WHO Global Task Force on TB Impact Measurement

Report of a subgroup meeting on methods used by WHO to estimate TB disease burden

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INTRODUCTION

One of WHO's core functions is monitoring the health situation and health trends.

Each year, WHO publishes estimates of TB disease burden (incidence and mortality) at global, regional and country level, covering the period from 2000 until the latest complete calendar year, in the annual WHO Global TB Report. Estimates of the incidence of drug-resistant TB specifically were added to the report in 2016, with a focus on rifampicin-resistant TB (RR-TB).

Since 2006, estimates of TB disease burden have been produced using standard methods that are periodically reviewed by the WHO Global Task Force on TB Impact Measurement (hereafter, the Task Force).

The Task Force was established in 2006, convened by the TB monitoring, evaluation and strategic information (TME) unit of WHO's Global TB Programme (GTB). Its initial aim was to ensure a robust, rigorous and consensus-based assessment of whether 2015 TB targets for reductions in TB disease burden (in terms of incidence, prevalence and mortality), set in the context of the United Nations (UN) Millennium Development Goals (MDGs, 2000–2015)) and WHO Stop TB Strategy (2006–2015), were achieved at global, regional and country levels. Its current mission is to ensure robust, rigorous and consensus-based assessment of progress towards milestones and targets for reductions in TB disease burden set in the Sustainable Development Goals (SDGs, 2016–2030) and WHO End TB Strategy (2016–2035), at global, regional and country levels; and to guide, promote and support analysis and use of TB surveillance and survey data for policy, planning and programmatic action. SDG 3 includes a target to "End the TB epidemic" by 2030, with TB incidence (per 100 000 population) defined as the indicator for assessment of progress. The End TB Strategy milestones and targets are shown in Table 1.

Table 1. The WHO End TB Strategy milestones and targets

Indicator	**Milestones**		**Targets**	
	2020	**2025**	**2030**	**2035**
Reduction in annual number of TB deaths *(compared with baseline of 2015)*	35%	75%	90%	95%
Reduction in TB incidence rate *(compared with baseline of 2015)*	20%	50%	80%	90%
Percentage of TB patients and their households facing catastrophic costs due to TB disease	0%	0%	0%	0%

To fulfil this mission, the Task Force has defined major strategic areas of work *(1)*. These are:

- Strengthening surveillance. This includes strengthening of national disease notification systems, for direct measurement of TB incidence; and strengthening of national vital registration (VR) systems, for direct measurement of the number of deaths caused by TB.
- Priority studies to periodically measure TB disease burden. These include national TB prevalence surveys, national surveys of drug resistance among TB patients, national surveys of costs faced by TB patients and their households, and mortality surveys.
- Periodic review of methods used by WHO to estimate the burden of TB disease.
- Analysis and use of TB surveillance and survey data.

The first two strategic areas of work focus on direct measurement of TB disease burden (epidemiological and, in the case of cost surveys, economic). The underlying principle for the Task Force's work since 2006 has been that estimates of the level of and trends in disease burden should be based on direct measurements from routine national surveillance systems and surveys as much as possible. The ultimate goal is that in all countries, TB incidence and mortality can be reliably tracked using surveillance data from national disease notification and VR systems.

The first comprehensive reviews of methods used by WHO to produce estimates of TB disease burden under the umbrella of the Task Force were completed in 2006 (at the first Task Force meeting) and in

2008–2009. The methods used to produce WHO's assessment of whether the 2015 targets were achieved (published in the 2015 WHO Global TB Report) followed a thorough review at a Task Force meeting held in March 2015. Subsequent reviews of methods were part of Task Force meetings held in 2016 and 2018.

In the context of new methods for estimation of TB incidence and mortality required in the context of the COVID-19 pandemic as well as recent challenges and developments related to estimates of the incidence of RR-TB, it was necessary to convene a meeting of a Task Force subgroup to conduct an up-to-date review of methods used by WHO to produce estimates of TB disease burden.

