GLOBAL TUBERCULOSIS REPORT

2019

World Health Organization

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Foreword

It has been a year since the historic United Nations (UN) high-level meeting on tuberculosis (TB) that brought together world leaders to accelerate the TB response. The commitments made at the meeting are currently being translated into action in countries, supported by the "Find. Treat. All. #EndTB" initiative of the World Health Organization (WHO), the Stop TB Partnership and the Global Fund to Fight AIDS, Tuberculosis and Malaria.

This year's global TB report reveals that countries are making progress. About 7 million people were reported to have been reached with quality TB care in 2018, up from 6.4 million in 2017. In addition, TB-related deaths dropped from 1.6 million in 2017 to 1.5 million in 2018. However, TB remains the top infectious killer worldwide, with 10 million people falling ill with TB in 2018.

Although some countries are significantly accelerating their TB response, most WHO regions and many high-burden countries are still not on track to reach the 2020 milestones of the End TB Strategy. About 3 million people with TB did not access quality care in 2018. The situation is even more acute for people with drug-resistant TB, with only one in three accessing treatment. Prevention efforts are expanding but need to be intensified. Funding gaps of close to US$ 5 billion annually impede progress in the overall TB response, including TB research.

To ensure that we match our talk with real, lasting change, WHO released a multisectoral accountability framework at this year's World Health Assembly, to help countries drive action with accountability across all sectors. Sustained progress will require a commitment to universal health coverage, based on strong primary health care, as underscored at the high-level meeting on universal health coverage at the UN General Assembly this year.

Ultimately, the best investment that countries can make to ensure faster progress towards ending TB is to ensure that TB services are designed and delivered as part of an overall commitment to universal health coverage, built on the foundation of strong primary health care. WHO is committed to working with countries to ensure TB services are integrated into national benefit packages to ensure that no one misses out on the services they need, or is impoverished by using them.

The WHO global TB report delivers a clear message: sustained acceleration of efforts and increased collaboration are urgently required to turn the tide of the TB epidemic. To maintain momentum, I personally wrote to Heads of State this year urging them to keep the promises made at last year's high-level meeting on TB. This was followed by a joint statement with the WHO civil society taskforce. Civil society, partners and affected communities are important drivers of progress against this top killer.

Our vision is that no one with TB will miss out on the care they need. WHO will stand by every country, partner, society or person that decides TB has no place in its future. It is time to deliver. There has never been a better opportunity to make TB history.

Dr Tedros Adhanom Ghebreyesus
Director-General
World Health Organization

Message
from the WHO Global TB Programme

This is a pivotal moment for the global fight to end tuberculosis (TB).

For the first time, we have political commitment at the highest level – from heads of state, ministers and other leaders. Member States, partners and civil society are all united in working towards accelerating the response to end TB – the world's top infectious disease killer.

This year's global TB report showcases global, regional and country progress, while highlighting that much remains to be done to reach the TB targets set in the World Health Organization (WHO) End TB Strategy, the United Nations (UN) Sustainable Development Goals (SDGs) and the political declaration at last year's UN high-level meeting on TB. It is now imperative to maintain the positive momentum we have achieved.

In this report, WHO is announcing that the first milestone towards one of the targets set in the political declaration at the UN high-level meeting on TB has been achieved: 7 million people were reached with TB care in 2018. Nonetheless, there were still around 3 million people with TB who either had no access to quality care or were not reported, and only one in three people with drug-resistant TB accessed care. There has been an expansion of access to TB preventive treatment, but the numbers currently being reached fall far short of what is needed to reach the target of providing preventive treatment to at least 30 million people in the period 2018–2022. The Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) has recently been replenished with more resources than ever before for HIV, TB and malaria, but despite this good news, progress continues to be impeded by shortfalls in domestic and international funding for TB prevention and care, and for TB research.

WHO has been intensifying its efforts to support countries in accelerating the TB response, with the engagement of all stakeholders. Actions taken in the past year include high-level missions to countries to optimize the national response; the development and roll-out of new guidelines, roadmaps and tools; the implementation of the WHO Director-General's Flagship initiative, "Find. Treat. All. #EndTB", undertaken jointly with the Global Fund and the Stop TB Partnership; strengthened collaboration with civil society; and implementation of a multisectoral accountability framework for TB to drive sustained action across all sectors.

As we look forward, 2020 is a critical year when Member States will report to the WHO Director-General and UN Secretary-General on progress towards the targets of the SDGs, the End TB Strategy and the UN high-level meeting. As a precursor to the next critical year, this year's global TB report highlights that although we have achieved much in the fight to end TB, we can and must do better. It is time to critically analyse, review and optimize programmes; strengthen surveillance systems; and move decisively from rhetoric to action.

We believe that the WHO global TB report is essential for this effort, and for high-level advocacy, increasing awareness and fundraising. Knowledge and data are powerful weapons in the fight against TB. That is why the WHO global TB report is for you. Read it, know more about TB and act!

Dr Tereza Kasaeva
Director, Global Tuberculosis Programme
World Health Organization

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Abbreviations

aDSM	active TB drug-safety monitoring and management
AIDS	acquired immunodeficiency syndrome
APEC	Asia-Pacific Economic Cooperation
ART	antiretroviral therapy
BCG	bacille Calmette-Guérin
BRICS	Brazil, Russian Federation, India, China and South Africa
CAD	computer-aided detection
CDC	Centers for Disease Control and Prevention (United States of America)
CFR	case fatality ratio
CHOICE	CHOosing Interventions that are Cost-Effective (WHO)
CHW	community health worker
CI	confidence interval
CRS	creditor reporting system
CV	community volunteer
CXR	chest X-ray
DAC	Development Assistance Committee (OECD)
DALY	disability-adjusted life-year
DFID	Department for International Development (United Kingdom)
DNA	deoxyribonucleic acid
DST	drug susceptibility testing
EECA	Eastern Europe and Central Asia
ELISA	enzyme-linked immunosorbent assay
ELISPOT	enzyme-linked immunosorbent spot assay
GDP	gross domestic product
GHCC	Global Health Cost Consortium
Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
GPW 13	Thirteenth General Programme of Work, 2019–2023 (WHO)
GTB	Global TB Programme
HBC	high-burden country
HDC	Health Data Collaborative
HIV	human immunodeficiency virus
Hr-TB	isoniazid-resistant, rifampicin-susceptible TB
ICD-10	International Classification of Diseases (10th edition)
IFN	interferon
IGRA	interferon gamma release assay
IHME	Institute for Health Metrics and Evaluation
IU	international units
LAM	lipoarabinomannan
LF-LAM	lateral flow lipoarabinomannan assay
LTBI	latent TB infection
MAF-TB	multisectoral accountability framework for TB
MDG	Millennium Development Goal
MDR	multidrug-resistant
MDR/RR-TB	multidrug-resistant TB or rifampicin-resistant TB
MDR-TB	multidrug-resistant TB
M:F	male to female (ratio)
MGIT	mycobacteria growth indicator tube
NIAID	National Institute of Allergy and Infectious Diseases
NIH	National Institutes of Health
NTP	national TB programme
OECD	Organisation for Economic Co-operation and Development
PanACEA	Pan-African Consortium for the Evaluation of Antituberculosis Antibiotics
PBMC	peripheral blood mononuclear cell
PEPFAR	President's Emergency Plan for AIDS Relief
PLHIV	people living with HIV
P:N	prevalence to notification (ratio)
PPD	purified protein derivative
PPM	public–public and public–private mix
ReSeqTB	Relational Sequencing TB Knowledgebase
RNA	ribonucleic acid
RNTCP	Revised National TB Control Programme (India)
RR-TB	rifampicin-resistant TB
RT-qPCR	reverse transcriptase quantitative PCR
SCI	service coverage index
SDG	Sustainable Development Goal
SHA	system of health accounts
TAG	Treatment Action Group
TB	tuberculosis
TB Alliance	Global Alliance for TB Drug Development
TBTC	TB Trial Consortium
TNF	tumour necrosis factor
TST	tuberculin skin test
TU	tuberculin units
UHC	universal health coverage
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
US	United States
USA	United States of America
VR	vital registration
WHO	World Health Organization
WRD	WHO-recommended rapid diagnostic
XDR-TB	extensively drug-resistant TB

An outreach worker from Operation ASHA makes a home visit to a TB patient in Delhi, India, to check if she is adhering to her treatment.

Andrew Aitchison/Getty Images

Executive summary

Background

Tuberculosis (TB) is a communicable disease that is a major cause of ill health, one of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent (ranking above HIV/AIDS). It is caused by the bacillus *Mycobacterium tuberculosis*, which is spread when people who are sick with TB expel bacteria into the air; for example, by coughing. It typically affects the lungs (pulmonary TB) but can also affect other sites (extrapulmonary TB). About a quarter of the world's population is infected with *M. tuberculosis* and thus at risk of developing TB disease.[1]

With a timely diagnosis and treatment with first-line antibiotics for 6 months, most people who develop TB can be cured and onward transmission of infection curtailed. The number of TB cases occurring each year (and thus the number of TB-related deaths) can also be driven down by reducing the prevalence of health-related risk factors for TB (e.g. smoking, diabetes and HIV infection), providing preventive treatment to people with a latent TB infection, and taking multisectoral action on broader determinants of TB infection and disease (e.g. poverty, housing quality and undernutrition).

This report

The World Health Organization (WHO) has published a global TB report every year since 1997. Its purpose is to provide a comprehensive and up-to-date assessment of the TB epidemic, and of progress in the response to the epidemic, at global, regional and country levels, in the context of global commitments and strategies. The report is based primarily on data gathered by WHO in annual rounds of data collection, and databases maintained by other multilateral agencies. In 2019, data were reported by 202 countries and territories that account for more than 99% of the world's population and estimated number of TB cases.

Global commitments to end TB and multisectoral accountability

On 26 September 2018, the United Nations (UN) held its first-ever high-level meeting on TB, elevating discussion about the status of the TB epidemic and how to end it to the level of heads of state and government. It followed the first global ministerial conference on TB hosted by WHO and the Russian government in November 2017. The outcome was a political declaration agreed by all UN Member States, in which existing commitments to the Sustainable Development Goals (SDGs) and WHO's End TB Strategy were reaffirmed, and new ones added.

SDG Target 3.3 includes ending the TB epidemic by 2030. The End TB Strategy defines milestones (for 2020 and 2025) and targets (for 2030 and 2035) for reductions in TB cases and deaths. The targets for 2030 are a 90% reduction in the number of TB deaths and an 80% reduction in the TB incidence rate (new cases per 100 000 population per year) compared with levels in 2015. The milestones for 2020 are a 35% reduction in the number of TB deaths and a 20% reduction in the TB incidence rate. The strategy also includes a 2020 milestone that no TB patients and their households face catastrophic costs as a result of TB disease.

The political declaration included four new global targets:

- treat 40 million people for TB disease in the 5-year period 2018–2022;
- reach at least 30 million people with TB preventive treatment for a latent TB infection in the 5-year period 2018–2022;
- mobilize at least US$ 13 billion annually for universal access to TB diagnosis, treatment and care by 2022; and
- mobilize at least US$ 2 billion annually for TB research.

The political declaration also requested the UN Secretary-General, with support from WHO, to provide a report in 2020 to the General Assembly on global and national progress, as the basis for a comprehensive review at a high-level meeting in 2023. The Director-General of WHO was requested to continue to develop a multisectoral accountability framework for TB (MAF-TB) and to ensure its timely implementation.

Status of the TB epidemic

Globally, an estimated 10.0 million (range, 9.0–11.1 million)[2] people fell ill with TB in 2018, a number that has been relatively stable in recent years. The burden of disease varies enormously among countries, from fewer than five to more than 500 new cases per 100 000 population per year, with the global average being around 130.

There were an estimated 1.2 million (range, 1.1–1.3 million) TB deaths among HIV-negative people in 2018 (a 27% reduction from 1.7 million in 2000), and an additional 251 000 deaths (range, 223 000–281 000)[3] among HIV-positive people (a 60% reduction from 620 000 in 2000).

TB affects people of both sexes in all age groups but the highest burden is in men (aged ≥15 years), who accounted

for 57% of all TB cases in 2018. By comparison, women accounted for 32% and children (aged <15 years) for 11%. Among all TB cases, 8.6% were people living with HIV (PLHIV).

Geographically, most TB cases in 2018 were in the WHO regions of South-East Asia (44%), Africa (24%) and the Western Pacific (18%), with smaller percentages in the Eastern Mediterranean (8%), the Americas (3%) and Europe (3%). Eight countries accounted for two thirds of the global total: India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%) and South Africa (3%). These and 22 other countries in WHO's list of 30 high TB burden countries accounted for 87% of the world's cases.[4]

Drug-resistant TB continues to be a public health threat. In 2018, there were about half a million new cases[5] of rifampicin-resistant TB (of which 78% had multidrug-resistant TB).[6] The three countries with the largest share of the global burden were India (27%), China (14%) and the Russian Federation (9%). Globally, 3.4% of new TB cases and 18% of previously treated cases had multidrug-resistant TB or rifampicin-resistant TB (MDR/RR-TB), with the highest proportions (>50% in previously treated cases) in countries of the former Soviet Union.

Progress towards the 2020 milestones of the End TB Strategy

Currently, the world as a whole, most WHO regions and many high TB burden countries are not on track to reach the 2020 milestones of the End TB Strategy.

Globally, the average rate of decline in the TB incidence rate was 1.6% per year in the period 2000–2018, and 2.0% between 2017 and 2018. The cumulative reduction between 2015 and 2018 was only 6.3%, considerably short of the End TB Strategy milestone of a 20% reduction between 2015 and 2020. The global reduction in the total number of TB deaths[7] between 2015 and 2018 was 11%, also less than one third of the way towards the End TB Strategy milestone of a 35% reduction by 2020.

The good news is that the WHO European Region is on track to achieve the 2020 milestones for reductions in cases and deaths. Between 2015 and 2018, the incidence rate fell 15% and the number of TB deaths fell by 24%. Incidence and deaths are also falling relatively fast in the WHO African Region (4.1% and 5.6%, respectively, per year), with cumulative reductions of 12% for incidence and 16% for deaths between 2015 and 2018. Seven high TB burden countries are on track to achieve the 2020 milestones: Kenya, Lesotho, Myanmar, the Russian Federation, South Africa, the United Republic of Tanzania and Zimbabwe.

From 2016 to 2019, 14 countries (including seven high TB burden countries) completed a national facility-based survey of costs faced by TB patients and their households. Best estimates of the percentage facing total costs that were catastrophic ranged from 27% to 83% for all forms of TB, and from 67% to 100% for drug-resistant TB. Survey results are being used to inform approaches to financing, service delivery and social protection that will reduce these costs. A further 37 surveys are underway or planned in 2019–2020.

TB diagnosis and treatment

Achieving the UN high-level meeting target of treating 40 million people with TB between 2018 and 2022 requires treating about 7 million people in 2018 and about 8 million people in subsequent years. The targets were built on the WHO Flagship Initiative "Find. Treat. All. #EndTB".

Based on case notification data reported to WHO, the target for 2018 was achieved. Globally, 7.0 million new cases of TB were notified in 2018 – an increase from 6.4 million in 2017 and a large increase from the 5.7–5.8 million notified annually in the period 2009–2012.

Most of the increase in global notifications of TB cases since 2013 is explained by trends in India and Indonesia, the two countries that rank first and third worldwide in terms of estimated incident cases per year.[8] In India, notifications of new cases rose from 1.2 million to 2.0 million between 2013 and 2018 (+60%). In Indonesia, notifications rose from 331 703 in 2015 to 563 879 in 2018 (+70%), including an increase of 121 707 (+28%) between 2017 and 2018.

Despite increases in TB notifications, there is still a large gap between the number of new cases reported (7.0 million) and the estimated 10.0 million (range, 9.0–11.1 million) incident cases in 2018. This gap is due to a combination of underreporting of detected cases and underdiagnosis (i.e. people with TB do not access health care or are not diagnosed when they do).

Ten countries accounted for about 80% of the gap, with India (25%), Nigeria (12%), Indonesia (10%) and the Philippines (8%) accounting for more than half of the total.[9] In these countries in particular, intensified efforts are required to improve reporting of detected TB cases and access to diagnosis and treatment.

As countries intensify efforts to improve TB diagnosis and treatment and close gaps between incidence and notifications, the proportion of notified cases that are bacteriologically confirmed needs to be monitored, to ensure that people are correctly diagnosed and started on the most effective treatment regimen as early as possible. The aim should be to increase the percentage of cases confirmed bacteriologically by scaling up the use of recommended diagnostics (e.g. rapid molecular tests) that are more sensitive than smear microscopy. In 2018, 55% of pulmonary cases were bacteriologically confirmed, a slight decrease from 56% in 2017. In high-income countries with widespread access to the most sensitive diagnostic tests, about 80% of pulmonary TB cases are bacteriologically confirmed.

The percentage of notified TB patients who had a documented HIV test result in 2018 was 64%, up from 60% in 2017. In the WHO African Region, where the burden of HIV-associated TB is highest, 87% of TB patients had a documented HIV test result. A total of 477 461 TB cases among HIV-positive people were reported, of which 86% were on antiretroviral therapy.

The latest treatment outcome data for new cases of TB show a global treatment success rate of 85% in 2017, an increase from 81% in 2016. The improvement was mainly due to progress in India.

Drug-resistant TB: diagnosis and treatment

The political declaration at the UN high-level meeting on TB included commitments to improve the coverage and quality of diagnosis, treatment and care for people with drug-resistant TB.

Detection of MDR/RR-TB requires bacteriological confirmation of TB and testing for drug resistance using rapid molecular tests, culture methods or sequencing technologies. Treatment requires a course of second-line drugs for at least 9 months and up to 20 months, supported by counselling and monitoring for adverse events.

There was some progress in testing, detection and treatment of MDR/RR-TB between 2017 and 2018. Globally in 2018, 51% of people with bacteriologically confirmed TB were tested for rifampicin resistance, up from 41% in 2017.[10] Coverage of testing was 46% for new and 83% for previously treated TB patients. A global total of 186 772 cases of MDR/RR-TB were detected and notified in 2018, up from 160 684 in 2017, and 156 071 cases were enrolled in treatment, up from 139 114 in 2017.

Despite these improvements, the number of people enrolled in treatment in 2018 was equivalent to only one in three of the approximately half a million people who developed MDR/RR-TB in 2018. Closing this wide gap requires one or more of the following to be increased: detection of TB cases, the proportion of TB cases bacteriologically confirmed, coverage of testing for drug resistance among bacteriologically confirmed cases and coverage of treatment for those diagnosed with MDR/RR-TB.

Ten countries accounted for 75% of the global gap between treatment enrolments and the estimated number of new cases of MDR/RR-TB in 2018, and thus will have a strong influence on progress in closing this gap. Those 10 countries were China, India, Indonesia, Mozambique, Myanmar, Nigeria, Pakistan, the Philippines, the Russian Federation and Viet Nam. China and India alone accounted for 43% of the global gap.

The latest treatment outcome data for people with MDR/RR-TB show a global treatment success rate of 56%. Examples of high MDR-TB burden countries with better treatment success rates (>70%) are Bangladesh, Ethiopia, Kazakhstan and Myanmar.

TB prevention services

The main health care intervention available to reduce the risk of a latent TB infection progressing to active TB disease is TB preventive treatment.[11] Vaccination of children with the bacille Calmette–Guérin (BCG) vaccine can also confer protection, especially from severe forms of TB in children.

WHO guidance issued in 2018 recommends TB preventive treatment for PLHIV, household contacts of bacteriologically confirmed pulmonary TB cases and clinical risk groups (e.g. those receiving dialysis). The breakdown of the target to reach 30 million people with TB preventive treatment in the 5-year period 2018–2022 set at the UN high-level meeting on TB was 6 million PLHIV and 24 million household contacts (4 million children aged under 5 years, and 20 million other household contacts).

Globally in 2018, 65 countries reported initiating TB preventive treatment for 1.8 million PLHIV (61% in South Africa), up from just under 1 million in 2017. The 2018 number suggests that the target of 6 million in the period 2018–2022 can be achieved. In the 16 high TB or TB/HIV burden countries that reported providing treatment, coverage ranged from 10% of PLHIV newly enrolled in care in Indonesia to 97% in the Russian Federation. Overall, in 66 countries for which it could be calculated, coverage was 49%.

The number of household contacts initiated on TB preventive treatment in 2018 was much smaller: 349 487 children aged under 5 years (a 20% increase from 292 182 in 2017), equivalent to 27% of the 1.3 million estimated to be eligible; and 79 195 people in other age groups (a 30% decrease from 103 344 in 2017). Substantial scale-up will be needed to reach the targets set at the UN high-level meeting.

In 2018, 153 countries reported providing BCG vaccination as a standard part of childhood immunization programmes, of which 113 reported coverage of ≥90%.

Financing for TB prevention, diagnosis and treatment

Funding for the provision of TB prevention, diagnostic and treatment services has doubled since 2006 but still falls far short of what is needed.

In 119 low- and middle-income countries that reported data (and accounted for 97% of reported TB cases globally), funding reached US$ 6.8 billion in 2019, up from US$ 6.4 billion in 2018 and US$ 3.5 billion in 2006. However, the amount in 2019 is US$ 3.3 billion less than the US$ 10.1 billion estimated to be required in the Stop TB Partnership's *Global Plan to End TB 2018–2022*, and only just over half of the global target of at least US$ 13 billion per year by 2022 that was agreed at the UN high-level meeting on TB.

As in previous years, most of the funding (87%) available in 2019 is from domestic sources. This aggregate figure is strongly influenced by the BRICS group of countries (Brazil, Russian Federation, India, China and South Africa). The BRICS countries account for 53% of the available funding in 2019, and 95% of their funding is from domestic sources. In India, domestic funding quadrupled between 2016 and 2019.

In other low- and middle-income countries, international donor funding remains crucial, accounting for 38% of the funding available in the 25 high TB burden countries outside BRICS and 49% of the funding available in low-income countries.

International donor funding amounts to US$ 0.9 bil-

lion in 2019, with 73% of that amount coming from the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund). This total is far below the annual requirement of US$ 2.7 billion estimated in the Global Plan. The largest bilateral donor is the US government, which provides almost 50% of total international donor funding for TB, when combined with funds channelled through and allocated by the Global Fund.

Universal health coverage, multisectoral action and social determinants

The End TB Strategy milestones for 2020 and 2025 can only be achieved if TB diagnosis, treatment and prevention services are provided within the context of progress towards universal health coverage (UHC), and if there is multisectoral action to address the broader determinants that influence TB epidemics and their socioeconomic impact.

UHC means that everyone can obtain the health services they need without suffering financial hardship. SDG Target 3.8 is to achieve UHC by 2030; the two indicators to monitor progress are a UHC service coverage index (SCI), and the percentage of the population experiencing household expenditures on health care that are large in relation to household expenditures or income.

The SCI increased steadily between 2000 and 2017, from a global value of 45 (out of 100) in 2000 to 66 in 2017. The SCI in the 30 high TB burden countries (with 87% of global TB cases) was mostly in the range 40–60, showing that much remains to be done to achieve UHC in these settings. Higher values in Brazil (79), China (79) and Thailand (80) are encouraging.

In 2015, at least 930 million people or 12.7% of the world's population faced catastrophic expenditures on health care (defined as 10% or more of annual household expenditure or income), up from 9.4% in 2010.

In 2018, an estimated 2.3 million TB cases were attributable to undernourishment, 0.9 million to smoking (of which 0.8 million were among men), 0.8 million to alcohol abuse, 0.8 million to HIV infection and 0.4 million to diabetes.

Following the request to the WHO Director-General at the UN high-level meeting, a MAF-TB was released in May 2019. Countries are being supported to adapt and use the framework.

TB research and development

The SDG and End TB Strategy targets set for 2030 cannot be met without intensified research and development. Technological breakthroughs are needed by 2025, so that the annual decline in the global TB incidence rate can be accelerated to an average of 17% per year. Priorities include a vaccine to lower the risk of infection, a vaccine or new drug treatment to cut the risk of TB disease in the 1.7 billion people already latently infected, rapid diagnostics for use at the point of care, and simpler, shorter drug regimens for treating TB disease.

The diagnostic pipeline appears robust in terms of the number of tests, but no new technology emerged in 2019. As of August 2019, there were 23 drugs, various combination regimens and 14 vaccine candidates in clinical trials. Recently, the M72/AS01$_E$ vaccine candidate was found to be protective against TB disease in a Phase IIb trial among individuals with evidence of latent TB infection. If the findings are confirmed in a Phase III trial, this vaccine could transform global TB prevention efforts.

The latest data published by Treatment Action Group showed funding of US$ 772 million for TB research and development in 2017, much less than the target of at least US$ 2 billion per year set at the UN high-level meeting on TB.

Conclusion

Leaders of all UN Member States have committed to "ending the global TB epidemic" by 2030, backed up by concrete milestones and targets.

Progress is being made. Global indicators for reductions in TB cases and deaths, improved access to TB prevention and care and increased financing are moving in the right direction. One WHO region and seven high TB burden countries are on track to reach 2020 milestones for reductions in TB cases and deaths.

Nonetheless, the pace of progress worldwide and in most regions and countries is not yet fast enough. In the next 3 years, annual financing for TB prevention and care and for TB research needs to approximately double, access to TB care and preventive treatment needs to expand, substantial costs faced by TB patients and their households must be mitigated and multisectoral action on the broader determinants of the TB epidemic needs to intensify.

The UN Secretary-General's report to the General Assembly in 2020, to be prepared with WHO support, will provide the next opportunity to assess progress towards agreed TB targets and milestones.

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[1] The lifetime risk is about 5–10%.

[2] Here and elsewhere, "range" refers to the 95% uncertainty interval.

[3] When an HIV-positive person dies from TB disease, the underlying cause is coded as HIV in the International Classification of Diseases system.

[4] The other 22 countries are Angola, Brazil, Cambodia, Central African Republic, the Congo, the Democratic People's Republic of Korea, the Democratic Republic of the Congo, Ethiopia, Kenya, Lesotho, Liberia, Mozambique, Myanmar, Namibia, Papua New Guinea, the Russian Federation, Sierra Leone, Thailand, the United Republic of Tanzania, Viet Nam, Zambia and Zimbabwe.

[5] The 95% uncertainty interval is 420 000–560 000.

[6] Defined as resistance to rifampicin and isoniazid.

[7] Including TB deaths among both HIV-negative and HIV-positive people.

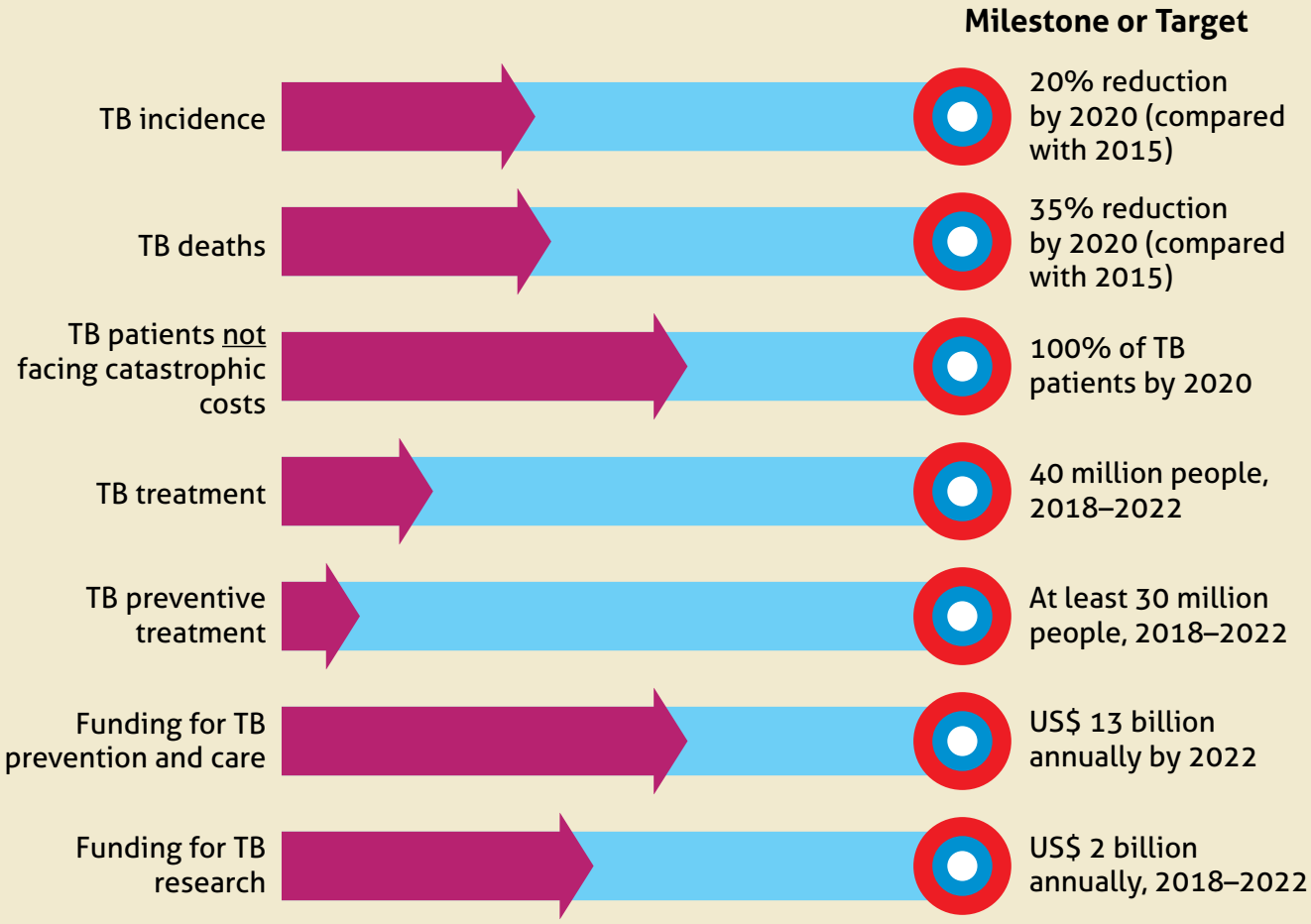
[8] Other countries with large relative increases in 2016–2018 are shown in **Fig. 4.2**.

[9] The other six countries are shown in **Fig. 4.20**.

[10] The numbers cited refer to pulmonary cases.

[11] The four drug regimens currently recommended by WHO are explained in **Chapter 5**.

Progress towards End TB Strategy milestones for 2020 and the four global targets set in the political declaration at the UN high-level meeting on TB: latest status[a]



[a] End of 2018 except for funding for TB prevention and care (2019) and funding for TB research (2017).

BOX 1.1

Basic facts about tuberculosis

Tuberculosis (TB) is an old disease – studies of human skeletons show that it has affected humans for thousands of years – but its cause remained unknown until 24 March 1882, when Dr Robert Koch announced his discovery of the bacillus subsequently named *Mycobacterium tuberculosis*.[a,b] The disease is spread when people who are sick with TB expel bacteria into the air; for example, by coughing. It typically affects the lungs (pulmonary TB) but can also affect other sites (extrapulmonary TB).

A relatively small proportion (5–10%) of the estimated 1.7 billion people infected with *M. tuberculosis* will develop TB disease during their lifetime. However, the probability of developing TB disease is much higher among people living with HIV; it is also higher among people affected by risk factors such as undernutrition, diabetes, smoking and alcohol consumption.

Diagnostic tests for TB disease include sputum smear microscopy (developed more than 100 years ago), rapid molecular tests (first endorsed by WHO in 2010) and culture-based methods; the latter take up to 12 weeks to provide results but remain the reference standard. TB that is resistant to first-line and second-line anti-TB drugs can be detected using rapid tests, culture methods and sequencing technologies.

Without treatment, the mortality rate from TB is high. Studies of the natural history of TB disease in the absence of treatment with anti-TB drugs (conducted before drug treatments became available) found that about 70% of individuals with sputum smear-positive pulmonary TB died within 10 years of being diagnosed, as did about 20% of people with culture-positive (but smear-negative) pulmonary TB.[c]

Effective drug treatments were first developed in the 1940s. The currently recommended treatment for cases of drug-susceptible TB disease is a 6-month regimen of four first-line drugs: isoniazid, rifampicin, ethambutol and pyrazinamide. The Global TB Drug Facility supplies a complete 6-month course for about US$ 40 per person. Treatment success rates of at least 85% for cases of drug-susceptible TB are regularly reported to WHO by its 194 Member States. Treatment for people with rifampicin-resistant TB (RR-TB) and multidrug-resistant TB (MDR-TB)[d] is longer, and requires drugs that are more expensive (≥US$ 1000 per person) and more toxic. The latest data reported to WHO show a treatment success rate for MDR-TB of 56% globally.

Four options for treatment of a latent TB infection are available: a weekly dose of rifapentine and isoniazid for 3 months; a daily dose of rifampicin plus isoniazid for 3 months; a daily dose of rifampicin for 3–4 months; and a daily dose of isoniazid for at least 6 months.

The only licensed vaccine for prevention of TB disease is the bacille Calmette-Guérin (BCG) vaccine. The BCG vaccine was developed almost 100 years ago, prevents severe forms of TB in children and is widely used. There is currently no vaccine that is effective in preventing TB disease in adults, either before or after exposure to TB infection, although results from a Phase II trial of the M72/AS01$_E$ candidate are promising.[e]

[a] Hershkovitz I, Donoghue HD, Minnikin DE, May H, Lee OY, Feldman M, et al. Tuberculosis origin: the Neolithic scenario. Tuberculosis. 2015;95 Suppl 1:S122–6 (https://www.ncbi.nlm.nih.gov/pubmed/25726364, accessed 3 July 2019).

[b] Sakula A. Robert Koch: centenary of the discovery of the tubercle bacillus, 1882. Thorax. 1982;37(4):246–51 (https://www.ncbi.nlm.nih.gov/pubmed/6180494, accessed 3 July 2019).

[c] Tiemersma EW, van der Werf MJ, Borgdorff MW, Williams BG, Nagelkerke NJ. Natural history of tuberculosis: duration and fatality of untreated pulmonary tuberculosis in HIV negative patients: a systematic review. PLoS One. 2011;6(4):e17601 (https://www.ncbi.nlm.nih.gov/pubmed/21483732, accessed 3 July 2019).

[d] Defined as resistance to isoniazid and rifampicin, the two most powerful anti-TB drugs.

[e] Further details are provided in **Chapter 8**.

Chapter 1
Introduction

Worldwide, around 10 million people fall ill with tuberculosis (TB) each year. TB is one of the top 10 causes of death, and the leading cause from a single infectious agent (*Mycobacterium tuberculosis*), ranking above HIV/AIDS. The disease can affect anyone anywhere, but most people who develop TB (about 90%) are adults, the male:female ratio is 2:1, and case rates at national level vary from less than 50 to more than 5000 per 1 million population per year. Almost 90% of cases each year are in 30 high TB burden countries. Globally, an estimated 1.7 billion people are infected with *M. tuberculosis* and are thus at risk of developing the disease.

With a timely diagnosis and treatment with antibiotics, most people who develop TB can be cured and onward transmission curtailed. The number of cases occurring each year (and thus the number of TB-related deaths) can also be driven down by reducing the prevalence of health-related risk factors for TB (e.g. smoking, diabetes and HIV infection), providing preventive treatment to people with a latent TB infection, and action on broader determinants of TB infection and disease (e.g. poverty, housing quality and undernutrition).

In 2014 and 2015, all Member States of the World Health Organization (WHO) and the United Nations (UN) committed to ending the TB epidemic. They did this by unanimously endorsing WHO's End TB Strategy at the World Health Assembly in May 2014, and by adopting the UN Sustainable Development Goals (SDGs) in September 2015. SDG Target 3.3 includes ending the TB epidemic by 2030. The End TB Strategy defines milestones (for 2020 and 2025) and targets (for 2030 and 2035) for reductions in TB cases and deaths. The targets for 2030 are a 90% reduction in the number of TB deaths and an 80% reduction in the TB incidence rate (new cases per 100 000 population per year) compared with levels in 2015. The milestones for 2020 are reductions of 35% and 20%, respectively.

In 2017 and 2018, political commitment to ending TB was stepped up.

The first global ministerial conference on ending TB was held in November 2017, jointly hosted by WHO and the government of the Russian Federation. The outcome was the Moscow Declaration to End TB, which in May 2018 was welcomed by all of WHO's 194 Member States at the World Health Assembly.

On 26 September 2018, the UN held its first-ever high-level meeting on TB; the meeting was attended by heads of state and government, and the outcome was a political declaration agreed by all UN Member States. Existing commitments to the SDGs and End TB Strategy were reaffirmed and new ones added. Global targets for the funding to be mobilized for TB prevention and care (at least US$ 13 billion per year by 2022) and TB research and development (US$ 2 billion per year) were defined for the first time, and new targets set for the total numbers of people to be reached with treatment for disease (40 million globally) and infection (30 million globally) between 2018 and 2022. The political declaration also requested the UN Secretary-General, with support from WHO, to provide a report to the General Assembly in 2020 on global and national progress, as the basis for a comprehensive review at a high-level meeting in 2023.

WHO has published a global TB report every year since 1997. Its purpose is to provide a comprehensive and up-to-date assessment of the TB epidemic and of progress in the response at global, regional and country levels, in the context of global commitments and strategies. The report is based primarily on data gathered by WHO from countries in annual rounds of data collection,[1] and databases maintained by other multilateral agencies. This 2019 edition provides a strong foundation for the UN Secretary-General's progress report on TB in 2020.

The main chapters of the report provide an overview of the SDGs, the End TB Strategy and political declarations related to TB (Chapter 2); estimates of TB disease burden 2000–2018 (Chapter 3); the latest data reported to WHO on TB diagnosis and treatment services (Chapter 4) and on prevention services (Chapter 5) and recent trends; the latest data reported to WHO on financing for TB prevention, diagnosis and treatment and trends since 2006 (Chapter 6); an assessment of progress towards universal health coverage and the status of broader determinants of TB incidence (Chapter 7); and a summary of the development pipelines for new TB diagnostics, drugs, drug regimens and vaccines as of August 2019 (Chapter 8). Chapters 3–8 give specific attention to progress towards the 2020 milestones of the End TB Strategy and the new global targets set in the political declaration at the UN high-level meeting on TB.

The report's annexes comprise an explanation of sources of data used for the report and how to access WHO's online global TB database, profiles for 30 high TB burden countries and WHO's six regions, and data for key indicators for all countries, for the latest available year.

Basic facts about TB are provided in **Box 1.1**.

[1] In the 2019 round of global TB data collection, 202 countries and territories with more than 99% of the world's population and estimated number of TB cases reported data. Further details are provided in **Annex 1**.

The first UN high-level meeting on TB was held on 26 September 2018. The theme of the meeting was "United to end TB: an urgent global response to a global epidemic".

Ben Hartschuh/WHO

Chapter 2

Global commitments to end TB and multisectoral accountability

From 2000 to 2015, global, regional and national efforts to reduce the burden of tuberculosis (TB) disease focused on achieving targets set within the context of the Millennium Development Goals (MDGs). The MDGs were established by the United Nations (UN) in 2000, and targets were set for 2015. Target 6c of MDG 6 was to "halt and reverse" TB incidence. The Stop TB Partnership adopted this target and set two additional targets: to halve TB prevalence and TB mortality rates by 2015 compared with their levels in 1990. The global TB strategy developed by the World Health Organization (WHO) for the decade 2006–2015 – the Stop TB Strategy – had the overall goal of reaching all three of these targets. In October 2015, WHO published its assessment of whether the 2015 global TB targets for reductions in TB incidence, prevalence and mortality had been achieved *(1)*.

For the period 2016–2035, global, regional and national efforts to reduce the burden of TB disease have the ambitious aim of "ending the TB epidemic", within the context of the UN's Agenda for Sustainable Development, and based on WHO's End TB Strategy. The Sustainable Development Goals (SDGs) and their associated indicators and targets were adopted by all UN Member States in September 2015. The SDGs cover the period 2016–2030 *(2)*, and the End TB Strategy is for the period 2016–2035 *(3)*. In 2017 and 2018, TB commitments included in the SDGs and End TB Strategy were reaffirmed at the first-ever global ministerial conference on TB (held in Moscow in November 2017) *(4)*, and the first-ever UN high-level meeting on TB (held at UN headquarters in New York in September 2018) *(5)*. Targets for TB that are consistent with those set in the End TB Strategy have been included in WHO's Thirteenth General Programme of Work, 2019–2023 (GPW 13) *(6)*.

This chapter provides the broad context for the rest of this report. It starts with an overview of the SDGs (**Section 2.1**) and the End TB Strategy (**Section 2.2**). It then describes the Moscow Declaration from the first global ministerial conference on TB (**Section 2.3**), the political declaration at the first UN high-level meeting on TB (**Section 2.4**), and the TB targets included in WHO's GPW 13 (**Section 2.5**). **Section 2.6** describes a multisectoral accountability framework for TB, developed under the leadership of WHO between January 2018 and April 2019, in response to commitments made in the Moscow Declaration, a TB resolution at the World Health Assembly in 2018 and the political declaration at the UN high-level meeting. **Section 2.7** identifies and explains countries defined by WHO as high burden (for TB, HIV-associated TB or drug-resistant TB); these countries are given particular attention throughout the report.

2.1 The Sustainable Development Goals

The 17 SDGs are shown in **Box 2.1**.

The consolidated goal for health is SDG 3, which is defined as "Ensure healthy lives and promote well-being for all at all ages". Thirteen targets have been set for this goal (**Box 2.2**), and one of these targets, Target 3.3, explicitly mentions TB: "By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases". The language of "ending epidemics" is a prominent element of global health strategies developed by WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS) for the SDG era *(7)*, including the End TB Strategy (**Section 2.2**). The TB indicator for Target 3.3 is the TB incidence rate (i.e. new TB cases per 100 000 population per year).

SDG 3 also includes a target (Target 3.8) related to universal health coverage (UHC) that specifically mentions TB. UHC means that everyone can obtain the health services they need without suffering financial hardship *(8, 9)*. Target 3.8 includes an indicator for the coverage of essential prevention, treatment and care interventions. This is a composite indicator based on the coverage of 16 "tracer interventions",[1] one of which is TB treatment.

The SDGs include considerable emphasis on disaggregated analysis and reporting of data (as well as reporting for an entire country). Depending on the indicator, examples include disaggregation by age, sex, location and economic status (e.g. bottom 40%, or bottom versus top income quintiles). Some indicators also give attention to specific subpopulations, such as pregnant women, people with disabilities, victims of work injuries and migrants.

In support of the requirement for disaggregation for many indicators, SDG 17 includes two targets and associated indicators under the subheading of "Data, monitoring and accountability", which specifically refer to disaggregated data and the mechanisms needed to generate such data (**Table 2.1**). Emphasis is also given to the importance of death registration within national

[1] There are many different prevention and treatment interventions. SDG Indicator 3.8.1 is based on the coverage of 16 interventions that have been selected as "tracers" for assessment of progress towards UHC for all interventions. Further details are provided in **Chapter 7**.

BOX 2.1

The Sustainable Development Goals

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts[a]

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

[a] Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

BOX 2.2

Sustainable Development Goal 3 and its 13 targets

SDG 3: Ensure healthy lives and promote well-being for all at all ages

Targets

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents

3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

TRIPS, Trade-Related Aspects of Intellectual Property Rights

TABLE 2.1

SDG 17, and targets and indicators related to data, monitoring and accountability

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development	
TARGETS	**INDICATORS**
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	**17.18.1** Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries	**17.19.2** Proportion of countries that (a) have conducted at least one population and housing census in the last 10 years; and (b) have achieved 100 per cent birth registration and 80 per cent death registration

BOX 2.3

The End TB Strategy at a glance

VISION	A WORLD FREE OF TB — zero deaths, disease and suffering due to TB			
GOAL	END THE GLOBAL TB EPIDEMIC			
INDICATORS	MILESTONES		TARGETS	
	2020	2025	SDG 2030[a]	END TB 2035
Percentage reduction in the absolute number of TB deaths (compared with 2015 baseline)	35%	75%	90%	95%
Percentage reduction in the TB incidence rate (compared with 2015 baseline)	20%	50%	80%	90%
Percentage of TB-affected households experiencing catastrophic costs due to TB (level in 2015 unknown)	0%	0%	0%	0%

PRINCIPLES

1. Government stewardship and accountability, with monitoring and evaluation
2. Strong coalition with civil society organizations and communities
3. Protection and promotion of human rights, ethics and equity
4. Adaptation of the strategy and targets at country level, with global collaboration

PILLARS AND COMPONENTS

1. INTEGRATED, PATIENT-CENTRED CARE AND PREVENTION

- A. Early diagnosis of TB including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups
- B. Treatment of all people with TB including drug-resistant TB, and patient support
- C. Collaborative TB/HIV activities, and management of comorbidities
- D. Preventive treatment of persons at high risk, and vaccination against TB

2. BOLD POLICIES AND SUPPORTIVE SYSTEMS

- A. Political commitment with adequate resources for TB care and prevention
- B. Engagement of communities, civil society organizations, and public and private care providers
- C. Universal health coverage policy, and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control
- D. Social protection, poverty alleviation and actions on other determinants of TB

3. INTENSIFIED RESEARCH AND INNOVATION

- A. Discovery, development and rapid uptake of new tools, interventions and strategies
- B. Research to optimize implementation and impact, and promote innovations

[a] Targets linked to the Sustainable Development Goals (SDGs).

vital registration systems, to allow for accurate tracking of causes of death (this is Part B of Indicator 17.19.2). Strengthening national vital registration systems as the basis for direct measurement of the number of TB deaths is one of the five strategic areas of work of the WHO Global Task Force on TB Impact Measurement, as discussed in Chapter 3.

Disaggregation is intended to inform analysis of within-country inequalities and associated assessments of equity, with findings used to identify areas or subpopulations where progress is lagging behind and greater attention is needed. Such disaggregation is also an important consideration for the TB community, given the influence of sex, age, socioeconomic status and differential access to health care on the risks for and consequences of TB infection and disease. Chapter 3 and Chapter 4 of this report include analyses of TB data disaggregated by age, sex and HIV status.

2.2 The End TB Strategy

The End TB Strategy was adopted by all WHO Member States at the World Health Assembly in 2014 *(3)*. It covers the period 2016–2035, and the strategy "at a glance" is shown in Box 2.3; operational guidance is available elsewhere *(10)*.

The overall goal is to "End the global TB epidemic",

and there are three high-level, overarching indicators and related targets (for 2030 – linked to the SDGs, and for 2035) and milestones (for 2020 and 2025). The three indicators are:

- the number of TB deaths per year;
- the TB incidence rate (new cases per 100 000 population per year); and
- the percentage of TB patients and their households experiencing catastrophic costs due to TB disease.

The 2030 targets are a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate, compared with levels in 2015. The 2035 targets are a 95% reduction in TB deaths and a 90% reduction in the TB incidence rate, compared with levels in 2015. The most immediate milestones, set for 2020, are a 35% reduction in TB deaths and a 20% reduction in the TB incidence rate, compared with levels in 2015. The trajectories of TB incidence and TB deaths that are required to reach these milestones and targets are shown in **Fig. 2.1**; assessment of the status of progress towards the 2020 milestones (based on estimates of TB incidence and TB deaths for the years 2015–2018) is part of **Chapter 3**. For the third indicator (the percentage of TB-affected households experiencing catastrophic costs due to TB disease), the milestone for 2020 is zero, to be sustained thereafter.

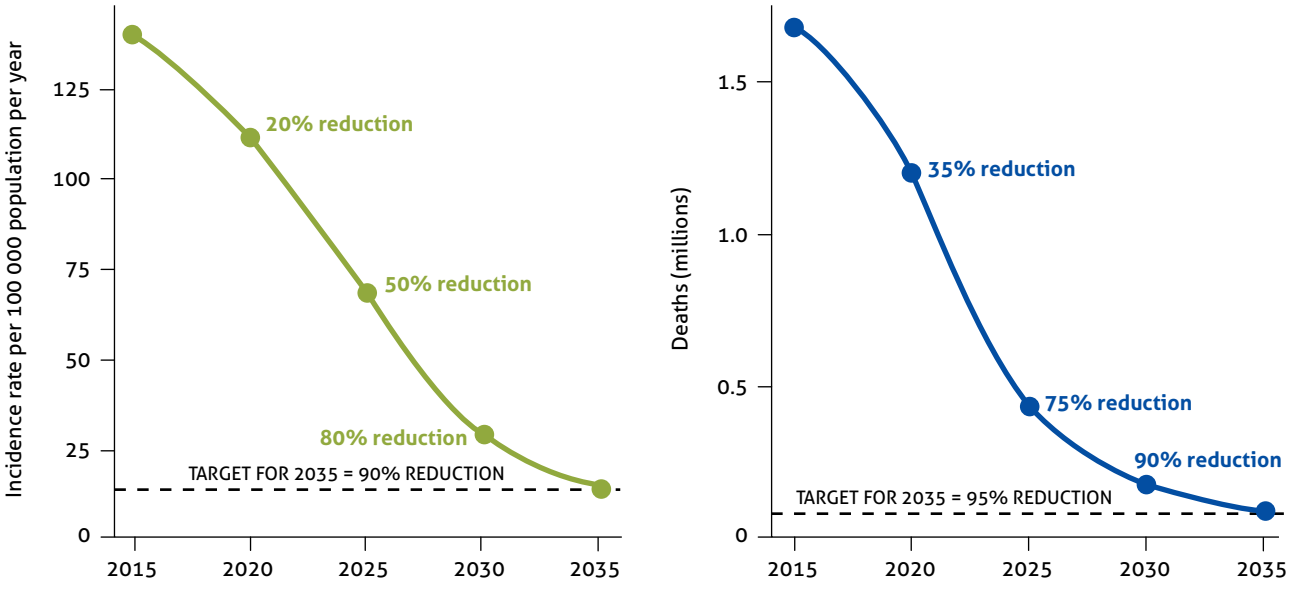
Progress towards UHC and actions to address health-related risk factors for TB (as well as broader social and economic determinants of TB) are fundamental to achieving the End TB Strategy targets and milestones for reductions in TB cases and deaths. Reaching the milestones requires acceleration in the annual decline in the global TB incidence rate, from 1.5% per year in 2015 to 4–5% per year by 2020, and then to 10% per year by 2025. The latter is equivalent to the fastest national declines documented to date (e.g. in countries in western Europe during the 1950s and 1960s), which occurred in the context of progress towards UHC combined with broader social and economic development. The milestones also require that the global proportion of people with TB who die from the disease (the case fatality ratio, or CFR) is reduced to 10% by 2020 and then to 6.5% by 2025. The latter is comparable to the current level in many high-income countries, but is only attainable if all those with TB disease can access high-quality treatment. Estimates of the CFR and of annual rates of decline in TB incidence at global, regional and country levels are reported in **Chapter 3**, and analysis of progress towards UHC and broader social and economic determinants of TB are two of the main topics covered in **Chapter 7**.

The percentage of TB patients and their households facing catastrophic costs due to TB disease is a good tracer indicator for progress towards UHC as well as social protection. If UHC and social protection are in place, then people with TB should be able to access high-quality diagnosis and treatment without incurring catastrophic costs. National health-facility based surveys can be used to measure the extent to which TB patients and their households face catastrophic costs and inform actions needed to eliminate such costs. Results from national surveys completed in 2015–2019 are featured in **Chapter 7**.

After 2025, reaching the 2030 and 2035 targets requires an unprecedented acceleration in the rate at which TB incidence falls globally, to an average of 17% per year. Such an acceleration will depend on technological breakthroughs that can substantially reduce the risk of developing TB disease among the approximately 1.7 billion people *(11)* (equivalent to about one quarter of the world's

FIG. 2.1

Projected incidence and mortality curves that are required to reach End TB Strategy targets and milestones, 2015–2035



population) who are already infected with *Mycobacterium tuberculosis*. Examples include an effective post-exposure vaccine or a short, efficacious and safe treatment for latent TB infection. **Chapter 5** contains data on TB prevention services (treatment of latent TB infection, bacille Calmette-Guérin [BCG] vaccination and infection control). An overview of the development pipelines for new TB diagnostics, drugs and vaccines, including a summary of recent findings from a Phase II trial of the M72/AS01$_E$ vaccine candidate, is provided in **Chapter 8**.

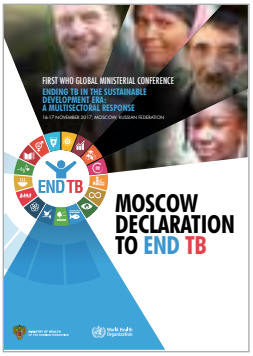
To achieve the targets and milestones, the End TB Strategy has four underlying principles and three pillars. The four principles are government stewardship and accountability, with monitoring and evaluation; a strong coalition with civil society organizations and communities; protection and promotion of human rights, ethics and equity; and adaptation of the strategy and targets at country level, with global collaboration. The three pillars are integrated, patient-centred TB care and prevention; bold policies and supportive systems (including UHC, social protection, and action on TB determinants); and intensified research and innovation. The 10 components of the three pillars of the End TB Strategy are shown in **Box 2.3**, and priority indicators for monitoring their implementation are shown in **Table 2.2**. The table also indicates the chapter of this report in which available data for each indicator can be found.

In 2015, the Stop TB Partnership developed the *Global Plan to End TB, 2016–2020 (12)*, which sets out the actions and funding needed to reach the 2020 milestones of the End TB Strategy. Following the UN high-level meeting on TB in September 2018, work to update this plan for the period 2018–2022 was initiated and the new plan is scheduled to be released in December 2019. Estimates of funding requirements in the updated plan, for the period 2018–2022, are included in **Chapter 6**.

2.3 The 2017 Moscow Declaration to end TB

On 16–17 November 2017, WHO and the Ministry of Health of the Russian Federation co-hosted the first global ministerial conference on TB, titled *Ending TB in the Sustainable Development Era: a Multisectoral Response*.

The conference was held in recognition of the fact that investments and actions were falling short of those needed to reach SDG and End TB Strategy targets and milestones. It brought together over 1000 participants, including ministers of health and other leaders from 120 countries, and over 800 partners, including civil society.



The key outcome of the conference was the Moscow Declaration to End TB *(4)*. This was developed through consultations with partners and Member States, led by the Russian Federation, and was adopted by almost 120 WHO Member States.

FIG. 2.2

The four outcome areas of the Moscow Declaration

The declaration included commitments by Member States and calls for actions by global agencies and other partners in four key areas (**Fig. 2.2**):[1]

- advancing the TB response within the SDG agenda;
- ensuring sufficient and sustainable financing;
- pursuing science, research and innovation; and
- developing a multisectoral accountability framework.

At the World Health Assembly in May 2018, all Member States committed to accelerate their actions to end TB *(13)*, building on the commitments of the Moscow Declaration.

In the 10 months between the global ministerial conference and the UN high-level meeting on TB, ministers and heads of state of major country blocs issued communiqués on the need for urgent action on TB, including drug-resistant TB in the wider context of antimicrobial resistance. Examples of such communiqués included those from the G20; the G7; Brazil, the Russian Federation, India, China and South Africa (BRICS); and the Asia-Pacific Economic Cooperation (APEC). New commitments were also made by ministers from countries in the WHO South-East Asia Region at the Delhi End TB Summit in March 2018, and by African leaders at a summit of the African Union in July 2018.

[1] The SDG agenda and the multisectoral accountability framework for TB (MAF-TB) are discussed in this chapter. The topic of financing is covered in **Chapter 6** and **Chapter 7**; research and development is the subject of **Chapter 8**.

TABLE 2.2

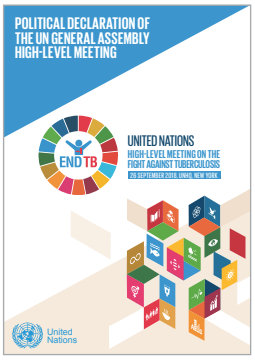
Top 10 indicators (not ranked) for monitoring implementation of the End TB Strategy at global and national levels, with recommended target levels that apply to all countries. The target level is for 2025 at the latest.

	INDICATOR	RECOMMENDED TARGET LEVEL	MAIN RATIONALE FOR INCLUSION IN TOP 10	MAIN METHOD OF MEASUREMENT, AND RELEVANT CHAPTER OF THIS REPORT
1	**TB treatment coverage** *Number of new and relapse cases that were notified and treated, divided by the estimated number of incident TB cases in the same year, expressed as a percentage.*	≥90%	High-quality TB care is essential to prevent suffering and death from TB and to cut transmission. High coverage of appropriate treatment is required to achieve the milestones and targets of the End TB Strategy.	Routinely collected notification data used in combination with estimate of TB incidence. Chapter 4
2	**TB treatment success rate** *Percentage of notified TB patients who were successfully treated. The target is for drug–susceptible and drug-resistant TB combined, although outcomes should also be reported separately.*	≥90%		Routinely collected data. Chapter 4
3	**Percentage of TB-affected households that experience catastrophic costs due to TB**[a] *Number of people treated for TB (and their households) who incur catastrophic costs (direct and indirect combined), divided by the total number of people treated for TB.*	0%	One of the End TB Strategy's three high-level indicators; a key marker of financial risk protection (one of the two key elements of UHC) and social protection for TB-affected households.	National survey of notified TB patients. Chapter 7
4	**Percentage of new and relapse TB patients tested using a WHO-recommended rapid diagnostic (WRD) at the time of diagnosis** *Number of new and relapse TB patients tested using a WRD at the time of diagnosis, divided by the total number of new and relapse TB patients, expressed as a percentage.*	≥90%	Accurate diagnosis is an essential component of TB care. Rapid molecular diagnostic tests help to ensure early detection and prompt treatment.	Routinely collected data (as part of case-based surveillance), or national survey of medical records or patient cards of TB patients. Chapter 4
5	**Latent TB infection (LTBI) treatment coverage** *Number of people enrolled on LTBI treatment divided by the number eligible for treatment, for 3 priority groups: people newly enrolled in HIV care; children aged <5 years who are household contacts of people with bacteriologically confirmed pulmonary TB; people aged ≥5 years who are household contacts of people with bacteriologically confirmed pulmonary TB.*	≥90%	Treatment of LTBI is the main treatment intervention available to prevent development of active TB disease in those already infected with *Mycobacterium tuberculosis*.	Routinely collected data (as part of case-based surveillance), or national survey of medical records or patient cards of people living with HIV and TB patients. Chapter 5
6	**Contact investigation coverage** *Number of contacts of people with bacteriologically confirmed TB who were evaluated for TB, divided by the number eligible, expressed as a percentage.*	≥90%	Contact tracing is a key component of TB prevention, especially in children.	Routinely collected data (as part of case-based surveillance), or national survey of medical records or patient cards of people living with HIV and TB patients.
7	**Drug-susceptibility testing (DST) coverage for TB patients** *Number of bacteriologically confirmed TB cases with DST results for at least rifampicin, divided by the total number of bacteriologically confirmed TB cases in the same year, expressed as a percentage.*[b]	100%	Testing for drug susceptibility for WHO-recommended drugs is essential to provide the right treatment for every person diagnosed with TB.	Routinely collected data (as part of case-based surveillance), or national survey of medical records or patient cards of TB patients. Chapter 4 (data restricted to pulmonary cases only).
8	**Treatment coverage, new TB drugs** *Number of TB patients treated with regimens that include new (endorsed after 2010) TB drugs, divided by the number of notified patients eligible for treatment with new TB drugs, expressed as a percentage.*	≥90%	An indicator that is relevant to monitoring the adoption of innovations in all countries. *The definition of which patients are eligible for treatment with new drugs may differ among countries.*	Routinely collected data (as part of case-based surveillance), or national survey of medical records or patient cards of TB patients.
9	**Documentation of HIV status among TB patients** *Number of new and relapse TB patients with documented HIV status, divided by the number of new and relapse TB patients notified in the same year, expressed as a percentage.*	100%	One of the core global indicators used to monitor collaborative TB/HIV activities. Documentation of HIV status is essential to provide the best care for HIV-positive TB patients, including antiretroviral therapy.	Routinely collected data for all TB patients. Chapter 4
10	**Case fatality ratio (CFR)** *Number of TB deaths divided by estimated number of incident cases in the same year, expressed as a percentage.*	≤5%	This is a key indicator for monitoring progress towards the 2020 and 2025 milestones. A CFR of 6% is required to achieve the 2025 global milestone for reductions in TB deaths and cases.	Mortality divided by incidence. In countries with a high-performance surveillance system, notifications approximate incidence. Chapter 3

[a] Catastrophic costs are provisionally defined as total costs that exceed 20% of annual household income.
[b] Testing for drug susceptibility is only possible among bacteriologically confirmed cases.

2.4 The political declaration at the UN high-level meeting on TB in 2018

The first UN General Assembly high-level meeting on TB was held in New York on 26 September 2018, titled *United to End TB: An Urgent Global Response to a Global Epidemic*.



The main outcome of the meeting was a political declaration *(5)*. This reaffirmed the commitment of Member States to the SDGs and the End TB Strategy, and to the actions required to accelerate progress that were defined in the Moscow Declaration. Examples included:

- providing access to TB diagnosis and treatment within the context of improving policies and systems on each country's path towards achieving and sustaining UHC;
- preventing TB disease among those at most risk of falling ill through the rapid scale-up of access to preventive treatment for latent TB infection;
- mobilizing sufficient and sustainable financing;
- overcoming the global public health crisis of multidrug-resistant TB (MDR-TB);
- ensuring and pursuing multisectoral collaboration at global, regional and local levels;
- addressing the economic and social determinants of TB infection and disease, giving special attention to poor and vulnerable populations and communities especially at risk;
- promoting an end to stigma and all forms of discrimination, including through the protection and promotion of human rights and dignity; and
- advancing research and innovation through global collaboration, including through WHO mechanisms and networks.

Member States also committed to four new global targets (Table 2.3). Two of these targets are for the numbers of people to be treated for TB disease (40 million)[1] or a latent TB infection (at least 30 million) in the 5 years from 2018 to 2022. These targets build on and are consistent with the milestones for reductions in TB incidence and deaths set for 2020 and 2025 in the End TB Strategy (Section 2.2). The other two targets are for the funding to be mobilized for universal access to TB diagnosis, treatment and care (at least US$ 13 billion annually by 2022) and TB research (US$ 2 billion annually in the period 2018–2022).

The political declaration included two specific requests to the heads of WHO and the UN, respectively. The first requested the Director-General of WHO to continue to develop a multisectoral accountability framework for TB, and to ensure its timely implementation (no later than 2019). The second requested the UN Secretary-General, with the support of WHO, to provide a report to the General Assembly in 2020 on global and national progress towards achieving agreed targets for TB, which should in turn inform preparations for a comprehensive review by heads of state and government at a high-level meeting in 2023.

Highlights of actions taken by the Global TB Programme in WHO in the year following the UN high-level meeting in 2018 are shown in Box 2.4.

2.5 WHO's GPW 13

WHO's GPW 13 was adopted by the World Health Assembly in May 2018 *(6)*. The thirteenth in a series of GPWs since WHO was established in 1948, it sets out the organization's strategic direction for the years 2019–2023. It is based on the foundation of the SDGs (Box 2.1). SDG 3 (Box 2.2) is of particular importance, but GPW 13 clearly recognizes the influence of other SDGs on health, and the need for multisectoral approaches to address the social, economic and environmental determinants of health.

TABLE 2.3

New global targets set in the political declaration at the first UN high-level meeting on TB, in September 2018

INDICATOR	TARGET
Number of people with TB disease diagnosed and treated in the five years 2018–2022	40 million, including 3.5 million children, and 1.5 million with drug-resistant TB, including 115 000 children
Number of people reached with treatment to prevent TB in the five years 2018–2022	At least 30 million, including 4 million children under 5 years of age, 20 million other people who are household contacts of people affected by TB, and 6 million people living with HIV
Funding mobilized for universal access to quality prevention, diagnosis, treatment and care of TB	At least US$ 13 billion annually by 2022
Funding mobilized for TB research in the five years 2018–2022	US$ 2 billion annually

[1] WHO has estimated that the approximate annual breakdown, for consistency with the 2020 and 2025 milestones set in the End TB Strategy for reductions in the TB incidence rate, should be around 7 million in 2018 and around 8 million in subsequent years.

BOX 2.4

Actions taken by the WHO Global TB Programme in follow-up to the UN high-level meeting on TB

WHO is working with countries, partners and civil society to translate the commitments made in the political declaration of the UN high-level meeting on TB into concrete action.

This box highlights actions taken by WHO's Global TB Programme in the year following the UN high-level meeting, in collaboration with and complementary to actions led by regional and country offices.

High-level dialogue – The WHO Director-General wrote to the heads of state of the 48 countries that are in WHO's lists of high TB, MDR-TB and TB/HIV burden countries to urge accelerated action to reach global TB targets. Missions were undertaken by senior WHO leadership to more than 10 countries to discuss how to accelerate the national TB response, alignment of national TB strategic plans with new global targets, and strengthening of multisectoral action and accountability.

New guidance, roadmaps and tools – Updated WHO guidelines were published on the treatment of drug-resistant TB, and infection prevention and control. Alongside partners, two new roadmaps (one on addressing TB in children and adolescents, and a second on scaling up public–private engagement) were released. Further details are provided in **Chapter 4** and **Chapter 5**.

Global TB Research Strategy – A strategy has been developed in consultation with Member States and other stakeholders. It will be considered for adoption at the 2020 World Health Assembly. Further details are provided in **Chapter 8**.

Multisectoral Accountability Framework for TB – This framework was released shortly in advance of the 2019 World Health Assembly, and countries are being supported to adapt and use it.

Find. Treat. All. #EndTB – This is a WHO flagship initiative that is being implemented with the Stop TB Partnership and the Global Fund. Support is being provided to countries to scale up access to TB prevention, diagnosis and treatment. Further details are provided in **Chapter 4**.

Technical assistance – Strategic support was provided to priority countries in all WHO regions; for example, for national reviews of progress and national planning, implementation of recent guidelines, strengthening of diagnostic networks, case detection, private sector and community engagement, strengthening of TB surveillance, and the design and implementation of national surveys. Discussions related to TB elimination were held with low-incidence countries.

Civil society engagement – This has been boosted with the creation of a revamped Civil Society Task Force on TB. In June 2019, the WHO Director-General met with members of the task force and issued a joint statement urging countries to accelerate progress, to keep the promises made at the UN high-level meeting.

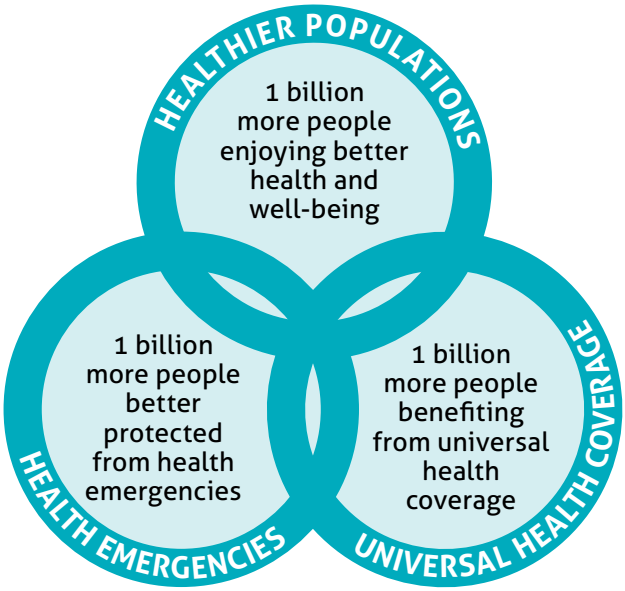
Monitoring and evaluation – Considerable progress has been made in strengthening routine TB surveillance systems and implementing national surveys to directly measure the burden of TB disease, under the umbrella of the WHO Global Task Force on TB Impact Measurement. Further details are provided in **Chapter 3**.

Advocacy and promotion – Events and communication to keep the spotlight on TB were organized on World TB Day, during the World Health Assembly and in association with a UN high-level meeting on UHC. A new campaign, "Race to End TB", was launched in high TB burden countries. WHO convened a Global Youth Town Hall in Indonesia to scale up youth mobilization to end TB, the outcome of which was a Youth Declaration to End TB.

In May 2019, the World Health Assembly reviewed a report by the WHO Director-General on progress since the 2018 UN high-level meeting on TB. Member States expressed strong support for the work done. As requested in the political declaration at the UN high-level meeting on TB, WHO has initiated work to support the UN Secretary-General to prepare a 2020 report to the General Assembly on global and national progress.

FIG. 2.3

WHO's 13th General Programme of Work: a set of interconnected strategic priorities and goals to ensure healthy lives and promote well-being for all at all ages



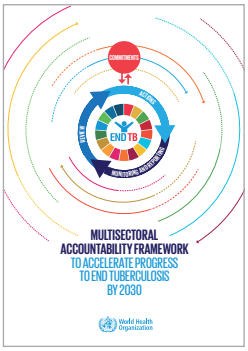
GPW 13 is structured around three strategic priorities and associated goals (Fig. 2.3). The three strategic priorities are UHC, addressing health emergencies and promoting healthier populations. The associated goals for 2023 are the "triple billion goals"; that is, that 1 billion more people are benefiting from UHC, 1 billion more people are better protected from health emergencies, and 1 billion more people are enjoying better health and well-being. Achieving all three goals depends on joint efforts by Member States, WHO and other partners.

GPW 13 includes 10 outcomes, one of which is directly linked to the SDG 3 target for ending epidemics and is defined as "Accelerated elimination and eradication of high-impact communicable diseases". Under this outcome, there are two targets for TB: that TB incidence (new cases per 100 000 population per year) is reduced by 27% between 2018 and 2023, and that by 2023 there is at least 80% treatment coverage for people with bacteriologically confirmed drug-resistant TB. The incidence target is consistent with the End TB Strategy milestones set for 2020 and 2025, and the target for drug-resistant TB is consistent with the overall target for TB treatment coverage shown in Table 2.2.

2.6 The WHO multisectoral accountability framework to accelerate progress to end TB

Multisectoral accountability was one of four key areas for action addressed in the Moscow Declaration (Section 2.3). Member States committed to "supporting the development of a multisectoral accountability framework" in advance of the first UN high-level meeting on TB in September 2018, and called on WHO to develop such a framework, working in close cooperation with Member States and partners.

The rationale for a multisectoral accountability framework for TB (MAF-TB) is that strengthened accountability for the response to TB at national, regional and global levels should contribute to faster progress towards the TB targets and milestones of the SDGs and WHO's End TB Strategy. Key definitions and concepts related to the MAF-TB are provided in Box 2.5.



In January 2018, WHO's Executive Board reiterated the request for the secretariat to lead the development of a MAF-TB, and asked for a draft to be available for consideration by the World Health Assembly in May 2018 and for presentation at the UN high-level meeting on TB in September 2018. As explained in Section 2.4, the political declaration at the high-level meeting asked the Director-General of WHO to continue to develop the MAF-TB and ensure its timely implementation (no later than 2019).

WHO initiated work on a MAF-TB in January 2018. The extensive preparatory and development work included background documentation, consultations, two rounds of review of full drafts by all Member States and one public review *(14, 15)*. Following this work, WHO finalized the framework and published it in May 2019, shortly in advance of the 2019 World Health Assembly *(16)*.

The key content of the MAF-TB is shown in Fig. 2.4. The framework has two major parts: national (including local) level, and global and regional levels. Each part comprises the four components shown in Fig. B2.5.1; that is, commitments, actions, monitoring and reporting, and review. In all components of the framework, the fundamental role of civil society, TB-affected communities and patient groups is recognized.

Key elements are listed under each of the four components. These are built on the foundations of the End TB Strategy and associated World Health Assembly resolutions; the SDGs and associated General Assembly resolutions, including political declarations of high-level meetings; the established core functions of actors operating at global or regional level; established systems and best practices for monitoring and reporting; and existing review mechanisms.

As acknowledged in the framework and noted in Fig. 2.4,[1] it is not possible to be exhaustive in listing all elements of potential relevance under each of the four components of the framework. Those listed are nonetheless intended to show the main elements of relevance in many settings, to ensure strong accountability. In

[1] See footnote c in Fig. 2.4.

BOX 2.5

A multisectoral accountability framework for TB: definitions and concepts

Accountability means being responsible and answerable for commitments made or actions taken.

A *framework* provides an overview and structure of essential components and subcomponents, and the relationships between them. A framework can be adapted; for example, by modifying, adding or deleting items, and by adding detail to subcomponents to customize or give them greater specificity.

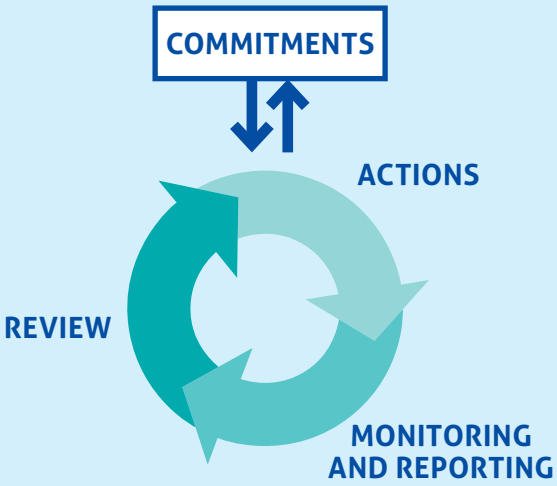
An *accountability framework* needs to define who is accountable (e.g. individuals, organizations and national governments), what commitments and actions they are accountable for, and how they will be held to account. Mechanisms for monitoring and reporting, as well as review, are critical in holding entities to account. The essential components of an accountability framework (commitments, actions, monitoring and reporting, and review), and how they are related, are shown in **Figure B2.5.1**. These components are underpinned and informed by laws, regulations and rules, and by political, social, professional, moral and ethical codes of conduct and conventions.

Conceptually, commitments should be followed by the actions needed to keep or achieve them. Monitoring and reporting are then used to track progress related to commitments and actions. Review is used to assess the results from monitoring that are documented in reports and associated products, and to make recommendations for future actions. The cycle of action, monitoring and reporting, and review can be repeated many times. The results from monitoring and reporting, and the recommendations from reviews based on these results, should drive new or improved actions, or both. Periodically, new commitments or reinforcement of commitments may be required.

Accountability can be strengthened by reinforcing one or more of the four components of the framework. Examples include adding new actions or improving existing ones; increasing the quality and coverage of data available to monitor progress towards commitments made and actions taken; improving reports to better inform reviews of progress; initiating or strengthening high-level reviews; improving review processes, such as by making them more independent, more transparent and with wider participation; and ensuring that reviews have meaningful consequences for action.

FIG. B2.5.1

Generic accountability framework



Multisectoral refers to the different sectors of an economy, which can be defined in various ways (e.g. agriculture and fisheries, health, education, justice, social services, manufacturing, retail services, finance, the media, information technology, telecommunications, defence, public sector or private sector). In the context of health, multisectoral is usually used to refer to sectors of the economy (and related parts of government) that influence health, and which need to be engaged by the health sector to address health issues. A multisectoral accountability framework needs to include content related to multiple sectors.

addition, some of the elements listed require customization, especially at national and subnational levels. This reflects differences in factors such as the size of the TB disease burden and its distribution (geographically as well as by age, sex and other risk factors); existing political, administrative and legislative systems; the nature of nongovernmental, civil society and private sector institutions and engagement; and the status of social and economic development. Therefore, major examples are provided, using generic language.

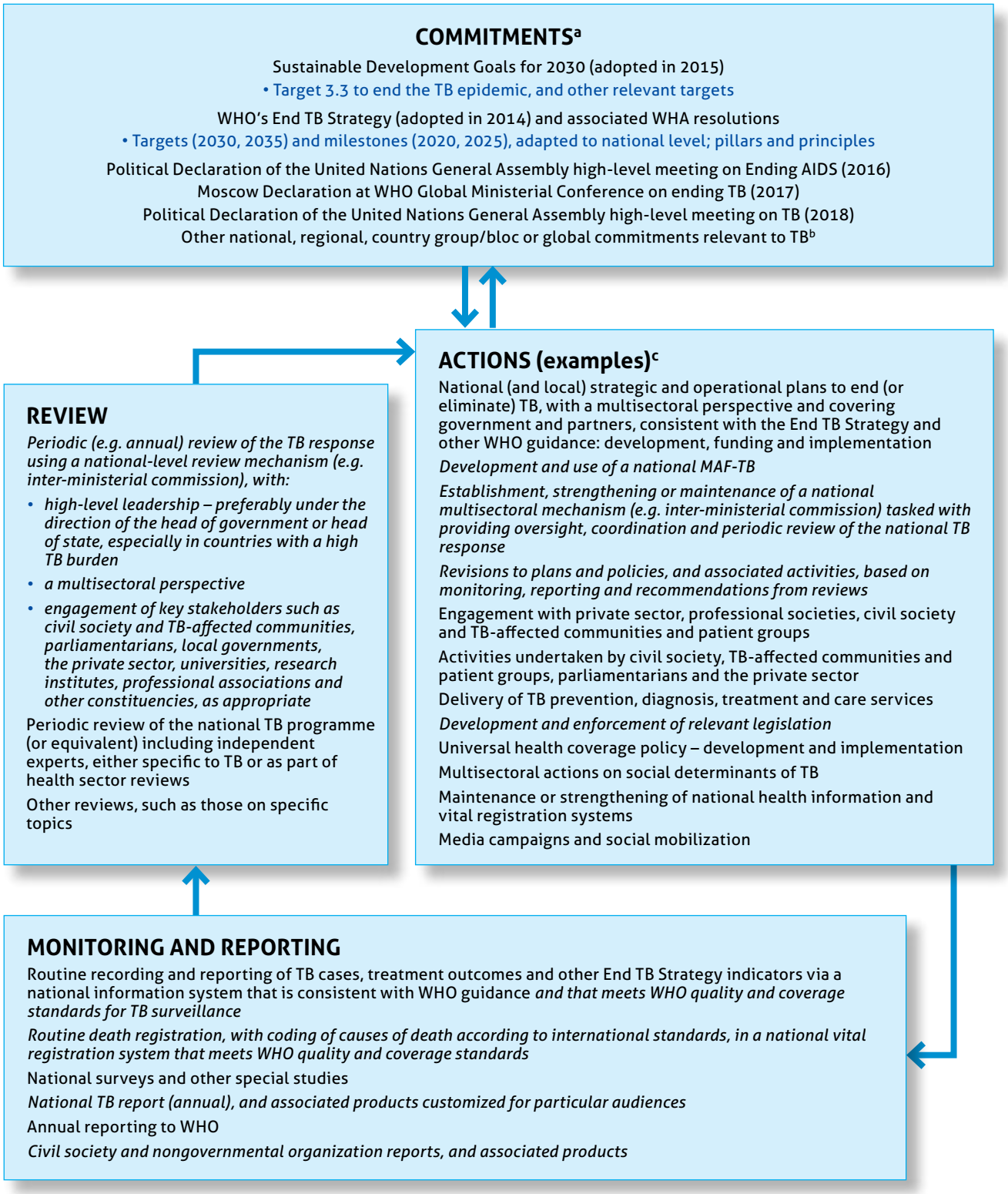
Both new and current elements that require strengthening in many countries are highlighted (in italics). Examples include high-level review mechanisms, revision of national strategies and plans based on review recommendations, routine death registration with coding of causes of death according to international standards, and definition of national targets consistent with the new global targets set in the political declaration at the UN high-level meeting on TB in 2018 (**Table 2.3**).

Many government institutions and other institutions

FIG. 2.4a

Multisectoral accountability framework for TB (MAF-TB):
national (including local) level – for individual countries, with adaptation according to national constitutional, legal and regulatory frameworks and other relevant factors

Italicized text indicates elements that do not yet exist or are not yet in place in many countries, including those with a high burden of TB. Other elements (especially those listed under actions) also need strengthening in many countries.



[a] Targets, milestones, pillars and principles are explained in the main text.
[b] Examples include political declarations of the United Nations General Assembly on antimicrobial resistance and noncommunicable diseases, and the Delhi Call to Action (signed by Member States in the WHO South-East Asia Region).
[c] It is not possible to list all relevant actions here, but major examples are provided.

FIG. 2.4b

Multisectoral accountability framework for TB (MAF-TB): global and regional levels – countries collectively

Italicized text indicates elements that do not yet exist, or are not yet in place in all regions

COMMITMENTS[a]

Sustainable Development Goals for 2030 (adopted in 2015)
- Target 3.3 to end the TB epidemic, and other relevant targets

WHO's End TB Strategy (adopted in 2014) and associated WHA resolutions
- Targets (2030, 2035), milestones (2020, 2025), pillars, principles

Political Declaration of the United Nations General Assembly high-level meeting on Ending AIDS (2016)
Moscow Declaration at WHO Global Ministerial Conference on ending TB (2017)
Political Declaration of the United Nations General Assembly high-level meeting on TB (2018)
Other global or regional commitments relevant to TB[b]

ACTIONS (examples)[c]

Development, funding and implementation of the strategic and operational plans of global agencies and regional entities, including joint initiatives across agencies, strategic alliances across sectors,[d] linkages with other global health priorities and initiatives, engagement of civil society and TB-affected communities, and regional targets and milestones as appropriate

Resource mobilization and allocation of funding by global financing agencies

WHO global TB strategy and associated WHO guidance, norms and standards – development, dissemination and implementation support

Global and regional advocacy and communication, including for financing, engagement of multiple sectors, civil society and TB-affected communities, and human rights

Strategic and technical support to countries by global and regional agencies

Global strategy for TB research and innovation, and related convening of international TB research networks

REVIEW

Periodic high-level reviews of the TB response at global and/or regional level, with multisectoral perspective and engagement of key stakeholders, including civil society and TB-affected communities, the private sector, and others. Existing examples are:
- United Nations General Assembly high-level meetings on TB (2018, 2023)
- United Nations General Assembly high-level political forum for Sustainable Development Goal review
- United Nations General Assembly reviews of Sustainable Development Goals (next in 2023)
- WHO Executive Board and World Health Assembly review of progress reports on TB (including 2018, 2019, 2020) and WHO Regional Committee review of progress reports on TB

High-level reviews by regional entities and country blocs (or equivalent)

Other reviews requested and approved by countries collectively, at either global or regional level

MONITORING AND REPORTING

WHO framework for TB recording and reporting (cases, treatment outcomes)

WHO TB-SDG monitoring framework

WHO global TB data collection (annual) and online database

WHO Global TB report (annual) and associated products

WHO progress reports on the End TB Strategy and actions in follow-up to high-level meetings, to the Executive Board and World Health Assembly

Report in 2020 on global and national progress in the TB response, prepared by the United Nations Secretary-General with WHO support

WHO Regional reports and associated products

United Nations data collection and reports on the SDGs

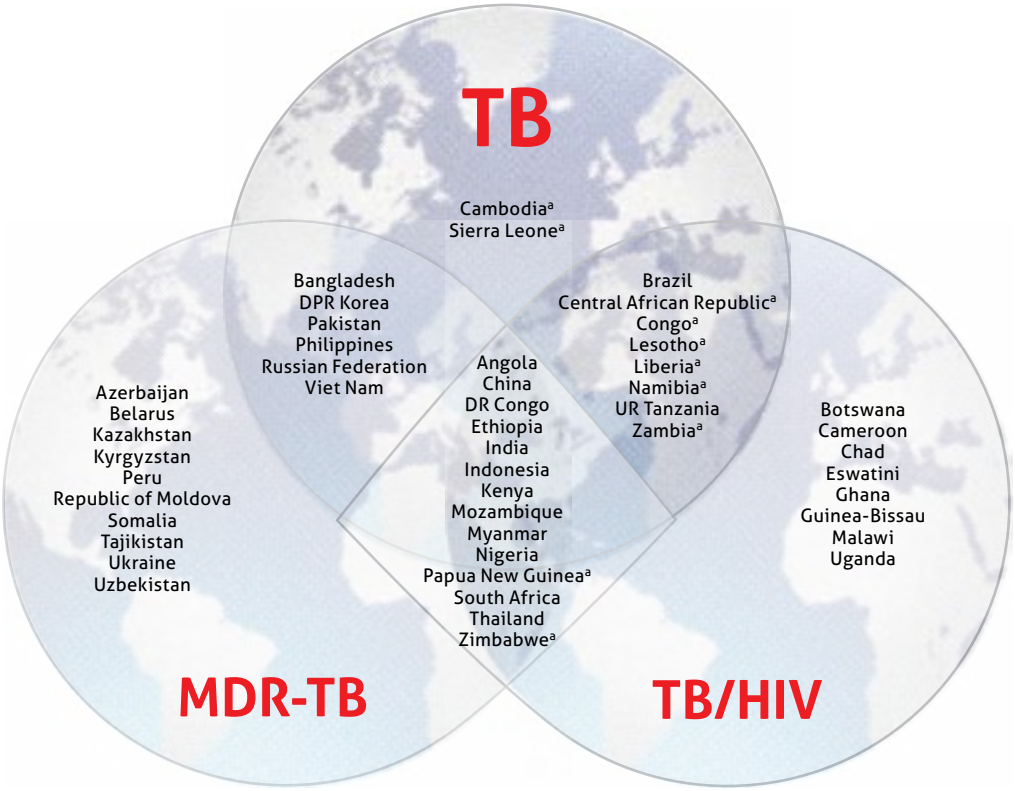
Treatment Action Group/Stop TB Partnership and G-Finder annual reports on trends in funding for TB research and product development, and periodic Médecins Sans Frontières/Stop TB Partnership reports on uptake of WHO policies

Other civil society and nongovernmental organization audits and reports, and associated products (e.g. scorecards)

[a] Targets, milestones, pillars and principles are explained in the main text.
[b] Examples include political declarations of the United Nations General Assembly high-level meetings on antimicrobial resistance and noncommunicable diseases, and the Delhi Call to Action (signed by WHO Member States in the South-East Asia Region).
[c] It is not possible to list all relevant actions, but major examples are provided.
[d] For example, with agencies working on poverty alleviation, social protection, housing, labour, justice, and migration.

FIG. 2.5

The three high-burden country lists for TB, TB/HIV and MDR-TB defined by WHO for the period 2016–2020, and their areas of overlap



[a] Indicates countries that are included in the list of 30 high TB burden countries on the basis of the severity of their TB burden (i.e. TB incident cases per 100 000 population per year), as opposed to the top 20, which are included on the basis of their absolute number of incident cases per year. Also see Table 2.4.

(e.g. UN organizations, including WHO) already have their own general accountability mechanisms. The framework can inform these mechanisms, and they can contribute to the aims of the MAF-TB. At the same time, the principal aim of the MAF-TB is to strengthen the accountability of governments and stakeholders at country level, and across countries collectively.

Countries will need to adapt the national part of the framework (Fig. 2.4a) for use in their own context. As a starting point, it is suggested that countries conduct a baseline assessment of the current status of each of the elements listed under the four components (commitments, actions, monitoring and reporting, and review) and use this to identify which components already exist, which need strengthening, and which do not yet exist but are relevant and should be put in place. Elements that are not listed but are relevant in the national context can be identified and added. This assessment should involve government ministries and institutes, local governments, civil society, TB-affected communities, patient groups, parliamentarians, the private sector, public–private partnerships (including product development partnerships), philanthropic organizations, professional associations, research institutes and universities (and associated research networks), among others. Informed by the baseline assessment, countries can then adapt, adopt and implement a national MAF-TB. The aim should be to do this in 2019, in line with the political declaration at the UN high-level meeting on TB (Section 2.4).

WHO will work with countries and other partners to help to guide and support national adaptation and use of the MAF-TB. This will include country-based work, meetings at global and regional levels, and documentation of experience in the development and use of a national MAF-TB and associated best practices, giving special attention to newer elements such as high-level review processes. WHO will also continue to collaborate with Member States and a range of institutions and partners, including civil society, to help ensure wide stakeholder engagement in strengthening accountability at global, regional and national levels. On World TB Day 2019, WHO launched a collaborative multistakeholder and multisectoral platform for coordination, monitoring and review at global level.

