The impact of social protection and poverty elimination on global tuberculosis incidence: a statistical modelling analysis of Sustainable Development Goal 1

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Summary

Background The End TB Strategy and the Sustainable Development Goals (SDGs) are intimately linked by their common targets and approaches. SDG 1 aims to end extreme poverty and expand social protection coverage by 2030. Achievement of SDG 1 is likely to affect the tuberculosis epidemic through a range of pathways. We estimate the reduction in global tuberculosis incidence that could be obtained by reaching SDG 1.

Methods We developed a conceptual framework linking key indicators of SDG 1 progress to tuberculosis incidence via well described risk factor pathways and populated it with data from the SDG data repository and the WHO tuberculosis database for 192 countries. Correlations and mediation analyses informed the strength of the association between the SDG 1 subtargets and tuberculosis incidence, resulting in a simplified framework for modelling. The simplified framework linked key indicators for SDG 1 directly to tuberculosis incidence. We applied an exponential decay model based on linear associations between SDG 1 indicators and tuberculosis incidence to estimate tuberculosis incidence in 2035.

Findings Ending extreme poverty resulted in a reduction in global incidence of tuberculosis of 33·4% (95% credible interval 15·5–44·5) by 2035 and expanding social protection coverage resulted in a reduction in incidence of 76·1% (45·2–89·9) by 2035; both pathways together resulted in a reduction in incidence of 84·3% (54·7–94·9).

Interpretation Full achievement of SDG 1 could have a substantial effect on the global burden of tuberculosis. Cross-sectoral approaches that promote poverty reduction and social protection expansion will be crucial complements to health interventions, accelerating progress towards the End TB targets.

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Articles

**Research in context**

**Evidence before this study**
Sustainable Development Goal 1 (SDG 1) commits to ending poverty and expanding social protection coverage. The link between poverty and tuberculosis has been well described and evidence from ecological studies supports an association between increased social protection and decreased tuberculosis burden. Both poverty reduction and social protection are codified as part of WHO’s End TB Strategy to implement and strengthen bold policies and supportive systems. Two articles published in 2016 describe a shared conceptual and pragmatic alignment between the End TB Strategy and the broader SDGs, but no quantitative evidence or projections of effect exist to support this strategic link.

**Added value of this study**
Conceptually, our study is the first to adopt an SDG framework to quantify the interdependence between tuberculosis elimination and development. Methodologically, the use of a well-defined conceptual framework and clear operationalisation of indicators and outcomes provides a robust approach to statistical modelling. The resulting estimate of a decrease in incidence of 84.3% (95% credible interval 54.7–94.9) from baseline by the target year for the SDGs reaffirms the role of poverty elimination and social protection in global tuberculosis control. Furthermore, because this methodological approach can be extended to SDGs other than SDG 1 and to diseases other than tuberculosis, our study provides a replicable analytical model suitable across a range of development and public health thematic areas.

**Methods**

**Overview**
To produce an estimate of the impact of attaining SDG 1 on tuberculosis incidence, we undertook three key steps: generation of a conceptual framework, reduction of that conceptual framework, and statistical modelling.

**Conceptual framework generation**
We sought to build a conceptual framework composed of theoretical pathways that link the relevant SDG 1 indicators, via several relevant risk factors, to an impact on tuberculosis incidence. The tuberculosis risk factors were selected on the basis of a review by Lönnroth and colleagues10 as proximal risk factors with the highest population attributable fraction. The risk factors include malnutrition, HIV infection, housing quality, and health behaviour. The health behaviour (smoking prevalence and diabetes prevalence) and housing quality (exposure to indoor air pollution and proportion living in an urban slum) risk factors are composite factors informed by a principal components analysis done on the data. Care was taken to select only those risk factors that were thought to be more proximal to tuberculosis than the SDG 1 subtargets themselves.

Data were extracted to populate the framework for 192 countries from 2010 to 2015 corresponding to the SDG subtargets and measures for the tuberculosis risk factors. The most recent value was carried forward. No data were more recent than 2015, so we consider 2015 the baseline year.

We populated the SDG subtargets with data taken from the SDG repository for their corresponding indicator.11 Indicators for SDG 1.1 and 1.2 are measures of poverty reduction. The primary indicator for SDG 1.1 is the proportion of individuals living under the extreme poverty line of $1.90 per day. The primary indicator for SDG 1.2 is the value of the multidimensional poverty index for that country. SDG 1.3 is composed of three primary indicators that are measures of social protection expansion: the proportion of people covered by labour market protections, transfers. We excluded subtargets SDG 1.4 (access to land rights and basic services for all) and SDG 1.5 (reduce mortality from climate-related disasters) from the overall analysis on the grounds of no evidence in the scientific literature for a relevant link to tuberculosis burden.9

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In view of the ubiquity of SDGs in the development agenda, the SDG 1 indicators and timeline provide an appropriate framework.

In this Article, reflecting a key target of the End TB Strategy, we estimate the reduction in global tuberculosis incidence that could be obtained by reaching SDG 1’s targets of reducing poverty and expanding social protection.
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