What is the cost of preventing tuberculosis (TB)? A cost-effectiveness analysis of household contact tracing with TB preventive therapy in rural and urban areas of Nepal

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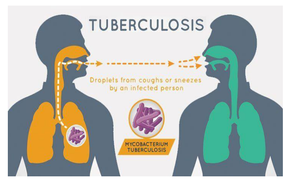
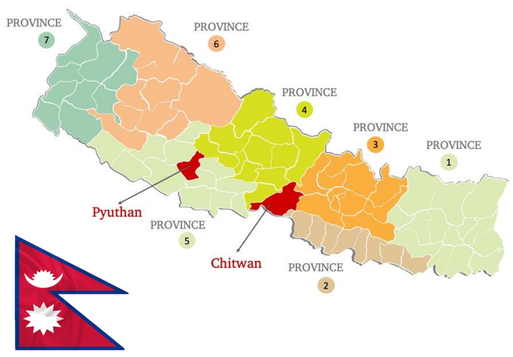
INTRODUCTION



Despite being a preventable and curable disease, tuberculosis (TB) remains one of the top ten causes of death worldwide, and the leading infectious killer[1].

Up to one-third of the world's population is estimated to have latent TB infection (LTBI), which if untreated, has the potential to progress into active TB disease[2].

Like many high burden settings across the world, the burden of TB in Nepal has remained unabated despite an increase in case-finding efforts and widespread availability of highly effective drugs.

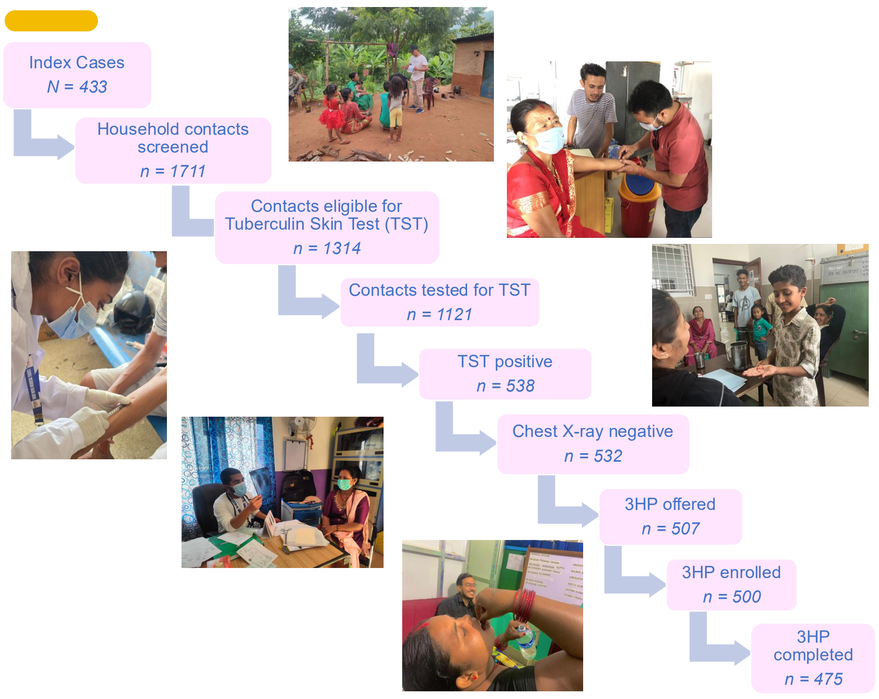


Birat Nepal Medical Trust (BNMT) in Nepal, had piloted the implementation of the WHO recommended 3 months of weekly rifapentine and isoniazid (3HP) therapy in two districts (Pyuthan and Chitwan) in addition to household contact tracing to identify and treat latent TB infection. Pyuthan district is predominantly rural compared to Chitwan district which is more economically developed.

OBJECTIVE

This research aimed to estimate the costs and cost-effectiveness of household contact tracing with 3HP regimen in Pyuthan and Chitwan districts of Nepal.

INTERVENTION



METHOD

- The cost of implementation was calculated using an ingredient-based approach and reported separately for two districts. We categorized the costs into following categories:
  a. Drug and test procurement costs
  b. Field implementation costs including screening of household contacts, administering TST, participant reimbursement and healthcare worker salaries
  c. Estimated cost of TB diagnosis and treatment
- We developed district-specific epidemiological models to project the long-term impacts of the intervention in terms of cases, TB cases prevented, and deaths averted over a 20-year time horizon, and estimated disability-adjusted life years (DALYs) averted by the intervention.
- The primary outcome was the incremental cost-effectiveness of household contact tracing with 3HP relative to the status quo of no intervention, expressed as 2022 US$ per DALY averted from a healthcare perspective.
- Both deterministic and probabilistic sensitivity analysis was performed.

RESULTS

Estimated costs of household contact 3HP intervention

Based on the analysis, the total test and drug procurement cost was estimated to be $7,522 in Chitwan and $4,116 in Pyuthan district. The cost associated with field implementation was $61,637 and $45,308 in Chitwan and Pyuthan district, respectively.