2.7 Lists of high-burden countries defined by WHO for the period 2016–2020

During the period 1998–2015, the concept of a high burden country (HBC) became familiar and widely used in the context of TB. In 2015, three HBC lists – for TB, HIV-associated TB and MDR-TB – were in use.

In 2015, the last year of the MDGs and Stop TB Strategy

TABLE 2.4

The three high-burden country lists for TB, TB/HIV and MDR-TB defined by WHO for the period 2016–2020

LIST	THE 30 HIGH TB BURDEN COUNTRIES		THE 30 HIGH TB/HIV BURDEN COUNTRIES		THE 30 HIGH MDR-TB BURDEN COUNTRIES	
Purpose and target audience	To provide a focus for global action on TB in the countries where progress is most needed to achieve End TB Strategy and SDG targets and milestones, to help build and sustain national political commitment and funding in the countries with the highest burden in terms of absolute numbers or severity, and to promote global monitoring of progress in a well-defined set of countries.		To provide a focus for global action on HIV-associated TB in the countries where progress is most needed to achieve End TB Strategy, UNAIDS and SDG targets and milestones, to help build and sustain national political commitment and funding in the countries with the highest burden in terms of absolute numbers or severity, and to promote global monitoring of progress in a well-defined set of countries.		To provide a focus for global action on the MDR-TB crisis in the countries where progress is most needed to achieve End TB Strategy targets and milestones, to help build and sustain national political commitment and funding in the countries with the highest burden in terms of absolute numbers or severity, and to promote global monitoring of progress in a well-defined set of countries.	
Definition	The 20 countries with the highest estimated numbers of incident TB cases, plus the top 10 countries with the highest estimated TB incidence rate that are not in the top 20 by absolute number (threshold, >10 000 estimated incident TB cases per year).		The 20 countries with the highest estimated numbers of incident TB cases among people living with HIV, plus the top 10 countries with the highest estimated TB/HIV incidence rate that are not in the top 20 by absolute number (threshold, >1000 estimated incident TB/HIV cases per year).		The 20 countries with the highest estimated numbers of incident MDR-TB cases, plus the top 10 countries with the highest estimated MDR-TB incidence rate that are not in the top 20 by absolute number (threshold, >1000 estimated incident MDR-TB cases per year).	
Countries in the list	*The top 20 by estimated absolute number (in alphabetical order):* Angola Bangladesh Brazil China DPR Korea DR Congo Ethiopia India Indonesia Kenya Mozambique Myanmar Nigeria Pakistan Philippines Russian Federation South Africa Thailand UR Tanzania Viet Nam	*The additional 10 by estimated incidence rate per 100 000 population and with a minimum number of 10 000 cases per year (in alphabetical order):* Cambodia Central African Republic Congo Lesotho Liberia Namibia Papua New Guinea Sierra Leone Zambia Zimbabwe	*The top 20 by estimated absolute number (in alphabetical order):* Angola Brazil Cameroon China DR Congo Ethiopia India Indonesia Kenya Lesotho Malawi Mozambique Myanmar Nigeria South Africa Thailand Uganda UR Tanzania Zambia Zimbabwe	*The additional 10 by estimated incidence rate per 100 000 population and with a minimum number of 1000 cases per year (in alphabetical order):* Botswana Central African Republic Chad Congo Eswatini Ghana Guinea-Bissau Liberia Namibia Papua New Guinea	*The top 20 by estimated absolute number (in alphabetical order):* Bangladesh China DPR Korea DR Congo Ethiopia India Indonesia Kazakhstan Kenya Mozambique Myanmar Nigeria Pakistan Philippines Russian Federation South Africa Thailand Ukraine Uzbekistan Viet Nam	*The additional 10 by estimated rate per 100 000 population and with a minimum number of 1000 cases per year (in alphabetical order):* Angola Azerbaijan Belarus Kyrgyzstan Papua New Guinea Peru Republic of Moldova Somalia Tajikistan Zimbabwe
Share of global incidence in 2018 (%)	84%	2.8%	83%	4.9%	86%	4.0%
Lifetime of list	5 years (review criteria and included countries in June 2020).		5 years (review criteria and included countries in June 2020).		5 years (review criteria and included countries in June 2020).	

DPR Korea, Democratic People's Republic of Korea; DR Congo, Democratic Republic of the Congo; HIV, human immunodeficiency virus; MDR, multidrug resistant; SDG, Sustainable Development Goal; TB, tuberculosis; UNAIDS, Joint United Nations Programme on HIV/AIDS; UR Tanzania, United Republic of Tanzania; WHO, World Health Organization.

before a new era of the SDGs and End TB Strategy, the lists were revisited and updated. Following a wide consultation process *(17)*, three new HBC lists were defined for the period 2016–2020: one for TB, one for MDR-TB and one for HIV-associated TB (**Fig. 2.5**, **Table 2.4**).

Each list contains 30 countries (**Table 2.4**). These are defined as the top 20 countries in terms of the absolute number of estimated incident cases, plus the additional 10 countries with the most severe burden in terms of incidence rates per capita that do not already appear in the top 20 and that meet a minimum threshold in terms of their absolute numbers of incident cases (10 000 per year for TB, and 1000 per year for HIV-associated TB and MDR-TB). The lists were defined using the estimates of

TB disease burden available in October 2015. Each list accounts for about 90% of the global burden, with most of this accounted for by the top 20 countries in each list.

There is overlap among the three lists, but 48 countries appear in at least one of them. The 14 countries that are in all three lists (shown in the central diamond in **Fig. 2.5**) are Angola, China, the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Kenya, Mozambique, Myanmar, Nigeria, Papua New Guinea, South Africa, Thailand and Zimbabwe.[1]

The 30 high TB burden countries are given particular attention in the main body of this report. Where estimates of disease burden and assessment of progress in the response are for HIV-associated TB or MDR-TB specifically, the countries in the other two lists are given particular attention. **Annex 2** contains a two-page profile for each of the 30 high TB burden countries. Country profiles for all countries (with the same content as those presented in **Annex 2**) are available online.[2]

In 2020, the lists will be reviewed and updated for the period 2021–2025.

References

1 Global tuberculosis report 2015 (WHO/HTM/TB/2015.22). Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/191102/9789241565059_eng.pdf;jsessionid=257E179B7641F5CE7FD14BEF18488436?sequence=1, accessed 28 June 2019).

2 Sustainable development goals [website]. New York: United Nations; (https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals, accessed 28 June 2019).

3 Uplekar M, Weil D, Lönnroth K, Jaramillo E, Lienhardt C, Dias HM et al. WHO's new End TB strategy. Lancet. 2015;385(9979):1799–801 (https://www.ncbi.nlm.nih.gov/pubmed/25814376, accessed 28 June 2019).

4 Moscow Declaration to End TB; First WHO global ministerial conference on ending TB in the sustainable development era: a multisectoral response. Geneva: World Health Organization and the Ministry of Health of the Russian Federation; 2017 (https://www.who.int/tb/features_archive/Moscow_Declaration_to_End_TB_final_ENGLISH.pdf?ua=1, accessed 28 June 2019).

5 United Nations General Assembly. Resolution 73/3: Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis. United Nations; 2018 (https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/3, accessed 28 June 2019).

6 Thirteenth General Programme of Work, 2019–2023. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/324775/WHO-PRP-18.1-eng.pdf, accessed 1 August 2019).

7 Accelerating progress on HIV, tuberculosis, malaria, hepatitis and neglected tropical diseases: A new agenda for 2016–2030. Geneva: World Health Organization; 2015 (https://www.who.int/about/structure/organigram/htm/progress-hiv-tb-malaria-ntd/en/, accessed 28 June 2019).

8 World Health Organization/World Bank. Tracking universal health coverage: 2017 global monitoring report. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/259817/9789241513555-eng.pdf, accessed 28 June 2019).

9 World Health Organization/World Bank. Tracking universal health coverage: first global monitoring report. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/174536/9789241564977_eng.pdf?sequence=1, accessed 28 June 2019).

10 Implementing the End TB Strategy: the essentials (WHO/HTM/TB/2015.31). Geneva: World Health Organization; 2015 (https://www.who.int/tb/publications/2015/The_Essentials_to_End_TB/en/, accessed 28 June 2019).

11 Houben RM, Dodd PJ. The global burden of latent tuberculosis infection: a re-estimation using mathematical modelling. PLoS Med. 2016;13(10):e1002152 (https://www.ncbi.nlm.nih.gov/pubmed/27780211, accessed 28 June 2019).

12 The Global Plan to End TB, 2016–2020. Geneva: Stop TB Partnership; 2015 (http://www.stoptb.org/global/plan/, accessed 28 June 2019).

13 Preparation for a high-level meeting of the General Assembly on ending tuberculosis (WHA71.3), Seventy-first World Health Assembly. Geneva: World Health Organization; 2018 (http://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R3-en.pdf, accessed 11 July 2018).

[1] These 14 countries accounted for 63% of the estimated global number of incident TB cases in 2018.

[2] See: www.who.int/tb/data

14 Developing a draft TB multisectoral accountability framework. Background document. Stakeholder consultation convened by Global TB Programme, World Health Organization, Chateau de Penthes, Geneva, 1– 2 March 2018. Geneva: World Health Organization; 2018 (https://www.who.int/tb/TBAccountabilityFramework_Consultation1_2March_BackgroundDocument_20180228.pdf?ua=1, accessed 28 June 2019).

15 Developing a draft TB multisectoral accountability framework. Meeting report. Stakeholder consultation convened by Global TB Programme, World Health Organization, Chateau de Penthes, Geneva, 1– 2 March 2018. Geneva: World Health Organization; 2018 (https://www.who.int/tb/TB_MAF_1_2Marchconsultation_meetingreport_20180322.pdf?ua=1, accessed 28 June 2019).

16 Multisectoral accountability framework to accelerate progress to end tuberculosis by 2030. Geneva: World Health Organization; 2019 (https://www.who.int/tb/WHO_Multisectoral_Framework_web.pdf?ua=1, accessed 28 June 2019).

17 World Health Organization Strategic and Technical Advisory Group for TB. Use of high burden country lists for TB by WHO in the post-2015 era (discussion paper). Geneva: World Health Organization; 2015 (https://www.who.int/tb/publications/global_report/high_tb_burdencountrylists2016-2020.pdf, accessed 28 June 2019).

Nurses at a field site during the repeat national TB prevalence survey in Myanmar in 2018.
Irwin Law/WHO

Chapter 3

TB disease burden

Key facts and messages

Tuberculosis (TB) remains a major cause of ill health and is one of the top 10 causes of death worldwide.

An estimated 10.0 million (range, 9.0–11.1 million) people fell ill with TB in 2018, a number that has been relatively stable in recent years.

Globally, there were 1.2 million (range, 1.1–1.3 million) TB deaths among HIV-negative people in 2018 (a 27% reduction from 1.7 million in 2000) and an additional 251 000 deaths (range, 223 000–281 000) among HIV-positive people (a 60% reduction from 620 000 in 2000).[a] Since 2007, TB has been the leading cause of death from a single infectious agent, ranking above HIV/AIDS.

TB affects people of both sexes in all age groups but the highest burden is in adult men, who accounted for 57% of all TB cases in 2018. By comparison, adult women accounted for 32% and children for 11%. Among all TB cases, 8.6% were people living with HIV.

Geographically, most TB cases in 2018 were in the World Health Organization (WHO) regions of South-East Asia (44%), Africa (24%) and the Western Pacific (18%), with smaller shares in the Eastern Mediterranean (8%), the Americas (3%) and Europe (3%). Eight countries accounted for two thirds of the global total: India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%) and South Africa (3%).

Global targets and milestones for reductions in the burden of TB disease have been set as part of the Sustainable Development Goals (SDGs) and WHO's End TB Strategy. SDG 3 includes a target to end the global TB epidemic by 2030. The End TB Strategy includes targets of a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate (new and relapse cases per 100 000 population per year) between 2015 and 2030, with 2020 milestones of a 35% reduction in TB deaths and a 20% reduction in TB incidence rates.

Currently, the world as a whole, most WHO regions and many high TB burden countries are not on track to reach the 2020 milestones of the End TB Strategy.

Globally, the average rate of decline in the TB incidence rate was 1.6% per year in the period 2000–2018, and 2.0% between 2017 and 2018. The cumulative reduction between 2015 and 2018 was only 6.3%. The global reduction in the number of TB deaths between 2015 and 2018 was 11%.

The WHO European Region is on track to achieve the 2020 milestones; between 2015 and 2018 the cumulative reduction in the incidence rate was 15% and the number of TB deaths fell by 24%. Incidence and deaths are also falling relatively fast in the WHO African Region (4.1% and 5.6%, respectively, per year), with cumulative reductions of 12% for incidence and 16% for deaths between 2015 and 2018. Seven high TB burden countries are on track to achieve the 2020 milestones for both incidence and deaths: Kenya, Lesotho, Myanmar, the Russian Federation, South Africa, the United Republic of Tanzania and Zimbabwe.

Faster reductions in TB incidence and deaths require improvements in access to diagnosis and care within the context of progress towards universal health coverage, action on broader determinants of TB incidence (e.g. levels of undernutrition, poverty, smoking and diabetes) and a new treatment or vaccine to substantially lower the risk of developing TB in people who have a latent TB infection.

The burden of drug-resistant TB is of major interest and concern at global, regional and country levels. In 2018, there were approximately half a million (range, 417 000–556 000) new cases of rifampicin-resistant TB (of which 78% had multidrug-resistant TB). The three countries with the largest share of the global burden were India (27%), China (14%) and the Russian Federation (9%). Globally, 3.4% of new TB cases and 18% of previously treated cases had MDR/RR-TB, with the highest proportions (>50% in previously treated cases) in countries of the former Soviet Union.

Sources of data to inform estimates of TB disease burden have improved considerably in recent years. Two recent examples are repeat national TB prevalence surveys in Myanmar and Viet Nam, which showed impressive reductions over a 10-year period. Nonetheless, improvements are still needed, especially in the availability of data to reliably track TB mortality in the WHO African Region.

[a] When an HIV-positive person dies from TB disease, the underlying cause is classified as HIV in the international classification of diseases system (10th edition).

Global targets and milestones for reductions in the burden of tuberculosis (TB) disease have been set as part of the Sustainable Development Goals (SDGs) and the World Health Organization's (WHO's) End TB Strategy (**Chapter 2**) *(1)*. SDG 3 includes a target to end the global TB epidemic by 2030, with the TB incidence rate (new and relapse cases per 100 000 population per year) defined as the indicator for measurement of progress. The 2030 targets set in the End TB Strategy are a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate, compared with levels in 2015. The End TB Strategy has also set targets for 2035 and milestones for 2020 and 2025 (**Table 3.1**).

TABLE 3.1

Targets for percentage reductions in TB disease burden set in WHO's End TB Strategy

	MILESTONES		TARGETS	
INDICATORS	2020	2025	2030	2035
Percentage reduction in the absolute number of TB deaths per year *(compared with 2015 baseline)*	35%	75%	90%	95%
Percentage reduction in the TB incidence rate (new and relapse cases per 100 000 population per year) *(compared with 2015 baseline)*	20%	50%	80%	90%

The first two sections of this chapter present and discuss estimates of TB incidence (**Section 3.1**) and TB mortality (**Section 3.2**) at global, regional and country levels for the period 2000–2018. This includes disaggregation by age and sex. With estimates for TB incidence and mortality now available for 2016–2018 as well as the baseline year of 2015, specific attention is given to the status of progress towards the 2020 milestones of the End TB Strategy; that is, a 35% reduction in the absolute number of TB deaths and a 20% reduction in the TB incidence rate compared with levels in 2015 (**Table 3.1**).

The burden of drug-resistant TB is of major interest and concern at global, regional and country levels. **Section 3.3** provides an overview of the data available to estimate this burden, along with estimates of the number of cases and deaths that occurred in 2018 and an analysis of recent trends in selected countries.

In many high TB burden countries, a national TB prevalence survey currently offers the best method for directly measuring the number of TB cases (and their distribution by age and sex). **Section 3.4** describes the latest status of progress in implementing such surveys and provides a synthesis of key findings. Results from two recent repeat surveys in Myanmar and Viet Nam, which showed impressive reductions in disease burden over a period of 10 years, are highlighted.

WHO updates its estimates of the burden of TB disease annually,[1] using the latest available data and analytical methods. Since 2006, concerted efforts have been made to improve the available data and methods used for estimations, under the umbrella of the WHO Global Task Force on TB Impact Measurement (**Box 3.1**). A summary of the main updates to available data and methods since the 2018 global TB report *(2)* is provided in **Box 3.2**, and full details about methods are provided in an online technical appendix.[2]

For broader context, **Box 3.3** provides a high-level comparison of burden estimates for TB published by WHO and the Institute of Health Metrics and Evaluation (IHME) at the University of Washington, United States of America. **Box 3.3** also provides a short commentary on annual updates for TB, including how these compare with regular updates published for other diseases.

3.1 TB incidence

3.1.1 Methods to estimate TB incidence

TB incidence has never been directly measured at national level because it requires a long-term study that enrols and follows up with hundreds of thousands of people, which would involve (prohibitively) high costs and challenging logistics. However, notifications of TB cases provide a good proxy indication of TB incidence in countries that have high-performance surveillance systems (e.g. with little underreporting of diagnosed cases), and in which the quality of and access to health care means that few cases are not diagnosed.

The ultimate goal is to directly measure TB incidence and monitor trends from TB notifications in all countries. This requires a combination of strengthened surveillance, better quantification of underreporting (i.e. the number of cases that are missed by surveillance systems)[3] and universal health coverage (UHC). A TB surveillance checklist developed by the WHO Global Task Force on TB Impact Measurement (**Box 3.1**) defines the standards that need to be met for notification data to provide a direct measure of TB incidence and for national vital registration (VR) data to provide a direct measure of TB mortality *(3)*.[4] Between January 2016 and August 2019, 60 countries, including 27 of the 30 high TB burden countries (listed in **Table 3.2**), used the checklist to assess the performance of their national TB notification and VR systems and to identify weaknesses that needed to be addressed (**Fig. 3.1** and **Table 3.2**). Common recommen-

[1] The updates can affect the entire time series back to 2000. Therefore, estimates presented in this chapter for 2000–2017 supersede those of previous reports, and direct comparisons (e.g. between the 2017 estimates in this report and the 2017 estimates in the previous report) are not appropriate.

[2] The **online technical appendix** is available at http://www.who.int/tb/data.

[3] Inventory studies can be used to measure the number of cases that are diagnosed but not reported. For a guide to inventory studies, see WHO (2019) *(4)*.

[4] One of the standards is that levels of underreporting of detected TB cases should be minimal.

BOX 3.1

The WHO Global Task Force on TB Impact Measurement

Establishment and progress made, 2006–2015

The WHO Global Task Force on TB Impact Measurement (the Task Force) was established in 2006 and is convened by the TB Monitoring and Evaluation unit of WHO's Global TB Programme. The original aim of the Task Force was to ensure a rigorous, robust and consensus-based assessment of whether 2015 targets set in the context of the Millennium Development Goals (MDGs) were achieved at global, regional and country levels. The Task Force pursued three strategic areas of work:

- strengthening routine surveillance of TB cases (via national notification systems) and TB deaths (via national vital registration [VR] systems) in all countries;
- undertaking national TB prevalence surveys in 22 global focus countries; and
- periodically reviewing methods used to produce TB disease burden estimates.

Work on strengthened surveillance included the following:

- Development of a TB surveillance checklist of standards and benchmarks (with 10 core standards and three supplementary ones) *(3)*. This checklist can be used to systematically assess the extent to which a surveillance system meets the standards required for notification and VR data to provide a direct measurement of TB incidence and mortality, respectively.
- Electronic recording and reporting. Case-based electronic databases are the reference standard for recording and reporting TB surveillance data. A guide to their design and implementation was produced in 2011 *(5)*.
- Development of a guide on inventory studies to measure underreporting of detected TB cases *(4)*, and support of such studies in priority countries. An inventory study can be used to quantify the number of cases that are detected but not reported to national surveillance systems, and can serve as a basis for improving estimates of TB incidence and addressing gaps in reporting.
- Expanded use of data from VR systems and mortality surveys to produce estimates of the number of TB deaths, and contributions to wider efforts to promote VR systems.

There was substantial success in the implementation of national TB prevalence surveys in the period 2007–2015 (**Section 3.4**). A Task Force subgroup undertook two major reviews of methods used to produce TB disease burden estimates (the first in 2008–2009 and the second in 2015). The latter achieved consensus on methods to be used for the assessment of 2015 targets published in WHO's 2015 global TB report *(6)*.

Updated strategic areas of work, 2016–2020

In the context of a new era of the SDGs and WHO's End TB Strategy, the Task Force met in April 2016 to review and reshape its mandate and strategic areas of work for the post-2015 era. An updated mandate and five strategic areas of work for the period 2016–2020 were agreed *(7)*.

The updated mandate is as follows:

- To ensure that assessments of progress towards End TB Strategy and SDG targets and milestones at global, regional and country levels are as rigorous, robust and consensus-based as possible.
- To guide, promote and support the analysis and use of TB data for policy, planning and programmatic action.

The five strategic areas of work are as follows:

1. Strengthening of national notification systems for direct measurement of TB cases, including drug-resistant TB and HIV-associated TB specifically.
2. Strengthening of national VR systems for direct measurement of TB deaths.
3. Priority studies to periodically measure TB disease burden, including surveys on:
   a. national TB prevalence;
   b. drug resistance;
   c. mortality; and
   d. costs faced by TB patients and their households.
4. Periodic review of methods used by WHO to estimate the burden of TB disease and latent TB infection.
5. Analysis and use of TB data at country level, including:
   a. disaggregated analyses (e.g. by age, sex and location) to assess inequalities and equity;
   b. projections of disease burden; and
   c. guidance, tools and capacity-building.

The SDG and End TB Strategy targets and milestones referred to in the mandate are the targets (2030, 2035) and milestones (2020, 2025) set for the three high-level indicators; that is, TB incidence, the number of TB deaths and the percentage of TB-affected households that face catastrophic costs as a result of TB disease (**Chapter 2**).

Strategic areas of work 1–3 are focused 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 surveillance and surveys as much as possible (as opposed to indirect estimates based on modelling and expert opinion). However, strategic area of work 4 remains necessary because indirect estimates will be required until all countries have the surveillance systems or the periodic studies required to provide direct measurements. Strategic area of work 5 recognizes the importance of analysing and using TB data at country level (as well as generating data, as in strategic areas of work 1–3), including the disaggregated analyses that are now given much greater attention in the SDGs and End TB Strategy.

In the years up to 2020, the top priorities for the Task Force are strengthening of national notification and VR systems as the basis for direct measurement of TB incidence and TB mortality. The global status of progress in using the WHO TB surveillance checklist to assess the performance of notification and VR systems is shown in **Fig. 3.1**. The status of progress in implementing case-based electronic surveillance is discussed in **Chapter 4**. The global status of progress in implementation of inventory studies is shown in **Fig. 3.1**. The number of countries for which VR data are used to estimate the number of TB deaths is shown in **Fig. 3.13**.

Further details about the work of the Task Force are available online *(8)*; an up-to-date summary is provided in the latest brochure about its work *(9)*.

BOX 3.2

Updates to estimates of TB disease burden in this report and anticipated updates

Updates in this report

Estimates of TB incidence and mortality in this report cover the period 2000–2018. Estimates of incidence and mortality for drug-resistant TB are for 2018. The main country-specific updates in this report are for estimates of TB incidence in Viet Nam (Box 3.6) and Myanmar (Box 3.7).

1. Drug-resistant TB

Between August 2018 and August 2019, new data on levels of drug resistance were reported for the following countries:

First-ever national anti-TB drug resistance survey completed in 2017–2019: Cameroon (2017), Eritrea (2018), Indonesia (2018), Lao People's Democratic Republic (2018), Togo (2018).

Repeat national anti-TB drug resistance survey completed in 2017–2019: Bangladesh (2019), Cambodia (2018), Eswatini (2018), the Philippines (2019), Sri Lanka (2018), Tajikistan (2017), Thailand (2018), Turkmenistan (2018), the United Republic of Tanzania (2018).

Transition from having no quality-approved surveillance data to having quality-approved surveillance data for anti-TB drug resistance in 2017–2019: Greenland, Guyana, Kiribati, Micronesia (Federated States of), Saint Kitts and Nevis, Tonga, Trinidad and Tobago, Tuvalu.

Transition from relying on survey data to approved quality-approved surveillance data for anti-TB drug resistance in 2017–2019: Armenia, Azerbaijan, Costa Rica, Egypt, Ethiopia, Ghana, Mongolia, Myanmar, Namibia, Rwanda, Uganda, Uzbekistan, Viet Nam, Zambia, Zimbabwe.

The estimated incidence of RR-TB in 2018 is based on the following formula:

$$I_{rr} = I[(1-f)p_n((1-r) + r\rho) + fp_r]$$

where I is overall TB incidence, I_{rr} is the incidence of rifampicin resistance, f is the cumulative risk for incident cases to receive a non-relapse retreatment (following treatment failure or return after default), r is the proportion of relapses, ρ is the relative risk ratio in relapses compared with first episodes of TB, and p_n and p_r denote the proportion of rifampicin-resistant cases among previously untreated and previously treated patients, respectively.

Improvements in the estimation of ρ were implemented in March 2019 and reflected in the publication of updated estimates online. The main consequence was lower estimates of the incidence of MDR/RR-TB in countries in which there is a relatively small difference between the prevalence of rifampicin resistance in new cases and the prevalence of rifampicin resistance in previously treated cases. In turn, these country updates had an impact on the global estimate, and explain why the global estimate in this report has been revised downwards (by about 10%) compared with that published in the 2018 global TB report *(2)*. Estimates in this report are consistent with the updated estimates that were incorporated in online datasets in March 2019 (http://www.who.int/tb/data).

2. Newly reported data and updated estimates from other agencies

New cause-of-death data from national VR systems were reported to WHO between mid-2017 and mid-2018. Several countries reported historical data that were previously missing, or made corrections to previously reported data. In total, 1986 country-year data points from the WHO mortality database were retained for analysis.

Updated estimates of HIV prevalence and mortality were obtained from the Joint United Nations Programme on HIV/AIDS (UNAIDS) in July 2019 *(10)*. In combination with new data from routine HIV testing of people diagnosed with TB, these resulted in revisions to estimates of the number of TB cases and deaths among HIV-positive people for years prior to 2018.

In most instances, any resulting changes to TB burden estimates were well within the uncertainty intervals of previously published estimates, and trends were generally consistent.

For 20 countries (shown in Fig. 3.13), estimates of TB mortality among HIV-negative people were based on estimates published by IHME *(11)*. These estimates use data from national and sample VR systems and from verbal autopsy surveys. Estimates of TB mortality in South Africa are adjusted by IHME for miscoding of deaths caused by HIV and TB. IHME estimates used in this report were slightly adjusted from those published by IHME, to fit WHO estimates of the total number of deaths (i.e. the total mortality envelope). The median country-year envelope ratio (WHO/IHME) was 1.04 (interquartile range: 0.96–1.11) among 380 data points.

3. Findings from national TB epidemiological reviews

Small adjustments to incidence trajectories were made in various countries based on findings from recent national TB epidemiological reviews.

4. Inventory studies

Results from an inventory study to assess underreporting of detected TB cases in China allowed updating of incidence estimates. The change in estimated incidence was relatively small compared with previously published estimates.

5. Estimates of the burden of TB in children

Methods used to derive age-specific incidence were revised to address previous inconsistencies in the estimated gap between incidence and notifications. A fundamental difficulty with estimating childhood TB disease burden is the lack of quality data based on consistent and strict case definitions, particularly in high TB burden countries. Cases are often notified based on inconsistent criteria for childhood TB disease, leading to instances of overreporting, whereas other cases may be diagnosed in paediatric hospitals and not reported to public health authorities, leading to underreporting. The scarcity of nationwide population-based survey data results in great uncertainty in incidence stratified by age group (reflected in large uncertainty bounds), limiting their usefulness for activities related to programme planning and evaluation. Greater priority should be given to the quality

of TB notification data for children, the consistency of case definitions and coverage of reporting. Inventory studies specific to childhood TB would help to improve the quality of TB disease burden estimates for children, and should be prioritized.

Updates anticipated in the near future

Updates to estimates of disease burden are expected towards the end of 2019 or in 2020 for Eswatini, Lesotho, Mozambique, Nepal and South Africa, following the completion of national TB prevalence surveys. Estimates of TB burden in India will be updated once results from a national TB prevalence survey being implemented in 2019–2020 become available. Updates to MDR/RR-TB estimates are expected for Albania, Angola, Burundi, Chad, Ethiopia, Guinea, Haiti, Malawi, Mali, Mozambique, Myanmar, Timor-Leste and Zambia, based on new national surveys.

dations include making or improving the transition from aggregated paper-based recording and reporting of TB cases to electronic case-based surveillance; measuring the level of underreporting and taking corrective actions based on findings; and establishing or strengthening VR systems.

Methods currently used by WHO to estimate TB incidence can be grouped into four major categories (Fig. 3.2), as follows:

- **Results from TB prevalence surveys.** Incidence is estimated using prevalence survey results and estimates of the duration of disease, with the latter derived from a model that accounts for the impact of HIV coinfection and antiretroviral therapy (ART) on the distribution of disease duration.[1] This method is used for 24 countries, of which 23 have national survey data and one – India – has a survey in one state. The 24 countries accounted for 60% of the estimated global number of incident cases in 2018.
- **Notifications adjusted by a standard factor to account for underreporting, overdiagnosis and underdiagnosis.** This method is used for a total of 142 countries: all high-income countries except the Netherlands and the United Kingdom; and selected middle-income countries with low levels of underreporting, including Brazil and the Russian Federation. These 142 countries accounted for 6% of the estimated global number of incident cases in 2018.

[1] Estimation of prevalence from incidence is not straightforward. For example, it requires assumptions about the duration of disease for different categories of case; since prevalence surveys focus on bacteriologically confirmed TB in adults, adjustments to include children and extrapulmonary TB are needed.

BOX 3.3

WHO estimates for TB disease burden in the context of other estimates

Global estimates of TB incidence and mortality published by WHO and IHME are similar. For example, the best estimate for TB incidence in 2017 from IHME (the latest year for which estimates had been published in August 2019) is 10.3 million *(11)*, compared with 10.1 million (range, 9.0–11 million) in 2017 in this report. The best estimate of the number of TB deaths among HIV-negative people in 2017 published by IHME is 1.2 million, compared with 1.3 million (range 1.2–1.4 million) in this report.

There is general consistency in mortality estimates in countries with good-quality VR systems and standard coding of causes of deaths, and in incidence estimates in countries with strong health care and notification systems. Discrepancies are most apparent for countries where the underlying data are weaker, owing to differences in the indirect estimation methods that are used.

When annual updates for TB are published by both WHO and IHME, entire time series (starting in 2000 for WHO and 1990 for IHME) are updated. New information or refinements to methods used to produce estimates can result in changes to the estimates for earlier years given in previous publications. This is an expected feature of disease burden estimation updates, and also occurs with disease burden estimates published for other diseases, such as HIV and malaria. For example, global estimates for 2015 for HIV, malaria and TB published by WHO, UNAIDS and IHME in consecutive years (2015 and 2016) by the same agency have been within about 2–8% of each other. Global estimates of TB disease burden in 2015 published by WHO in this and the previous two global TB reports are within 4–5% of each other.

Country-specific estimates of TB disease burden published by WHO are generally consistent from year to year. In WHO reports published in 2014–2018, updates that have been apparent at global level have been due to updates for three countries: Nigeria (2014 report, following results from the country's first national TB prevalence survey in 2012), Indonesia (2015 report, following completion of a national TB prevalence survey in 2013–2014) and India (2016 report, following accumulation of evidence from both survey and surveillance data).

As the availability and quality of data continue to improve, variability for the same year in consecutive reports will decrease, and estimates published by WHO should converge with those published by other agencies. Ideally, estimates of TB incidence and mortality are based on national notification and VR systems that meet quality and coverage standards.

TABLE 3.2

Sources of data available to inform estimates of TB disease burden in the 30 high TB burden countries, 2000–2018. Green indicates that a source is available, orange indicates it will be available in the near future, and red indicates that a source is not available.

COUNTRY	NOTIFICATION DATA	STANDARDS AND BENCHMARKS ASSESSMENT[a]	NATIONAL INVENTORY STUDY[b]	NATIONAL TB PREVALENCE SURVEY[c]	NATIONAL DRUG RESISTANCE SURVEY[d]	NATIONAL VR DATA OR MORTALITY SURVEY[e]
Angola	2000–2018	2016	–	–	–	–
Bangladesh	2000–2018	2014	–	2015	2011, 2019	–
Brazil	2000–2018	2018	–	NA	2008	2000–2016
Cambodia	2000–2018	2018	–	2002, 2011	2007, 2018	–
Central African Republic	2000–2018	–	–	–	2009	–
China	2000–2018	–	2018	2000, 2010	2007, 2013	2004–2018
Congo	2000–2018	2019	–	–	–	–
DPR Korea	2000–2018	2017	–	2016	2014	–
DR Congo	2000–2018	2017	–	–	2017	–
Ethiopia	2000–2018	2013, 2016	–	2011	2005	–
India	2000–2018	–	2011	–	2016	2000–2014
Indonesia	2000–2018	2013, 2017	2017	2013–2014	2018	2006–2007, 2009–2015
Kenya	2000–2018	2013, 2017	2013	2015	2014	–
Lesotho	2000–2018	2014, 2017	–	–	2014	–
Liberia	2000–2018	2015, 2019	–	–	–	–
Mozambique	2000–2018	2013	–	–	2007	–
Myanmar	2000–2018	2014, 2017	–	2009, 2018	2008, 2013	–
Namibia	2000–2018	2016	–	2017–2018	2008, 2015	–
Nigeria	2000–2018	2013, 2017	–	2012	2010	–
Pakistan	2000–2018	2016, 2019	2012, 2016	2011	2013	2006, 2007, 2010
Papua New Guinea	2000–2018	2017	–	–	2014	–
Philippines	2000–2018	2013, 2016	–	2007, 2016	2012, 2019	2000–2011
Russian Federation	2000–2018	2017	–	NA	2016–2018	2000–2018
Sierra Leone	2000–2018	2015	–	–	–	–
South Africa	2000–2018	2015	–	–	2014	2000–2017
Thailand	2000–2018	2013	–	2012	2012, 2018	2000–2016
UR Tanzania	2000–2018	2013, 2018	–	2012	2018	–
Viet Nam	2000–2018	2013, 2019	2017	2007, 2017	2006, 2012	–
Zambia	2000–2018	2014, 2016	–	2014	2000, 2008	–
Zimbabwe	2000–2018	2016, 2019	–	2014	2016	–

[a] The WHO TB surveillance checklist of standards and benchmarks is designed to assess the quality and coverage of notification data (based on 9 core standards) and VR data (1 standard). An assessment is scheduled in Central African Republic in 2019 and a partial assessment has been done in China. If more than two assessments have been done (Pakistan and Zimbabwe), the years of the last two only are shown.

[b] Studies in Philippines, South Africa and United Republic of Tanzania are being implemented in 2019.

[c] Lesotho, Mozambique and South Africa will complete surveys in 2019 and India is scheduled to implement a survey 2019–2020. Brazil and Russian Federation do not meet the criteria recommended by the WHO Global Task Force on TB Impact Measurement for implementing a national TB prevalence survey. The burden of TB disease is too low (making sample sizes prohibitive) and both countries have strong notification and VR systems.

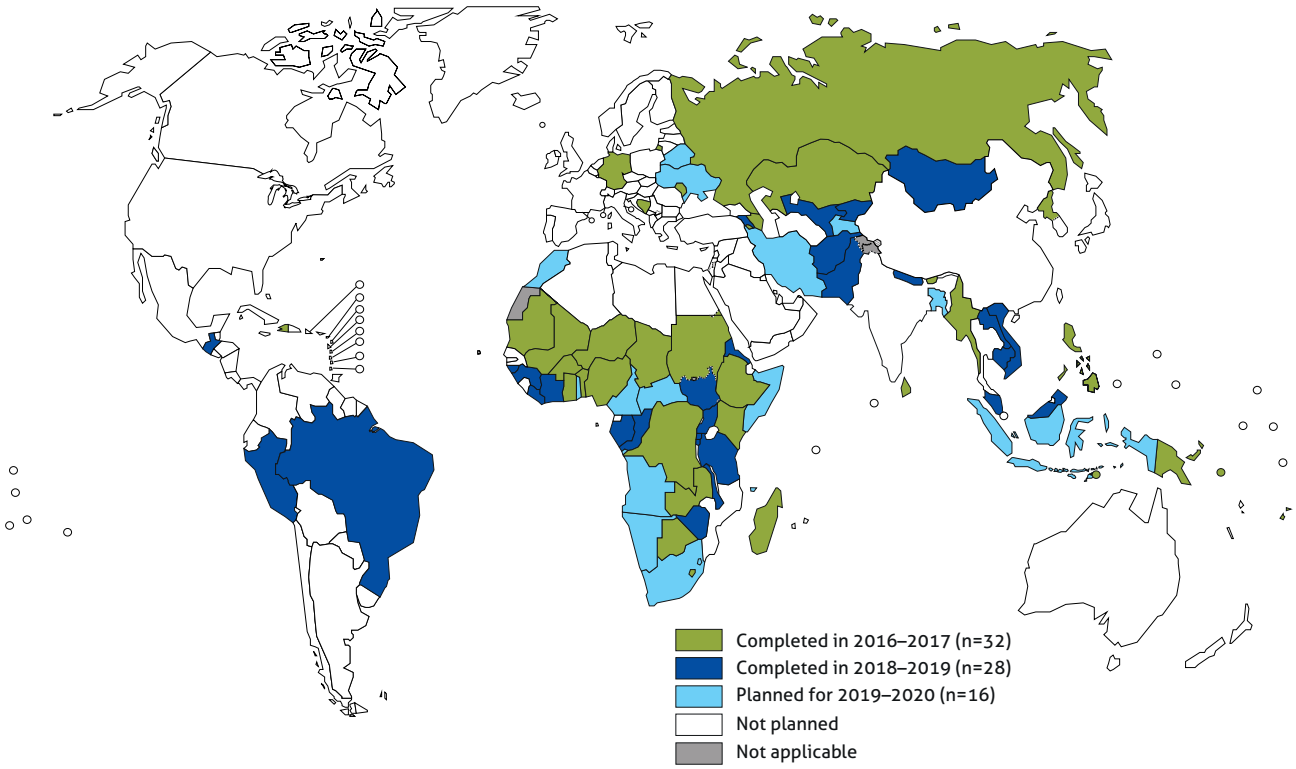
[d] The surveys in Brazil, Central African Republic, Democratic People's Republic of Korea and Papua New Guinea were subnational. Data for Russian Federation are from routine diagnostic testing of cases (as opposed to a national survey). In addition to national survey data, six countries (Ethiopia, Myanmar, Namibia, Viet Nam, Zambia and Zimbabwe) reported surveillance data from routine diagnostic testing for the first time in 2018. If more than two surveys have been done (Cambodia, Thailand, Philippines), the years of the last two only are shown. A survey in Angola is scheduled for 2020.

[e] Years of data availability for India, Indonesia, Pakistan and South Africa were provided to WHO by IHME.

FIG. 3.1

Strengthening national TB surveillance (status in August 2019)

(a) Assessment of the performance of TB surveillance using the WHO checklist of standards and benchmarks since January 2016[a]



[a] 28 of the 60 assessments completed since 2016 were repeat assessments, including 12 in high TB burden countries (details in Table 3.2).

(b) National inventory studies of the underreporting of detected TB cases implemented 2000–2019 or planned

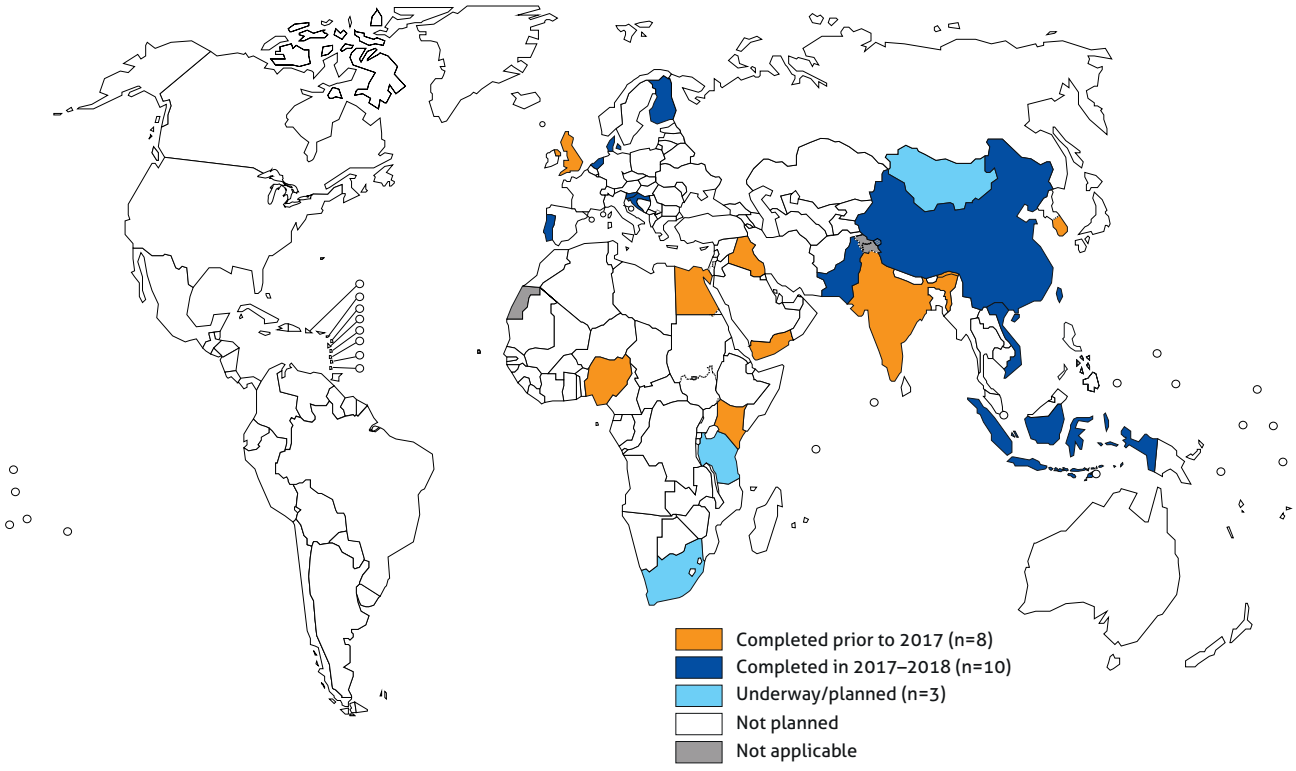
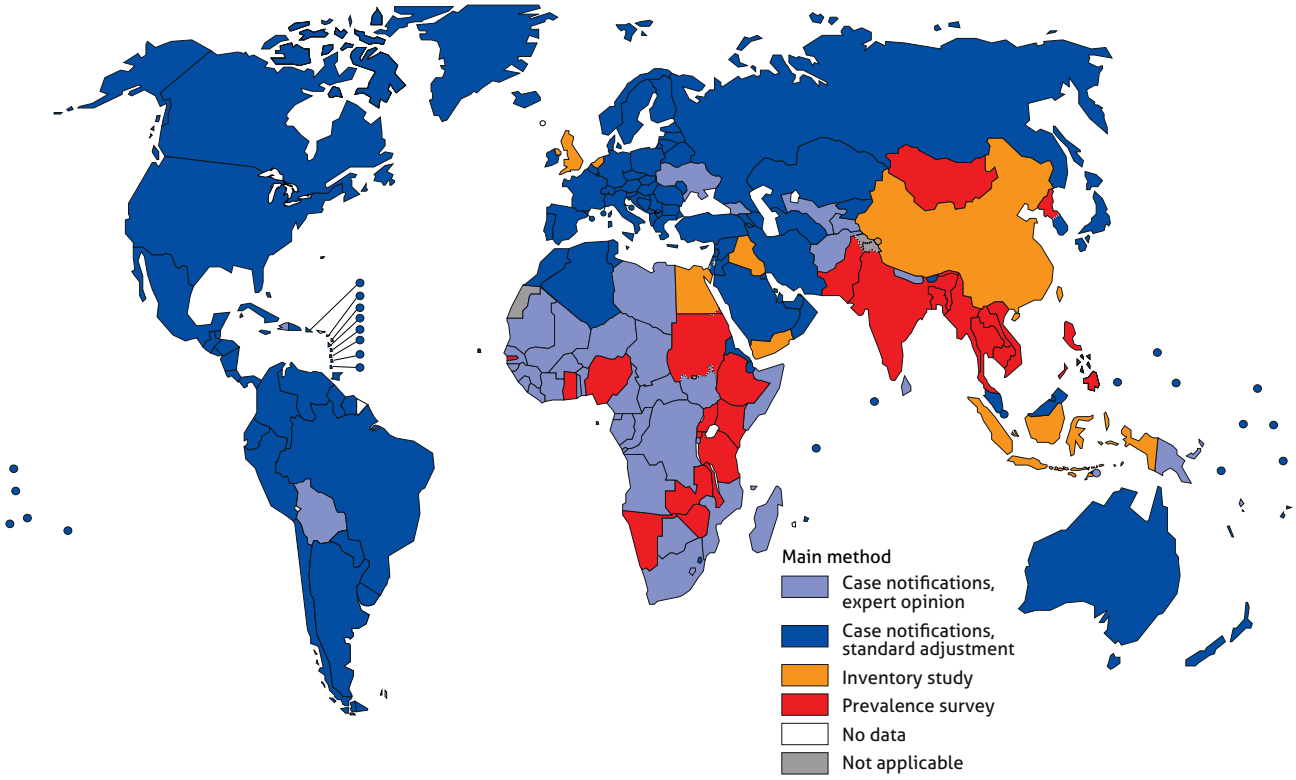


FIG. 3.2

Main methods used to estimate TB incidence



- **Results from national inventory studies that measured the level of underreporting of detected TB cases.** This method is used for seven countries: China, Egypt, Indonesia, Iraq, the Netherlands, the United Kingdom and Yemen. These countries accounted for 18% of the estimated global number of incident cases in 2018.[1]
- **Case notification data combined with expert opinion about case-detection gaps.** Expert opinion, elicited through regional workshops or country missions, is used to estimate levels of underreporting, overdiagnosis and underdiagnosis. Trends are estimated through mortality data, surveys of the annual risk of infection or exponential interpolation using estimates of case-detection gaps for 3 years. In this report, this method is used for 43 countries that accounted for 16% of the estimated global number of incident cases in 2018.

Of the four methods, the last one is the least preferred and it is relied on only if none of the other three methods can be used. As explained in **Box 3.1**, the underlying principle for the WHO Global Task Force on TB Impact Measurement since its establishment in 2006 has been that, as far as possible, estimates of the level of and trends in TB disease burden should be based on direct measurements from routine surveillance and surveys, as opposed to indirect estimates that rely on modelling and expert opinion. Sources of data available to estimate the burden of TB disease in the 30 high TB burden countries are summarized in **Table 3.2**.

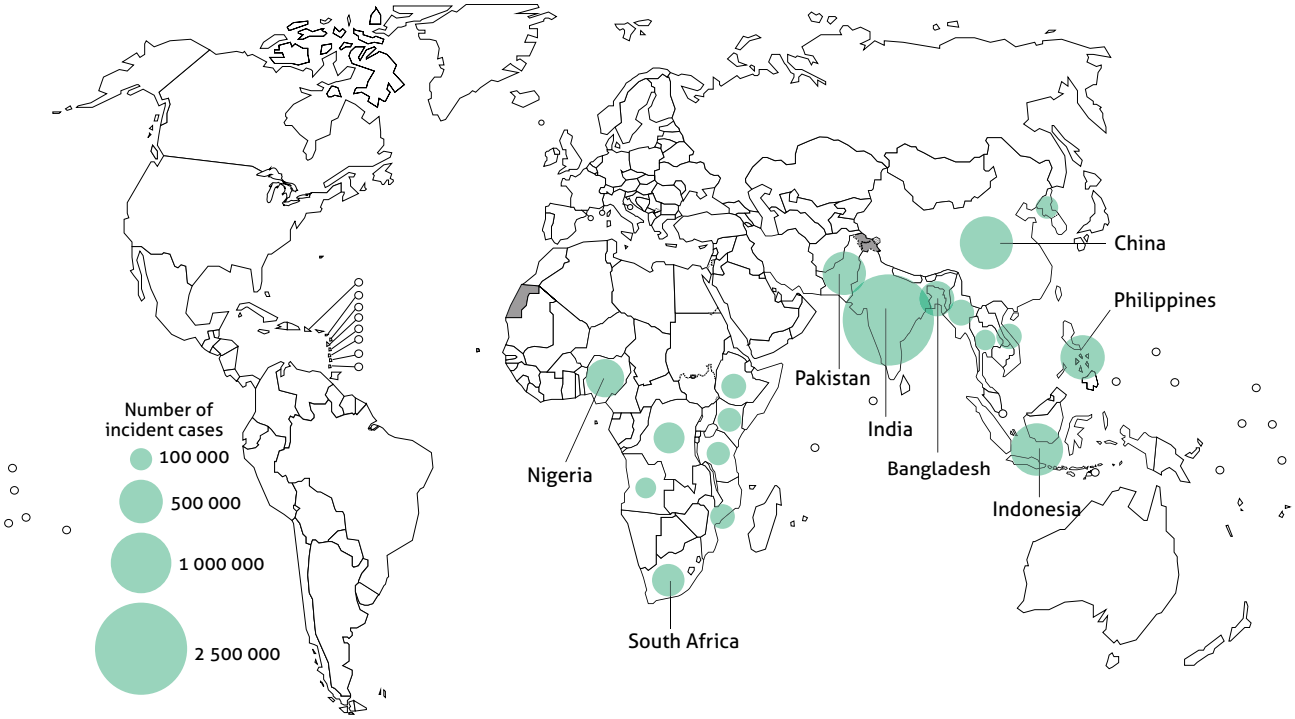
Estimates of TB incidence in children (aged <15 years) are based on dynamic modelling *(12)*. Results for the 0–14 year age group (0–4 and 5–14 years) in each country are further disaggregated using outputs from an established deterministic model *(12)*, followed by disaggregation by sex using results from a meta-analysis of the male to female (M:F) notification ratio.

Estimates of TB incidence in adults are derived by first subtracting incidence in children from incidence in all ages. The estimates for adults are then disaggre-

[1] The studies in Egypt, Indonesia, Iraq, the Netherlands, the United Kingdom and Yemen included use of capture–recapture modelling to estimate incidence. This approach is possible if six assumptions are met: (i) all cases are observable; (ii) the proportion of mismatches and matching failures in record-linkage is low, which typically requires a large sampling fraction; (iii) there is a closed population during the study period (typically 3–6 months); (iv) if S represents the number of case lists or data sources available, then at least three data sources are available (S≥3) and their dependencies are accounted for in the model design, while the full S-way interaction between sources is assumed null; (v) there is homogeneity of within-source observation probabilities across subpopulation groups, such as those defined by socioeconomic and demographic characteristics; (vi) the case definitions across data sources are consistent. Few high TB burden countries are expected to be able to implement inventory studies that will meet these six assumptions to a sufficient degree.

FIG. 3.3

Estimated TB incidence in 2018, for countries with at least 100 000 incident cases



gated into six age groups (15–24, 25–34, 35–44, 45–54, 55–64 and ≥65 years) using data from national TB prevalence surveys implemented in 2007–2018 (**Section 3.4**). Country-specific distributions are used for countries that have implemented a survey; for other countries, the age distribution is predicted using prevalence survey data. Disaggregation by sex is based on actual M:F ratios for countries that have implemented surveys; for other countries, this disaggregation is based on regional M:F ratios from a systematic review and meta-analysis *(7)*.

3.1.2 Estimates of TB incidence in 2018

Globally in 2018, an estimated 10.0 million (range, 9.0–11.1 million) people fell ill with TB,[1] equivalent to 132 cases (range, 118–146) per 100 000 population. Estimates of absolute numbers are shown in **Table 3.3** and estimates of rates per capita are shown in **Table 3.4**.

Most of the estimated number of cases in 2018 occurred in the WHO South-East Asia Region (44%), African Region (24%) and Western Pacific Region (18%); smaller proportions of cases occurred in the WHO Eastern Mediterranean Region (8.1%), Region of the Americas (2.9%) and European Region (2.6%).[2]

The 30 high TB burden countries[3] accounted for 87% of all estimated incident cases worldwide, and eight of these countries accounted for two thirds of the global total: India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%) and South Africa (3%) (**Fig. 3.3**).

The severity of national TB epidemics in terms of the annual number of incident TB cases relative to population size (the incidence rate) varied widely among countries in 2018 (**Fig. 3.4** and **Table 3.4**). There were under 10 incident cases per 100 000 population in most high-income countries, 150–400 in most of the 30 high TB burden countries and above 500 in the Central African Republic, the Democratic People's Republic of Korea, Lesotho, Mozambique, Namibia, the Philippines and South Africa. Among the 30 high TB burden countries, there were three with markedly lower incidence rates per capita: Brazil, China and the Russian Federation, which had best estimates of 45, 61 and 54, respectively.

An estimated 8.6% (range, 7.4–10%) of the incident TB cases in 2018 were among people living with HIV (**Table 3.3** and **Table 3.4**). The proportion of TB cases coinfected with HIV was highest in countries in the WHO African Region, exceeding 50% in parts of southern Africa (**Fig. 3.5**). The risk of developing TB in the 37 million

[1] Here and elsewhere in the report, "range" refers to the 95% uncertainty interval.

[2] Numbers do not sum to exactly 100 owing to rounding.

[3] These countries are listed in **Table 3.2**, **Table 3.3** and **Table 3.4**. For an explanation of how the list of 30 high TB burden countries was defined, see **Chapter 2**.

TABLE 3.3

Estimated epidemiological burden of TB in 2018 for 30 high TB burden countries, WHO regions and globally. Number in thousands.[a]

		TOTAL TB INCIDENCE		HIV-POSITIVE TB INCIDENCE		HIV-NEGATIVE TB MORTALITY		HIV-POSITIVE TB MORTALITY[b]	
	POPULATION	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Angola	31 000	109	71–156	11	6.8–15	19	11–28	3.7	2.4–5.3
Bangladesh	161 000	357	260–469	0.73	0.36–1.2	47	30–67	0.19	0.094–0.32
Brazil	209 000	95	81–110	11	9.3–13	4.8	4.6–5.0	1.9	1.4–2.4
Cambodia	16 000	49	27–77	1.1	0.59–1.7	3.0	1.9–4.3	0.38	0.21–0.60
Central African Republic	5 000	25	16–36	6.6	4.2–9.4	4.8	2.8–7.3	3.1	2.0–4.5
China	1 430 000	866	740–1 000	18	9.8–28	37	34–41	2.4	1.2–4.0
Congo	5 000	20	12–28	5.7	2.9–9.4	3.0	1.7–4.6	2.3	1.2–3.8
DPR Korea	26 000	131	114–149	0.22	0.12–0.36	20	14–27	0.068	0.035–0.11
DR Congo	84 000	270	175–385	31	9.4–65	43	25–65	10	3.2–22
Ethiopia	109 000	165	116–223	7.6	5.3–10	24	15–36	2.2	1.5–3.0
India[c]	1 350 000	2 690	1 840–3 700	92	63–126	440	408–472	9.7	5.7–15
Indonesia	268 000	845	770–923	21	8.9–38	93	87–99	5.3	2.1–9.8
Kenya	51 000	150	92–222	40	25–60	19	11–30	13	8.1–20
Lesotho[d]	2 000	13	8.3–18	8.4	5.4–12	0.95	0.56–1.4	3.3	2.1–4.7
Liberia	5 000	15	9.6–21	2.6	1.7–3.7	2.7	1.6–4.1	1.0	0.67–1.5
Mozambique[d]	29 000	162	105–232	58	38–83	21	13–32	22	14–31
Myanmar	54 000	181	119–256	15	10–22	21	12–31	3.7	2.5–5.2
Namibia	2 000	13	9.2–17	4.5	3.2–5.9	1.6	1.0–2.3	1.5	1.1–2.1
Nigeria	196 000	429	280–609	53	34–75	125	73–192	32	20–47
Pakistan	212 000	562	399–754	3.8	2.5–5.4	43	35–52	1.3	0.83–1.8
Papua New Guinea	9 000	37	30–45	2.7	2.2–3.3	4.5	3.0–6.2	0.25	0.10–0.45
Philippines	107 000	591	332–924	10	4.1–19	26	22–30	0.60	<0.01–4.2
Russian Federation	146 000	79	51–112	16	10–22	9.2	8.3–10	1.3	0.57–2.2
Sierra Leone	8 000	23	15–33	2.9	1.9–4.2	2.6	1.5–3.9	0.70	0.44–1.0
South Africa[d]	58 000	301	215–400	177	127–235	21	20–23	42	30–57
Thailand	69 000	106	81–136	11	8.2–14	9.2	6.9–12	2.3	1.7–3.0
UR Tanzania	56 000	142	67–245	40	19–69	22	10–40	16	7.8–27
Viet Nam	96 000	174	111–251	6.0	3.8–8.6	11	6.7–15	2.2	1.4–3.2
Zambia	17 000	60	39–86	36	23–51	4.8	2.9–7.3	13	8.3–19
Zimbabwe	14 000	30	22–39	19	14–24	1.1	0.69–1.7	3.5	2.4–4.8
High TB burden countries	**4 830 000**	**8 690**	**7 670–9 770**	**709**	**626–797**	**1 080**	**1 010–1 170**	**201**	**175–229**
Africa	1 060 000	2 450	2 190–2 730	615	539–697	397	331–468	211	184–239
The Americas	1 000 000	289	268–310	29	27–31	17	16–19	5.9	5.2–6.6
Eastern Mediterranean	704 000	810	639–1 000	6.9	5.3–8.8	77	66–89	2.2	1.6–2.8
Europe	927 000	259	225–296	30	23–37	23	22–24	4.4	3.3–5.6
South-East Asia	1 980 000	4 370	3 480–5 370	140	107–178	637	598–677	21	16–28
Western Pacific	1 920 000	1 840	1 520–2 180	41	30–54	90	83–98	6.5	4.9–8.4
GLOBAL	**7 600 000**	**10 000**	**8 990–11 100**	**862**	**776–952**	**1 240**	**1 160–1 320**	**251**	**224–280**

Population estimates were obtained from the United Nations 2019 Revision of World Population Prospects as prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. (https://population.un.org/wpp/, accessed 13 August 2019)

[a] Numbers shown to two significant figures if under 100 and to three significant figures otherwise.

[b] Deaths among HIV-positive TB cases are classified as HIV deaths according to ICD-10.

[c] Estimates of TB incidence and mortality for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.

[d] Estimates of TB incidence and mortality for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

TABLE 3.4

Estimated epidemiological burden of TB in 2018 for 30 high TB burden countries, WHO regions and globally. Rates per 100 000 population.

	TOTAL TB INCIDENCE		HIV PREVALENCE IN INCIDENT TB (%)		HIV-NEGATIVE TB MORTALITY		HIV-POSITIVE TB MORTALITY[a]	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Angola	355	230–507	9.6	9.4–9.8	60	36–91	12	7.9–17
Bangladesh	221	161–291	0.20	0.11–0.32	29	18–42	0.12	0.058–0.20
Brazil	45	39–52	11	11–12	2.3	2.2–2.4	0.88	0.66–1.1
Cambodia	302	169–473	2.1	2.0–2.3	18	12–26	2.3	1.3–3.7
Central African Republic	540	349–771	26	25–27	103	60–157	67	42–97
China	61	52–70	2.0	1.2–3.2	2.6	2.4–2.9	0.17	0.083–0.28
Congo	375	238–543	29	18–41	57	32–89	43	22–72
DPR Korea	513	446–584	0.17	0.093–0.27	80	56–107	0.27	0.14–0.44
DR Congo	321	208–458	11	3.9–22	51	30–77	12	3.8–26
Ethiopia	151	107–204	4.6	4.5–4.7	22	14–33	2.0	1.4–2.8
India[b]	199	136–273	3.4	3.4–3.4	32	30–35	0.72	0.42–1.1
Indonesia	316	288–345	2.5	1.1–4.5	35	33–37	2.0	0.79–3.7
Kenya	292	179–432	27	27–27	38	22–59	26	16–38
Lesotho[c]	611	395–872	65	64–66	45	27–68	155	98–223
Liberia	308	199–440	17	16–18	56	33–85	22	14–31
Mozambique[c]	551	356–787	36	35–36	72	43–109	73	46–106
Myanmar	338	222–477	8.5	8.4–8.7	39	23–58	6.9	4.6–9.7
Namibia	524	375–697	35	34–36	64	41–92	62	43–85
Nigeria	219	143–311	12	12–12	64	37–98	16	10–24
Pakistan	265	188–355	0.68	0.55–0.82	20	16–25	0.60	0.39–0.86
Papua New Guinea	432	352–521	7.3	7.0–7.6	52	35–72	2.8	1.2–5.2
Philippines	554	311–866	1.7	0.94–2.7	24	20–28	0.57	<0.01–4.0
Russian Federation	54	35–77	20	20–20	6.3	5.7–7.0	0.86	0.39–1.5
Sierra Leone	298	191–427	13	12–13	33	20–51	9.2	5.8–13
South Africa[c]	520	373–691	59	59–59	37	35–39	73	51–99
Thailand	153	116–195	10	9.9–10	13	9.9–17	3.3	2.4–4.4
UR Tanzania	253	119–435	28	28–28	40	18–70	29	14–49
Viet Nam	182	116–263	3.4	3.3–3.5	11	7.0–16	2.3	1.5–3.4
Zambia	346	225–493	59	59–60	28	16–42	74	48–107
Zimbabwe	210	155–272	62	61–63	7.7	4.8–11	24	16–33
High TB burden countries	180	159–202	8.2	7.1–9.3	22	21–24	4.2	3.6–4.8
Africa	231	206–257	25	23–27	37	31–44	20	17–22
Americas	29	27–31	10	7.7–13	1.7	1.6–1.8	0.59	0.52–0.66
Eastern Mediterranean	115	91–142	0.86	0.36–1.6	11	9.4–13	0.31	0.23–0.40
Europe	28	24–32	12	7.5–16	2.5	2.4–2.6	0.47	0.36–0.60
South-East Asia	220	175–271	3.2	2.4–4.1	32	30–34	1.1	0.79–1.4
Western Pacific	96	79–114	2.2	1.2–3.5	4.7	4.3–5.1	0.34	0.25–0.43
GLOBAL	132	118–146	8.6	7.4–9.9	16	15–17	3.3	2.9–3.7

[a] Deaths among HIV-positive TB cases are classified as HIV deaths according to ICD-10.
[b] Estimates of TB incidence and mortality for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[c] Estimates of TB incidence and mortality for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

FIG. 3.4

Estimated TB incidence rates, 2018

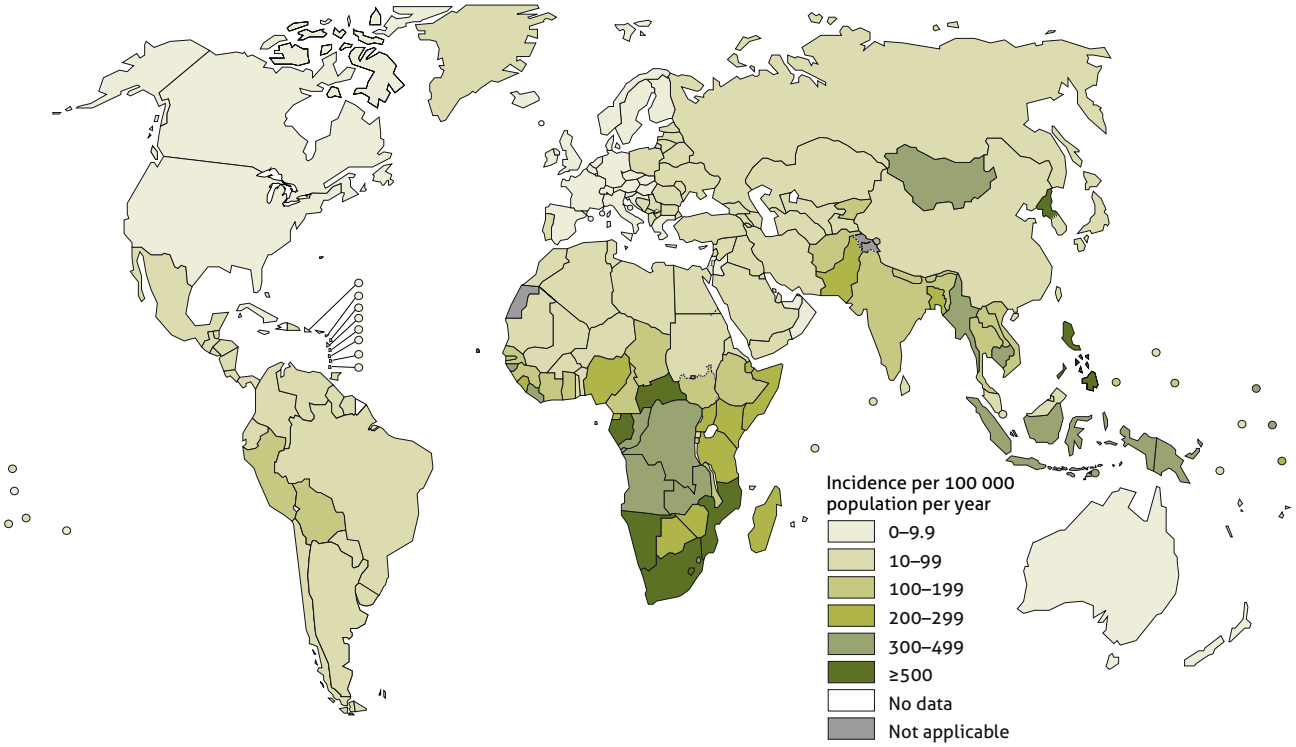


FIG. 3.5

Estimated HIV prevalence in new and relapse TB cases, 2018

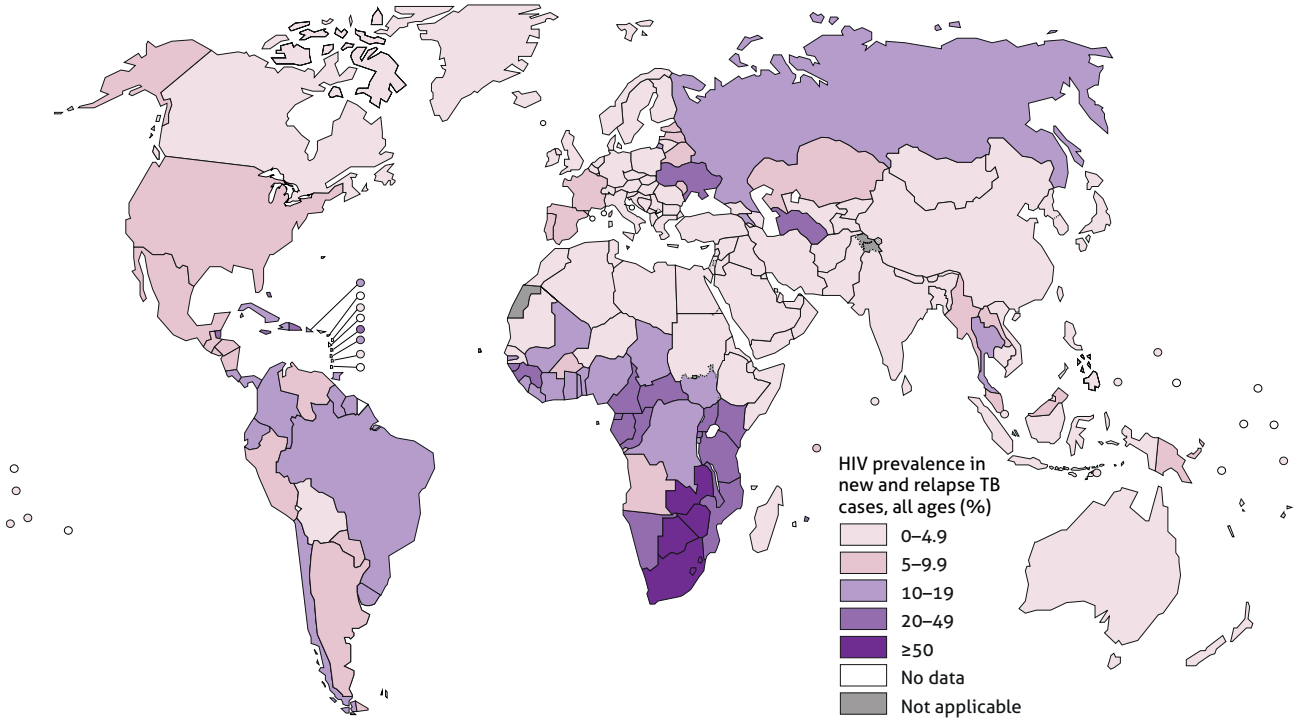


TABLE 3.5

Estimated incidence and mortality due to *M. bovis* TB,[a] 2018

WHO REGION	INCIDENT CASES		DEATHS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	69 800	18 800–154 000	9 100	2 410–20 200
The Americas	821	222–1 800	44	12–97
Eastern Mediterranean	7 940	2 050–17 700	655	174–1 450
Europe	1 150	308–2 550	91	25–200
South-East Asia	44 800	11 500–100 000	2 110	571–4 620
Western Pacific	18 600	4 900–41 300	310	84–681
GLOBAL	**143 000**	**71 200–240 000**	**12 300**	**4 820–23 300**

[a] Numbers shown to two significant figures if under 100 and to three significant figures otherwise.

people living with HIV was 19 (range, 15–22) times higher than the risk in the rest of the world population.

An estimated 143 000 (range, 71 000–240 000) new cases of zoonotic TB (caused by *Mycobacterium bovis*) occurred globally in 2018 (Table 3.5). However, only 16 countries reported the detection of *M. bovis* among pulmonary or extrapulmonary TB patients in 2018, of which only one (South Africa) was a high TB burden country. Better detection of cases of zoonotic TB requires greater awareness and expertise among health care providers, strengthened laboratory capacity, and improved access to accurate, rapid diagnostic tools.

3.1.3 TB incidence in 2018 disaggregated by age and sex

Estimates of TB incidence in 2018 disaggregated by age and sex are shown in Fig. 3.6 (global), Fig. 3.7 (WHO regions) and Fig. 3.8 (30 high TB burden countries), and in Table 3.6. People in all age groups are affected by TB but the highest burden is among adult men. They accounted for 57% of all cases in 2018, compared with 32% of cases in adult women and 11% in children.[1] The higher share of TB cases among men is consistent with evidence from prevalence surveys, which show that TB disease affects men more than women, and that gaps in case detection and reporting are higher among men (Section 3.4).

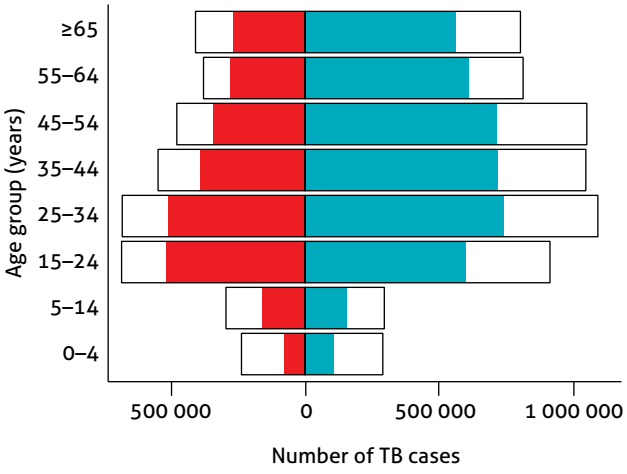
The M:F ratio of incident TB cases for all ages ranged from 1.3 in the WHO Eastern Mediterranean Region to 2.0 in the European and Western Pacific regions. In children, the global M:F ratio was close to 1.

3.1.4 Estimated trends in TB incidence, 2000–2018

Consistent with previous global TB reports, the number of incident cases is falling slowly, in both absolute terms and per capita (Fig. 3.9). Globally, the average rate of decline in the TB incidence rate was 1.6% per year in the period 2000–2018, and 2.0% per year between 2017 and 2018. This is too slow to reach the End TB Strategy milestone of a 20% reduction between 2015 and 2020 (see right panel of Fig. 3.9 and left panel of Fig. 3.10). The cumulative reduction between 2015 and 2018 was 6.3%.

FIG. 3.6

Global estimates of TB incidence (black outline) and case notifications disaggregated by age and sex (female in red; male in turquoise), 2018



Trends and a comparison of progress with the 2020 milestone of the End TB Strategy are shown for the six WHO regions in Fig. 3.11 and for the 30 high TB burden countries in Fig. 3.12.[2]

The fastest regional decline since 2010 has been in the WHO European Region (on average, 5% per year), driven in particular by the Russian Federation (5.4% per year). Incidence has also fallen relatively fast in the WHO African Region (3.8% per year), with particularly impressive reductions of 4–8% per year in several countries in southern Africa, following a peak in the HIV epidemic and the expansion of TB and HIV prevention and care.[3] The

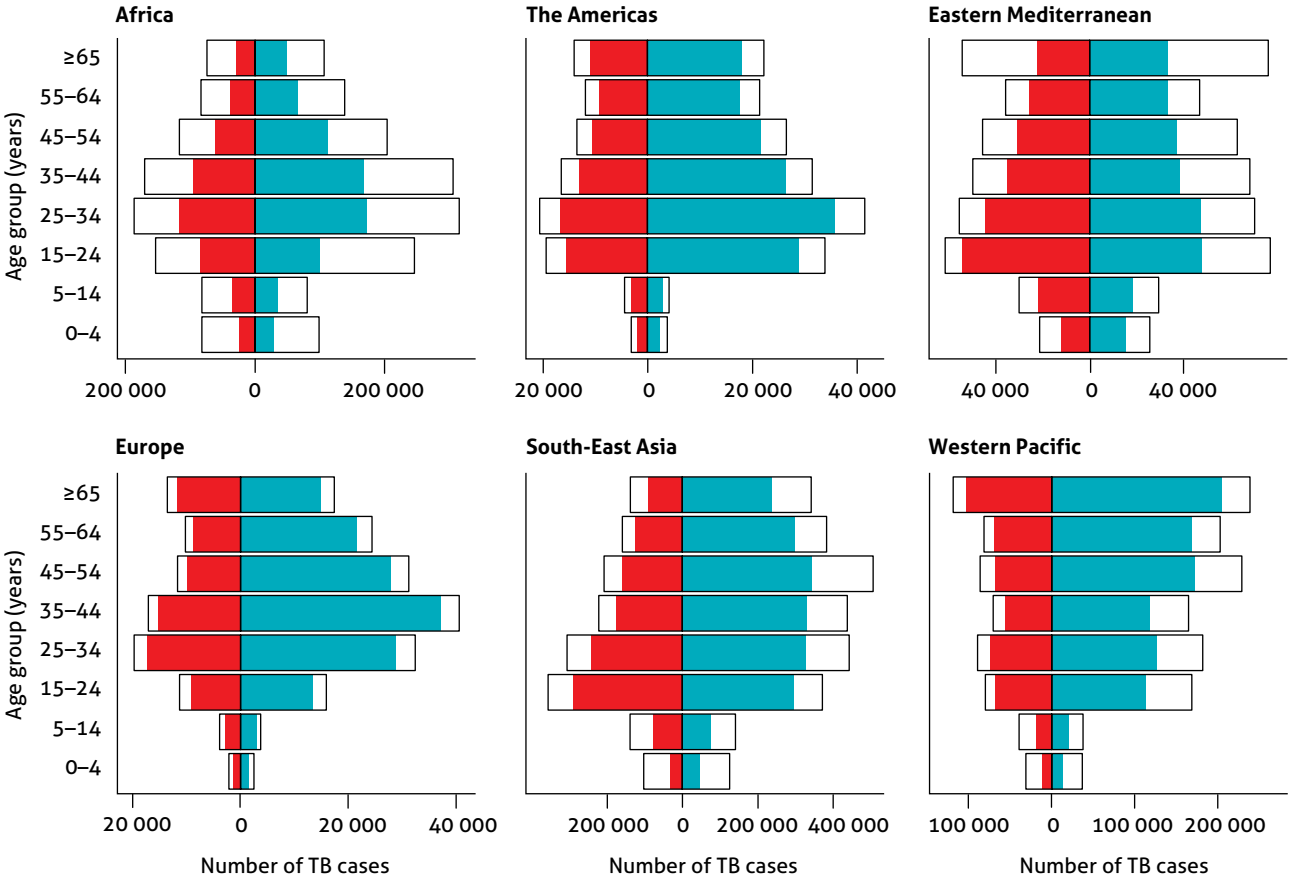
[1] Further breakdowns by HIV status are not possible, because data on the HIV status of TB cases by age and sex are not available.

[2] Time series of estimates for all countries are available online. Annex 1 explains how to access and download them.

[3] Further details are provided in Box 3.4 of the 2018 global TB report (*2*).

FIG. 3.7

Regional estimates of TB incidence (black outline) and case notifications disaggregated by age and sex (female in red; male in turquoise), 2018



cumulative reductions in these two regions for the period 2015–2018 were 15% and 12%, respectively, putting them on track to achieve the 2020 milestone.

Since 2010, annual declines in incidence have been much slower in the WHO regions of the Eastern Mediterranean (0.9% per year), South-East Asia (2.2% per year) and the Western Pacific (1.6% per year), with cumulative reductions of 2.8%, 6.6% and 3.8%, respectively, for the period 2015–2018. These three regions are not on track to reach the 2020 milestone. Of particular concern is the WHO Region of the Americas, where incidence is estimated to be increasing after many years of decline, owing to an upward trend in Brazil during 2016–2018.

Among the 30 high TB burden countries, those on track to reach the 2020 milestone of a 20% reduction in the TB incidence rate are Cambodia, Ethiopia, Kenya, Lesotho, Myanmar, Namibia, the Russian Federation, South Africa, the United Republic of Tanzania, Zambia and Zimbabwe (Fig. 3.12).

Faster reductions in other countries will require improvements in access to TB diagnosis and care within the context of progress towards UHC, action on broader determinants (e.g. levels of undernutrition, poverty, smoking and diabetes) and a new treatment or vaccine to substantially lower the risk of developing TB in people who already have a latent TB infection. These topics are discussed in more detail in Chapter 7 and Chapter 8.

3.2 TB mortality

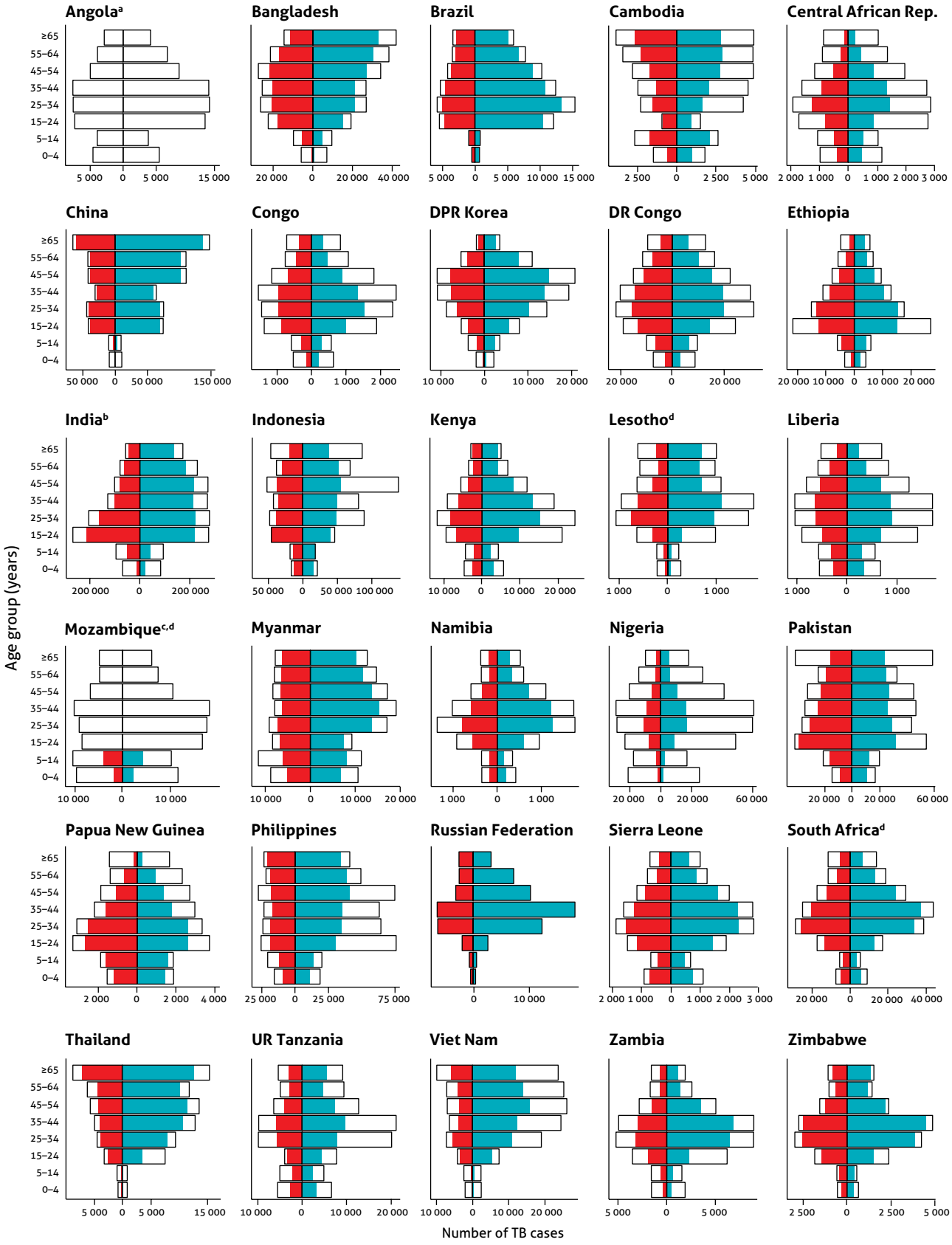
Deaths from TB among HIV-negative people are classified as TB deaths in the 10th edition of the international classification of diseases (ICD-10) *(13)*. When an HIV-positive person dies from TB, the underlying cause is classified as HIV. For consistency with international classifications, this section makes a clear distinction between TB deaths in HIV-negative people and TB deaths in HIV-positive people. The milestones and targets for reductions in TB deaths set in the End TB Strategy are for the combined total of deaths in HIV-positive and HIV-negative people; illustrations of progress towards the 2020 milestone in this chapter are presented accordingly.

3.2.1 Methods to estimate TB mortality

TB mortality among HIV-negative people can be measured directly using data from national VR systems, provided that these systems have high coverage and that causes of death are accurately determined and coded according to ICD-10. Sample VR systems covering rep-

FIG. 3.8

Estimates of TB incidence (black outline) and case notifications disaggregated by age and sex (female in red, male in turquoise), 2018, in the 30 high TB burden countries



[a] Age and sex disaggregated case notifications were not available.
[b] Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[c] Case notification data disaggregated by age and sex for people aged 15 years and above were not available for Mozambique.
[d] Estimates of TB incidence for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

TABLE 3.6

Estimated number of TB cases (in thousands) in children and adults,[a] globally and for WHO regions, 2018

WHO REGION	TOTAL		MALE		FEMALE	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	2 450	2 190–2 730	1 500	1 270–1 730	955	810–1 100
The Americas	289	268–310	185	167–204	103	93–113
Eastern Mediterranean	810	639–1000	459	315–602	351	241–461
Europe	259	225–296	169	138–200	90	74–107
South-East Asia	4 370	3 480–5 370	2 730	1 920–3 550	1 640	1 150–2 120
Western Pacific	1 840	1 520–2 180	1 250	948–1 550	585	444–727
GLOBAL	**10 000**	**8 990–11 100**	**6 290**	**5 390–7 200**	**3 720**	**3 180–4 260**

WHO REGION	TOTAL ≥15 YEARS		MALE ≥15 YEARS		FEMALE ≥15 YEARS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	2 110	1 840–2 380	1 320	1 090–1 550	791	654–929
The Americas	273	252–294	177	159–196	96	86–106
Eastern Mediterranean	703	525–882	404	260–547	300	193–406
Europe	247	212–283	163	132–194	84	68–101
South-East Asia	3 870	2 930–4 800	2 470	1 660–3 290	1 390	934–1 850
Western Pacific	1 700	1 360–2 030	1 180	873–1480	518	384–652
GLOBAL	**8 900**	**7 850–9 940**	**5 710**	**4 800–6 630**	**3 180**	**2 670–3 690**

WHO REGION	TOTAL 0–14 YEARS		MALE 0–14 YEARS		FEMALE 0–14 YEARS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	342	299–386	179	148–210	164	135–192
The Americas	16	15–17	8.2	7.3–9.0	7.6	6.9–8.4
Eastern Mediterranean	106	79–133	55	35–75	51	33–70
Europe	12	10–14	6.1	4.9–7.2	5.9	4.8–7.1
South-East Asia	503	381–625	261	175–347	242	162–323
Western Pacific	140	112–167	72	54–91	67	50–85
GLOBAL	**1 120**	**987–1 250**	**581**	**488–674**	**538**	**452–625**

[a] Numbers shown to two significant figures if under 100 and to three significant figures otherwise.

FIG. 3.9

Global trends in the estimated number of incident TB cases (left) and the incidence rate (right), 2000–2018. Shaded areas represent uncertainty intervals. The horizontal dashed line shows the 2020 milestone for incidence of the End TB Strategy.

