7TH GLOBAL FORUM ON TB VACCINES | 8-10 October 2024 Rio de Janeiro, Brazil

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Cost and Cost Effectiveness of Novel Tuberculosis Vaccines in Low-and Middle-income Countries: A Systematic Review of Modelling Studies

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Background

- Tuberculosis (TB) remains a major global health threat.
- BCG vaccine, the only licensed TB vaccine, has limited effectiveness in adolescents and adults.
- Novel vaccines targeting adolescents and adults are urgently needed.
- Understanding the cost and cost-effectiveness of these vaccines is crucial for informed investment decisions.

Research Question

What are the costs and cost-effectiveness of novel tuberculosis (TB) vaccines compared to the current standard of care (BCG) in various settings and for different age groups in LMICs?

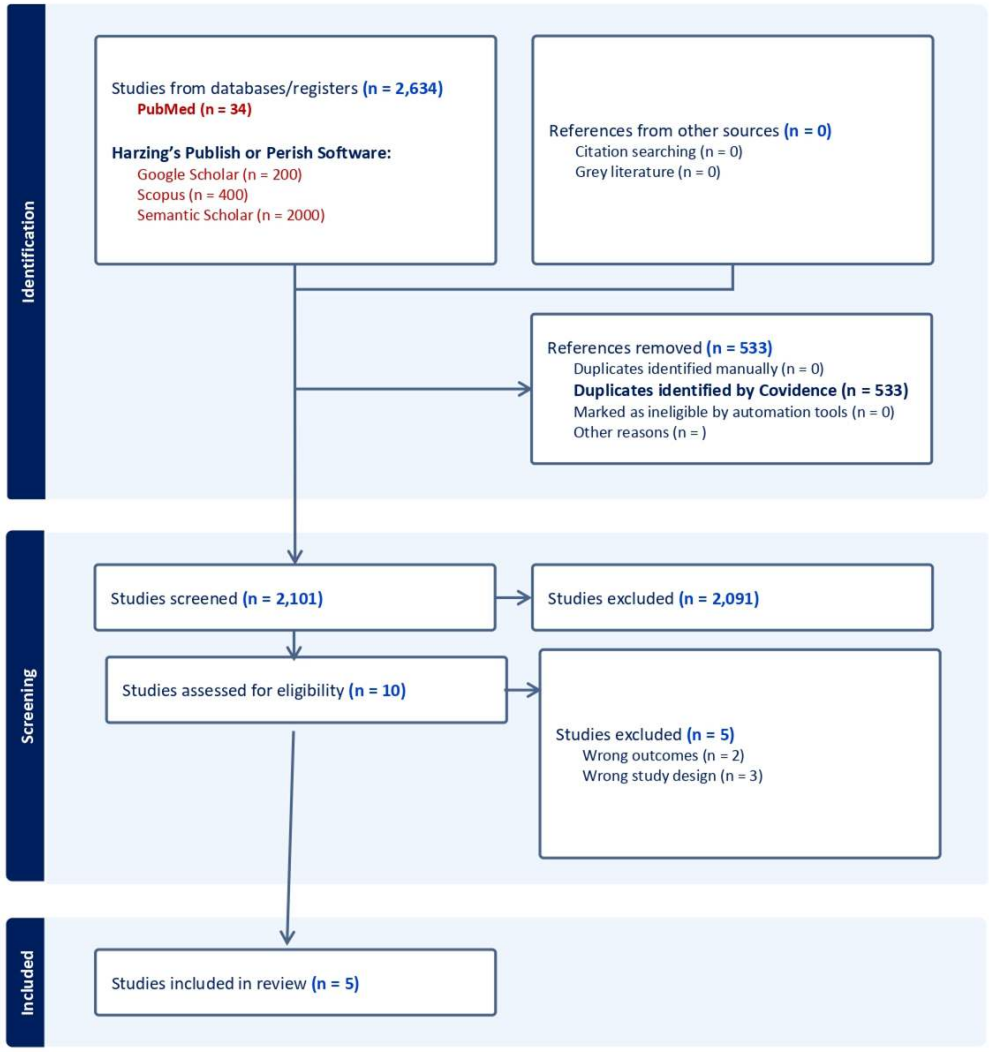
Guideline:

2022 PRISMA Guideline

Search Strategy:

- Search terms (keywords): tuberculosis vaccines, cost-effectiveness, and modelling studies

- **Study Design**
  - Modeling studies.
  - Peer-reviewed articles published in English.