This report of the meeting has four major sections:

1. Meeting purpose, objectives, expected outcomes and overall approach;
2. Methods for estimating TB incidence and mortality in the context of the COVID-19 pandemic;
3. Methods for estimating the incidence of RR-TB;
4. Next steps.

There are four annexes which provide the meeting agenda, the list of participants and the two templates used for group work.

1. MEETING PURPOSE, OBJECTIVES, EXPECTED OUTCOMES AND OVERALL APPROACH

1.1 Purpose

The purpose of the meeting was an up-to-date review of methods being used by WHO to produce estimates of TB disease burden, with a focus on two major topics.

1. **Methods for producing estimates of TB incidence and mortality in the context of the COVID-19 pandemic**

In the context of the COVID-19 pandemic, the production of estimates of TB incidence and mortality in 2020, for publication in the 2021 edition of the Global TB Report, required the use of new methods for many countries. These were developed in 2021 through a collaboration between WHO and Imperial College (London, United Kingdom of Great Britain and Northern Ireland). In February 2022, work to expand and refine these methods was initiated.

The new methods used in 2021 were presented and discussed at the June 2021 meeting of WHO's Strategic and Advisory Group for TB (STAG-TB), at which the work was commended as "impressive". There was also some peer-review of methods by experts in TB modelling in July 2021. However, the methods required a fuller review and discussion at a Task Force meeting focused on methods used by WHO to produce estimates of TB disease burden.

2. **Methods for producing estimates of the incidence of drug-resistant TB, with a focus on estimates of the incidence of rifampicin resistance**

From 2016 to 2020, estimates of the incidence of RR-TB at global, regional and country levels were published in the annual WHO Global TB Report, according to the methods reviewed and agreed upon at the Task Force meetings held in 2016 and 2018 (2016 *(2)* – p.38; 2017 *(3)* – p.45; 2018 *(4)* – p.50; 2019 *(5)* – p.58; 2020 *(6)* – p.56). Estimates were always for the most recent complete calendar year only (e.g. 2015 in the case of the 2016 report; 2019 in the case of the 2020 report), with no attempt to produce and publish time-series at global, regional or country levels.

In general, published estimates of the incidence of RR-TB have always been well-accepted by WHO Member States and partner agencies. However, there were also challenges, among which a leading one was difficulties in explaining changes to the annual number of estimated incident cases of RR-TB in consecutive global TB reports (especially the global aggregate).

Following discussions in GTB/TME in late 2021, a potential solution to this problem was identified:

the development and use of new methods to enable publication of time-series of RR-TB incidence estimates, for the period 2015–2021. In February 2022, WHO initiated work on the development of such methods through a collaboration with the University of Sheffield (United Kingdom). Prior to their potential use for production of estimates to be published in the WHO Global TB Report 2022, Task Force review was required. Since the new methods for producing time series still require use of the existing method to produce estimates for a single calendar year, review of the new methods also had the benefit of including an up-to-date review of the existing method.

1.2 Objectives

There were two meeting objectives:

1. To present and discuss methods for producing estimates of TB incidence and mortality in 2020–2021 and projections for 2022–2025 that account for the impact of the COVID-19 pandemic.
2. To present and discuss methods for producing estimates of the incidence of drug-resistant TB, with particular attention to new methods for time-series of RR-TB estimates, 2015–2021.

1.3 Expected outcomes

There were three expected outcomes from the meeting:

1. Proposed methods for producing estimates of TB incidence, TB mortality and RR-TB incidence for publication in the WHO Global TB Report 2022 thoroughly reviewed.
2. Suggestions for improvements to proposed methods for producing estimates of TB incidence and mortality in 2020–2021 and projections for 2022–2025, categorized into a) those which could be implemented in the near-term (by end July 2022) and b) those to be explored in the coming year.
3. Suggestions for how to improve proposed methods for producing estimates of the incidence of RR-TB, categorized into a) those which could be implemented in the near-term (by end July 2022) and b) those which could be explored in the coming year.

