

The potential impact of novel tuberculosis vaccines on health equity and financial protection in LMICs

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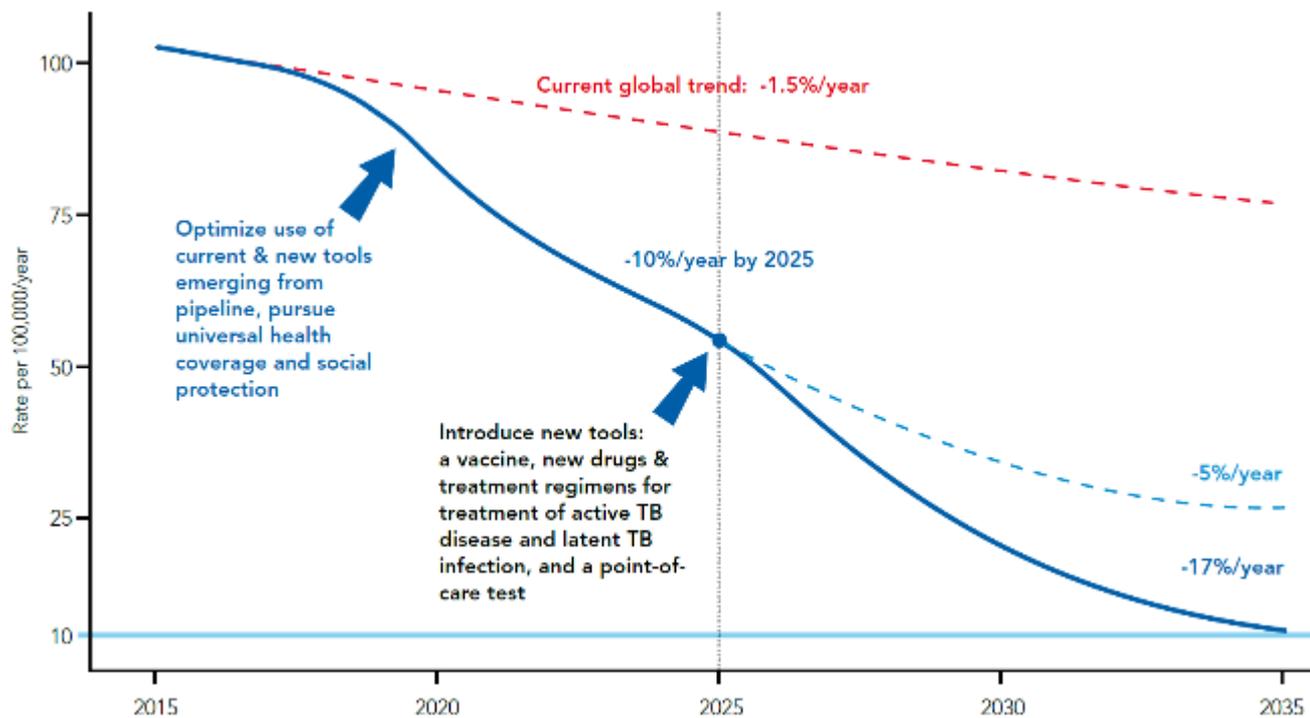