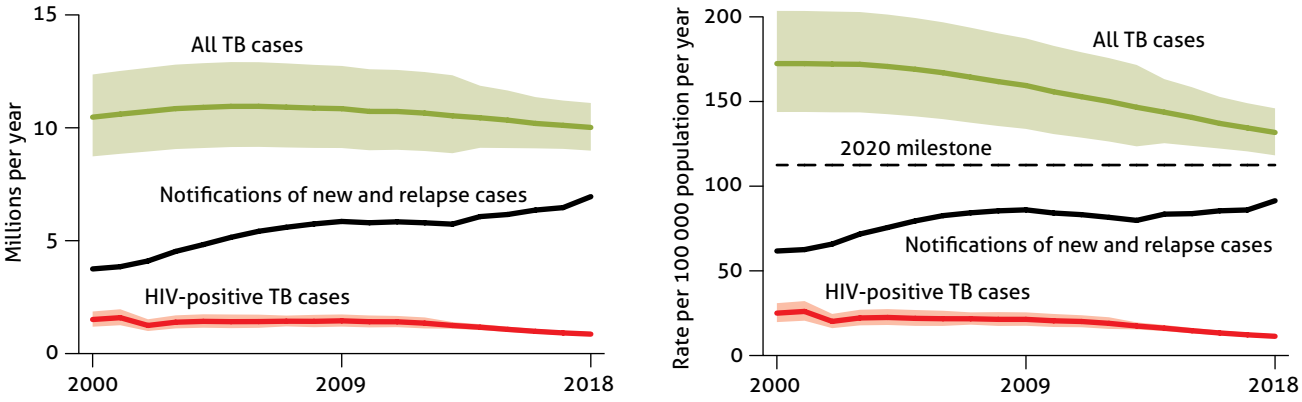


FIG. 3.10

Global trends in the TB incidence rate and the absolute number of TB deaths (solid lines) compared with those required to achieve the 2020 and 2025 milestones of the End TB Strategy (dashed lines)

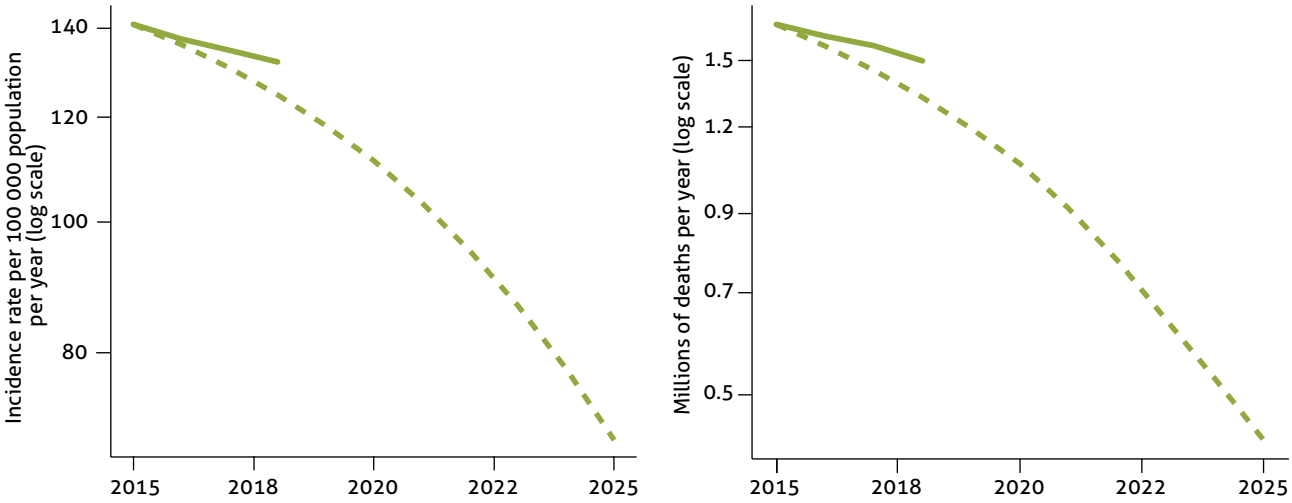


FIG. 3.11

Regional trends in estimated TB incidence rates by WHO region, 2000–2018. Total TB incidence rates are shown in **green** and incidence rates of HIV-positive TB are shown in **red**. The black solid lines show notifications of new and relapse cases for comparison with estimates of the total incidence rate. Shaded areas represent uncertainty intervals. The horizontal dashed line shows the 2020 milestone for incidence of the End TB Strategy.

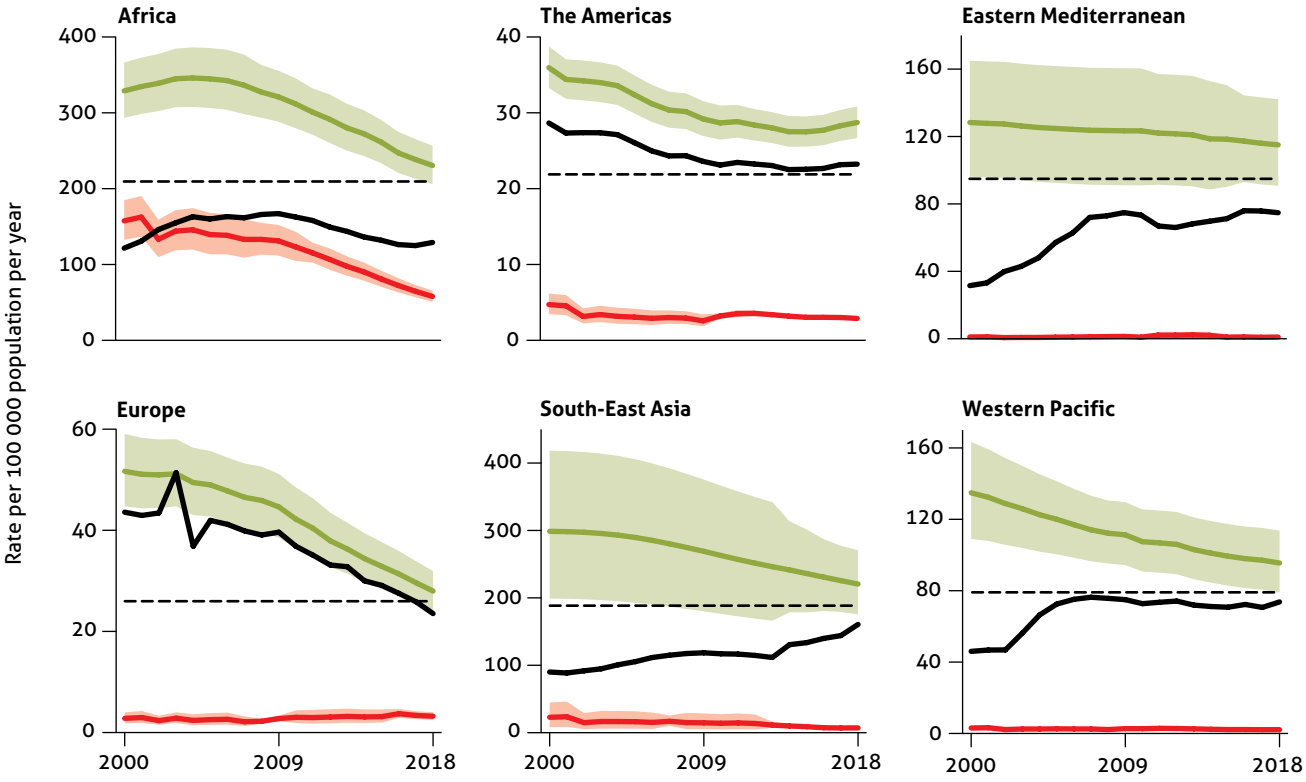
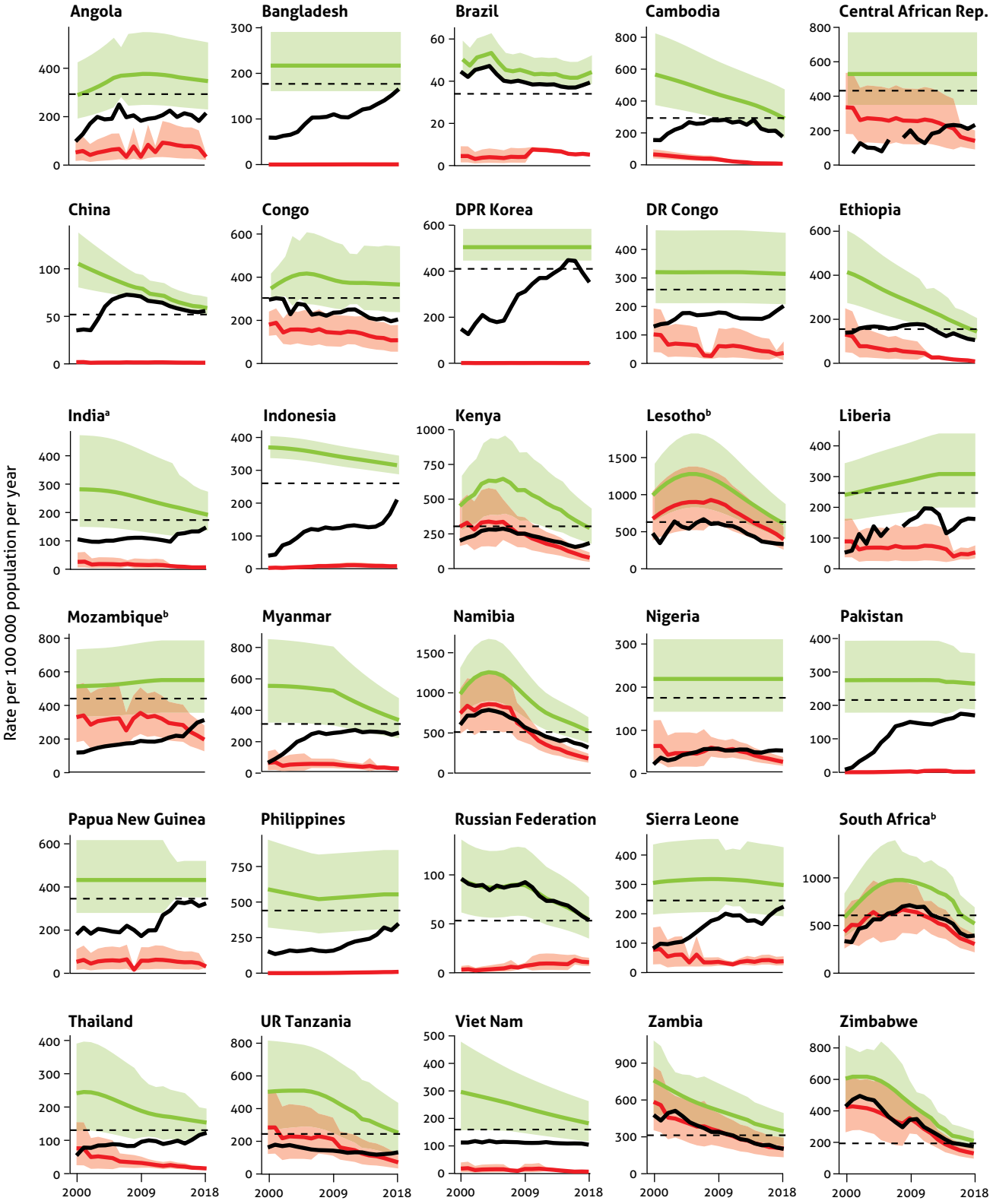


FIG. 3.12

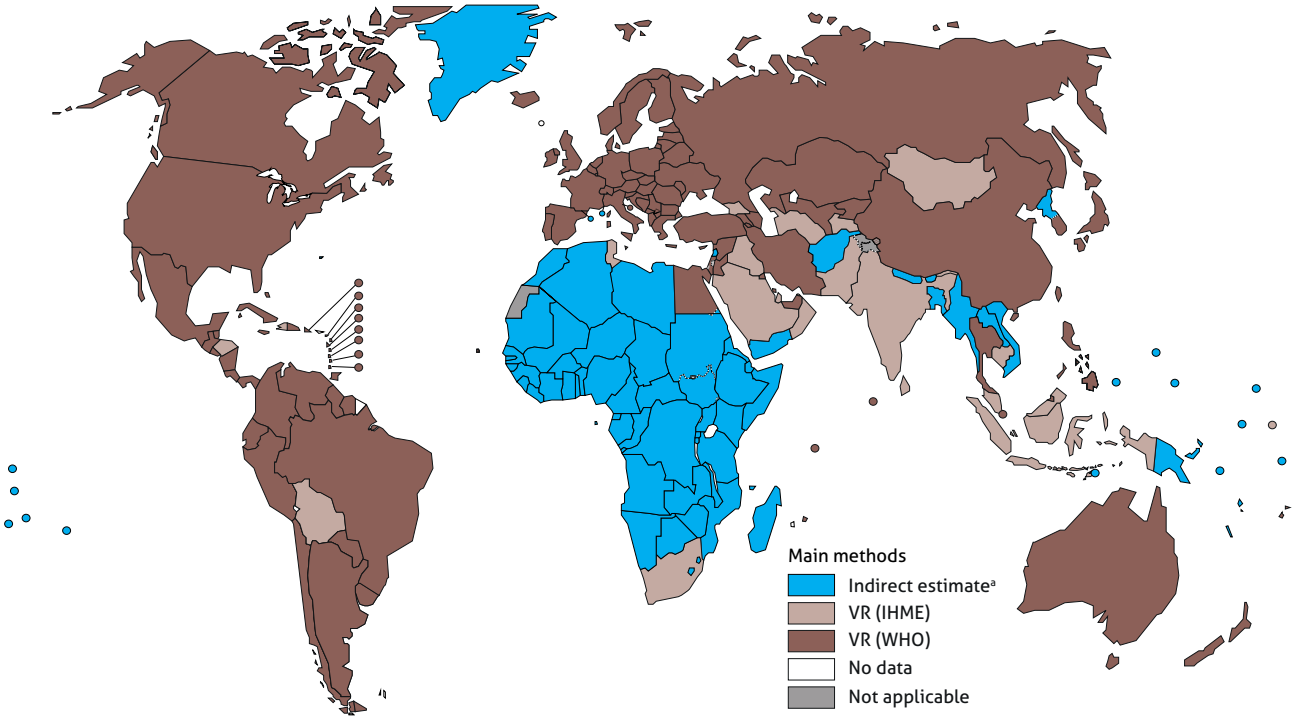
Trends in estimated TB incidence in the 30 high TB burden countries, 2000–2018. TB incidence rates are shown in **green** and incidence rates of HIV-positive TB are shown in **red**. Shaded areas represent uncertainty intervals. The black solid lines show notifications of new and relapse cases for comparison with estimates of the total incidence rate. The horizontal dashed line shows the 2020 milestone for incidence of the End TB Strategy.



[a] Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[b] Estimates of TB incidence for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

FIG. 3.13

Main methods used to estimate TB mortality in HIV-negative people



[a] Mortality is estimated as the product of TB incidence and the TB case fatality ratio. Further details are provided in the online technical appendix.

resentative areas of the country (the approach used, for example, in China) provide an interim solution. Mortality surveys can also be used to estimate deaths caused by TB. In 2018, most countries with a high burden of TB lacked national or sample VR systems, and few had conducted mortality surveys (Table 3.2). In the absence of VR systems or mortality surveys, TB mortality can be estimated as the product of TB incidence and the case fatality ratio (CFR), or through ecological modelling using mortality data from countries with VR systems.

TB mortality among HIV-positive people is hard to measure, even when VR systems are in place, because deaths among HIV-positive people are coded as HIV deaths and contributory causes (e.g. TB) are often not reliably assessed or recorded. TB deaths among HIV-positive people are estimated by WHO as the product of TB incidence and the CFR, with the latter accounting for the protective effect of ART.

For the current report, VR or mortality survey data were used for 123 countries (Fig. 3.13), which collectively accounted for 55% of the estimated number of TB deaths (among HIV-negative people) globally in 2018. For 20 of these countries, analyses of VR data and resulting estimates of TB deaths published by IHME were used.[1] The WHO African Region has the greatest need to introduce or strengthen VR systems in which causes of death are classified according to ICD-10.

[1] Downloaded from http://ghdx.healthdata.org/gbd-results-tool, July 2018.

TB mortality in children is estimated using a previously published approach derived from dynamic modelling *(14)*, and then disaggregated by sex on the assumption that the pattern is the same as that for incidence. If available, data on TB deaths among adults are disaggregated for six age groups (15–24, 25–34, 35–44, 45–54, 55–64 and ≥65 years) using VR data. For countries whose mortality estimates cannot be derived from VR data, a CFR is applied to the adult age- and sex-disaggregated incidence. This CFR accounts for differences between HIV-positive and HIV-negative TB cases, and for variation in HIV prevalence by age and sex.

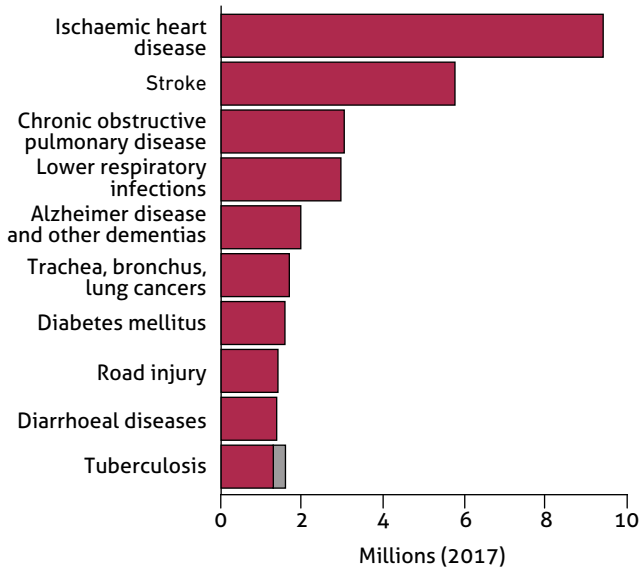
3.2.2 Estimates of TB mortality in 2018

Estimates of the absolute number of deaths caused by TB globally are shown for the six WHO regions and for the 30 high TB burden countries in Table 3.3. There were an estimated 1.2 million (range, 1.1–1.3 million) deaths from TB among HIV-negative people in 2018 and an additional 251 000 (range, 223 000–281 000) deaths from TB among HIV-positive people (33% of the total number of deaths caused by HIV/AIDS).

TB is the 10th leading cause of death worldwide, and since 2007 it has been the leading cause of death from a single infectious agent, ranking above HIV/AIDS (Fig. 3.14, Fig. 3.15 and Fig. 3.16) *(15)*. Most of these deaths could be prevented with early diagnosis and appropriate treatment (Chapter 1). For example, among people whose TB was detected, reported and treated in 2017, the treatment

FIG. 3.14

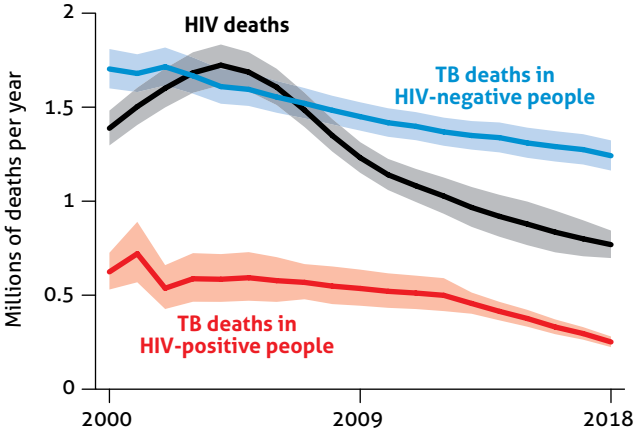
Top causes of death worldwide in 2017.[a,b] Deaths from TB among HIV-positive people are shown in grey.



[a] This is the latest year for which estimates for all causes are currently available. See WHO estimates, available at http://apps.who.int/gho/portal (accessed 13 August 2019).
[b] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

FIG. 3.16

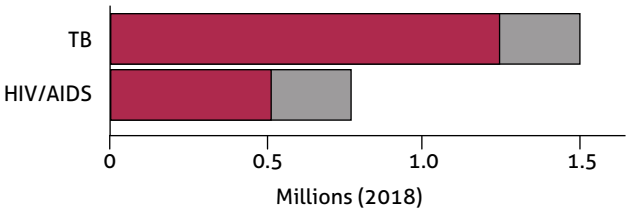
Global trends in the estimated number of deaths caused by TB and HIV, 2000–2018.[a,b] Shaded areas represent uncertainty intervals.



[a] For HIV/AIDS, the latest estimates of the number of deaths in 2018 that have been published by UNAIDS are available at http://www.unaids.org/en/resources/publications/all (accessed 16 August 2019). For TB, the estimates for 2018 are those published in this report.
[b] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

FIG. 3.15

Estimated number of deaths worldwide from HIV/AIDS and TB in 2018.[a,b] Deaths from TB among HIV-positive people are shown in grey.



[a] For HIV/AIDS, the latest estimates of the number of deaths in 2018 that have been published by UNAIDS are available at http://www.unaids.org/en/ (accessed 13 August 2019). For TB, the estimates for 2018 are those published in this report.
[b] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

success rate was 85% globally (Chapter 4); and in high-income countries with UHC, the proportion of people who die from TB can be under 5% (Section 3.2.5).

In 2018, about 83% of TB deaths among HIV-negative people occurred in the WHO African Region and the WHO South-East Asia Region; these regions accounted for 85% of the combined total of TB deaths in HIV-negative and HIV-positive people. India accounted for 35% of global TB deaths among HIV-negative people, and for 30% of the combined total number of TB deaths in HIV-negative and HIV-positive people.

Estimates of TB mortality rates (deaths per 100 000 population per year) are shown globally, for the six WHO regions and for the 30 high TB burden countries, in Table 3.4. Globally, the number of TB deaths among HIV-negative people per 100 000 population was 16 (range, 15–17) in 2018, and 20 (range, 18–21) when TB deaths among HIV-positive people were included. There was considerable variation among countries (Fig. 3.17), ranging from less than one TB death per 100 000 population in many high-income countries, to 40 or more deaths per 100 000 population in much of the WHO African Region and in two high TB burden countries in Asia (the Democratic People's Republic of Korea and Papua New Guinea).

Estimates of the number of deaths caused by zoonotic TB are shown in Table 3.5.

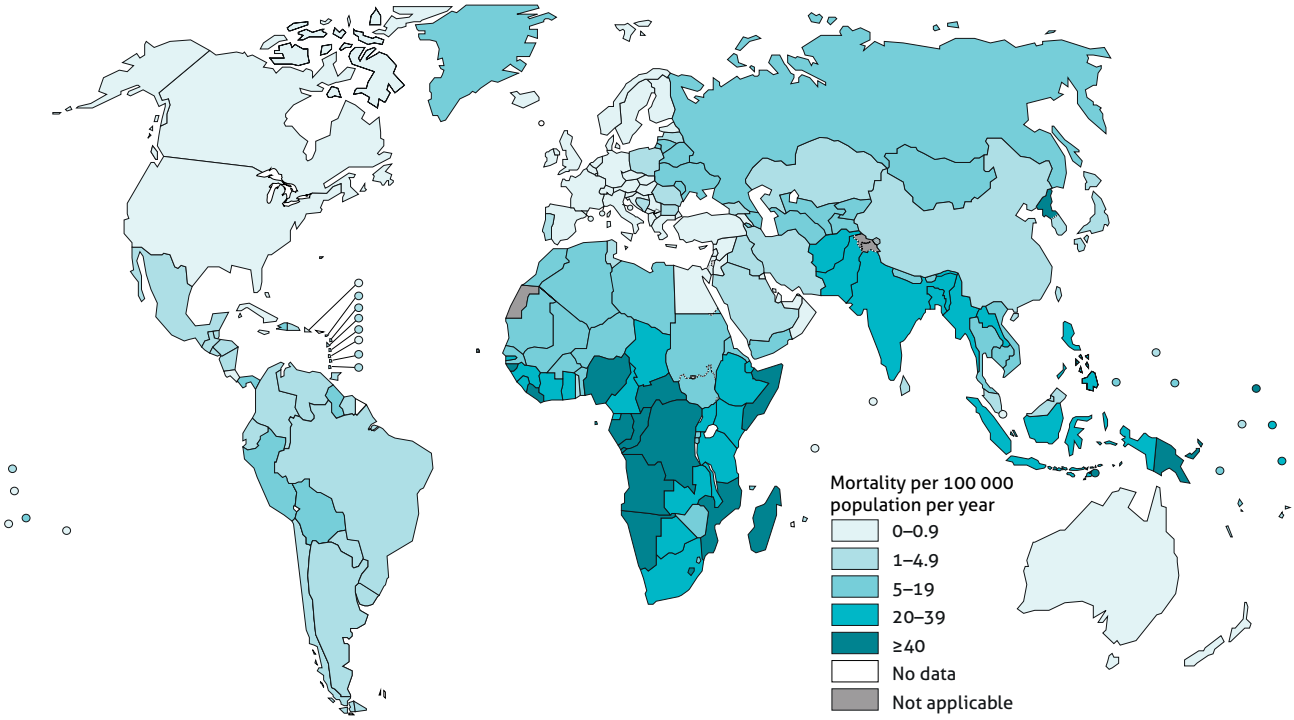
3.2.3 TB mortality in 2018 disaggregated by age and sex

Estimates of TB mortality in 2018 disaggregated by age and sex are shown in Fig. 3.18 (global), Fig. 3.19 (WHO regions) and Fig. 3.20 (30 high TB burden countries), and in Table 3.7. In Table 3.7, estimates are shown for HIV-positive and HIV-negative people separately, given that the cause of TB deaths among HIV-positive people is classified as HIV in ICD-10 (estimates in Fig. 3.18, Fig. 3.19 and Fig. 3.20 are for HIV-negative people only).

Globally in 2018, 55% of the HIV-negative people who died from TB were men (aged ≥15 years), 31% were wom-

FIG. 3.17

Estimated TB mortality rates in HIV-negative people, 2018



en and 14% were children (aged <15 years). The higher share for children compared with their estimated share of cases (11%) suggests poorer access to diagnosis and treatment.

Globally in 2018, 49% of the HIV-positive people who died from TB were men, 38% were women and 13% were children.

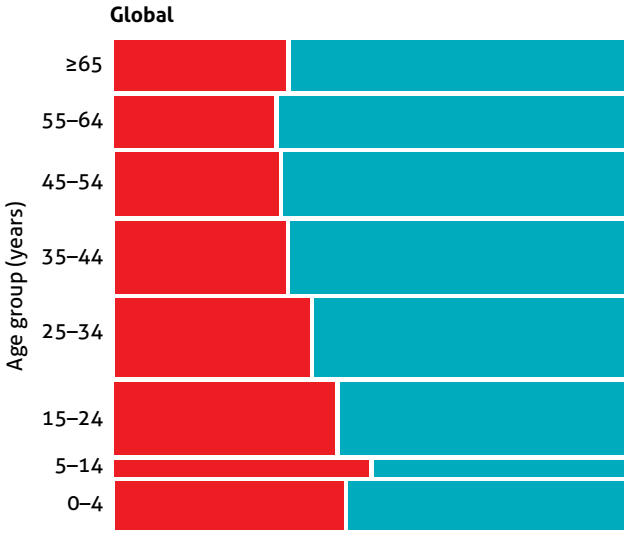
3.2.4 Estimated trends in TB mortality, 2000–2018

Global trends in the absolute number of TB deaths in HIV-negative and HIV-positive people and the mortality rate (deaths per 100 000 population per year) are shown in Fig. 3.21. The absolute number of TB deaths among HIV-negative people fell 27% between 2000 and 2018, from a best estimate of 1.7 million in 2000 to 1.2 million in 2018, and the mortality rate fell by 42% (including 3.6% between 2017 and 2018). Among HIV-positive people, the number of TB deaths fell faster, from 624 000 in 2000 to 251 000 in 2018 (a reduction of 60%), and the mortality rate fell 68% (from 10 to 3.3 per 100 000 population).

Despite this progress, the world is not on track to reach the End TB Strategy milestone of a 35% reduction in the total number of TB deaths between 2015 and 2020 (Fig. 3.10 and Fig. 3.21). The reduction between 2015 and 2018 was only 11%. The total number of deaths can be approximated as the product of two variables: TB incidence and the CFR (the proportion of people with TB who die from the disease). Reaching the 2020 milestone requires the TB incidence rate to be falling at 4–5% per

FIG. 3.18

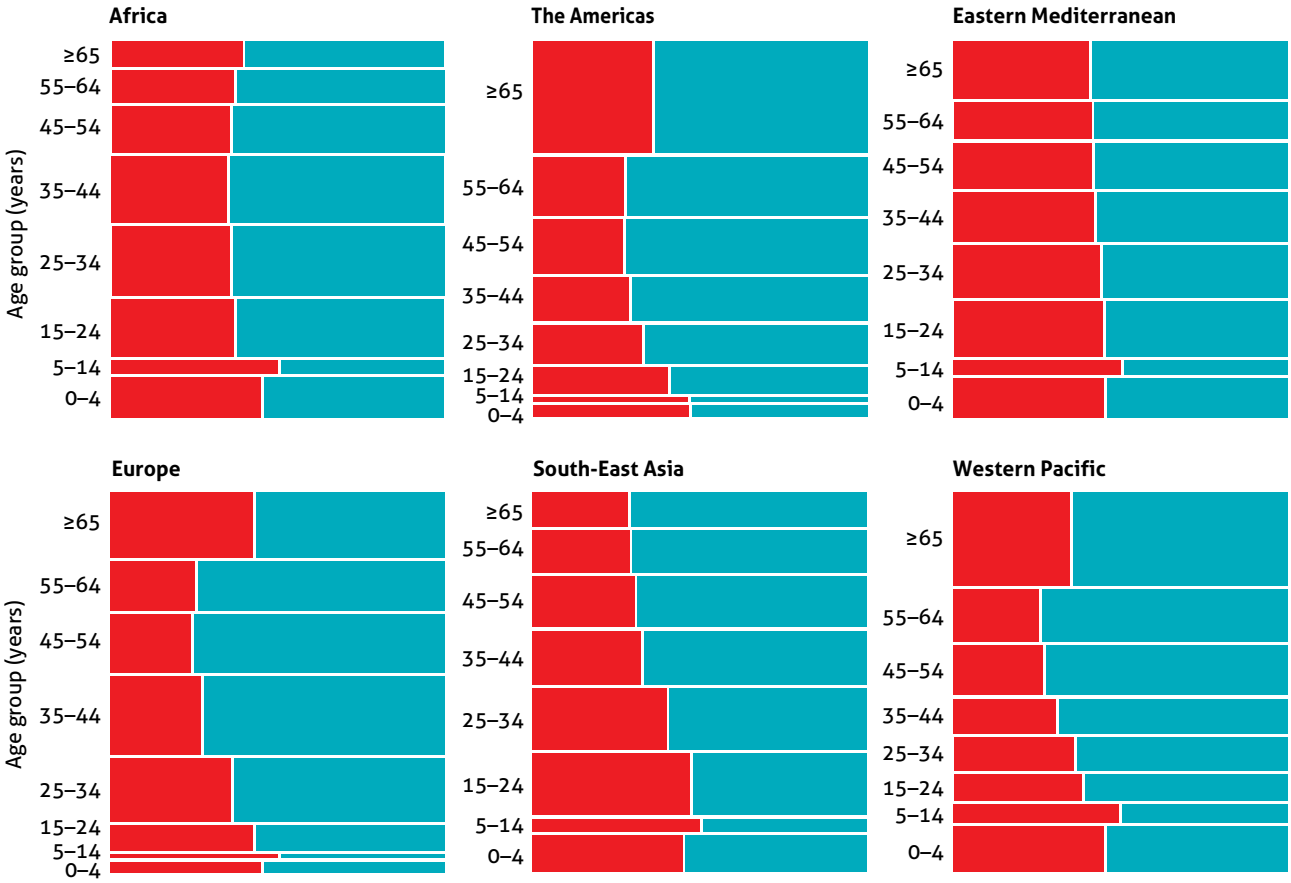
Global distribution of TB mortality in HIV-negative people by age group and sex (female in red; male in turquoise),[a] 2018



[a] The total area represents the global number of deaths due to TB and all rectangles are proportional to their share of total TB mortality.

FIG. 3.19

Regional distribution of TB mortality in HIV-negative people by age group and sex (female in red; male in turquoise),[a] 2018



[a] The total area represents TB mortality and all rectangles are proportional to their share of total TB mortality by region.

year by 2020 (more than double the current pace of progress) and a CFR of no more than 10% by 2020 (Chapter 2). The global CFR in 2018 was 15%.

Trends and a comparison of progress with the 2020 milestone of the End TB Strategy are shown for the six WHO regions in Fig. 3.22 and Fig. 3.23, and for the 30 high TB burden countries in Fig. 3.24 and Fig. 3.25.[1]

The fastest regional declines in TB deaths since 2010 have been in the WHO European Region (9.3% per year in HIV-negative people and 8.0% overall) and the WHO African Region (7.9% per year among HIV-positive people and 2.9% overall). The cumulative reductions in the total number of TB deaths in these two regions in the period 2015–2018 were 24% and 16%, respectively; the WHO European Region is on track to achieve the 2020 milestone (Fig. 3.23).

Annual declines in TB deaths have been much slower in the WHO Region of the Americas (2.2% per year), Eastern Mediterranean Region (3.6% per year), South-East Asia Region (2.2% per year) and Western Pacific Region (3.6% per year), with cumulative reductions of 6.6%, 9.8%, 6.8% and 10.0%, respectively, in the period 2015–2018. None of these regions is on track to reach the 2020 milestone.

Among the 30 high TB burden countries, those on track to reach the 2020 milestone of a 35% reduction in the total number of TB deaths compared with levels in 2015 include Bangladesh, Kenya, Lesotho, Mozambique, Myanmar, the Russian Federation, Sierra Leone, South Africa, Thailand, the United Republic of Tanzania, Viet Nam and Zimbabwe (Fig. 3.25).

Faster reductions in other countries will require improvements in access to TB diagnosis and care within the broader context of progress towards UHC (to lower the CFR), combined with efforts to accelerate the rate of decline in TB incidence. As noted in Section 3.1.4, this needs to include multisectoral action on the broader determinants of TB incidence (e.g. levels of undernutrition, poverty, smoking and diabetes) and investment in research to develop a new treatment or vaccine to substantially lower the risk of developing TB in people who already have a latent TB infection. These topics are discussed in more detail in Chapter 7 and Chapter 8.

[1] Time series of estimates for all countries are available online. Annex 1 explains how to access and download them.

FIG. 3.20

Distribution of TB mortality in HIV-negative people in the 30 high TB burden countries by age group and sex (female in red; male in turquoise),[a] 2018

[a] The total area represents TB mortality and all rectangles are proportional to their share of total TB mortality by country.
[b] Estimates of TB mortality for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[c] Estimates of TB mortality for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

TABLE 3.7

Estimated number of TB deaths (in thousands) by HIV status in children and adults,[a] globally and for WHO regions, 2018

HIV-NEGATIVE

WHO REGION	TOTAL		MALE 0–14 YEARS		FEMALE 0–14 YEARS		MALE ≥15 YEARS		FEMALE ≥15 YEARS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	397	331–468	32	23–41	28	20–36	213	155–272	123	90–157
The Americas	17	16–19	0.41	0.38–0.45	0.36	0.33–0.40	11	10–12	5.3	4.8–5.8
Eastern Mediterranean	77	66–89	6.3	4.8–7.8	5.6	4.2–6.9	38	29–47	28	21–34
Europe	23	22–24	0.45	0.42–0.48	0.40	0.37–0.42	15	14–16	7.2	6.7–7.6
South-East Asia	637	598–677	46	41–50	40	36–44	353	319–387	199	180–218
Western Pacific	90	83–98	7.5	6.5–8.4	6.5	5.7–7.3	52	45–58	25	22–28
GLOBAL	**1240**	**1 160–1 320**	**92**	**83–101**	**81**	**72–89**	**682**	**613–751**	**387**	**348–427**

HIV-POSITIVE

WHO REGION	TOTAL		MALE 0–14 YEARS		FEMALE 0–14 YEARS		MALE ≥15 YEARS		FEMALE ≥15 YEARS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	211	184–239	16	13–19	14	11–17	95	75–115	86	68–104
The Americas	5.9	5.3–6.6	0.08	0.07–0.09	0.07	0.06–0.08	4.5	3.8–5.2	1.3	1.1–1.5
Eastern Mediterranean	2.2	1.6–2.8	0.14	0.09–0.20	0.13	0.08–0.18	1.4	0.83–1.9	0.55	0.33–0.76
Europe	4.4	3.3–5.6	0.01	<0.01–0.02	0.01	<0.01–0.02	3.5	2.4–4.6	0.85	0.58–1.1
South-East Asia	21	16–28	0.92	0.55–1.3	0.80	0.48–1.1	15	8.7–20	5.1	3.1–7.1
Western Pacific	6.5	4.9–8.4	0.13	0.09–0.17	0.11	0.08–0.15	5.2	3.5–7.0	1.0	0.69–1.4
GLOBAL	**251**	**224–280**	**17**	**14–20**	**15**	**13–18**	**124**	**102–146**	**95**	**78–112**

[a] Numbers shown to two significant figures if under 100 and to three significant figures otherwise.

FIG. 3.21

Global trends in the estimated number of TB deaths (left) and the mortality rate (right), 2000–2018. The horizontal dashed line shows the 2020 milestone for TB deaths of the End TB Strategy.

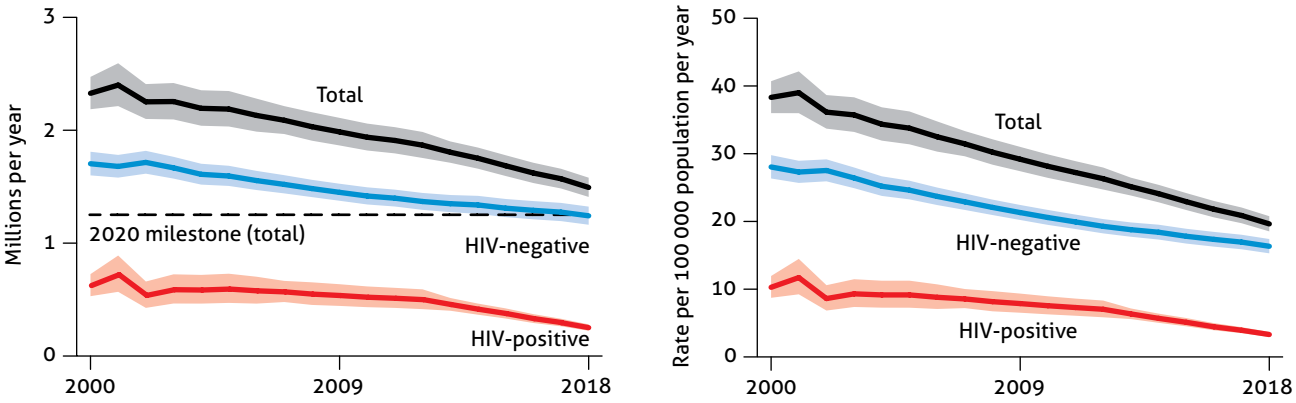
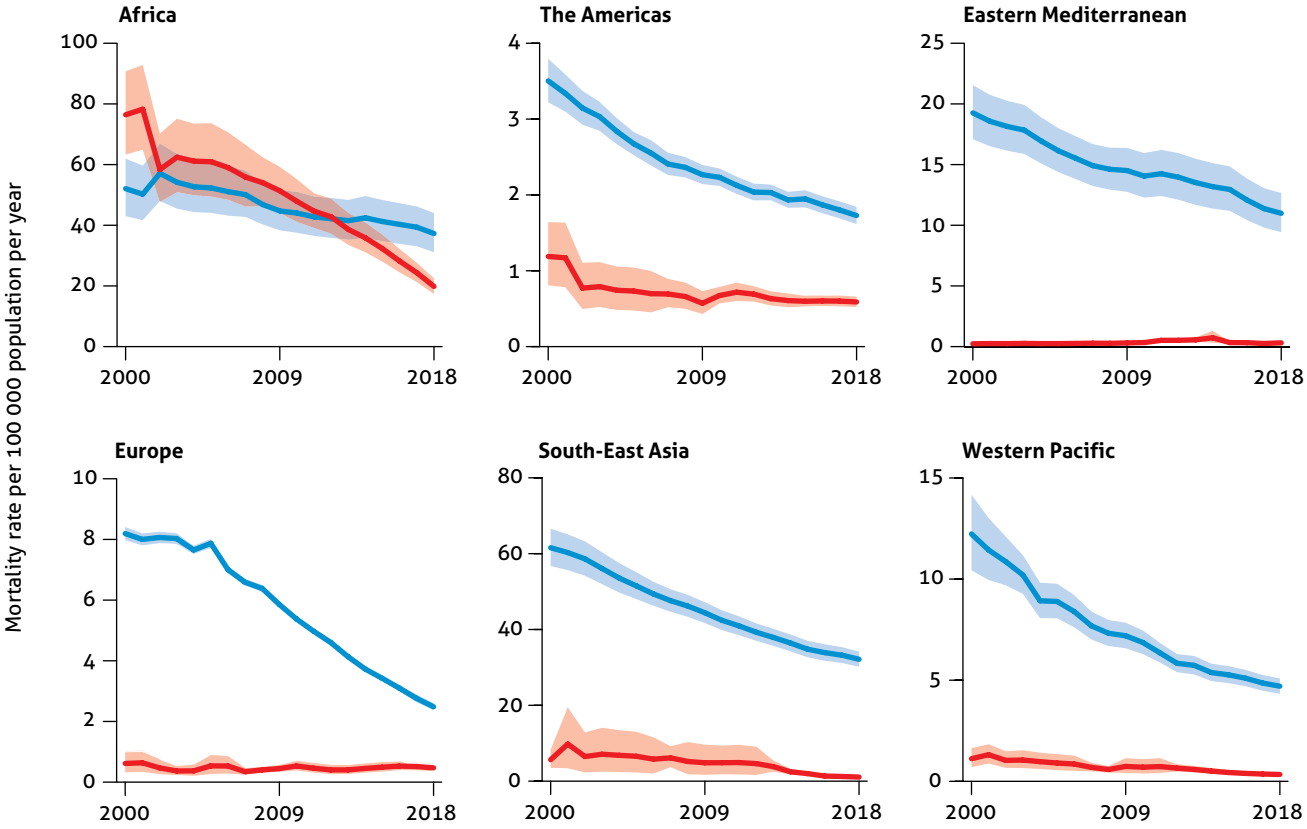


FIG. 3.22

Regional trends in estimated TB mortality rates by WHO region, 2000–2018. Estimated TB mortality rates among HIV-negative people are shown in **blue** and estimated mortality rates among HIV-positive people are shown in **red**. Shaded areas represent uncertainty intervals.



3.2.5 The case fatality ratio

The CFR is the proportion of people with TB who die from the disease; it can be approximated as the number of TB deaths divided by the number of new cases in the same year. The CFR allows assessment of variation in equity in terms of access to TB diagnosis and treatment among countries (because if everyone with TB had access to timely diagnosis and high-quality treatment, the CFR would be low in all countries). As noted in **Section 3.2.4**, achieving the End TB Strategy 2020 milestone of a 35% reduction in TB deaths for the period 2015–2020 requires a reduction in the global CFR, from 17% in 2015 to 10% in 2020.

In 2018, the global CFR (calculated as the combined number of TB deaths in HIV-negative people and HIV-positive people, divided by the total number of incident cases in both HIV-negative and HIV-positive people)[1] was 15%, down from 22% in 2000 and 16% in 2015. It varied widely among countries (**Fig. 3.26**), from under 5% in a few countries to more than 20% in most countries in the WHO African Region. Intensified efforts are required to reduce the CFR to 10% globally by 2020.

3.2.6 Estimated number of deaths averted by TB treatment, 2000–2018

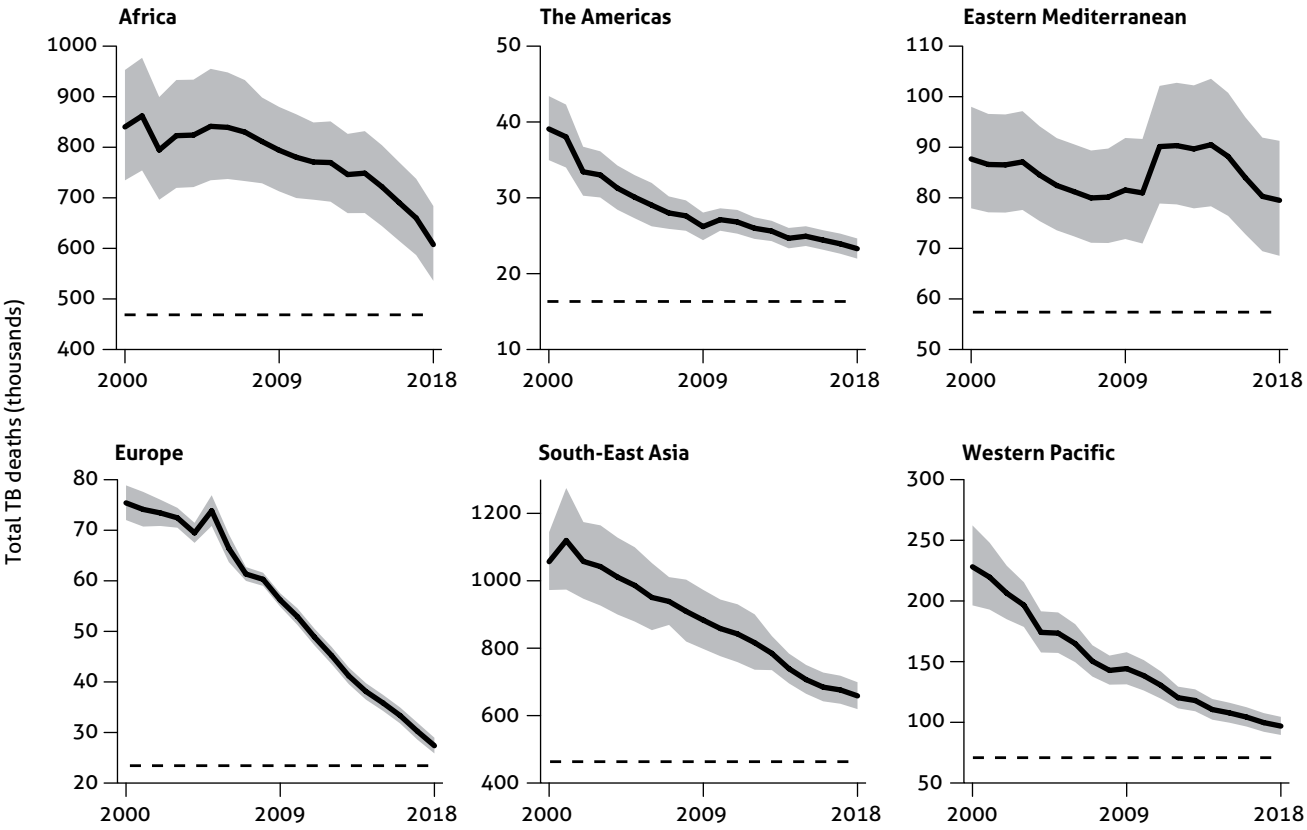
To estimate the number of deaths averted by TB interventions, the actual numbers of TB deaths (presented in **Section 3.2**) can be compared with the number of TB deaths that would have occurred in the absence of TB treatment (and without ART provided alongside TB treatment for HIV-positive cases). The latter number can be conservatively estimated as the number of estimated incident cases (**Section 3.1**) multiplied by the relevant estimated CFR for untreated TB.[2] Estimates are conservative because they do not account for the impact of TB services or the availability of ART on the level of TB incidence, or for the indirect, downstream impact of these interventions on future levels of infections, cases and deaths.

[1] The CFR was calculated based on the combined total of deaths in HIV-negative and HIV-positive people for the purpose of cross-country comparisons; in particular, to illustrate the high CFRs in African countries, which could be reduced by effective detection and care programmes. CFRs restricted to HIV-negative TB deaths and cases can also be calculated but are not shown here. At the subnational level, CFRs can also be restricted to HIV-negative TB deaths, depending on the country and its HIV burden.

[2] Further details about methods used to estimate deaths averted, including CFRs for different categories of TB case, are provided in the **online technical appendix**, available at http://www.who.int/tb/data.

FIG. 3.23

Regional trends in the estimated absolute number of TB deaths (HIV-positive and HIV-negative) by WHO region, 2000–2018. Shaded areas represent uncertainty intervals. The horizontal dashed line shows the 2020 milestone for TB deaths of the End TB Strategy.



Between 2000 and 2018, TB treatment alone averted an estimated 48 million deaths among HIV-negative people (Table 3.8). Among HIV-positive people, TB treatment supported by ART averted an additional 10 million deaths.

3.3 Drug-resistant TB

Drug-resistant TB remains a major public health concern in many countries. Three major categories are used for global surveillance and treatment. Multidrug-resistant TB (MDR-TB) is TB that is resistant to both rifampicin and isoniazid, the two most powerful anti-TB drugs; it requires treatment with a second-line regimen. Rifampicin-resistant TB (RR-TB) also requires treatment with second-line drugs. With increasing use of the Xpert® MTB/RIF assay for simultaneous detection of TB and resistance to rifampicin (without further testing for isoniazid resistance), an increasing number of RR-TB cases

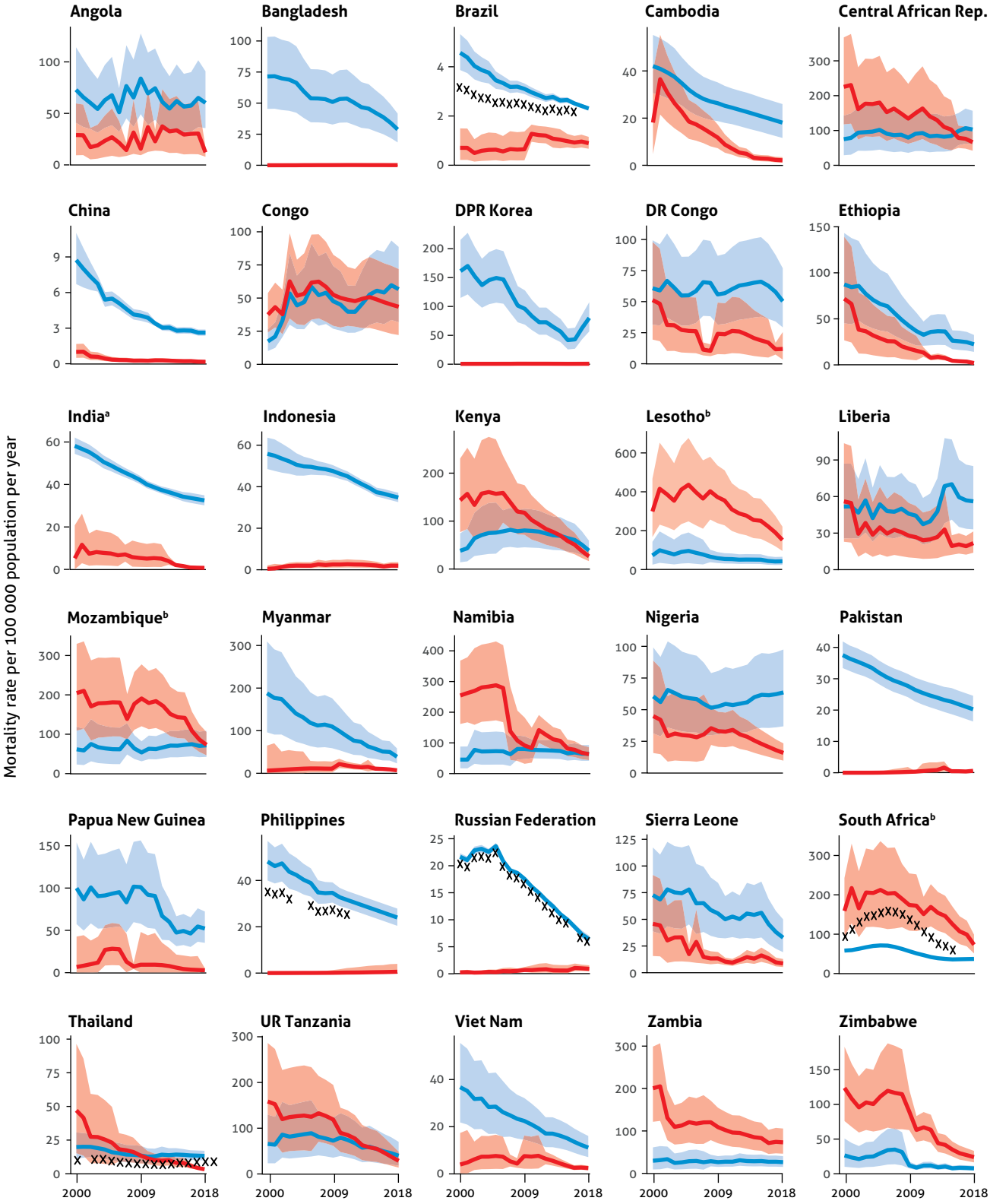
TABLE 3.8

Cumulative number of deaths averted by TB and TB/HIV interventions 2000–2018 (in millions), globally and by WHO region

	HIV-NEGATIVE PEOPLE		HIV-POSITIVE PEOPLE		TOTAL	
WHO REGION	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	5.6	4.6–6.5	6.6	5.7–7.4	12	11–13
The Americas	1.6	1.5–1.8	0.32	0.29–0.35	1.9	1.8–2.1
Eastern Mediterranean	4.2	3.7–4.7	0.07	0.05–0.09	4.3	3.7–4.8
Europe	1.9	1.7–2.1	0.30	0.26–0.34	2.2	2.0–2.4
South-East Asia	21	18–25	2.1	1.4–2.8	24	20–27
Western Pacific	14	12–15	0.42	0.36–0.49	14	13–15
GLOBAL	**48**	**43–55**	**9.8**	**8.6–11**	**58**	**53–64**

FIG. 3.24

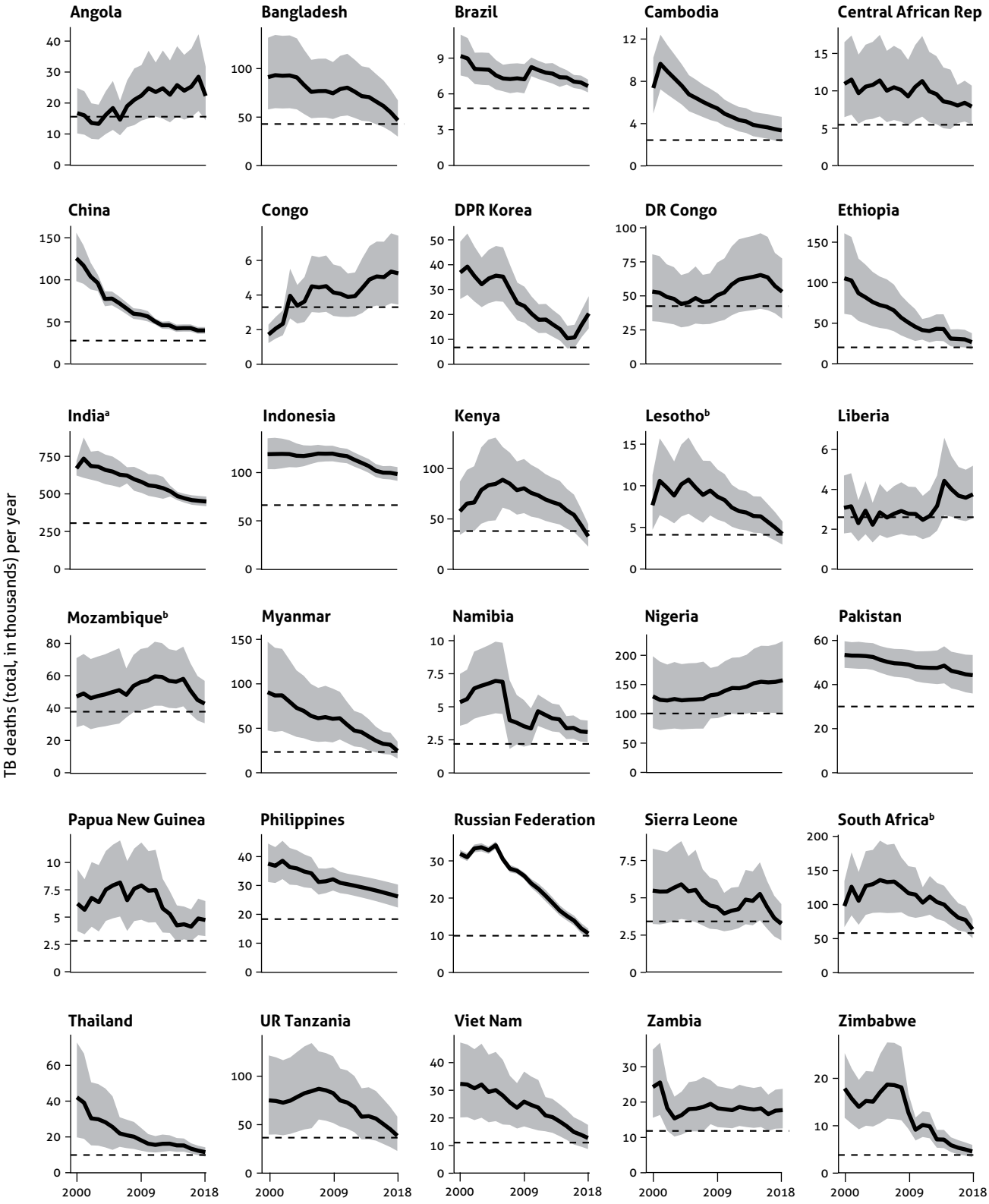
Trends in estimated TB mortality rates in the 30 high TB burden countries, 2000–2018. TB mortality rates in HIV-negative people are shown in **blue** and mortality rates of HIV-positive TB are shown in **red**. The black crosses show observations from vital registration systems. Shaded areas represent uncertainty intervals.



[a] Estimates of TB mortality for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[b] Estimates of TB mortality for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

FIG. 3.25

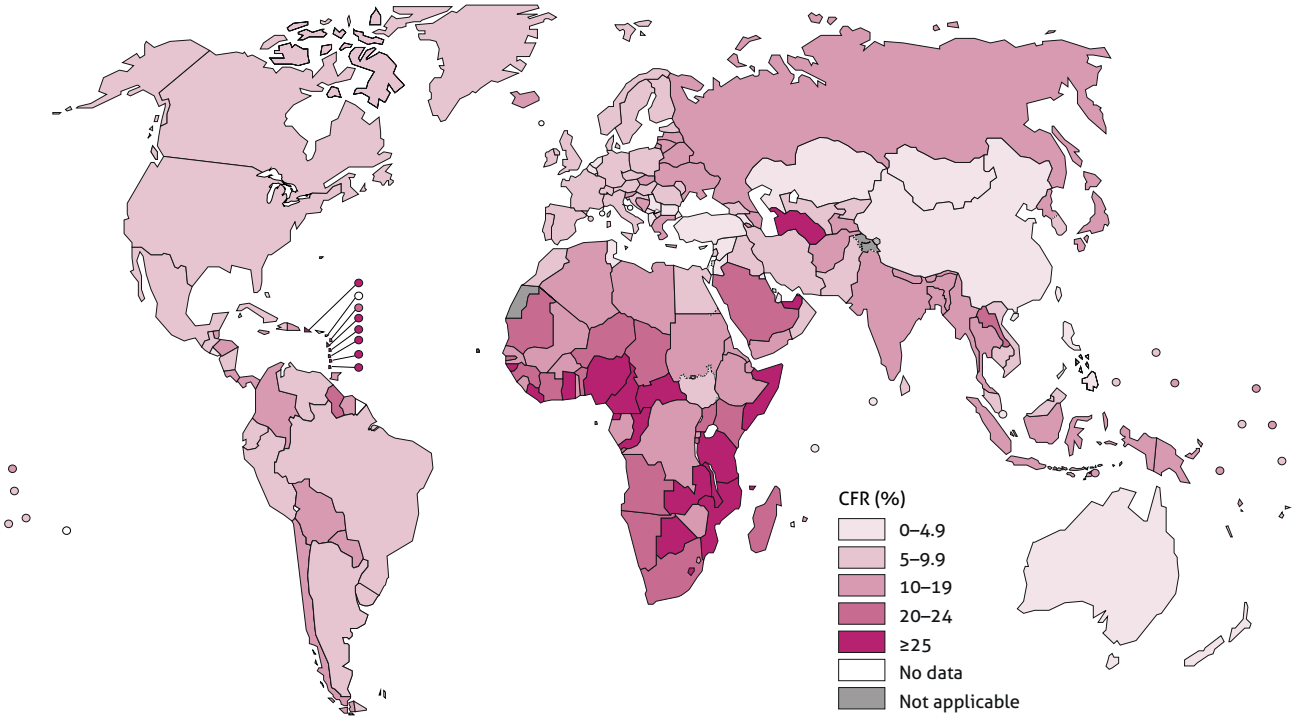
Trends in the estimated absolute number of TB deaths (HIV-positive and HIV-negative TB) in the 30 high TB burden countries, 2000–2018. Shaded areas represent uncertainty intervals. The horizontal dashed line shows the 2020 milestone for TB deaths of the End TB Strategy.



[a] Estimates of TB deaths for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[b] Estimates of TB deaths for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

FIG. 3.26

Estimates of the case fatality ratio (CFR), including HIV-negative and HIV-positive people, 2018



are being detected and notified (Chapter 4). Extensively drug-resistant TB (XDR-TB) is defined as MDR-TB plus resistance to at least one of the fluoroquinolones and one of the injectable agents used in MDR-TB treatment regimens. This section focuses on estimates for MDR/RR-TB.

3.3.1 Global surveillance of anti-TB drug resistance

Since the launch of the Global Project on Anti-tuberculosis Drug Resistance Surveillance in 1994, data on drug resistance have been systematically collected and analysed from 164 countries worldwide (85% of the 194 WHO Member States), which collectively have more than 99% of the world's population and TB cases. This includes 105 countries that have continuous surveillance systems based on routine diagnostic drug susceptibility testing (DST) of *M. tuberculosis* isolates obtained from TB patients, and 59 countries that rely on epidemiological surveys of bacterial isolates collected from representative samples of patients (Fig. 3.27). National surveys conducted about every 5 years represent the most common approach to investigating the burden of drug resistance in resource-limited settings, where routine DST is not accessible to all TB patients due to insufficient laboratory capacity or funding.

The global coverage of drug-resistance surveillance data is shown in Fig. 3.28. Among the 30 high TB burden countries and the 30 high MDR-TB burden countries (which comprise a total of 40 countries, because of overlap between the two groups[1]), 37 have data on levels of drug resistance. The three countries that have never conducted a drug-resistance survey are Angola, Congo and Liberia. Angola began planning a national survey in 2018 and it is expected that this will be completed in 2020. Among the other 37 high TB burden or high MDR-TB burden countries, four countries (Brazil, Central African Republic, Democratic People's Republic of Korea and Papua New Guinea) rely on drug-resistance data gathered from subnational areas only and the most recent data for Sierra Leone are old (from 1997). The number of data points on rifampicin resistance is shown for each country in Fig. 3.29.

In 2017–2019, the first-ever national drug-resistance surveys were completed in Cameroon, Eritrea, Indonesia, Lao People's Democratic Republic and Togo, and repeat surveys were completed in Bangladesh, Cambodia, Eswatini, the Philippines, Sri Lanka, Tajikistan, Thailand, Turkmenistan and United Republic of Tanzania. In 2018–2019, drug-resistance surveys were underway in 13 countries, with the first nationwide surveys in eight countries (Albania, Angola, Burundi, Chad, Guinea, Haiti, Mali and Timor-Leste) and repeat surveys in five countries (Ethiopia, Malawi, Mozambique, Myanmar and Zambia).

The use of whole genome sequencing in surveillance of anti-TB drug resistance is increasing, and a recent example of its value, from Eswatini, is illustrated in Box 3.4.

[1] For a full list of the high TB burden and high MDR-TB burden countries, see Chapter 2.

FIG. 3.27

Source of data for rifampicin resistance among new cases, 1995–2019

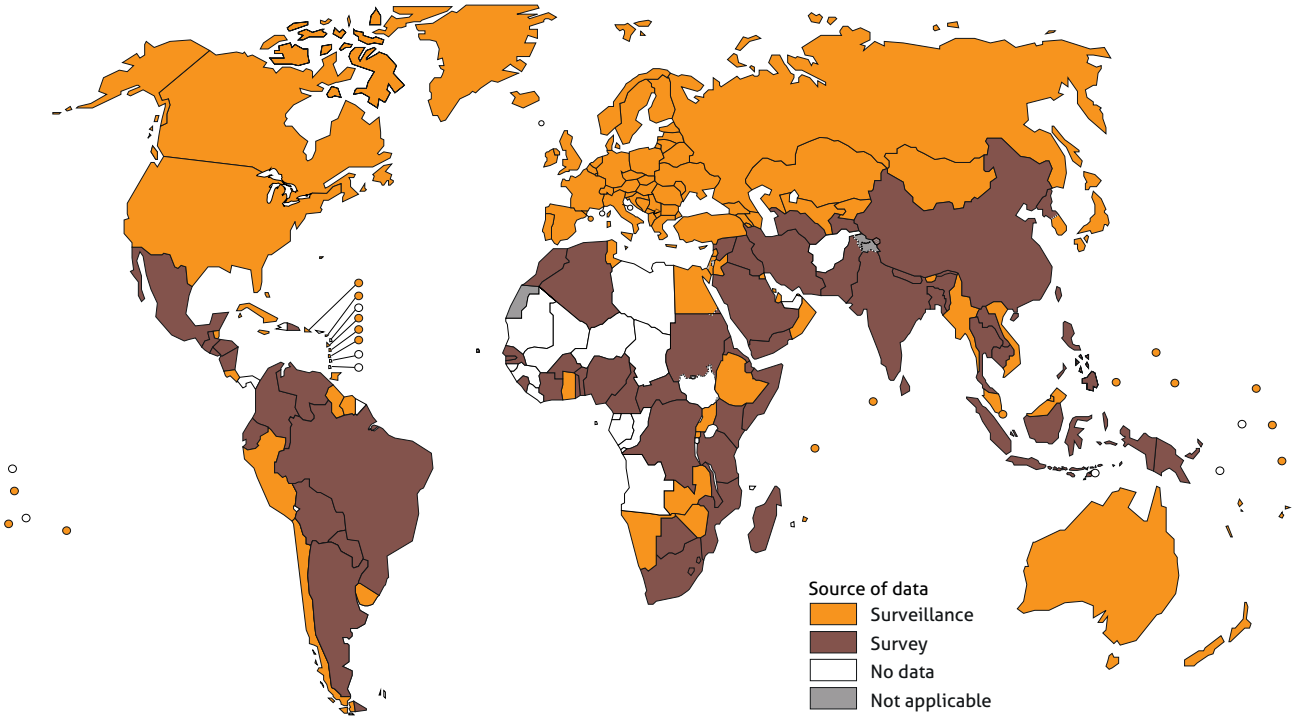


FIG. 3.28

Most recent year of data on rifampicin resistance among new cases, 1995–2019

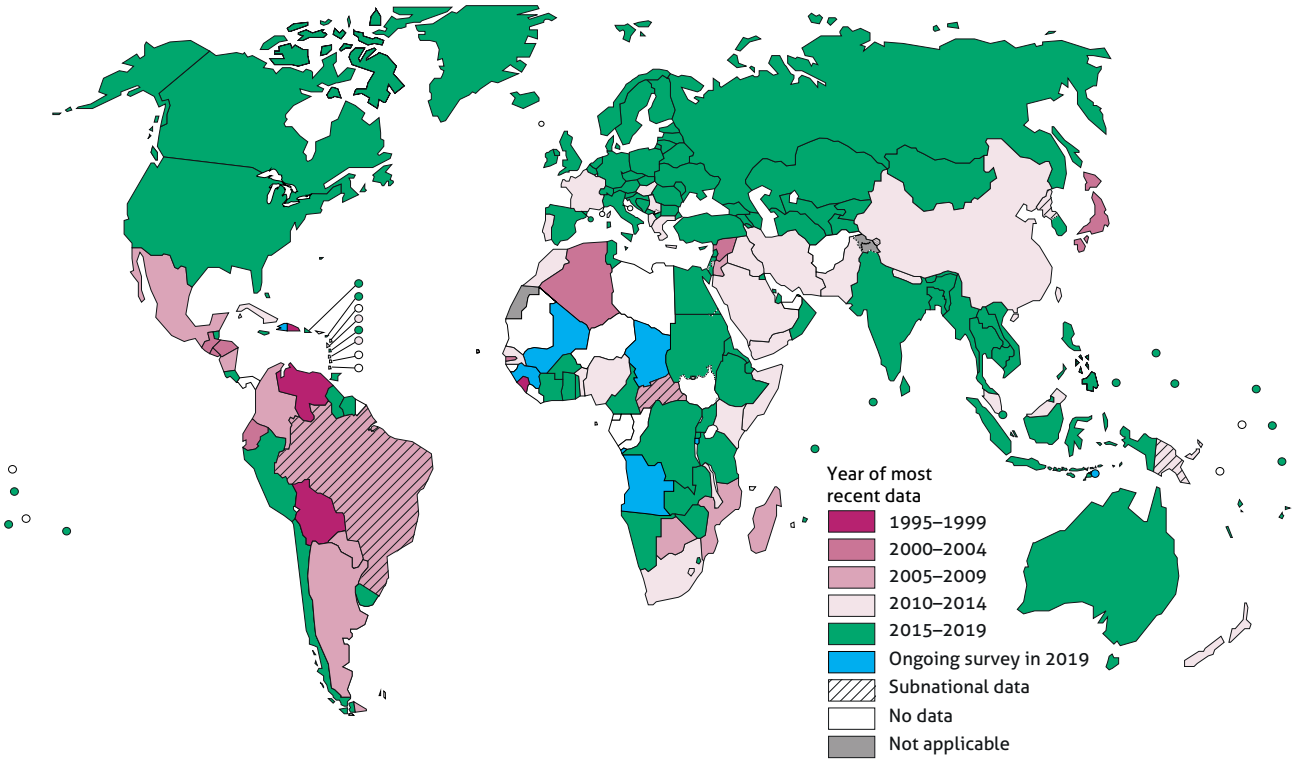
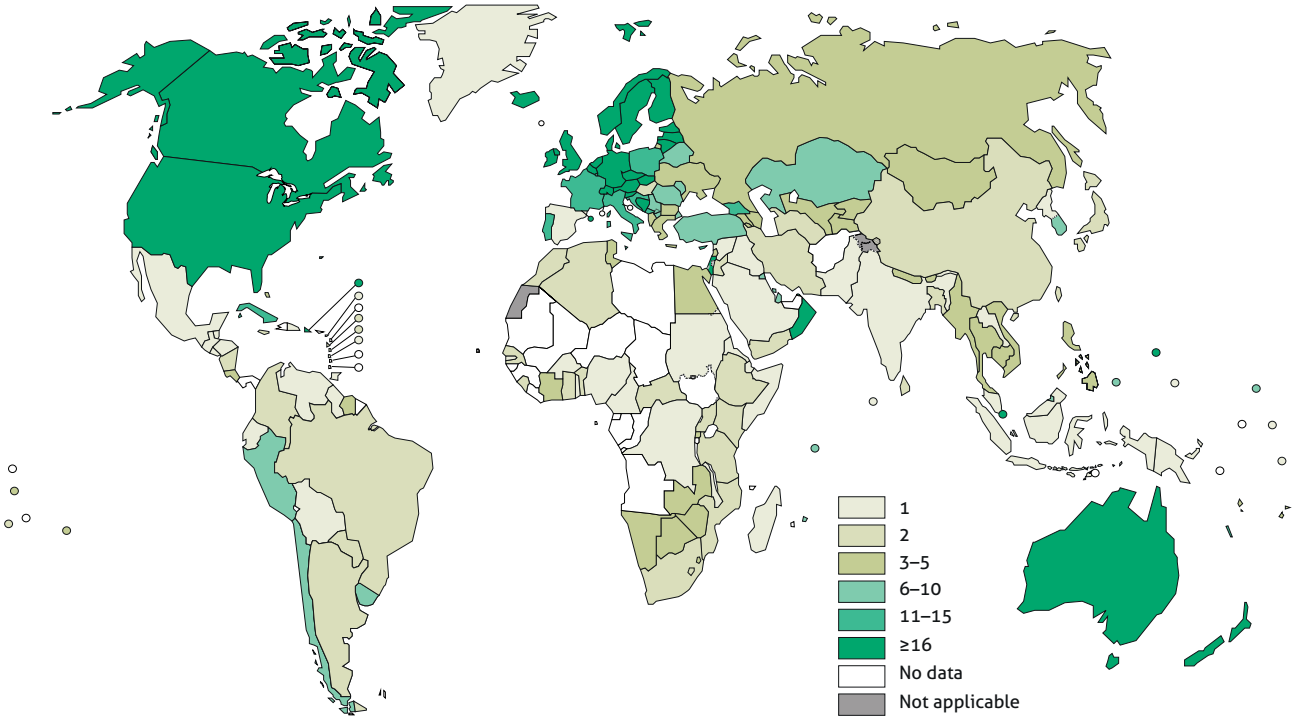


FIG. 3.29

Number of data points on rifampicin resistance among new cases, 1995–2019



BOX 3.4

Ongoing transmission of a rifampicin-resistant clone in Eswatini: results of the second national anti-TB drug resistance survey

Next-generation sequencing is a valuable tool for the surveillance of drug-resistant TB. Compared with conventional phenotypic DST, it provides accurate and more rapid results for both first-line and second-line anti-TB drugs *(16)*. It also offers valuable insights into molecular epidemiology, including phylogenetics, strain evolution and transmission.

A national drug-resistance survey was undertaken in Eswatini in 2017–2018. Sputum samples from presumptive pulmonary TB patients were tested using the Xpert MTB/RIF assay, of which 1443 were positive for *M. tuberculosis*. These 1443 samples were cultured in liquid media using the BD BACTEC™ MGIT™ 960 system, followed by extraction of genomic DNA and whole genome sequencing. Data from whole genome sequencing were available for 734 patients.

The national prevalence of rifampicin resistance was 8.6% among new TB patients and 17.5% among previously treated TB patients, comparable to levels observed in the previous survey in 2009. However, 56% of these cases harboured the Ile491Phe mutation in the *rpoB* gene, which is missed by Xpert MTB/RIF. Although the presence of this clone was detected among 30% of RR-TB cases in the previous survey *(17)*, ongoing transmission is evident.

The results of this survey have important policy implications for Eswatini. Whole genome sequencing has demonstrated that Xpert MTB/RIF remains an accurate test for the diagnosis of TB in the country but cannot be relied on for detection of rifampicin resistance, because cases will be missed. The national diagnostic algorithm in the country should be modified accordingly, to improve detection of patients with RR-TB, and ensure access to appropriate treatment and care.

Reassuringly, evidence suggests that the circulation of this clone remains geographically localized. In multicountry sequencing databases *(18–20)* that collectively contain isolates from more than 20 000 patients, less than 0.5% harboured this mutation. Incorporating sequencing into surveillance activities will improve understanding of the distribution of this clone, particularly in south-eastern Africa.

TABLE 3.9

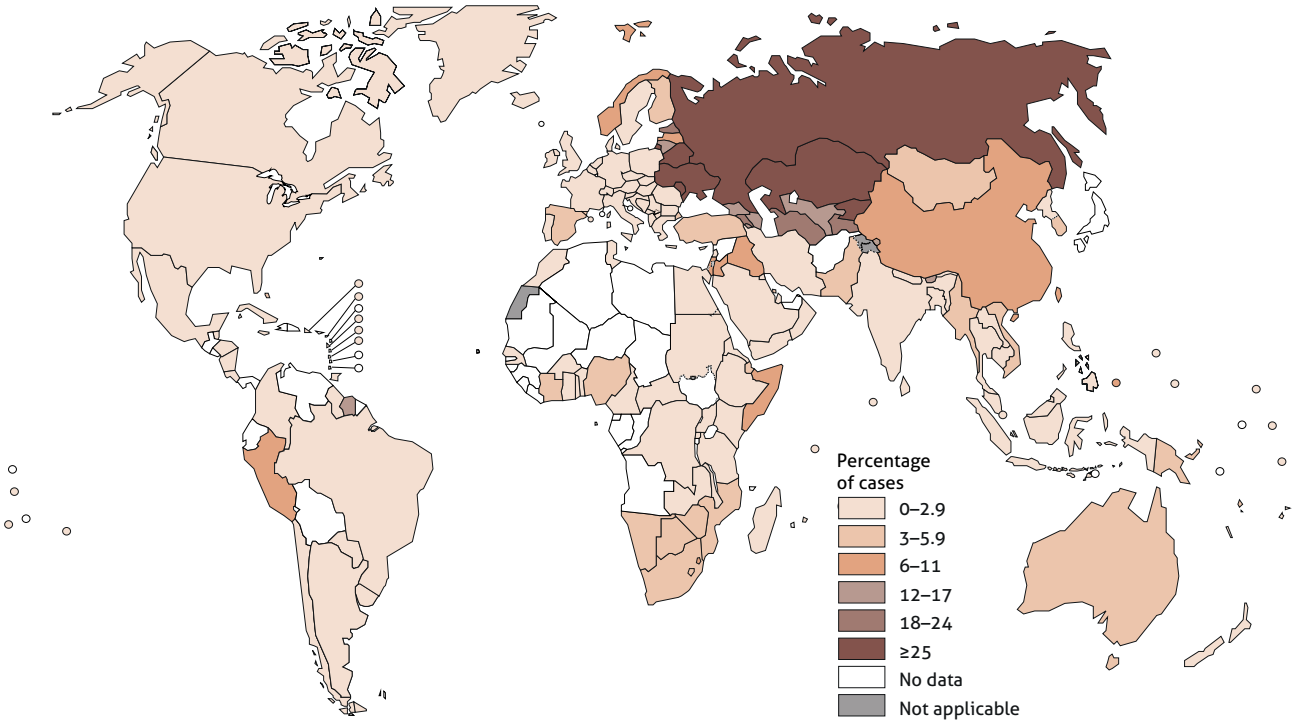
Estimated incidence of MDR/RR-TB[a] in 2018 for 30 high MDR-TB burden countries, WHO regions and globally

	ESTIMATED % OF NEW CASES WITH MDR/RR-TB		ESTIMATED % OF PREVIOUSLY TREATED CASES WITH MDR/RR-TB		INCIDENCE OF MDR/RR-TB				
	BEST ESTIMATE[b]	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	NUMBER (IN 1000s)	UNCERTAINTY INTERVAL	RATE[c]	UNCERTAINTY INTERVAL	% OF RR-TB WITH MDR-TB
Angola	2.4	1.1–4.2	15	11–19	3.9	1.7–7.1	13	5.4–23	84
Azerbaijan	12	11–13	26	24–27	1.3	0.94–1.6	13	9.5–16	73
Bangladesh[d]	1.5	0.9–2.3	4.9	3.0–7.9	5.9	3.2–9.6	3.7	2.0–5.9	99
Belarus	37	34–39	69	66–73	1.4	1.0–1.7	14	11–18	100
China	7.1	5.6–8.7	21	20–21	66	50–85	4.6	3.5–6.0	74
DPR Korea	2.2	0.82–4.2	16	9.1–25	5.2	2.5–8.8	20	9.9–34	88
DR Congo	1.7	1.1–2.6	9.5	8.8–10	6.0	3.0–10	7.2	3.6–12	55
Ethiopia	0.71	0.62–0.80	16	14–17	1.6	1.0–2.2	1.4	0.96–2.0	100
India	2.8	2.3–3.5	14	14–14	130	77–198	9.6	5.7–15	69
Indonesia	2.4	1.8–3.3	13	9.0–18	24	17–32	8.8	6.2–12	99
Kazakhstan	27	26–28	64	63–66	4.8	3.0–6.9	26	16–38	59
Kenya	1.3	0.74–2.0	4.4	3.7–5.2	2.3	1.1–4.1	4.5	2.1–7.9	62
Kyrgyzstan	29	27–31	68	66–71	3.0	2.4–3.6	47	39–57	100
Mozambique	3.7	2.5–5.2	20	5.2–40	8.3	4.4–14	28	15–46	82
Myanmar	4.9	4.7–5.1	20	19–21	11	7.4–16	21	14–30	100
Nigeria	4.3	3.2–5.5	15	11–19	21	12–32	11	6.4–16	73
Pakistan	4.2	3.2–5.3	16	15–17	28	18–40	13	8.4–19	90
Papua New Guinea	3.4	1.7–5.0	26	15–36	2.0	1.2–2.9	23	14–33	78
Peru	6.3	5.9–6.7	20	19–22	3.2	2.4–4.1	10	7.6–13	80
Philippines	1.7	1.1–2.5	16	13–20	18	7.7–32	17	7.3–30	73
Republic of Moldova	29	26–31	60	56–64	1.4	1.1–1.6	34	28–40	93
Russian Federation	35	34–35	71	70–71	41	26–59	28	18–40	90
Somalia	8.7	6.1–12	47	29–65	4.0	2.2–6.3	27	15–42	61
South Africa	3.4	2.5–4.3	7.1	4.8–9.5	11	7.2–16	19	12–28	62
Tajikistan	21	19–24	38	34–42	1.9	1.4–2.4	20	15–26	95
Thailand	2.3	1.3–3.4	24	18–31	4.0	2.3–6.1	5.7	3.3–8.8	76
Ukraine	29	28–30	46	45–48	13	8.1–18	29	18–41	78
Uzbekistan	15	14–16	34	32–36	4.7	3.2–6.6	15	9.9–20	57
Viet Nam	3.6	3.4–3.8	17	17–18	8.6	5.4–13	9.1	5.7–13	83
Zimbabwe	3.9	3.5–4.3	14	8.9–20	1.5	1.1–2.0	10	7.4–14	71
MDR-TB HBCs	**3.6**	**2.7–4.6**	**18**	**8.9–30**	**438**	**371–510**	**9.3**	**7.9–11**	**78**
Africa	2.5	1.6–3.6	12	0.55–39	77	65–91	7.3	6.1–8.5	75
The Americas	2.5	1.5–3.8	12	4.0–24	11	9.2–12	1.0	0.92–1.2	84
Eastern Mediterranean	4	2.8–5.4	16	2.2–41	38	28–50	5.5	4.0–7.2	85
Europe	18	16–19	54	47–61	77	60–95	8.3	6.5–10	84
South-East Asia	2.6	2.0–3.4	14	7.7–23	182	126–249	9.2	6.3–13	77
Western Pacific	4.6	3.5–5.9	16	7.4–28	99	79–122	5.2	4.1–6.4	74
GLOBAL	**3.4**	**2.5–4.4**	**18**	**7.6–31**	**484**	**417–556**	**6.4**	**5.5–7.3**	**78**

Numbers shown to two significant figures if under 100 and to three significant figures otherwise.
[a] MDR-TB is a subset of RR-TB (78% globally).
[b] Best estimates are for the latest available year.
[c] Rates are per 100 000 population.
[d] Estimates for Bangladesh are interim, pending final results from the national drug resistance survey of 2018–2019.

FIG. 3.30

Percentage of new TB cases with MDR/RR-TB[a]



[a] Percentages are based on the most recent data point for countries with representative data from 2004 to 2019. Model-based estimates for countries with data before 2004 are not shown. MDR-TB is a subset of RR-TB.

3.3.2 Estimates of the disease burden caused by drug-resistant TB

Globally in 2018, an estimated 3.4% (95% confidence interval [CI]: 2.5–4.4%) of new cases and 18% (95% CI: 7.6–31%) of previously treated cases had MDR/RR-TB (**Table 3.9**). The proportions of new and previously treated TB cases with MDR/RR-TB at the country level are shown in **Fig. 3.30** and **Fig. 3.31**. The highest proportions are in several countries of the former Soviet Union (above 25% in new cases and above 50% in previously treated cases).

Overall, there were an estimated 484 000 (range, 417 000–556 000) incident cases of MDR/RR-TB in 2018. This is an approximately 10% downward revision from the best estimate published in the 2018 edition of the WHO global TB report *(2)* (**Box 3.2**), but both estimates have wide uncertainty intervals. The global proportion of RR-TB cases estimated to have MDR-TB was 78% (**Table 3.9**). The geographical distribution of cases of MDR/RR-TB is shown in **Fig. 3.32**; 50% of cases were in India (27%), China (14%) and the Russian Federation (9%).

In 2018, there were about 214 000 (range, 133 000–295 000) deaths from MDR/RR-TB. This is a downward revision from the best estimate published in 2018, due to revisions to estimates of MDR/RR-TB incidence (**Box 3.2**).

3.3.3 Trends in drug resistance

Of the 40 countries with a high TB or MDR-TB burden (or both), only 28 have data from multiple years to evaluate trends in drug resistance. Among these countries, 13 have at least 3 years of data: Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Myanmar, Peru, the Republic of Moldova, the Russian Federation, Tajikistan, Thailand, Ukraine, Viet Nam and Zambia. For these settings, **Fig. 3.33** shows trends in the number of new TB cases notified, the proportion of new TB cases with multidrug resistance, and per capita TB and MDR-TB rates. There is a slight trend for cases of MDR-TB to increase as a proportion of all notified TB cases in these countries, while the estimated incidence of TB continues to fall.

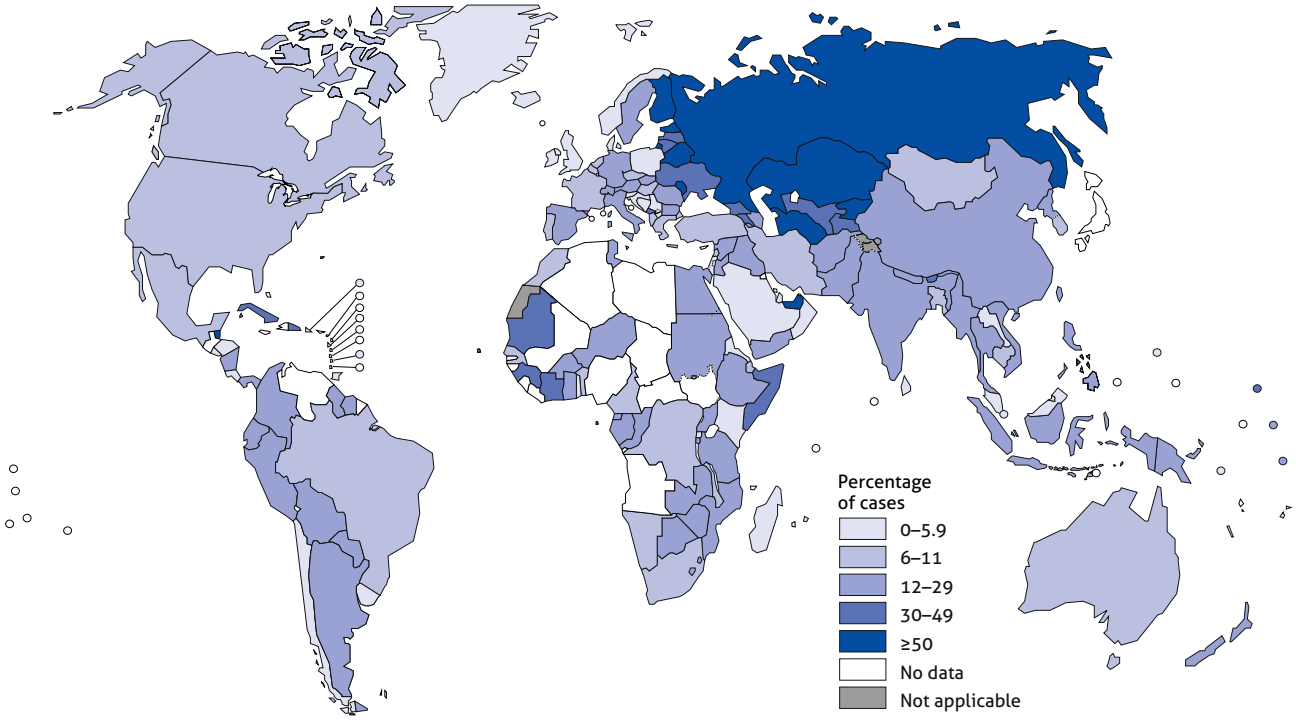
3.3.4 Resistance to other anti-TB drugs

Data on levels of resistance to isoniazid without concurrent rifampicin resistance are available for 156 countries in the period 2002–2018. The proportions of TB patients resistant to isoniazid but susceptible to rifampicin in each country were weighted according to the number of TB cases that were notified in the country, to generate a global average. The global averages of isoniazid resistance without concurrent rifampicin resistance were 7.2% (95% CI: 6.2–8.2%) in new TB cases and 11.6% (95% CI: 9.9–13.3%) in previously treated TB cases.