Epidemiological impact of the intervention

We estimated that the pilot intervention that screened for and treated both TB and LTBI among adult household contacts of TB cases was projected to avert 96 (63 - 130) cases and 15 (9 - 24) deaths in Chitwan, and 59 (38 - 84) cases and 9 (5 - 14) deaths in Pyuthan, resulting in a total of 155 (101 - 214) cases and 24 (13 - 38) deaths averted in the two districts over a 20-year analytic time horizon.

Table A: Cost-effectiveness of implementing 3 months of weekly rifapentine and isoniazid to adult household contacts of tuberculosis patients

	Costs in 2022 figures (95% UI)			Impact (95% UI)			Cost-effectiveness (95% UI)
	Total cost of intervention	Estimated future cost savings (associated with TB treatment)	Net cost	TB cases prevented	TB deaths averted	Discounted estimated DALYs averted	Cost per DALYs averted
Chitwan	$69,159 (52,718 – 112,480)	$22,158 (14,597 – 29,432)	$47,001 (38,121 – 83,048)	96 (63 – 130)	15 (9 – 24)	397 (249 - 587)	115 (56 – 242)
Pyuthan	$46,336 (39,830 – 75,321)	$13,652 (8959 – 18,839)	$35,772 (30,869 – 56,480)	59 (38 – 84)	9 (5 – 14)	233 (143 - 354)	149 (81 – 288)
Combined	$118,583 (92,546 – 187,799)	$35,810 (23,557 – 48,271)	$82,773 (68,989 – 139,528)	155 (101 – 214)	24 (13 – 38)	631 (393 - 942)	132 (69 – 265)

Cost effectiveness of 3HP intervention

The incremental cost-effectiveness of providing 3HP to adult household contacts (compared to no intervention) was $132 (69 - 265) per DALY averted overall, and $115 (56 – 242) and $149 (81 – 288) per DALY averted in Chitwan and Pyuthan, respectively. The intervention was cost-effective, against the country-specific cost-effectiveness threshold of $38 - $612[2] (inflated to 2022 US$).

Sensitivity analysis

The deterministic sensitivity analysis showed that the proportion of household contacts with active TB and the unit cost of intervention per case were the most influential parameters.

According to probabilistic sensitivity analysis, 100% of the simulations were deemed cost-effective at the threshold (GDP per capita 2022 Nepal) of $1385 per DALY averted[3].

Figure A: Deterministic Sensitivity Analysis

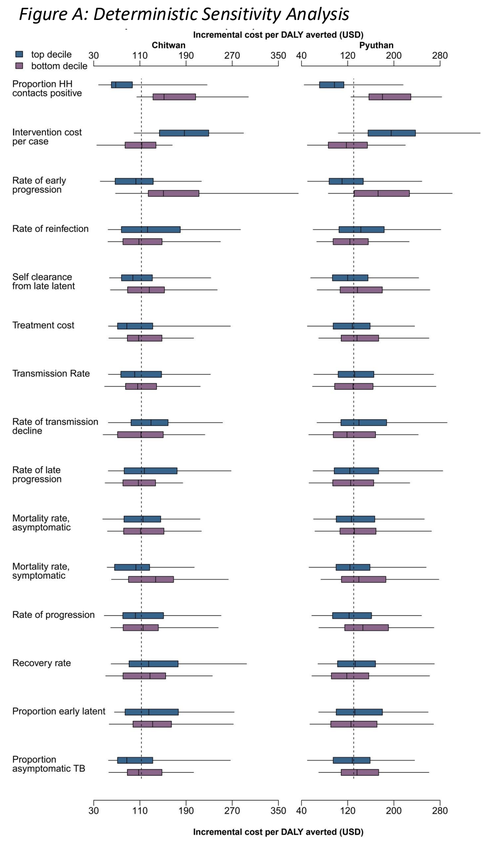
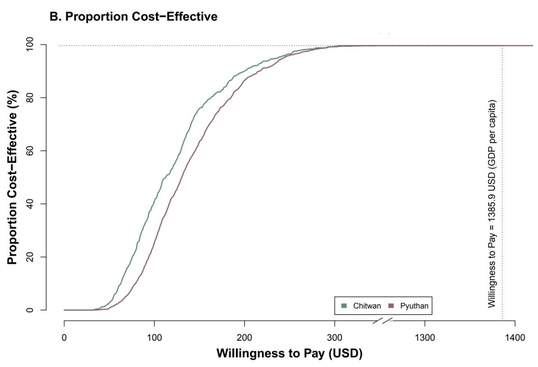


Figure B: Cost effectiveness analysis curve



CONCLUSION

- In conclusion, this analysis shows that screening and treating household contacts of people affected by TB for both active TB and latent infection using the 3HP can be successfully implemented in both rural and urban settings in Nepal.
- Implementing 3HP with the existing healthcare structure is cost-effective, though differences in district-level costs imply the need for context-specific planning.
- In a high-burden setting like Nepal, comprehensive household contact tracing, including short course, patient-centered TB preventive treatment for LTBI should be prioritized to accelerate progress towards TB free Nepal.

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