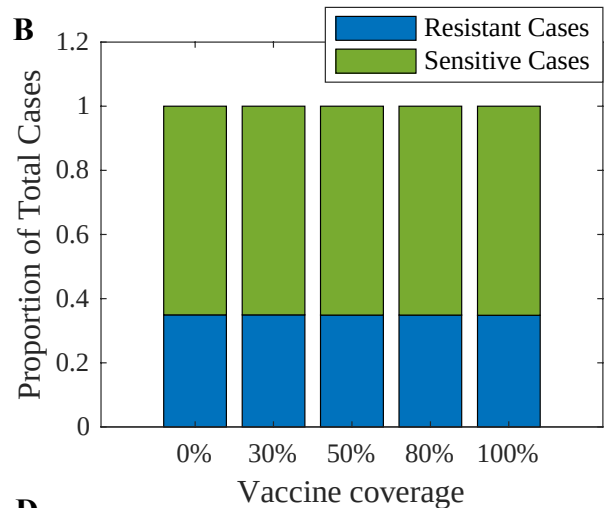
Model predictions for the impact of TCVs on AMR





Vaccination is predicted to decrease the **incidence** of typhoid fever, and the incidence of AMR cases, but does NOT affect the **proportion** of cases that are resistant

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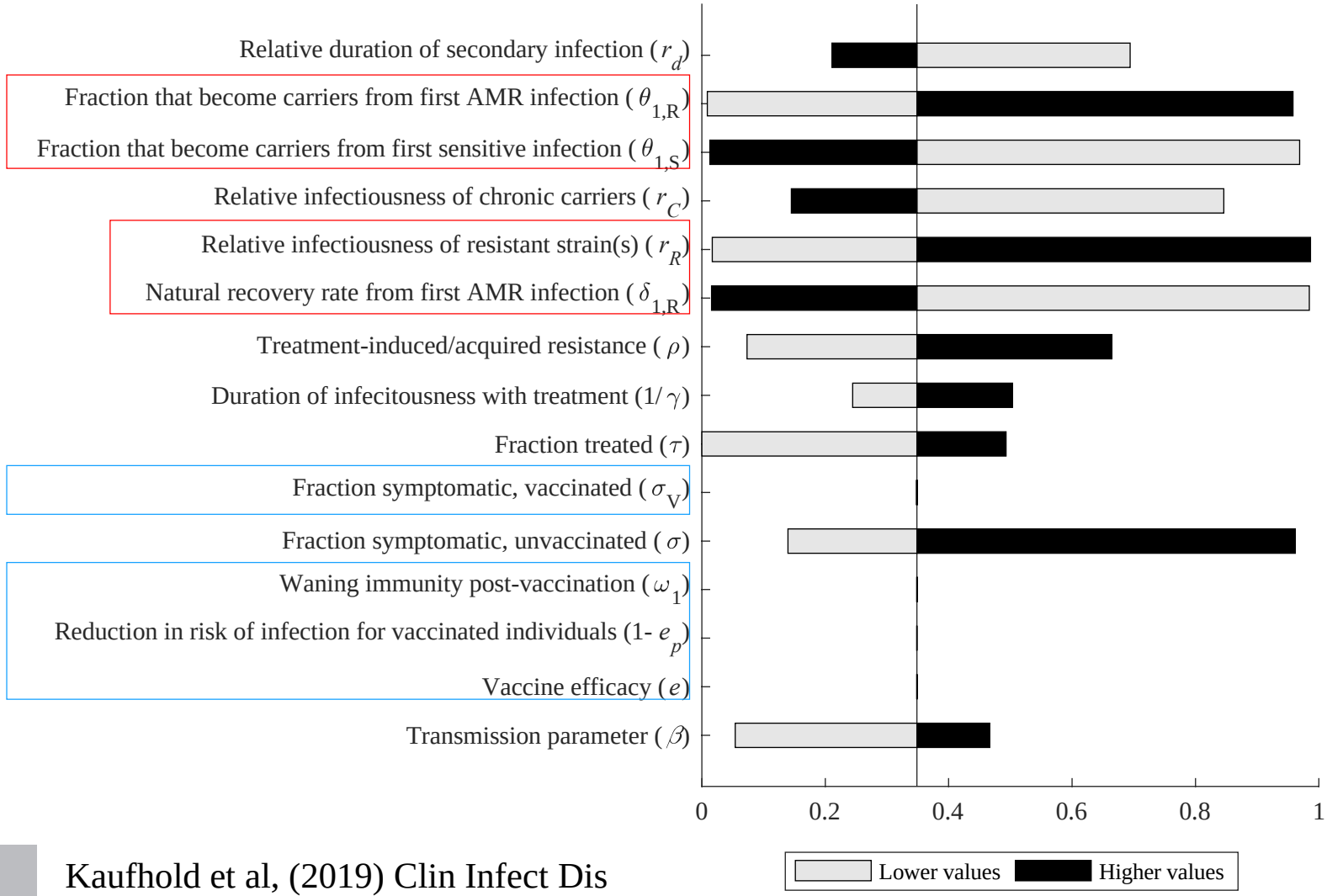
No vaccination — 30% coverage — 50% coverage — 80% coverage — 100% coverage