A multicountry analysis of resistance to levofloxacin

FIG. 3.31

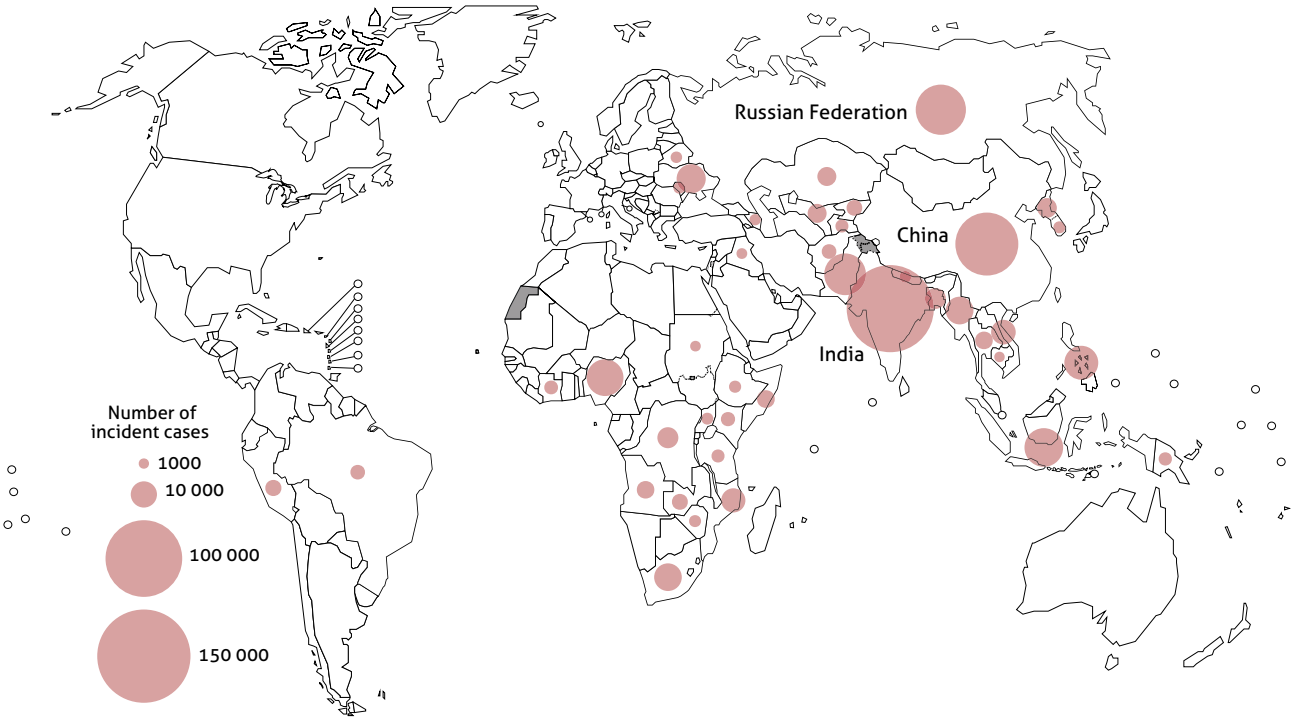
Percentage of previously treated TB cases with MDR/RR-TB[a]



[a] Percentages are based on the most recent data point for countries with representative data from 2004 to 2019. Model-based estimates for countries with data before 2004 are not shown. MDR-TB is a subset of RR-TB.

FIG. 3.32

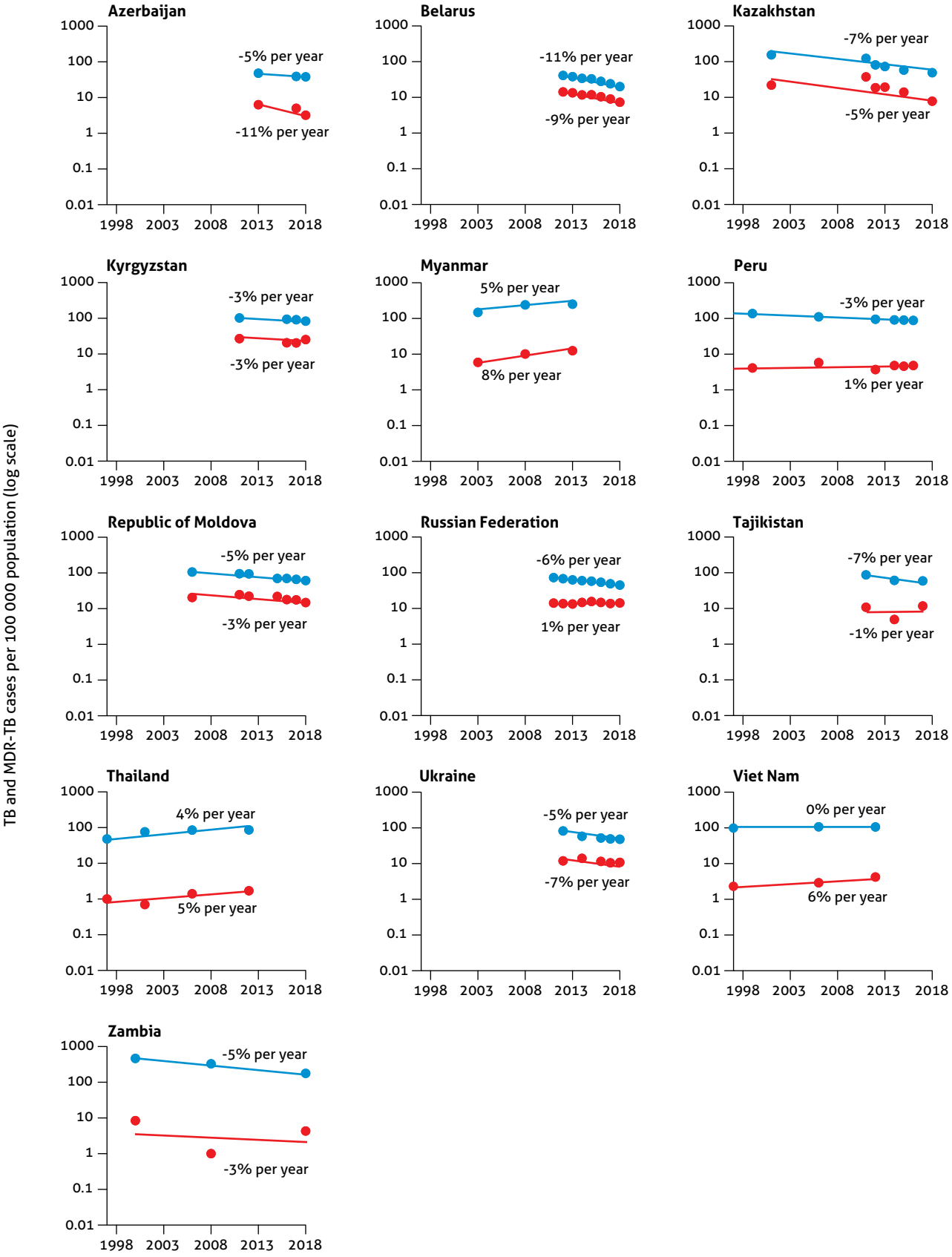
Estimated incidence of MDR/RR-TB[a] in 2018, for countries with at least 1000 incident cases



[a] MDR-TB is a subset of RR-TB.

FIG. 3.33

Trends in levels of drug resistance in selected high MDR-TB burden countries with at least three years of data. The **blue** lines show rates of new notified TB cases per 100 000 population, and the **red** lines show rates of MDR-TB cases among new TB patients per 100 000 population in high MDR-TB burden countries with at least three years of data. Change is indicated as an average annual percentage. The scale is logarithmic.



BOX 3.5

Resistance of TB strains to fluoroquinolones and pyrazinamide

Although nationally representative data on rifampicin resistance are available for more than 99% of the world's population and TB cases, testing coverage for other medicines used in TB treatment remains low.

WHO recently released updated guidance on the treatment of drug-resistant TB *(21)*. Levofloxacin (a fluoroquinolone) and pyrazinamide are included as components of the treatment regimens for MDR/RR-TB and isoniazid-resistant, rifampicin-susceptible TB (Hr-TB). Data on levofloxacin[a] and pyrazinamide[b] resistance from surveys conducted in six countries (Azerbaijan, Bangladesh, Belarus, Pakistan, the Philippines and South Africa) were used to assess how effective these medicines are likely to be in different patient groups. The methodology of these surveys is described in detail elsewhere *(20, 22)*.

Among patients who were susceptible to both rifampicin and isoniazid, the prevalence of resistance to either levofloxacin or pyrazinamide was low (**Table B3.5.1**). A notable exception was Pakistan, where levofloxacin resistance occurred in 9% of rifampicin- and isoniazid-susceptible patients. Although there was variation across settings, the prevalence of resistance to pyrazinamide or levofloxacin (or both) was generally higher among Hr-TB patients than among rifampicin- and isoniazid-susceptible patients. Combined resistance to levofloxacin and pyrazinamide was rare among Hr-TB patients, which provides further justification for the modified treatment regimen. The highest prevalence of resistance to either drug occurred among RR-TB patients.

TABLE 3.5.1

Prevalence (%) of resistance to levofloxacin and pyrazinamide among TB patients in six countries. 95% confidence intervals are shown in brackets.

		AZERBAIJAN, 2013	BANGLADESH, 2011	BELARUS (MINSK CITY), 2010	PAKISTAN, 2013	PHILIPPINES, 2012	SOUTH AFRICA (GAUTENG), 2014	SOUTH AFRICA (KWAZULU NATAL), 2014
Levofloxacin resistance								
Rifampicin susceptible	Isoniazid susceptible	0 (0–0.7)	4.3 (3.1–6.0)	0 (0–4.9)	9.0 (7.5–10.7)	0 (0–0.6)	0 (0–0.4)	0 (0–0.6)
	Isoniazid resistant	1.9 (0.5–7.4)	0 (0–7.5)	9.5 (2.4–31.1)	13.5 (8.6–20.6)	0 (0–1.9)	0 (0–6.6)	0 (0–9.0)
Rifampicin resistant		21.4 (15.5–28.8)	9.4 (4.3–19.3)	25.7 (18.2–35.1)	16.7 (10.6–25.2)	0.8 (0.1–5.6)	6.5 (2.1–18.4)	5.6 (1.4–19.7)
Pyrazinamide resistance								
Rifampicin susceptible	Isoniazid susceptible	0.2 (0–1.4)	0.8 (0.4–1.7)	1.3 (0.2–8.8)	0.2 (0–0.7)	0.1 (0–0.9)	0.6 (0.3–1.5)	0.3 (0.1–1.3)
	Isoniazid resistant	5.7 (2.6–5.1)	0 (0–7.4)	8.7 (2.1–28.9)	0.8 (0.1–5.5)	2.5 (0.8–7.5)	0 (0–6.7)	2.6 (0.4–16.5)
Rifampicin resistant		31.0 (24.0–39.0)	13.7 (7.5–23.6)	64.7 (55.0–73.3)	13.1 (7.9–20.9)	7.2 (3.3–15.2)	26.1 (15.5–40.5)	21.9 (11.8–37.1)
Any resistance to levofloxacin or pyrazinamide								
Rifampicin susceptible	Isoniazid susceptible	0.2 (0–14.1)	5.2 (3.8–6.9)	1.4 (0.2–9.0)	9.0 (7.5–10.8)	0.3 (0–1.0)	0.7 (0.3–1.6)	0.2 (0–1.2)
	Isoniazid resistant	5.8 (2.6–12.4)	0 (0–7.5)	9.5 (2.4–31.1)	14.5 (9.3–21.9)	2.5 (0.8–7.5)	0 (0–7.1)	2.6 (0.4–16.5)
Rifampicin resistant		42.6 (34.8–50.9)	21.9 (13.4–33.6)	72.0 (62.4–79.9)	28.3 (20.3–37.9)	7.3 (3.3–15.3)	25.6 (14.8–40.5)	22.9 (11.9–39.5)
Combined resistance to levofloxacin and pyrazinamide								
Rifampicin susceptible	Isoniazid susceptible	0 (0–0.7)	0 (0–0.5)	0 (0–4.9)	0 (0–0.6)	0 (0–0.5)	0 (0–0.5)	0 (0–0.6)
	Isoniazid resistant	1.0 (0.1–6.6)	0 (0–7.5)	9.5 (2.4–31.1)	0 (0–2.9)	0 (0–3.1)	0 (0–7.1)	0 (0–9.3)
Rifampicin resistant		9.1 (5.4–15.0)	1.6 (0.2–10.3)	19.0 (12.5–27.9)	3.0 (1.0–9.0)	1.2 (0.2–8.1)	2.3 (0.3–14.7)	2.9 (0.4–17.7)

[a] Levofloxacin testing: In all countries except the Philippines, culture isolates were tested for phenotypic susceptibility to moxifloxacin at 0.5 mg/L using MGIT 960. Those that were resistant to moxifloxacin were then tested for levofloxacin at 1.5 mg/L using MGIT 960, while those that were susceptible to moxifloxacin were assumed to also be susceptible to levofloxacin. In the Philippines, levofloxacin testing was performed directly on a random selection of isolates. In addition to phenotypic testing, whole genome or targeted gene sequencing was performed for the *gyrA* and *gyrB* genes. An isolate was classified as resistant to levofloxacin if detected as resistant by either phenotypic testing or by sequencing, according to an established framework to classify detected mutations.

[b] Pyrazinamide testing: Whole genome or targeted gene sequencing was performed for the *pncA* gene, and interpreted using an established framework to classify detected mutations. There are a range of different mutations occurring in this gene and many cannot yet be statistically classified as conferring resistance. For this reason, the prevalence of pyrazinamide resistance may be underestimated. As more data become available, the sensitivity of sequencing to detect resistance will increase.

FIG. 3.34

National surveys of the prevalence of TB disease, actual (2000–2019) and planned (2020)

2000	China				
2001					
2002	Cambodia				
2003	Malaysia				
2004	Indonesia[a]				
2005	Eritrea[b]				
2006	Thailand				
2007	Philippines	Viet Nam			
2008	Bangladesh[b]				
2009	Myanmar				
2010	China				
2011	Cambodia	Ethiopia	Lao PDR	Pakistan	
2012	Gambia	Nigeria	Rwanda	UR Tanzania	Thailand
2013	Malawi	Ghana	Sudan		
2014	Indonesia	Zambia	Zimbabwe		
2015	Bangladesh	Kenya	Mongolia	Uganda	
2016	DPR Korea	Philippines			
2017	Mozambique[c]	Myanmar	Namibia	South Africa[d]	Viet Nam
2018	Nepal[d]	Eswatini[d]			
2019	India[e]	Lesotho[c]			
2020	Botswana[f]				

[a] The survey in Indonesia (2004) did not use chest X-ray to screen individuals for sputum submission.
[b] The surveys in Bangladesh (2008) and Eritrea (2005) collected sputum samples from all individuals (aged ≥15 years), and did not use chest X-ray and/or a symptom questionnaire to screen individuals for sputum submission.
[c] Field operations are ongoing.
[d] Field operations are completed and analysis is ongoing.
[e] Field operations scheduled to start in 2019.
[f] Field operations scheduled to start in 2020.

and pyrazinamide, which form part of WHO-recommended regimens for people with isoniazid-resistant TB and MDR/RR-TB, is summarized in **Box 3.5**.

By the end of 2018, at least one case of XDR-TB had been reported by 131 WHO Member States. Over the past 15 years, 128 countries (including 117 Member States) and five territories have reported representative data from continuous surveillance or surveys regarding the proportion of MDR-TB cases that had XDR-TB. Combining their data, the average proportion of MDR-TB cases with XDR-TB was 6.2% (95% CI: 4.4–8.2%). This is lower than the 8.5% that was published in the 2018 edition of the WHO global TB report *(2)*, reflecting new data from 10 countries (including India) with lower proportions of XDR-TB among MDR-TB cases.

Among the 40 countries with a high TB or MDR-TB burden, 24 have representative data from the past 15 years on resistance to second-line anti-TB drugs. The proportion of MDR/RR-TB cases with resistance to any fluoroquinolone for which testing was done – including ofloxacin, levofloxacin and moxifloxacin – was 20.8% (95% CI: 16.3–25.8%).

3.4 National TB prevalence surveys

The prevalence of TB disease is not an indicator in the SDGs or a high-level indicator of the End TB Strategy, and no global target has been set for the period 2016–2035.[1] Furthermore, indirect estimates of prevalence suffer from considerable uncertainty, because they are derived from estimates of incidence and assumptions about disease duration. Nonetheless, in an important subset of countries with a large proportion of the world's TB burden (**Fig. 3.2**), national TB prevalence surveys continue to provide the best method for directly measuring the number of cases and informing estimates of TB incidence (including its distribution by age and sex), and direct measurement of trends when repeat surveys are done. Findings from surveys can also inform assessment of actions needed to reduce the burden of TB disease.

The WHO Global Task Force on TB Impact Measurement retained national TB prevalence surveys within its strategic areas of work for 2016–2020 (**Box 3.1**). The group of countries where these surveys continue to be relevant are defined as those with a relatively high estimated burden of TB (about 150 incident cases per 100 000 population per year) that do not yet have health, national notification and VR systems of the quality and coverage required to provide reliable and routine direct measurements of the number of TB cases and deaths.[2]

Countries in which national prevalence surveys were implemented in 2000–2019 or are planned to start in 2020 are shown in **Fig. 3.34** and **Fig. 3.35**. An unprecedented number of surveys were implemented in 2007–2015, a period in which the WHO Global Task Force on TB Impact Measurement defined national TB prevalence surveys in 22 global focus countries as one of its three strategic areas of work (**Box 3.1**).

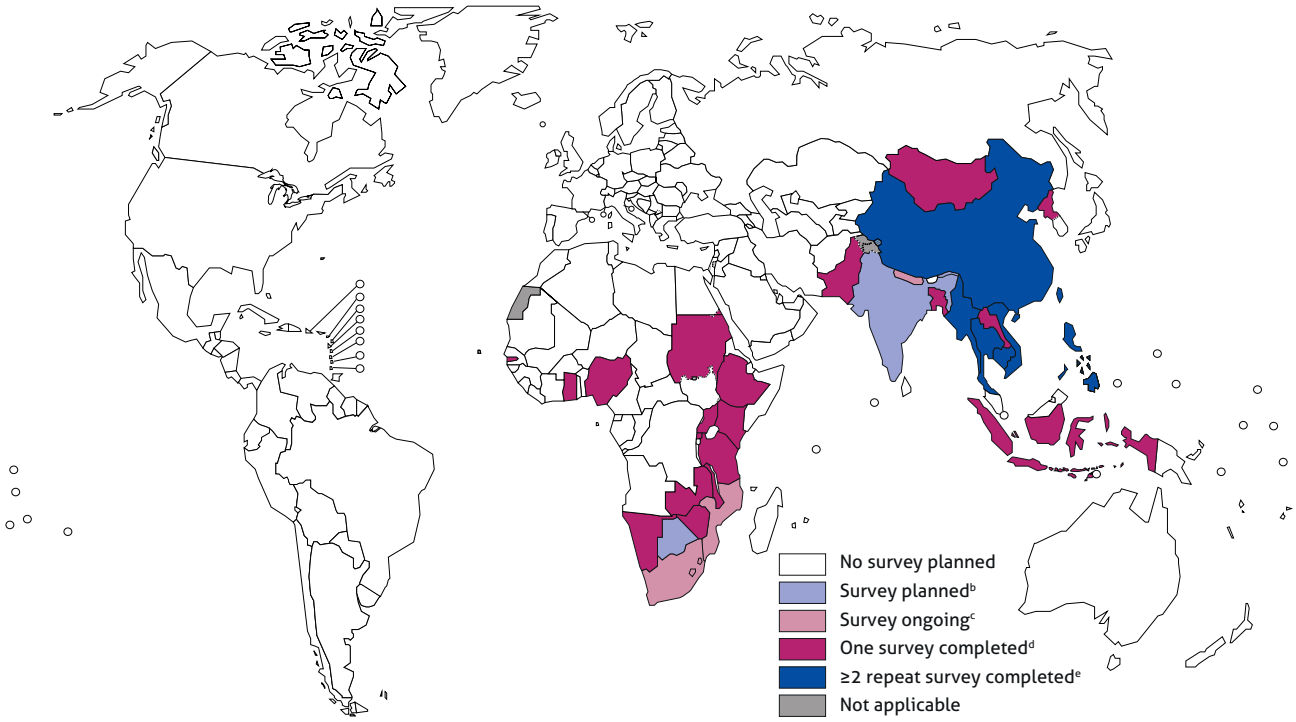
Between 2007 and the end of 2018, a total of 28 surveys that used the screening and diagnostic methods recommended in the second edition of the WHO handbook on prevalence surveys *(23)* were completed. This included 15 surveys in Asian countries and 13 in African countries. In 2018, the first national survey in Namibia was com-

[1] This is in contrast to the era of the Millennium Development Goals and Stop TB Strategy, when one of the global targets for reductions in TB disease burden was to halve prevalence between 1990 and 2015.

[2] In the Task Force's April 2016 meeting, epidemiological criteria for conducting a survey were defined for two groups of countries: those that implemented a survey in 2009–2015 and in which a repeat survey could be considered; and those that have never conducted a survey. There were 24 countries in the first group and 33 in the second group. For any of these 57 countries, it was emphasized that feasibility criteria must also be considered. In particular, the prerequisites for conducting a survey defined in the WHO handbook on national TB prevalence surveys should be met. For further details on the meeting, see WHO (2016) *(7)*.

FIG. 3.35

Countries in which national population-based surveys of the prevalence of TB disease have been implemented using currently recommended screening and diagnostic methods[a] since 2000 or are planned in the future (status in August 2019)



[a] Screening methods include field chest X-ray; at least culture was used to confirm diagnosis. The most recent surveys in Bangladesh, Kenya, Namibia, Myanmar, Nepal, Philippines, South Africa and Viet Nam used both culture and Xpert MTB/RIF to confirm diagnosis.
[b] A country has submitted at least a draft survey protocol and a budget plan to the WHO Global Task Force on TB Impact Measurement.
[c] Countries were implementing field operations in August 2019 or were undertaking data cleaning and analysis.
[d] A survey was conducted in accordance with WHO recommendations as outlined in 'Tuberculosis prevalence surveys: a handbook (2011)' and at least a preliminary report has been published.
[e] A repeat national survey is one in which participants were screened with chest X-ray, and (at least) culture was used to diagnose TB cases.

pleted, and repeat surveys were completed in Myanmar (following a first survey in 2009) and Viet Nam (following a first survey in 2007). As of August 2019, field operations were ongoing in Lesotho and Mozambique. Three countries – Eswatini, Nepal and South Africa – completed field operations in 2019, and results are expected before the end of the year or in early 2020. The first national survey in India, which will be the largest national survey ever undertaken (the planned sample size is around 500 000 people) is scheduled to start before the end of 2019.

The recently completed repeat surveys in Myanmar and Viet Nam are excellent examples of how surveys can be used to assess the level of, and trends in, TB disease burden. The key findings from these surveys are summarized in **Box 3.6** and **Box 3.7**.

The distribution of TB disease by age (in adults) and sex based on prevalence survey data from 28 surveys in 25 countries implemented in 2007–2018 (with repeat surveys in Myanmar, the Philippines and Viet Nam) is shown in **Fig. 3.36** and **Fig. 3.37**. In Asia and some African countries (e.g. Ghana, Malawi, Rwanda, the United Republic of Tanzania and Zimbabwe), prevalence increased with age. However, in several African countries (e.g. Ethiopia, Gambia, Namibia, Nigeria, Sudan, Uganda and Zambia), prevalence per 100 000 population peaked among those aged 35–54 years. The M:F ratio of cases for the same set of surveys showed a systematically higher burden of TB disease among men, with ratios ranging from 1.2 (in Ethiopia) to 4.9 (in Viet Nam) for bacteriologically confirmed pulmonary TB. In most countries, the ratio was in the range 2–4, with generally higher ratios in Asia than in Africa.

The ratio of prevalence to notifications (P:N) can be used to assess detection and reporting gaps (**Fig. 3.38a**) and variation in these gaps by sex (**Fig. 3.38b**). The P:N ratios from surveys implemented in 2007–2018 suggest that these gaps are marginally higher in Africa than in Asia. The data also suggest that women are accessing available diagnostic and treatment services more effectively than men. The higher disease burden in men, combined with larger gaps in detection and reporting, indicates a need for strategies to improve access to and use of health services among men *(24)*.

BOX 3.6

Decline in TB disease burden in Viet Nam, 2007–2017

The national TB programme (NTP) in Viet Nam conducted the country's first national TB prevalence survey in 2007 *(25)*. A repeat survey was implemented in 2017 and results were finalized in February 2019. Details of the results from the repeat survey will be published in a peer-reviewed journal; updated estimates of TB incidence that were derived from the two surveys, accounting for methodological differences between the two surveys, are summarized here.

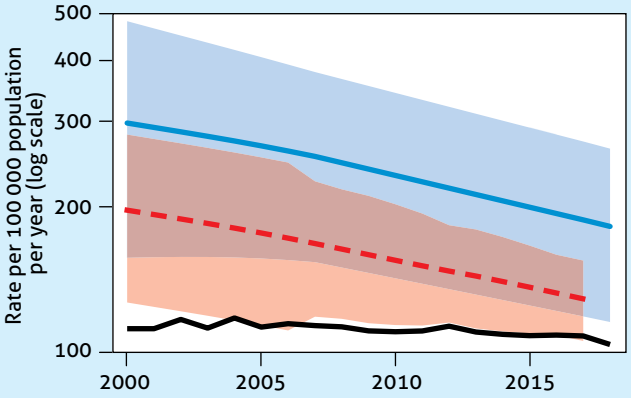
The burden of TB disease in Viet Nam declined substantially between 2007 and 2017, and the updated time series is statistically consistent with previously published estimates. On average, the TB incidence rate fell 3% per year, with a particularly marked reduction in more severe, smear-positive pulmonary disease. This was a period in which the NTP introduced a range of interventions, including household contact investigations, TB preventive treatment, new TB diagnostics, and active case finding. Routine services for TB diagnosis and treatment were also strengthened. The number of case notifications was 47% of the best estimate of TB incidence in 2007, improving to 57% in 2017, which can be explained by improvements in reporting coverage from general hospitals, prisons and the private sector.

Incidence estimates for 2007 and 2017 and how they compare with notifications of TB cases in the same years are shown in **Table B3.6.1** and the updated time series of estimated incidence from 2000 to 2017 is shown in **Fig. B3.6.1**.

The burden of TB disease shows a geographic gradient, declining from south to north (**Table B3.6.2**).

FIG. B3.6.1

Estimated TB incidence in Viet Nam 2000–2018



Blue, updated incidence estimates. **Red**, previously published incidence estimates in the global TB report 2018. **Black**, case notifications (new and relapse). Shaded areas represent uncertainty bands.

TABLE B3.6.1

Estimated TB incidence (all forms, all ages) and notifications of TB cases in 2007 and 2017

INDICATOR	2007	2017
Incidence per 100 000 population	238 (range, 141–365)	188 (range, 111–264)
Notification rate (new and relapse cases) per 100 000 population	113	108
Notifications as a percentage of estimated incidence	47%	57%

TABLE B3.6.2

Estimated TB incidence in the three regions of Viet Nam

REGION	RATE PER 100 000 POPULATION IN 2017
North	147 (range, 72–223)
Centre	165 (range, 58–273)
South	212 (range, 121–303)

Decline in TB disease burden in Myanmar, 2009–2018

Myanmar's NTP conducted a national TB prevalence survey in 2009 and a repeat survey in 2018. The first survey enumerated 57 607 adults (≥15 years) in 70 clusters, of whom 51 367 (89%) participated. The 2018 survey was implemented in 138 clusters selected from three strata (Yangon, region, state); 75 676 eligible adults were enumerated, of whom 66 480 (88%) participated. In both surveys, participants were screened by symptom questionnaire and chest radiography, as recommended in WHO guidance published in 2011 *(23)*.

The prevalence of pulmonary TB among adults (≥15 years) in 2018 was 436 per 100 000 population (95% CI: 361–511). This increased with age, from 156 (95% CI: 87–225) per 100 000 population among those aged 15–24 years to 1091 (95% CI: 768–1413) per 100 000 population among those aged 65 years and over. The M:F ratio was 3.6 (range, 2.4–4.8). Of the three strata, Yangon had the highest prevalence.

To compare changes between the 2009 and 2018 surveys, analysis of the 2018 survey was restricted to those with sputum smear-positive and bacteriologically confirmed TB in the 70 clusters in which culture testing was done for all individuals who screened positive (i.e. the same screening and testing algorithm as that used in the 2009 survey). Results are shown in Table B3.7.1 and Fig. B3.7.1. Between 2009 and 2018, the prevalence of bacteriologically confirmed pulmonary TB in adults fell 51%, and the prevalence of smear-positive TB fell even more, by 71%. The average rate of decline in TB prevalence was 6.8% per year.

Explanations for these impressive findings include the expansion and strengthening of service coverage (particularly in states) and better linkages with the private sector, supported by increased financing from the government, the Global Fund to Fight AIDS, Tuberculosis and Malaria, and the Three Millennium Development Goal Fund (3MDG) (which was established to provide support for HIV, TB and malaria interventions).

Estimates of TB incidence derived from the 2009 and 2018 survey results are shown in Table B3.7.2 and Fig. B3.7.2. On average, the incidence rate declined at 4.9% per year. The updated time series of incidence rates for 2000–2018 is statistically consistent with previously published estimates (Fig B3.7.2). The number of case notifications was 49% of the best estimate of TB incidence in 2009, improving to 76% in 2018.

Incidence in 2018 was also estimated for each of the three strata (Table B3.7.3), highlighting a higher burden of TB in Yangon. States had the lowest incidence rate; states have been prioritized for interventions in recent years, following concerns about low service coverage a decade ago.

TABLE B3.7.1

Comparison of TB prevalence among adults (≥15 years) in 2009 and 2018

PREVALENCE OF PULMONARY TB PER 100 000 POPULATION	2009 (95% CI)	2018 (95% CI)
Culture-positive	520 (415–624)	256 (173–339)
Smear-positive	195 (143–247)	57 (25–88)
Smear:culture ratio	38%	22%

FIG. B3.7.1

Density distribution of the prevalence of bacteriologically confirmed pulmonary TB in adults (≥15 years) in 2009 and 2018

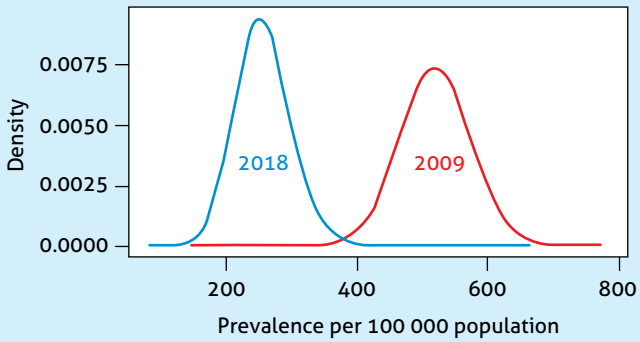


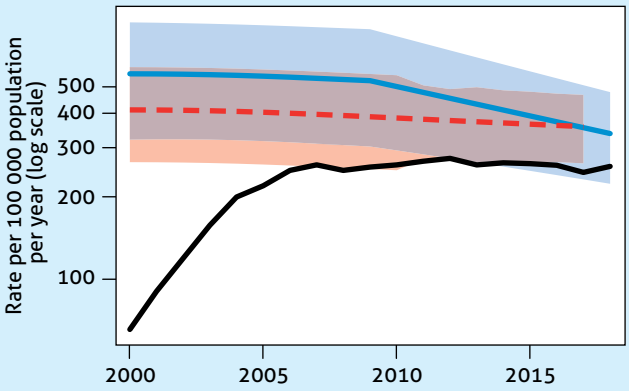
TABLE B3.7.2

Estimated TB incidence (all forms, all ages) in 2009 and 2018

INDICATOR	2009	2018
Incidence per 100 000 population	526 (307–802)	339 (222–478)
Notification rate (new and relapse cases) per 100 000 population	258	256
Notifications as a percentage of estimated incidence	49%	76%

FIG. B3.7.2

Estimated TB incidence in Myanmar 2000–2018



Blue, updated incidence estimates. Red, previously published incidence estimates in the global TB report 2018. **Black**, case notifications (new and relapse). Shaded areas represent uncertainty bands.

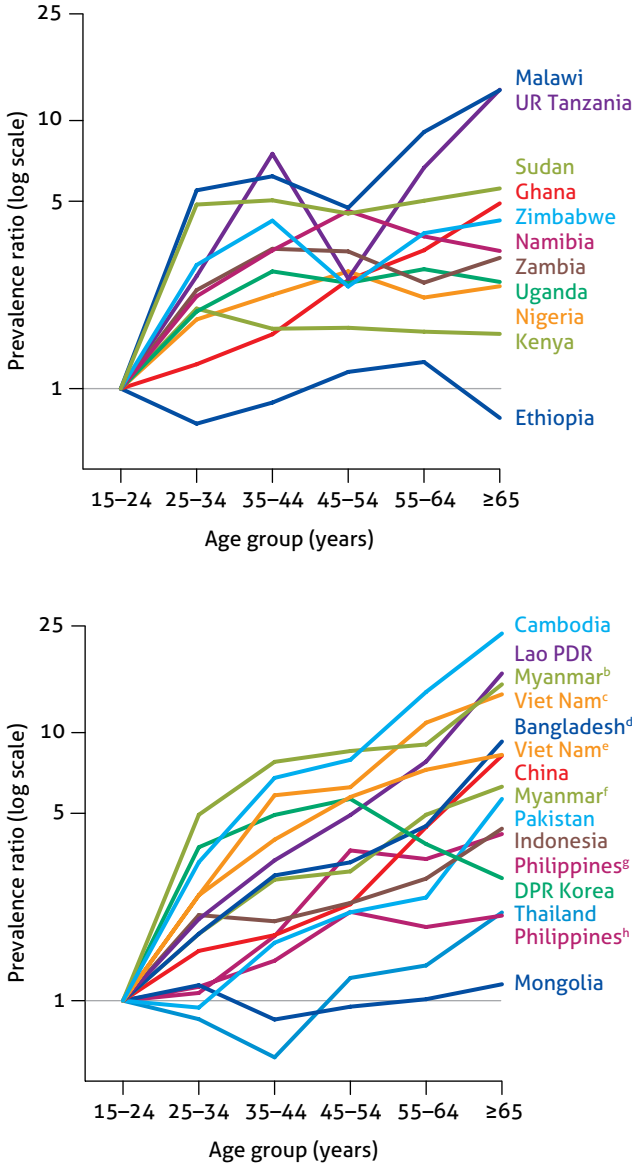
TABLE B3.7.3

Estimated TB incidence in the three survey strata

STRATUM	RATE PER 100 000 POPULATION IN 2018
Regions	330 (range, 199–461)
States	282 (range, 165–399)
Yangon	506 (range, 296–714)

FIG. 3.36

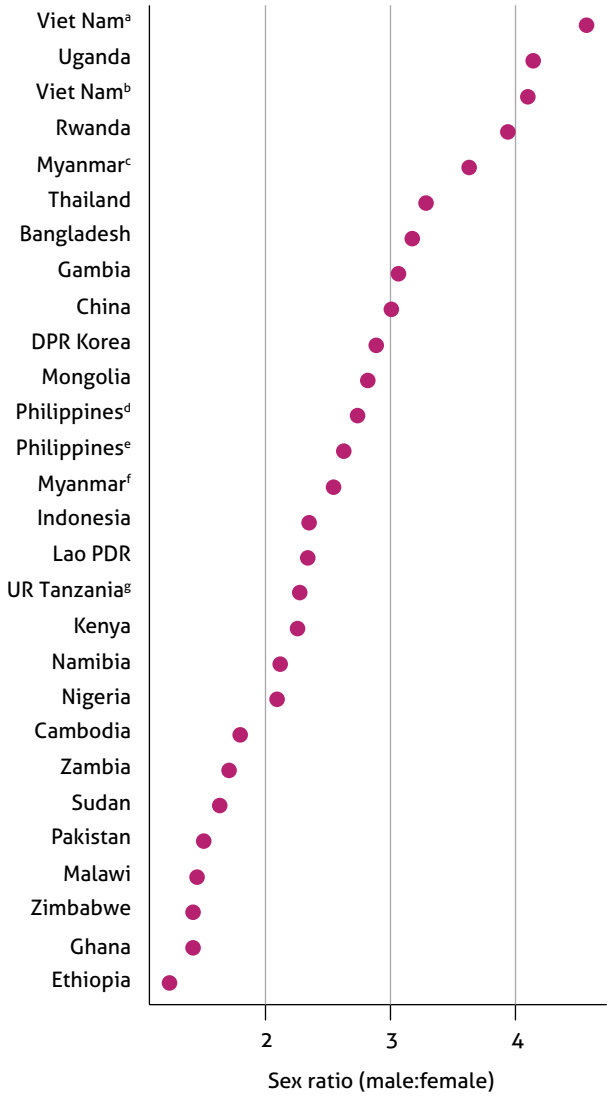
Age-specific prevalence rate ratio of bacteriologically confirmed TB in surveys implemented 2007–2018[a]



[a] Age-specific prevalence ratios were calculated using the prevalence of the 15–24 year age group as the baseline. Data in the presented age groups were not available for Gambia and Rwanda. Due to laboratory challenges during the survey in UR Tanzania, it was only possible to directly estimate the prevalence of smear-positive (as opposed to bacteriologically confirmed) TB.
[b] These data are for the prevalence survey of Myanmar conducted in 2009–2010.
[c] These data are for the prevalence survey of Viet Nam conducted in 2006–2007.
[d] These data are for the prevalence survey of Bangladesh conducted in 2015–2016.
[e] These data are for the repeat prevalence survey of Viet Nam conducted in 2017.
[f] These data are for the repeat prevalence survey of Myanmar conducted in 2018.
[g] These data are for the prevalence survey of Philippines conducted in 2007.
[h] These data are for the repeat prevalence survey of Philippines conducted in 2016.

FIG. 3.37

The male to female ratio of bacteriologically confirmed adult TB cases detected in prevalence surveys implemented 2007–2018



[a] These data are for the repeat prevalence survey of Viet Nam conducted in 2017.
[b] These data are for the prevalence survey of Viet Nam conducted in 2006–2007.
[c] These data are for the repeat prevalence survey of Myanmar conducted in 2018.
[d] These data are for the repeat prevalence survey of Philippines conducted in 2016.
[e] These data are for the prevalence survey of Philippines conducted in 2007.
[f] These data are for the prevalence survey of Myanmar conducted in 2009–2010.
[g] Due to laboratory challenges during the survey in UR Tanzania, it was only possible to directly estimate the prevalence of smear-positive (as opposed to bacteriologically confirmed) TB.

FIG. 3.38a

The prevalence to notification (P:N) ratio of adult TB cases in prevalence surveys implemented 2007–2018[a]

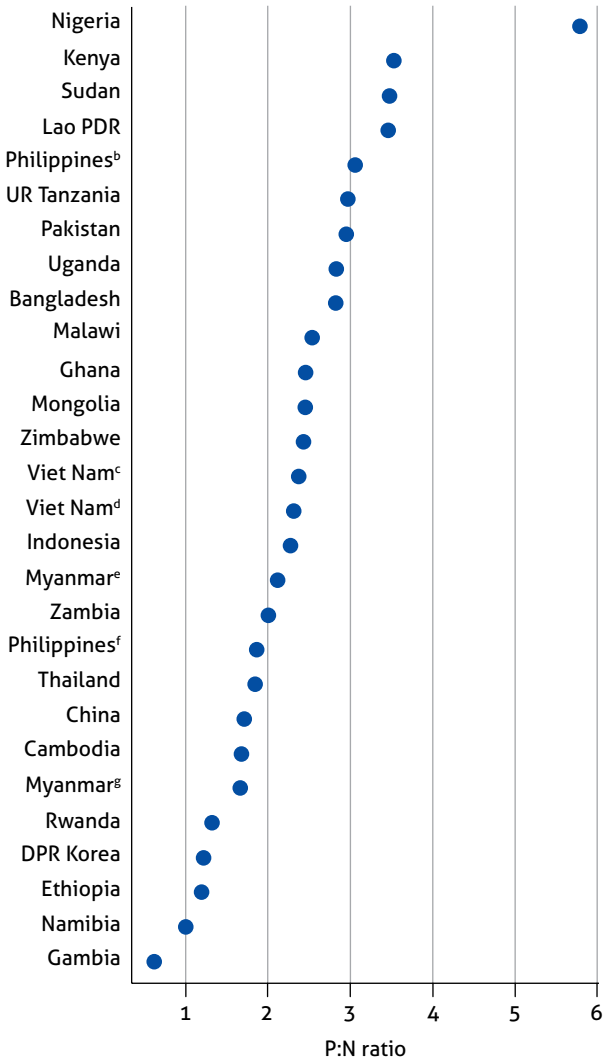
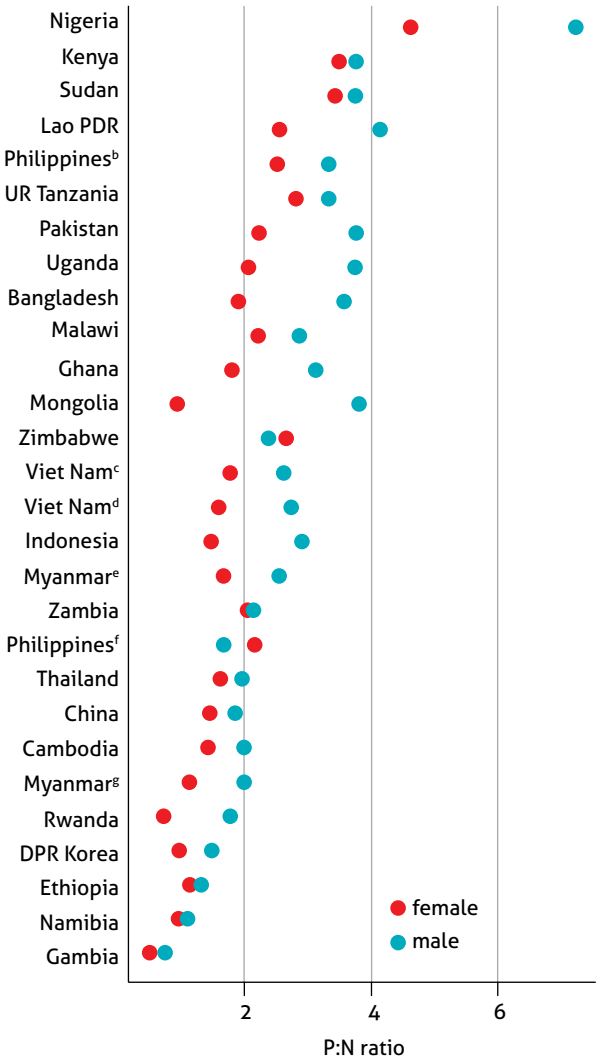


FIG. 3.38b

The prevalence to notification (P:N) ratio by sex for adult TB cases in prevalence surveys implemented 2007–2018[a]



[a] The P:N ratio is for smear-positive TB, except for Bangladesh, DPR Korea, Kenya, Myanmar (2018), Namibia (2018), Uganda, Viet Nam (2017) and Zimbabwe where it was based on bacteriologically confirmed TB. Prevalence estimates are from a cross-sectional survey, and therefore only represent one point in time. Notification data are from the main year of the survey.
[b] These data are for the repeat prevalence survey of Philippines conducted in 2016.
[c] These data are for the repeat prevalence survey of Viet Nam conducted in 2017.
[d] These data are for the prevalence survey of Viet Nam conducted in 2006–2007.
[e] These data are for the prevalence survey of Myanmar conducted in 2009–2010.
[f] These data are for the prevalence survey of Philippines conducted in 2007.
[g] These data are for the repeat prevalence survey of Myanmar conducted in 2018.

References

1 Floyd K, Glaziou P, Houben R, Sumner T, White RG, Raviglione M. Global tuberculosis targets and milestones set for 2016-2035: definition and rationale. Int J Tuberc Lung Dis. 2018;22(7):723–30 (https://www.ncbi.nlm.nih.gov/pubmed/29914597, accessed 8 August 2019).

2 Global tuberculosis report 2018. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/274453, accessed 2 July 2019).

3 Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: World Health Organization; 2014 (https://www.who.int/tb/publications/standardsandbenchmarks/en/, accessed 8 August 2019).

4 Assessing tuberculosis under-reporting through inventory studies. Geneva: World Health Organization; 2012 (https://www.who.int/tb/publications/inventory_studies/en/, accessed 8 August 2019).

5 Electronic recording and reporting for tuberculosis care and control. Geneva: World Health Organization; 2012 (https://www.who.int/tb/publications/electronic_recording_reporting/en/, accessed 25 July 2018).

6 World Health Organization Global Task Force on TB Impact Measurement. Third meeting of the TB estimates subgroup: methods to use for WHO's definitive assessment of whether 2015 global TB targets are met. Geneva: World Health Organization; 2015 (https://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/consultation_april_2015_tb_estimates_subgroup/en/, accessed 8 August 2018).

7 World Health Organization Global Task Force on TB Impact Measurement. Report of the sixth meeting of the full Task Force; 19–21 April 2016, Glion-sur-Montreux, Switzerland. Geneva: World Health Organization; 2016 (https://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_report.pdf?ua=1, accessed 8 August 2019).

8 Global Task Force on TB Impact Measurement [website]. Geneva: World Health Organization; 2019 (https://www.who.int/tb/areas-of-work/monitoring-evaluation/impact_measurement_taskforce/en/, accessed 22 July 2019).

9 TB fact sheet. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/factsheet_tb_impactmeasurement.pdf?ua=1, accessed 22 July 2019).

10 UNAIDS. AIDS info [website]. 2019 (http://aidsinfo.unaids.org/, accessed 15 August 2019).

11 GBD results tool [website]. Global Health Data Exchange; 2019 (http://ghdx.healthdata.org/gbd-results-tool, accessed June 2019).

12 Dodd PJ, Gardiner E, Coghlan R, Seddon JA. Burden of childhood tuberculosis in 22 high-burden countries: a mathematical modelling study. Lancet Glob Health. 2014;2(8):e453–9 (https://www.ncbi.nlm.nih.gov/pubmed/25103518, accessed 20 August 2019).

13 International statistical classification of diseases and health related problems (The) ICD-10. Geneva: World Health Organization; 2016 (https://icd.who.int/browse10/2016/en, accessed 8 August 2019).

14 Dodd PJ, Yuen CM, Sismanidis C, Seddon JA, Jenkins HE. The global burden of tuberculosis mortality in children: a mathematical modelling study. Lancet Glob Health. 2017;5(9):e898–e906 (https://www.ncbi.nlm.nih.gov/pubmed/28807188, accessed 19 August 2019).

15 Global health estimates 2016: disease burden by cause, age, sex, by country and by region, 2000-2016. Geneva: World Health Organization; 2018 (https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html, accessed 8 August 2019).

16 The use of next-generation sequencing technologies for the detection of mutations associated with drug resistance in Mycobacterium tuberculosis complex: technical guide. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/274443/WHO-CDS-TB-2018.19-eng.pdf, accessed 17 July 2019).

17 Sanchez-Padilla E, Merker M, Beckert P, Jochims F, Dlamini T, Kahn P et al. Detection of drug-resistant tuberculosis by Xpert MTB/RIF in Swaziland. N Engl J Med. 2015;372(12):1181–2 (https://www.ncbi.nlm.nih.gov/pubmed/25785984, accessed 15 August 2019).

18 Relational sequencing TB data platform [website]. Geneva: World Health Organization; 2019 (https://platform.reseqtb.org, accessed 8 August 2019).

19 Miotto P, Tessema B, Tagliani E, Chindelevitch L, Starks AM, Emerson C et al. A standardised method for interpreting the association between mutations and phenotypic drug resistance in Mycobacterium tuberculosis. Eur Respir J. 2017;50(6)(https://www.ncbi.nlm.nih.gov/pubmed/29284687, accessed 8 August 2019).

20 Zignol M, Cabibbe AM, Dean AS, Glaziou P, Alikhanova N, Ama C et al. Genetic sequencing for surveillance of drug resistance in tuberculosis in highly endemic countries: a multi-country population-based surveillance study. Lancet Infect Dis. 2018;18(6):675–83 (https://www.ncbi.nlm.nih.gov/pubmed/29574065, accessed 8 August 2019).

21 WHO consolidated guidelines on drug-resistant tuberculosis treatment. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/consolidated-guidelines-drug-resistant-TB-treatment/en/, accessed 17 July 2019).

22 Zignol M, Dean AS, Alikhanova N, Andres S, Cabibbe AM, Cirillo DM et al. Population-based resistance of Mycobacterium tuberculosis isolates to pyrazinamide and fluoroquinolones: results from a multicountry surveillance project. Lancet Infect Dis. 2016;16:30190–6 (https://www.ncbi.nlm.nih.gov/pubmed/27397590, accessed 8 August 2019).

23 Tuberculosis prevalence surveys: a handbook (WHO/HTM/TB/2010.17). Geneva: World Health Organization; 2011 (https://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/resources_documents/thelimebook/en/, accessed 17 July 2019).

24 Horton KC, MacPherson P, Houben RM, White RG, Corbett EL. Sex differences in tuberculosis burden and notifications in low- and middle-income countries: a systematic review and meta-analysis. PLoS Med. 2016;13(9):e1002119 (https://www.ncbi.nlm.nih.gov/pubmed/27598345, accessed 31 August 2019).

25 Hoa NB, Sy DN, Nhung NV, Tiemersma EW, Borgdorff MW, Cobelens FGJ. National survey of tuberculosis prevalence in Viet Nam. Bulletin of the World Health Organization. 2010;88(4):273–80 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2855599/, accessed 19 August 2019).

Macrophages (pink) engulf TB mycobacteria (orange) in a pulmonary alveolus in the lungs.

Juan Gaertner/Science Photo Library/ Getty Images

Chapter 4

TB diagnosis and treatment

Key facts and messages

The political declaration at the first United Nations high-level meeting on tuberculosis (TB) on 26 September 2018 included a target to diagnose and treat 40 million people with TB in the 5-year period 2018–2022. The approximate breakdown of the target is around 7 million in 2018 and around 8 million in subsequent years.

Based on data reported to the World Health Organization (WHO) by 202 countries with 99% of the world's population and estimated TB cases, the target for 2018 was achieved. Globally, 7.0 million new cases of TB were notified in 2018, up from 6.4 million in 2017 and a big increase from the 5.7–5.8 million notified annually in the period 2009–2012. Of the 7.0 million cases, 58% were men (aged ≥15 years), 34% were women and 8% were children (aged <15 years).

Most of the increase in global notifications since 2013 is explained by trends in India and Indonesia, the two countries that rank first and third worldwide in terms of estimated incident cases per year. In India, notifications rose from 1.2 million to 2.0 million between 2013 and 2018 (+60%), including an increase of 207 000 (+12%) between 2017 and 2018. In Indonesia, notifications rose from 331 703 in 2015 to 563 879 in 2018 (+70%), including an increase of 121 707 (+28%) between 2017 and 2018.

Despite increases in TB notifications, there is still a large gap between the estimated number of incident cases (9.0–11.1 million globally in 2018) and the number of new cases reported (7.0 million), due to a combination of underreporting of detected cases and underdiagnosis (if people with TB do not access health care or are not diagnosed when they do). Ten countries accounted for about 80% of the gap, with India (25%), Nigeria (12%), Indonesia (10%) and the Philippines (8%) accounting for more than half of the total. In these countries in particular, intensified efforts are required to reduce underreporting of detected TB cases and improve access to diagnosis and treatment.

Globally, TB treatment coverage (the number of people notified and treated divided by estimated incidence) was 69% (range, 63–77%) in 2018, up from 64% (range, 58–72%) in 2017 and 53% (range, 46–64%) in 2010. Three WHO regions achieved levels above 75%: the Americas, Europe and the Western Pacific. Four high TB burden countries had levels >80% in 2018: Brazil, China, the Russian Federation and Zimbabwe. The lowest levels, with best estimates of 50% or less, were in the Central African Republic and Nigeria.

As countries intensify efforts to improve TB diagnosis and treatment and close incidence–notification gaps, the proportion of notified cases that are bacteriologically confirmed needs to be monitored, to ensure that people are correctly diagnosed and started on the most effective treatment regimen as early as possible. The aim should be to increase the percentage of cases confirmed bacteriologically by scaling up the use of recommended diagnostics that are more sensitive than smear microscopy. In 2018, 55% of pulmonary cases were bacteriologically confirmed, a slight decrease from 56% in 2017. In high-income countries with widespread access to the most sensitive diagnostic tests, about 80% of pulmonary TB cases are bacteriologically confirmed.

Globally in 2018, 51% of bacteriologically confirmed pulmonary TB cases were tested for rifampicin resistance, up from 41% in 2017. Coverage was 46% for new and 83% for previously treated TB patients.

A global total of 186 772 cases of multidrug-resistant TB or rifampicin-resistant TB (MDR/RR-TB) were notified in 2018, up from 160 684 in 2017, and 156 071 cases were enrolled in treatment, up from 139 114 in 2017. Despite these improvements, the number of people enrolled in treatment in 2018 was equivalent to only 32% of the estimated incidence of 484 000 cases (range, 417 000–556 000). China and India accounted for 43% of the global gap between incidence and treatment enrolments and a further 8 countries (Indonesia, Mozambique, Myanmar, Nigeria, Pakistan, the Philippines, the Russian Federation and Viet Nam) accounted for 32%.

Closing the incidence-treatment enrolment gap for MDR/RR-TB requires increasing one or more of the following: the proportion of TB cases detected; the proportion of TB cases bacteriologically confirmed; the proportion of bacteriologically confirmed cases tested for drug resistance; and the proportion of detected cases of MDR/RR-TB started on treatment.

Globally in 2018, 64% of notified TB patients had a documented HIV test result, up from 60% in 2017. In the WHO African Region, where the burden of HIV-associated TB is highest, 87% of TB patients had a documented HIV test result. A total of 477 461 TB cases among HIV-positive people were reported (56% of the estimated incidence of 862 000 cases). Of these, 86% were on antiretroviral therapy.

The latest treatment outcome data show success rates of 85% for TB, 75% for HIV-associated TB, 56% for MDR/RR-TB and 39% for extensively drug-resistant TB.

Prompt and accurate diagnosis followed by provision of treatment in line with international standards prevents deaths and limits ill health among people who develop tuberculosis (TB). It also prevents further transmission of infection to others. The 2020 and 2025 milestones for reductions in TB incidence and TB deaths set in the End TB Strategy (Chapter 2) require the case fatality ratio (i.e. the proportion of people with TB who die from the disease) to fall to 10% by 2020 and to 6.5% by 2025. The latter is only feasible if all people with TB are diagnosed promptly and treated effectively. Patient-centred care and prevention – backed by bold policies and supportive systems such as universal health coverage (UHC) and social protection – are Pillars 1 and 2 of the End TB Strategy (Box 4.1).

The political declaration at the first United Nations (UN) high-level meeting on TB held on 26 September 2018 included commitments by Member States to four new global targets (Chapter 2) *(1)*. One of these targets is to diagnose and treat 40 million people with TB in the 5-year period 2018–2022. The approximate breakdown of the target is around 7 million in 2018 and around 8 million in subsequent years.

This chapter provides the latest national data reported to the World Health Organization (WHO) on the diagnosis and treatment of TB in 2018, as well as data for previous years. Section 4.1 presents and discusses data for 2018 on notifications of TB cases and associated coverage of diagnostic testing, as well as trends since 2000. It includes data on the contribution to case-finding efforts of public–public and public–private mix (PPM) and community engagement initiatives. Section 4.2 focuses on treatment coverage (and on detection and treatment gaps) for patients with TB, HIV-associated TB and drug-resistant TB, comparing numbers detected and treated with underlying estimates of disease burden. Section 4.3 contains the most recent data on treatment outcomes, for new and relapse TB patients, TB patients living with HIV and patients with multidrug-resistant TB or rifampicin-resistant TB (MDR/RR-TB), as well as time trends for these three groups.

Throughout the chapter, data are presented at global, regional and country levels, giving particular attention to high burden countries (HBCs).[1] Further country-specific details for all of the indicators covered in this chapter are provided in Annex 2 and Annex 4.

BOX 4.1

Pillars 1 and 2 of the End TB Strategy

Pillar 1 of the End TB Strategy is "Integrated, patient-centred care and prevention". It has four components:

- early diagnosis of TB, including universal drug susceptibility testing, and systematic screening of contacts and high-risk groups;
- treatment of all people with TB, including drug-resistant TB, and patient support;
- collaborative TB/HIV activities and management of comorbidities; and
- preventive treatment of persons at high risk and vaccination against TB.

The fourth component of Pillar 1 is the topic of Chapter 5.

Pillar 2 of the End TB Strategy is "Bold policies and supportive systems". This pillar also has four components:

- political commitment with adequate resources for TB care and prevention;
- engagement of communities, civil society organizations and providers of public and private care;
- UHC policy and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control; and
- social protection, poverty alleviation and actions on other determinants of TB.

The components of Pillar 2 are primarily discussed in Chapter 7.

For an overview of all aspects of the End TB Strategy, see Chapter 2.

4.1 Case notifications and testing coverage

4.1.1 TB case notifications in 2018 and trends since 2000

Globally in 2018, 7.0 million people with a new episode of TB (i.e. new and relapse cases) were notified to national TB programmes (NTPs) and reported to WHO (Table 4.1), a 9% increase from 6.4 million in 2017. Based on these data, the 2018 target of around 7 million required to be on track to achieve the cumulative target set at the UN high-level meeting on TB, of 40 million in the period 2018–2022, was achieved.

An additional 300 000 people who had been previously diagnosed with TB and whose treatment was changed to a retreatment regimen were also notified.

Trends in notifications of new and relapse cases since 2000 are shown in Fig. 4.1. Numbers increased between 2000 and 2009, stabilized at around 5.7–5.8 million annually during 2009–2012 and then started to increase again. The worldwide increase since 2013 is mostly explained by trends in two countries that rank first and third globally in terms of their estimated number of incident TB cases: India and Indonesia (Fig. 4.2).[2]

In India, notifications increased from 1.2 million in 2013 to 2.0 million in 2018 (+60%), including a 12% increase of 207 000 between 2017 and 2018. This followed the introduction of a national policy of mandatory noti-

[1] The three lists of HBCs (for TB, HIV-associated TB and multidrug-resistant TB [MDR-TB]) are explained in Chapter 2.

[2] Estimates of TB incidence are provided in Chapter 3. See, for example, Table 3.3.

TABLE 4.1

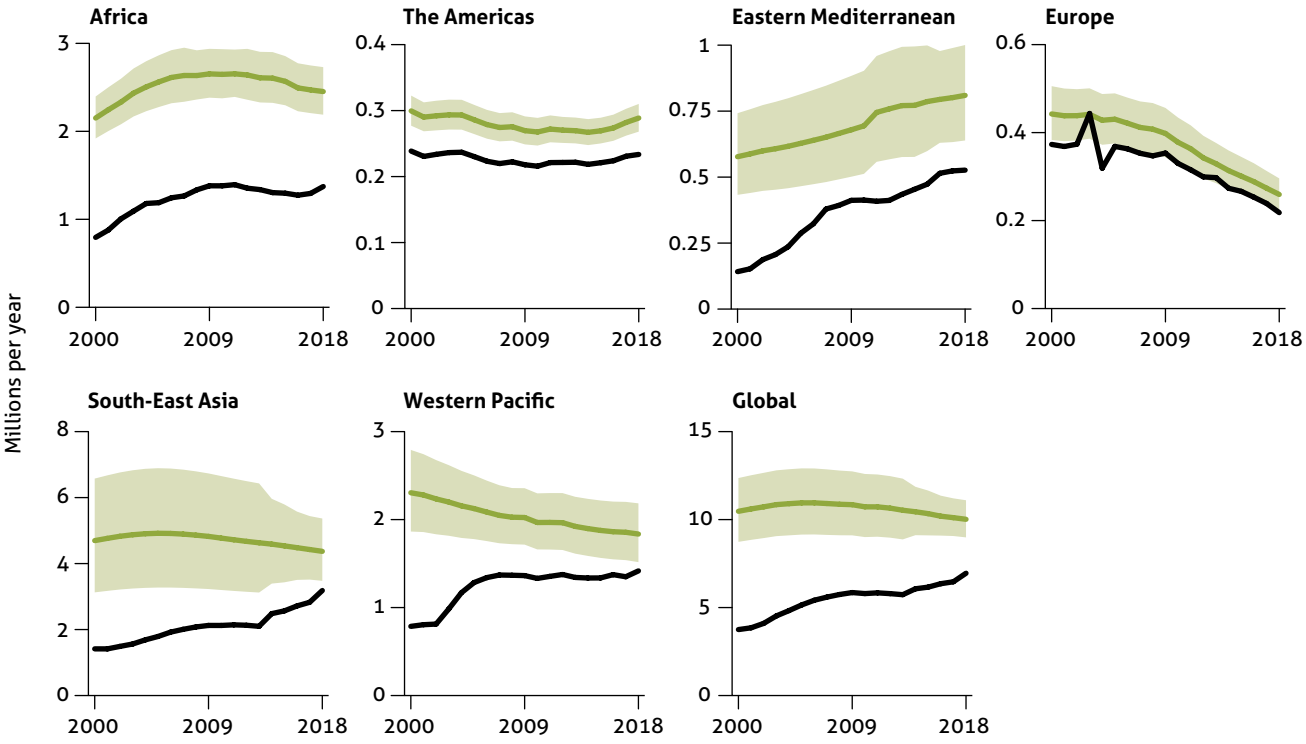
Notifications of TB, HIV-positive TB, MDR/RR-TB and XDR-TB cases, globally and for WHO regions, 2018

	TOTAL NOTIFIED	NEW AND RELAPSE[a]	PULMONARY NEW AND RELAPSE		EXTRA-PULMONARY NEW AND RELAPSE (%)	HIV-POSITIVE NEW AND RELAPSE	MDR/RR-TB	XDR-TB
			NUMBER	OF WHICH BACTERIOLOGICALLY CONFIRMED (%)				
Africa	1 402 743	1 372 748	1 162 468	65%	15%	339 050	24 712	727
The Americas	248 135	233 549	198 214	79%	15%	19 899	4 759	149
Eastern Mediterranean	537 761	526 379	397 565	53%	24%	1 749	5 584	122
Europe	260 331	218 090	182 950	66%	16%	24 081	48 739	7 899
South-East Asia	3 362 783	3 183 255	2 641 554	56%	17%	76 858	75 964	3 580
Western Pacific	1 441 363	1 416 729	1 306 593	41%	8%	15 824	27 014	591
Global	**7 253 116**	**6 950 750**	**5 889 344**	**55%**	**15%**	**477 461**	**186 772**	**13 068**

[a] *New and relapse* includes cases for which the treatment history is unknown. It excludes cases that have been re-registered as *treatment after failure*, as *treatment after loss to follow-up* or as *other previously treated* (whose outcome after the most recent course of treatment is unknown or undocumented).

FIG. 4.1

Notifications of TB cases (new and relapse cases, all forms) (black) compared with estimated TB incident cases (green), 2000–2018, globally and for WHO regions. Shaded areas represent uncertainty intervals.

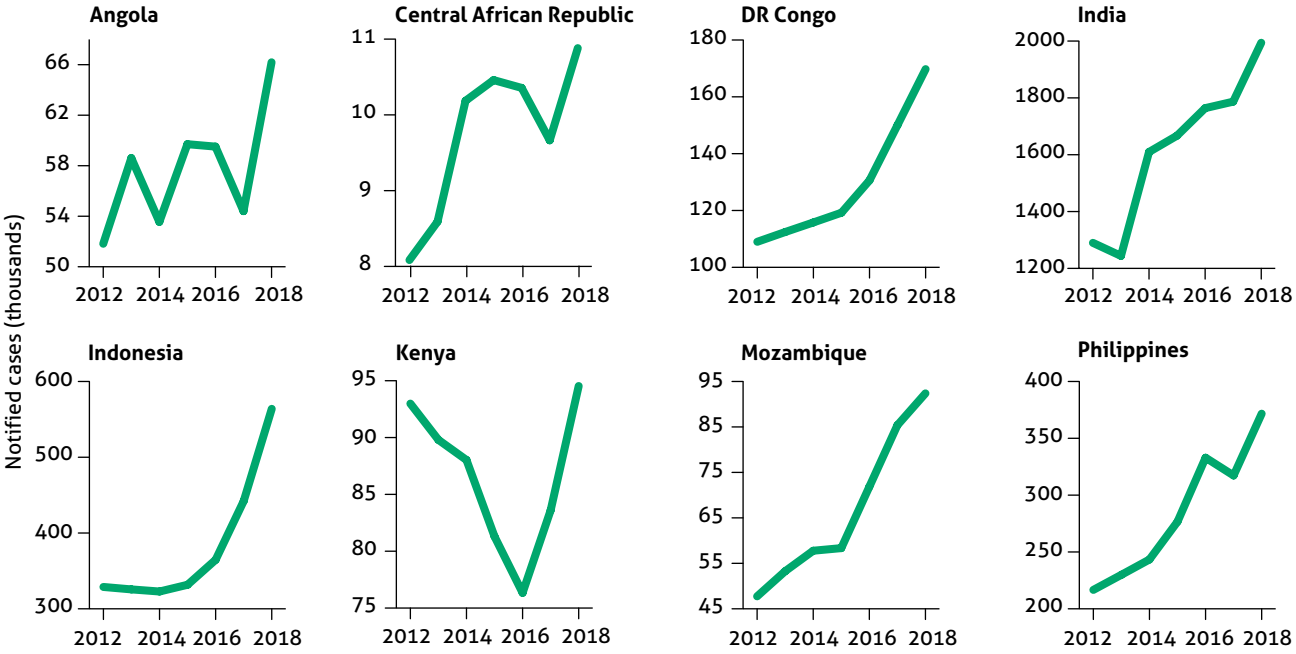


fication in 2012, and the rollout (also since 2012) of a nationwide web-based and case-based reporting system (called "Nikshay") that facilitates reporting of detected cases by care providers in the public and private sectors.

In Indonesia, notifications increased from 331 703 in 2015 to 563 879 in 2018 (+70%), including a 28% increase of 121 707 between 2017 and 2018. These increases followed the introduction of a national policy of mandatory notification, a major push to engage major hospitals in both public and private sectors and the introduction of simplified case reporting for the private sector through an Android app. All three developments and associated progress were galvanized by evidence from a national TB prevalence survey implemented during 2013–2014 and a national inventory study of the underreporting of detected TB cases in 2017 (itself prompted by findings from the national TB prevalence survey). This evidence indicated that most of the gap between the estimated number of incident cases and official notifications of TB cases was attributable to underreporting to national authorities of cases

FIG. 4.2

Trends in TB case notifications in selected high TB burden countries, 2012–2018. The countries shown are those in which case notifications increased by at least 10% between 2017 and 2018 or by an average of 10% per year between 2016 and 2018.



detected and treated in the public and private sectors.

The worldwide increase in notifications has also occurred in the context of two global initiatives. The first is a strategic initiative on finding an additional 1.5 million people with TB between 2017 and the end of 2019, compared with a baseline year of 2016, with a focus on 13 priority countries. This initiative is funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), supported by WHO and the Stop TB Partnership *(2)*. The second is a joint initiative, Find. Treat. All. #EndTB *(3)*. It aims to reach 40 million people with quality TB care between 2018 and 2022, in line with the target set at the UN high-level meeting on TB. It is jointly implemented by WHO, the Stop TB Partnership and the Global Fund.

Engagement of all care providers in the public and private sectors should be integral components of national TB strategies, to ensure that everyone with TB is detected and appropriately treated. PPM initiatives have particular relevance to HBCs in Africa and Asia. The contribution of PPM to total notifications in countries that have reported PPM data for several years are shown in **Box 4.2**.

4.1.2 Notifications disaggregated by age and sex

The distribution of notified cases in 2018 by age and sex is shown globally and for the six WHO regions in **Fig. 4.3**. Of the global total, 58% were men (aged ≥15 years), 34% were women and 8% were children (aged <15 years).[1] The global male:female (M:F) ratio for notifications was 1.7, but ranged across regions from 1.1 (WHO Eastern Mediterranean Region) to 2.1 (Western Pacific Region) and among the 30 high TB burden countries from 1.1 (Mozambique) to 2.6 (Viet Nam). In contrast, the M:F ratio in 25 national TB disease prevalence surveys of adults in African and Asian countries implemented in 2007–2018 was about 2.4 overall, and reached 4.5 in Viet Nam (see **Chapter 3** for further details).

In the WHO regions of the Eastern Mediterranean, South-East Asia and Western Pacific, the TB epidemic is a markedly ageing one, with a progressive increase in the notification rate with age, and a peak among those aged 65 years or over. Elsewhere, notification rates were highest among younger adults, most noticeably in the WHO African Region (for ages 45–54 years) and the European Region (for ages 35–44 years) (**Fig. 4.3**). In most European countries, as well as three high TB burden countries in Asia – China, Thailand and Viet Nam – less than 2% of notified cases were children (**Fig. 4.4**).

Variation among countries in the child:adult and M:F ratios of cases may reflect real differences in epidemiology, differential access to or use of health care services, or differential diagnostic and reporting practices. In general, notification data appear to understate the share of the TB burden accounted for by men and children (see **Chapter 3** for further details). Particular issues with diagnosis and reporting of TB in children include variable case definitions and underreporting of cases diagnosed by paediatricians in the public and private sectors. Greater attention to the quality of TB notification data for children is warranted in many countries.

[1] The breakdown is restricted to notifications for which age–sex disaggregation was reported.

Trends in the contribution of PPM approaches to TB case notifications

"Public–public" mix refers to engagement by a country's NTP with public health sector providers of TB care that are not under the direct purview of the NTP. Examples include public hospitals, public medical colleges, prisons and detention centres, military facilities and public health insurance organizations. "Public–private" mix refers to engagement by the NTP with private sector providers of TB care. Examples include private individual and institutional providers, the corporate or business sector, mission hospitals, nongovernmental organizations and faith-based organizations. Engaging with all health providers through PPM approaches is essential to achieve universal access to TB prevention and care services. Other benefits include easing the heavy workload of NTPs and accelerating the introduction of new technologies.

Trends in the contribution of PPM to notifications in selected countries where PPM has been recognized as a priority, and data for countries that have reported to WHO each year during 2012–2018, are shown in Fig. B4.2.1 (public–public mix) and Fig. B4.2.2 (public–private mix). Countries that have prioritized public non-NTP sector engagement, clearly shown by increasing trends in the contribution of this sector to TB case notifications, are Bangladesh, Indonesia, Thailand and Viet Nam. Prioritization of private sector engagement is visible from trends in notifications in Bangladesh, Ethiopia, India, Indonesia, Myanmar, Pakistan and the Philippines. National TB inventory studies that quantify the underreporting of detected TB cases in both public and private sectors can help to identify the types of PPM approaches that should be prioritized, since they identify the type of providers that are diagnosing and treating a large proportion of the total number of detected TB cases.

As electronic case notification systems and digital technologies are expanded (Box 4.5), including for PPM approaches, contributions to case notifications from the private sector and from the currently unengaged parts of the public sector are likely to increase. The next step is ensuring efficient monitoring of treatment outcomes to ensure that all people with TB access quality care.

In 2018, a roadmap for PPM was released by WHO's Global TB Programme, the Public–Private Mix Working Group of the Stop TB Partnership, and international partner agencies *(4)*. The roadmap sets out the actions needed to accelerate and expand the engagement of all care providers in global efforts to end TB. The roadmap was released alongside a companion document *(5)* that provides a landscape analysis of current efforts and challenges in engaging with private providers of health care for TB. In July 2019, during the 14th Global PPM Working Group Meeting in Jakarta, Indonesia, 18 high TB burden countries presented the first steps they had taken to implement actions set out in the roadmap *(4)*.

International support for scaling up PPM approaches has been provided by the United States Agency for International Development (USAID), the Global Fund's strategic initiative to find an additional 1.5 million people with TB by the end of 2019 compared with 2016 *(2)*, and the joint initiative Find. Treat. All. #EndTB *(3)* (Section 4.1.1).

FIG. B4.2.1

Contribution of public-public mix to TB case notifications in eight countries, 2012–2018

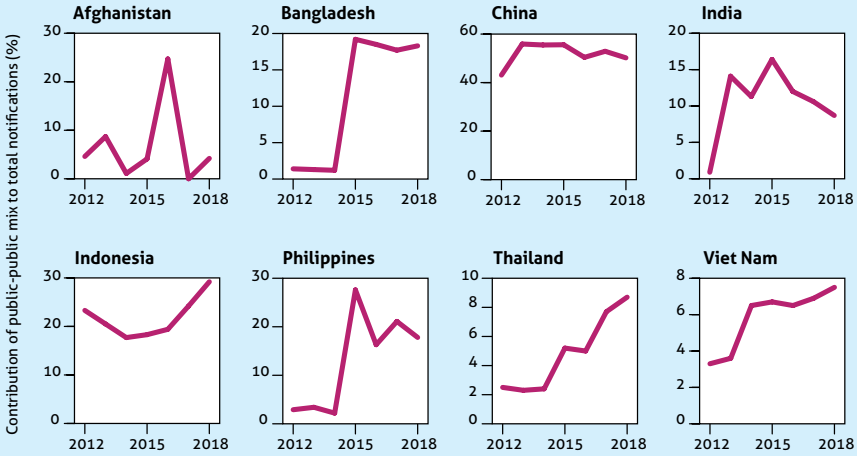


FIG. B4.2.2

Contribution of public-private mix to TB case notifications in eight countries, 2012–2018

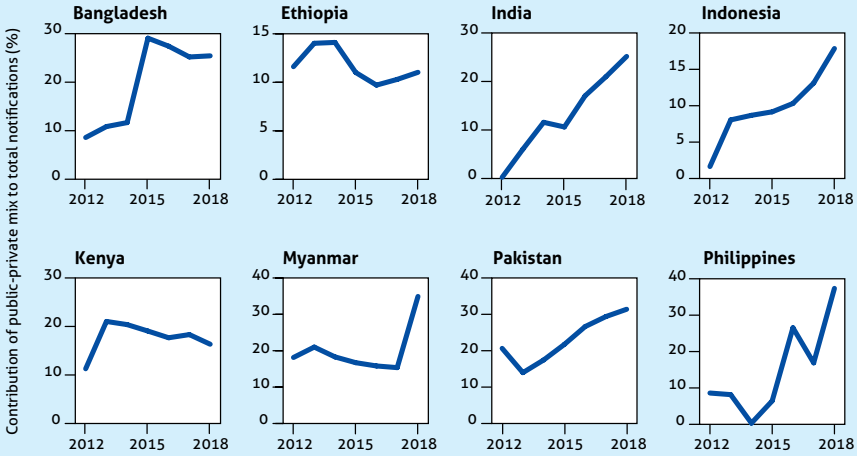
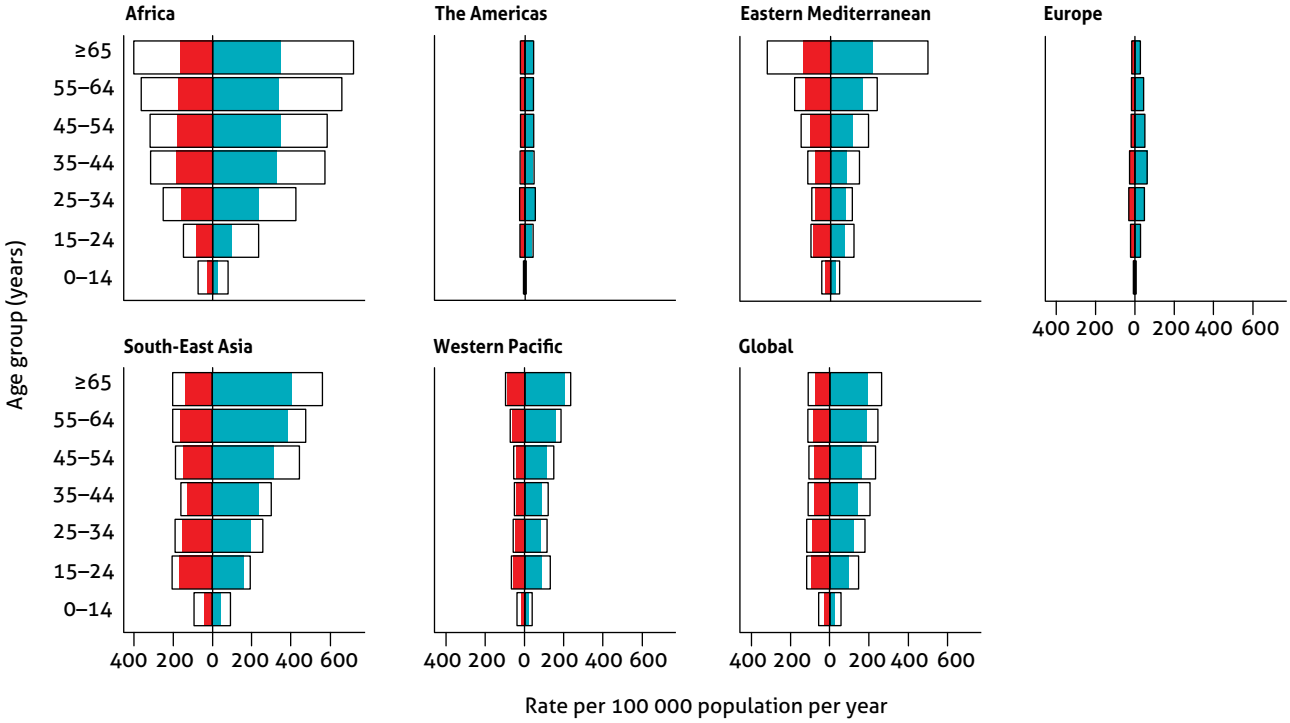


FIG. 4.3

Estimated TB incidence (black outline) and new and relapse TB case notification rates by age and sex[a] (female in red; male in turquoise) in 2018, globally and for WHO regions



[a] Countries not reporting cases in these categories are excluded. Cases included accounted for 90% of reported cases.

FIG. 4.4

Percentage of new and relapse TB cases that were children (aged <15), 2018

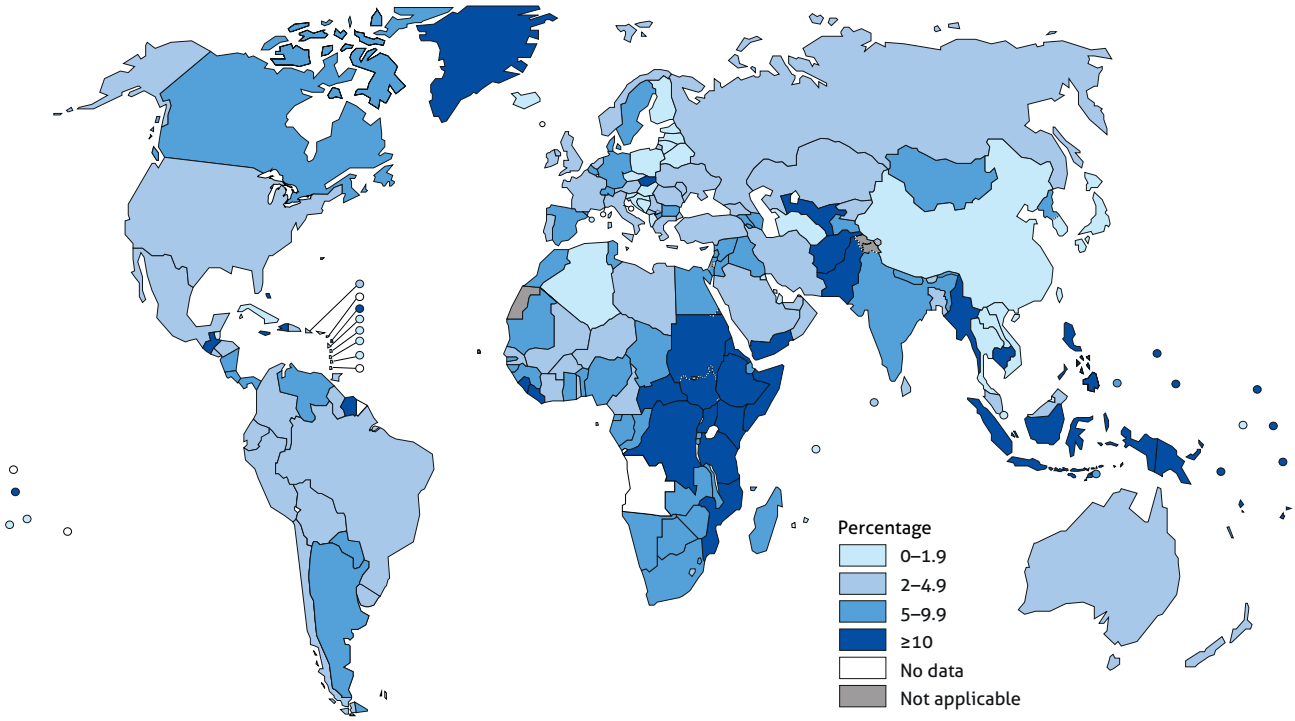
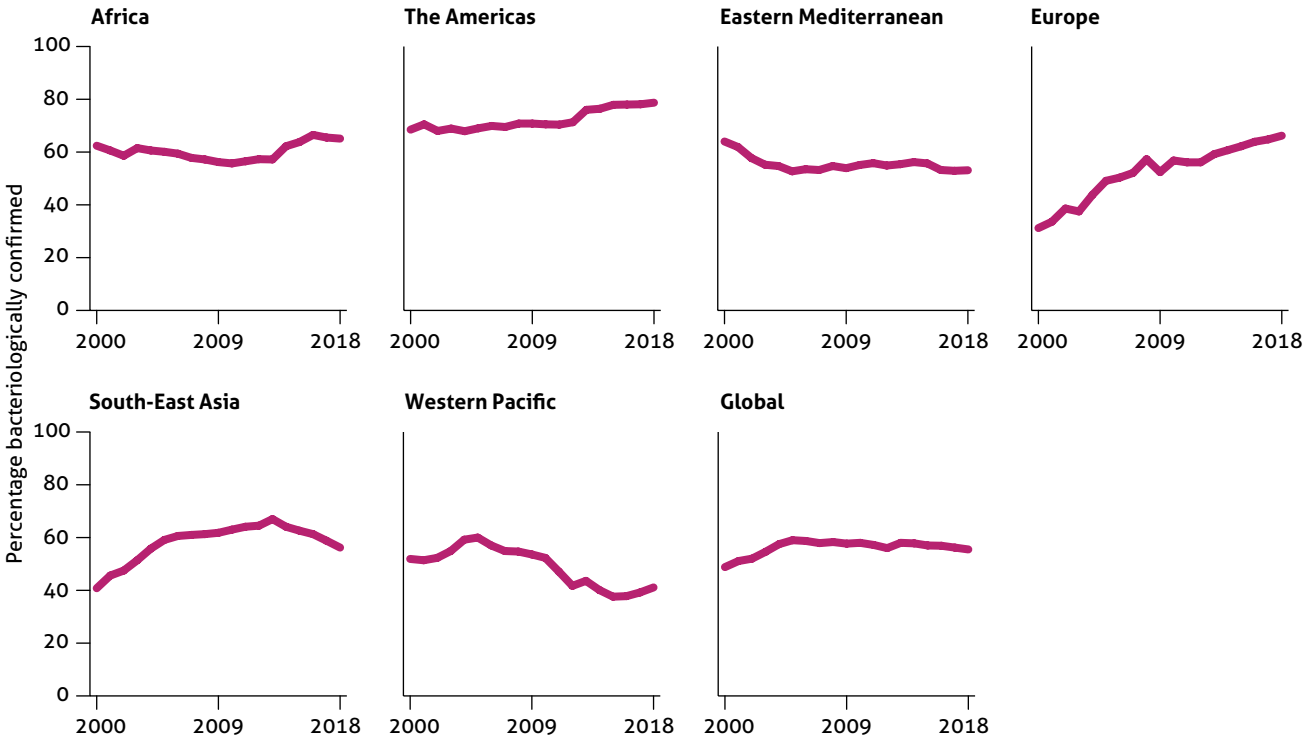


FIG. 4.5

Percentage of new and relapse[a] pulmonary TB cases with bacteriological confirmation, globally and for WHO regions, 2000–2018



[a] The calculation for new and relapse pulmonary cases in years prior to 2013 is based on smear results, except for the European Region where data on confirmation by culture was also available for the period 2002–2012.

4.1.3 Bacteriological confirmation of notified cases of pulmonary TB

Of the 7.0 million new and relapse cases notified in 2018, 5.9 million (85%) had pulmonary TB (Table 4.1). Of these, 55% were bacteriologically confirmed, a slight decrease from 56% in 2017 and 58% in 2013 (Fig. 4.5).[1] The remaining patients were diagnosed clinically; that is, based on symptoms, abnormalities on chest radiography or suggestive histology.

The global decline in levels of bacteriological confirmation between 2013 and 2018 is mostly due to a decrease from 67% to 56% in the WHO South-East Asia Region (Fig. 4.5), which has occurred during a period of increased notifications of TB cases (Fig. 4.1, Fig. 4.2). Elsewhere, there were improvements in the WHO African Region (57% to 65%) and the European Region (59% to 66%). Trends in the 30 high TB burden countries are shown in Fig. 4.6, and levels of bacteriological confirmation in all countries in 2018 are shown in Fig. 4.7. There is considerable variation, even among countries with a similar epidemiological profile.

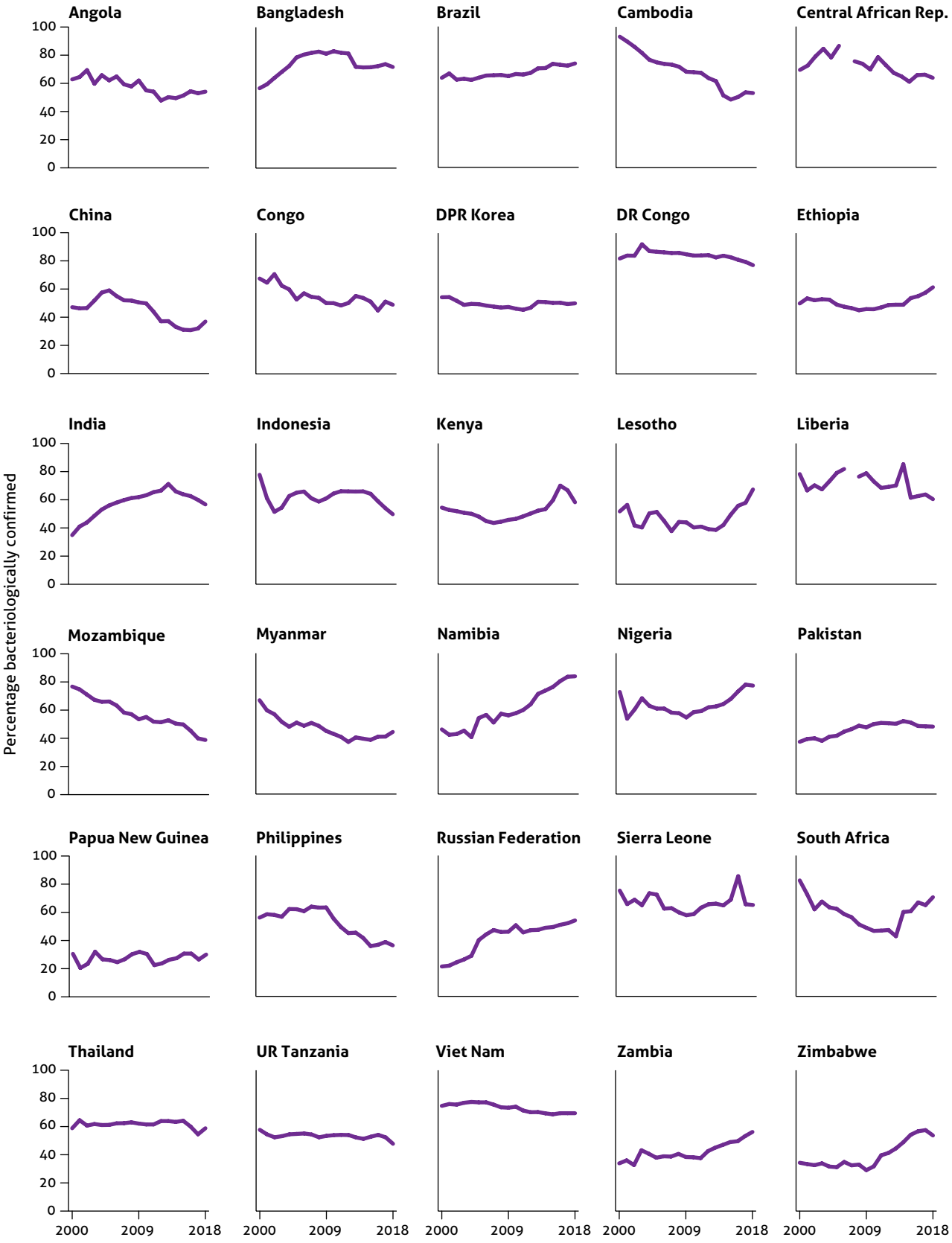
As countries seek to improve TB diagnosis and treatment and to close gaps between estimated incidence and notifications of TB cases – especially in the context of recent global initiatives to "find the missing cases" (Section 4.1.1) and the new global target set at the UN high-level meeting on TB in September 2018 – the proportion of notified cases that are bacteriologically confirmed needs to be monitored (Box 4.3). The microbiological detection of TB is critical because it allows people to be correctly diagnosed and started on the most effective treatment regimen as early as possible. Most clinical features of TB and abnormalities on chest radiography or histology results generally associated with TB have low specificity, which may lead to false diagnoses of TB, and hence to people being enrolled in TB treatment unnecessarily. The aims should be to increase the percentage of cases confirmed bacteriologically (based on scaling up the use of recommended diagnostics that are more sensitive than smear microscopy) and to ensure that people with a negative bacteriological test result are not started on TB treatment unless they meet the relevant clinical criteria.