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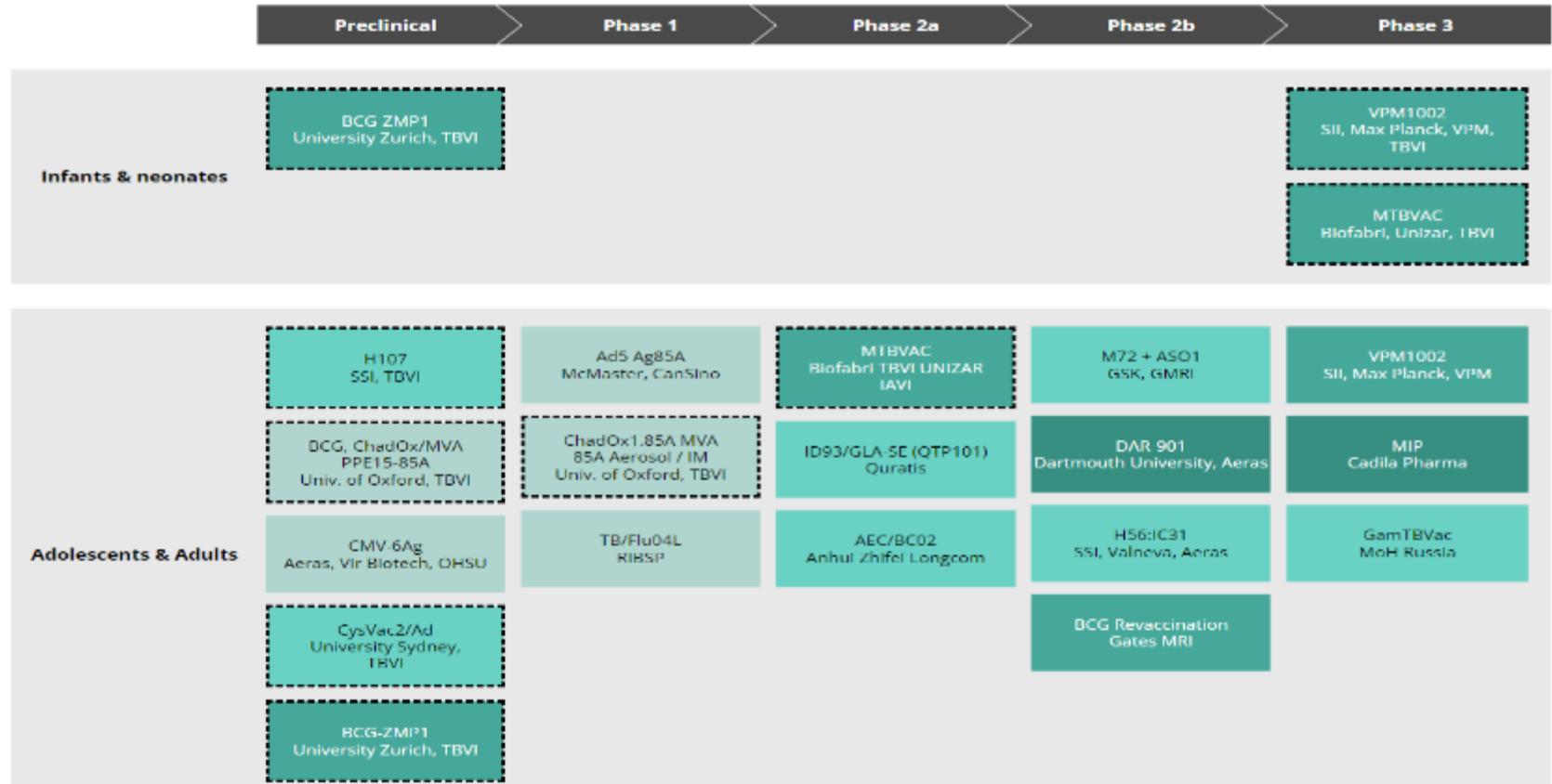
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Motivation



