

## Predicting the effect of improved socioeconomic health determinants on the tuberculosis epidemic



Two important public health documents have recently established programmatic goals for tuberculosis control. The first is WHO's End TB Strategy, which represents the evolution of previous DOTS (directly observed treatment, short-course) and Stop TB strategies.<sup>1</sup> End TB is built around three pillars: pillar 1 focuses on diagnosis, treatment, and prevention; pillar 2 on ways to tackle socioeconomic factors (eg, poverty reduction, social protection, and universal access); and pillar 3 on scientific research.

The second key document, published in 2016, sets out the UN's Sustainable Development Goals (SDGs), replacing the Millennium Developing Goals. There are 13 SDGs. SDG 3 is to ensure healthy lives and promote wellbeing for all at all ages. Within SDG 3 are several subtargets,<sup>2</sup> including ending the epidemics of HIV, tuberculosis, malaria, and neglected tropical diseases, and combating hepatitis, waterborne, and other communicable diseases by 2030. SDG 1 is aimed at ending extreme poverty in all its forms everywhere. The WHO's End TB Strategy and the UN's SDGs are clearly connected because the End TB Strategy specifies indicators, targets, and strategic thinking necessary for elimination of one of the three pandemics specified in SDG 3. Additionally, one of the three main indicators of the End TB strategy—namely, reducing costs by 100% by 2035<sup>3</sup>—is directly associated with SDG 1.

The relation between poverty and disease is well known, and tuberculosis has provided a striking example throughout human history. Even in settings where tuberculosis treatment is cost-free, it has still been shown to generate catastrophic costs, so that individuals with lower resources have worse outcomes.<sup>4</sup>

Although it is methodologically complex to show the causal association between single interventions aimed at improving socioeconomic conditions and global tuberculosis incidence,<sup>5</sup> the large decrease in tuberculosis incidence that occurred throughout the 20th century is unlikely to have happened without the advancement of living conditions and overall socioeconomic development.<sup>6,7</sup> Historical studies show the relation between tuberculosis and poverty; the important reduction in tuberculosis incidence achieved,

such as the 10% reduction achieved per year in Europe after World War 2, was largely due to the improvement of the socioeconomic conditions.<sup>5,7</sup> To quantify this association, poverty has been defined in the scientific literature by various different indicators, mostly with economic measures of individual or household income. SDG 1 introduces new concepts and indicators. Among them are social protection schemes, which aim to alleviate general poverty, vulnerability, and social exclusion. Higher spending on social protection programmes has been shown to be associated with lower tuberculosis prevalence, incidence, and mortality.<sup>8</sup> Social protection includes measures designed to reduce vulnerability to poverty, labour market interventions, contributory welfare programmes, and cash transfers. SDG 1 subtargets are linked to the four main risk factors for tuberculosis (malnutrition, HIV, health behaviours, and housing quality), which directly affect tuberculosis incidence.

In *The Lancet Global Health*, Daniel J Carter and colleagues<sup>9</sup> modelled the effects of social protection and poverty elimination to quantify tuberculosis incidence reduction. The authors developed a conceptual framework linking the core indicators of SDG 1 to tuberculosis incidence using a pathway of risk factors and real WHO data from 192 countries. The results show that the achievement of the goals in these two subtargets, even on their own, will greatly affect the tuberculosis epidemic. Ending extreme poverty (living on less than US\$1.90) is estimated to reduce global tuberculosis incidence by 33.4% (95% credible intervals 15.5–44.5) and expanding social protection is estimated to reduce the incidence by 76.1% (45.2–89.9); achievement of both pathways is estimated to reduce incidence by 84.3% (54.7–94.9). These results, which highlight the clear need for multisectoral approaches to tackle global pandemics, have major policy implications and suggest the need for monitoring their implementation at the country level.

In Moscow, in November, 2017, WHO organised the Global Inter-Ministerial Conference on Ending Tuberculosis, which had the unprecedented participation of Ministries of Health from all over the world. The key message from the conference was that the tuberculosis services (under the Ministry of Health of

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each country) need to work in strict collaboration with other ministries dealing with socioeconomic issues.

Thanks largely to WHO, the technical elements of tuberculosis control and elimination are now established throughout most of the world: active case-finding, effective diagnosis and treatment of infectious cases, and management of latent tuberculosis infection.<sup>10</sup> The statistical model presented by Carter and colleagues<sup>9</sup> underlines the need to tackle socioeconomic determinants just as vigorously as these technical elements if we are to see the final demise of tuberculosis throughout the world.

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We declare no competing interests.

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- 1 Sotgiu G, Spanevello A, Migliori GB. History of tuberculosis and drug resistance. *N Engl J Med* 2013; **368**: 88–89.
- 2 UN. SDG indicators. <https://unstats.un.org/sdgs/metadata/> (accessed March 13, 2018).
- 3 Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. *Eur Respir J* 2014; **43**: 1763–75.
- 4 Wingfield T, Boccia D, Tovar M, et al. Defining catastrophic costs and comparing their importance for adverse tuberculosis outcome with multi-drug resistance: a prospective cohort study, Peru. *PLoS Med* 2014; **11**: e1001675.
- 5 Grange JM, Gandy M, Farmer P, Zumla A. Historical declines in tuberculosis: nature, nurture and the biosocial model. *Int J Tuberc Lung Dis* 2001; **5**: 208–12.
- 6 Hermans S, Horsburgh CR Jr, Wood R. A century of tuberculosis epidemiology in the northern and southern hemisphere: the differential impact of control interventions. *PLoS One* 2015; **10**: e0135179.
- 7 Wilson LG. The historical decline of tuberculosis in Europe and America: its causes and significance. *J Hist Med Allied Sci* 1990; **45**: 366–96.
- 8 Siroka A, Ponce NA, Lönnroth K. Association between spending on social protection and tuberculosis burden: a global analysis. *Lancet Infect Dis* 2016; **16**: 473–79.
- 9 Carter DJ, Glaziou P, Lönnroth K, et al. The impact of social protection and poverty elimination on global tuberculosis incidence: a statistical modelling analysis of Sustainable Development Goal 1. *Lancet Glob Health* 2018; published online March 23. [http://dx.doi.org/10.1016/S2214-109X\(18\)30195-5](http://dx.doi.org/10.1016/S2214-109X(18)30195-5).
- 10 Gilpin C, Korobitsyn A, Migliori GB, Raviglione MC, Weyer K. The World Health Organization standards for tuberculosis care and management. *Eur Respir J* (in press).