Extrapulmonary TB represented 15% of the 7.0 million incident cases that were notified in 2018, ranging from 8% in the WHO Western Pacific Region to 24% in the Eastern Mediterranean Region (Fig. 4.8 and Table 4.1).

[1] A bacteriologically confirmed case is one from whom a biological specimen is positive by smear microscopy, culture or WHO-recommended rapid diagnostic test, such as the Xpert MTB/RIF® assay.

FIG. 4.6

Percentage of new and relapse[a] pulmonary TB cases with bacteriological confirmation, 2000–2018, 30 high TB burden countries



[a] The calculation for new and relapse pulmonary cases in years prior to 2013 is based on smear results, except for the Russian Federation where data on confirmation by culture was also available for the period 2002–2012.

FIG. 4.7

Percentage of new and relapse pulmonary TB cases with bacteriological confirmation, 2018

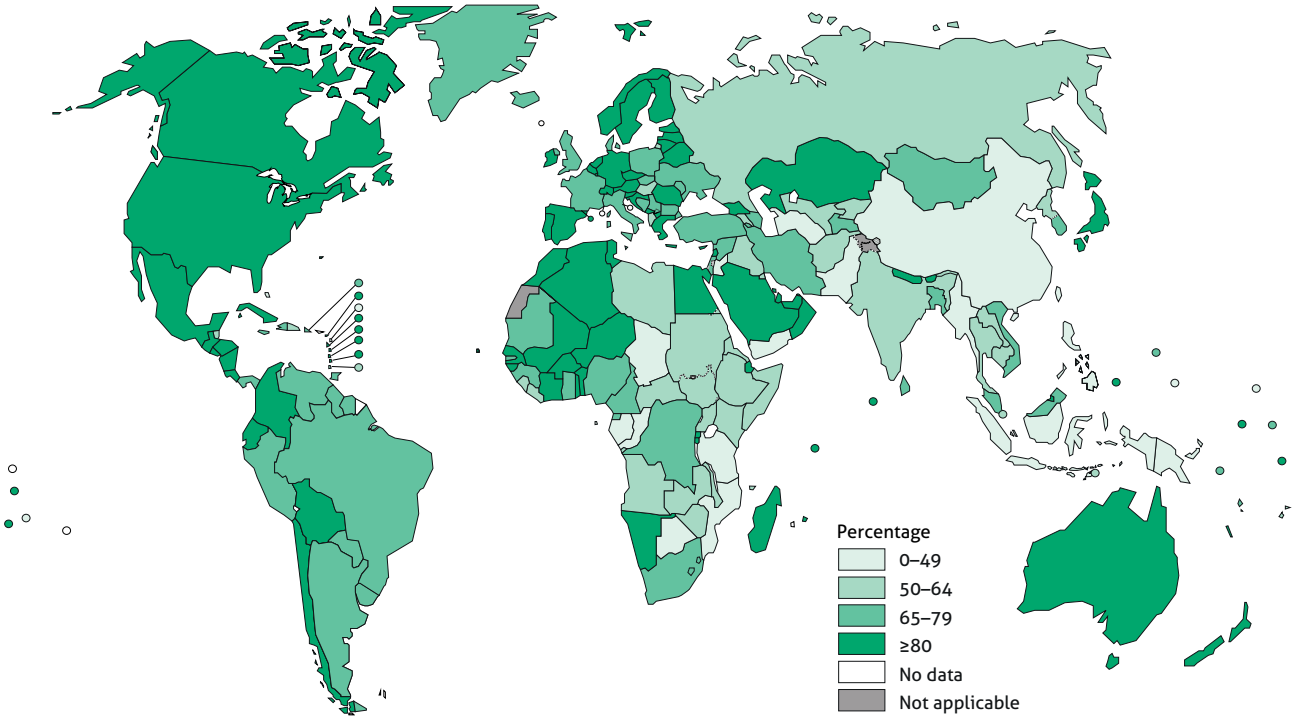
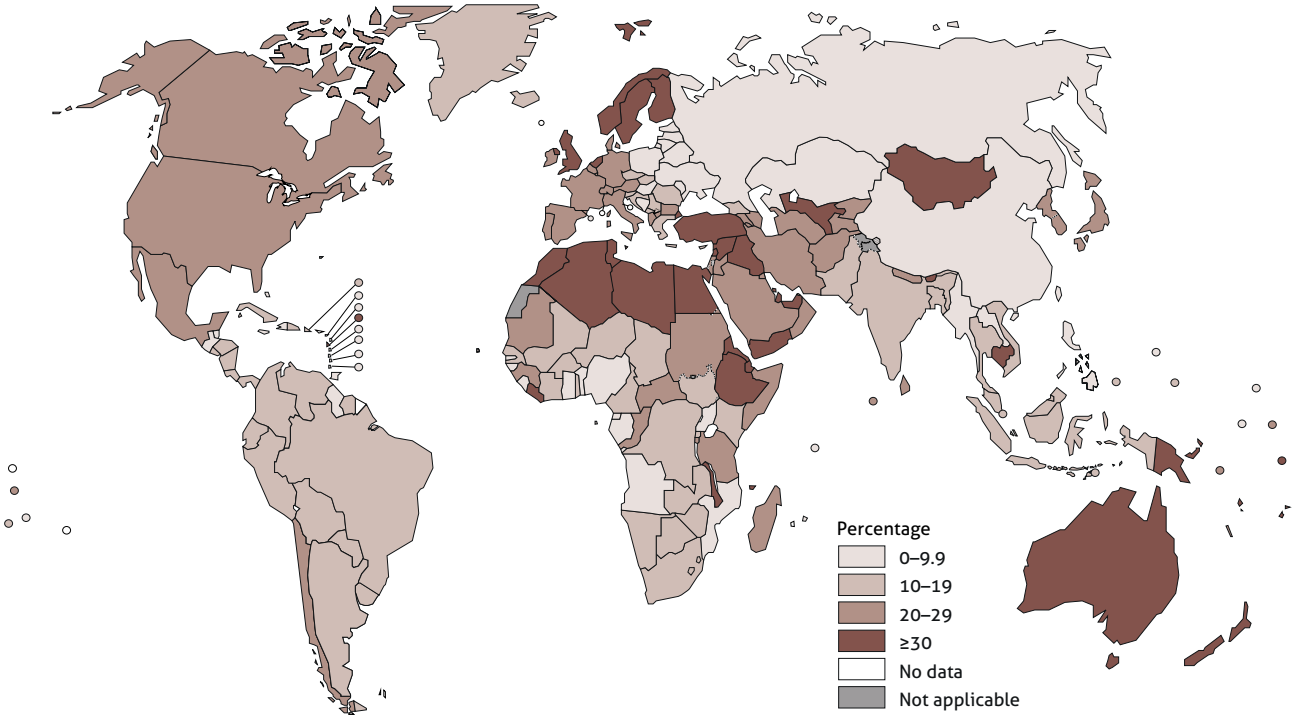


FIG. 4.8

Percentage of extrapulmonary cases among new and relapse TB cases, 2018

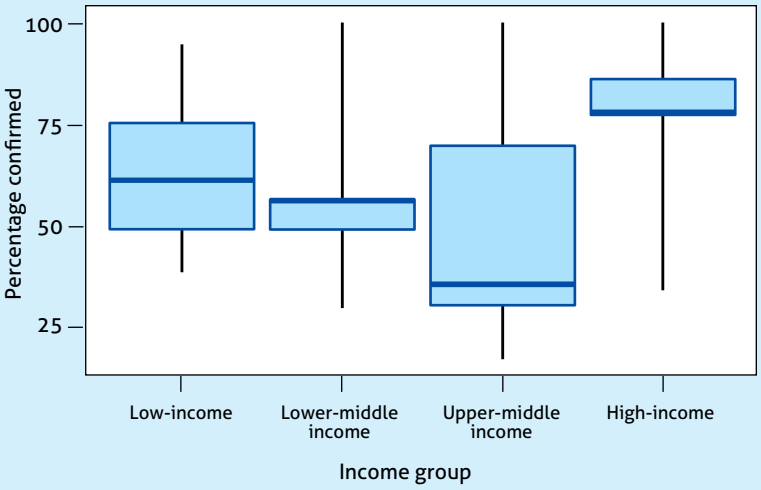


BOX 4.3

Proportion of notified cases with bacteriological confirmation: status in 2018, recent trends and implications

FIG. B4.3.1

Distribution of the proportion of notified pulmonary cases that were bacteriologically confirmed in 2018, by country income group. Boxes indicate the first, second (median) and third quartiles weighted by a country's number of pulmonary cases; vertical lines extend to the minimum and maximum values. Countries with less than 10 cases are excluded.



In high-income countries with universal access to the most sensitive TB diagnostic tests, about 80% of notified cases of pulmonary TB are bacteriologically confirmed and about 20% are clinically diagnosed (without a positive bacteriological test result). In other countries that rely primarily on direct smear microscopy and increasingly the Xpert MTB/RIF® assay, the percentage of notified pulmonary cases that were bacteriologically confirmed in 2018 was about 50% (Fig. B4.3.1). The global average in 2018 was 55%.

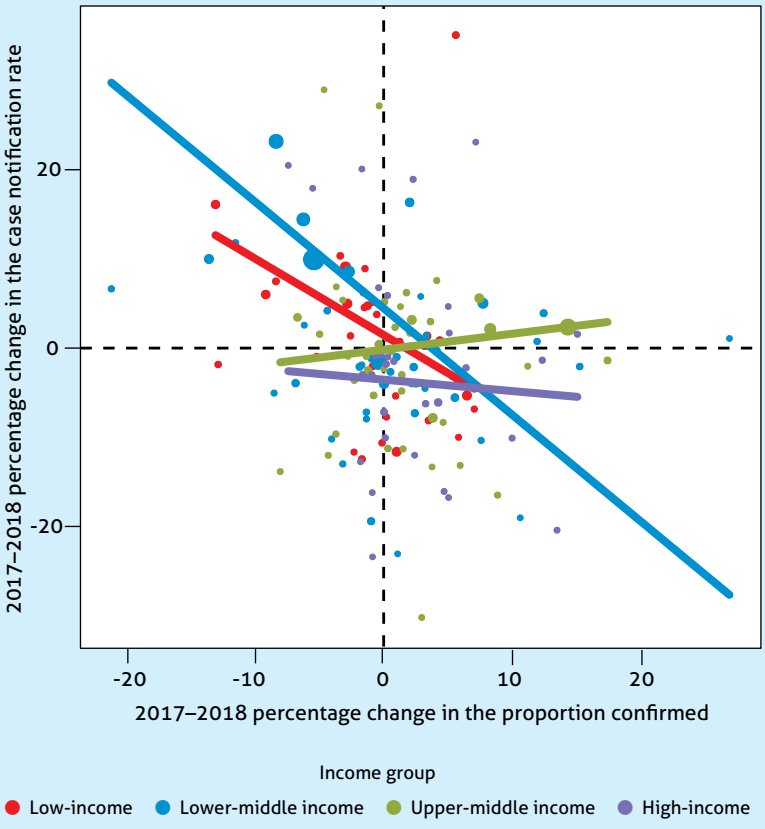
Reliance on direct smear microscopy alone is inherently associated with a relatively high proportion of unconfirmed pulmonary TB cases. However, differences in diagnostic and reporting practices are the most likely cause of variation in the proportion of pulmonary cases that are bacteriologically confirmed in high TB burden countries, in which the weighted median was 57% in 2018, with values ranging from 30% in Papua New Guinea to 84% in Namibia. Trends in the 30 high TB burden countries in the period 2000–2018 are shown in Fig. 4.6.

Recent increases in the diagnostic coverage of the rapid test Xpert MTB/RIF®, which has much higher sensitivity than smear microscopy, would be expected to increase the proportion of pulmonary cases that are bacteriologically confirmed. Although this has happened in certain countries such as South Africa, in general this pattern has not been observed in lower-middle-income countries (Fig. B4.3.2) or in the 30 high TB burden countries (Fig. B4.3.3).

Global initiatives to increase the number of TB case notifications and to close the gap between case notifications and estimated incidence started in 2017, and a new global target for the

FIG. B4.3.2

Changes in the proportion of pulmonary cases that were bacteriologically confirmed in relation to changes in case notification rates, 2017–2018. Points denote countries and their size is proportional to the number of pulmonary cases. The lines indicate least square linear regression fits, weighted by the number of pulmonary cases, by income group. Countries with less than 10 cases are excluded.

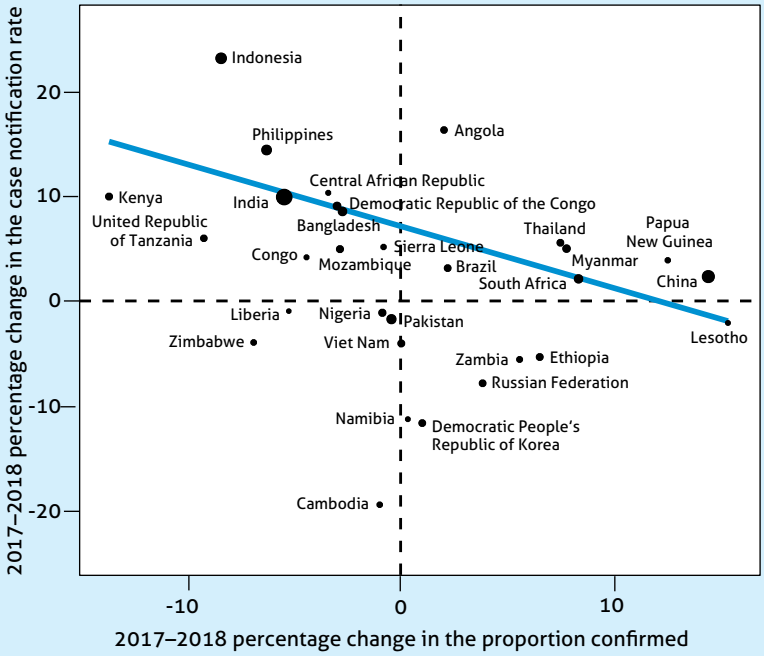


number of people to be diagnosed and treated was set at the first UN high-level meeting on TB in 2018 (Section 4.1). In this context, attention to trends in bacteriological confirmation is needed. As an example, one country with a marked drop in the proportion of pulmonary cases that were bacteriologically confirmed between 2017 and 2018 responded to a WHO query about this decrease by explaining that greater emphasis had been given to clinical diagnoses in the context of a national strategy to find the "missing cases". Other reasons for decreases may include expanded engagement with and reporting by care providers that have less access to or make less use of the best diagnostic tests.

If the proportion of notified pulmonary cases that are bacteriologically confirmed is below 50% in a given setting, a review of the diagnostics being used and the validity of clinical diagnoses would be warranted. In general, greater efforts are needed to improve the availability and use of the most sensitive diagnostic tests for TB and to ensure that international standards for TB care are met, to avoid both missed diagnoses of people who have TB and overtreatment of people who do not have TB. The aim should be to increase the percentage of cases confirmed bacteriologically.

FIG. B4.3.3

Changes in the proportion of pulmonary cases that were bacteriologically confirmed in relation to changes in case notification rates in 30 high TB burden countries, 2017–2018. Points denote high TB burden countries and their size is proportional to the number of pulmonary cases. The blue line indicates a least square linear regression fit, weighted by the number of pulmonary cases.



4.1.4 HIV testing for TB patients and screening for TB among people living with HIV

In 2018, 173 countries reported 4.3 million notified new and relapse TB patients with a documented HIV test result (a 15% increase from 3.8 million in 2017), equivalent to 64% of notified TB cases. This represented a 27-fold increase in the number of people with TB tested for HIV since 2004, when WHO first asked countries to report data (Fig. 4.9). In 118 countries and territories, at least 75% of TB cases knew their HIV status (Fig. 4.10). Documentation of HIV status averaged 70% of TB patients in the 30 high TB/HIV burden countries, but varied considerably, from 19% in Congo to above 80% in 18 countries. In the WHO African Region, which accounted for 71% of the global burden of HIV-associated TB in 2018 (Chapter 3), 87% of TB patients knew their HIV status.

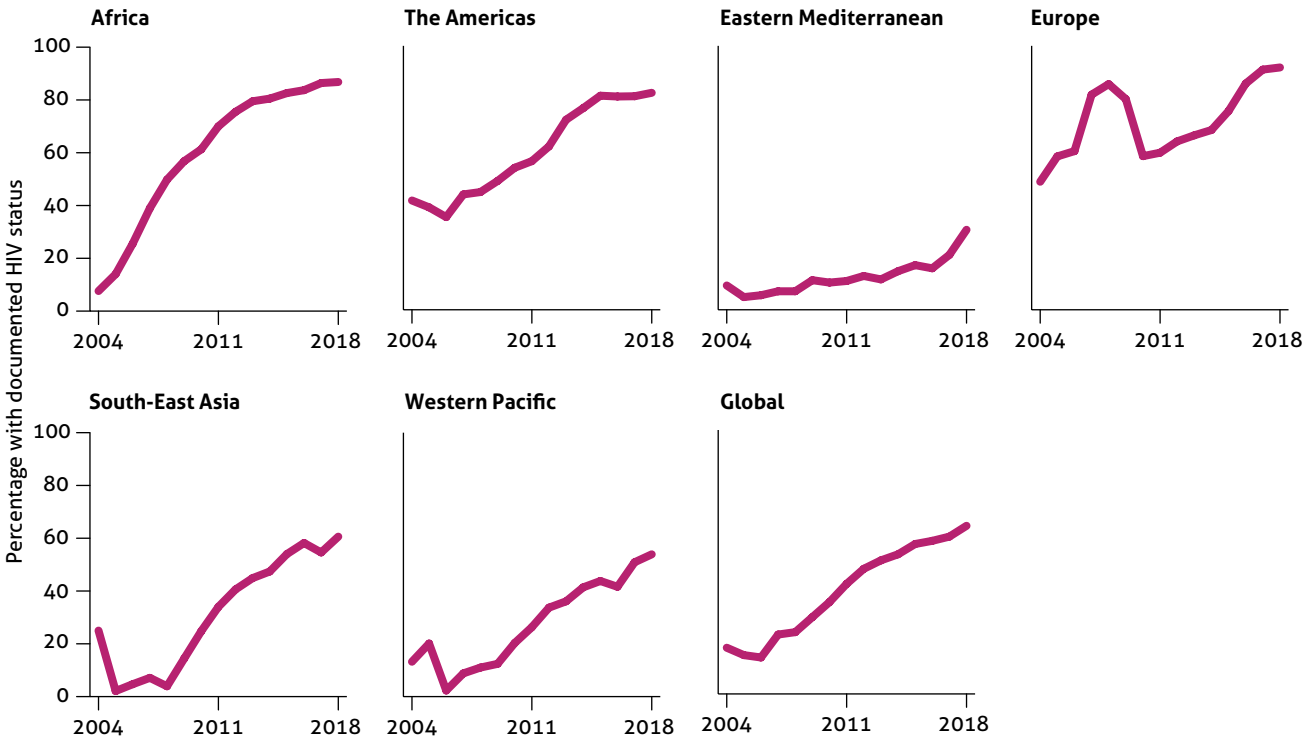
Globally, 477 461 cases of TB among people living with HIV (PLHIV) were notified in 2018 (Table 4.1), equivalent to 11% of TB patients with an HIV test result. The number notified was only 56% of the estimated number of incident cases among PLHIV (Fig. 4.11).[1] Overall, the percentage of TB patients testing HIV-positive has fallen globally since 2008. This decline is evident in all WHO regions except the WHO European Region.

Systematic screening for TB symptoms among PLHIV is recommended by WHO as an essential component of the HIV care package, together with linkage to diagnostic services, as necessary. In 2018, 92 countries reported annual data on the number of TB cases notified among those newly enrolled in HIV care. In total, 98 593 (8%) of the 1.2 million people who were reported to be newly enrolled in HIV care in 2018 were diagnosed with TB during the same year; data for the 14 high TB/HIV burden countries that reported data are shown in Table 4.2.

[1] See also Table 3.3 in Chapter 3 for the global estimate of TB incidence among PLHIV. The best estimate was 862 000 cases in 2018 (8.6% of the total number of incident cases).

FIG. 4.9

Percentage of new and relapse[a] TB cases with documented HIV status, 2004–2018, globally and for WHO regions[b]



[a] The calculation is for all cases in years prior to 2015.
[b] Countries were excluded if the number with documented HIV status was not reported to WHO.

FIG. 4.10

Percentage of new and relapse TB cases with documented HIV status, 2018

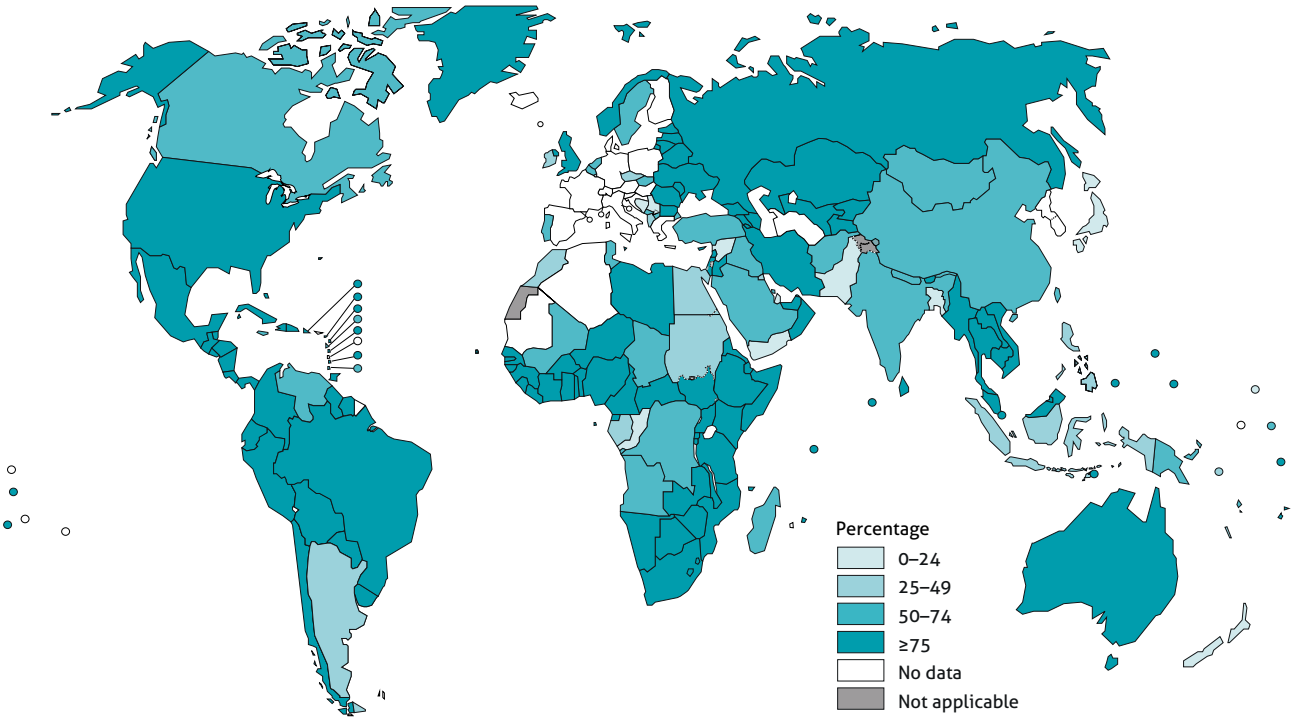
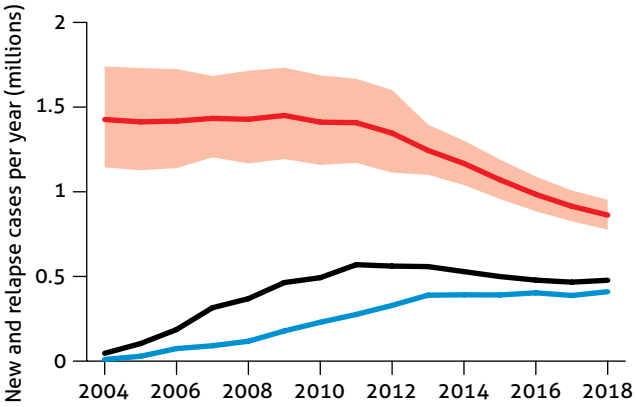


FIG. 4.11

Global number of notified new and relapse cases[a] known to be HIV-positive (black), number started on antiretroviral therapy (blue) and estimated number of incident HIV-positive TB cases (red), 2004–2018. Shaded areas represent uncertainty intervals.



[a] The calculation is for all cases in years prior to 2015.

TABLE 4.2

Number of people newly enrolled in HIV care in 2018 who were also notified as a TB case in 2018, 14 high TB/HIV burden countries that reported annual data

	NUMBER OF PEOPLE NEWLY ENROLLED IN HIV CARE	NUMBER NOTIFIED AS A TB CASE	NOTIFIED TB CASES AS A PERCENTAGE OF THOSE NEWLY ENROLLED IN HIV CARE
Angola	22 830	2 038	8.9%
China	127 725	2 706	2.1%
Congo	2 166	553	26%
DR Congo	70 172	5 965	8.5%
Ethiopia	29 237	1 159	4.0%
Ghana	30 410	929	3.1%
India	175 361	29 766	17%
Indonesia	50 544	10 554	21%
Liberia	6 730	463	6.9%
Malawi	171 415	1 091	0.64%
Myanmar	37 277	3 892	10%
Nigeria	179 241	12 746	7.1%
Papua New Guinea	4 151	643	15%
Thailand	30 241	6 780	22%
Total	937 500	79 285	8.5%

4.1.5 Rapid testing for TB

Increasing access to early and accurate diagnosis using a WHO-recommended rapid diagnostic (WRD[1]) is one of the main components of TB laboratory-strengthening efforts under the End TB Strategy. As a first step, countries should adopt policies that include diagnostic algorithms in which a WRD is the initial diagnostic test for all people with signs or symptoms of TB. They should also adopt such policies as part of working towards the first indicator of the *Framework of indicators and targets for laboratory strengthening under the End TB Strategy (6)* which was launched in 2016. Such policies should be an especially high priority for the 48 countries included in one or more of the lists of high TB, TB/HIV and multidrug-resistant TB (MDR-TB) burden countries; of these 48 countries, 37 reported having policies that included such an algorithm by the end of 2018 (Table 4.3). The second indicator of the framework is the percentage of new and relapse TB cases actually tested with a WRD as the initial diagnostic test. Globally, 2.2 million new and relapse TB cases were identified by a WRD in 2018. Among the 48 HBCs, 15 countries reported that a WRD had been used as the initial diagnostic test for more than half of their notified TB cases (Fig. 4.12).

Data on the quality of laboratory services in the 48 countries are shown in Table 4.4. About a third (35%) of the national reference laboratories in these countries have attained the standard[2] for medical laboratory quality and competence defined by the International Organization for Standardization *(7)*. Among countries reporting data, an average of 65% of testing sites were covered by a comprehensive external quality assessment system for the Xpert MTB/RIF® assay (Cepheid, United States of America), the most-used WRD worldwide.

4.1.6 Drug susceptibility testing and detection of drug-resistant TB

Drug-resistant TB threatens global TB care and prevention, and it remains a major public health concern in many countries. Three categories are used for global surveillance and treatment: rifampicin-resistant TB (RR-TB), MDR-TB and extensively drug-resistant TB (XDR-TB). MDR-TB is TB that is resistant to both rifampicin and isoniazid, the two most powerful anti-TB drugs. Both MDR-TB and RR-TB require treatment with a second-line drug regimen *(8)*. With increasing use of Xpert MTB/RIF for simultaneous detection of TB and resistance to rifampicin, a growing number of RR-TB cases (without further testing for isoniazid resistance) are being detected and notified.[3] XDR-TB is defined as MDR-TB plus resistance to

[1] WRDs use molecular techniques to detect TB among people with signs or symptoms of TB. They include the Xpert MTB/RIF® assay (Cepheid, United States of America) and the LoopampTM MTBC Detection Kit (Eiken Chemical Company Ltd, Japan).

[2] This standard is ISO 151189. It defines the components necessary for quality management systems to be effective in medical laboratories.

[3] Surveillance and survey data show that about 78% of RR-TB cases have MDR-TB. Further details are provided in Chapter 3.

TABLE 4.3

National policies to increase access to rapid TB testing and universal DST, and their implementation,[a] 2018

■ YES ☐ NO	HIGH TB BURDEN	HIGH TB/HIV BURDEN	HIGH MDR-TB BURDEN	NATIONAL POLICY AND ALGORITHM INDICATE A WRD AS THE INITIAL DIAGNOSTIC TEST FOR ALL PEOPLE PRESUMED TO HAVE TB	PERCENTAGE OF NOTIFIED NEW AND RELAPSE TB CASES TESTED WITH A WRD AS THE INITIAL DIAGNOSTIC TEST	NATIONAL POLICY AND ALGORITHM INDICATE UNIVERSAL ACCESS TO DST	PERCENTAGE OF NOTIFIED BACTERIOLOGICALLY CONFIRMED TB CASES WITH DST RESULTS FOR RIFAMPICIN[b]	PERCENTAGE OF NOTIFIED RR-TB CASES WITH DST RESULTS FOR FLUOROQUINOLONES AND SECOND-LINE INJECTABLES	NATIONAL POLICY AND ALGORITHM INDICATE THE USE OF LATERAL FLOW URINE LIPOARABINOMANNAN ASSAY (LF-LAM) TO ASSIST IN THE DETECTION OF TB IN PEOPLE LIVING WITH HIV
Angola	■	■	■	■		■	1.7	0	☐
Azerbaijan	☐	☐	■	■	69	■	>100	92	☐
Bangladesh	■	☐	■	■	18	■	29	69	☐
Belarus	☐	☐	■	■	93	■	>100	97	☐
Botswana	☐	■	☐	■	32	■	7.8	0	■
Brazil	■	■	☐	■	34	■	51	13	☐
Cambodia	■	☐	☐	☐	—	■	8.4	98	☐
Cameroon	☐	■	☐	■	56	☐	51	100	☐
Central African Republic	■	■	☐	■	0.32	☐	3.6	0	■
Chad	☐	■	☐	☐	8.4	☐	25	0	☐
China	■	■	■	☐	15	■	63	—	☐
Congo	■	■	☐	☐	8.6	☐	21	0	☐
DPR Korea	■	☐	■	☐	—	☐	6.2	0	☐
DR Congo	■	■	■	■	7.4	■	21	43	☐
Eswatini	☐	■	☐	■	75	■	>100	85	■
Ethiopia	■	■	■	■	—	■	55	49	☐
Ghana	☐	■	☐	■	60	■	94	29	☐
Guinea-Bissau	☐	■	☐	☐	—	☐	3.6	0	☐
India	■	■	■	■	50	■	90	66	☐
Indonesia	■	■	■	■	12	■	>100	28	☐
Kazakhstan	☐	☐	■	■	89	■	>100	90	☐
Kenya	■	■	■	■	47	■	87	27	☐
Kyrgyzstan	☐	☐	■	■	62	■	81	55	☐
Lesotho	■	■	☐	■	—	■	62	79	☐
Liberia	■	■	☐	■	9.1	■	22	—	☐
Malawi	☐	■	☐	☐	—	☐	—	0.79	■
Mozambique	■	■	■	■	41	■	98	41	☐
Myanmar	■	■	■	☐	42	■	92	27	☐
Namibia	■	■	☐	■	60	■	78	62	☐
Nigeria	■	■	■	■	54	■	72	83	■
Pakistan	■	☐	■	☐	22	■	47	76	☐
Papua New Guinea	■	■	■	■	—	■	—	58	☐
Peru	☐	☐	■	■	2.5	■	89	41	☐
Philippines	■	☐	■	☐	36	☐	70	29	☐
Republic of Moldova	☐	☐	■	■	95	■	92	83	☐
Russian Federation	■	☐	■	■	73	■	73	90	☐
Sierra Leone	■	☐	☐	■	5.3	☐	—	72	☐
Somalia	☐	☐	■	■	18	■	—	36	☐
South Africa	■	■	■	■	71	■	—	57	■
Tajikistan	☐	☐	■	■	74	■	>100	54	☐
Thailand	■	■	■	■	19	■	53	51	☐
Uganda	☐	■	☐	■	46	■	78	31	■
Ukraine	☐	☐	■	■	–	■	91	100	■
UR Tanzania	■	■	☐	■	18	■	67	14	☐
Uzbekistan	☐	☐	■	■	88	■	>100	78	☐
Viet Nam	■	☐	■	☐	20	■	81	61	☐
Zambia	■	■	☐	■	46	■	82	24	■
Zimbabwe	■	■	■	■	87	■	90	—	■

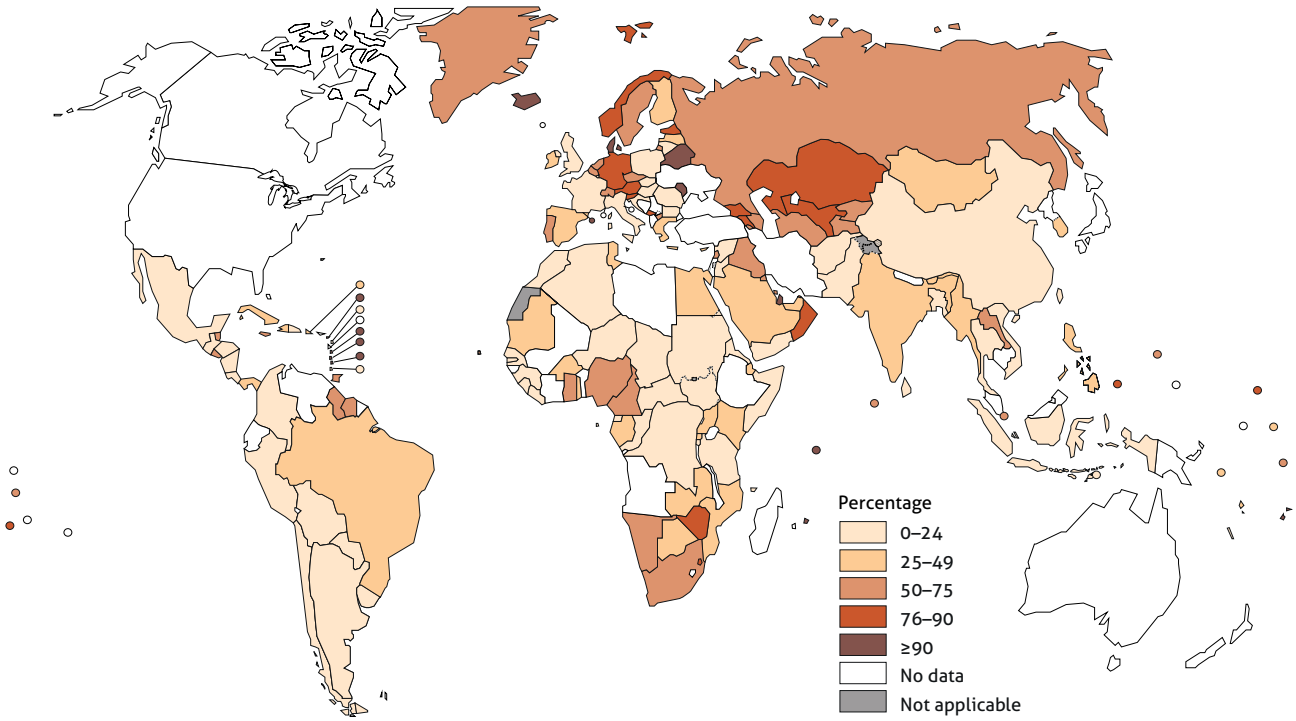
Blank cells indicate data not reported. – Indicates value that cannot be calculated. WRD, WHO-recommended rapid diagnostic. DST, drug susceptibility testing.

[a] The 48 countries shown in the table are the countries that are in one or more of the three lists of high TB, TB/HIV and MDR-TB burden countries (see also Chapter 2, Fig. 2.5 and Table 2.4).

[b] Testing in cases with unknown previous treatment history is not included. The percentage may exceed 100% for several reasons, e.g. samples rather than cases are counted in the numerator; laboratory specimen results are not linked to the denominator data source when enumerated; or there is incomplete reporting of bacteriologically confirmed cases in the denominator. Bacteriologically confirmed extrapulmonary cases are not included in the denominator because they cannot be differentiated from clinically diagnosed ones in the way data are reported to WHO.

FIG. 4.12

Percentage of new and relapse TB cases initially tested with a WHO-recommended rapid diagnostic test, 2018



at least one fluoroquinolone and a second-line injectable agent.

The End TB Strategy calls for universal access to drug susceptibility testing (DST). The focus in this section is on DST for notified TB patients with bacteriologically confirmed TB. These are the TB cases that can be tested for MDR/RR-TB using diagnostic tests recommended by WHO.

Drug susceptibility testing for first-line drugs and detection of MDR/RR-TB

Fig. 4.13 shows progress in DST coverage since 2009, when WHO intensified efforts to track progress in the programmatic response to drug-resistant TB.[1] In 2018, 1.8 million (51%) of the 3.2 million bacteriologically confirmed pulmonary TB cases notified globally were tested for rifampicin resistance, up from 1.3 million (41%) in 2017, with coverage of 46% for new and 83% for previously treated TB patients. DST coverage increased in all six WHO regions between 2017 and 2018. The highest increase in coverage was seen in the WHO African Region, while the highest level of coverage (91%) was in the European Region. DST coverage varied substantially between countries (even within the same region) and among the 30 high MDR-TB burden countries (Fig. 4.14).

Globally, 186 772 cases of MDR/RR-TB were detected and notified in 2018, representing a 16% increase from 160 684 in 2017 (Table 4.1, Fig. 4.15). Progress was faster in several priority countries, including China, India, Indonesia and the Philippines (Fig. 4.16).

The global number of MDR/RR-TB cases notified in 2018 was 39% of the estimated 484 000 (range, 417 000–556 000)[2] MDR/RR-TB incident cases in 2018 (Fig. 4.15; incidence estimates are discussed in more detail in Chapter 3). Closing this large detection gap will require improvements in overall TB detection (Section 4.2), the proportion of pulmonary cases that are bacteriologically confirmed and coverage of DST. The latter two require further strengthening of laboratory capacity and wider use of diagnostics that are more sensitive than smear microscopy, including rapid molecular tests.

Drug susceptibility testing for second-line drugs and detection of XDR-TB

Among MDR/RR-TB patients notified in 2018, 59% were tested for resistance to both fluoroquinolones and second-line injectable agents, a considerable increase from the 49% tested in 2017. Coverage varied widely among countries (Fig. 4.17). A total of 13 068 cases of XDR-TB were reported by 81 countries, with 88% of cases being from the WHO European Region and the South-East Asia Region (Table 4.1). The five countries that reported the largest numbers of cases were Belarus, India, the Russian Federation, South Africa and Ukraine.

[1] This happened following a ministerial conference for high MDR-TB burden countries, held in Beijing, China, in April 2009; a World Health Assembly resolution was adopted the following month: WHO (2009) *(9)*.

[2] Range refers to the 95% uncertainty interval.

TABLE 4.4

Quality of laboratory services,[a] 2018

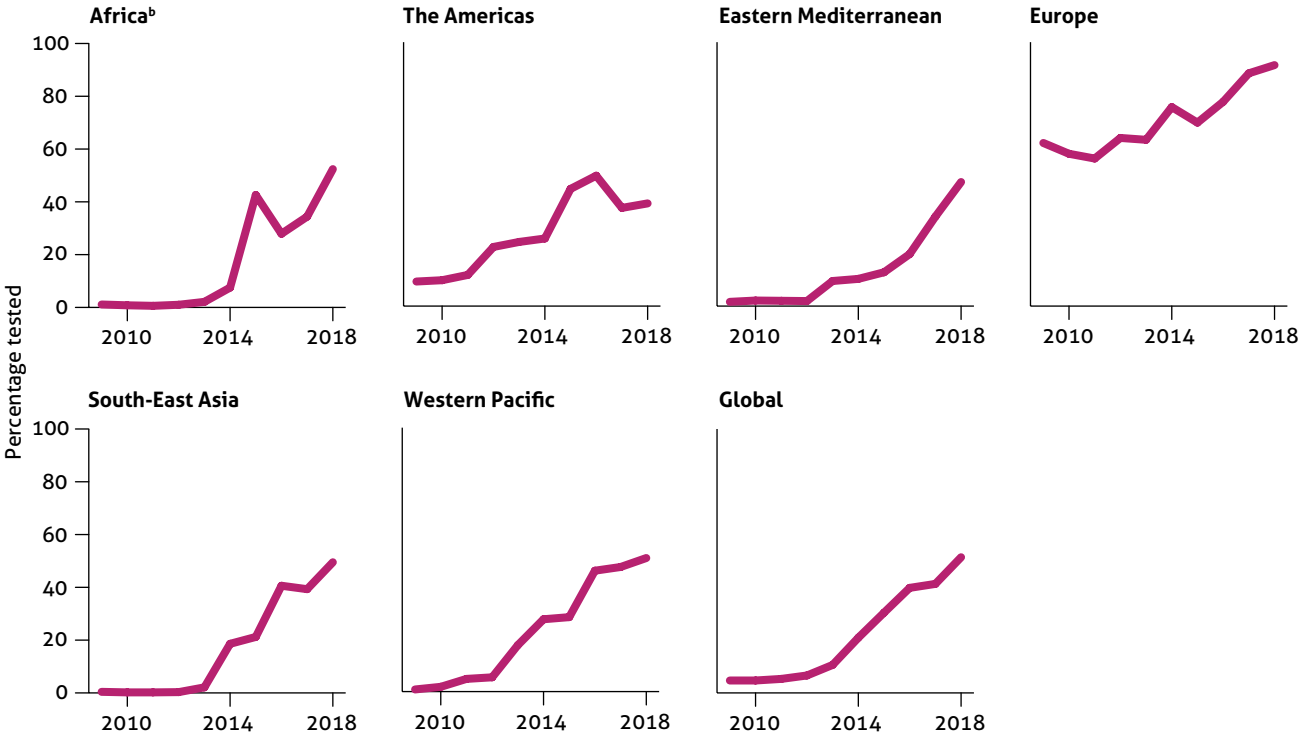
■ YES ☐ NO	NATIONAL REFERENCE LABORATORY ACCREDITED ACCORDING TO THE ISO 15189 STANDARD	PERCENTAGE OF TESTING SITES COVERED BY A COMPREHENSIVE EQA SYSTEM		PERCENTAGE OF TESTING SITES THAT DEMONSTRATED PROFICIENCY BY PANEL TESTING			
		SMEAR MICROSCOPY	XPERT MTB/RIF	PHENOTYPIC DST FOR FIRST-LINE DRUGS ONLY	PHENOTYPIC DST FOR FIRST-LINE AND SECOND-LINE DRUGS	LPA FOR RIFAMPICIN AND ISONIAZID ONLY	LPA FOR RIFAMPICIN, ISONIAZID, FLUROGUINOLONES AND SECOND-LINE INJECTABLES
Angola	☐	0	0	0	—	—	—
Azerbaijan	☐	49	100	100	100	100	100
Bangladesh	☐	100	0	100	100	100	100
Belarus	☐	78	100	—	100	—	100
Botswana	■	100	100	100	100	100	100
Brazil	■	22	2.3	48	100	—	—
Cambodia	☐	100	9.4	100	100	—	100
Cameroon	■	74	95	100	100	100	100
Central African Republic	■	62	100	100	100	100	100
Chad	☐	34	100	—	—	—	—
China	☐	96	54	100	96	73	—
Congo	☐	100	100	—	—	—	—
DPR Korea	☐	100	0	0	0	0	0
DR Congo	☐	100	100	—	100	—	67
Eswatini	☐	100	100	—	100	—	100
Ethiopia	■	90	86	100	0	100	0
Ghana	☐	69	100	25	—	25	0
Guinea-Bissau	☐	100	100	100	100	100	—
India	■	100	100	100	100	100	100
Indonesia	■	40	85	0	89	—	100
Kazakhstan	■	98	0	100	100	9.1	9.1
Kenya	■	90	100	100	100	100	100
Kyrgyzstan	☐	100	0	50	100	50	100
Lesotho	☐	100	100	0	—	100	—
Liberia	☐	61	29	—	—	—	—
Malawi	■	74	89	50	0	—	—
Mozambique	■	34	73	100	100	—	100
Myanmar	☐	88	100	0	0	0	0
Namibia	☐	100	100	100	100	100	100
Nigeria	☐	72	100	22	0	89	78
Pakistan	☐	98	78	67	80	80	80
Papua New Guinea	☐	96	0	—	—	—	—
Peru	☐	80	0	100	100	100	100
Philippines	■	75	12	100	100	—	100
Republic of Moldova	☐	100	100	100	100	100	100
Russian Federation	☐	16	9.7		36		
Sierra Leone	☐	5.9	100	100	—	100	100
Somalia	☐	85	7.3	—	—	—	—
South Africa	■	94	100	100	86	100	100
Tajikistan	☐	95	0	100	100	17	17
Thailand	■	90	73	100	100	100	100
Uganda	■	78	100	100	100	100	100
Ukraine	☐	100	51	100	100	0	0
UR Tanzania	■	100	100	100	100	100	100
Uzbekistan	☐	96	100	—	29	57	29
Viet Nam	■	90	96	0	100	—	100
Zambia	☐	38	17	100	—	0	0
Zimbabwe	☐	87	63	100	100		

Blank cells indicate data not reported. – Indicates value that cannot be calculated. DST, drug susceptibility testing. EQA, external quality assurance. LPA, line probe assay.

[a] The 48 countries shown in the table are the countries that are in one or more of the three lists of high TB, TB/HIV and MDR-TB burden countries (see also Chapter 2, Figure 2.5 and Table 2.4).

FIG. 4.13

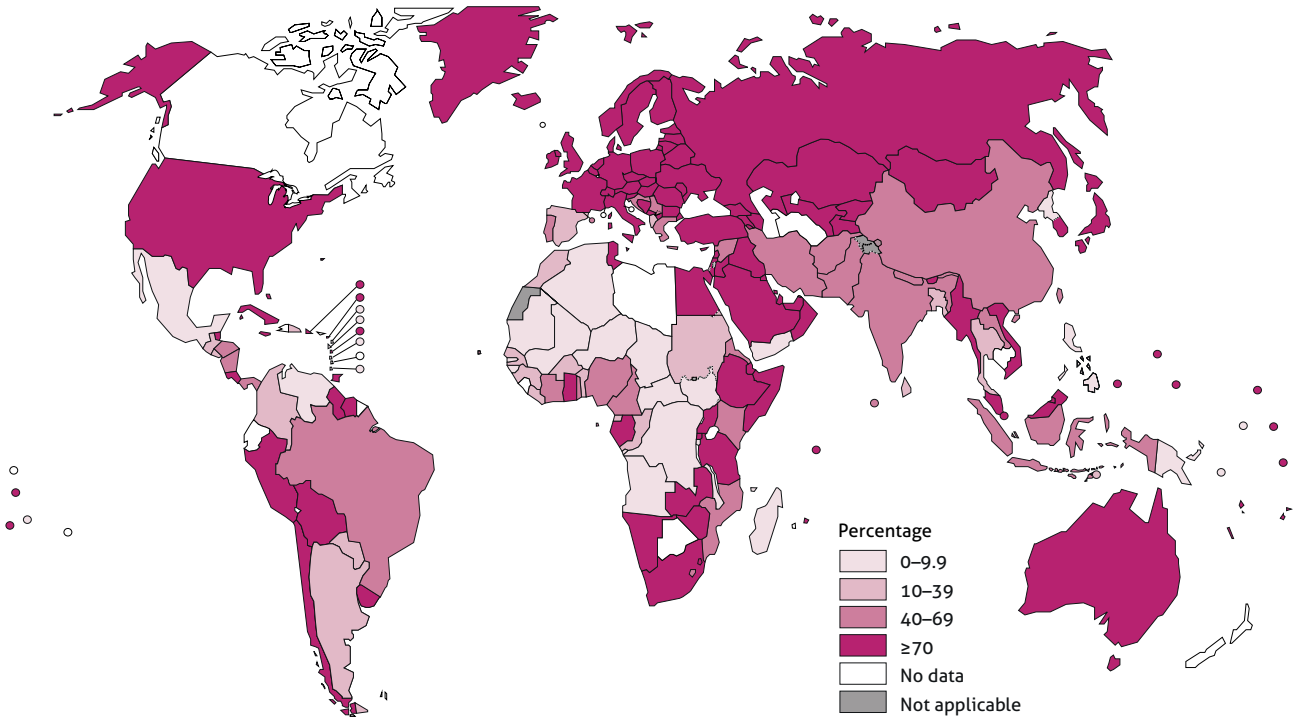
Percentage of bacteriologically confirmed TB cases tested for RR-TB,[a] globally and for WHO regions, 2009–2018



[a] Includes both new and previously treated cases; data for 2017 and 2018 are for pulmonary cases only.
[b] The increase in the African Region from 2014 to 2015 was due to a large increase in reporting of laboratory results for cases in South Africa in 2015.

FIG. 4.14

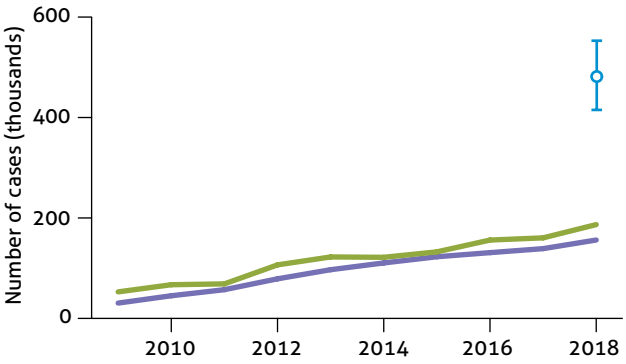
Percentage of bacteriologically confirmed TB cases tested for RR-TB, 2018[a]



[a] Includes both new and previously treated cases; data are for pulmonary cases only.

FIG. 4.15

Global number of MDR/RR-TB cases detected (green) and number enrolled on MDR-TB treatment (purple), 2009–2018, compared with estimate for 2018 of the number of incident cases of MDR/RR-TB (uncertainty interval shown in blue)



4.1.7 Electronic, case-based surveillance for TB

Globally, a growing number of countries are capturing data for notified TB cases in electronic case-based surveillance systems. These systems have several advantages compared with more traditional paper-based reporting of aggregated data, including more timely access to data (up to "real time") and the availability of data at the level of individual patients at the health facility up to national level. They also greatly facilitate data analysis (including by age, sex and location) to inform adaptation and targeting of response efforts, both geographically and for specific population groups. Further details, including of global efforts to support the adoption of case-based surveillance for TB, are provided in Box 4.4 and Box 4.5.

4.2 Treatment coverage

The Sustainable Development Goals (SDGs) include a target to "Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all" (Chapter 2). One of the indicators for Target 3.8 of SDG 3 is the coverage of essential health services; this is a composite indicator based on 16 tracer indicators, one of which is TB treatment. Achieving UHC is a fundamental requirement for achieving the milestones and targets of the End TB Strategy; hence, priority indicators for monitoring progress in implementing the End TB Strategy include both TB treatment coverage and the percentage of TB patients and their households that face catastrophic costs as a result of TB disease (Chapter 2).

TB treatment coverage is defined as the number of new and relapse cases detected and treated in a given year, divided by the estimated number of incident TB cases in the same year, expressed as a percentage. In this section, numbers of notified new and relapse cases in 2018 are used as the numerator for the indicator, because these are the data that are available. However, as discussed further below, there are people with TB who are treated but not notified to national authorities (and in turn are not notified to WHO), and people who are notified but who may not be started on treatment.

Antiretroviral therapy (ART) is recommended for all HIV-positive TB patients, and a second-line MDR-TB treatment regimen is recommended for people with MDR/RR-TB. This section includes estimates of treatment coverage for these two interventions as well.

4.2.1 TB treatment coverage

Trends in notifications of new and relapse cases and estimated incidence are shown for the 30 high TB burden countries in Fig. 4.18. Estimates of TB treatment coverage in 2018 are shown globally, for WHO regions and the 30 high TB burden countries, in Fig. 4.19.

Globally, TB treatment coverage was 69% (range, 63–77%)[1] in 2018, up from 53% (range, 46–64%) in 2010 and 35% (range, 30–43%) in 2000. Three WHO regions achieved levels above 75%: the WHO Region of the Americas, the European Region and the Western Pacific Region. High TB burden countries with high levels of treatment coverage in 2018 (>80%) included Brazil, China, the Russian Federation and Zimbabwe. The lowest levels, with best estimates of 50% or less, were in the Central African Republic and Nigeria.

Globally in 2018, there was a gap of about 3.0 million cases between the 7.0 million new and relapse cases that were notified, and the estimated 10.0 million (range, 9.0–11.1 million) incident TB cases in the same year (Fig. 4.1). The global gap has been narrowing, especially in the WHO Eastern Mediterranean Region, the South-East Asia Region and the Western Pacific Region.[2] Ten countries account for 80% of the total estimated global gap between incidence and notifications (Fig. 4.20), with India (25%), Nigeria (12%), Indonesia (10%) and the Philippines (8%) accounting for more than half the global total.

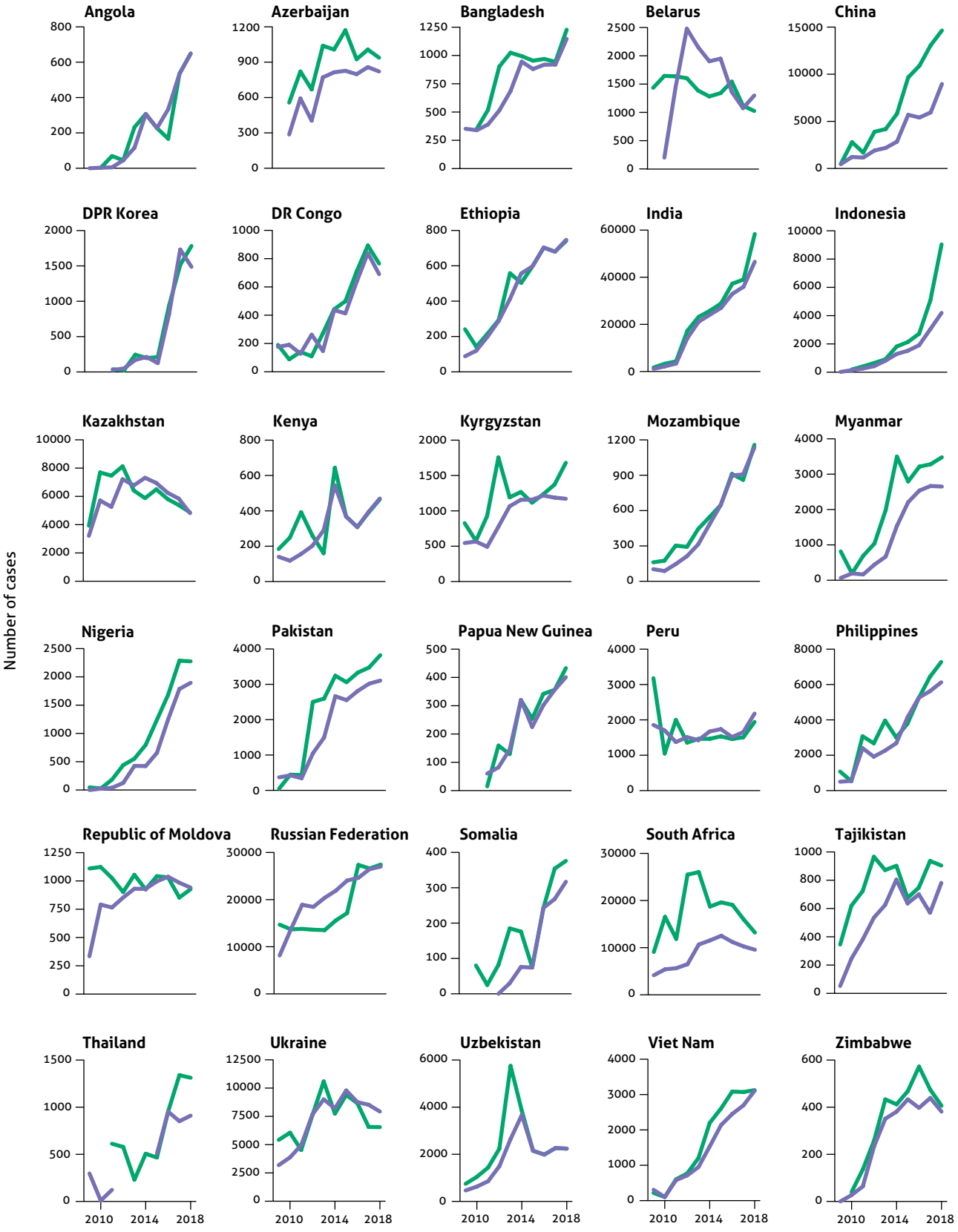
The main reasons for a gap between notifications and estimated incidence are:

- **Underreporting of detected TB cases.** In many countries, levels of underreporting may be high; this is especially the case for those countries that lack policies on mandatory notification and other measures to ensure reporting of detected cases by all care providers, and that have large private health sectors.
- **Underdiagnosis of people with TB.** Underdiagnosis can occur for reasons such as poor geographical and financial access to health care; lack of or limited symptoms that delay seeking of health care; failure to test for TB when people do present to health facilities; and diagnostic tests that are not sufficiently sensitive or specific to ensure accurate identification of all cases.

[1] Range refers to the 95% uncertainty interval.
[2] Time trends in countries and regions are shown in Annex 2 and Annex 3, respectively.

FIG. 4.16

Number of MDR/RR-TB cases detected (green) and enrolled on MDR-TB treatment (purple), 2009–2018, 30 high MDR-TB burden countries



National case-based electronic surveillance systems for TB: global status of progress and broader context

Case-based electronic surveillance systems for TB with national coverage have several advantages over more traditional paper-based reporting of aggregated data; for example, more timely access to data (up to real time) and the availability of data at the level of individual patients from health facility up to national level. They also greatly facilitate data analysis (including by age, sex and location) to inform adaptation and targeting of response efforts, both geographically and for specific population groups.

WHO has promoted case-based electronic surveillance for TB for several years, following guidance issued in 2012 *(10)*.

Status of progress

Data on the type of TB surveillance system in place at national level were available for 213 countries (Fig. B4.4.1). Of these, 146 had a case-based electronic surveillance system that covered all TB cases (both drug-susceptible and drug-resistant TB). These countries accounted for 71% of global TB notifications in 2018.

A further 24 countries, mainly in the WHO African Region and the South-East Asia Region, had a case-based surveillance system for all cases of drug-resistant TB. These countries are in a transition phase between aggregate paper-based reporting and case-based electronic surveillance. The initial prioritization of MDR-TB is explained by the additional complexity of monitoring treatment and treatment outcomes compared with drug-susceptible TB, which is much easier to manage with case-based surveillance; and by the fact that often the numbers of treatment centres and laboratories that need to be involved are smaller, making introduction more feasible from a logistics perspective. About half of the countries in the WHO African Region still have paper-based systems for recording and reporting of data.

Broader context

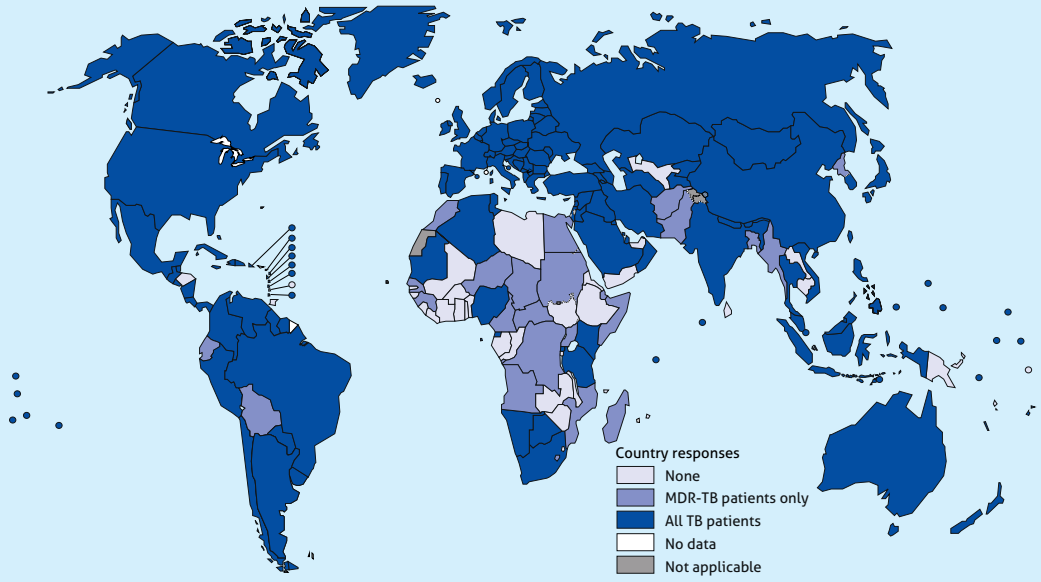
Efforts to expand national case-based electronic surveillance systems for TB are part of wider efforts to support the strengthening of routine national health information systems.

The Health Data Collaborative (HDC) *(11)* is a joint effort of multiple global health partners to work alongside countries to improve the availability, quality and use of data for local decision-making and the tracking of progress towards the health-related SDGs. The HDC Secretariat is based at WHO headquarters. The role of the HDC is to build on existing efforts by establishing a network of working groups to address specific technical issues, and to identify and fill technical gaps.

Under the umbrella of the HDC, a 3-year workplan (2018–2020) to support the strengthening of country health information systems is being implemented by four WHO departments (the Global TB Programme, the Global HIV and Hepatitis Programme, the Global Malaria Programme and the WHO Department of Immunization) and the University of Oslo. The workplan covers three major topics: strengthening country health information systems (in general and for specific diseases); strengthening analysis and use of the data generated by country information systems; and ensuring quality in the data generated by country health information systems and in the analysis and use of data.

FIG. B4.4.1

Countries with national case-based electronic surveillance for TB, 2018



BOX 4.5

Global guidance and tools for strengthening routine country health information systems and the analysis and use of data they produce

WHO's Global TB Programme has been working with other WHO departments, the University of Oslo and the Global Fund to develop and implement packages for analysis and use of data collected through routine health facility information systems *(12)*. In doing so, it has built on WHO guidance for the establishment of case-based electronic TB surveillance issued in 2012 *(10)*, as well as guidance on the routine analysis and use of TB data *(13)* and the WHO TB surveillance checklist of standards and benchmarks *(14)*.

The packages are based on WHO data standards and have been developed in the DHIS2 software,[a] but can easily be adapted for use with different software. Each package contains a facility analysis guide with a core set of indicators and dashboards, an accompanying exercise book and machine-readable DHIS2 configuration.

A TB-specific package for the electronic management of data in aggregated format[b] has been available since early 2018, for use by countries that are not yet ready to transition to case-based electronic surveillance. The TB package for case-based data, which enables electronic management of data for both drug-susceptible and drug-resistant TB in one system, is in the pilot-testing phase. Both TB packages are based on the WHO recording and reporting framework *(15)* and both allow extensive data analysis at different levels of the health system (e.g. health facility and subnational administrative area). The standard dashboards include graphs, tables and maps for core surveillance indicators (e.g. notifications, coverage of testing for drug resistance and HIV, and treatment outcomes) and data quality indicators (e.g. completeness and internal consistency).

The TB-specific package for aggregated data has been implemented in countries for prospective use, either to compile quarterly reports at the health facility or subnational level, or to analyse data from these reports through the standardized dashboards (depending on country needs). It has also been implemented for retrospective use, by uploading historical data (e.g. as part of a national TB epidemiological review). As of August 2019, a total of 16 countries had implemented the package for prospective use, and an additional 17 countries had used it to facilitate analysis and use of data in the context of a national TB epidemiological review during the period 2018–2019 (**Fig. B4.5.1**).

[a] DHIS2 was chosen because many countries are already using this software within their health information systems. It is an open-source software with no licence fees, and it is supported by a wide range of international technical and funding partners.
[b] A full demonstration is available at https://tbhistoric.org/.

FIG. B4.5.1

DHIS2 TB package for aggregated data (status of implementation as of August 2019)

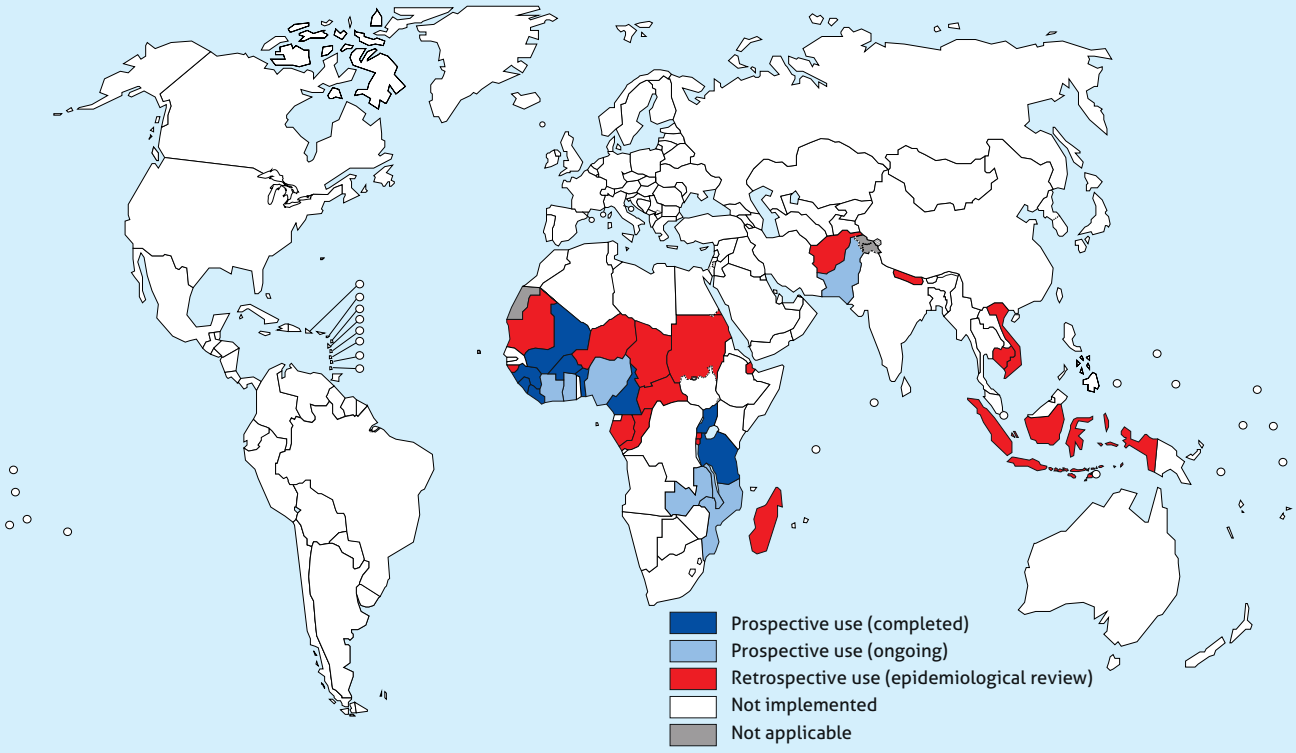
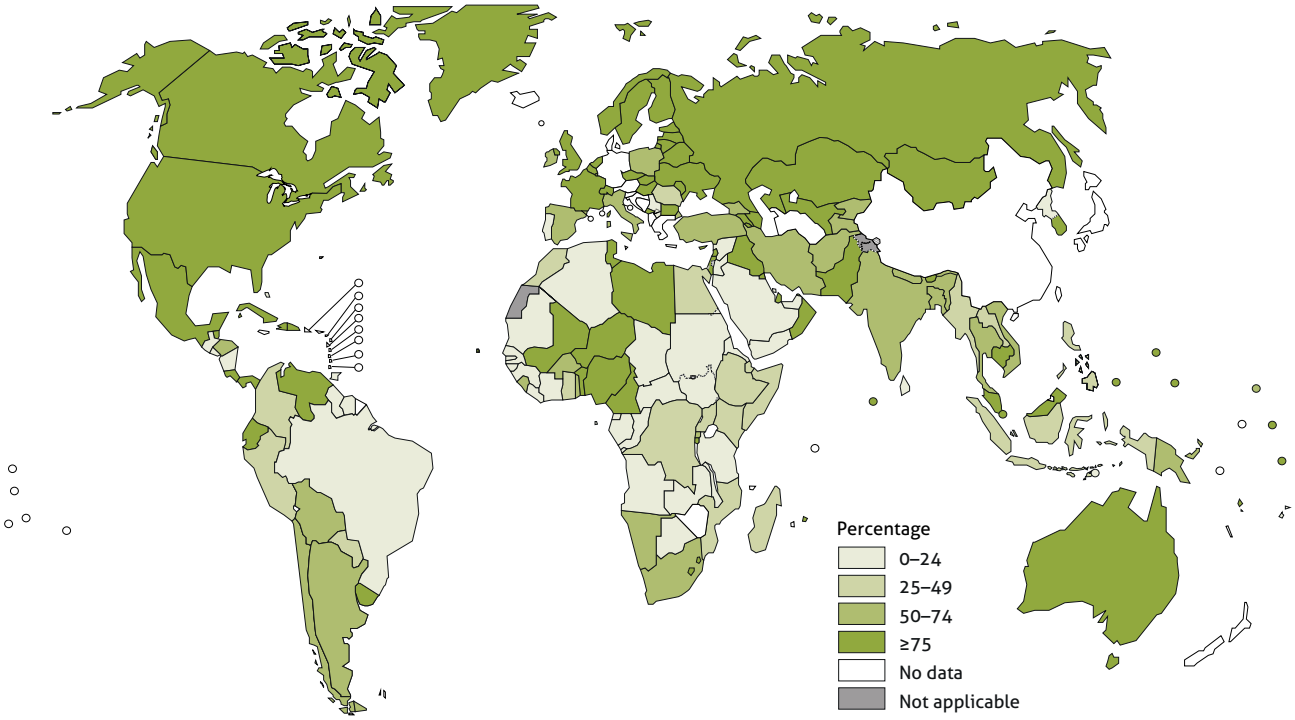


FIG. 4.17

Percentage of MDR/RR-TB cases tested for susceptibility to second-line drugs, 2018



Some of the countries with the largest estimated gaps between notifications and TB incidence already possess good evidence about the reasons for such gaps, and are taking or planning actions to address them. As highlighted in **Section 4.1.1**, two excellent examples are India and Indonesia, where studies that showed high levels of underreporting of detected TB cases have been followed by actions such as the introduction of policies on mandatory notification, intensified engagement with care providers not yet reporting to national authorities and the development and implementation of electronic systems to facilitate and simplify the reporting of cases. These actions have been followed by marked increases in notifications (**Fig. 4.2**).

One source of evidence about underreporting in India and Indonesia was a national inventory study, in which electronic lists of notified cases are compared with electronic lists of TB cases detected by all care providers (ideally employing unique identifiers).[1] Other high TB burden countries that have implemented an inventory study are China, Kenya, Pakistan and Viet Nam.[2] Two more studies are underway or being planned in South Africa and the United Republic of Tanzania.

A good example of a high TB burden country where underdiagnosis is a major challenge is Nigeria. The 2012 national TB prevalence survey found that 75% of the smear-positive cases detected had symptoms that met national screening criteria but had not been previously diagnosed, demonstrating a need to strengthen access to screening, diagnostic and treatment services of high quality. National TB prevalence surveys in many countries in Africa and Asia have also shown that detection and reporting gaps are systematically higher for men than for women *(17)*, suggesting that specific efforts are needed to improve access to TB diagnosis and treatment for men.

Systematic screening for active TB among specific populations can help to ensure early diagnosis and reduce levels of underdiagnosis. WHO recommends such screening for contacts of bacteriologically confirmed cases, PLHIV and people exposed to silica dust *(18)*.[3] Other individuals at risk should be considered for systematic screening based on an assessment of TB epidemiology in each setting. To date, in countries that are currently introducing or scaling up systematic screening, there have been few assessments of the implementation or its outcomes. However, this is expected to become a more prominent part of national programme monitoring and evaluation efforts in future. Engaging communities can

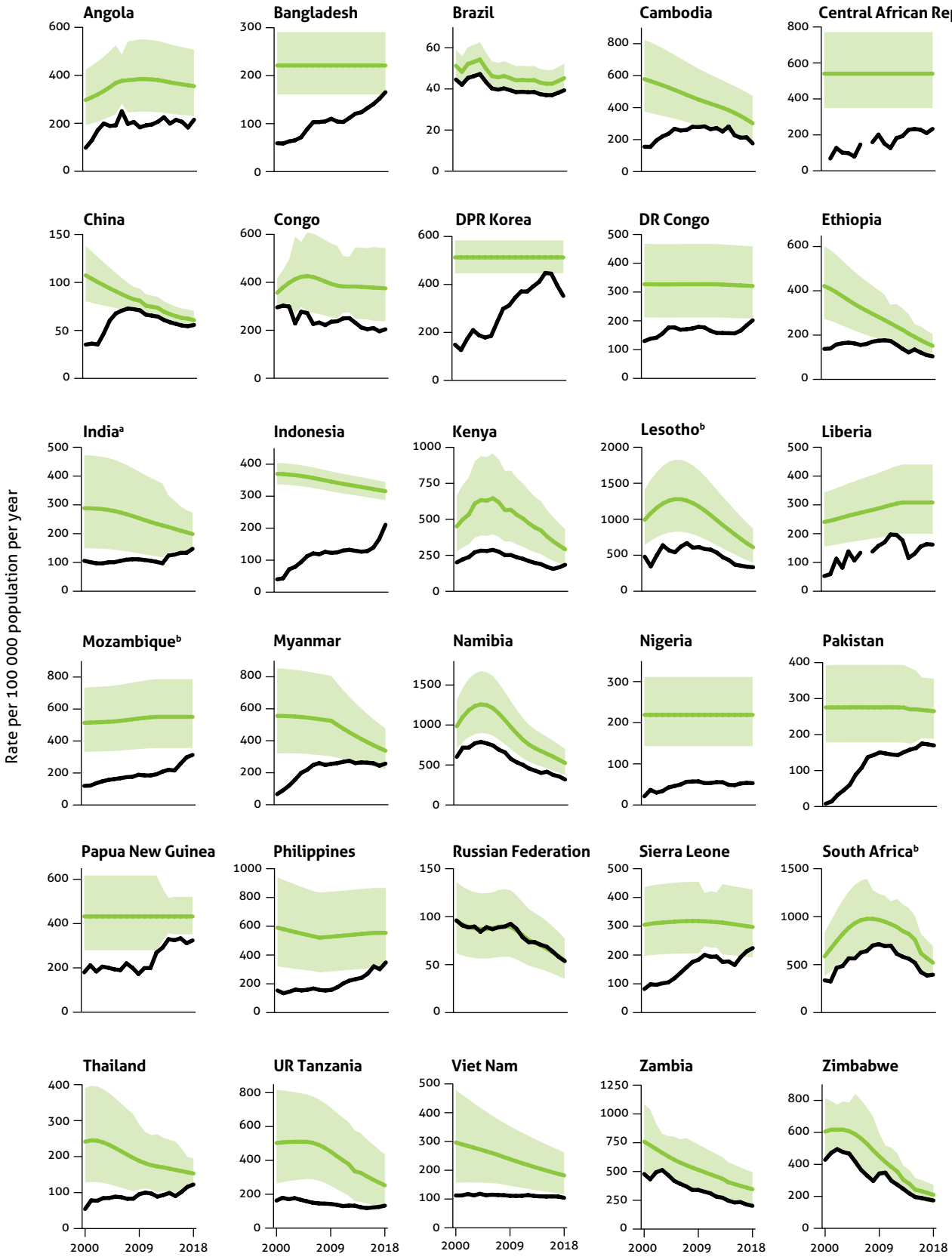
[1] For a guide to inventory studies, see WHO (2012) *(16)*. When this type of study is done prospectively (as opposed to retrospectively, using electronic databases that are already available), the mapping of providers that is required at the beginning can subsequently help with efforts to engage all care providers, including in reporting.

[2] Results from these studies have been used to inform estimates of TB incidence.

[3] The data requested as part of WHO's global monitoring focus on screening among PLHIV and close contacts. Hence, the data requested in WHO's annual round of global TB data collection also focus on screening among PLHIV and close contacts. These data are presented in **Chapter 5**.

FIG. 4.18

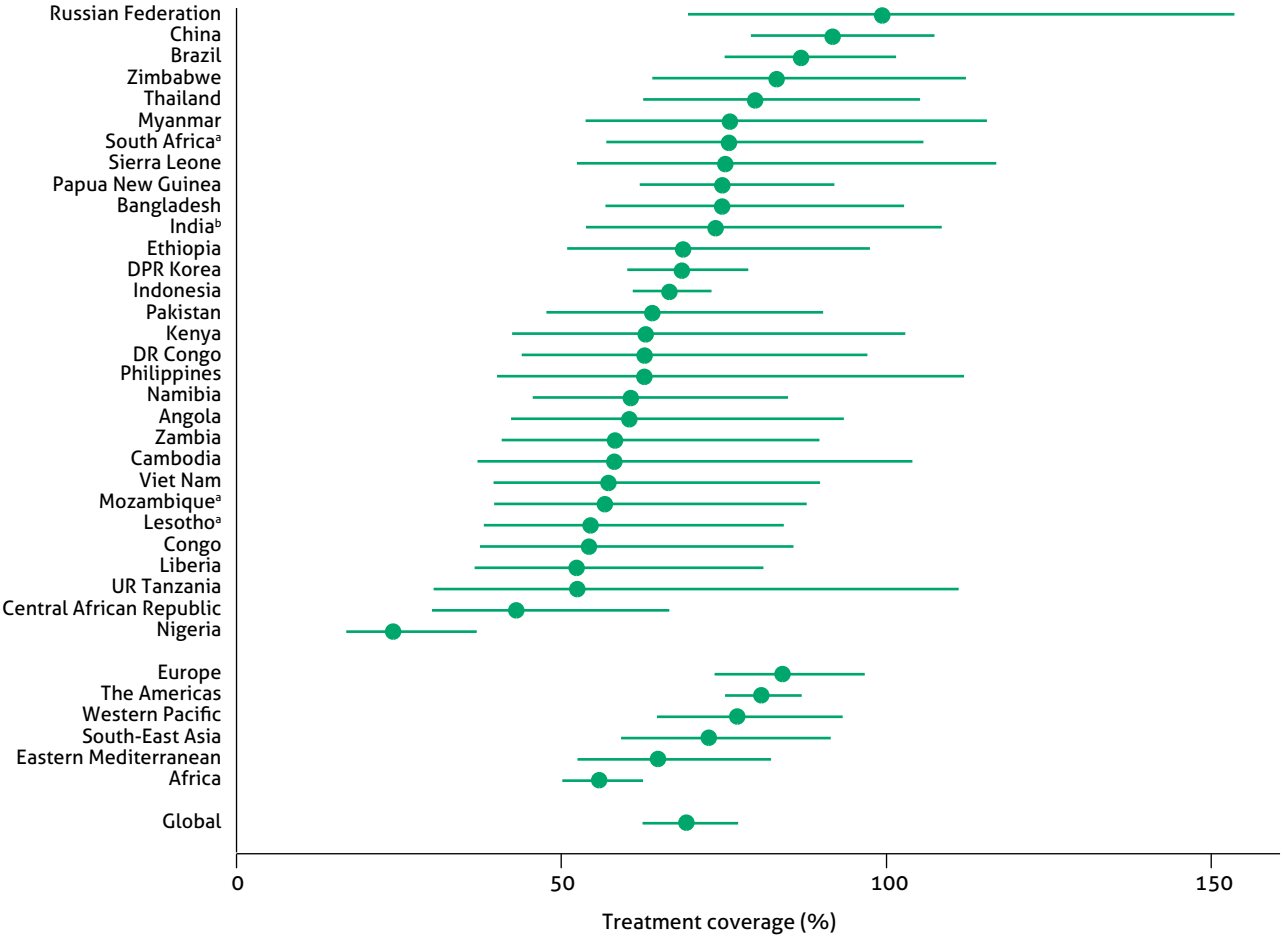
Case notification rates (new and relapse cases, all forms) (black) compared with estimated TB incidence rates (green), 2000–2018, 30 high TB burden countries. Shaded areas represent uncertainty intervals.



[a] Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.
[b] Estimates of TB incidence for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

FIG. 4.19

Estimated TB treatment coverage (new and relapse patients as a percentage of estimated TB incidence) in 2018, 30 high TB burden countries, WHO regions and globally



[a] Estimates of TB incidence for Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.
[b] Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.

also help to improve case detection and patient support (Box 4.6).

4.2.2 Treatment coverage of ART for HIV-positive TB cases

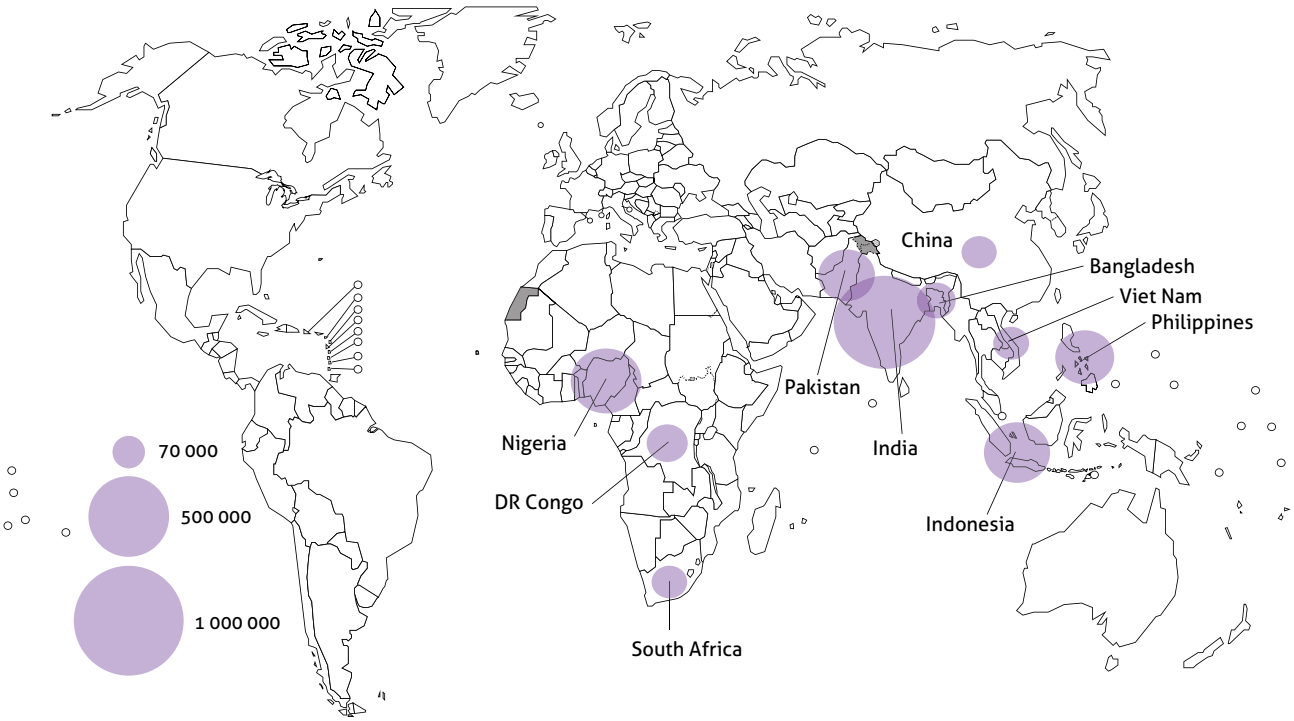
WHO recommends ART for all HIV-positive TB patients within the first 8 weeks of starting TB treatment, and within 2 weeks in profoundly immunosuppressed HIV-positive TB patients with CD4 counts of less than 50. The number of notified HIV-positive TB patients on ART reached 409 770 in 2018, equivalent to 86% of the notified TB patients known to be HIV-positive (Fig. 4.11).[1] In the 30 high TB/HIV burden countries, overall, 87% of the TB patients known to be HIV-positive were on ART. Twelve of these countries (Botswana, Cameroon, Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Uganda, the United Republic of Tanzania and Zambia) maintained coverage of at least 90% in both 2017 and 2018. In contrast, there were four high TB/HIV burden countries (Angola, Congo, Ghana and Indonesia) in which less than 50% of HIV-positive TB patients were started on ART in 2018.

Coverage of ART for people with TB can also be assessed by comparing the number of HIV-positive TB patients on ART with the estimated number of HIV-positive incident TB cases (Fig. 4.21, Fig. 4.22). This comparison shows larger gaps. Globally in 2018, the number of HIV-positive TB patients on ART was 48% of the estimated global number of incident HIV-positive TB cases; this was much lower than the global ART coverage of 62% among all PLHIV in 2018. There was considerable variation among the high TB/HIV burden countries and, according to best estimates, only 10 countries achieved ART coverage of more than 50% (Eswatini, Ethiopia, Kenya, Mozambique, Namibia, South Africa, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe).

[1] There may be discrepancies in data on provision of ART to HIV-positive TB patients as reported by NTPs and national HIV programmes. These discrepancies have reduced in recent years and have mostly been resolved through follow-up and validation efforts.

FIG. 4.20

The ten countries with the largest gaps between notifications of new and relapse (incident) TB cases and the best estimates of TB incidence, 2018[a]



[a] The ten countries ranked in order of the size of the gap between notified cases and the best estimates of TB incidence in 2018 are India, Nigeria, Indonesia, Philippines, Pakistan, DR Congo, Bangladesh, Viet Nam, South Africa and China. Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020. Estimate of TB incidence for South Africa will be reviewed after final results from its national TB prevalence survey are available in 2020.