ELIGIBILITY CRITERIA

INCLUSION CRITERIA

Population

- Studies involving populations in low- and middle-income countries (LMICs).
- Participants may include infants, children, adolescents, and adults at risk of tuberculosis.

Intervention

- Research focusing on novel tuberculosis vaccines, including candidates in clinical trials.
- Examination of different vaccination strategies (e.g., mass vaccination, routine immunization).

Comparators

Studies comparing novel vaccines to standard care, existing TB vaccines, or no vaccination.

Outcome

- Reporting of cost-effectiveness ratios, quality-adjusted life years (QALYs), or disability-adjusted life years (DALYs) averted.
- Factors influencing cost effectiveness

QUALITY ASSESSMENT

Framework: Evaluated using the **2022 CHEERS checklist** (28 items, 7 dimensions).

Compliance Rating:

- **Full Compliance**: 1.0
- **Partial Compliance**: 0.5
- **Non-Compliance**: 0.0

Score Calculation:

- **Quality Score (%)** = (Total Achieved Score / 28) × 100

Quality Categories:

- **High**: ≥ 85%
- **Relatively High**: 70% - 84%
- **Medium**: 55% - 69%
- **Low**: < 55%

DATA SYNTHESIS

- A narrative synthesis was conducted to summarize the findings of the included studies.
- A meta-analysis was not feasible due to the expected heterogeneity in economic models.

Quality Assessment using 2022 CHEERS Checklist

Study Name	Score	Remark
Harris et al., 2022	77	Relatively high
Portnoy et al., 2023	80	Relatively high
Jayawardana et al., 2022	95	High
Knight et al., 2014	79	Relatively high
Weerasuriya et al., 2021	88	High

Table 1: Study Overview and Model Details

Study Name	Publication Date	Study Country	Year Range of Analysis	Model Type	Cost Effectiveness Perspective
Harris et al., 2022	2022	South Africa and India	2025–2050	Age-structured compartmental dynamic model	Health system
Portnoy et al., 2023	2023	105 LMICs	2028–2050	Age-structured TB transmission model	Health system
Jayawardana et al., 2022	2022	South Africa	2025–2050	Age-structured compartmental dynamic model	Health system
Knight et al., 2014	2014	91 LMICs	2009–2050	Age-structured TB transmission model	Health system and societal
Weerasuriya et al., 2021	2021	India	1950–2050	Age, treatment history, and drug resistance stratified model	Health system

Table 2: Study Parameters

Study Name	Study Country	Vaccine Type	Efficacy	Coverage Target	Duration of Protection	Target
Harris et al., 2022	South Africa and India	M72/AS01	50%	50-80%	10 years	Adolescents
Portnoy et al., 2023	105 LMICs	Hypothetical	50%- 80%	70-80%	5 - 10 years	Children, adolescents, and adults
Jayawardana et al., 2022	South Africa	M72/AS01	50% - 70%	40% - 60%	5 - 10 years	Children, adolescents, and adults at risk
Knight et al., 2014	91 LMICs	Hypothetical	40% - 80%	50%	5 years to lifelong	Children, adolescents, and adults at risk
Weerasuriya et al., 2021	India	Hypothetical	30% - 90%	70%-80%	10 years	Children, adolescents, and adults

Table 3: Epidemiological Impact, Cost and Cost Effectiveness

Study	Study Country	Epidemiological Impact	Cost of Vaccine	Cost-Effectiveness
Harris et al., 2022	South Africa and India	Incidence rate reduction in 2050: SA: 14.1% (9.2, 18.4); India: 21.8% (18.3, 26.4)	NA	ICER: $20.6/DALY averted (SA); $264/DALY averted (India)
Portnoy et al., 2023	105 LMICs	NA	$11.8 billion to $50.5 billion	ICER: $219/DALY averted
Jayawardana et al., 2022	South Africa	490,008 cases averted	2x mass vaccination: $507 million	Net Health Benefit (NHB): 1.2 million DALYs averted
Knight et al., 2014	91 LMICs	40% of cases averted by 2025	NA	ICER: $149 (149-387)/DALY averted
Weerasuriya et al., 2021	India	Incidence rate reduction in 2050: 72% (65-77)	Vaccination program costs: $38.6 (37.1-39.9) billions	ICER: $151 (82-210)/DALY averted