Global TB vaccine development pipeline



Objective

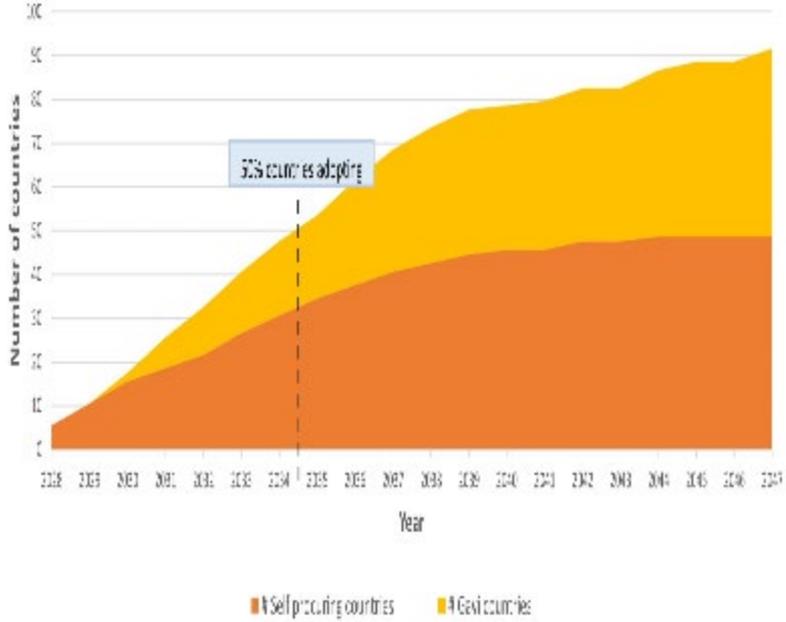
We assessed the potential health gains and financial risk protection from introducing novel TB vaccines, and how these benefits would be distributed across income quintiles

Model development

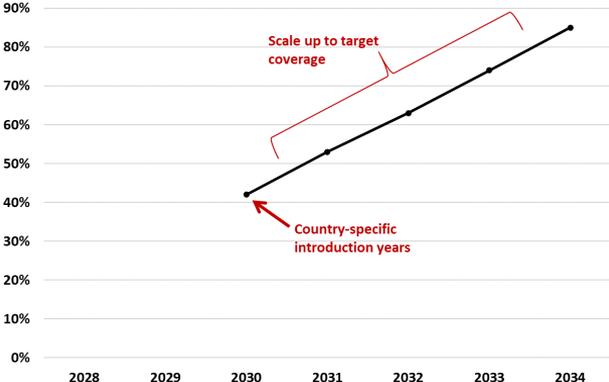
- A novel age-structured *Mtb* transmission model separately calibrated to demographic and epidemiological data from 105 countries, representing 93% of the TB incidence in LMICs
 - Clark, R. A., et al (2023). "The impact of alternative delivery strategies for novel tuberculosis vaccines in low-income and middle-income countries: a modelling study." *Lancet Glob Health* 11(4): e546-e555.
- Model calibration allowed for negative correlation between tuberculosis burden and health care access
 - 2 explicit groups: high-access-to-care, representing top 3 quintiles (60% of the population), and low-access-to-care, representing bottom 2 quintiles (40% of the population)
 - TB prevalence rate ratio, upper 60% to lower 40% = 0.67 (0.57-0.80) in 2019 (11 studies)
- As data limited on mechanism, relative to lower-access-to-care group, we assumed the high-access-to-care group has:
 - Reduced *Mtb* transmission probability per contact
 - Increased rate of treatment initiation
 - Reduced rate of progression to tuberculosis disease