Improvements are still needed in the detection of active TB disease among PLHIV, the coverage of HIV testing among TB patients and the enrolment of HIV-positive TB patients in ART. An overview of progress and gaps in TB preventive treatment among PLHIV is provided in **Chapter 5**.

4.2.3 Treatment coverage for MDR/RR-TB

Trends in the number of patients enrolled in MDR-TB treatment globally and in the 30 high MDR-TB countries since 2009 are shown in **Fig. 4.15** and **Fig. 4.16**, respectively. The number of people enrolled in treatment globally was 156 071 in 2018, up from 139 114 in 2017 and a more than fivefold increase from 30 500 in 2009 (when WHO first asked countries to report data). However, the number of enrolments fell in eight high MDR-TB burden countries (**Fig. 4.16**).

Globally, the 156 071 patients starting second-line MDR-TB treatment in 2018 represented 32% of the estimated 484 000 (range, 417 000–556 000)[1] incident cases of MDR/RR-TB in 2018 (**Fig. 4.23**). China and India accounted for 43% of the global gap between incidence and treatment enrolments and a further 8 countries (Indonesia, Mozambique, Myanmar, Nigeria, Pakistan, the Philippines, the Russian Federation and Viet Nam) accounted for 32% (**Fig. 4.24**). Treatment coverage will not improve globally unless there is an intensification of efforts to diagnose and treat MDR/RR-TB in these countries in particular. Closing the incidence-treatment enrolment gap requires increasing one or more of the following: the proportion of TB cases detected; the proportion of TB cases bacteriologically confirmed; the proportion of bacteriologically confirmed cases tested for drug resistance; and the proportion of detected cases of MDR/RR-TB started on treatment.

The number of cases starting MDR-TB treatment in 2018 was equivalent to 84% of the 186 772 MDR/RR-TB patients notified in 2018 (**Fig. 4.15**). The figure exceeded 90% in 16 high MDR-TB burden countries (**Fig. 4.16**), especially in the WHO European Region; however, it was much lower in the African Region and the Western Pacific Region.[2] These low percentages show that progress in detection is outstripping the capacity to provide treatment; they may also reflect weaknesses in data collection systems. In these settings, the risk of transmission of drug-resistant TB is high, and efforts are needed to rapidly close gaps in diagnosis and treatment enrolment.

In many countries, one of the barriers to adequate

[1] Range refers to the 95% uncertainty interval.

[2] For data for WHO regions, see **Annex 3**.

BOX 4.6

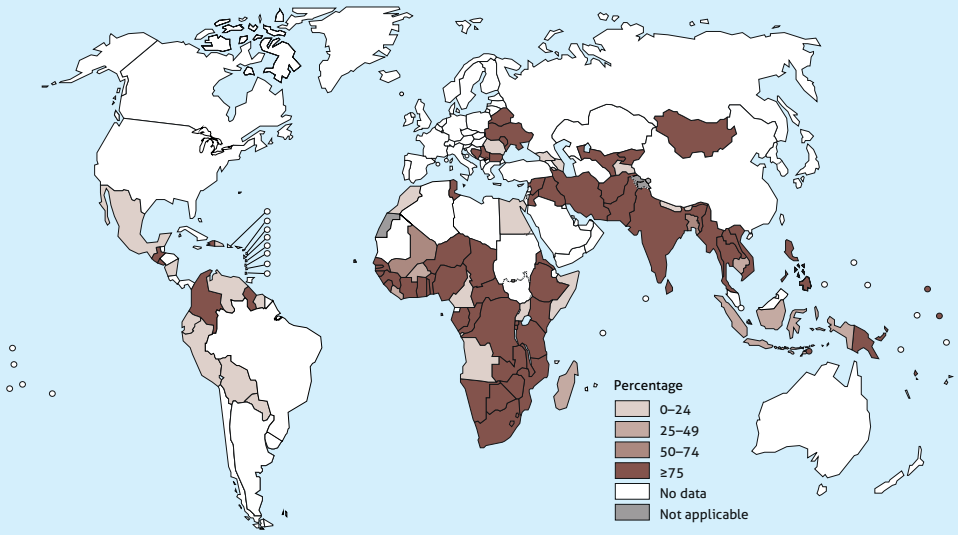
Community contributions to TB notifications and treatment support

The WHO's End TB Strategy calls for close collaboration between NTPs, affected communities and civil society organizations in the planning and implementation of programmatic activities, and monitoring and evaluation.

Community-based TB activities are found all along the pathway of TB prevention and care, and can positively influence the quality and outcome of health services offered. They are delivered primarily by community health workers (CHWs) and community volunteers (CVs)[a] who are drawn from within the community, and thus are both accessible and acceptable to community members. In the context of the SDGs and UHC, primary health care is receiving greater attention. A growing number of countries are taking steps to absorb cadres of CHWs into the workforce of national health systems. WHO guidelines *(19)* promote the establishment of CHW programmes as an integral part of primary health care, demonstrated to be feasible even in low- to middle-income countries. Harnessing the full potential of CHWs has the potential to remove barriers to care and promote equitable access to health services at the community level.

FIG. B4.6.1

Percentage of basic management units in which there was community contribution to case finding and/or to treatment adherence support, 2018[a]

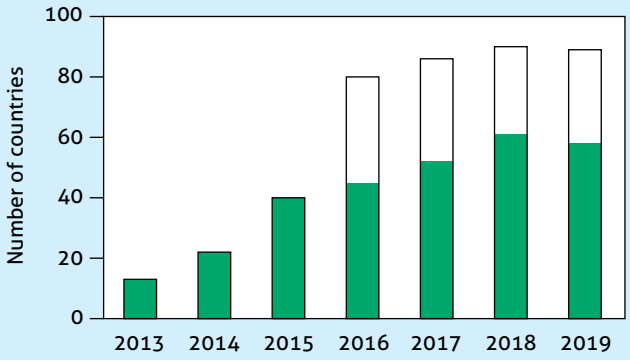


[a] Data only requested from 101 countries.

In the 2019 round of global TB data collection by WHO, 101 countries were asked to report data on community contributions to TB care. Of those, 89 (88%) countries reported implementing community-based TB activities, on average in 78% of their TB basic management units (Fig. B4.6.1). Of those, 58 countries reported more detailed data on the contribution of communities, through CHWs or CVs, to TB case notifications or TB treatment outcomes. Although this represents a more than fourfold increase in reporting since 2013 (when data were first collected on these two core indicators), the total number of reporting countries in 2019 was lower than the total of 61 that reported data in 2018 (Fig. B4.6.2). Although reasons for the small decline have not yet been systematically analysed, a common explanation provided by countries was the slowing down of the implementation of workplans in the context of time spent on Global Fund grant negotiations during much of 2018.

FIG. B4.6.2

Number of countries reporting implementing any community-based activity in line with WHO community indicators[a] (black outline) and countries reporting on these indicators (green), 2013–2019



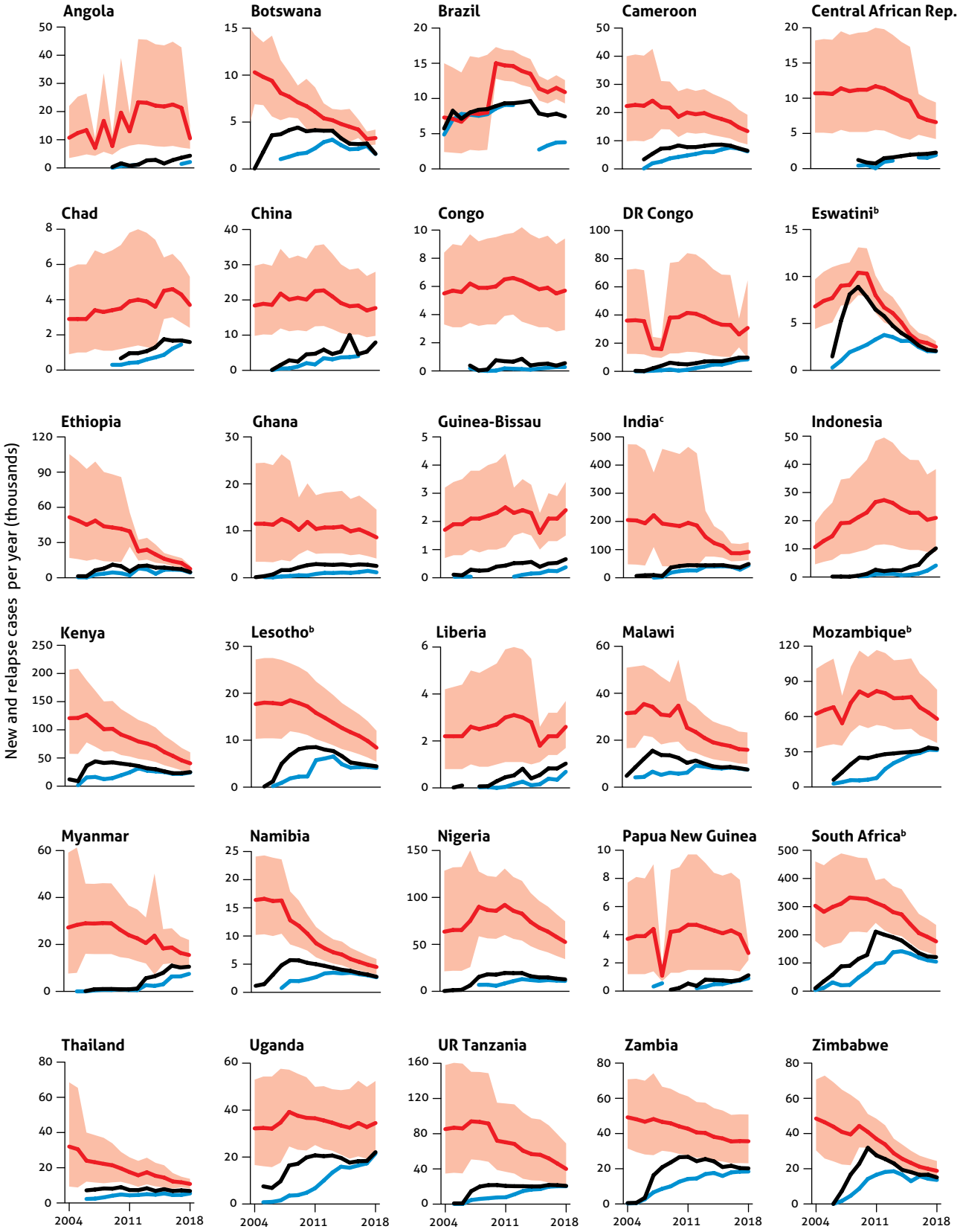
[a] Data have been collected since 2016.

The contribution of community referrals to TB case notifications was reported by 56 countries, in which the percentage of notified TB patients attributed to community referrals averaged 27%. The treatment success rate for people who benefited from any form of community treatment support was reported by 38 countries; the average figure was 87%.

[a] CHWs and CVs are defined in WHO (2012) *(20)*.

FIG. 4.21

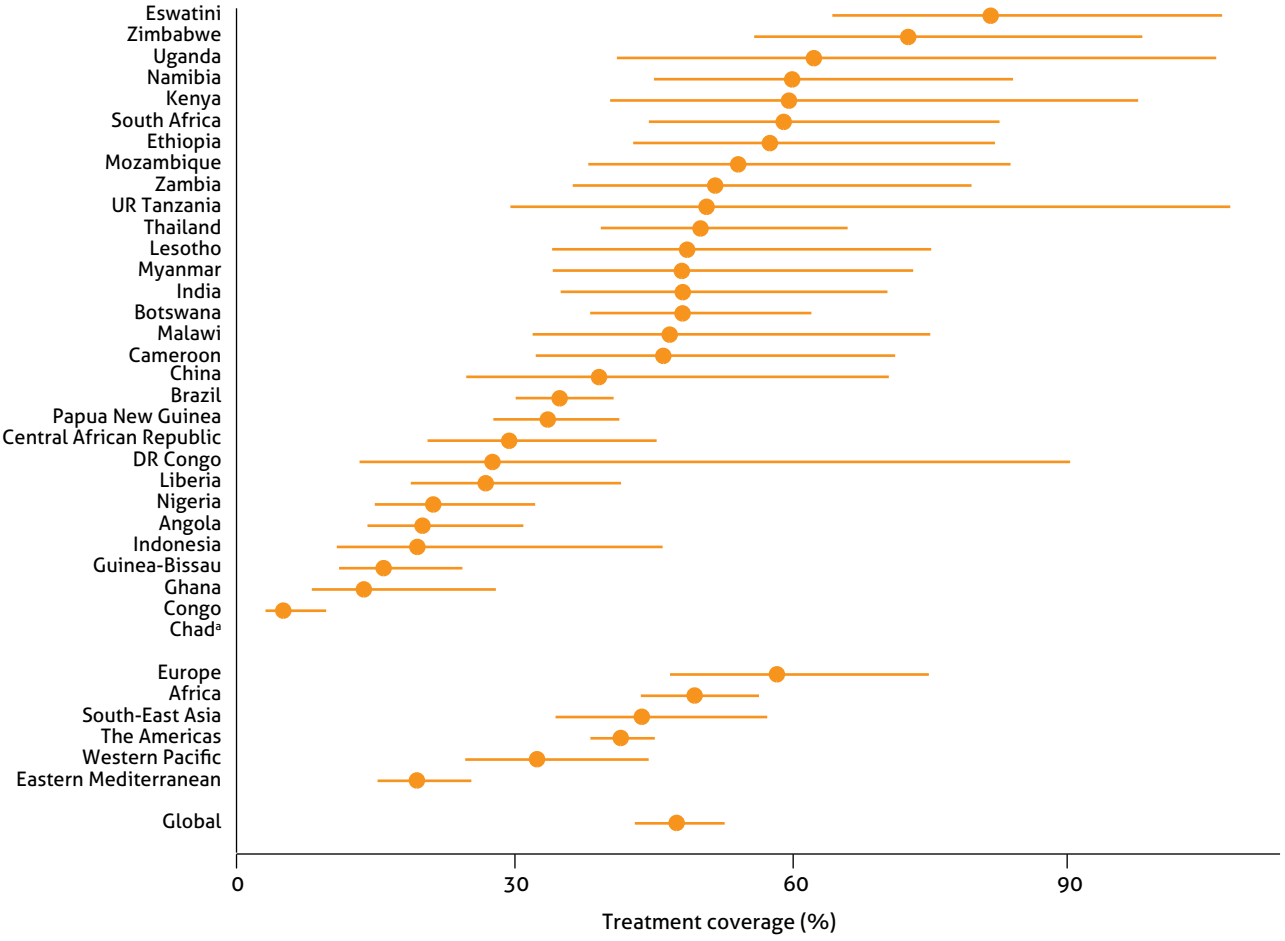
Number of new and relapse cases[a] known to be HIV-positive (black) and number started on ART (blue) compared with estimated number of incident HIV-positive TB cases (red), 2004–2018, 30 high TB/HIV burden countries. Shaded areas represent uncertainty intervals.



[a] The calculation is for all cases in years prior to 2015.
[b] Estimates of TB incidence for Eswatini, Lesotho, Mozambique and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.
[c] Estimates of TB incidence for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.

FIG. 4.22

Estimated coverage of ART for HIV-positive TB cases (HIV-positive TB patients on ART as a percentage of the estimated incidence of HIV-positive TB) in 2018, 30 high TB/HIV burden countries, WHO regions and globally



[a] No data.

access to treatment of drug-resistant TB is that the network for the programmatic management of drug-resistant TB is too centralized and too reliant on hospital-based models of care. Greater decentralization of services and expansion of ambulatory models of care are needed.

Globally, 11 403 patients with XDR-TB were enrolled in treatment in 78 countries and territories, a 16% increase compared with 2017. In 26 of these countries, the number of XDR-TB cases enrolled in treatment was less than the number notified. Only one high MDR-TB burden country (Thailand) and three other countries (Algeria, Bhutan and Uganda) reported prescribing morphine to treat pain or terminal dyspnoea in patients for whom second-line TB treatment regimens did not work. This finding suggests that there are widespread unmet needs in terms of palliative care as well as inadequate data gathering on this issue.

4.3 Treatment outcomes

This section summarizes the latest results of treatment for new and relapse cases of TB who started treatment on a first-line regimen in 2017 (including people with HIV-associated TB), and people detected with RR-TB, MDR-TB or XDR-TB who started a second-line MDR-TB regimen in 2016.[1]

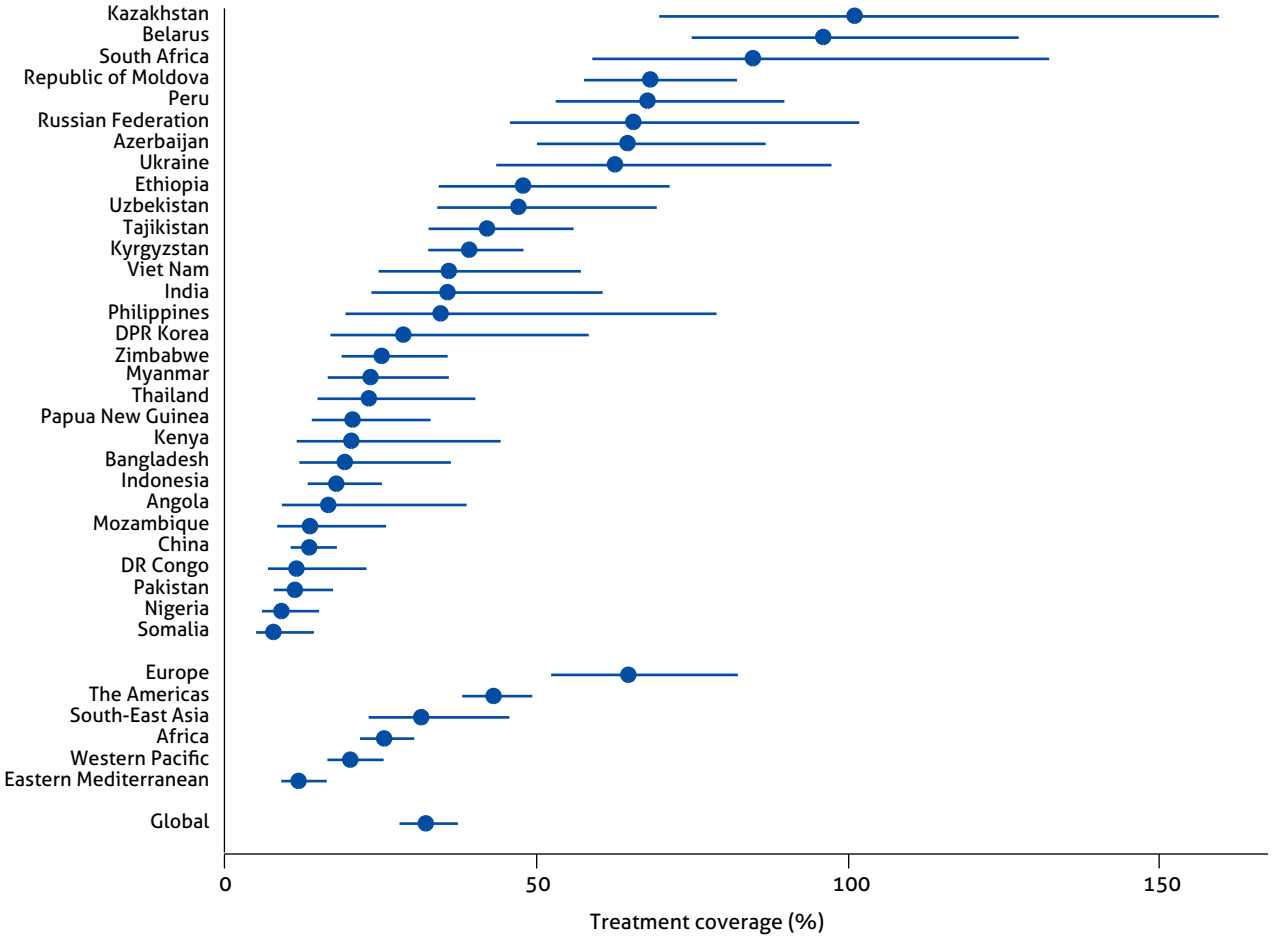
4.3.1 Treatment outcomes for new and relapse TB patients

Data on treatment outcomes for new and relapse cases of TB in 2017 are shown for the world, the six WHO regions and the 30 high TB burden countries in Fig. 4.25. The global trend for 2012–2017 is shown in Fig. 4.26. Globally, the treatment success rate for the 6.4 million new and relapse cases who were treated in the 2017 cohort was 85%, an improvement from 82% in 2016 primarily as a result of efforts in India to reduce the size of the "lost to follow-up" category in the private sector. The absolute number of TB patients reported to have been successfully treated rose substantially over the period 2000–2017, both globally and in all WHO regions (Fig. 4.27).

[1] For definitions of treatment outcomes, see WHO (2013) *(15)*.

FIG. 4.23

Estimated treatment coverage for MDR/RR-TB (patients started on treatment for MDR-TB as a percentage of the estimated incidence of MDR/RR-TB) in 2018, 30 high MDR-TB burden countries, WHO regions and globally[a]



[a] Reasons for a higher than expected coverage (even exceeding 100%) include that the numerator included empirical treatment of TB patients considered at risk of having MDR/RR-TB but for whom a laboratory-confirmed diagnosis was missing, incomplete reporting of laboratory data, duplicated case reporting, or enrolment of 'waiting lists' of people with MDR/RR-TB who were detected before 2018.

Among the six WHO regions, the highest treatment success rates in 2017, of 91%, were in the WHO Eastern Mediterranean Region and the Western Pacific Region. The lowest rates were 76% in the WHO Region of the Americas (due to high levels of loss to follow-up and missing data) and 78% in the European Region (due to high rates of treatment failure and death, influenced by the high frequency of MDR/RR-TB).

Only 12 of the 30 high TB burden countries reached or exceeded a 90% treatment success rate, although the validity of treatment outcome data was not always ascertained. On the other hand, in several high TB burden countries, the completeness of outcome reporting was low.

4.3.2 Treatment outcomes for new and relapse TB patients living with HIV

A total of 121 countries reported treatment outcomes for the 2017 patient cohort disaggregated by HIV status. These 121 countries included 27 of the 30 high TB/HIV burden countries; no data were reported by Angola, Chad and Ethiopia (Fig. 4.28). Overall, the treatment success rate was 75%, an increase from 68% in 2012 (Fig. 4.26), although worse than the level of 85% for all new and relapse TB patients in the same countries.

Globally, the proportion of HIV-positive TB patients who died during treatment was 11%, which was similar to previous years and about three times the level among all new and relapse cases (4%). In the WHO regions, the relative difference was smallest in the WHO African Region (10% versus 5%) and highest in the Western Pacific Region (11% versus 3%). In the WHO Region of the Americas and the European Region, the proportions of HIV-positive

FIG. 4.24

The ten countries with the largest gaps between the number of patients started on treatment for MDR-TB and the best estimates of MDR/RR-TB incidence, 2018[a]

[a] The ten countries ranked in order of the size of the gap between the number of patients started on MDR-TB treatment and the best estimate of MDR/RR-TB incidence in 2018 are India, China, Pakistan, Indonesia, Nigeria, Russian Federation, Philippines, Myanmar, Mozambique and Viet Nam.

TB patients who died were 20% and 21%, respectively.

Reasons for comparatively poor outcomes for HIV-positive TB patients include late detection of HIV-associated TB and delays in starting ART or TB treatment. To reduce excessive TB mortality in PLHIV, WHO recommends TB screening among PLHIV, early ART, improved infection control and provision of TB preventive treatment. Options that could help to ensure earlier diagnosis and reduce mortality include strategic placement of WHO-recommended rapid molecular TB diagnostics such as Xpert MTB/RIF within HIV care settings, and uptake of the lateral flow urine lipoarabinomannan assay (LF-LAM) for seriously ill PLHIV.[1]

4.3.3 Treatment outcomes for TB patients with drug-resistant TB

A total of 141 countries and territories reported treatment outcomes for people started on MDR-TB treatment in 2016.[2] The number of cases reported in annual cohorts has steadily increased over time, reaching 126 089 cases globally in the 2016 cohort. Overall, the proportion of MDR/RR-TB patients in the 2016 cohort who successfully completed treatment (i.e. cured or treatment completed) was 56%: in 8% the treatment failed, 15% died, 15% were lost to follow-up and for 6% there was no outcome information (Fig. 4.29).

Globally, treatment success has increased in recent years (Fig. 4.26). At regional level, the treatment success rate in 2016 was highest in the WHO Eastern Mediterranean Region (65%) and was lowest in the South-East Asia Region (52%). Treatment failure was highest in the WHO European Region (12%), and the death rate was highest in the African Region (18%). Loss to follow-up was highest in the WHO Region of the Americas (25%), whereas the Western Pacific Region had the highest percentage of cases without outcome data (8%).

Among the 30 high MDR-TB burden countries, seven had treatment success rates of more than 75% in their 2016 cohorts. Treatment success rates were 50% or lower in India, Indonesia, Mozambique and Ukraine. Reasons for these lower success rates included high rates of death and loss to follow-up in Indonesia (17% and 26%) and India (19% and 19%); a high death rate and missing data about treatment outcome in Mozambique (16% and 21%); and high rates of treatment failure, or loss to follow-up or missing data about treatment outcome in Ukraine (18%, 16% and 16%).

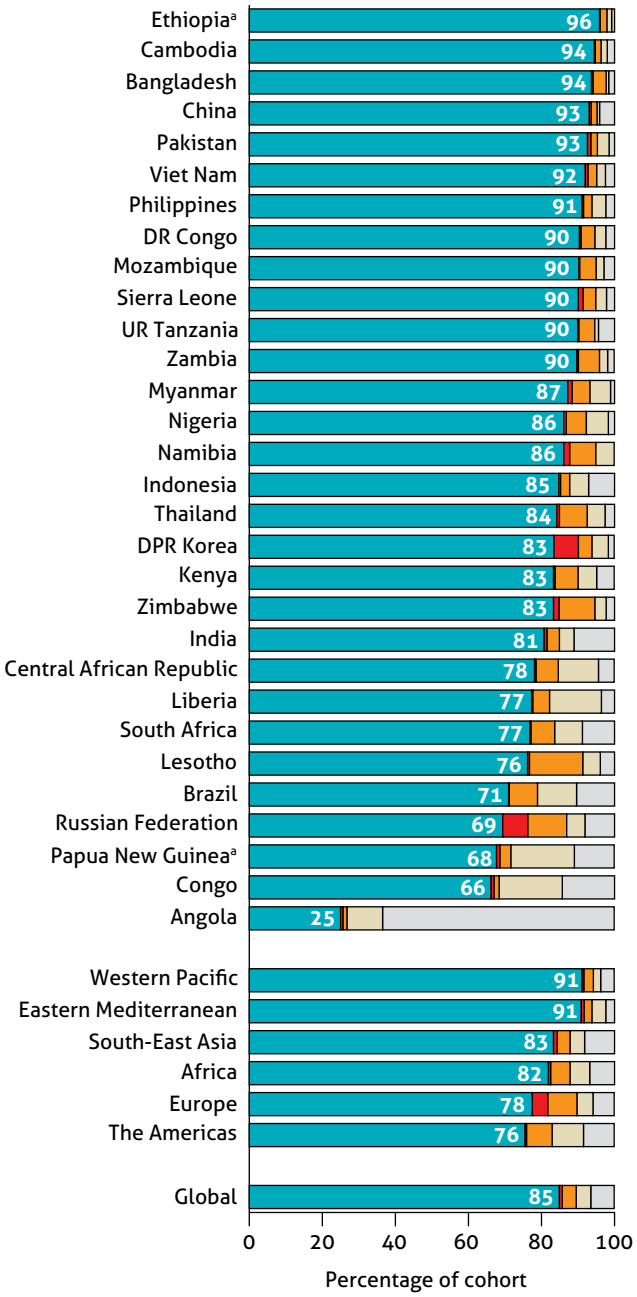
Among 9258 patients started on treatment for XDR-TB in 2016, in 57 countries and territories for which outcomes

[1] Further information about this assay is provided in Chapter 8.

[2] This is the latest year for which data on treatment outcomes for drug-resistant TB have been reported to WHO. The longer duration of treatment for drug-resistant TB means that there is a longer lag time for reporting of data.

FIG. 4.25

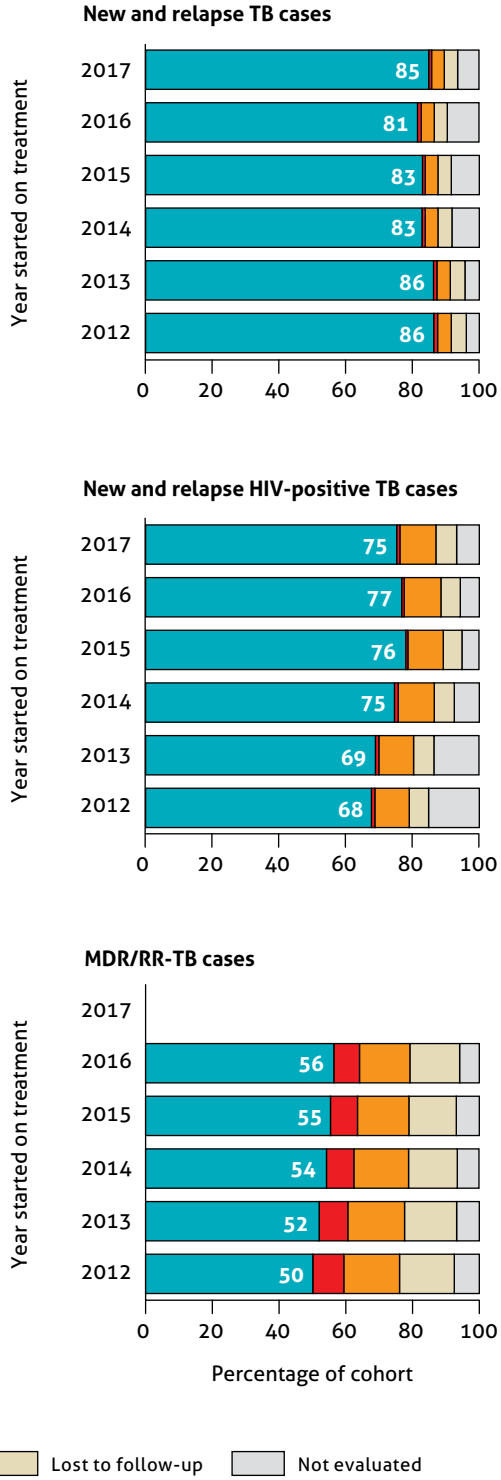
Treatment outcomes for new and relapse TB cases in 2017, 30 high TB burden countries, WHO regions and globally



[a] Treatment outcomes are for new cases only.

FIG. 4.26

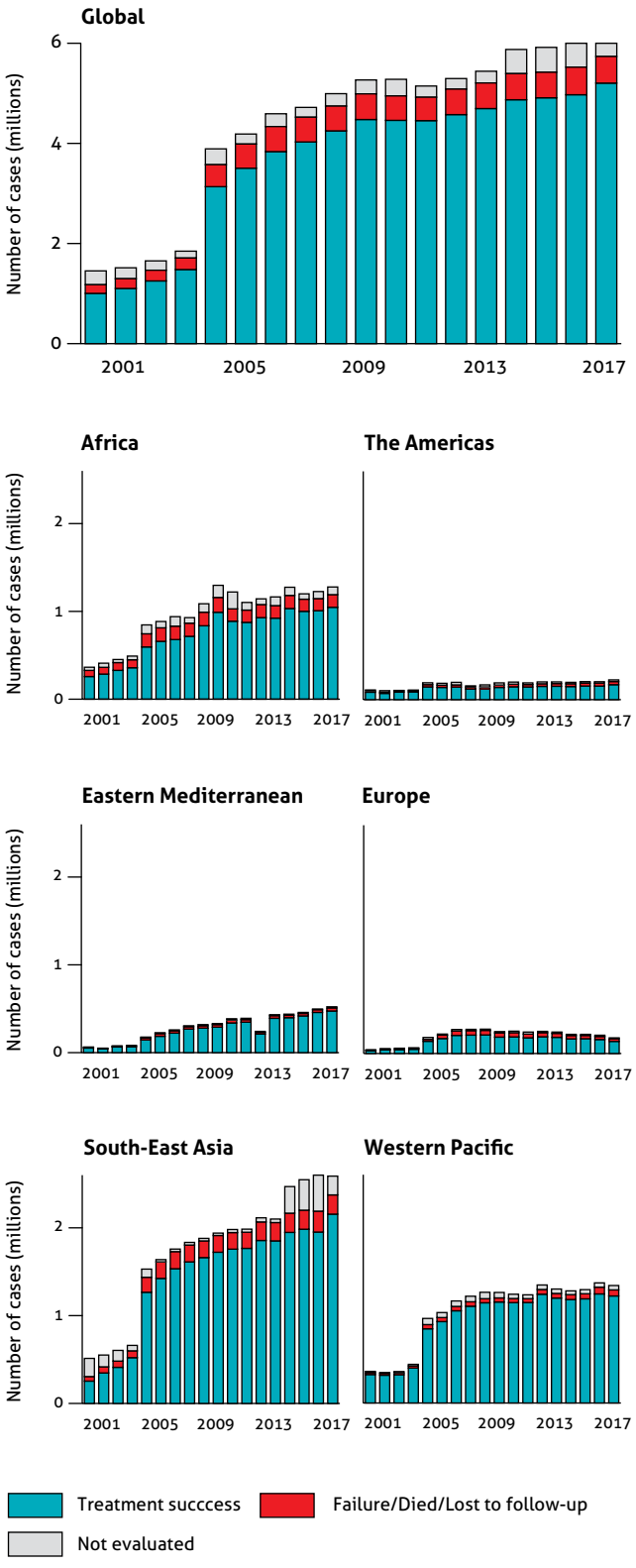
Treatment outcomes for new and relapse TB cases, new and relapse HIV-positive TB cases, and MDR/RR-TB cases, 2012–2017 globally[a]



[a] Outcomes for MDR/RR-TB annual treatment cohorts are reported one year later than other TB cohorts.

FIG. 4.27

Treatment outcomes for new and relapse TB cases[a] (absolute numbers), 2000–2017, globally and for WHO regions



[a] Cohorts before 2012 included new cases only.

were reported, 39% completed treatment successfully, 26% died, treatment failed for 18%, and 18% were lost to follow-up or their treatment outcome was not evaluated. India, the Russian Federation and Ukraine accounted for 84% of the 2016 XDR-TB cohort. Among seven countries with XDR-TB cohorts of more than 100 individuals, mortality was highest in India and Uzbekistan (41% and 26%).

Although improving in some countries, the treatment success rate for MDR/RR-TB globally remains unacceptably low. The wider use of more effective MDR-TB treatment regimens designed on the basis of the latest available evidence, and the use of more patient-centred models of care, are expected to help improve this situation. New guidance related to the treatment of drug-resistant TB was issued by WHO in March 2019 (**Box 4.7**) *(21)*.

By the end of 2018, 82 countries, mostly in Africa and Asia, reported having used shorter MDR-TB regimens (**Fig. 4.30**). These regimens have been reported to achieve high rates of treatment success (87–90%) in selected MDR/RR-TB patients. By the end of 2018, a total of 90 countries reported having imported or started using bedaquiline, and 57 countries had used delamanid (**Fig. 4.31** and **Fig. 4.32**). Most (79%) of the patients treated with bedaquiline were reported by two countries: the Russian Federation and South Africa.

With the introduction of new drugs and regimens *(21)*, there is a need for active TB drug-safety monitoring and management (aDSM) for all patients on treatment. aDSM is defined as the active and systematic clinical and laboratory assessment of patients on treatment with new TB drugs, novel MDR-TB regimens or XDR-TB regimens, in order to detect, manage and report suspected or confirmed drug toxicities *(22)*. In 2018, 18 of the 30 high MDR-TB burden countries reported that data on adverse events were being systematically collected in their TB information systems.

National programmes and other contributors are reporting aDSM data to a WHO global database for the surveillance of adverse events *(23)*. This collaborative initiative aims to generate evidence on the safety profile of regimens to inform future TB treatment guidelines. Developed and managed by the WHO Global TB Programme and the Special Programme for Research and Training in Tropical Diseases, the aDSM framework is designed to detect signals of previously unknown or poorly documented adverse events in patients on MDR/XDR-TB regimens. In 2017–2018, 16 countries contributed data; preliminary analysis of the data did not suggest any emerging safety signals. The aDSM framework is being actively supported by the WHO network (headquarters, regional and country offices), technical partners and global technical networks. These include the Global Tuberculosis Network and its ongoing initiative to initiate use of the aDSM framework in 27 countries *(24)*.

FIG. 4.28

Treatment outcomes for new and relapse HIV-positive TB cases in 2017, 30 high TB/HIV burden countries, WHO regions and globally

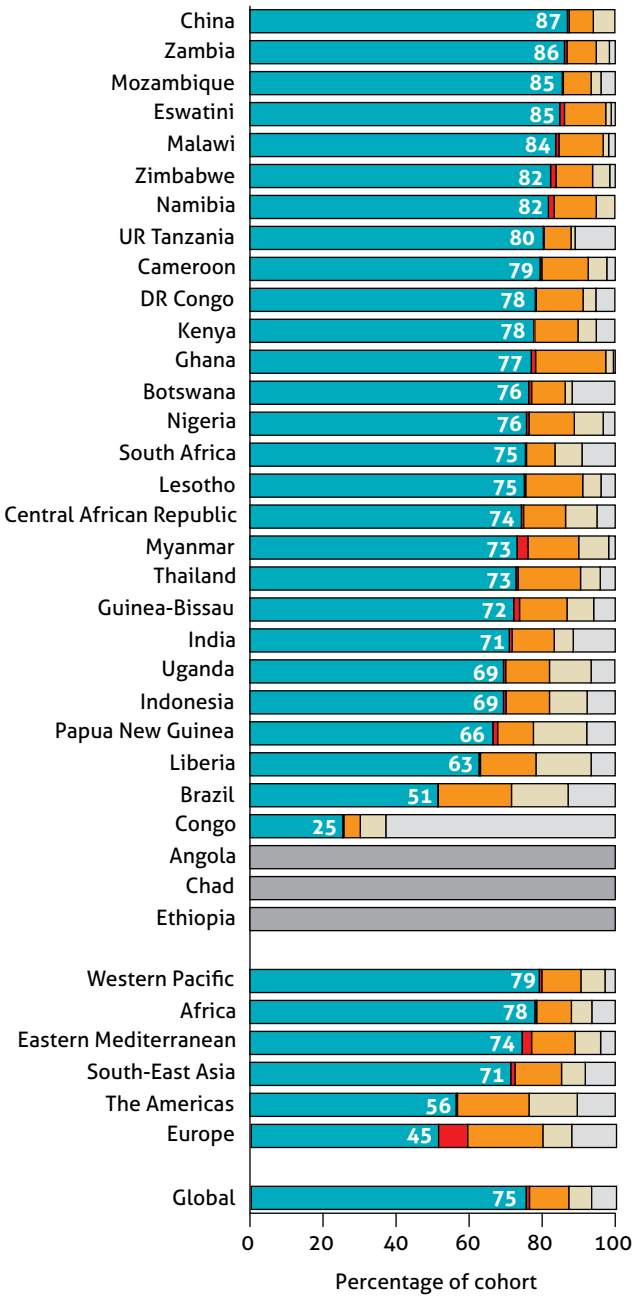
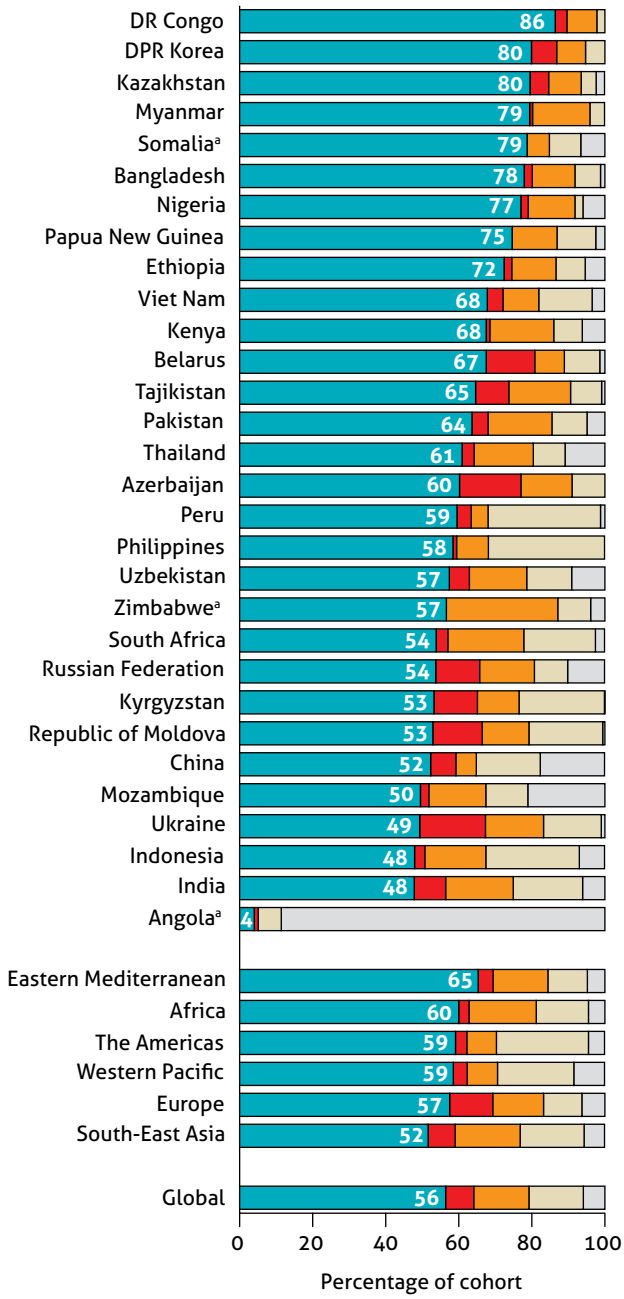


FIG. 4.29

Treatment outcomes for MDR/RR-TB cases started on treatment in 2016, 30 high MDR-TB burden countries, WHO regions and globally



Treatment success | Failure | Died | Lost to follow-up | Not evaluated | No data reported

[a] These countries reported cohorts of less than 500 MDR/RR-TB cases in 2016.

BOX 4.7

WHO consolidated guidelines for drug-resistant TB treatment

In March 2019, the WHO Global TB Programme released updated guidelines on the treatment of drug-resistant TB *(21)*. These included some important changes in recommended approaches to care. New recommendations (made since 2018) to treatment policies for MDR/RR-TB and for isoniazid-resistant, rifampicin-susceptible TB (Hr-TB) were based on an extensive review of the most recently available evidence.

The new guidance envisages that most MDR/RR-TB patients can be treated with fully oral drug regimens. These regimens, lasting 18–20 months, should start with a combination of a fluoroquinolone, bedaquiline and linezolid, plus one or more other agents likely to be effective. The classification of medicines to be used in these regimens was updated based on an assessment of their relative benefits and potential harms. Injectable agents should only be used if other options are not possible; two such agents (kanamycin and capreomycin) are no longer recommended. The standardized, shorter MDR-TB regimen (with a treatment duration of 9–12 months) can be offered to eligible patients who agree to shorter treatment but this requires a daily injectable agent for at least 4 months. Most Hr-TB can be treated with 6 months of rifampicin, ethambutol, pyrazinamide and levofloxacin, once rifampicin susceptibility has been reliably confirmed.

Several recommendations made before 2018 remain valid. The use of culture, preferably at monthly intervals, is still recommended to enable timely detection of a failing MDR-TB regimen and rapid action. Partial resection surgery, early initiation of ART in PLHIV, support for adherence (including digital technologies) and decentralized care are also recommended. The role of active TB drug-safety monitoring and management to minimize treatment-related harm should be expanded to people receiving any MDR-TB regimen *(22)*.

Since the first evidence-based guidelines on MDR-TB treatment were released in 2011, WHO has used GRADE (Grading of Recommendations Assessment, Development and Evaluation) to update its policies. Guideline development groups advise WHO on treatment policy updates, based on meta-analyses of individual patient data collected from observational studies, programmatic cohorts and randomized controlled trials. New evidence is either gathered from published studies or reported in response to WHO's public call for data.

The implementation of the latest WHO evidence-based guidance is expected to improve global outcomes for patients with drug-resistant TB. More studies, trials and operational research are needed to fill knowledge gaps on how to make future regimens shorter, safer and more feasible to implement.

FIG. 4.30

Countries that used shorter MDR-TB treatment regimens by the end of 2018

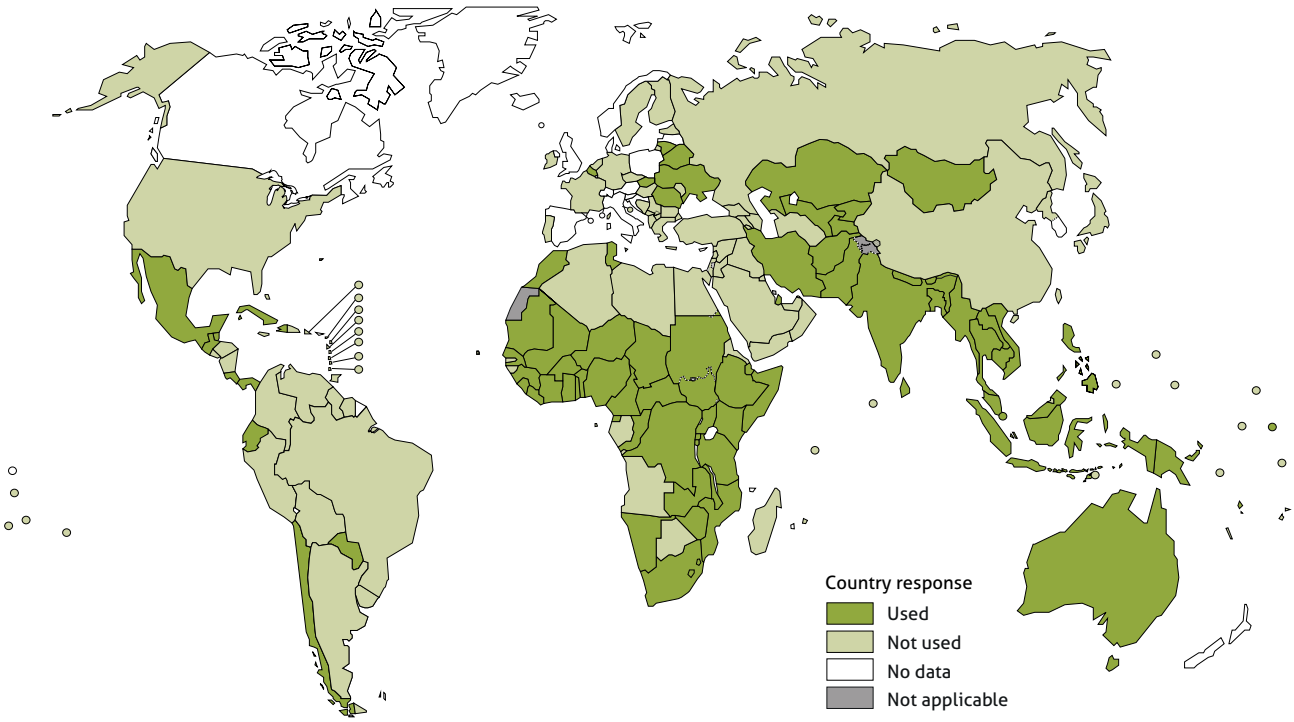


FIG. 4.31

Countries that used bedaquiline for the treatment of MDR/XDR-TB as part of expanded access, compassionate use or under normal programmatic conditions by the end of 2018

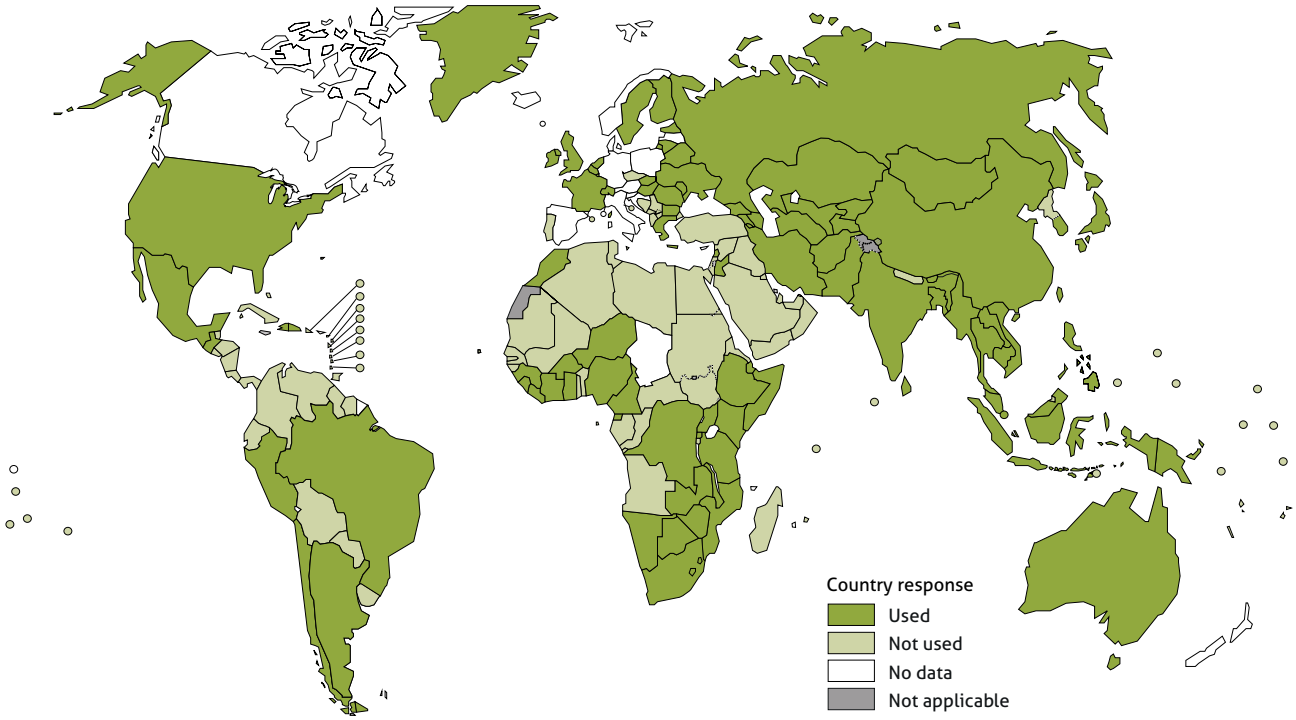
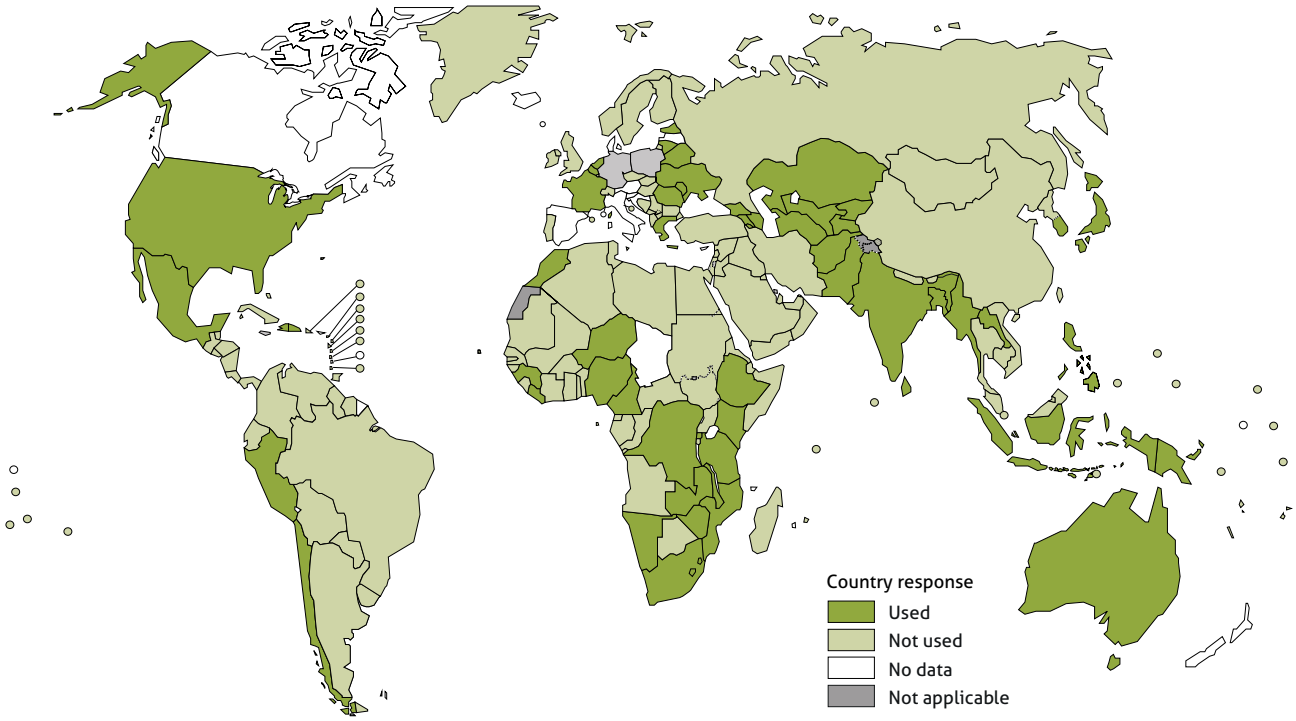


FIG. 4.32

Countries that used delamanid for the treatment of MDR/XDR-TB as part of expanded access, compassionate use or under normal programmatic conditions by the end of 2018



References

1 United Nations General Assembly. Resolution 73/3: Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis. United Nations; 2018 (https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/3, accessed 23 August 2019).

2 WHO and Global Fund sign cooperation agreement. Strategic Initiative to reach missed TB cases a critical component of grant [website]. Geneva: World Health Organization; 2019 (https://www.who.int/tb/features_archive/WHO_Global_Fund_agreement/en/, accessed 12 August 2019).

3 Joint Initiative "FIND. TREAT. ALL. #ENDTB" [website]. Geneva: World Health Organization; 2019 (https://www.who.int/tb/joint-initiative/en/, accessed 12 August 2019).

4 Public–private mix (PPM) for TB prevention and care [website]. Geneva: World Health Organization; 2019 (https://www.who.int/tb/areas-of-work/public-private-mix/en/, accessed 12 August 2019).

5 Engaging private health care providers in TB care and prevention: a landscape analysis (WHO/CDS/TB/2018.33). Geneva: World Health Organization; 2018 (https://www.who.int/tb/publications/2018/PPMlandscape/en/, accessed 12 August 2019).

6 Framework of indicators and targets for laboratory strengthening under the End TB Strategy (WHO/HTM/TB/2016.18). Geneva: World Health Organization; 2016 (https://www.who.int/tb/publications/labindicators/en/, accessed 15 August 2019).

7 ISO15189:2012 Medical laboratories – requirements for quality and competence. Geneva: International Standardisation Organisation; 2012 (https://www.iso.org/standard/56115.html, accessed 5 September 2019).

8 WHO treatment guidelines for drug-resistant tuberculosis (2016 update) (WHO/HTM/TB/2016.04). Geneva: World Health Organization; 2016 (https://apps.who.int/iris/bitstream/handle/10665/250125/9789241549639-eng.pdf?sequence=1, accessed 23 August 2019).

9 WHA62.15. Prevention and control of multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis. Sixty-second World Health Assembly. Resolutions and decisions (annexes). Geneva: World Health Organization; 2009 (https://apps.who.int/gb/ebwha/pdf_files/WHA62-REC1/WHA62_REC1-en.pdf, accessed 23 August 2019).

10 Electronic recording and reporting for tuberculosis care and control. Geneva: World Health Organization; 2012 (https://www.who.int/tb/publications/electronic_recording_reporting/en/, accessed 12 August 2019).

11 Data for health and sustainable development [website]. Health Data Collaborative; 2019 (https://www.healthdatacollaborative.org, accessed 12 August 2019).

12 Analysis and use of health facility data [website]. Geneva: World Health Organization; 2019 (https://www.who.int/healthinfo/tools_data_analysis_routine_facility/en/, accessed 12 August 2019).

13 Understanding and using tuberculosis data. Geneva: World Health Organization Global Task Force on TB Impact Measurement; 2014 (https://www.who.int/tb/publications/understanding_and_using_tb_data/en/, accessed 12 August 2019).

14 Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: World Health Organization; 2014 (https://www.who.int/tb/publications/standardsandbenchmarks/en/, accessed 8 August 2019).

15 Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014) (WHO/HTM/TB/2013.2). Geneva: World Health Organization; 2013 (https://apps.who.int/iris/bitstream/handle/10665/79199/9789241505345_eng.pdf;jsessionid=FD522CF3B90C25716F96288BFDEA6C75?sequence=1, accessed 23 August 2019).

16 Assessing tuberculosis under-reporting through inventory studies. Geneva: World Health Organization; 2012 (https://www.who.int/tb/publications/inventory_studies/en/, accessed 23 August 2019).

17 Onozaki I, Law I. National TB prevalence surveys: 2009–2015. Geneva: TB Monitoring & Evaluation Global TB Programme, World Health Organization; (https://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_p06_prevalence_surveys_2009_2015.pdf, accessed 12 August 2019).

18 Systematic screening for active tuberculosis: principles and recommendations (WHO/HTM/TB.2013.04). Geneva: World Health Organization; 2013 (https://www.who.int/tb/tbscreening/en/, accessed 15 August 2018).

19 WHO guideline on health policy and system support to optimize community health worker programmes. Geneva: World Health Organization; 2018 (https://www.who.int/hrh/resources/health-policy-system-support-hw-programmes/en/, accessed 7 August 2019).

20 ENGAGE-TB approach: operational guidance: integrating community-based tuberculosis activities into the work of nongovernmental and other civil society organizations (WHO/HTM/TB/2012.8). Geneva: World Health Organization; 2012 (https://www.who.int/tb/publications/2012/engage_tb_policy/en/, accessed 13 August 2019).

21 WHO consolidated guidelines on drug-resistant tuberculosis treatment. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/consolidated-guidelines-drug-resistant-TB-treatment/en/, accessed 7 August 2019).

22 Active tuberculosis drug-safety monitoring and management (aDSM): framework for implementation (WHO/HTM/TB/2015.28). Geneva: World Health Organization; 2015 (https://www.who.int/tb/areas-of-work/drug-resistant-tb/treatment/pharmacovigilance/en/, accessed 30 July 2019).

23 WHO global database for TB active drug safety monitoring home page [website]. Geneva: World Health Organization; 2019 (https://www.who.int/tdr/research/tb_hiv/adsm/en/, accessed 14 August 2019).

24 Akkerman O, Aleksa A, Alffenaar JW, Al-Marzouqi NH, Arias-Guillen M, Belilovski E et al. Surveillance of adverse events in the treatment of drug-resistant tuberculosis: a global feasibility study. Int J Infect Dis. 2019;83:72–6 (https://www.ncbi.nlm.nih.gov/pubmed/30953827, accessed 14 August 2019).

A participant in a TB elimination programme in Honduras reads information about how to protect himself from TB infection.

John Rae Photography

Chapter 5

TB prevention services

Key facts and messages

Prevention of new infections of *Mycobacterium tuberculosis* and their progression to tuberculosis (TB) disease is critical to reduce the burden of ill health and death caused by TB, and to achieve the End TB Strategy targets set for 2030 and 2035.

Current health care interventions for TB prevention are treatment of people with latent TB infection, prevention of transmission of *M. tuberculosis* through infection prevention and control, and vaccination of children with the bacille Calmette-Guérin (BCG) vaccine.

At the first United Nations (UN) high-level meeting on TB on 26 September 2018, Member States committed to providing TB preventive treatment to at least 30 million people in the 5-year period 2018–2022: 6 million people living with HIV (PLHIV), 4 million children aged under 5 years who are household contacts of people affected by TB, and 20 million other household contacts. They also committed to greater investment in research to accelerate the development of new treatments and vaccines.

The World Health Organization (WHO) recommends TB preventive treatment for PLHIV, household contacts of bacteriologically confirmed pulmonary TB cases and clinical risk groups (e.g. those receiving dialysis) in all countries.

Globally in 2018, 65 countries reported initiating TB preventive treatment for 1.8 million PLHIV, up from just under 1 million in 2017, and substantially higher than the 30 000 people in 2005 (the first year for which WHO compiled data). The 2018 number suggests that the target of 6 million in the period 2018–2022 can be achieved.

South Africa accounted for 61% of the total number of PLHIV enrolled in TB preventive treatment in 2018. Of the 38 high TB or TB/HIV burden countries, 16 reported providing treatment to people newly enrolled in HIV care in 2018. Coverage of TB preventive treatment ranged from 10% of PLHIV newly enrolled in care in Indonesia to 97% in the Russian Federation. Overall, in 66 countries for which it could be calculated, coverage was 49%.

Globally in 2018, an estimated 1.3 million children aged under 5 years were household contacts of bacteriologically confirmed pulmonary TB cases. Data reported by 109 countries show a total of 349 487 children aged under 5 years initiated on TB preventive treatment in 2018 (equivalent to coverage of 27%). This was an increase of 20% from 292 182 in 2017, and a more than fourfold increase from 87 242 in 2015 (the first year for which WHO compiled data).

Globally in 2018, 69 countries reported that 79 195 household contacts aged 5 years or older were initiated on TB preventive treatment in 2018, a decrease of 30% from the reported number of 103 344 in 2017.

The number of contacts placed on TB preventive treatment in 2018 fell far short of the numbers required to meet the targets set at the UN high-level meeting on TB in 2018.

The ratio of the TB notification rate among health care workers to the TB notification rate in the general adult population is a good indicator of the impact of TB infection prevention and control in health facilities and should be around one. In 2018, a total of 22 819 health care workers from 74 countries were reported with TB; India accounted for 56% of these cases and China for 16%. In eight countries (Algeria, Burkina Faso, Colombia, Dominican Republic, Honduras, India, Lesotho and the United Republic of Tanzania), the number of TB cases per 100 000 health care workers was more than double the notification rate in the general adult population.

BCG vaccination is recommended as part of national childhood immunization programmes according to a country's TB epidemiology. In 2018, 153 countries reported providing BCG vaccination as a standard part of these programmes; 113 of these countries reported coverage of at least 90%. Only 13 countries reported coverage of 70% or less.

Prevention of new infections of *Mycobacterium tuberculosis* and their progression to tuberculosis (TB) disease is critical to reduce the burden of ill health and death caused by TB, and to achieve the End TB Strategy targets set for 2030 and 2035 *(1)*. The targets of an 80% reduction in TB incidence from the 2015 level by 2030, and of a 90% reduction by 2035, require a historically unprecedented acceleration in the rate at which TB incidence falls after 2025 (**Chapter 2**). Achieving this accelerated rate (which averages 17% per year between 2025 and 2035) will require substantial reductions in the probability of progression from latent TB infection (LTBI) to active TB disease among the approximately 1.7 billion people already infected worldwide *(2)*.[1] Health care interventions that could help to cut the risk of progression from LTBI to active TB disease include new diagnostic tests that are better at predicting who is at risk of progression to active TB disease; more effective drug treatments for people with LTBI; and development of a vaccine to prevent reactivation of LTBI in adults. Action on the broader determinants of TB could also cut the risk, as discussed in **Chapter 7**.

Currently, three major categories of health care interventions are available for TB prevention:

- TB preventive treatment;
- prevention of transmission of *M. tuberculosis* through infection prevention and control; and
- vaccination of children with the bacille Calmette-Guérin (BCG) vaccine.

At the first United Nations (UN) high-level meeting on TB, held on 26 September 2018, Member States made a range of commitments to accelerate progress towards ending the TB epidemic. This included setting a new global target of providing TB preventive treatment to at least 30 million people in the 5-year period 2018–2022: 6 million people living with HIV (PLHIV), 4 million children aged under 5 years who are household contacts of people affected by TB, and 20 million other household contacts of TB cases. Member States also committed to greater investment in research to accelerate the development of new treatments and vaccines. The recent availability of shorter treatments for people with LTBI, combined with the new global target, provides an opportunity to galvanize national and global efforts to scale up TB preventive treatment.

This chapter presents and discusses the latest data about progress in TB preventive treatment (**Section 5.1**) as well as infection prevention and control (**Section 5.2**) and provision of BCG vaccination (**Section 5.3**). Particular attention is given to the 30 high TB burden countries and the 30 high TB/HIV burden countries (**Chapter 2**).

[1] In an article published in 2000, the lifetime risk was estimated at 5–10%. See Vynnycky and Fine (2000) *(3)*.

5.1 TB preventive treatment

LTBI is defined as a state of persistent immune response to *M. tuberculosis* without clinically manifested evidence of active TB disease.

World Health Organization (WHO) guidelines for the programmatic management of LTBI, published in 2018, recommended systematic testing and preventive treatment for three high-risk population groups: PLHIV, household contacts of bacteriologically confirmed pulmonary TB cases and clinical risk groups *(4)*.

Recommended options for treatment included a weekly dose of rifapentine and isoniazid for 3 months (3HP), a daily dose of rifampicin plus isoniazid for 3 months (3RH), a daily dose of rifampicin for 4 months (4R), and a daily dose of isoniazid for 6 months (6H) or longer.

In July 2019, WHO convened an expert group to update the 2018 guidelines in the context of new evidence on the use of two other TB preventive treatment regimens: 4R in high TB burden settings, and 1 month of daily isoniazid and rifapentine (1HP). Updated recommendations will be published in the first quarter of 2020. WHO is also developing operational guidance to support rapid uptake of the recommendations at country level.

This section presents the latest data (for 2018) reported to WHO on provision of TB preventive treatment, and data available for previous years. For household contacts, data for those aged under 5 years and those aged 5 years and older are reported separately, because data are available for different time periods, and targets were set separately for these groups in the political declaration at the UN high-level meeting on TB in September 2018.

Collection of data routinely at country level remains challenging; in turn, this affects the quantity and quality of data reported to WHO. To facilitate faster and more systematic and complete data collection, WHO has developed a mobile phone application (app) that can be adapted at country level to record and report case-based data on TB preventive treatment *(5)*. Four countries are in the process of piloting the app and adapting it to their local context, and an updated version featuring the ability to capture data from multiple sources will be ready by mid-2020.

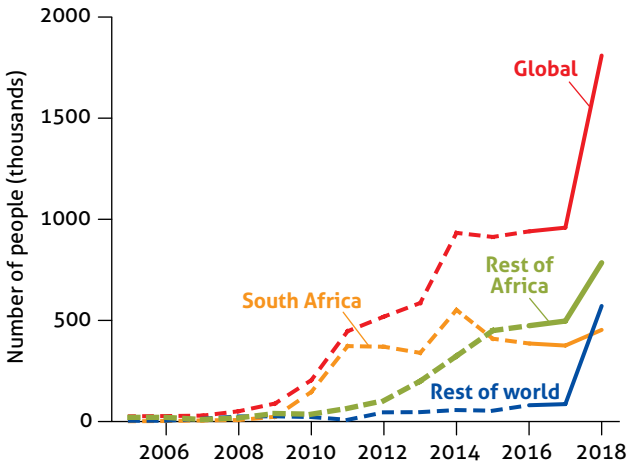
5.1.1 People living with HIV

Data on provision of TB preventive treatment to PLHIV enrolled in HIV care, which are collected by the Joint United Nations Programme on HIV/AIDS (UNAIDS), then jointly reviewed and validated with WHO, cover the period 2005–2018. For the period 2005–2016, countries were requested to report data for PLHIV newly enrolled in HIV care. Subsequently, countries have been encouraged to report TB preventive treatment for all PLHIV enrolled in HIV care, and a growing number of countries are doing so.

Globally, substantial progress has been made. Based on reporting by 65 countries, the number of PLHIV provided with TB preventive treatment by national HIV programmes and other providers reached 1.8 million in

FIG. 5.1

Provision of TB preventive treatment to people enrolled in HIV care,[a] 2005–2018



[a] Prior to 2017, data were collected for PLHIV newly enrolled in HIV care (dotted lines). In 2017 and 2018, data were also collected for PLHIV currently enrolled in HIV care (solid lines).

2018 (including 747 579 people in 55 countries who were newly enrolled in HIV care), up from just under 1 million in 2017 and a massive increase from under 30 000 in 2005 (Fig. 5.1). The 2018 number suggests that it is possible to achieve the target of 6 million during the years 2018–2022 that was set in the political declaration at the UN high-level meeting on TB in September 2018 *(6)*. Seven countries reported not providing TB preventive treatment at all to PLHIV in 2018.

Only 16 of the 38 high TB and TB/HIV burden countries reported provision of TB preventive treatment to PLHIV newly enrolled in HIV care in 2018, down from 22 countries in 2017. Coverage among people newly enrolled in HIV care could be calculated for 15 of those 16 countries;[1] it ranged from 10% in Indonesia to 97% in the Russian Federation[2] (Table 5.1). In the 66 countries for which data were available, coverage was 49%, up from 36% in 2017.

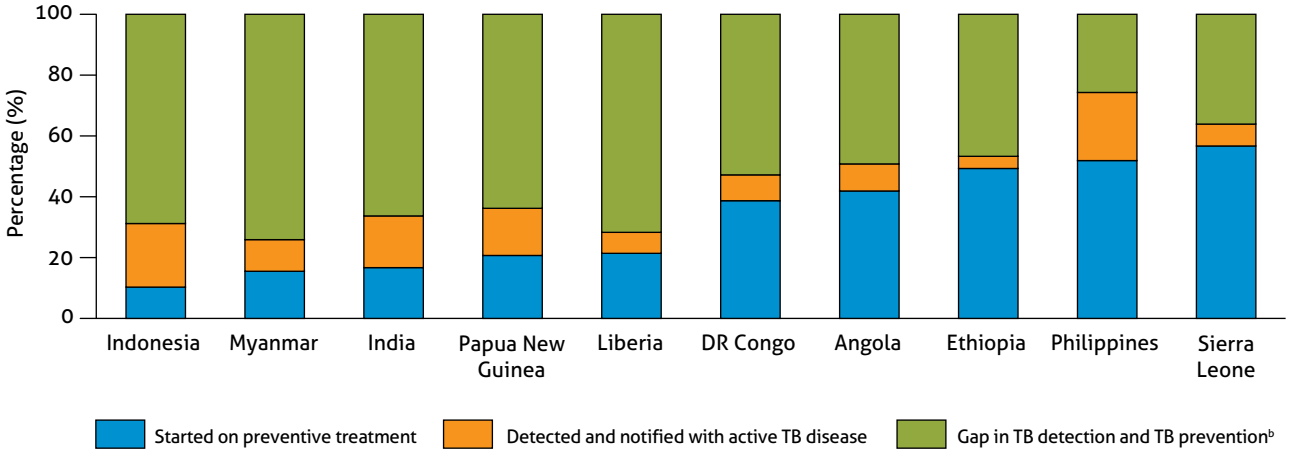
As in previous years, in 2018 South Africa accounted for the largest share (61%) of the global total of people newly enrolled in HIV care who were provided with TB preventive treatment – an even higher share than in 2017 (39%). Large absolute increases in numbers in 2018 compared with 2017 were reported for South Africa (+77 499), Nigeria (+19 389), India (+11 052) and Lesotho (+10 366; no data reported in 2017). The data for India and the Democratic Republic of the Congo also demonstrated their commitment to ensuring that all PLHIV currently in HIV care are provided with TB preventive treatment. In addition to people newly enrolled in HIV care, India reported providing treatment to 466 084 people who were already in HIV care in 2018, and the Democratic Republic of the Congo reported providing treatment to 69 827 such people in 2018. For the Democratic Republic of the Congo and Lesotho, data were reported for the first time in at least 4 years.

Despite this evidence of progress, substantial challenges with implementation and reporting remain. Gaps in the provision of TB preventive treatment to PLHIV are illustrated for selected high TB burden countries or high TB/HIV burden countries in Fig. 5.2.

Provisional data collected by the United States Presi-

FIG. 5.2

Gaps in TB prevention and TB detection for people who were newly enrolled in HIV care in 2018, selected countries[a]



[a] The selected countries are high TB or TB/HIV burden countries that reported on all three of the following: the number of people newly enrolled in HIV care; the number of TB cases detected among people newly enrolled in HIV care; and the number of people newly enrolled in HIV care who were started on TB preventive treatment. Testing for LTBI is not a requirement for initiation of TB preventive treatment, such that all those without active TB disease are eligible for TB preventive treatment.

[b] The gap represents people living with HIV who should have undergone complete evaluation for TB disease or TB preventive treatment.

[1] The exception was Zimbabwe.

[2] Based on subnational data for the Russian Federation.

dent's Emergency Plan for AIDS Relief (PEPFAR) in the 6-month period from October 2018 to March 2019 suggest that widespread efforts to accelerate access to TB preventive treatment in the past year are having an impact. In this period, 1.3 million PLHIV started TB preventive treatment in 23 countries.[1] In 13 of these 23 countries, many more enrolments were reported in this 6-month time frame than in the previous 12 months (October 2017–September 2018), with an overall increase of about 60%. In five other countries, the number for 6 months was more than 50% of that reported for the previous 12 months. Countries that reported data to PEPFAR but did not report data for 2018 via the Global AIDS Monitoring *(7)* system of UNAIDS (and for which data are thus not included in **Fig. 5.1** or **Table 5.1**) included Eswatini, Kenya, Namibia and Zambia.

There is an urgent need to align recording and reporting systems to capture the data needed to monitor progress towards the target of 6 million for the period 2018–2022, set in the political declaration at the UN high-level meeting on TB *(6)*. Compilation of data on completion rates for TB preventive treatment would also help to inform assessment of its effectiveness.

5.1.2 Children aged under 5 years who are household contacts of TB cases

Data collected by WHO on provision of TB preventive treatment to children aged under 5 years who are household contacts of TB cases cover the period 2015–2018.

A total of 166 countries reported at least one notified case of bacteriologically confirmed pulmonary TB in 2018; of these, 114 (68%) reported data about the number of household contacts aged under 5 years who were started on TB preventive treatment. In turn, 109 of these 114 countries reported that at least one child aged under 5 years was started on TB preventive treatment in 2018 (down from 124 countries in 2017). This included 28 of the 38 high TB or high TB/HIV burden countries (**Table 5.1**), of which three reported data to WHO for the first time (Lesotho, Pakistan and Papua New Guinea).

A total of 349 487 children aged under 5 years were reported to have been initiated on TB preventive treatment in 2018. This was an increase of 20% from 292 182 in 2017, and a more than fourfold increase from 87 242 in 2015. However, it fell short of what is needed to achieve the target of 4 million during the years 2018–2022 that was set in the political declaration at the UN high-level meeting on TB in September 2018.

The largest numbers were reported by the WHO African Region (40% of the global total; 31 countries reported data) and the WHO South-East Asia Region (37% of the global total; 11 countries reported data). In the 28 high TB and TB/HIV burden countries that reported data, 266 040 children started TB preventive treatment (76% of the global total). At country level, India reported the highest number (83 109), followed by Mozambique (27 751), South Africa (25 357), Bangladesh (23 748) and the Democratic Republic of the Congo (21 896) (**Table 5.1**).

Globally, the 349 487 children aged under 5 years who were started on TB preventive treatment in 2018 represented 27% of the approximately 1.3 million children estimated to be eligible for treatment. Higher levels of coverage were estimated for 15 countries in the WHO European Region (of which 10 reached coverage of ≥75%), followed by 24 countries in the WHO Region of the Americas (of which 13 reached coverage of ≥75%) and 19 countries in the WHO Eastern Mediterranean Region (of which 10 reached coverage of ≥75%) (**Fig 5.3**).

In several countries, data reporting remains unreliable, and interruptions in data availability make it difficult to draw conclusions about trends. Moreover, overestimations of coverage (including numerators that exceed denominators) occur when the number of children aged under 5 years who are eligible for treatment based on WHO guidelines *(8)* is underestimated, or when the numerator includes children who are not household contacts or are contacts who are aged 5 years and older.

5.1.3 Household contacts aged 5 years and older

The political declaration at the UN high-level meeting on TB in September 2018 included a target to treat 20 million household contacts aged 5 years and older in the period 2018–2022.

Data about TB preventive treatment for contacts aged 5 years and older were collected by WHO in 2018 and 2019 (for the years 2017 and 2018, respectively). Of the 166 countries that reported at least one notified bacteriologically confirmed pulmonary TB case in 2018, 116 (69%) reported data about all household contacts who were started on TB preventive treatment. In 47 countries, the total number of contacts reported was identical to the number of contacts aged under 5 years, implying that systems focused primarily on treatment or data collection for this age group. Of the 116 countries, 69 reported that at least one contact aged 5 years or older was started on preventive treatment. Of these countries, six (belonging to the high TB burden, high multidrug-resistant TB [MDR-TB] burden or high TB/HIV burden groups) reported over 1000 contacts started on preventive treatment: Azerbaijan, Democratic People's Republic of Korea, Peru, Republic of Moldova, Ukraine and Uzbekistan.

A total of 79 195 household contacts aged 5 years or older were reported to have been initiated on TB preventive treatment in 2018, down 30% from 103 344 in 2017, and far short of the number needed to achieve the target set in the political declaration at the UN high-level meeting on TB (an average of 4 million per year in the period 2018–2022). In 2018, the largest numbers were reported by the WHO European Region (43 668, 55% of the global total) and the WHO Region of the Americas (14 452, 18% of the global total). At country level, Ukraine reported the larg-

[1] Angola, Burundi, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Eswatini, Ethiopia, Haiti, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, Rwanda, South Africa, South Sudan, Uganda, Ukraine, United Republic of Tanzania, Viet Nam, Zambia and Zimbabwe.

TABLE 5.1

TB preventive treatment for people living with HIV and children under 5 years of age who were household contacts of a bacteriologically confirmed pulmonary TB case, high TB or TB/HIV burden countries, 2018

	PEOPLE LIVING WITH HIV NEWLY ENROLLED IN CARE			PEOPLE LIVING WITH HIV CURRENTLY ENROLLED IN CARE	ESTIMATED NUMBER OF CHILD CONTACTS UNDER 5 YEARS OF AGE ELIGIBLE FOR TB PREVENTIVE TREATMENT[A]		CHILDREN UNDER 5 YEARS OF AGE STARTED ON TB PREVENTIVE TREATMENT		
								COVERAGE[B] (%)	
	NUMBER	NUMBER OF PEOPLE STARTED ON TB PREVENTIVE TREATMENT	COVERAGE (%)	NUMBER OF PEOPLE STARTED ON TB PREVENTIVE TREATMENT	BEST ESTIMATE	UNCERTAINTY INTERVAL	NUMBER	BEST ESTIMATE	UNCERTAINTY INTERVAL
Angola	22 830	9 567	42	9 567	25 800	23 500–28 100			
Bangladesh					55 200	50 200–60 100	23 748	43	40–47
Botswana					294	268–321			
Brazil					3 000	1 940–4 060			
Cambodia					4 370	3 980–4 760			
Cameroon					10 100	9 180–11 000	2 444	24	22–27
Central African Republic					182	166–199	459[C]		
Chad					5 080	4 630–5 530			
China					13 900	8 960–18 700			
Congo					2 370	2 160–2 580			
DPR Korea					8 550	7 790–9 320	10 522	>100	
DR Congo	70 172	27 157	39	97 029	92 300	84 100–101 000	21 896	24	22–26
Eswatini					991	903–1 080	122	12	11–14
Ethiopia	29 237	14 406	49		29 500	26 900–32 100	6 433	22	20–24
Ghana					3 580	3 260–3 900			
Guinea-Bissau					1 860	1 700–2 030	233	12	11–14
India	175 361	29 214	17	495 298	322 000	293 000–350 000	83 109	26	24–28
Indonesia	50 544	5 195	10	13 766	79 400	72 300–86 400	8 075	10	9.3–11
Kenya					20 600	18 800–22 500	7 007	34	31–37
Lesotho	31 413	10 366	33		1 510	1 370–1 640	767	51	47–56
Liberia	6 730	1 442	21	1 766	2 050	1 870–2 230	42	2.0	1.9–2.3
Malawi				40 050	4 000	3 650–4 360	2 641	66	61–72
Mozambique				164 813	21 700	19 800–23 600	27 751	>100	
Myanmar	37 277	5 776	15		17 500	15 900–19 000	534	3.1	2.8–3.4
Namibia					2 690	2 450–2 930	1 179	44	40–48
Nigeria	180 490	111 262	62		56 000	51 000–61 000	10 522	19	17–21
Pakistan					108 000	98 000–117 000	6 146	5.7	5.2–6.3
Papua New Guinea	4 151	859	21		2 850	2 600–3 110	768	27	25–30
Philippines	8 097	4 202	52		57 400	52 200–62 500	5 409	9.4	8.7–10
Russian Federation[D]	16 100	15 598	97		1 600	1 030–2 160	7 489	>100	
Sierra Leone	9 290	5 265	57	13 396	7 950	7 240–8 660			
South Africa	697 551	453 149	65	453 149	43 100	39 300–47 000	25 357	59	54–65
Thailand					7 430	6 770–8 100	479	6.4	5.9–7.1
Uganda					20 700	18 800–22 500	3 098	15	14–16
UR Tanzania	256 280			291 813	20 100	18 300–21 900	4 426	22	20–24
Viet Nam	15 011	5 796	39		15 200	13 900–16 600	3 416	22	21–25
Zambia					12 900	11 700–14 000			
Zimbabwe		22 138			6 630	6 040–7 220	1 968	30	27–33

Blank cells indicate data not reported.

[a] Estimates are shown to three significant figures.

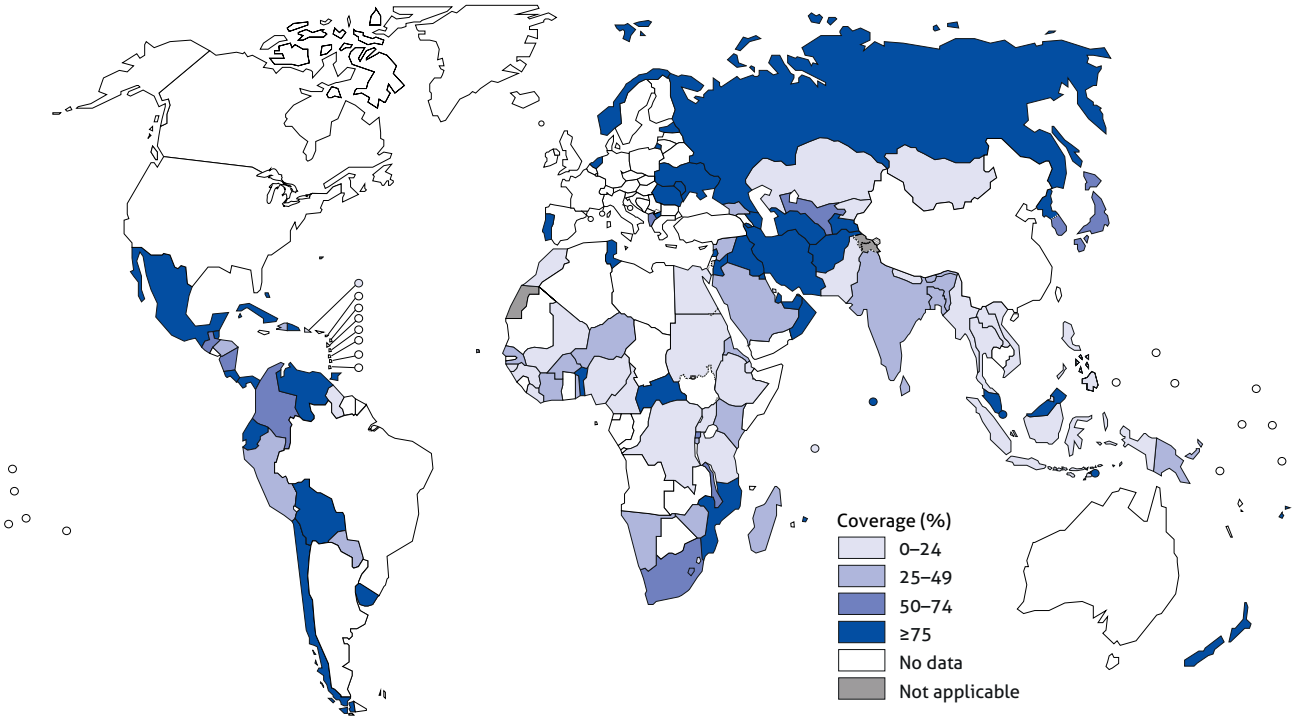
[b] Reasons for a higher than expected coverage might be that the numerator reported did not fully meet WHO's definition, e.g. it included non-household contacts, household contacts of clinically diagnosed TB cases or children five years or older. Uncertainty intervals could not be calculated for DPR Korea, Mozambique or the Russian Federation.

[c] Data reported are from a survey of a random sample of medical records or treatment cards of TB patients.

[d] For Russian Federation, data reported for the numerator and the denominator for the indicator "people living with HIV newly enrolled in care started on TB preventive treatment" are based on subnational data.

FIG. 5.3

Coverage of TB preventive treatment among eligible children aged under 5 years,[a] 2018



[a] Children aged <5 years who were household contacts of bacteriologically confirmed pulmonary TB cases.

est number (16 278), followed by Uzbekistan (8488) and Guinea (5251).[1]

5.1.4 Uptake of shorter rifamycin-containing regimens

Use of shorter rifamycin-containing regimens can facilitate the uptake and completion of TB preventive treatment. In 2018, 21 countries reported data on patients treated with shorter rifamycin-containing regimens. By the end of June 2019, rifapentine had been used as part of shorter treatment regimens in at least 18 low-, middle- and high-income countries distributed in all WHO regions (**Box 5.1**). The extent of use in these countries varied. Rifapentine has been used in trials in a further 10 countries. This medicine has been registered for TB preventive treatment by regulatory authorities in eight countries, and new registrations in several African and Asian countries are expected in 2020. Several countries in which rifapentine is not yet registered have accessed it using local waiver mechanisms.

5.2 TB infection prevention and control

Strengthening TB infection prevention and control is part of Pillar 2 of the End TB Strategy; it is also one of the collaborative TB/HIV activities that fall under Pillar 1 (**Chapter 2**). Transmission of *M. tuberculosis* can occur in a variety of congregate and other settings, including health care facilities and households. Health care workers may be at increased risk of TB infection, and nosocomial transmission of MDR-TB and extensively drug-resistant TB (XDR-TB) in hospitalized patients has been documented *(9–11)*.

The risk of TB among health care workers relative to the risk in the general adult population is one of the indicators recommended by WHO for measuring the impact of interventions for TB infection prevention and control in health care facilities. If effective prevention and control measures are in place, the relative risk of TB in health care workers compared with the general adult population should be close to one.

In 2018, 22 819 TB cases among health care workers were reported from 74 countries; India accounted for 56% of these cases, and China accounted for 16%. The notification rate among health care workers could be calculated for 55 of the 74 countries; it ranged from zero to 1138 cases per 100 000 health care workers, with the highest rate observed in India.

The notification rate among the general adult population in each country was calculated based on the number of notified TB cases in adults and the latest estimated size of the adult population from the UN population division *(12)*, restricted to those aged 15–64 years for comparability with the health workforce. The ratios of the TB notification rate among health care workers to the rate in

[1] **Annex 1** explains how to access data reported by other countries.