1.4 Overall approach

Two **background documents** were prepared for the meeting: one for each of the two major topics being covered.

Background document 1, on methods to estimate TB incidence and mortality in the context of the COVID-19 pandemic, was circulated one week in advance of the meeting to all participants as well as those who were invited but unable to attend. There was no request to send in comments in advance of the meeting, but following feedback from a few people, minor updates were made to the document and a second version was shared the day before the meeting (see Background document 1) *(7)*.

Background document 2, on new methods for producing RR-TB incidence estimates for the period 2015–2021, was circulated three weeks in advance of the meeting to all participants as well as those who were invited but unable to attend. An initial round of feedback was requested, based on three questions that were posed in the document. The WHO secretariat in collaboration with Pete Dodd (University of Sheffield) produced a revised version that addressed all feedback received (almost all meeting participants, as well as three people invited but unable to attend in person, provided feedback); the list of questions for discussion during the meeting was also revised. This updated draft (see Background document 2) *(8)* was shared in advance of the meeting.

In the opening session of the meeting (see the Agenda in Annex 1), Katherine Floyd provided an overview of the work of the Task Force as a whole as well as an explanation of the meeting objectives and expected outcomes (see presentation) *(9)*. The rest of the first day was used to present and discuss methods for producing estimates of TB incidence and mortality in the context of the COVID-19 pandemic. The second day of the meeting was used to present and discuss methods for production of estimates of RR-TB incidence to be published in the WHO Global TB Report 2022. For both topics,

there was an interactive presentation, followed by group work[1] on the questions posed in the respective background document, followed by feedback in plenary. The secretariat then prepared a draft synthesis of feedback (in the form of a short set of PPT slides) for review by all, which was then finalized.

The list of participants is provided in Annex 2. This includes those who were unable to attend but who nonetheless provided comments on the background documents. Overall, 23 people reviewed the background documents in advance of the meeting, of whom 19 attended in person. Participants included experts in statistics, modelling and epidemiology from academia; representatives from government institutions in high TB burden countries; representatives from major technical and funding partner agencies; and WHO staff from GTB, the Regional Office for Europe and the department at headquarters responsible for surveillance of antimicrobial resistance.

2. METHODS FOR ESTIMATING TB INCIDENCE AND MORTALITY IN THE CONTEXT OF THE COVID-19 PANDEMIC

Following introductory remarks by the WHO secretariat (Philippe Glaziou), an interactive presentation (i.e. allowing for questions and answers during the presentation) covering the material included in **Background document 1** was given by Nim Arinaminpathy (Imperial College London) (see presentation) *(10)*.

Background document 1 explained the methods that were used to produce estimates of TB incidence and mortality in all countries in 2020 as well as projections for 2021–2025 for the subset of countries (n=16) for which country-specific models were used; and how these methods were being expanded and refined to produce estimates for 2021 and projections for 2022–2025.

The background document was accompanied by a technical appendix. A detailed explanation of the methods used to produce estimates published in the Global TB Report 2021 had previously been published as an online appendix to the report, at the time of report release in October 2021. A summary was also provided on the web pages that accompanied the main report PDF (*11, 12)*.

In essence, the methods used to produce estimates of TB incidence and mortality in 2020 were as follows:

- Dynamic models were used for 16 priority countries. These were the countries that accounted for the largest share – 93% collectively – of the global drop in TB notifications between 2019 and 2020. In the time available for this work in 2021, 16 was the maximum number of countries for which it was feasible to develop a country-specific model.
- A statistical model was used to extrapolate results from the dynamic models to other low and middle-income countries.
- The methods used for high-income countries up to 2019 (i.e. a standard adjustment to notification data for estimation of TB incidence and cause-of-death data from national vital registration (VR) systems for estimation of TB mortality) were retained for use in 2020.