Vaccine scenarios

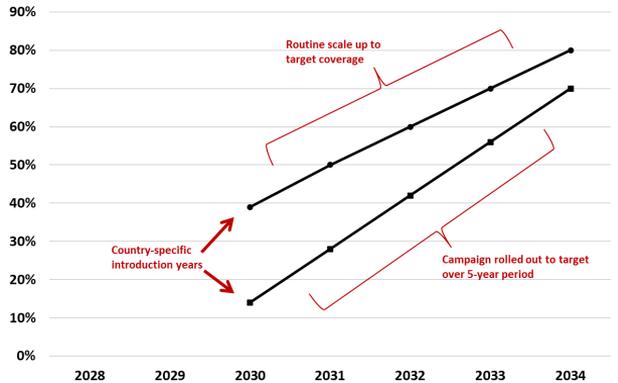
Timelines for introduction in LMICs



Infant vaccine



Adolescent/adult vaccine

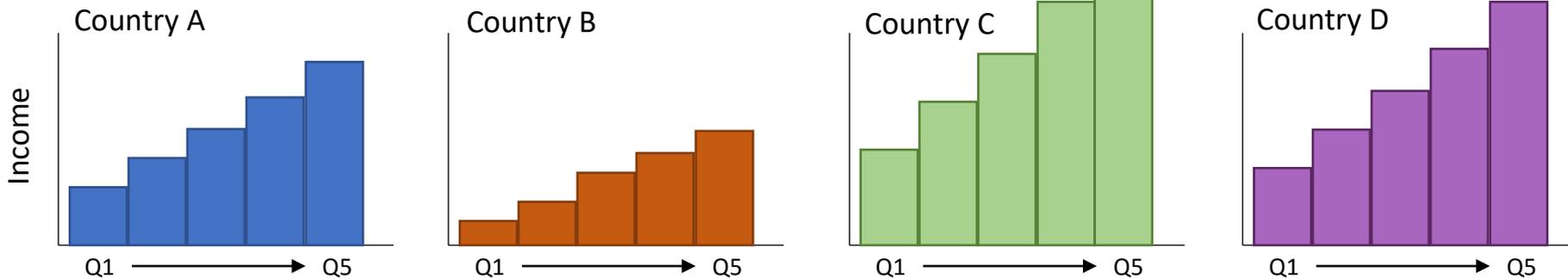


Health equity and financial risk protection

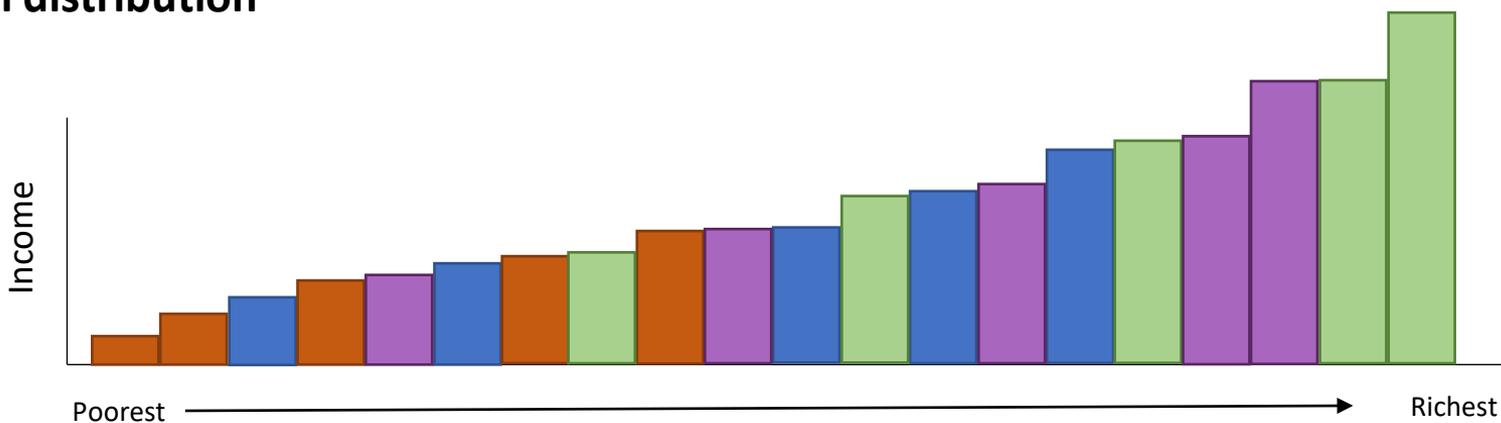
- Two SES strata stratified into outcomes across 5 income quintiles within each modeled country, based on current distribution of TB burden
- For each country and quintile, costs incurred by patients (direct medical, direct non-medical, indirect costs) estimated by extrapolating from national TB patient cost survey data (N=20 surveys, in 2020 constant dollars)
- Catastrophic costs of TB defined as patient costs per TB episode >20% of household annual income