Uptake of rifapentine-containing TB preventive treatment

Rifamycins make it possible to shorten TB preventive treatment, increasing the likelihood that treatment will be completed. One such treatment regimen, requiring a weekly dose of rifapentine and isoniazid for 3 months (3HP), has been recommended for use by WHO since 2015, and a growing number of countries are using it (Fig. B5.1.1). Several initiatives have been launched to increase the uptake of this regimen in eligible patients, including two projects in two high TB burden countries (Pakistan and Bangladesh), for which findings are summarized here.

Pakistan

The Indus Health Network has implemented 3HP among household contacts of drug-susceptible TB patients aged over 2 years in two large cities in Pakistan. This has been done in collaboration with Interactive Research & Development (IRD) and provincial TB programmes, with financial support from the Global Fund to Fight AIDS, Tuberculosis and Malaria. Between October 2016 and June 2019, 36 310 household contacts of 9751 patients with pulmonary TB in Karachi and Peshawar were approached. Of these, 81% were verbally screened for TB symptoms, and invited for chest radiography and other investigations. In total, 11 558 (43%) contacts were investigated, of whom 212 (2%) were diagnosed with active TB and initiated on treatment. The remaining contacts who had normal chest radiography, negative sputum tests and unremarkable clinical evaluations were considered eligible for TB preventive treatment. Of these 11 346 contacts, 6816 (60%) agreed to start 3HP. The latest data show a completion rate of 70%.

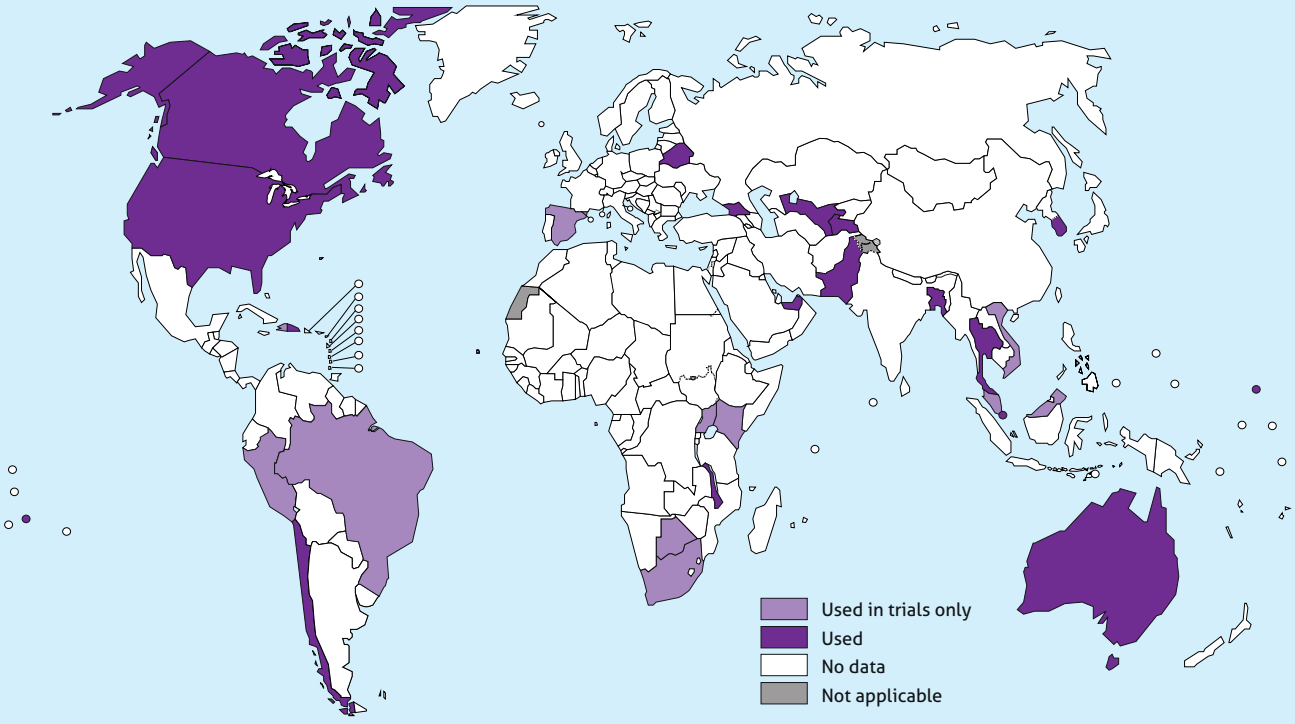
Bangladesh

The national TB programme in Bangladesh implemented a study from February 2018 to May 2019, to assess the feasibility of implementing community-based treatment with 3HP among household contacts of 883 drug-susceptible TB patients aged over 2 years, who were enrolled from 12 treatment centres in urban Dhaka. This was done in collaboration with the Challenge TB project, with funding from the United States Agency for International Development (USAID).

The contacts were first screened and evaluated to rule out active TB disease. Those contacts considered not to have active TB disease were invited to enrol on treatment with the 3HP regimen. Incentives to promote treatment adherence were provided to nongovernmental community health workers and to the participating families (travel and investigation costs were reimbursed for screening and evaluation, visits to initiate treatment and monthly follow-up). Among 1216 contacts who were enrolled, 97% completed treatment. Adverse events were observed in 5% of the study population; most of these events were of mild severity. The study suggests that community-based preventive treatment using 3HP is feasible and could be scaled up more widely.

FIG. B5.1.1

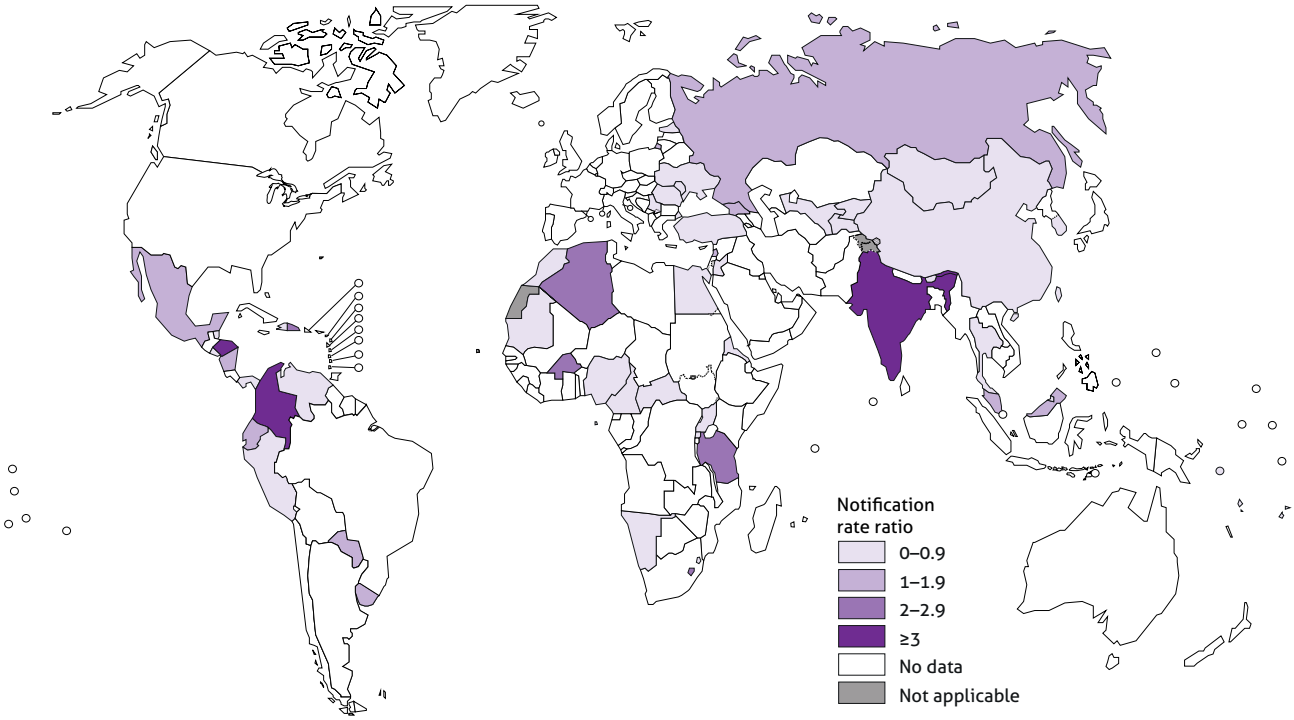
Use of rifapentine in regimens for TB preventive treatment by July 2019[a]



[a] Currently registered for use in China, Hong Kong SAR, India, Indonesia, Mongolia, Philippines, Singapore, South Africa, Thailand and the United States of America [Source: Sanofi, September 2019].

FIG. 5.4

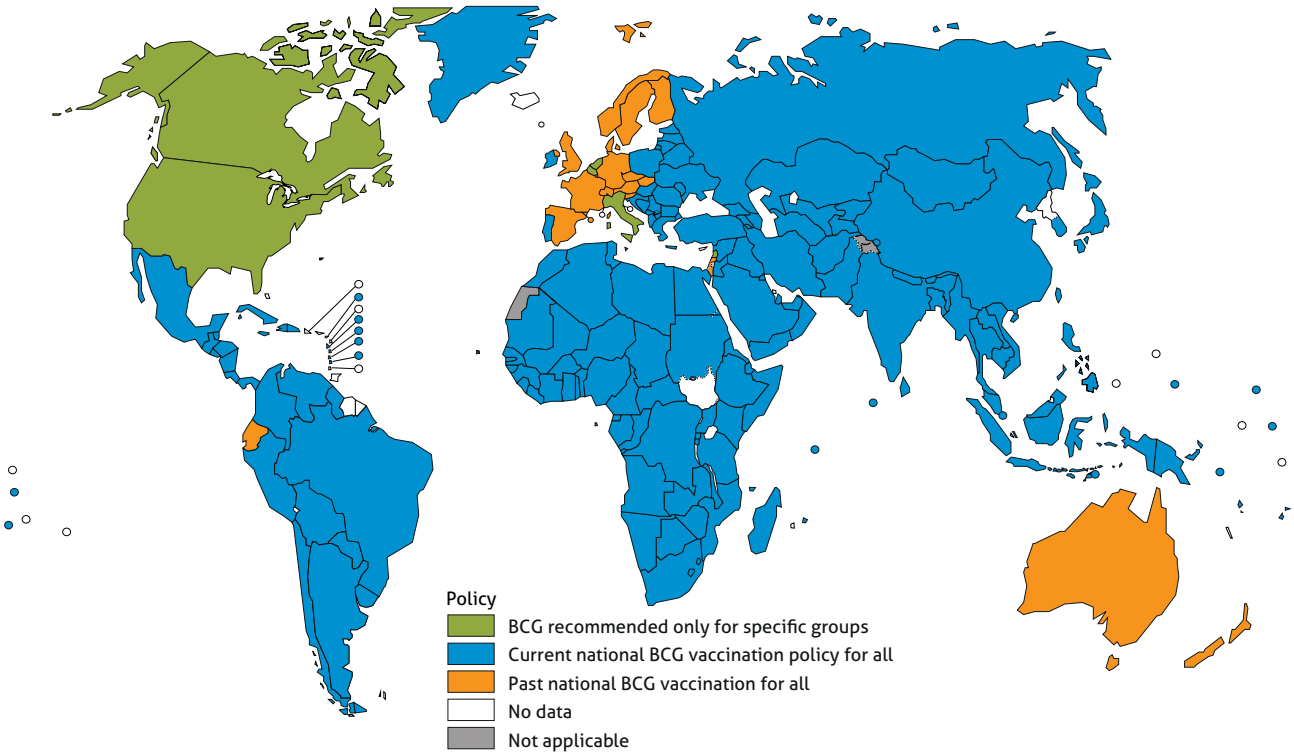
Notification rate ratio of TB among healthcare workers compared with the general adult population,[a] 2018



[a] Data from two countries were excluded where the number of healthcare workers reported was less than 1000.

FIG. 5.5

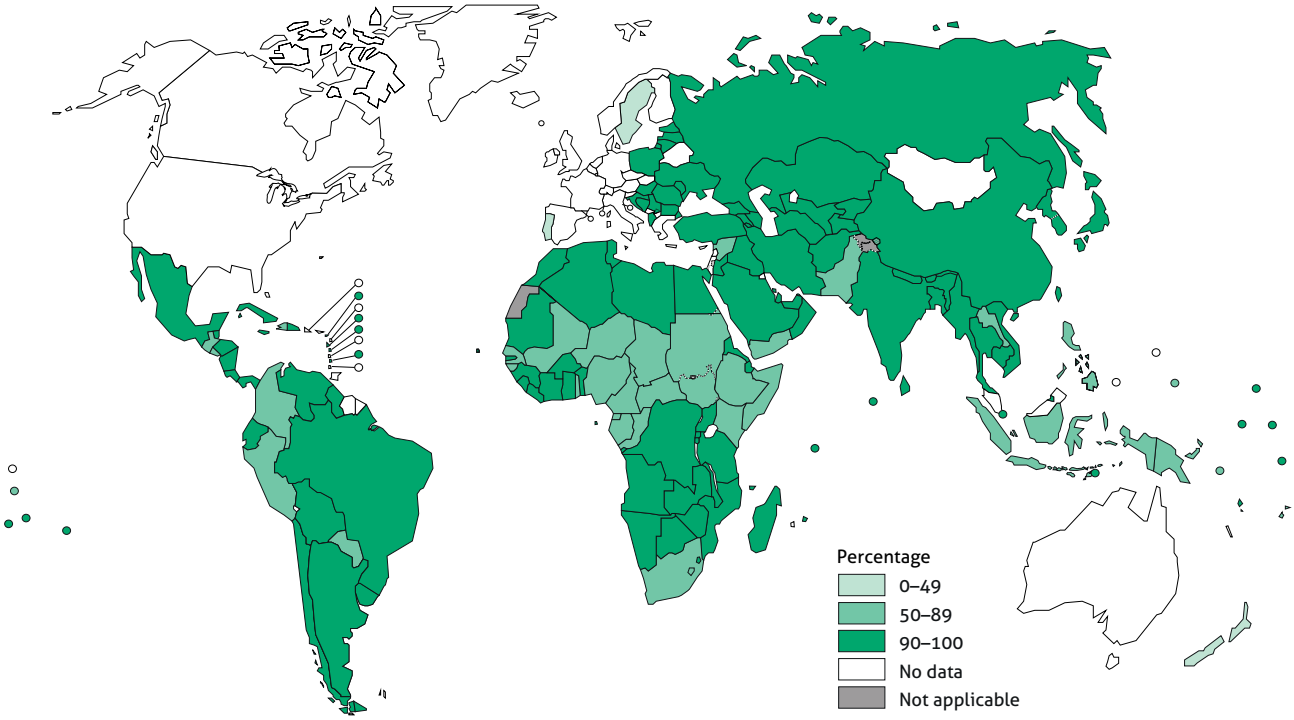
BCG vaccination policy by country



Source: The BCG World Atlas 2nd Edition, http://www.bcgatlas.org/, accessed 23 July 2019.

FIG. 5.6

Coverage of BCG vaccination, 2018[a]



[a] The target population of BCG coverage varies depending on national policy, but is typically for the number of live births in the year of reporting.
Source: http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tscoveragebcg.html, accessed 7 August 2019

the general adult population are shown in Fig. 5.4. The ratio was above two in Algeria, Burkina Faso, Dominican Republic, Lesotho and the United Republic of Tanzania; between three and six in Colombia and Honduras; above six in India; and below one in Central African Republic, China, Namibia, Nigeria and Thailand (all of which are high TB burden countries).

In 2019, WHO released new guidance on TB infection prevention and control based on the most recent evidence *(13)*. The recommended approaches include administrative, environmental and personal protection measures. To ensure that appropriate measures are in place, regular monitoring and audit, and timely feedback of health care practices *(14)*, including TB infection prevention and control services, are essential.

5.3 TB vaccination

After many years, a positive signal has emerged from the global vaccine pipeline, indicating that a promising new vaccine against TB might be on the horizon. In 2018, the experimental TB vaccine candidate M72/AS01$_E$, developed by GlaxoSmithKline and the International AIDS Vaccine Initiative, was found to be significantly protective against TB disease in individuals with evidence of LTBI in a Phase IIb trial conducted in Kenya, South Africa and Zambia. The best estimate of vaccine efficacy was 54% (90% confidence interval [CI], 14–75%) after approximately 2 years of follow-up *(15)*. In April 2019, WHO organized a high-level consultation to discuss strategies and actions needed to accelerate the development pathway of this vaccine candidate *(16)*. Further details are provided in Chapter 8.

Meanwhile, the BCG vaccine is the only approved vaccine against TB; it provides moderate protection against severe forms of TB (TB meningitis and miliary TB) in infants and young children. WHO recommends that, in countries with a high TB burden, a single dose of the BCG vaccine should be provided to all infants as soon as possible after birth, as part of childhood immunization programmes. In countries with low TB incidence rates, provision of the BCG vaccine may be limited to neonates and infants in recognized high-risk groups, or to older children who are skin-test negative for TB infection.

Fig. 5.5 summarizes national policies on BCG vaccination *(17)*. Among 180 countries for which data were collected, 154 recommended universal BCG vaccination, 20 reported having had a national BCG policy for everyone in the past, and the remaining six countries had policies of selective vaccination for at-risk individuals in high-risk groups.

The latest data on BCG coverage *(18)* (for 2018) are shown in Fig. 5.6. In the 153 countries for which data were available, 113 reported coverage of at least 90%, and only 13 countries reported coverage of 70% or less. Among the 30 high TB burden countries, coverage ranged from 52% in Papua New Guinea to 99% in Bangladesh,

China, Thailand and the United Republic of Tanzania. Compared with data reported in 2017, a total of 14 countries reported a decrease in coverage; in particular, Papua New Guinea (–32%) and the Philippines (–31%). Sustaining and improving on vaccination coverage requires sufficient production capacity, effective demand forecast and procurement strategies at national level, and effective engagement with all segments of society to promote more comprehensive vaccination.

References

1 WHO End TB Strategy: global strategy and targets for tuberculosis prevention, care and control after 2015. Geneva: World Health Organization; 2015 (https://www.who.int/tb/post2015_strategy/en/, accessed 23 August 2019).

2 Houben RM, Dodd PJ. The global burden of latent tuberculosis infection: a re-estimation using mathematical modelling. PLoS Med. 2016;13(10):e1002152 (https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002152, accessed 23 August 2019).

3 Vynnycky E, Fine PE. Lifetime risks, incubation period, and serial interval of tuberculosis. Am J Epidemiol. 2000;152(3):247–63 (https://academic.oup.com/aje/article/152/3/247/73190, accessed 23 August 2019).

4 Latent tuberculosis infection: updated and consolidated guidelines for programmatic management. Geneva: World Health Organization; 2018 (https://www.who.int/tb/publications/2018/latent-tuberculosis-infection/en/, accessed 23 August 2019).

5 LTBI care: a mobile app to support programmatic management of LTBI [website]. Geneva: World Health Organization (https://www.who.int/tb/areas-of-work/preventive-care/ltbi/ltbi_app/en/, accessed 23 August 2019).

6 United Nations General Assembly. Resolution 73/3: Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis. United Nations; 2018 (https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/3, accessed 23 August 2019).

7 Global AIDS monitoring 2019: indicators for monitoring the 2016 Political Declaration on Ending AIDS. Geneva: Joint United Nations Programme on HIV/AIDS (UNAIDS); 2018 (https://www.unaids.org/sites/default/files/media_asset/global-aids-monitoring_en.pdf, accessed 23 August 2019).

8 Methods to estimate number of child household contacts less than 5 years old eligible for latent tuberculosis treatment. Geneva: World Health Organization; 2018 (https://www.who.int/tb/publications/global_report/gtbr2018_online_technical_appendix_child_contacts.pdf, accessed 23 August 2019).

9 Moro ML, Gori A, Errante I, Infuso A, Franzetti F, Sodano L et al. An outbreak of multidrug-resistant tuberculosis involving HIV-infected patients of two hospitals in Milan, Italy. AIDS. 1998;12(9):1095–102 (https://journals.lww.com/aidsonline/Fulltext/1998/09000/An_outbreak_of_multidrug_resistant_tuberculosis.18.aspx, accessed 23 August 2019).

10 Gandhi NR, Weissman D, Moodley P, Ramathal M, Elson I, Kreiswirth BN et al. Nosocomial transmission of extensively drug-resistant tuberculosis in a rural hospital in South Africa. J Infec Dis. 2013;207(1):9–17 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3523793/, accessed 23 August 2019).

11 Moro ML, Errante I, Infuso A, Sodano L, Gori A, Orcese CA et al. Effectiveness of infection control measures in controlling a nosocomial outbreak of multidrug-resistant tuberculosis among HIV patients in Italy. Int J Tuberc Lung Dis. 2000;4(1):61–8 (https://www.ingentaconnect.com/content/iuatld/ijtld/2000/00000004/00000001/art00012%3bjsessionid=1vofc8l9gccg6.x-ic-live-01, accessed 23 August 2019).

12 Revision of world population prospects [website]. 2019 (https://population.un.org/wpp/, accessed 23 August 2019).

13 WHO guidelines on tuberculosis infection prevention and control, 2019 update. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/handle/10665/311259/9789241550512-eng.pdf, accessed 23 August 2019).

14 Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva: World Health Organization; 2016 (https://www.who.int/gpsc/core-components.pdf, accessed 23 August 2019).

15 Van Der Meeren O, Hatherill M, Nduba V, Wilkinson RJ, Muyoyeta M, Van Brakel E et al. Phase 2b controlled trial of M72/AS01$_E$ vaccine to prevent tuberculosis. N Engl J Med. 2018;379(17):1621–34 (https://www.nejm.org/doi/10.1056/NEJMoa1803484, accessed 23 August 2019).

16 Report of the high-level consultation on accelerating the development of the M72/AS01$_E$ tuberculosis vaccine candidate. Geneva: World Health Organization; 2019 (https://www.who.int/tb/areas-of-work/research/meeting_report_m72_vaccine.pdf, accessed 23 August 2019).

17 The BCG world atlas: a database of global BCG vaccination policies and practices, 2nd edition [website]. 2017 (http://www.bcgatlas.org/, accessed 23 August 2019).

18 Reported estimates of BCG coverage [website]. Geneva: World Health Organization; 2019 (https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tscoveragebcg.html, accessed 23 August 2019).

A staff member of the International Organization for Migration gives a class to raise awareness about TB in Thailand.

Thierry Falise/IOM/LightRocket via Getty Images

Chapter 6

Financing for TB prevention, diagnosis and treatment

Key facts and messages

The political declaration at the first United Nations (UN) high-level meeting on tuberculosis (TB), held in September 2018, includes a target to mobilize at least US$ 13 billion annually by 2022 for TB prevention, diagnosis and treatment.[a] The Stop TB Partnership's *Global Plan to End TB, 2018–2022* (the updated Global Plan) estimates that US$ 10.1 billion is required in low- and middle-income countries in 2019, rising to US$ 14.9 billion in 2022.[b]

Based on data reported to the World Health Organization (WHO) by 119 low- and middle-income countries with 97% of the world's notified TB cases, US$ 6.8 billion is available in 2019, up from US$ 6.4 billion in 2018 and US$ 3.5 billion in 2006. Compared with the updated Global Plan, this leaves a shortfall of US$ 3.3 billion in 2019. Efforts to mobilize additional funding from domestic sources and international donors need to be urgently stepped up.

Of the total of US$ 6.8 billion available in 2019, US$ 4.2 billion is for drug-susceptible TB and US$ 2.2 billion is for multidrug-resistant TB (MDR-TB). The remainder is for interventions specifically related to HIV-associated TB and miscellaneous items.

Overall, most of the US$ 6.8 billion available in 2019 is from domestic sources (US$ 5.9 billion, 87% of the total). However, this aggregate figure is strongly influenced by the BRICS group of countries (Brazil, Russian Federation, India, China and South Africa). They account for 53% of the available funding in 2019 (and 47% of the world's TB cases), and 95% of their funding is from domestic sources (ranging from 88% in India to 100% in the Russian Federation).

In other low- and middle-income countries, international donor funding remains crucial. For example, it accounted for 38% of the funding available in the 25 high TB burden countries outside BRICS (which have 40% of the world's notified TB cases) and for 49% of the funding available in low-income countries.

International donor funding reported by national TB programmes (NTPs) dropped from US$ 1.0 billion in 2018 to US$ 0.9 billion in 2019, far below the annual requirement of US$ 2.7 billion that was estimated in the 2016–2020 Global Plan. The single largest source (73% of the total) of international donor funding reported by NTPs is the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund).

International donor funding documented in the Organisation for Economic Co-operation and Development (OECD) creditor reporting system includes funding for TB that flows through NTPs, as well as funding provided to other recipients. The total amount recorded in 2017 (the latest year for which data are available) was US$ 1.1 billion, of which 69% was from the Global Fund (the Fund's contribution averaged 64% from 2006 to 2017).

Funding for TB documented by the OECD in 2017 is much lower than for HIV (US$ 7.7 billion) and malaria (US$ 2.1 billion). To provide some context for these amounts, the latest estimates (for 2017) of the burden of disease in terms of disability-adjusted life years (DALYs) lost due to illness and death are 54 million for HIV/AIDS, 45 million for malaria and 45 million for TB.

The median cost per patient treated in 2018 was US$ 973 for drug-susceptible TB and US$ 6430 for MDR-TB.

Health financing data from national health accounts provide important insights into the status of progress towards universal health coverage. This is discussed in **Chapter 7**.

[a] The declaration also includes a financing target for TB research and development. The target is to mobilize US$ 2 billion per year in the period 2018–2022. Further details are provided in **Chapter 8**.

[b] This plan is an update of the original Global Plan to End TB, which was for the period 2016–2020. It is scheduled for release in December 2019.

Progress in reducing the burden of tuberculosis (TB) disease requires adequate funding sustained over many years. The World Health Organization (WHO) began annual monitoring of funding for TB prevention, diagnosis and treatment in 2002 and has published findings in global TB reports and peer-reviewed publications *(1)*.[1] The Treatment Action Group (TAG) has monitored funding for TB research and development since 2005, and publishes its findings in an annual report.[2]

In 2018, global financing targets for TB were set for the first time, as part of the political declaration at the United Nations (UN) high-level meeting on TB that was held on 26 September 2018 (**Chapter 2**). The targets are to mobilize at least US$ 13 billion annually by 2022 for TB prevention, diagnosis and treatment, and an additional US$ 2 billion annually for TB research and development in the 5-year period 2018–2022. The progress report in 2020 that was requested from the UN Secretary-General will include assessment of whether these financing targets are on track to be met, building on the annual monitoring of funding done by WHO and TAG.

The first part of this chapter provides an up-to-date summary of estimated financial resources needed to achieve the 2020 milestones of the End TB Strategy, as well as two new global targets for TB treatment and prevention that were set in the UN high-level meeting political declaration (**Section 6.1**). The focus is on resources needed for TB prevention, diagnosis and treatment, as opposed to TB research and development.[3] The next two sections present and discuss trends in funding for TB prevention, diagnosis and treatment by category of expenditure and source of funding for the period 2006–2019 (**Section 6.2**), and funding gaps reported to WHO by national TB programmes (NTPs) for the same period (**Section 6.3**). Data are shown overall for 119 low- and middle-income countries that account for 97% of reported TB cases, and for major country groupings. More detailed country-specific data for 2019 are shown for 30 high TB burden countries.[4] **Section 6.4** provides the latest estimates (for 2018) of the unit costs of treatment for drug-susceptible TB and multidrug-resistant TB (MDR-TB).

As highlighted in previous editions of the global TB report, analysis of health financing data (overall and not specific to TB) can provide important insights into progress towards universal health coverage (UHC), which is necessary to achieve the End TB Strategy milestones set for 2020 and 2025 (**Chapter 2**). Measurement of costs faced by TB patients and their households is also required to assess progress towards one of the three high-level indicators of the End TB Strategy; that is, the percentage of TB patients and their households facing catastrophic costs due to TB disease. The 2020 milestone of zero set for this indicator requires progress towards UHC and social protection (included under Pillar 2 of the End TB Strategy). These two topics – analysis of health financing data, and measurement of costs faced by TB patients and their households – are discussed in **Chapter 7**.

Further country-specific data on TB financing can be found in finance profiles that are available online.[5]

6.1 Estimates of funding required for TB prevention, diagnosis and treatment, 2018–2022

In 2015, the Stop TB Partnership published the *Global Plan to End TB, 2016–2020 (the Global Plan) (3)*. This included estimates of the funding required for TB prevention, diagnosis and treatment to reach the 2020 milestones of the End TB Strategy: a 35% reduction in the number of TB deaths compared with 2015, a 20% reduction in the TB incidence rate (i.e. new cases per 100 000 population per year) compared with 2015, and that no TB patients and their households face catastrophic costs due to TB disease.[6] The plan also provided estimates of the funding required for TB research and development (US$ 2 billion per year).

The political declaration agreed by all UN Member States at the first UN high-level meeting on TB on 26 September 2018 included two new global targets for the numbers of people to be treated for TB disease (40 million) or a latent TB infection (at least 30 million) in the period 2018–2022.[7] These targets build on and are consistent with the milestones for reductions in TB incidence and deaths set for 2020 and 2025 in the End TB Strategy. In this context, work to produce an updated plan for the period 2018–2022 was initiated, and the final document is scheduled for release in December 2019.

The updated estimates of funding required for TB prevention, diagnosis and treatment in 129 low- and middle-income countries are shown in **Fig. 6.1**. The total for 2018–2022 is US$ 60 billion (an average of US$ 12 billion per year).[8] Included in this total is the estimated cost of diagnosing and treating 40 million TB patients and providing TB preventive treatment to 30 million people with a latent TB infection.[9]

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[1] This is the most recent peer-reviewed publication at the time of writing.

[2] The latest report was published jointly with the Stop TB Partnership in December 2018 and covers the period 2005–2017 *(2)*.

[3] Funding for TB research and development is discussed in **Chapter 8**.

[4] The WHO list of 30 high TB burden countries defined for the period 2016–2020 is described and explained in **Chapter 2**.

[5] See https://www.who.int/tb/data/en/.

[6] For further details about the milestones and targets of the End TB Strategy, see **Chapter 2**.

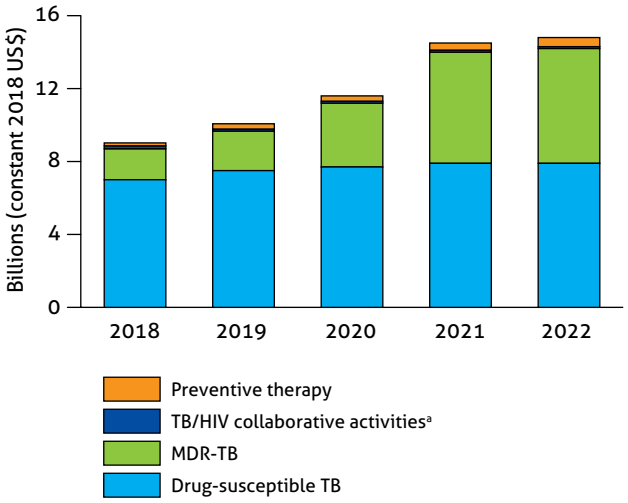
[7] See **Table 2.3** in **Chapter 2**.

[8] The plan estimates that an additional US$ 3 billion is needed in other countries, bringing the total to US$ 63 billion. The annual total for all countries is US$ 10.7 billion in 2018, rising to US$ 15.5 billion in 2022.

[9] The number of 30 million is much higher than in the original Global Plan to End TB. To reach this target, the updated plan includes greater investment in household contact tracing (reaching 100% coverage for contacts of bacteriologically confirmed pulmonary cases by 2022) and assumes that all people living with HIV (PLHIV) on antiretroviral therapy (ART) are provided with TB preventive treatment.

FIG. 6.1

Estimates of funding required for TB prevention, diagnosis and treatment in 129 low- and middle-income countries in the Global Plan to End TB 2018–2022



[a] Funding estimates for TB/HIV collaborative activities exclude the cost of antiretroviral therapy (ART) for TB patients living with HIV. Such costs are included in global estimates of the funding required for HIV, published by UNAIDS.

Source: Stop TB Partnership Global Plan to End TB 2018–2022. This plan is an update of the original Global Plan to End TB, which was for the period 2016–2020. It is scheduled for release in December 2019.

The amount required in 2019 is US$ 10.1 billion, increasing to US$ 14.9 billion in 2022. Of the estimated total in 2019, US$ 7.5 billion (74%) is for diagnosis and treatment of drug-susceptible TB, US$ 2.2 billion is for diagnosis and treatment of drug-resistant TB,[1] US$ 0.3 billion is for TB prevention services and US$ 0.1 billion is for interventions specifically related to HIV-associated TB.[2] The amount for the latter is comparatively small because it does not include the funding needed for antiretroviral therapy (ART) for people living with HIV (PLHIV).[3]

The 2016–2020 Global Plan included estimates of the funding that could be mobilized from domestic sources and the balance that would be needed from international donor sources, for low- and middle-income countries eligible to apply to the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund).[4] In an optimistic scenario for domestic funding, it was estimated that US$ 2.7 billion per year would be required from international donors.

6.2 TB funding, overall and by category of expenditure and source of funding, 2006–2019

Data reported by NTPs to WHO since 2006 were used to analyse funding trends for 2006–2019 in 119 low- and middle-income countries (Fig. 6.2). These countries accounted for 97% of the global number of TB cases notified in 2018. The methods used to compile, review, validate and analyse financial data are summarized in Box 6.1.

In these 119 low- and middle-income countries, funding for TB prevention, diagnosis and treatment reached US$ 6.8 billion in 2019, an increase from US$ 6.4 billion in 2018, and almost double the US$ 3.5 billion that was available in 2006 (Fig. 6.3; all figures are in constant 2019 US dollars). Despite this growth in funding, comparison with Fig. 6.1 shows that these amounts continue to fall far short of what is needed.

Of the total of US$ 6.8 billion available in 2019, US$ 4.2 billion (66%) is for diagnosis and treatment of drug-susceptible TB.[5] This is equivalent to 56% of the estimated requirement (US$ 7.5 billion) in the updated Global Plan.

Funding for MDR-TB reached US$ 2.2 billion in 2019; the annual amount has increased relatively steadily over time, from only US$ 0.4 billion in 2006 (Fig. 6.3). The total amount and overall trend since 2006 largely reflect the pattern in the BRICS group of countries (Brazil, Russian Federation, India, China and South Africa) (Fig. 6.4), which account for two thirds of total funding for MDR-TB (66% in the years 2006–2019, 68% in 2019) and 58% of the total notifications of MDR-TB cases in 2018.

The US$ 2.2 billion available for MDR-TB in 2019 is the same as the estimated requirement for 2019 in the updated Global Plan. However, this aggregate comparison conceals the fact that there is more funding compared with the estimated requirement in the plan in some countries, and less in others. In 2019, 62 countries reported funding gaps for MDR-TB. In addition, as shown in Fig. 6.1, the funding required for MDR-TB will continue to increase, reaching an estimated US$ 6.3 billion in 2022 – nearly triple the amount available in 2019. The need for more funding is also evident in the persistently large gaps in detection and treatment of people with MDR-TB.[6]

Overall, most funding during the period 2006–2018 was provided from domestic sources, and this remains

[1] The burden of drug-resistant TB (in terms of new cases per year) is not projected to increase between 2018 and 2022; however, increased funding is required to close detection and treatment gaps (see also Chapter 4).

[2] The updated Global Plan includes a more detailed breakdown of resource needs, using the following 10 categories: first-line drugs; second-line drugs; laboratory infrastructure, equipment and supplies; programme costs for first-line treatment (for drug-susceptible TB); programme costs for second-line treatment (for drug-resistant TB); use of inpatient and outpatient care for drug-susceptible TB; use of inpatient and outpatient care for drug-resistant TB; collaborative TB/HIV activities; TB preventive treatment; patient enablers (e.g. food support, transport vouchers).

[3] This is instead included in estimates of funding required for HIV, published by the Joint United Nations Programme on HIV/AIDS (UNAIDS).

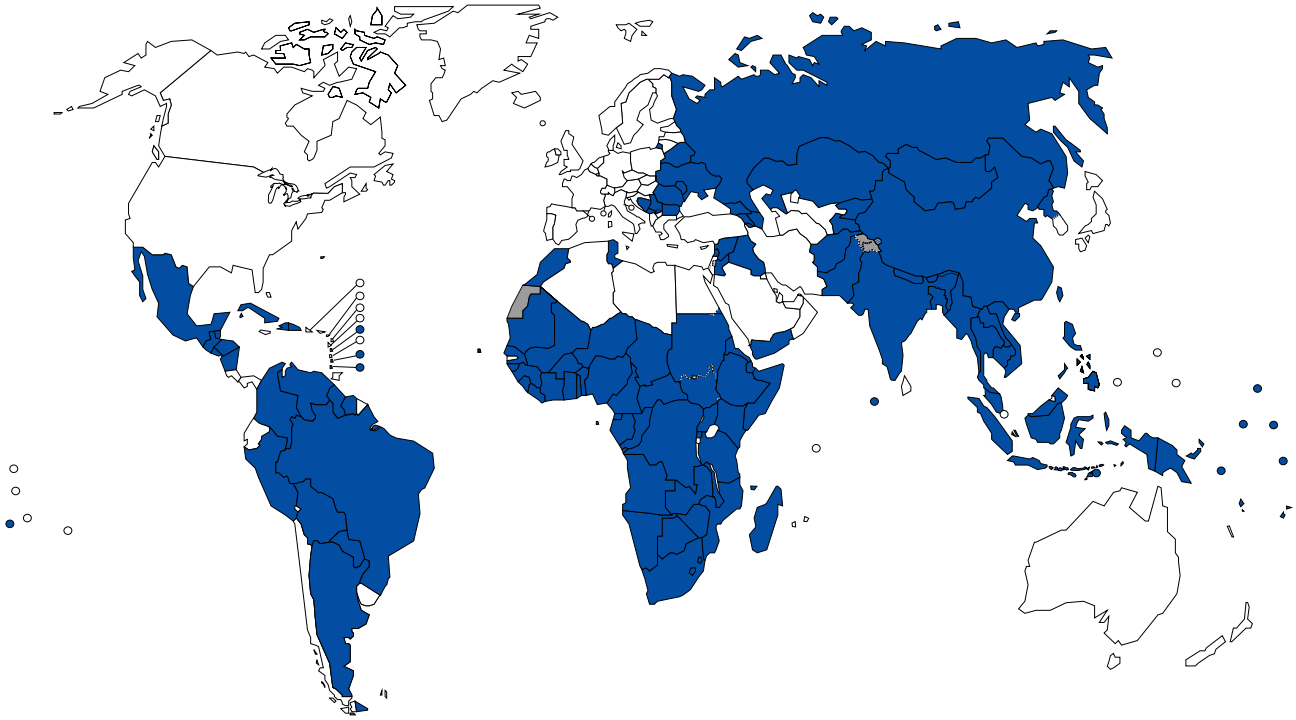
[4] Countries not eligible to apply to the Global Fund include Brazil, China, the Russian Federation and 46 other countries classified as upper-middle-income.

[5] This includes funding for diagnostic testing using the Xpert MTB/RIF or Xpert Ultra assays, which simultaneously test for TB and rifampicin resistance.

[6] Further details are provided in Chapter 4.

FIG. 6.2

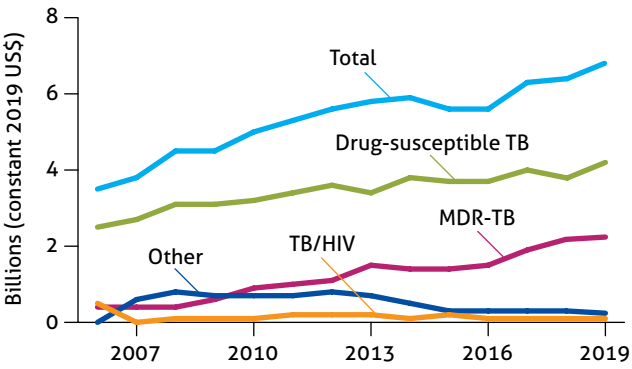
The 119 low- and middle-income countries included in analyses of TB financing, 2006–2019[a]



[a] Countries marked in blue on the map were included in trend analyses if at least three years of high-quality finance data were available in the period 2006–2019. Low-income (29/31), lower-middle-income (44/47), and upper-middle-income (46/59) countries representing 13%, 63% and 21% of 2018 notified cases, respectively, were included. The following 18 low- and middle-income countries were not included: Albania, Algeria, Burundi, Costa Rica, Dominica, Ecuador, Egypt, Gambia, Iran (Islamic Republic of), Jamaica, Libya, Mauritius, Micronesia (Federated States of), North Macedonia, Samoa, Turkey, Turkmenistan, Uzbekistan. Countries in grey are "not applicable".

FIG. 6.3

Funding for TB prevention, diagnosis and treatment in total and by category of expenditure, 2006–2019, 119 countries with 97% of reported cases



the case in 2019 (Fig. 6.5).[1] In 2019, US$ 5.9 billion (87%) of the total funding of US$ 6.8 billion for TB is from domestic sources. However, aggregated figures for the 119 low- and middle-income countries are strongly influenced by BRICS, and they conceal substantial variation among countries in the share of funding from domestic and international sources (Fig. 6.6).

The BRICS group of countries account for 53% of the available funding in 2019 (and 47% of the world's TB cases), and overall 95% (ranging from 88% in India to 100% in the Russian Federation) of their funding is from domestic sources (Fig. 6.6). In India, there has been a particularly striking and impressive increase in the TB-specific budget, and in domestic funding for this budget, since 2016 (Fig. 6.7). Between 2016 and 2019, the national TB budget almost doubled, and domestic funding for this budget

[1] Domestic funding includes both funding for TB-specific budgets, and funding for inpatient and outpatient care (usually funded through more general budget lines), as explained in Box 6.1. In Fig. 6.5 and Fig. 6.6, it is assumed that funding for inpatient and outpatient care is provided domestically rather than by international donors. This is justified on the basis that most (99%) of the funding estimated to be used for inpatient and outpatient care for TB patients is accounted for by middle-income countries, where international donor funding for such components of care is unlikely (such support is more likely to occur in low-income countries, via general budget support to the health sector).

BOX 6.1

Methods used to compile, review, validate and analyse financial data reported to WHO

Overview

WHO began monitoring government and international donor financing for TB in 2002. All data are stored in the WHO global TB database. The standard methods used to compile, review, validate and analyse these data have been described in detail elsewhere *(1, 4)*; this box provides a summary.

Each year, WHO asks NTPs in all low- and middle-income countries to report:

- the funding they estimate will be needed for TB prevention, diagnosis and treatment in their current fiscal year, by category of expenditure and source of funding; and
- expenditures for the most recently completed fiscal year, also by category of expenditure and source of funding.

In the 2019 round of global TB data collection, the fiscal years were 2019 (for funding needs) and 2018 (for expenditures). Categories of expenditure used to report TB budget and expenditure data have been kept consistent as far as possible, to enable monitoring of trends.

Categories used for reporting of budgets and expenditures from 2002 to 2019

The categories used for annual reporting of funding needs (current fiscal year) and expenditures (last fiscal year) by NTPs in low- and middle-income countries are summarized below.

1. Drug-susceptible TB

- Laboratory infrastructure, equipment and supplies.
- NTP staff at central and subnational levels (e.g. NTP managers, and provincial or district TB coordinators).
- First-line drugs.
- Programme costs; for example, management and supervision activities, training, policy development, meetings, purchase of office equipment and vehicles, recording and reporting of notifications and treatment outcomes, advocacy and communication, public–private mix activities and community engagement.
- Operational research, including surveys.
- Patient support.

2. MDR-TB

- Second-line drugs.
- Programme costs specifically related to MDR-TB.

3. TB/HIV

- Collaborative TB/HIV activities, including TB preventive treatment for people newly enrolled in HIV care. This category excludes any budget items that are financed by HIV programmes, such as antiretroviral therapy for TB patients living with HIV.

An "other" category is used to capture miscellaneous items that do not fit into any of the categories listed above.

Sources of funding

Low- and middle-income countries use four standard categories to report on the breakdown of the total amount of available or committed funding by source. These categories are domestic funding including loans; the Global Fund; USAID; and international donor financing from sources other than the Global Fund and USAID.

High-income countries

As in previous years, in 2019, all high-income countries were asked to report their funding requirements and expenditures in total, without any breakdown by category of expenditure or source of funding. Of the 72 high-income countries, 20 reported total TB expenditures and 21 reported the amount of funding needed in 2019. Trend data for 2015–2019 are available for 17 countries.[a] These data are available in online profiles but are not featured in this chapter, given its focus on low- and middle-income countries.

Average cost of drugs per patient (since 2014)

Since 2014, data on the average cost of drugs per patient treated have been requested. These data allow reviewers to better assess the validity of budgets reported for first-line and second-line drugs, and to identify whether reported budgets include funding for buffer stocks.

Use of general health services (2002–2019)

Annually since 2002, all countries (irrespective of income level) have been asked to report on the use of inpatient and outpatient care for treatment of people with drug-susceptible TB and MDR-TB on a per-patient basis (i.e. the average number of days spent in hospital, and the average number of outpatient visits to a health facility). These data can be based on actual use of services (preferable where such data are available), or on the expected use of services based on the typical approach used to deliver treatment (which may be defined in national policy documents and protocols). These data on health service use are then combined with other data to estimate the financial resources used for TB treatment that are not reflected in NTP-reported budgets and expenditures (further details are provided below).

Data validation by WHO's Global TB Programme

The core methods used to review and validate data have remained consistent since 2002. They include the following:

- routine checks for plausibility and consistency, including validation checks that are built into the online reporting system; examples of validation checks are checks for implausibly large year-to-year changes (e.g. in total reported funding by source and by category of expenditure), or implausibly high or low values of funding for drugs relative to the number of TB patients (that differ substantially from prices quoted by the Global TB Drug Facility);
- discussions with country respondents to resolve queries; and
- triangulation with other data sources – these include estimates of unit costs from independent economic ▶

evaluations[b] and data extracted by the Global Fund from funding applications submitted to the Fund (comprehensive budgets for national strategic plans for TB are an essential part of funding applications to the Global Fund); further details about the comparisons with other data sources are available from WHO upon request.

Particular attention has always been given to high TB burden countries. In 2019, additional efforts to improve the quality of financial data included discussions with NTP staff during country missions, and individual, customized follow-up with in-country staff involved in the development of national strategic plans and reporting of financial data.

Estimates of the costs of inpatient and outpatient care for patients with drug-susceptible TB or MDR-TB

TB funding reported by NTPs does not usually include the financial costs associated with inpatient and outpatient care required during TB treatment (exceptions among high TB burden countries are China and the Russian Federation). Since detailed costing studies in numerous countries show that these costs can account for a large share of the cost of treating someone with TB, WHO analyses of TB financing have always included estimates of the funding required for both inpatient and outpatient care. These costs have been estimated from a provider perspective only, and do not include the costs faced by TB patients and their households. Costs faced by TB patients and their households are discussed in **Chapter 7**.

To estimate the funding used to provide inpatient and outpatient care for TB patients, WHO multiplies the number of outpatient visits and days of inpatient care per patient (reported by NTPs each year, as explained above) by the cost per bed day and per clinic visit available from the WHO CHOosing Interventions that are Cost-Effective (WHO-CHOICE) database *(5)*, and then by the reported number of TB patients notified or projected to be notified. These estimates are done separately for drug-susceptible TB and MDR-TB. In 2019, costs per bed day and per clinic visit were estimated using the WHO-CHOICE regression model *(6)* and the latest data available from the World Bank.

Where possible, estimates are compared with hospital and clinic expenditure data for drug-susceptible TB and MDR-TB tracked through the system of health accounts (SHA) *(7)*. In 2019, SHA estimates for one of the 5 years from 2012 to 2016 were available for 20 countries, including five high TB burden countries (Democratic Republic of the Congo, Ethiopia, Namibia, Philippines and Zambia).[c] SHA data were used in preference to the Global TB Programme's estimate for 20 country-year combinations.[d] The WHO Health Governance and Financing Department continues to assess the validity of the latest results from the new SHA, including disease-specific results.

Expanded implementation of SHA and validation against existing disease-specific tracking systems may facilitate more comprehensive reporting of domestic funding for TB. In particular, it may facilitate reporting of the contributions from subnational administrative levels that are not always known or compiled at the national level. Although much of this contribution is probably for delivery of inpatient and outpatient care (which is included in current WHO estimates of domestic funding for TB, as explained above), reporting of funding from these levels is a particular challenge in large countries with decentralized systems. As an example, the NTP in Indonesia was able to report total funding requirements for the country in 2019 and the funding available at the national level, but funding available from district and provincial authorities was unknown.

Estimates of the cost of providing treatment for drug-susceptible TB and MDR-TB, per patient

Since 2014, WHO has been reporting estimates of the costs per patient treated for drug-susceptible TB and MDR-TB. Costs are calculated separately for drug-susceptible TB and MDR-TB. In each case, the numerator is the total estimated cost of treatment, which has two main parts – the national expenditures reported by the NTP, and the system (not patient) costs associated with the use of health services for TB patients. Categories of expenditure considered as costs for MDR-TB include second-line drugs and all other inputs used or activities implemented for the programmatic management of MDR-TB. All other categories (except collaborative TB/HIV activities) are assumed to be for drug-susceptible TB. In 2018, an exception was made for the Russian Federation; total expenditures for staff and infrastructure were allocated by WHO to drug-susceptible TB (29%) and MDR-TB (71%), based on the proportion of bed days used for these two categories of patients in 2018. For any given year, unit costs are then calculated as the sum of NTP expenditures and total costs for use of inpatient and outpatient care, divided by the reported number of patients treated.

Analysis of trends (all indicators)

All trend data are shown in *constant* (as opposed to current) 2019 US dollars. In other words, funding amounts are shown in real terms, with the effect of inflation (changes in prices) removed. Figures and tables that show data for 2019 only are labelled as *current* 2019 US dollars.

[a] The 17 countries are Andorra, Estonia, Guam, Japan, Kuwait, Latvia, Netherlands, Northern Mariana Islands, Palau, Puerto Rico, Republic of Korea, Saint Kitts and Nevis, Seychelles, Singapore, Sint Maarten (Dutch part), Slovakia and Switzerland.

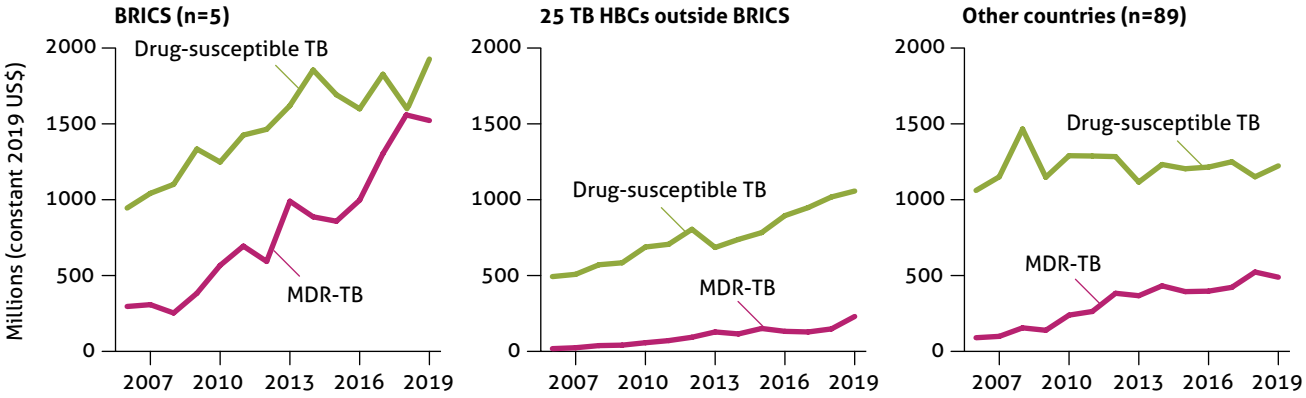
[b] Global Health Cost Consortium unit cost study data repository (see https://ghcosting.org/pages/data/ucsr/app/index).

[c] Data shared by WHO Health Governance and Financing Department in June 2019.

[d] Armenia (2016), Benin (2015), Bhutan (2016), Burkina Faso (2016), Cabo Verde (2014), Democratic Republic of the Congo (2016), Ethiopia (2014), Gabon (2016), Guinea (2016), Kyrgyzstan (2014), Mali (2016), Mauritania (2013), Namibia (2014), Niger (2014), Philippines (2012), Sao Tome and Principe (2014), Tajikistan (2016), Togo (2016), Uganda (2014) and Zambia (2016).

FIG. 6.4

Funding for drug-susceptible TB and MDR-TB, 2006–2019, by country group[a]



[a] BRICS accounted for 47% of the total number of TB cases notified globally in 2018. The 25 high TB burden countries outside BRICS accounted for 40%. The remaining countries (n=89) included in financing analyses accounted for 10% of the TB cases notified globally in 2018.

quadrupled, from US$ 112 million in 2016 to US$ 450 million in 2019. Domestic funding for the national TB budget is 10 times higher in 2019 than it was in 2006.

In other low- and middle-income countries, international donor funding remains crucial (Fig. 6.6). For example, it accounted for 38% of the funding available in the 25 high TB burden countries outside BRICS[1] (which have 40% of the world's notified TB cases) and for 49% of the funding available in low-income countries. Nonetheless, it is encouraging that in the 25 high TB burden countries outside BRICS, the share of funding from domestic sources increased from 56% in 2017, to 57% in 2018 and 62% in 2019. In this group, countries with notable increases in funding from domestic sources between 2017 and 2019 were Angola, Bangladesh and Indonesia.[2]

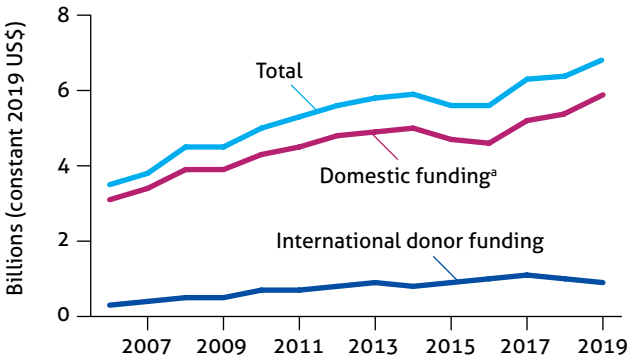
International donor funding reported by NTPs to WHO amounted to US$ 0.9 billion in 2019, a slight decline from US$ 1.0 billion in 2018. Of this amount, 73% was provided by the Global Fund (Fig. 6.5).

The importance of international donor funding in high TB burden countries is particularly evident when considering only the TB-specific budgets included in national strategic plans for TB (Fig. 6.8, Table 6.1 and Table 6.2). In 19 of the 30 high TB burden countries, more than 50% of funding for the TB-specific budgets included in national strategic plans for TB in 2019 is from international donors.

Both Fig. 6.7 and Fig. 6.8 illustrate the potential to increase domestic funding in some high TB burden countries.[3] In the group of eight low-income countries, the proportion of the TB budget funded from domestic sourc-

FIG. 6.5

Funding for TB prevention, diagnosis and treatment by funding source, 2006–2019, 119 countries with 97% of reported TB cases



[a] Domestic funding includes TB-specific budgets and the estimated resources used for inpatient and outpatient care (see Box 6.1). 92% of the funding of US$ 2.1 billion for inpatient and outpatient care for 2019 is accounted for by middle-income countries; such countries do not typically receive international donor funding for inpatient and outpatient care services.

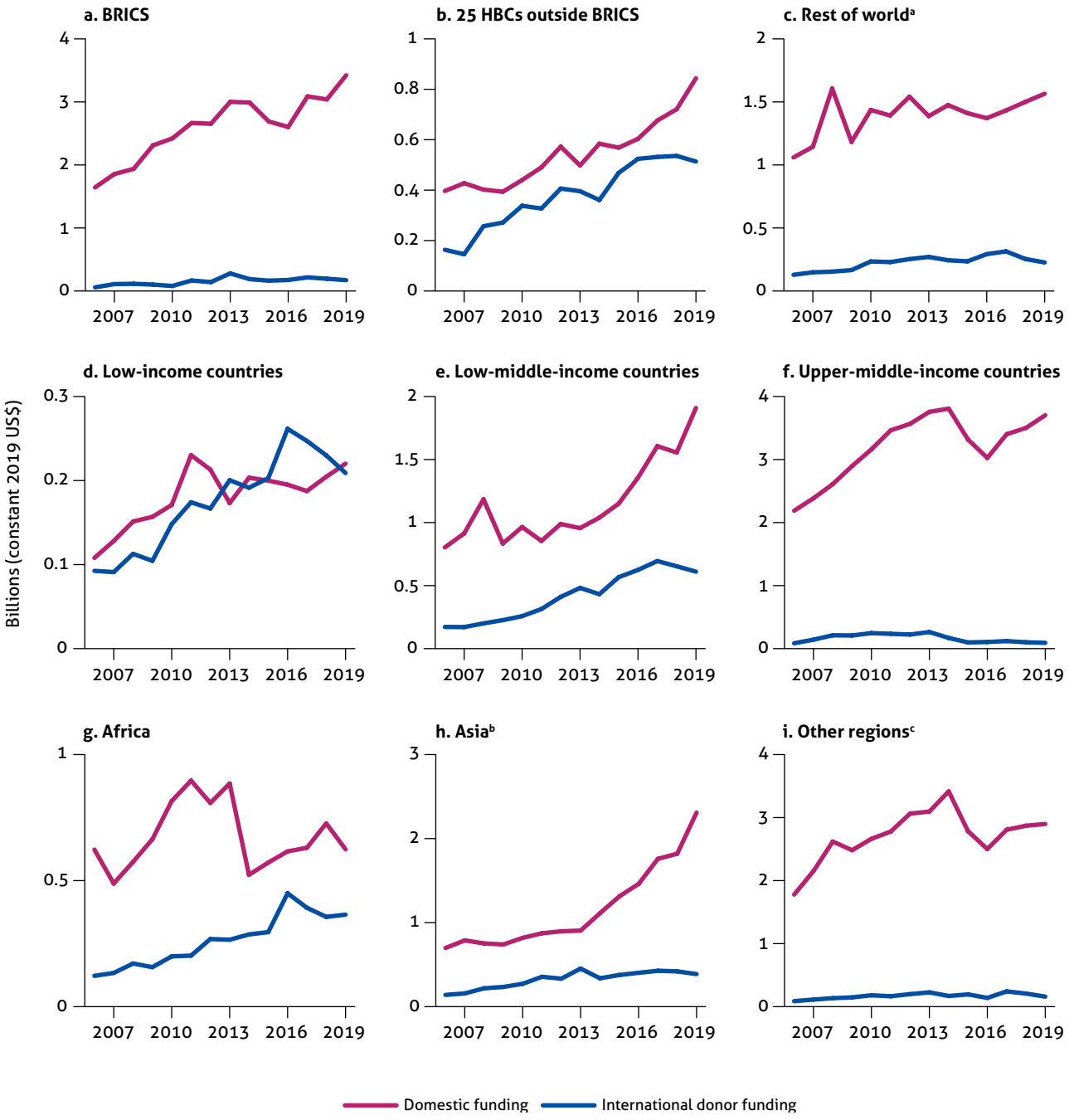
[1] The list of 30 high TB burden countries being used by WHO during the period 2016–2020 is explained in Chapter 2. The countries are those listed in Fig. 6.8, Table 6.1 and Table 6.2.

[2] For further details, see Annex 2.

[3] Sustained and increased financing was one of the four topics of the Moscow Declaration to End TB *(8)*. For further details, see Section 2.3 of Chapter 2.

FIG. 6.6

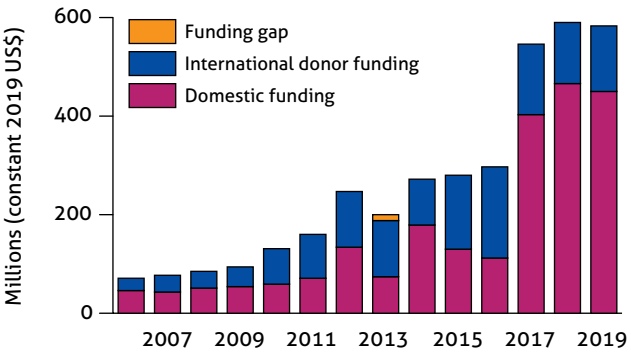
Funding for TB prevention, diagnosis and treatment from domestic sources and international donors, 2006–2019, 9 country groups



[a] Rest of world includes 89 countries that are not in the list of 30 high TB burden countries.
[b] Asia includes the WHO regions of South-East Asia and the Western Pacific.
[c] Other regions consist of three WHO regions: the Eastern Mediterranean Region, the European Region, and the Region of the Americas.

FIG. 6.7

National budget for TB and sources of funding in India, 2006–2019



es in 2018 ranges from 0% in Liberia to 27% in the Central African Republic. In the group of 16 lower-middle-income countries, the proportion ranges from 0.4% in Zimbabwe to 77% in India. In the group of six upper-middle-income countries, the proportion ranges from 61% in Namibia to 100% in the Russian Federation.

Funding reported by NTPs to WHO does not capture all international donor funding for TB.[1] For this reason, a complementary analysis based on donor reports to the Organisation for Economic Co-operation and Development (OECD) is provided in Box 6.2.[2]

6.3 Funding gaps reported by NTPs, 2006–2019

Reported funding gaps are calculated as the difference between assessments by NTPs of funding needs for TB prevention, diagnosis and treatment in their national strategic plans, and the actual amount of available funding reported by NTPs. Data for the period 2006–2019 are shown in Fig. 6.8, Fig. 6.9 and Table 6.2.

Many NTPs continue to report funding gaps. The total reported gap in 2019 is US$ 1.3 billion, much higher than the amount of US$ 1.0 billion reported in 2017 but the same as the level reported for 2018. The most striking trends are the increase in the size of the reported funding gap in lower-middle-income countries and the African Region (Fig. 6.9). These increases suggest that although national strategic plans and associated budgets for TB have become more ambitious, mobilization of funding has not kept pace. Overall, lower-middle-income countries accounted for 73% (US$ 0.9 billion) of the total reported gap in 2019, with the largest gaps reported by Nigeria (US$ 168 million), Philippines (US$ 129 million), Pakistan (US$ 90 million), Kenya (US$ 51 million), Angola (US$ 46 million), Viet Nam (US$ 45 million), Zimbabwe (US$ 29 million) and Myanmar (US$ 23 million).

Reported funding gaps have been relatively stable in low-income countries and in the WHO Region of the Americas and Eastern Mediterranean Region. They have declined in upper-middle-income countries and the WHO European Region. Low-income countries that reported sizeable gaps in 2019 include Ethiopia (US$ 56 million), the United Republic of Tanzania (US$ 44 million), the Democratic People's Republic of Korea (US$ 37 million) and the Democratic Republic of the Congo (US$ 18 million) (Table 6.2).

Of the US$ 1.3 billion funding gap reported by NTPs in 2019, US$ 1.1 billion (82%) is for drug-susceptible TB and US$ 0.2 billion (18%) is for MDR-TB. Relative to total funding needs, the funding gap is larger for drug-susceptible TB than for MDR-TB.

The total reported gap of US$ 1.3 billion is less than half of the gap that exists when available funding in 2019 (US$ 6.8 billion) is compared with the Global Plan's estimated requirement of US$ 10.1 billion in 2019 (Section 6.1). The difference can be explained by the fact that, in many countries, national strategic plans for TB are less ambitious than the targets set in the Global Plan.

6.4 Unit costs of treatment for drug-susceptible TB and MDR-TB, 2018

The cost per patient treated in 2018 for drug-susceptible TB and MDR-TB was estimated for 109 countries and 87 countries, respectively.[3] All 30 countries in the lists of high TB burden countries and all high MDR-TB burden countries except for Uzbekistan (which did not report data in 2019) were included in the analyses.[4] Unit cost estimates are shown in Fig. 6.10 and Fig. 6.11, and analytical methods are summarized in Box 6.1.

6.4.1 Drug-susceptible TB

The median cost per patient treated for drug-susceptible TB in 2018 was US$ 973 (Fig. 6.10).[5] In general, about 67% of this cost was accounted for by reported NTP expenditures, with the remainder being costs for inpatient and outpatient care. There was a positive relationship between the cost per patient treated and gross domestic product (GDP) per capita, and a negative relationship with the size of the patient caseload (indicating economies of scale, e.g. in China, India and Indonesia). In all but two of the 30 high TB burden countries included in the analysis, the cost per patient treated for drug-susceptible TB was less than the GDP per capita; the exceptions were Liberia and Sierra Leone.

The cost per patient treated was typically higher in the

[1] Donor funding is also provided to entities other than NTPs, including international and national organizations, both governmental and nongovernmental.

[2] Out-of-pocket expenditures are also not included in the financing data reported by NTPs; these are discussed in more detail in Chapter 7.

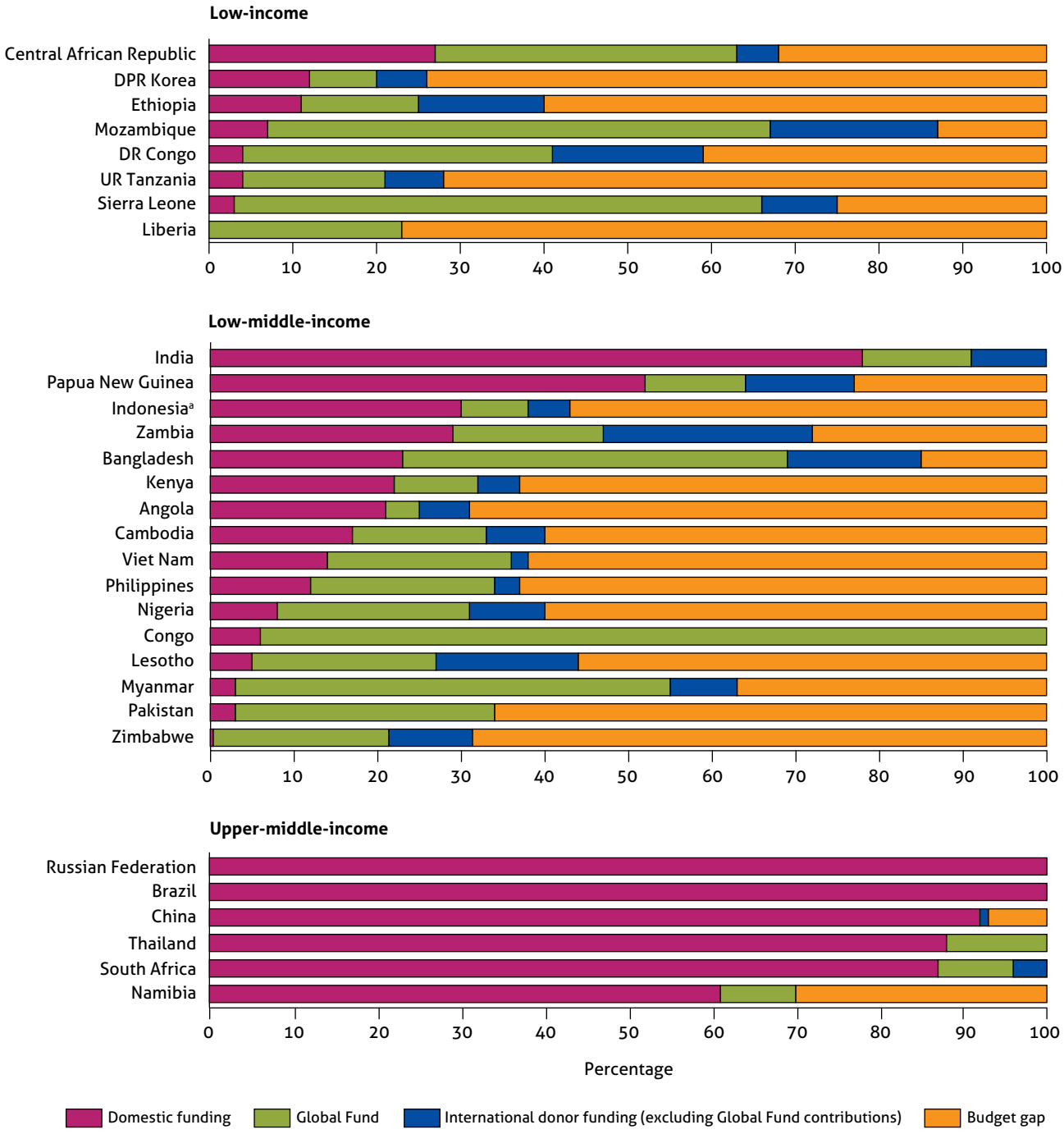
[3] Analysis for drug-susceptible TB was limited to countries that notified at least 100 TB cases in 2018; for MDR-TB, estimates were restricted to countries that reported at least 20 patients on second-line treatment for MDR-TB in 2018.

[4] For further details about both lists, see Chapter 2.

[5] Median values are cited rather than means because of extreme values for a few countries.

FIG. 6.8

Sources of funding and funding gaps for the TB-specific budgets included in national strategic plans for TB in 2019, 30 high TB burden countries



[a] The funding gap shown for Indonesia is the difference between funding at national level and the budget in the national strategic plan. However, funding from provincial and district budgets is unknown and is expected to cover or reduce the gap.

TABLE 6.1

Reported budget in national strategic plans for TB, by intervention area and estimated cost of inpatient and outpatient care for drug-susceptible (DS-TB) and MDR-TB, 30 high TB burden countries, 2019 (current US$ millions)

	TOTAL BUDGET IN NATIONAL STRATEGIC PLAN FOR TB	DS-TB	MDR-TB	TB/HIV	INPATIENT AND OUTPATIENT CARE (DS-TB)	INPATIENT AND OUTPATIENT CARE (MDR-TB)	ESTIMATED TOTAL RESOURCES REQUIRED FOR TB CARE
Angola	67	55	9.1	2.9	19	6.9	93
Bangladesh	80	68	11	0.02	3.4	1.3	84
Brazil[a]	38	33	5.1	0.2	26	1.9	66
Cambodia	31	28	2.0	0.9	30	0.5	61
Central African Republic	2.9	2.2	0.7	0	0.7	0.02	3.6
China[b]	719	532	186	0	—	—	719
Congo	0.9	0.5	0.4	0.1	1.4	0.02	2.3
DPR Korea	50	39	10	0	44	8.4	102
DR Congo	44	38	4.0	2.5	3.2	1.2	49
Ethiopia	94	75	12	7.5	48	1.4	143
India	583	500	82	1.5	366	175	1 125
Indonesia	366	319	42	5.2	57	16	439
Kenya	81	72	5.5	3.5	10	1.8	94
Lesotho	12	11	0.7	0.5	0.6	0.1	13
Liberia	7.3	6.9	0.3	0.1	0.1	0.4	7.9
Mozambique	28	17	9.1	2.3	5.6	0.5	34
Myanmar	62	52	7.6	2.0	2.9	0.6	65
Namibia	50	38	6.3	5.6	4.1	7.4	62
Nigeria	278	211	60	8	3.6	6.9	289
Pakistan	135	90	45	0.2	7.6	0.4	143
Papua New Guinea	36	18	10	8.2	0.7	1.3	38
Philippines	205	169	21	15	121	10	336
Russian Federation[b,c]	1 451	384	1 065	1.4	—	—	1 451
Sierra Leone	9.5	6.5	2.7	0.25	19	0.8	29
South Africa	240	205	23	11	17	37	294
Thailand[a]	27	16	11	0.02	6.9	9.3	43
UR Tanzania	62	49	7.7	4.9	3.8	1.3	67
Viet Nam[a]	72	57	13	1.8	27	8.1	107
Zambia	31	22	6.6	2.2	2.3	1.7	35
Zimbabwe	41	32	3.8	5.2	1.0	0.4	43
30 high TB burden countries	**4904**	**3 147**	**1 664**	**93**	**831**	**301**	**6 036**

– indicates values that cannot be calculated.

[a] In 2019, the budget reported by Brazil, Thailand and Viet Nam was for the central (or federal) level only. The amounts do not include provincial level contributions.

[b] No amounts for the additional resources required for inpatient and outpatient care are shown for China and the Russian Federation because the NTP budgets reported by those countries include all budgets for inpatient and outpatient care.

[c] In the Russian Federation, the staff and infrastructure reported for TB care and control were allocated to DS-TB (29%) and MDR-TB (71%) by WHO based on the proportion of beddays used by DS-TB and MDR-TB patients.

TABLE 6.2

Reported budget in national strategic plans for TB, available funding for this budget from domestic and international donor sources and funding gap, 30 high TB burden countries, 2019 (current US$ millions)

	TOTAL BUDGET IN NATIONAL STRATEGIC PLAN FOR TB	DOMESTIC FUNDING (A)	INTERNATIONAL DONOR FUNDING (B)	SHARE OF AVAILABLE FUNDING (A+B) PROVIDED FROM DOMESTIC SOURCES (%)	SHARE OF AVAILABLE FUNDING (A+B) PROVIDED BY INTERNATIONAL DONORS (%)	FUNDING GAP[c]
Angola	67	14	6.4	68	32	46
Bangladesh	80	18	50	27	73	12
Brazil[a]	38	38	0.1	100	0.3	0
Cambodia	31	5.2	7.2	42	58	19
Central African Republic	2.9	0.8	1.2	40	60	0.9
China	719	664	6.8	99	1.0	48
Congo	0.9	0.05	0.9	5.7	94	0
DPR Korea	50	5.9	6.8	46	54	37
DR Congo	44	1.7	25	6.5	93	18
Ethiopia	94	10	28	27	73	56
India	583	450	133	77	23	0
Indonesia[b]	366	109	48	69	31	209
Kenya	81	18	12	59	41	51
Lesotho	12	0.6	4.8	11	89	7.0
Liberia	7.3	0	1.6	0	100	5.6
Mozambique	28	2.1	23	8.4	92	3.6
Myanmar	62	1.8	37	4.7	95	23
Namibia	50	31	4.5	87	13	15
Nigeria	278	22	88	20	80	168
Pakistan	135	3.6	42	7.9	92	90
Papua New Guinea	36	19	8.9	68	32	8.6
Philippines	205	24	58	32	68	122
Russian Federation	1 451	1 451	0	100	0	0
Sierra Leone	9.5	0.3	6.8	4.2	96	2.4
South Africa	240	208	31	87	13	0
Thailand[a]	27	24	3.3	88	12	0
UR Tanzania	62	2.4	15	13	87	44
Viet Nam[a]	72	9.8	17	36	64	45
Zambia	31	9.0	13	40	60	8.7
Zimbabwe	41	0.1	13	1.1	99	29
30 high TB burden countries	**4 904**	**3 143**	**693**	**82**	**18**	**1 068**

– indicates values that cannot be calculated.

[a] In 2019, the budget reported by Brazil, Thailand and Viet Nam was for the central (or federal) level only. The amounts do not include provincial level contributions.

[b] The funding gap shown for Indonesia is the difference between funding at national level and the budget in the national strategic plan. However, funding from provincial and district budgets is unknown and is expected to cover or reduce the gap.

[c] The funding gap reflects the anticipated gap for the year at the time a country reported data to WHO in the 2019 round of global TB data collection (1 July 2019).

BOX 6.2

International donor funding for TB prevention, diagnosis and treatment, based on donor reports to the OECD

Not all international donor funding that is provided for TB prevention, diagnosis and treatment is channelled through NTPs. The creditor reporting system (CRS) of the OECD is the most comprehensive source of information about international donor funding. As of 2018, funding data (both commitments and disbursements) are provided by 37 multilateral donor organizations; members of the OECD's Development Assistance Committee (DAC), which comprise 29 individual countries and the European Union; and a further 20 countries beyond the DAC that report to the OECD.

Disbursement data include both direct transfers to countries, and the provision of goods and services (e.g. in-kind transfers or technical assistance). Data on gross disbursements[a] for TB (code 12263: Tuberculosis control) received by non-OECD countries during 2007–2017 were analysed. Of note, funding for TB that flows from one OECD member to an institution or government within the OECD – for example, grants from the United States (US) National Institutes of Health (NIH) flowing to the United Kingdom – is not captured in the CRS. In addition, government contributions that are channelled through multilateral organizations are attributed to the multilateral organization, not the government of origin.[b]

Fig. B6.2.1 shows trends in international donor funding between 2007 and 2017, globally and for four of the major regions of the world, as organized geographically by the OECD. The total from all sources in 2017 was US$ 1.1 billion, a 3.5-fold increase from US$ 303 million in 2007. In 2017, 69% of international donor funding was provided by the Global Fund. The second largest donor was the US government, which contributed US$ 249 million (23% of the global total) in bilateral overseas development assistance for TB.[c] Given that about one third of the contributions to the Global Fund are from the US government, in 2017 about 46% of international donor funding for TB globally originated from the US government.

From 2007 to 2017, the Global Fund was consistently the largest provider of international donor funding (with the share averaging 64% in this period). The total from the Global Fund in 2017 was US$ 735 million. Disbursements from the US government steadily increased from 2006 to 2014, peaking at US$ 257 million in 2014 before declining to US$ 183 million in 2016, with a recovery to US$ 249 million in 2017.[c] The regional panels show that most international donor funding flows to Africa and Asia. ▶

FIG. B6.2.1

International donor funding for TB prevention, diagnosis and treatment by source, globally and by OECD region, 2007–2017

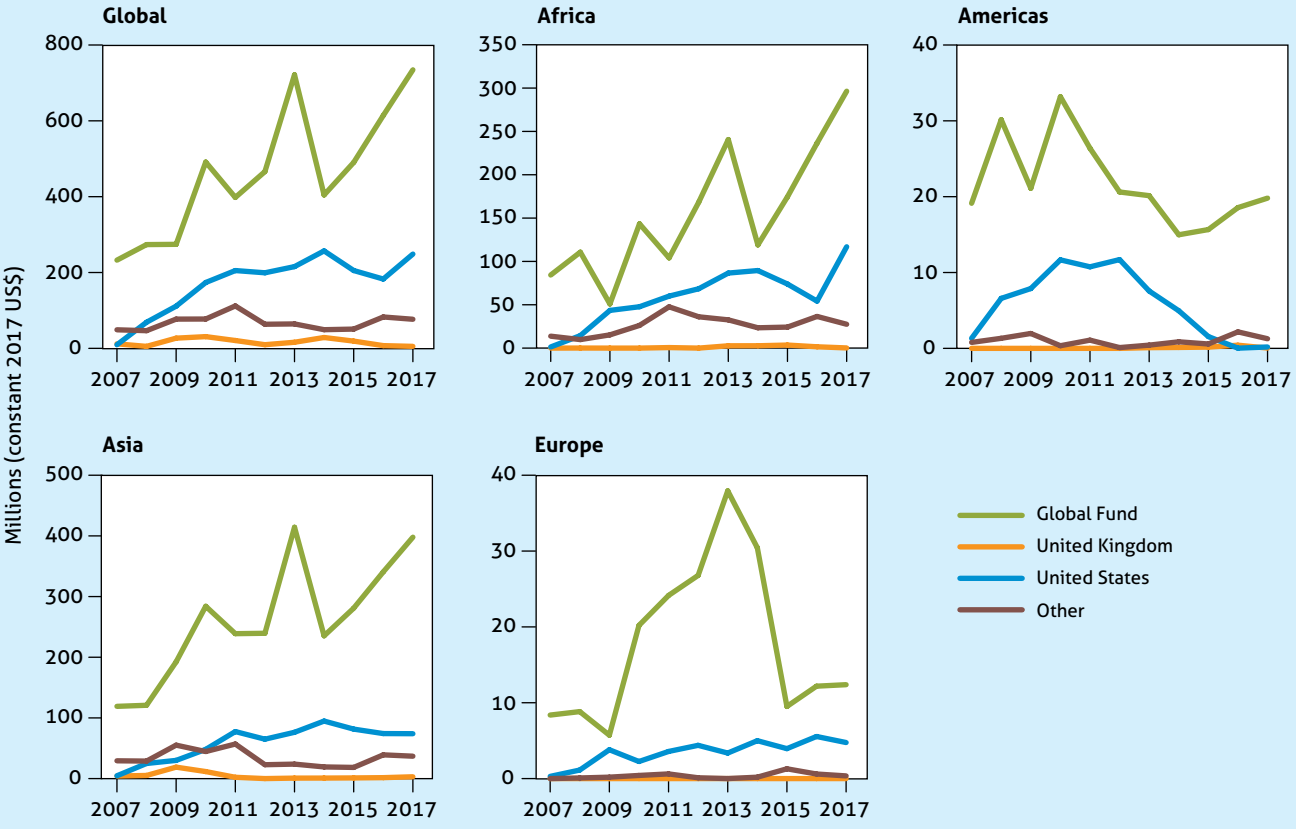


FIG. B6.2.2

International donor funding (in 2017 US$ millions) for TB prevention, diagnosis and treatment from individual countries, 2007–2017[d]

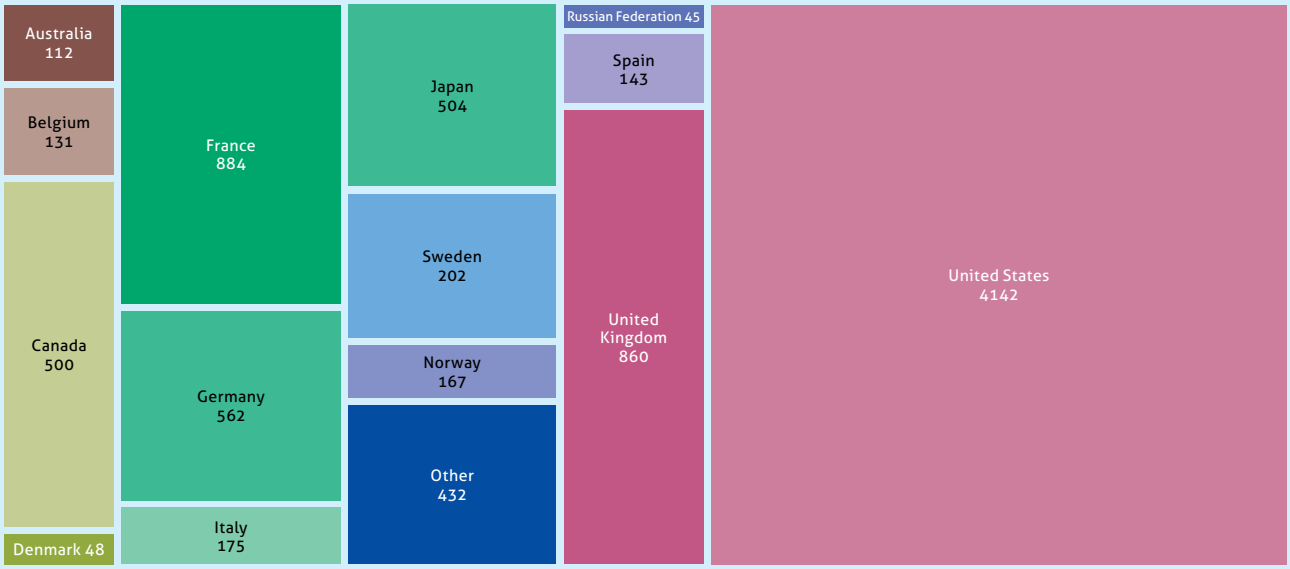


Fig. B6.2.2 shows the proportion and amounts of funding from 2007 to 2017 from individual DAC countries to non-OECD countries, including their estimated funding for TB via contributions to the Global Fund.[d] Over this period, 47% of funding came from the United States of America. The next largest individual country contributors were France (10%), the United Kingdom (10%), Canada (6%), Germany (6%) and Japan (6%).

Fig. B6.2.3 shows that international funding for TB is about one half that for malaria (US$ 2.1 billion in 2017) and about 14% of that for HIV (US$ 7.7 billion in 2017). To provide some context for these amounts, the DALYs lost due to illness and death for these three diseases in 2017 were 54 million for HIV/AIDS, 45 million for malaria and 45 million for TB.[e] This translates into US$ 142 of international donor financing per DALY lost for HIV, US$ 46 for malaria and US$ 24 for TB.

[a] As opposed to commitments, which may not materialize.
[b] An important example is funding from the Global Fund to non-OECD countries, which is attributed to the Global Fund and not to the governments or other entities that contribute to the Global Fund.
[c] Disbursements from the US government captured in the OECD database are lower than official allocations.
[d] Funding amounts include bilateral funding as well as estimated funding for TB via contributions to the Global Fund, with the assumption that 18% of Global Fund contributions are allocated to TB. It is also assumed that a country's contribution to TB funding provided by the Global Fund is the same as its share of total contributions to the Global Fund (e.g. if a country provided 5% of the total contributions to the Global Fund, it was assumed to provide 5% of the TB funding attributed to the Global Fund).
[e] See http://ghdx.healthdata.org/gbd-results-tool

FIG. B6.2.3

International donor funding for TB, HIV and malaria, 2007–2017

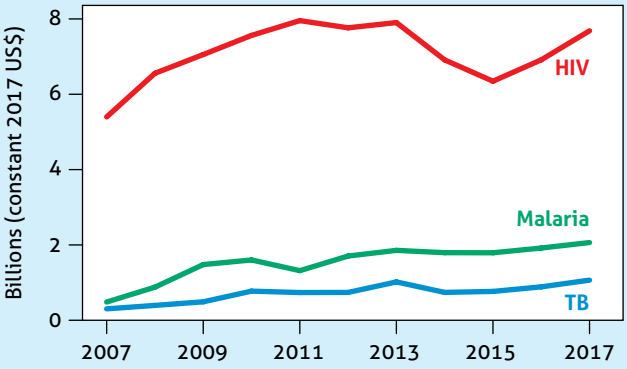
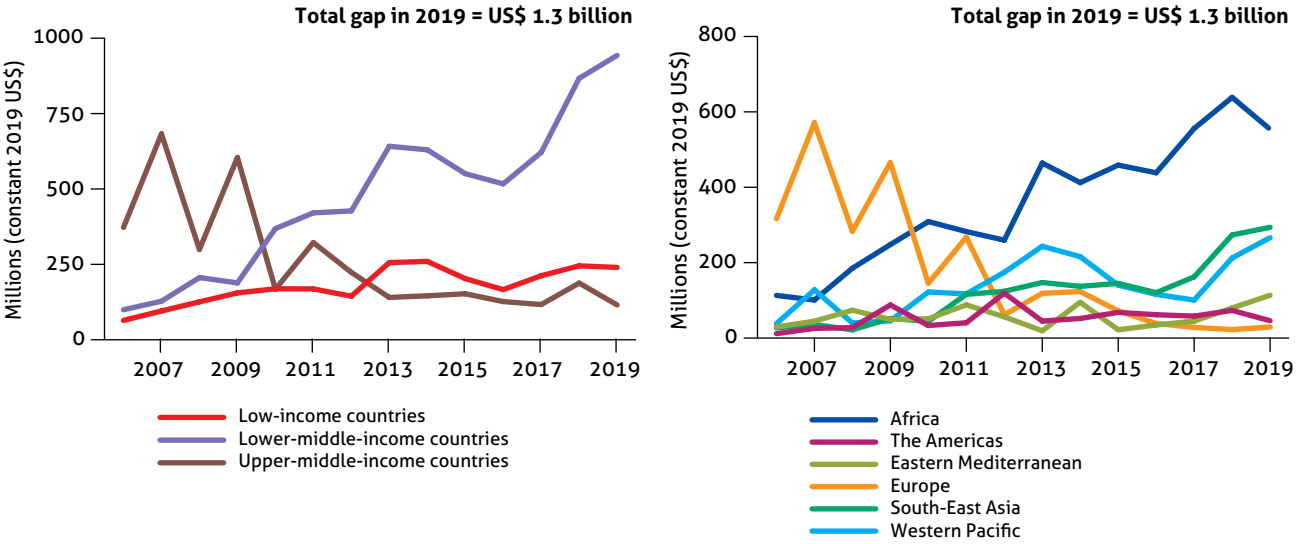


FIG. 6.9

Reported funding gaps for TB by income group and by WHO region, 2006–2019



15 countries included from the WHO European Region. Countries in Eastern Europe and Central Asia (EECA) have relatively high costs due to extensive use of hospitalization for patients in the intensive phase of treatment, with hospital admissions averaging 59 days per person in 2018. High programme costs relative to a smaller pool of patients also help to explain comparatively high per-patient costs in some countries (e.g. in Bulgaria, with a per-patient cost of US$ 12 791).