FACTORS AFFECTING COST EFFECTIVENESS

Study Specific Factors

- Vaccination Strategy
- Discounting

Population-Specific Factors

- Target Population
- Vaccination Frequency

Contextual Factors

- Economic status/Income category of country
- Type of Vaccine

Other

- Vaccine Efficacy
- Duration of Protection
- Coverage Level

LIMITATIONS OF THE SYSTEMATIC REVIEW

Methodological and Contextual Gap Limitations

Methodological Limitations

- Focused exclusively on studies published in English.
- Limited databases searched, primarily using Harzing's Publish or Perish software.

Contextual Gap Limitations

- A dearth of modeling studies specifically targeting high TB burden countries in the region.

CONCLUSION AND RECOMMENDATIONS

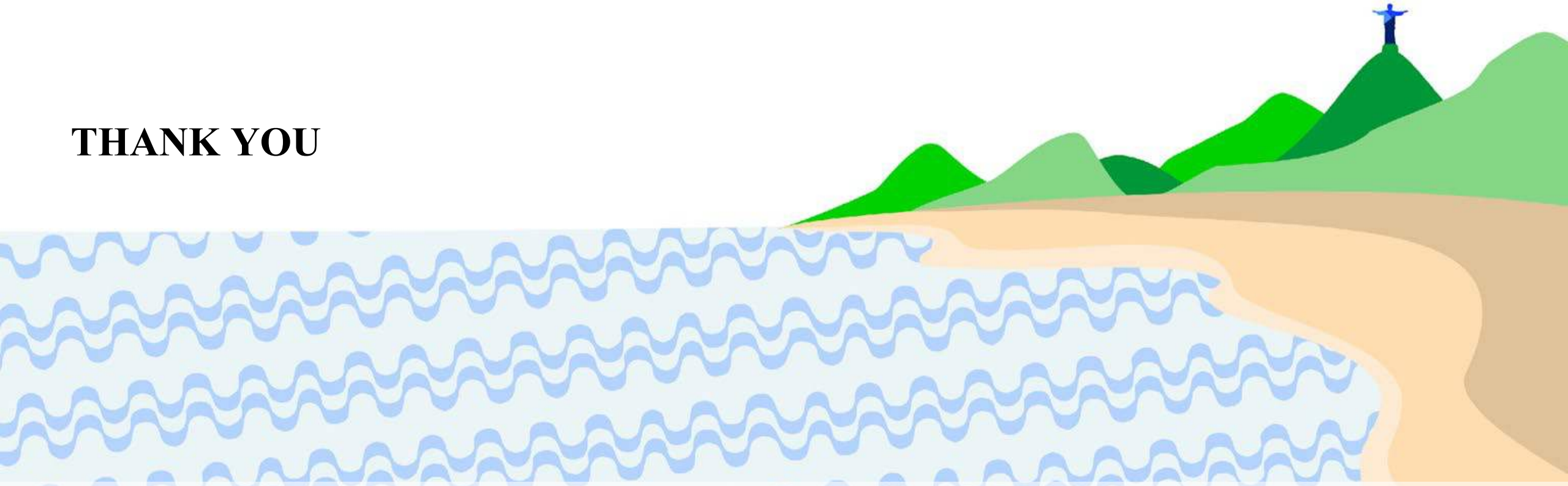
Conclusion

- Novel tuberculosis (TB) vaccines, particularly those targeting adolescents and adults, are more cost-effective in low- and middle-income countries (LMICs) compared to the continuous use of BCG or the absence of new vaccines.

Recommendations

- Further research is essential to:
- Refine cost-effectiveness models.
- Explore the impact of various vaccine pricing strategies to enhance accessibility and uptake.

THANK YOU



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