Which parameters affect the proportion of cases that are resistant?



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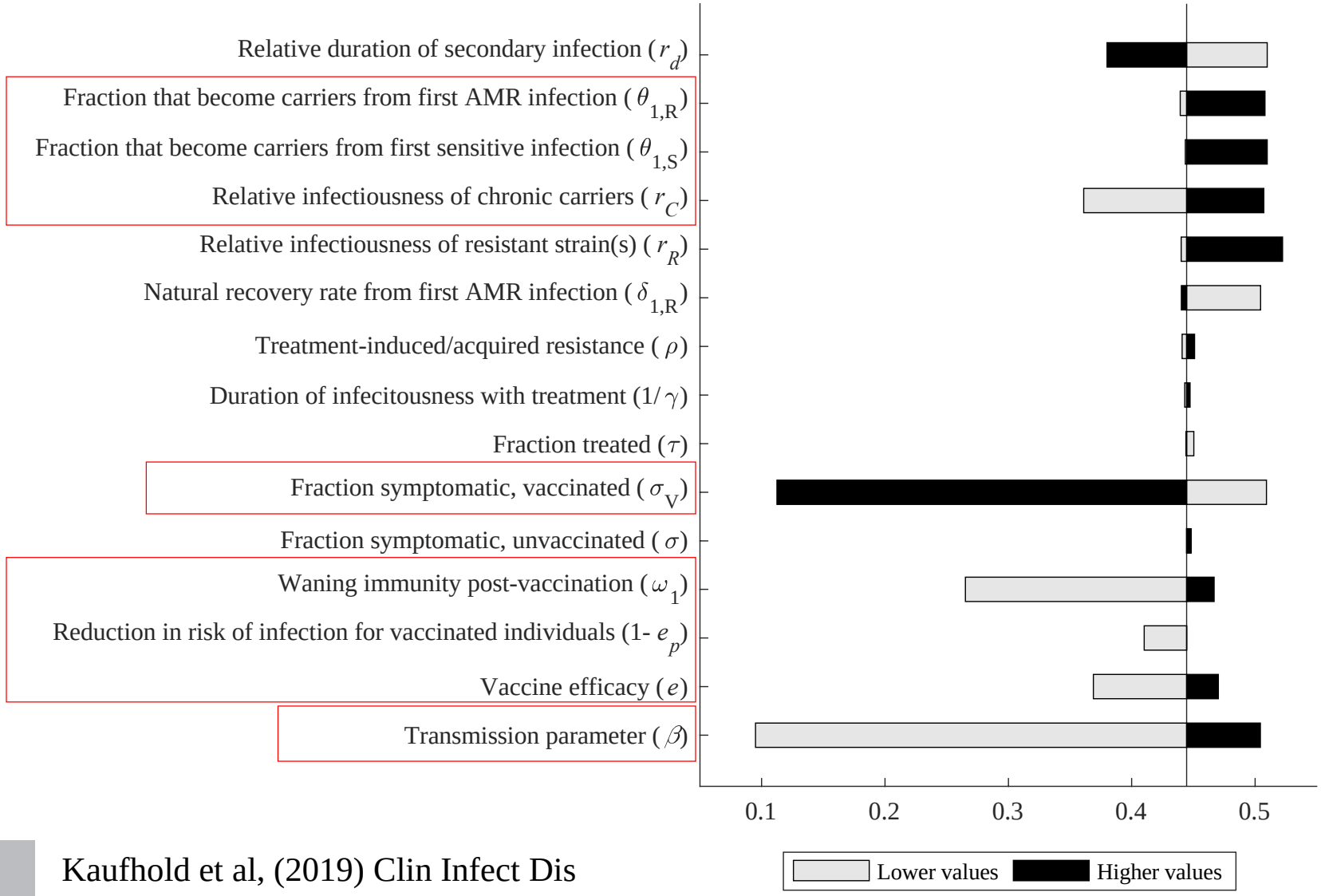
Which parameters affect the proportion of cases averted by vaccination?