Distribution of benefits across countries and income strata

Within country distribution



Global distribution



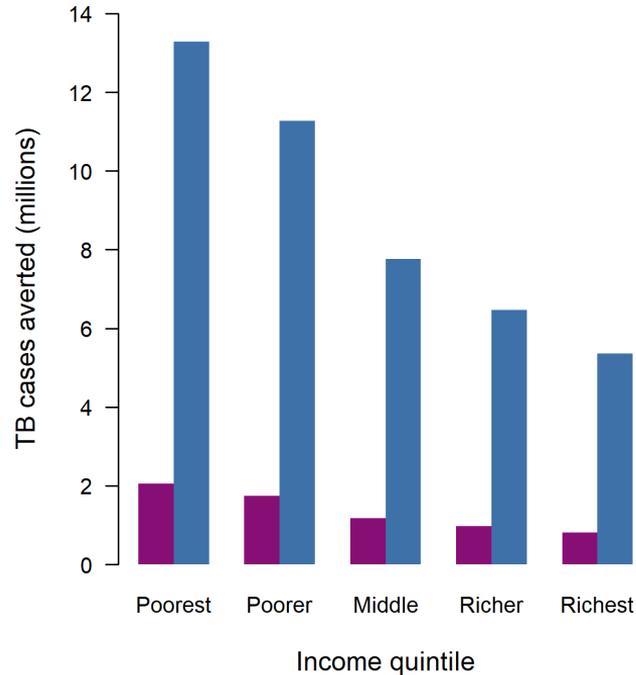
Results

TB cases and catastrophic costs averted for all modelled countries, by income quintile

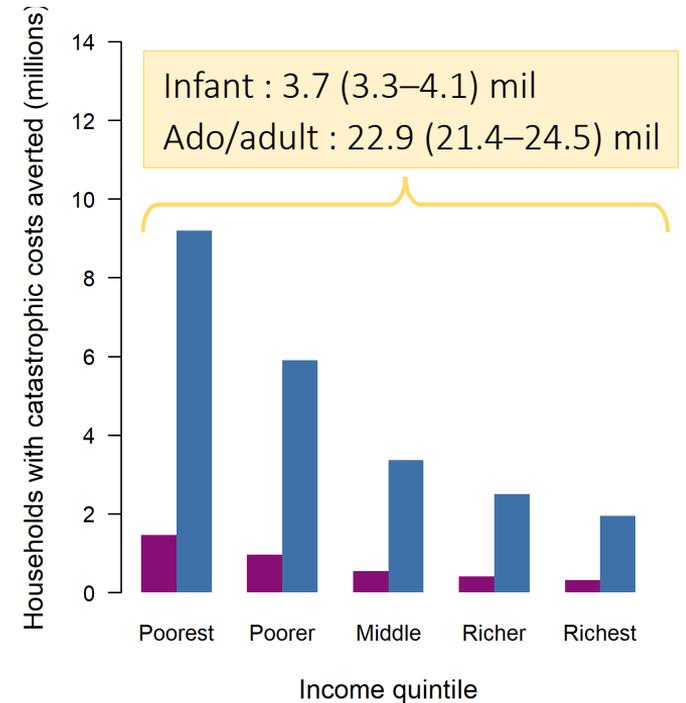
Lower income quintiles:

- Higher TB incidence
- Greater proportion with catastrophic costs

TB cases averted, by income quintile



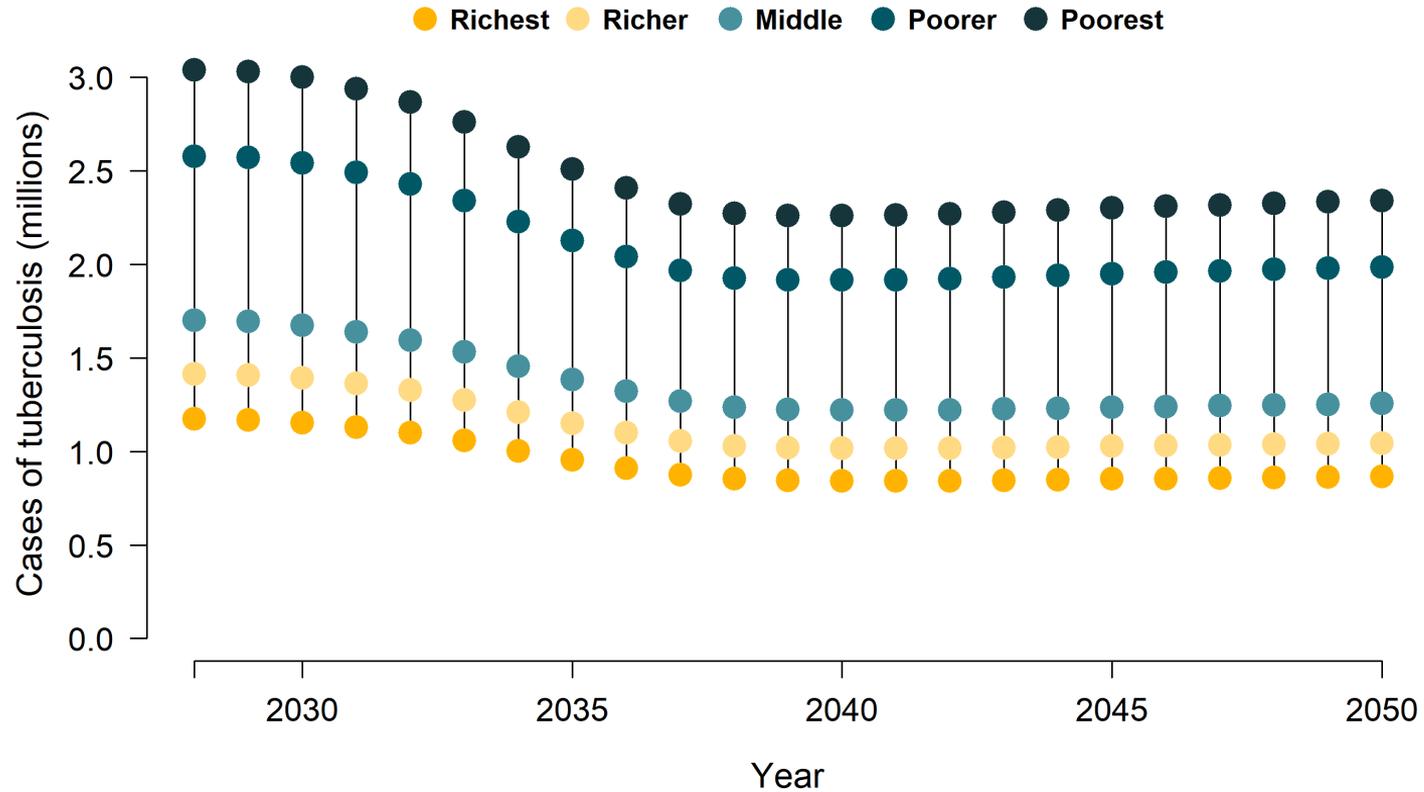
Catastrophic costs averted, by income quintile