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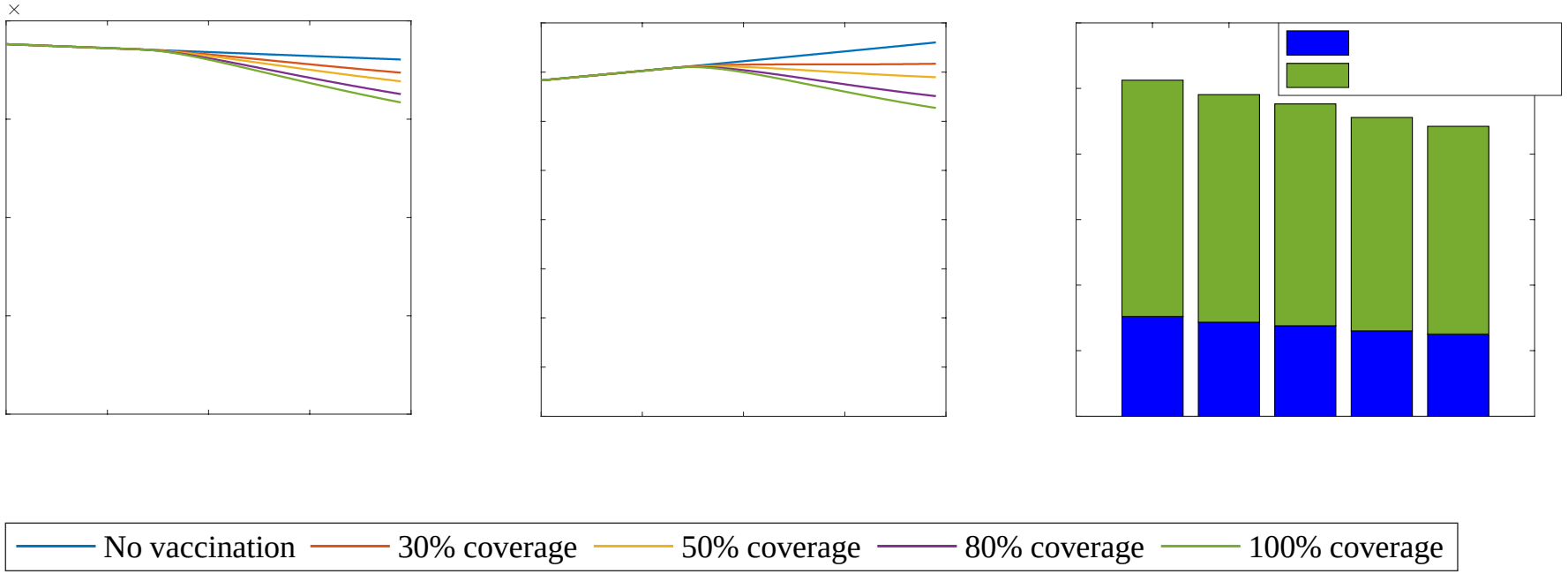
Impact of vaccination on chronic carriers



Vaccination is predicted to **slightly decrease** the prevalence of chronic carriers that harbor AMR strains

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Limitations

- Simplified model, not fit to data from any particular typhoid-endemic setting
- Proportion of cases treated was assumed constant over time
- We assume vaccination provides equal protection against resistant and sensitive strains
- We assume the reduction in treatment is directly proportional to the incidence of typhoid fever

Impact of TCVs beyond typhoid fever

- Typhoid fever is a major driver of antimicrobial treatment
- For every culture-positive typhoid fever case, there are up to 25 other suspected cases

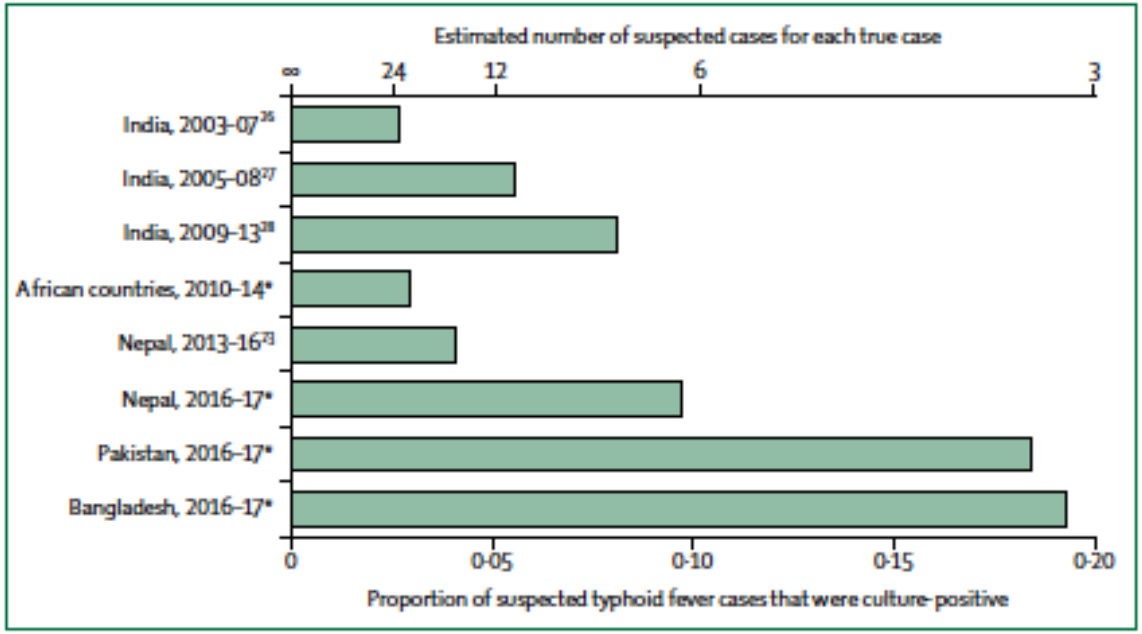

Figure: Proportion of suspected typhoid fever cases that were culture-positive, and the estimated number of suspected typhoid cases for each true case

The number of suspected typhoid cases for each true case were estimated by dividing the inverse of the culture-positive proportion by the sensitivity of the culture, estimated from a meta-analysis.[25] Studies with data from the past 10 years,[23,26–28] and unpublished data from the authors' ongoing prospective cohort studies were included, and indicate that many patients with suspected typhoid are treated for each true case. *Unpublished.

Andrews et al (2018) Lancet Infect Dis

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