■ Infant Vaccine

■ Adolescent/Adult Vaccine

Cases of tuberculosis over time and by income quintile

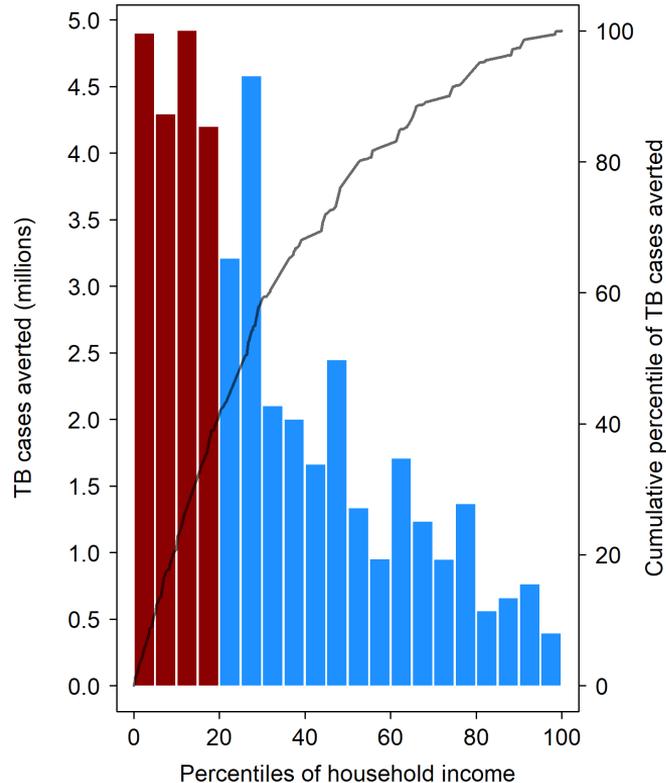


TB cases and catastrophic costs averted across all modelled strata, ordered by household income

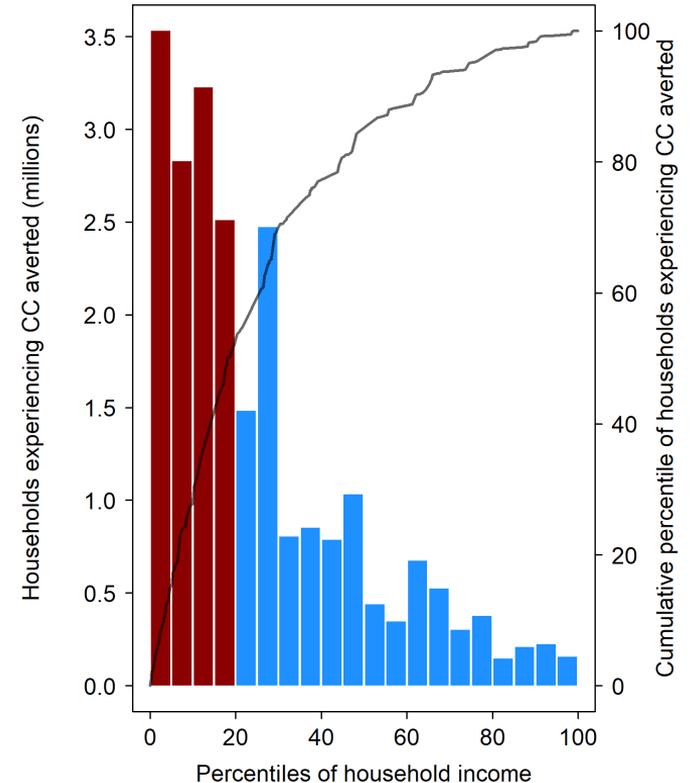
Poorest 20% of households:

- 18.3 (14.2–22.7) million TB cases projected to be averted (41% of total)
- 12.1 (9.4–15.0) million households experiencing catastrophic costs averted (53% of total)

TB cases averted across all strata



Catastrophic costs averted across all strata



Limitations

- Constrained by data availability for many LMIC settings; only 105 countries were successfully parameterized and calibrated
- Not a comprehensive set of analyses, but demonstrate the potential distributional consequences of novel TB vaccines according to specified characteristics
- We assumed that per-patient costs of TB would not change in future years
- We assumed vaccines would be provided free-of-charge
 - Requiring payment to receive a new TB vaccine would likely reduce uptake, particularly within low-income groups

Summary

- New TB vaccines could be highly impactful and help narrow income-based disparities in health and economic consequences of TB for LMICs
 - Benefits concentrated in lower income quintiles
- Countries will need to commit to rapid introduction once an effective vaccine is approved, achieve high population coverage, and prevent differentials in vaccine uptake by poor and marginalized groups
 - Requires sustained political and financial commitments by affected countries and international partners, as well as implementation research on approaches to eliminate uptake barriers
- While challenges remain, successful development and introduction of a new TB vaccine has potential to accelerate burden reduction for a disease that represents one of the greatest health threats for poor households

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