However, it is also evident that some EECA countries have markedly reduced the use of hospitalization and changed their model of care for patients with drug-susceptible TB. From 2014 to 2018, 14 of the 15 EECA countries reduced the number of bed days per patient. The relative size of the reduction (which is influenced by both the percentage of TB patients hospitalized and the average length of stay if hospitalized) ranged from 11% in Romania to 75% (54 to 14 days) in Armenia. In two of the countries with the largest number of TB cases, Kazakhstan and the Russian Federation, there were reductions of 15% (67 to 56 days) and 74% (70 to 18 days), respectively. The exception where the average number of days remained stable was Ukraine.

6.4.2 Multidrug-resistant TB

In the 87 countries for which the unit cost of MDR-TB treatment was estimated, the median cost in 2018 was US$ 6430 (Fig. 6.11). As with drug-susceptible TB, the cost per patient treated was positively correlated with GDP per capita.

Second-line drug costs accounted on average for 18% of total costs, while inpatient care and outpatient visits accounted for 27%. Between 2014 and 2018, the average length of hospital stay was stable at around 141 days (the median was also stable, at around 146 days). Nonetheless, the average length of stay fell in 75% (65/87) of these countries. The most drastic reductions were in Nicaragua (–92%, from 180 days to 15 days), Armenia (–85%, from 240 to 35 days) and Pakistan (–85%, from 100 to 15 days). In contrast, the average length of stay increased in several countries, including Kenya, Mozambique, Myanmar, Philippines, Thailand and Zimbabwe.

6.4.3 Recent efforts to improve evidence about the unit costs of TB services

The best way to estimate the unit costs of TB interventions in different countries is costing studies based on recommended methods, including primary data collection at national and local levels. However, such studies require people with expertise and experience in recommended methods for economic evaluation in the context of the health sector, as well as funding and time. Unfortunately, there is a global scarcity of recent costing studies for TB services; the Global Health Cost Consortium (GHCC), which is hosted at the University of Washington in Seattle, United States of America, has a unit cost study repository.[1]

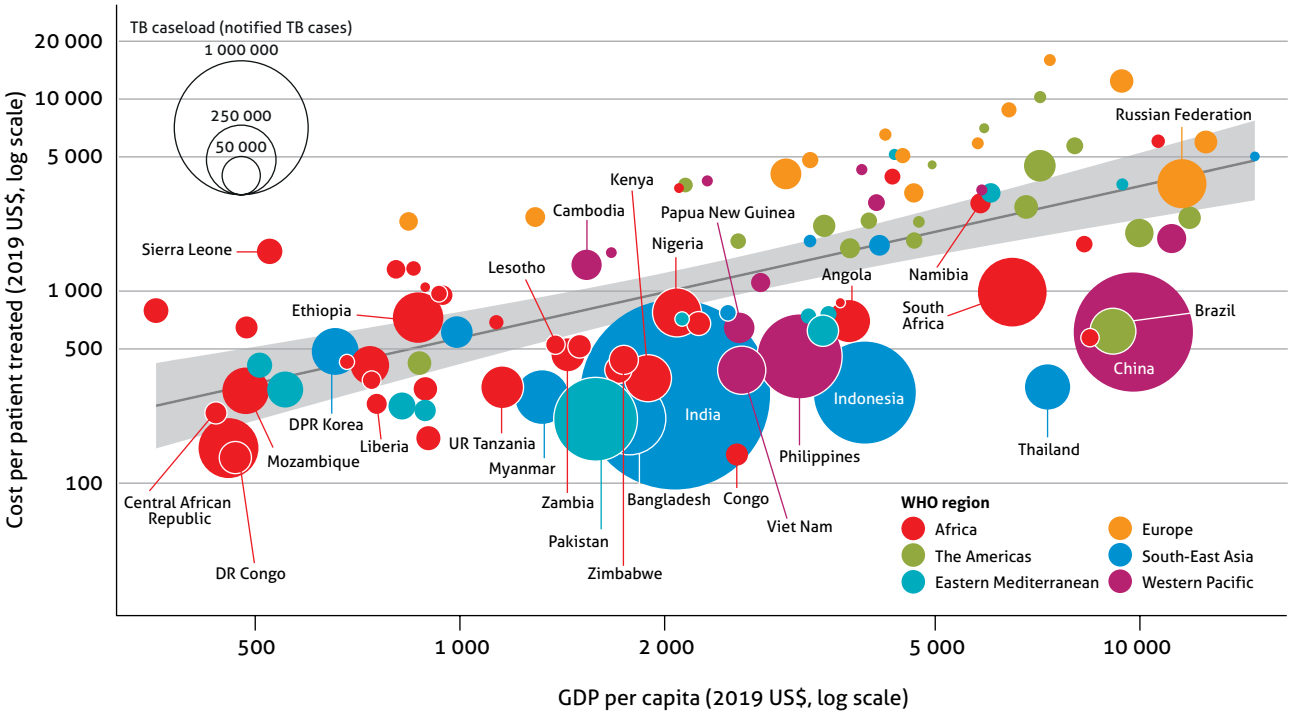
In 2017, efforts to update guidance on methods for costing TB services and to collect primary cost data in selected countries were initiated, with funding from the Bill & Melinda Gates Foundation. Partners involved include the GHCC, the London School of Hygiene & Tropical Medicine, the University of Cape Town, WHO, and NTPs and universities in countries that were selected for primary data collection.

A guidance document, *Costing guidelines for tuberculosis interventions (9)*, has been developed and published. It is consistent with the GHCC's *Reference case for estimating the costs of global health services and interventions (10)*, which provides a set of standardized principles and

[1] See https://ghcosting.org/.

FIG. 6.10

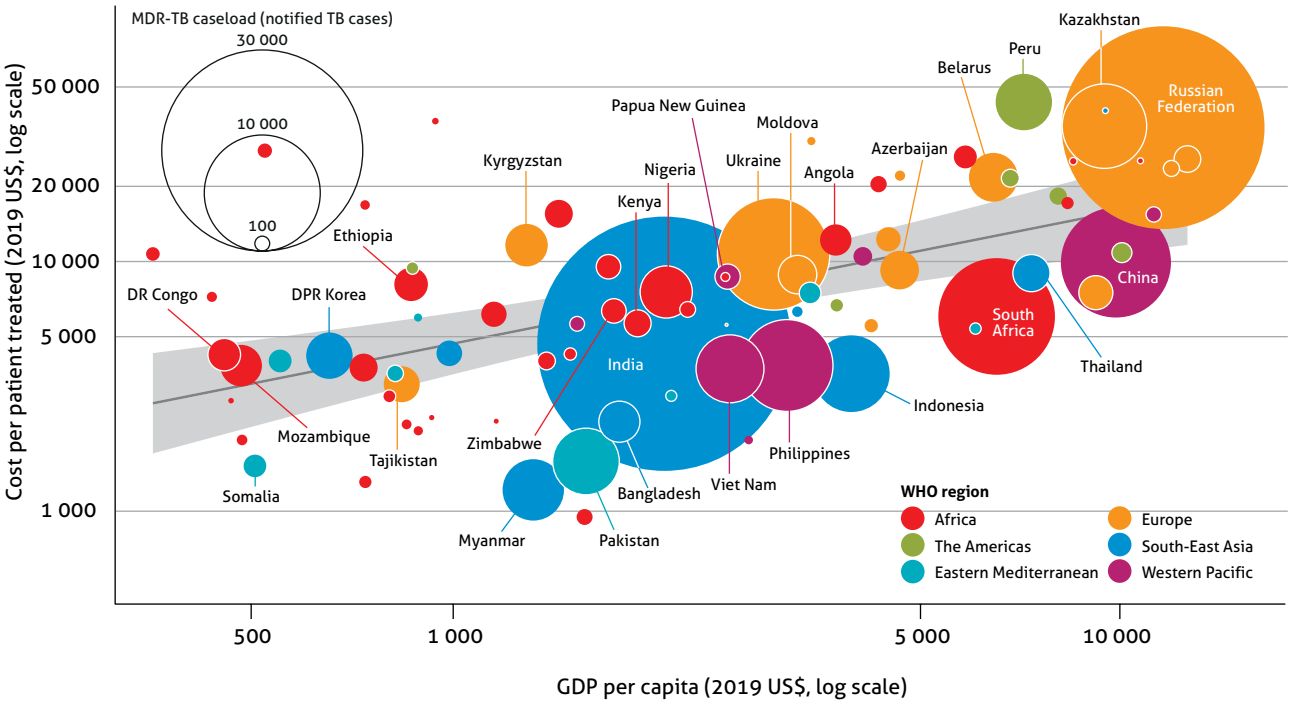
Estimated cost per patient treated for drug-susceptible TB in 109 countries, 2018[a]



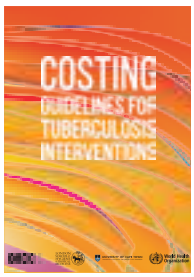
[a] Limited to countries with at least 100 patients on first-line treatment in 2018.

FIG. 6.11

Estimated cost per patient treated for MDR-TB in 87 countries, 2018[a]



[a] Limited to countries with at least 20 patients on second-line treatment in 2018.



methods for collecting and evaluating cost data from a provider perspective (as opposed to that of a patient or household). The TB guidelines define the main principles and methods related to costing of TB services provided in health facilities (e.g. inpatient care, outpatient visits, outreach services and laboratory tests), and they describe and explain the main steps in implementing a costing study, from protocol design to data analysis, reporting and use.[1] The guidance includes data-collection tools that can be adapted to align with the objectives of the study (e.g. to assess the cost–effectiveness of different interventions, or to inform budgeting and financial planning).

Users of the guidelines are expected to include health economists, staff in NTPs and ministries of health, and international funding and technical agencies.

The new guidance is being tested and applied for the first time by the London School of Hygiene & Tropical Medicine, the University of Cape Town and WHO in the Value-TB project. This project started in 2017 and will be completed in early 2020. It will provide standardized and comparable nationally representative estimates of the unit costs of TB services provided at health facility level in five countries: Ethiopia, Georgia, India, Kenya and the Philippines.

References

1 Floyd K, Fitzpatrick C, Pantoja A, Raviglione M. Domestic and donor financing for tuberculosis care and control in low-income and middle-income countries: an analysis of trends, 2002–11, and requirements to meet 2015 targets. Lancet Glob Health. 2013;1(2):e105–15 (https://www.ncbi.nlm.nih.gov/pubmed/25104145, accessed 2 July 2019).

2 Tuberculosis research funding trends 2005–2017. New York, NY: Treatment Action Group; 2018 (http://www.treatmentactiongroup.org/sites/default/files/tb_funding_2018_final.pdf, accessed 28 June 2019).

3 The Global Plan to End TB, 2016–2020. Geneva: Stop TB Partnership; 2015 (http://www.stoptb.org/global/plan/, accessed 28 June 2019).

4 Floyd K, Pantoja A, Dye C. Financing tuberculosis control: the role of a global financial monitoring system. Bull World Health Organ. 2007;85(5):334–40 (https://www.ncbi.nlm.nih.gov/pubmed/17639216, accessed 12 July 2018).

5 Cost effectiveness and strategic planning (WHO-CHOICE): health service delivery costs [website]. Geneva: World Health Organization; (https://www.who.int/choice/cost-effectiveness/inputs/health_service/en/, accessed 2 July 2019).

6 Stenberg K, Lauer JA, Gkountouras G, Fitzpatrick C, Stanciole A. Econometric estimation of WHO-CHOICE country-specific costs for inpatient and outpatient health service delivery. Cost Effectiveness and Resource Allocation. 2018;16(1):11 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5858135/, accessed 2 August 2019).

7 OECD/Eurostat/WHO. A system of health accounts. OECD Publishing; 2011 (https://www.who.int/health-accounts/methodology/sha2011.pdf, accessed 12 July 2018).

8 Moscow Declaration to End TB; First WHO global ministerial conference on ending TB in the sustainable development era: a multisectoral response. Geneva: World Health Organization and the Ministry of Health of the Russian Federation; 2017 (https://www.who.int/tb/Moscow_Declaration_MinisterialConference_TB/en/, accessed 28 June 2019).

9 Cunnama L, Garcia Baena I, Gomez G, Lawrence Y, Levin C, Siapka M et al. Costing guidelines for tuberculosis interventions. Geneva: World Health Organization; 2019.

10 Vassall A, Sweeney S, Kahn J, Gomez GB, Bollinger L, Marseille E et al. Reference case for estimating the costs of global health services and interventions. Global Health Cost Consortium; 2017 (https://ghcosting.org/pages/standards/reference_case, accessed 12 July 2018).

[1] The guidance is complementary to WHO guidance on assessment of costs faced by TB patients and their households; such costs are discussed in **Chapter 7**. In combination, they allow assessment of costs from a societal perspective.

Motorbike drivers wearing face masks in morning peak-hour traffic in Hanoi, Viet Nam.

Linh Pham/Getty Images

Chapter 7

Universal health coverage, multisectoral action and social determinants

Key facts and messages

Achieving the tuberculosis (TB) targets and milestones of the End TB Strategy and the TB target set in the Sustainable Development Goals (SDGs) requires provision of TB care and prevention within the broader context of universal health coverage (UHC), and multisectoral action to address the social and economic determinants and consequences of TB.

In 2017, the World Health Organization (WHO) developed a TB-SDG monitoring framework of 14 SDG-related indicators that are associated with TB incidence. These 14 indicators comprise four health-related risk factors under the health goal (SDG 3), three indicators related to health service coverage and expenditures (also under SDG 3) and seven indicators (related to poverty, social protection, undernutrition, income growth, income inequality, housing quality and indoor air pollution) under other SDGs.

UHC means that everyone can obtain the health services they need without suffering financial hardship. SDG Target 3.8 is to achieve UHC by 2030; the two indicators to monitor progress are a UHC service coverage index (SCI), and the percentage of the population experiencing household out-of-pocket expenditures on health care that are large in relation to household expenditures or income.

The SCI increased steadily between 2000 and 2017, from a global value of 45 (out of 100) in 2000 to 66 in 2017. Improvements were made in all WHO regions (especially the Western Pacific Region) and all World Bank income groups (especially low-income and lower-middle-income countries). However, values of the SCI in 2017 in the 30 high TB burden countries were mostly in the range 40–60, showing that much remains to be done to achieve UHC in these settings. Higher values in Brazil (79), China (79) and Thailand (80) are encouraging.

In 2015, at least 930 million people or 12.7% of the world's population faced out-of-pocket expenditures on health care that accounted for 10% or more of their household expenditure or income (a threshold used to define expenditures as "catastrophic"), up from 9.4% in 2010.

WHO estimates of the financial resources needed to make progress towards UHC and reach other SDG-related health targets by 2030 suggest that most middle-income countries could mobilize the required funding domestically, but that this is unlikely in low-income countries.

The End TB Strategy includes a target that no TB patients and their households face total costs (including direct medical expenditures, non-medical expenditures and income losses) that are catastrophic. From 2016 to 2019, 14 countries (including seven high TB burden countries) completed a national facility-based survey of costs faced by TB patients and their households. Best estimates of the percentage facing total costs that were catastrophic ranged from 27% to 83% for all forms of TB and from 67% to 100% for drug-resistant TB. Survey results have been used to inform approaches to financing, service delivery and social protection that will reduce these costs.

Many new cases of TB are attributable to five risk factors: undernourishment, smoking (especially among men), alcohol abuse, HIV infection, and diabetes. In 2018, the best estimates of the numbers of cases attributable to these risk factors were 2.3 million, 0.86 million (0.81 million among men), 0.83 million, 0.81 million and 0.36 million, respectively.

Although levels of undernourishment are falling in most of the 30 high TB burden countries, the prevalence of diabetes is increasing in all of them and in 10 the prevalence of smoking among men is above 40%. Actions to address these and other broader determinants of TB, including levels of poverty, are needed to accelerate the generally slow rates of decline in TB incidence in these countries.

The tuberculosis (TB) epidemic is strongly influenced by social and economic development, and by health-related risk factors. For example, numbers of TB cases and deaths started to decline in western Europe, North America and some other parts of the world around the turn of the 20th century, in association with growth in incomes, improvements in housing and better nutrition *(1, 2)*. The fastest declines in western Europe occurred in the 1950s and 1960s, in the context of universal health coverage (UHC), rapid social and economic development, and the availability of effective drug treatments. The links between TB and poverty, social protection, income per capita, indoor air pollution and the prevalence of undernutrition, diabetes, HIV, alcohol use and smoking are well recognized, and have been summarized elsewhere *(3–6)*.

Achieving the global milestones and targets for reductions in TB cases and deaths set in the End TB Strategy and the Sustainable Development Goals (SDGs) requires provision of TB care and prevention within the broader context of UHC, multisectoral action to address the social and economic determinants and consequences of TB, and technological breakthroughs by 2025 so that incidence can fall much faster than it has done historically (this is explained in more detail in **Chapter 2**). The 2025 milestones are a 75% reduction in the annual number of TB deaths and a 50% reduction in the TB incidence rate (new cases per 100 000 population per year) compared with levels in 2015; the 2030 targets are a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate compared with 2015. Closely linked to the broader UHC agenda, the End TB Strategy also includes the target that no TB patients and their households face catastrophic costs (including direct medical expenditures, non-medical expenditures and income losses) due to TB disease.

This chapter discusses UHC and a range of health, social and economic factors that influence the TB epidemic and the consequences of developing TB disease. **Section 7.1** describes and explains a TB-SDG monitoring framework developed by the World Health Organization (WHO) to help focus attention on SDG-related indicators that are associated with trends in TB incidence. Analysis of these indicators can inform action in the health sector and beyond. **Section 7.2** provides an overview of the status of progress towards UHC at global, regional and country levels, and a summary of WHO estimates of the resources required for progress towards UHC and other SDG health targets during the period 2016–2030. This includes presentation and discussion of the two SDG indicators for UHC as well as a third indicator of health expenditure per capita. **Section 7.3** synthesizes results from national facility-based surveys of costs faced by TB patients and their households completed in 2016–2019 and highlights the implications of these results for approaches to TB service delivery, financing and social protection. **Section 7.4** describes the status of four health-related risk factors for TB (diabetes, HIV infection, smoking and alcohol use) and seven other indicators (related to poverty, social protection, undernutrition, income growth, income inequality, housing quality and indoor air pollution) that are part of the TB-SDG monitoring framework.

7.1 A TB-SDG monitoring framework

A TB-SDG monitoring framework was developed by WHO in 2017, linked to preparations for the first global ministerial conference on TB (**Chapter 2**). It was based on previously published work *(3–6)* that identified clear linkages between TB incidence and various indicators that are part of the SDG framework, and new analysis of the relationship between these indicators and TB incidence.[1] The TB-SDG framework comprises 14 indicators under seven SDGs (**Table 7.1**).

For SDG 3, the seven indicators selected for monitoring are:

- coverage of essential health services;
- proportion of the population with large household expenditures on health as a share of total household expenditure or income;
- current health expenditure per capita;
- HIV prevalence;
- prevalence of smoking;
- prevalence of diabetes; and
- prevalence of alcohol use disorder.

For SDGs 1, 2, 7, 8, 10 and 11, the seven indicators selected for monitoring are:

- proportion of the population living below the international poverty line;
- proportion of the population covered by social protection floors or systems;
- prevalence of undernourishment;
- proportion of the population with primary reliance on clean fuels and technology;
- gross domestic product (GDP) per capita;
- Gini index for income inequality;[2] and
- proportion of the urban population living in slums.

The framework includes only indicators for which a relationship with TB incidence could be established. It excludes:

- subindicators of indicators that have already been included (e.g. subindicators related to UHC, under SDG 3); and
- indicators that are only remotely associated with TB risks, and that operate mainly through other SDGs (e.g. education under SDG 4, gender equality under SDG 5 and resilient infrastructure under SDG 9).

Collection and reporting of data for the 14 indicators does not require any additional data collection and reporting efforts by national TB programmes (NTPs). Nor does

[1] Monitoring and evaluation of TB in the context of the Sustainable Development Goals: Background Paper for WHO Ministerial Conference on "TB in the context of the Sustainable Development Goals". Available on request from WHO Global TB Programme.

[2] The index can take values between 0 and 1, with 0 representing perfect equality and 1 representing perfect inequality.

TABLE 7.1a

TB-SDG monitoring framework: indicators to monitor within SDG 3

SDG 3: Ensure healthy lives and promote well-being for all at all ages					
SDG TARGETS FOR 2030	**SDG INDICATORS**	**ALTERNATIVE INDICATORS TO MONITOR**	**RATIONALE**	**DATA SOURCE**	**COLLECT DATA FOR TB PATIENTS SPECIFICALLY?**
3.3 End the epidemics of AIDS, TB, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	**3.3.1** Number of new HIV infections per 1000 uninfected population **3.3.2** TB incidence per 100 000 population	HIV prevalence	HIV is a strong risk factor for development of TB disease and is associated with poorer treatment outcomes. HIV prevalence is selected in preference to HIV incidence because it is directly measured.	UNAIDS WHO	Yes, already routinely collected. NA
3.4 Reduce premature mortality by one third from non-communicable diseases and promote mental health and well-being	**3.4.1** Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease	Prevalence of diabetes	Diabetes is a strong risk factor for development of TB disease, although a link with TB incidence at the national (as opposed to individual) level has been difficult to establish due to confounding. Diabetes prevalence is more relevant than mortality for TB since it directly influences the risk of developing TB.	WHO	Could be considered at country level, to inform planning of care for comorbidities.
3.5 Strengthen prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	**3.5.2** Alcohol consumption per capita per year (in litres of pure alcohol) among those aged ≥15 years (harmful level defined nationally)	Prevalence of alcohol use disorder	Alcohol use is a strong risk factor for TB disease and poorer treatment outcomes at the individual level, although a link with TB incidence at the national (as opposed to individual) level has been hard to establish due to confounding. The prevalence of alcohol use disorder is the most relevant indicator in the context of TB.	WHO	Could be considered at country level, to inform planning of care for comorbidities.
3.8 Achieve UHC, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	**3.8.1** Coverage of essential health services (defined as the average coverage of essential services based on 16 tracer interventions). **3.8.2** Proportion of population with large household expenditures on health as a share of total household expenditure or income	NA NA	Achieving UHC is required to achieve the three high-level targets of the End TB Strategy for reductions in the TB incidence rate, reductions in the number of TB deaths and elimination of catastrophic costs for TB patients and their households. TB treatment coverage has been monitored for years and is one of the 16 tracer indicators that have been selected to measure SDG indicator 3.8.1.	WHO	To assess progress in elimination of catastrophic costs for TB patients and their households, periodic facility-based surveys of TB patients are recommended.
3.a Strengthen implementation of the WHO Framework Convention on Tobacco Control	**3.a.1** Age-standardized prevalence of current tobacco use among those aged ≥15 years	Prevalence of smoking among those aged ≥15 years (%)	Smoking is a strong risk factor for TB disease at the individual level, although a link with TB incidence at the national (as opposed to individual) level has been difficult to establish due to confounding.	WHO	Could be considered (e.g. to inform access to smoking cessation interventions).
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	**3.c.1** Health worker density and distribution	Current health expenditure per capita	Health expenditure per capita is correlated with TB incidence.	WHO	No

AIDS, acquired immune deficiency syndrome; HIV, human immunodeficiency virus; NA, not applicable; SDG, Sustainable Development Goal; TB, tuberculosis; UHC, universal health coverage; UNAIDS, Joint United Nations Programme on HIV/AIDS; WHO, World Health Organization

TABLE 7.1b

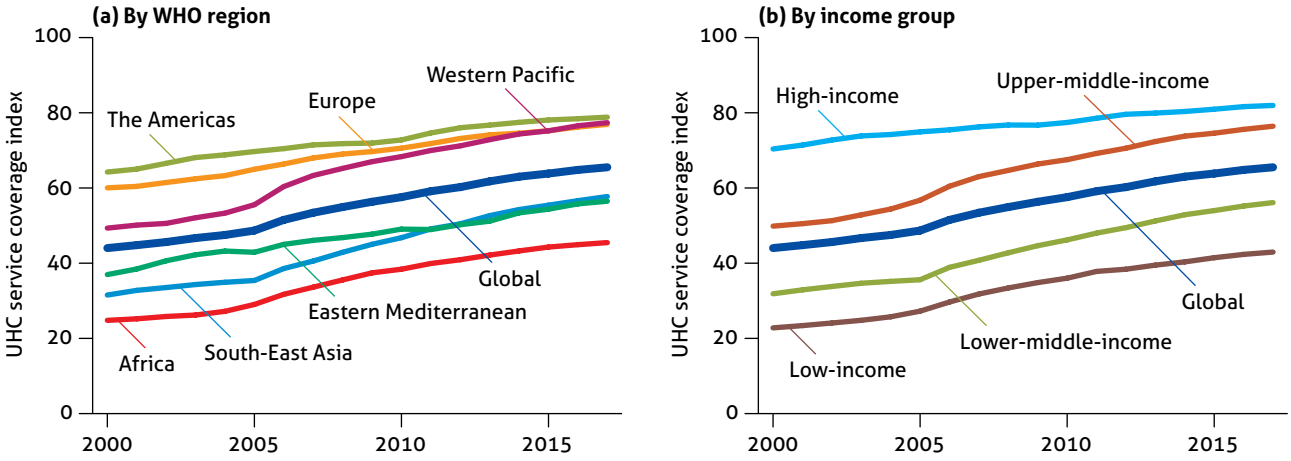
TB-SDG monitoring framework: indicators to monitor beyond SDG 3

SDG TARGETS FOR 2030	SDG INDICATORS	ALTERNATIVE INDICATORS TO MONITOR	RATIONALE	DATA SOURCE	COLLECT DATA FOR TB PATIENTS SPECIFICALLY?
SDG 1: End poverty in all its forms everywhere					
1.1 Eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	**1.1.1** Proportion of population living below the international poverty line	NA	Poverty is a strong risk factor for TB, operating through several pathways. Reducing poverty should also facilitate prompt health-care seeking. Countries with higher levels of social protection have lower TB burden. Progress on both indicators will help to achieve the End TB Strategy target to eliminate catastrophic costs for TB patients and their households.	UN SDG database, World Bank	No
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and achieve substantial coverage of the poor and vulnerable	**1.3.1** Proportion of population covered by social protection floors/systems	NA			Could be considered (e.g. to facilitate access to social protection).
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture					
2.1 End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food year-round	**2.1.1** Prevalence of undernourishment	NA	Under-nutrition weakens the body's defence against infections and is a strong risk factor for TB at the national and individual level.	UN SDG database	Could be considered (e.g. to plan food support).
SDG 7: Ensure access to affordable, reliable, sustainable, and modern energy for all					
7.1 Ensure universal access to affordable, reliable and modern energy services	**7.1.2** Proportion of population with primary reliance on clean fuels and technology	NA	Indoor air pollution is a risk factor for TB disease at the individual level. There has been limited study of ambient air pollution but it is plausible that it is linked to TB incidence.	WHO	No
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all					
8.1 Sustain per capita growth in accordance with national circumstances and, in particular, at least 7% GDP growth per year in the least developed countries	**8.1.1** Annual growth rate of real GDP per capita	GDP per capita	Historic trends in TB incidence are closely correlated with changes in the absolute level of GDP per capita (but not with the growth rate).	World Bank	No
SDG 10: Reduce inequality within and among countries					
10.1 Achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average	**10.1.1** Growth rates of household expenditure or income per capita, overall and for the bottom 40% of the population	Gini index for income inequality	TB is a disease of poverty. Decreasing income inequalities combined with economic growth should have an effect on the TB epidemic.	World Bank OECD	No
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable					
11.1 Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	**11.1.1** Proportion of urban population living in slums, informal settlements or inadequate housing	NA	Living in a slum is a risk factor for TB transmission due to its link with overcrowding. It is also a risk factor for developing TB disease, due to links with air pollution and under-nutrition.	UN SDG database	No

GDP, gross domestic product; NA, not applicable; OECD, Organisation for Economic Co-operation and Development; SDG, Sustainable Development Goal; TB, tuberculosis; UN, United Nations; WHO, World Health Organization.

FIG. 7.1

Trends in the UHC service coverage index in WHO regions and World Bank income groups, 2000–2017



Source: WHO Universal Health Coverage data portal (http://apps.who.int/gho/portal/uhc-overview.jsp)

it require data collection and reporting efforts that go beyond those to which countries have already committed in the context of the SDGs. At the global level, the United Nations (UN) has established a monitoring system for SDG indicators, and countries are expected to report data on an annual basis via the appropriate UN agencies (including WHO). Therefore, analysis of the status of, and trends in, the 14 indicators related to TB can be based primarily on data held in the UN's SDG database, as shown in **Table 7.1**.[1] In some cases, the official SDG indicator was not considered the best metric, and a better (but closely related) alternative was identified and justified (five indicators under SDG 3, one under SDG 8 and one under SDG 10). In such cases, the data sources are one of the following: WHO, the Organisation for Economic Co-operation and Development (OECD), the Joint United Nations Programme on HIV/AIDS (UNAIDS) or the World Bank.

7.2 Global progress towards UHC

UHC means that everyone can obtain the health services they need without suffering financial hardship *(7)*.

The SDG targets are for 2030, and SDG Target 3.8 is defined as "Achieve UHC, including financial risk protection, access to quality essential health care services and access to safe, effective, quality and affordable essential medicines and vaccines" (**Table 7.1a**).

Two SDG indicators have been defined to monitor progress towards SDG Target 3.8. The first (Indicator 3.8.1) is the coverage of essential health services; this is a composite index (with values from 0 to 100) that is based on 16 tracer indicators (one of which is TB treatment[2]). The second (Indicator 3.8.2) is the "proportion of the population with large household expenditures on health as a share of total household expenditure or income".[3] The SDG framework includes two alternative thresholds (10% and 25%) to define "large". When these thresholds for household out-of-pocket expenditures[4] are surpassed, WHO reports on tracking progress towards UHC classify them as "catastrophic".

The latest WHO report on tracking progress towards UHC was released in September 2019 *(8)*. It included an assessment of the status of the two SDG indicators for UHC based on the latest available data, and key findings are summarized here. For catastrophic health expenditures, results based on the threshold of 10% of household expenditure and income are cited.

7.2.1 UHC service coverage index

The service coverage index (SCI) increased steadily between 2000 and 2017, from a global value of 45 (out of 100) in 2000 to 66 in 2017 (**Fig. 7.1**). Improvements were made in all WHO regions (especially the Western Pacific Region) and all World Bank income groups. In both 2000 and 2017, low-income and lower-middle-income countries had the lowest SCI values; however, they also had the fastest rate of increase. There was little change over time in high-income countries.

National values for the SCI in 2017 are shown in **Fig. 7.2**. There was a great deal of variation among countries. The

[1] Further details are provided in **Annex 1**.

[2] The indicator used in the WHO/World Bank report is "effective TB treatment coverage" *(8)*. It was calculated as treatment coverage multiplied by the treatment success rate, to capture a "quality" dimension of care. This differs from the definition of "treatment coverage" in the list of priority End TB Strategy indicators (see **Chapter 2**).

[3] Since this measure is population based, the denominator includes many people who either did not use health services or had only very minor contact with the health system.

[4] Out-of-pocket health expenditures are defined as household spending on medicines, health products and health care services (outpatient, inpatient and other health services such as medical laboratory services) that are not reimbursed by a third party (e.g. the government, a health insurance fund or a private insurance company). They exclude household spending on health insurance premiums.

highest values were in high-income countries in Asia, Europe and North America. The lowest values were predominantly in countries in the WHO African Region; other countries with values below 40 were Afghanistan and Somalia. Values of the SCI in 2017 in the 30 high TB burden countries were mostly in the range 40–60 (**Table 7.2**), showing that much remains to be done to achieve UHC in these settings. However, higher values in Brazil (79), China (79) and Thailand (80) are encouraging.

7.2.2 Proportion of the general population incurring catastrophic expenditures on health

In contrast to improvements in the SCI, the proportion of the general population facing catastrophic expenditures on health has increased in recent years. Globally, the proportion of households that incurred expenditures on health that were above 10% of their income or expenditure rose from 9.4% in 2010 to 12.7% (930 million people) in 2015.[1] National values are shown in **Fig. 7.3**. More geographic variability is evident for this indicator than for the SCI, including within regions.

Countries in the highest category for catastrophic expenditures on health (≥15% of the general population) include those that rank first (India) and second (China) in terms of their total number of TB cases, Brazil and several countries in the WHO African Region. In high TB burden countries, the median value during the period 2007–2018 was 4.9% (**Table 7.2**).

Countries with the lowest levels (0–3%) include a mix of high-income, middle-income and low-income countries. Importantly, some countries may have low levels of measured spending on health because people do not access health care at all, or because capacity to spend household resources on health is very low. One example is Mozambique, for which the value of the SCI was 46 while the estimated proportion of households facing catastrophic expenditures on health was 1.6% (based on data for 2014).

7.2.3 UHC financing prospects, 2016–2030

In 2017, WHO published estimates of the resources needed during the period 2016–2030 to make progress towards UHC and to reach other SDG-related health targets. These were compared with projected total health expenditures in the same time period. Referred to in shorthand as the *WHO SDG health price tag (9)*, the estimates are for 67 low- and middle-income countries that account for 75% of the world's population, and they focus on the additional (or incremental) resources needed compared with levels in 2014. Two scenarios were considered for resource needs (termed "ambitious" and "progress"); also, two scenarios (referred to as "moderate" and "optimistic") were considered for total health expenditures.

Key findings included the following:

- In the "ambitious" scenario for resource needs (based on achievement of the 2030 SDG targets), the additional investment (compared with 2014) required per year grew from US$ 134 billion in 2016 to US$ 371 billion (equivalent to an extra US$ 58 per person) in 2030.
- Most of the increased investment required (75% of the total) was for expanding and strengthening the health workforce and health services infrastructure (including buildings and medical equipment) to reach recommended benchmarks. The remainder was for specific priorities, including TB. The largest share of investments needed for specific diseases or programmes was accounted for by noncommunicable diseases.
- Overall, health expenditure (in both the "moderate" and "optimistic" scenarios) was projected to be sufficient to cover "ambitious" scenario investment needs in middle-income countries. This is potentially positive news, given that 84% of the estimated burden of TB (in terms of new cases each year) is in middle-income countries. However, given uneven capacity to mobilize additional resources, some countries were expected to face gaps, especially in the first few years. In the period 2026–2030, it was predicted that about five of the 39 middle-income countries included in the analysis would face funding gaps.
- Overall, projected health expenditures were not sufficient to cover investment needs in low-income countries, even in the "optimistic" scenario for health expenditures and the "progress" scenario for resource needs.
- Improved revenue generation and management of public expenditures, and increased public health budgets, were needed in both low- and middle-income countries.

Trends in health expenditure (from all sources of funding) per capita over the period 2000–2016 in the 30 high TB burden countries are shown in **Fig. 7.4**. There was a striking increase in the absolute amount of spending per person in a few countries: Brazil, China, the Russian Federation, South Africa and Thailand. A steady upward trend was evident in India, Indonesia, the Philippines and Viet Nam; also, despite some year-to-year fluctuation, funding in Namibia doubled. Elsewhere, levels of spending were relatively stable, and at generally much lower levels.

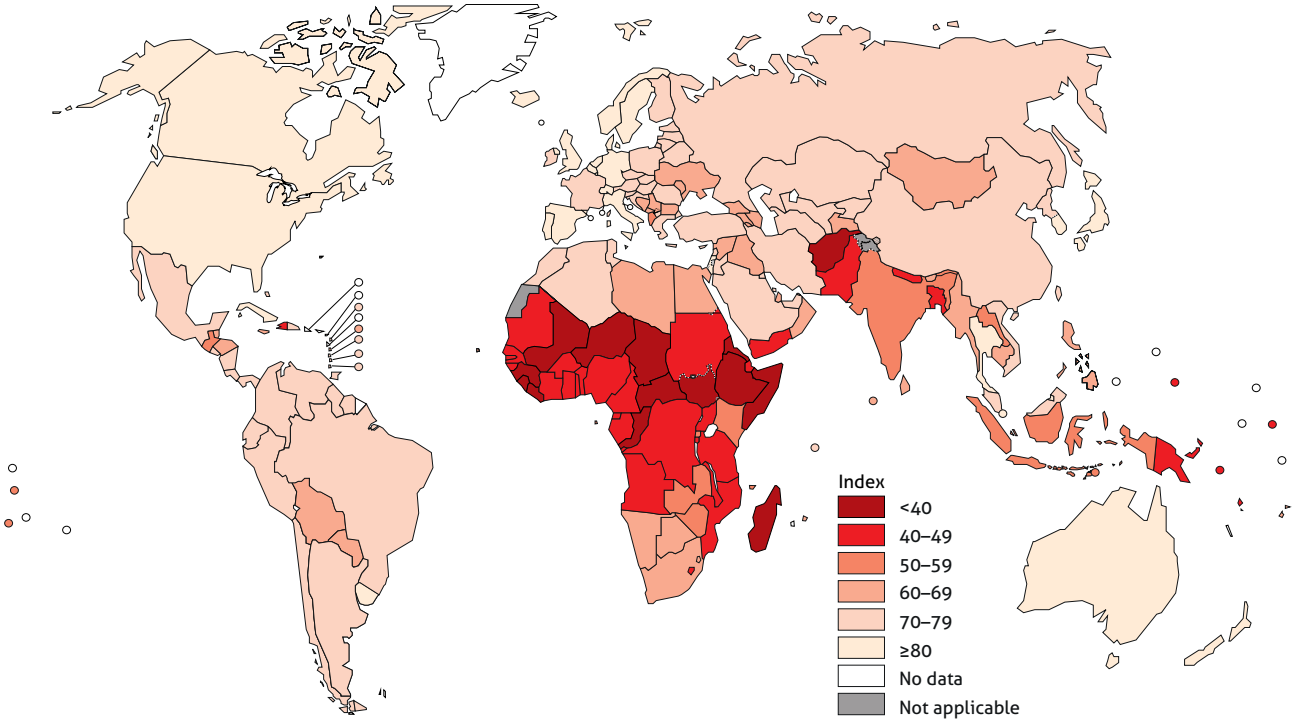
7.3 National surveys of costs faced by TB patients and their households (TB patient cost surveys)

The End TB Strategy includes the target that no TB patients and their households face catastrophic costs (including direct medical expenditures, non-medical expenditures and income losses) due to TB disease (**Chapter 2**). Monitoring of progress towards this target can also inform monitoring of progress towards UHC. The distinction between the indicator of catastrophic total costs due

[1] Estimates for later years are not yet available.

FIG. 7.2

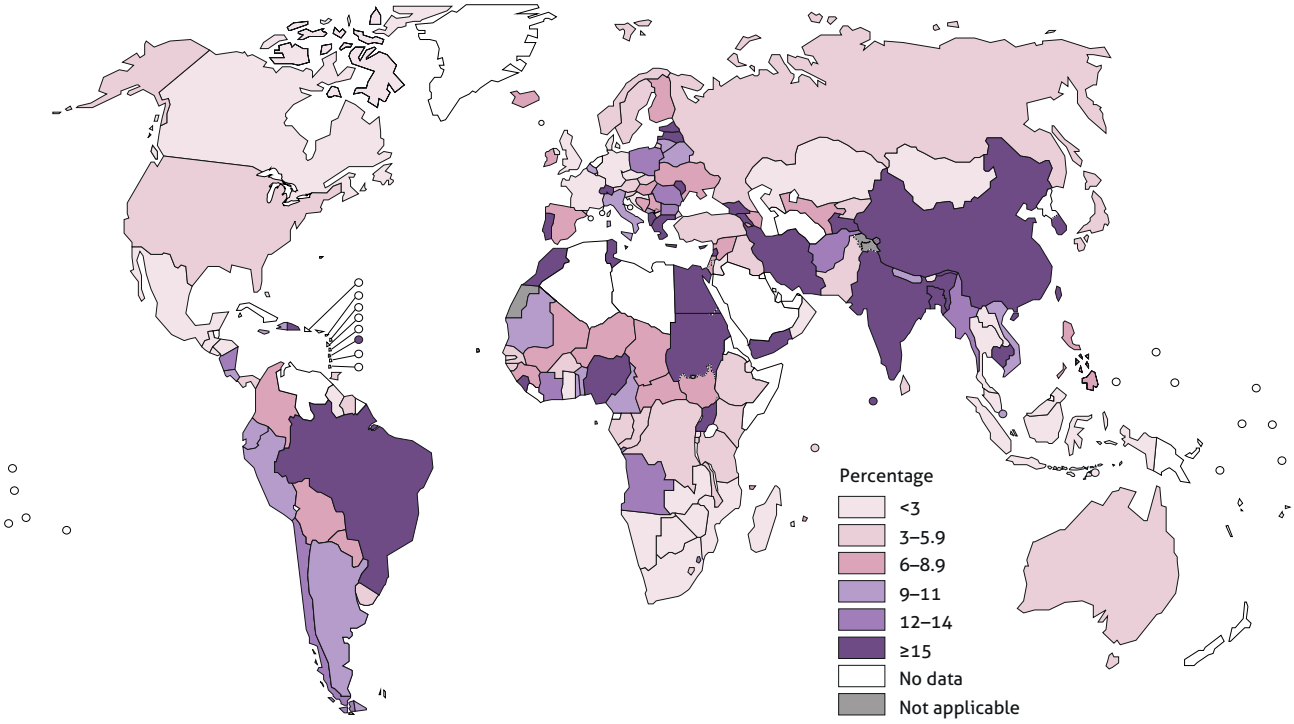
UHC service coverage index by country, 2017



Source: WHO Universal Health Coverage data portal (http://apps.who.int/gho/portal/uhc-overview.jsp)

FIG. 7.3

Percentage of the general population facing catastrophic health expenditures,[a] latest available year of data[b]



[a] Defined as ≥10% of total household consumption or income.
[b] The latest available year ranges from 1993 to 2018.

Source: WHO Universal Health Coverage data portal (http://apps.who.int/gho/portal/uhc-financial-protection-v3.jsp)

TABLE 7.2

UHC service coverage index (SDG 3.8.1)[a] and percentage of the general population facing catastrophic health expenditures (SDG 3.8.2),[b] 30 high TB burden countries, stratified by income group[c]

COUNTRY	SERVICE COVERAGE INDEX	CATASTROPHIC HEALTH EXPENDITURE
LOW INCOME		
Mozambique	46	1.6
UR Tanzania	43	3.8
DR Congo	41	4.8
Ethiopia	39	4.9
Central African Republic	33	6.7
Sierra Leone	39	54
Liberia	39	
DPR Korea	71	
LOWER-MIDDLE-INCOME		
Zambia	53	0.3
Zimbabwe	54	2.1
Indonesia	57	2.7
Pakistan	45	4.5
Lesotho	48	4.5
Congo	39	4.6
Kenya	55	5.4
Philippines	61	6.3
Viet Nam	75	9.4
Angola	40	12
Myanmar	61	14
Nigeria	42	15
Cambodia	60	15
India	55	17
Bangladesh	48	25
Papua New Guinea	40	
UPPER-MIDDLE-INCOME		
Namibia	62	1.2
South Africa	69	1.4
Thailand	80	2.2
Russian Federation	74	4.9
China	79	20
Brazil	79	26

Blank cells indicate data were not available.

[a] Data are for 2017.

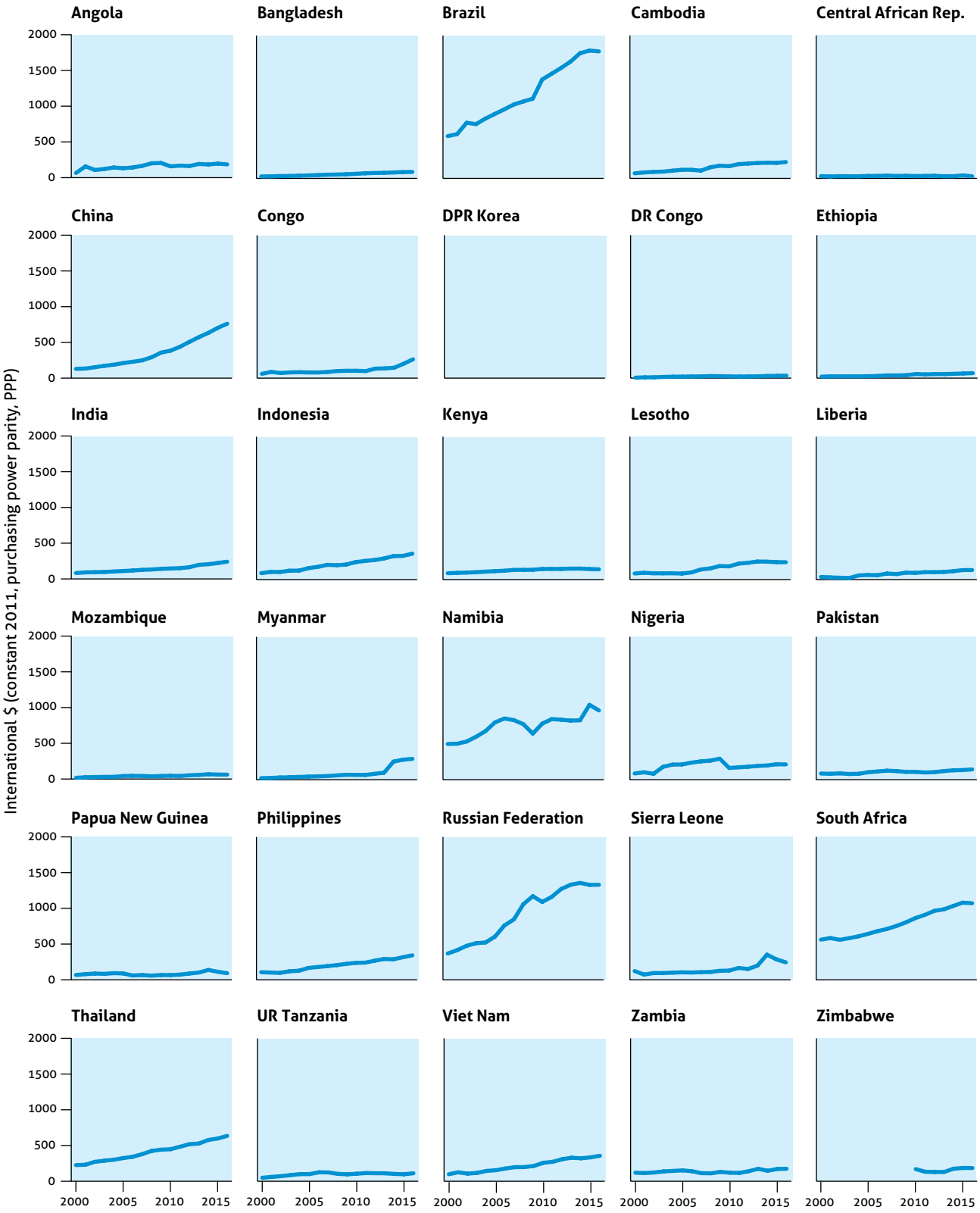
[b] Defined as ≥ 10% of total household consumption or income. The latest available year ranges from 2007 to 2018 for 30 high TB burden countries.

[c] Countries are listed within each income group (as per the 2019 World Bank classification) according to their level of catastrophic health expenditures (from lowest to highest).

Source: WHO Universal Health Coverage data portal (http://apps.who.int/gho/portal/uhc-financial-protection-v3.jsp)

FIG. 7.4

Current health expenditure per capita, 30 high TB burden countries, 2000–2016



Source: WHO Global Health Expenditure Database (http://apps.who.int/nha/database/ViewData/Indicators/en, accessed 20 May 2019)

BOX 7.1

The difference between "catastrophic total costs" for TB patients and their households, and the SDG indicator of catastrophic expenditures on health care

It is important to distinguish between the indicator of "the proportion of the population with large household expenditures on health as a share of total household expenditure or income" used within the SDG monitoring framework (SDG Indicator 3.8.2) and the indicator of "the percentage of TB patients and their households facing catastrophic costs due to TB" that is part of the WHO End TB Strategy.

The SDG indicator is for the general population and health expenditures are defined as direct expenditures on medical care. This indicator attempts to capture the impact of direct health spending on economic well-being at household level. The denominator includes many people who had no contact with the health system and thus had zero expenditures on health. Although these people did not experience financial hardship as a consequence of direct expenditures on health care, they may nonetheless have faced financial barriers to accessing health services that they needed.

Due to the nature of the illness, TB patients and their households can face severe direct and indirect financial and economic costs. These pose barriers which can greatly impact their ability to complete treatment successfully. Costs included in the TB-specific indicator include not only direct medical payments for diagnosis and treatment, but also direct non-medical payments (e.g. for transportation and lodging) and indirect costs (e.g. lost income). In contrast to SDG indicator 3.8.2, the TB-specific indicator is restricted to a particular population: diagnosed TB patients who are users of health services that are part of NTP networks.

Given these conceptual differences, the percentage of TB patients facing "catastrophic total costs" (defined as costs that account for 20% or more of their household income) is expected to be much higher than the percentage of the general population facing catastrophic expenditures on health care. Hence, the two indicators cannot and should not be compared directly.

to TB disease and the broader indicator of catastrophic spending on health care (**Section 7.2.2**) is explained in **Box 7.1**.

In 2015, WHO established a standardized protocol for conducting a national survey to assess the direct and indirect costs incurred by TB patients and their households (TB patient cost surveys). Based on experience in pathfinding countries that conducted the first surveys, the protocol was refined and expanded into a handbook in 2017 *(10)*.

TB patient cost surveys have three primary objectives:

- to document the magnitude and main drivers of different types of costs incurred by TB patients (and their households);
- to assess the percentage of TB patients (and their households) treated in the NTP network who incur total costs due to TB that are catastrophic; and
- to use survey findings as the basis for actions to reduce financial barriers to accessing care and to minimize the adverse socioeconomic impact of TB.

In the context of TB patient cost surveys, catastrophic costs for TB patients and their households have been defined as direct medical and non-medical costs plus income losses that sum to 20% or more of household income.

WHO recommends conducting a baseline survey by 2020 at the latest, especially in high TB burden countries.

7.3.1 Global progress in implementation of surveys

The status of progress in planning and implementation of national TB patient cost surveys is shown in **Fig. 7.5**. By July 2019, 14 countries had completed a survey:[1] China (2017), Fiji (2017), Ghana (2016), Kenya (2017), Lao People's Democratic Republic (2019), Mongolia (2017), Myanmar (2015), Nigeria (2017), the Philippines (2017), Republic of Moldova (2017), Timor-Leste (2017), Uganda (2017), Viet Nam (2016) and Zimbabwe (2018).[2]

In July 2019, national surveys were underway in nine countries: Brazil, the Democratic Republic of the Congo, Dominican Republic, Lesotho, Malawi, Papua New Guinea, Solomon Islands, Sudan and the United Republic of Tanzania. In a further 28 countries, surveys were scheduled to start in 2019 or 2020: Bangladesh, Bhutan, Burkina Faso, Cameroon, Colombia, Ethiopia, El Salvador, Gabon, Guatemala, Honduras, India, Indonesia, Japan, Maldives, Mali, Mauritania, Mozambique, Namibia, Nepal, Paraguay, Portugal, Romania, Senegal, South Africa, Sri Lanka, Thailand, the United Kingdom of Great Britain and Northern Ireland, and Zambia.

The main survey results for 12 countries are shown in **Fig. 7.6**. The plot on the left shows the best estimate of the percentage of TB patients and their households that faced catastrophic costs among all TB patients, and the associ-

[1] Defined as having completed survey field work, analysis of data, and documentation of results (e.g. in a report).

[2] The year indicates the year in which data were collected.

FIG. 7.5

National surveys of costs faced by TB patients and their households since 2016: progress and plans (as of July 2019)

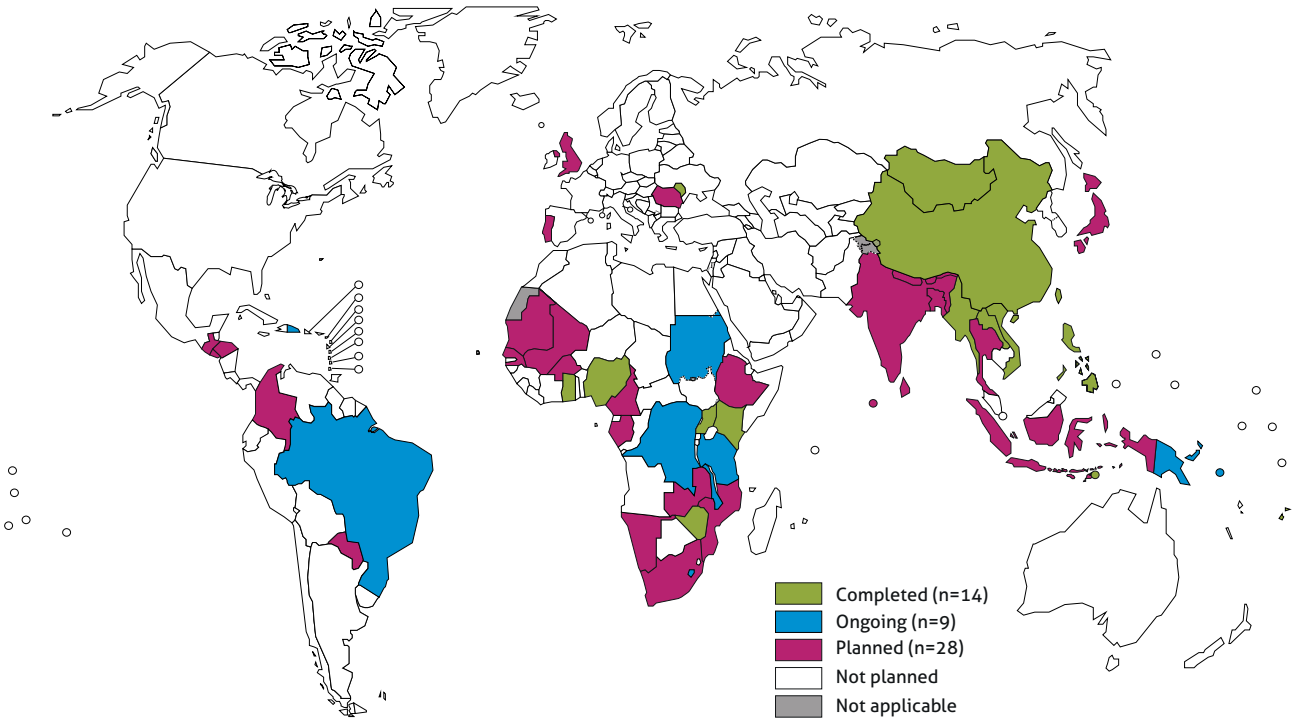
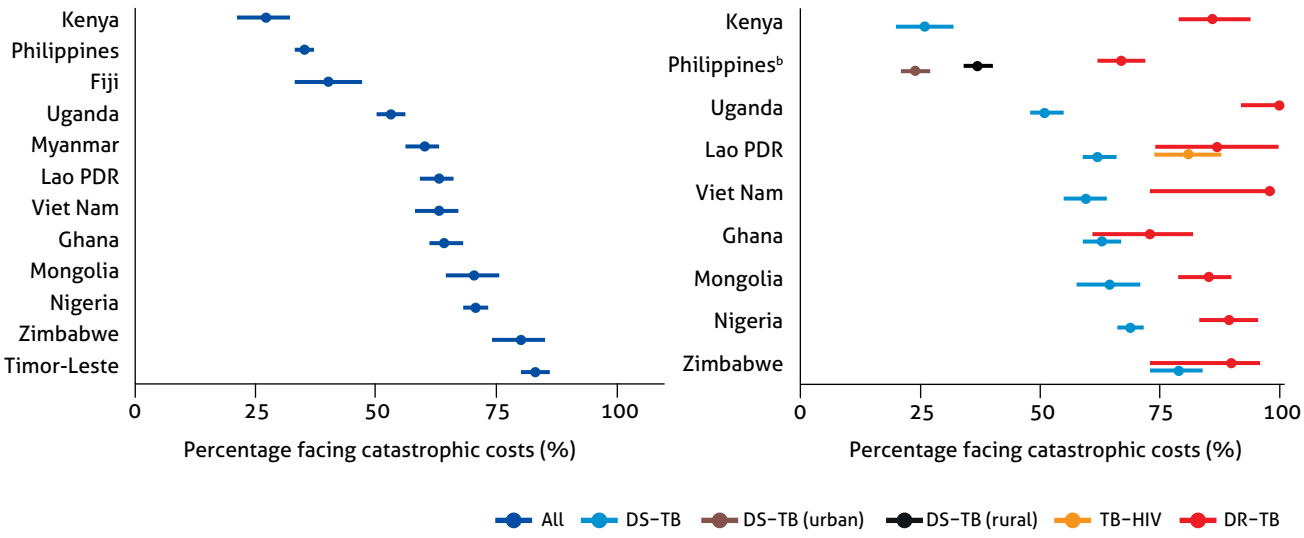


FIG. 7.6

Estimates of the percentage of TB patients and their households facing catastrophic costs due to TB disease in 12 national surveys. Best estimates and uncertainty intervals are shown.[a]



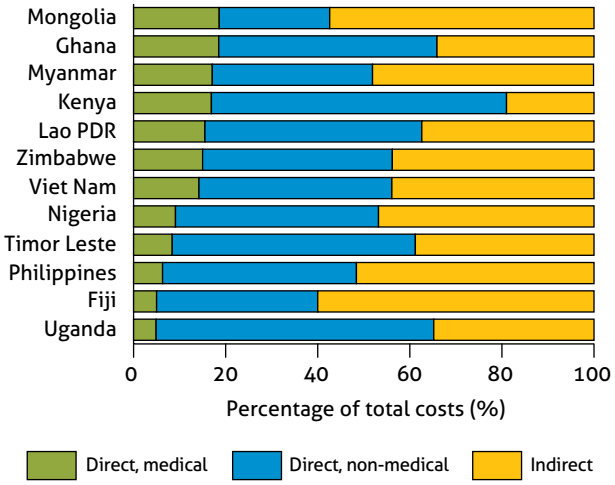
DS-TB: drug-susceptible TB; DR-TB: drug-resistant TB; TB-HIV: TB patients coinfected with HIV.

[a] Data were not available from surveys conducted in China and the Republic of Moldova.
[b] The survey in the Philippines had separate samples of DS-TB patients in urban and rural areas.

Source: WHO Global TB Programme

FIG. 7.7

Distribution of costs faced by TB patients and their households in 12 national surveys



Source: WHO Global TB Programme

ated 95% confidence intervals (CIs).[1] The plot on the right shows the same indicator disaggregated by subgroups (drug-resistant and drug-susceptible TB for all countries, urban and rural for the Philippines, and HIV status for Lao People's Democratic Republic).

The percentage of TB-affected households that experienced total costs that were catastrophic ranged from 27% (95% CI: 21–32%) in Kenya to 83% (95% CI: 80–86%) in Timor-Leste. The figure was much higher for drug-resistant TB, ranging from 67% (95% CI: 62–72%) in the Philippines to 100% (95% CI: 92–100%) in Uganda.

The distribution of costs by three major cost categories is illustrated in Fig. 7.7. Although the distribution varied among countries, it was evident that – despite the widespread norm of "free TB care" policies – direct medical costs faced by TB-affected households can be high.[2] Such costs accounted for a large proportion of total costs in some countries (e.g. in Ghana and Mongolia). Minimizing direct medical costs borne by TB patients should be a high priority for NTPs and ministries of health.

The surveys also showed that actions are needed to eliminate non-medical costs and to reduce income losses. The combined cost of transportation, food, nutritional supplements and other non-medical expenditures ("direct non-medical costs") accounted for the largest share of total costs in Ghana, Kenya, Lao People's Democratic Republic, Timor-Leste, and Uganda. Income losses associated with loss of employment or time lost while seeking or staying in care accounted for the largest single share of total costs in Fiji, Mongolia, Myanmar, Nigeria, the Philippines, Viet Nam and Zimbabwe.

All cost categories are influenced by the model of TB care; for example, to what extent there is reliance on hospitalization or outpatient care, and the frequency with which attendance at health facilities is requested. They are also influenced by ease of access to the health facilities used to provide care.

7.3.2 Policy and strategy implications of survey results

Results from TB patient cost surveys can inform policy and strategy in two major ways. First, costs can be reduced by improving approaches to TB service delivery and financing; for example, by removing user fees and introducing more patient-centred models of care. Second, any costs that remain after the optimization of health care delivery can be mitigated by improved social protection measures, in collaboration with stakeholders across the social sector. Survey results should be used to stimulate multisectoral engagement and action on both topics.

A multistakeholder consultation can be an effective way to initiate discussions about survey results and the actions needed in response. An early example was a meeting in Viet Nam in March 2017, which was used to disseminate findings and formulate a joint action plan with the country's Ministry of Labour and Social Affairs. Similar dissemination and stakeholder consultations have subsequently been held in Myanmar in 2017; in Ghana, Kenya and Mongolia in 2018; and in Lao People's Democratic Republic, Nigeria, Uganda and Zimbabwe in 2019. These consultations resulted in identification of multisectoral actions required to improve social support for TB patients and their households. Case studies from Ghana and Kenya were profiled in the *Global tuberculosis report 2018 (11)*. Two more recent examples, from Mongolia and Nigeria, are described in Box 7.2.

Guidance on dissemination of survey findings and policy translation is provided in WHO guidance *(10)* and activities such as national TB programme reviews provide opportunities for periodic review of actions taken and progress achieved.

7.4 Broader determinants of the TB epidemic

The most recent data on the prevalence of four health-related risk factors (diabetes, HIV infection, smoking and alcohol use) under SDG 3 that are associated with TB incidence (Table 7.1a) as well as undernourishment are shown for the 30 high TB burden countries in Table 7.3.[3] For all of the indicators shown, a lower level is more desirable.

The countries with generalized HIV epidemics (a prevalence of >1% in the general population) include 14 of the 16 high TB burden countries in the WHO African Region (the exceptions are the Democratic Republic of the Con-

[1] Where available, 95% confidence intervals were taken from the original survey reports. In cases where they were not available in the reports, simple binomial confidence intervals were calculated based on a given sample size.

[2] In most countries that have implemented surveys to date, costs after diagnosis were higher than costs prior to diagnosis.

[3] The three indicators relating to coverage of health services and health expenditure per capita are not included here, because these indicators are discussed in Section 7.2.

BOX 7.2

National surveys of costs faced by TB patients and their households in Mongolia and Nigeria: results, high-level advocacy and policy translation

Accumulating experience shows that findings from national TB patient cost surveys convey powerful messages that draw political attention, raise public awareness and facilitate multisectoral engagement to strengthen the TB response. The socioeconomic hardships and social consequences faced by TB patients and their households are relatively easily understood, and messages can resonate with politicians, other high-level officials and the general public.

Examples featured in previous editions of the global TB report include Myanmar (2017), VietNam (2017), Ghana (2018) and Kenya (2018). Two recent examples, from Mongolia (2018) and Nigeria (2019), are featured here.

Mongolia

Building on the political momentum created by the UN high-level meeting on TB *(12)*, the Prime Minister of Mongolia called for a high-level national TB forum in November 2018, titled "End TB by multisectoral partnership and collaboration in the SDG era". Under the leadership of the Prime Minister's advisor for social policy and the Minister of Health, the forum convened multisectoral stakeholders including government ministries (labour and social welfare, justice and defence), parliamentarians, representatives from local government, and international and national partner agencies.

During the forum, findings from the first national TB patient cost survey, conducted in 2017, were highlighted. Findings included that 70% of TB patients and their households faced catastrophic costs (>20% of annual household income), 39% took out a loan, 46% lost their job, and the proportion living below the poverty line rose from 8% to 36%. The forum also included a speech from a person representing people affected by TB, who spoke of the socioeconomic hardship faced by many TB patients and their families during and after their struggle with TB, and the challenges of social stigma and discrimination that further exacerbate the suffering of TB patients and their families.

At the end of the forum, the "Ulaanbaatar Declaration" was adopted. This included priority actions in line with the political declaration from the UN high-level meeting. Examples of actions were:

- reaffirming national targets for TB diagnosis and treatment and provision of preventive treatment consistent with the "Find. Treat. All. #EndTB" initiative;
- improving financial sustainability for the national TB response through a progressive increase in domestic funding;
- eliminating the economic burden faced by TB patients and their households through improving patient-centred TB care delivery and enhancing multisectoral social support;
- expanding TB service provision, including TB screening, among key populations, through multisectoral collaboration;
- strengthening the legal environment to support TB care and prevention through creation and amendment of relevant laws and regulations; and
- strengthening the national response to drug-resistant TB.

Nigeria

The National Tuberculosis and Leprosy Control Programme (NTBLCP) of the Federal Ministry of Health of Nigeria conducted the first national TB patient cost survey in 2017, to assess the magnitude and main drivers of costs incurred by TB patients and their households. The cross-sectional survey enrolled 1190 TB patients (of whom 1095 had drug-susceptible TB and 95 had drug-resistant TB) across the country's 22 states. Key findings included:

- 69% of patients with drug-susceptible TB and 89% of patients with drug-resistant TB incurred catastrophic costs (>20% of household annual income);
- during treatment, the mean annual individual income decreased by 63% among those with drug-susceptible TB and 59% among those with drug-resistant TB;
- more than one third (37%) of TB patients were living below the poverty line at the time of TB diagnosis, a figure that increased substantially (to 58%) during TB treatment;
- 74% of TB patients were unemployed at the time of the survey and 30% reported that they had lost their job as a result of TB;
- more than half (54%) of patients were unable to pay for their TB treatment from income alone, and had to rely on borrowing (45%) or selling assets (29%) to pay for TB-related care; in the latter category, 37% sold livestock and 25% sold farm produce;
- less than 4% of TB patients in the survey had health insurance;
- although 39% of patients with drug-resistant TB received some form of social support (e.g. food or transport vouchers), only 12% of those with drug-susceptible TB received such support.

Survey results were released in March 2019, as part of an event to mark World TB Day. There was high-level attendance from the government, partners and communities. Following the event, a multisectoral workshop was organized to facilitate policy dialogue and define actions to eliminate catastrophic costs faced by TB patients and their households. The workshop was attended by the NTBLCP, state and health insurance authorities, national and international TB stakeholders and national multisectoral partners (e.g. ministries of labour, women affairs and finance). After intensive discussions among stakeholders, the workshop agreed upon the recommendations summarized below.

1. Redesign the TB service package and explore effective integration in health insurance schemes to address medical costs. This should include:
    - reviewing the TB services not yet included in the free-of-charge TB service package; major costs include hospitalization, diagnostic procedures and basic laboratory tests;
    - reviewing and expanding the contents of the free-of-charge TB service package;
    - designing a TB-specific benefit package that is integrated into the health insurance benefit package across the country; and

▶

BOX 7.2

- incentivizing the provision of certain TB services through a fee-for-service provider payment mechanism, especially at the primary health care level (e.g. TB testing to improve case finding), while deploying appropriate measures to avoid over-provision of services and gaming (e.g. to avoid unnecessary hospitalization).

2. Improve TB service delivery. This should include mitigating some of the costs faced by TB patients through:
   - early access to diagnostics;
   - decentralization of treatment services;
   - effective private sector engagement; and
   - enhancing community-based services.
3. Enhance social support and protection through multisectoral collaboration. This should include:
   - collaborating with the Federal Ministry of Labour and Employment – the 2013 National Work Place policy on HIV/AIDS should be expanded to cover TB, and a revised policy should address discrimination, paid sick leave for workers affected by TB, flexible working arrangements, prevention activities, routine screening, management of contacts and preventive treatment;
   - collaborating with the Nigeria Social Insurance Trust Fund (NSITF) – the Employees' Compensation Act (2010) established a social insurance scheme designed to provide compensation to employees who suffer from occupational diseases; the NTP should engage in discussions with the NSITF to discuss ways to expand coverage among TB patients and facilitate access to compensation;
   - collaborating with the Federal Ministry of Women Affairs and Social Development to explore how to include TB in various social protection schemes and to enhance collaboration to address discrimination, nutritional support, household economic empowerment, and routine TB screening for orphans and vulnerable children;
   - collaborating with the nutrition and food security sector, to conduct a retrospective analysis of available data to determine the magnitude of malnutrition among TB patients, to develop a policy for systematic assessment of nutritional status for all TB patients and associated provision of therapeutic and supplementary feeding for TB patients, and to explore the supply sources of ready-to-use therapeutic food that can be used to support TB patients.

go and Ethiopia), with especially high levels in southern Africa (24% in Lesotho, 13% in Mozambique, 12% in Namibia, 19% in South Africa, 12% in Zambia and 13% in Zimbabwe). The only high TB burden country outside the WHO African Region that has a generalized epidemic is Thailand (1.1% of the population).

The prevalence of smoking in adult men (aged ≥15 years) is above 40% in 10 of the 30 high TB burden countries, and is exceptionally high (76%) in Indonesia; the only countries where it is below 20% are Brazil, Ethiopia, Liberia and Nigeria. Smoking is much less common among adult women, with levels below 5% in most high TB burden countries and exceeding 10% only in Brazil, Papua New Guinea and the Russian Federation. These striking differences between men and women contribute to the higher burden of TB disease among men (**Chapter 3**).

The prevalence of diabetes in men and women is similar and generally in the range of 5–10%. The three countries with higher levels are Pakistan (13% among men and 12% among women), Papua New Guinea (15% among men and 14% among women) and South Africa (13% among women).

The prevalence of alcohol use disorders is generally low among adult women but higher among men (1–10%, but 31% in the Russian Federation).

The prevalence of undernourishment is above 20% in 14 of the 30 high TB burden countries; the Democratic Republic of Korea, Pakistan and 12 of the 16 high TB burden countries in the WHO African Region. The country with the highest value (62%) is Central African Republic.

Estimates of the number of incident TB cases attributable to these five health-related risk factors for TB in 2018 are shown in **Table 7.4**. The best estimates were 2.3 million cases attributable to undernourishment, 0.86 million to smoking, 0.83 million to alcohol abuse, 0.81 million to HIV infection and 0.36 million to diabetes. Country-specific estimates are shown in **Fig. 7.8**. There is considerable variation among countries in the relative contribution of the five factors, and thus also variation in which of them need to be prioritized as part of national efforts to reduce the burden of TB disease.

The most recent data for six of the seven indicators associated with TB incidence listed in **Table 7.1b** are shown for the 30 high TB burden countries in **Fig. 7.9**.[1] In this figure, the outer edge of the hexagon (100) is the ideal value for each indicator. Therefore, better performance corresponds to a larger shaded-in region. To achieve this representation visually, the indicators "proportion of the urban population living in slums" and "proportion of the population living below the international poverty line" are inverted in **Fig. 7.9**. All indicator values in **Fig. 7.9** are for the general population, as opposed to people with TB; values for TB patients specifically (e.g. out-of-pocket

[1] GDP per capita is not included in **Fig. 7.9** because it is the only indicator that is not measured on a scale of 0–100. However, the latest value and recent trends in this indicator are shown in **Fig. 7.10**.

TABLE 7.3

Status of selected risk factors for TB, 30 high TB burden countries, latest available year

COUNTRY	PREVALENCE OF UNDERNOURISHMENT (% OF POPULATION)	HIV PREVALENCE (% OF POPULATION AGED 15–49 YEARS)	SMOKING PREVALENCE (% OF POPULATION AGED ≥15 YEARS)		DIABETES PREVALENCE (% OF POPULATION AGED ≥18 YEARS)		ALCOHOL USE DISORDERS, 12 MONTH PREVALENCE (% OF POPULATION AGED ≥15 YEARS)	
			FEMALE	MALE	FEMALE	MALE	FEMALE	MALE
Angola	24	1.9			7.8	8.5	1.4	8.6
Bangladesh	15	0.1	1.0	45	9.3	10	0.2	1.3
Brazil	2.5	0.6	10	18	8.7	7.8	3.2	8.2
Cambodia	19	0.5	2.0	34	6.9	7.4	1.4	7.6
Central African Republic	62	4.0			7.6	8.0	0.7	5.5
China	8.7		1.9	48	7.6	9.9	0.2	9.3
Congo	38	3.1	1.7	52	7.6	7.7	0.4	3.1
DPR Korea	43				5.9	5.8	0.9	5.1
DR Congo		0.7			6.1	6.2	0.9	7.4
Ethiopia	21	0.9	0.4	8.5	5.0	5.8	0.6	3.7
India	15	0.2	1.9	21	8.3	9.1	0.5	4.5
Indonesia	7.7	0.4	2.8	76	8.0	7.4	0.3	1.3
Kenya	24	4.8	1.2	20	6.2	5.8	0.8	5.8
Lesotho	13	24	0.4	54	9.9	7.3	1.1	7.5
Liberia	39	1.4	1.5	18	7.6	7.8	1.1	7.4
Mozambique	31	13	5.1	29	6.2	6.6	0.6	4.8
Myanmar	11	0.7	6.3	35	7.9	6.9	0.5	2.7
Namibia	25	12	9.7	34	7.5	7.3	1.7	8.8
Nigeria	12	2.8	0.6	11	6.0	6.3	0.4	3.8
Pakistan	21	0.1	2.8	37	12	13	0.1	0.5
Papua New Guinea		0.9	24	49	14	15	1.4	7.7
Philippines	14	0.1	7.8	41	7.3	7.1	1.4	7.7
Russian Federation	2.5		23	58	8.0	7.4	6.2	31
Sierra Leone	26	1.4	8.8	41	6.6	7.1	0.5	4.9
South Africa	6.1	19	8.1	33	13	9.7	1.5	10
Thailand	9.0	1.1	1.9	39	8.8	8.3	1.0	9.1
UR Tanzania	32	4.5	3.3	27	6.1	6.0	1.8	9.3
Viet Nam	11	0.3	1.0	46	5.1	5.5	0.9	8.7
Zambia	45	12	3.1	25	6.7	6.5	1.0	7.9
Zimbabwe	47	13	1.6	31	7.6	6.5	1.6	9.0

Blank cells indicate no data or estimate available.

Sources: World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/ , accessed 20 May 2019) and WHO Global Health Observatory (http://www.who.int/gho/en/).

TABLE 7.4

Global estimates of the number of TB cases attributable to selected risk factors[a]

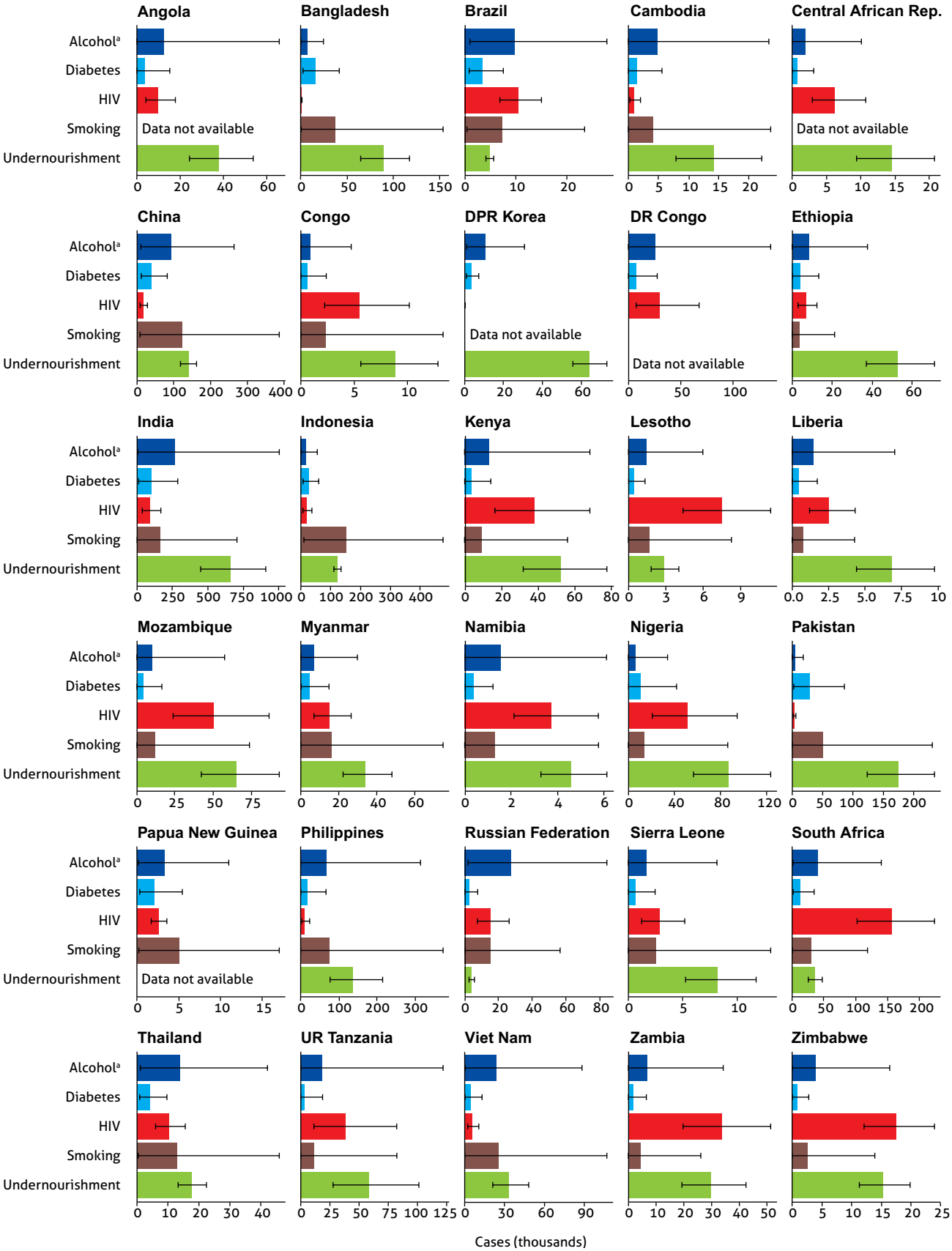
RISK FACTOR	RELATIVE RISK (UNCERTAINTY INTERVAL)		EXPOSED (MILLIONS)	POPULATION ATTRIBUTABLE FRACTION (%)	ATTRIBUTABLE TB CASES (MILLIONS, UNCERTAINTY INTERVAL)	
Diabetes	1.5	1.3–1.8	482	3.1	0.36	0.12–0.74
Harmful use of alcohol	3.3	2.1–5.2	286	8.1	0.83	0.1–2.3
HIV	19	16–22	38	8.1	0.81	0.72–0.9
Smoking	1.6	1.2–2.1	1 100	7.6	0.86	0.078–2.6
Undernourishment	3.2	3.1–3.3	803	19	2.3	1.6–3.1

[a] Estimates of the number of incident TB cases attributable to diabetes and harmful use of alcohol have been updated significantly compared with those published in the 2018 global TB report. The main reasons are a significant reduction in the estimated relative risk of developing TB among people with diabetes in recently published literature and updates to the estimated size of the exposed population (both risk factors). Uncertainty intervals for these risk factors, as well as those for smoking and undernourishment, are wide.

Sources: Imtiaz S et al. Eur Resp Jour (2017); Hayashi S et al. Trop Med Int Health (2018); Lönnroth K et al. Lancet (2010); World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/); WHO Global Health Observatory (http://www.who.int/gho/en/), both were accessed on 20 May 2019; and WHO Global TB Programme.

FIG. 7.8

Estimated number of TB cases attributable to five risk factors, 30 high TB burden countries, 2018.
Best estimates (in colour) and uncertainty intervals (black) are shown.

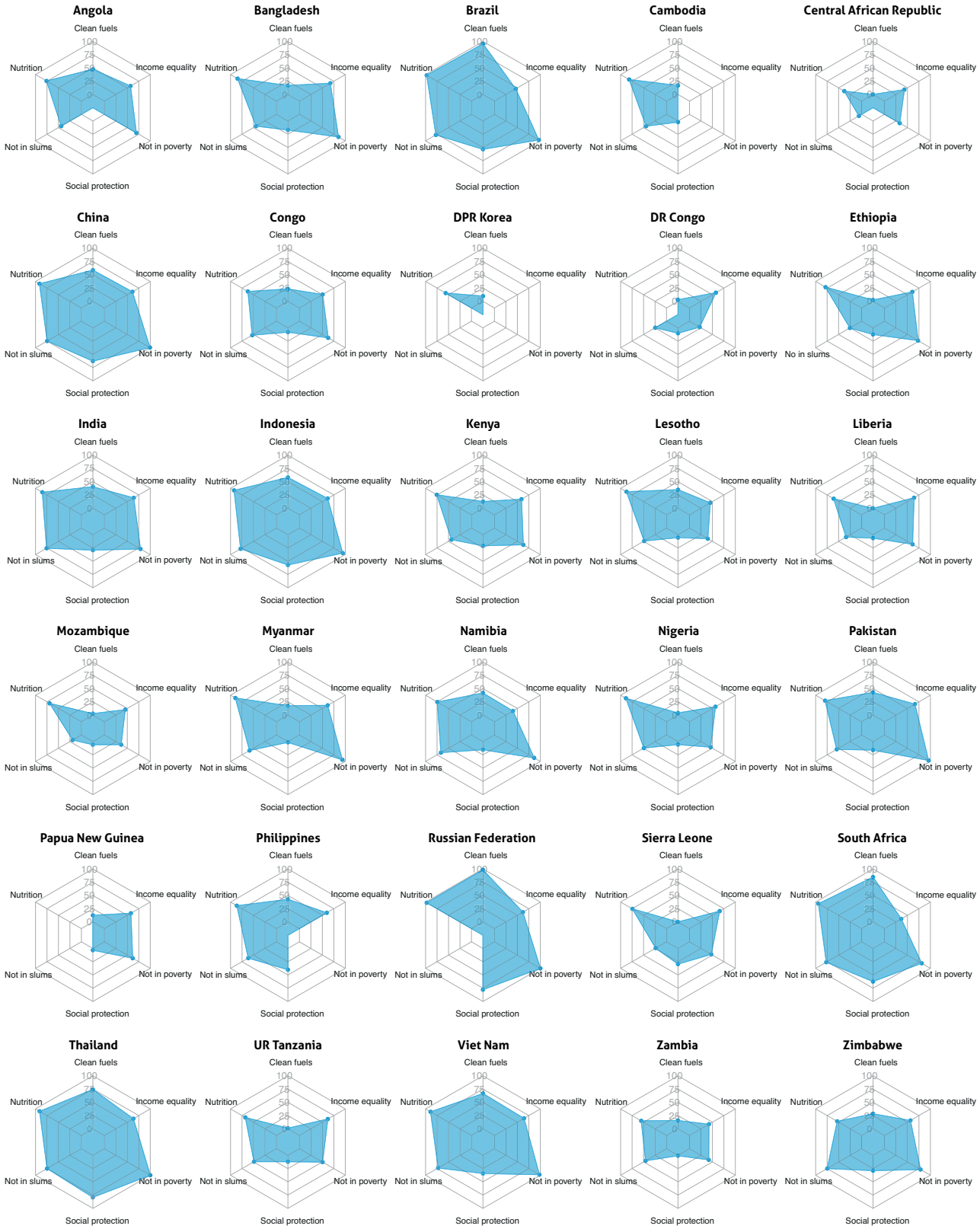


[a] "Alcohol" in the label means "harmful use of alcohol". See also Table 7.4.

Sources: Imtiaz S et al. Eur Resp Jour (2017); Hayashi S et al. Trop Med Int Health (2018); Lönnroth K et al. Lancet (2010); World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/); WHO Global Health Observatory (http://www.who.int/gho/en/); and WHO Global TB Programme. Both were accessed on 20 May 2019.

FIG. 7.9

Status of selected SDG indicators beyond SDG 3 that are associated with TB incidence, 30 high TB burden countries, latest available year



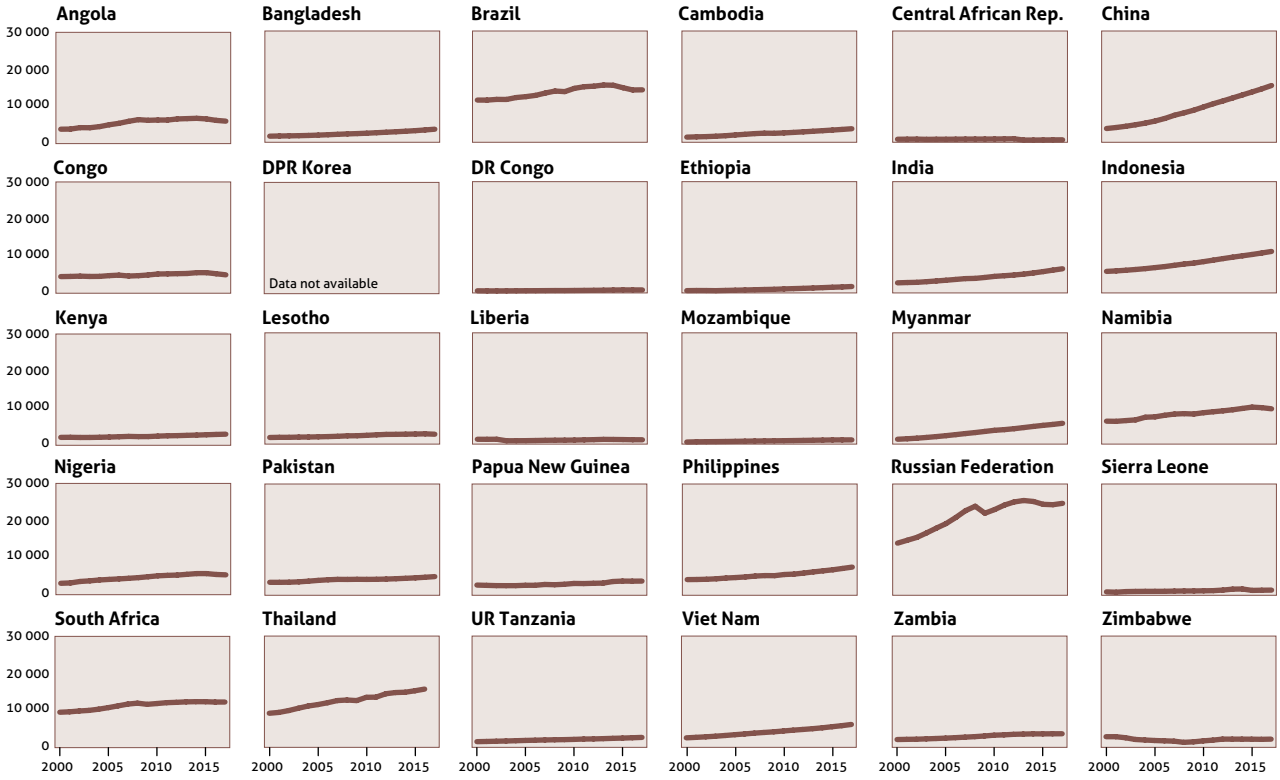
Income equality: A reverse GINI index is shown where 0 is perfect inequality and 100 is perfect equality.
Not in poverty: Percentage of population living above the international poverty line.
Social protection: Percentage of population covered by social protection and labour programmes.
Not in slums: Percentage of urban population not living in slums.
Nutrition: Percentage of population not undernourished.
Clean fuels: Percentage of population with access to clean fuels and technologies for cooking.

Source: World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/ , accessed 20 May 2019).

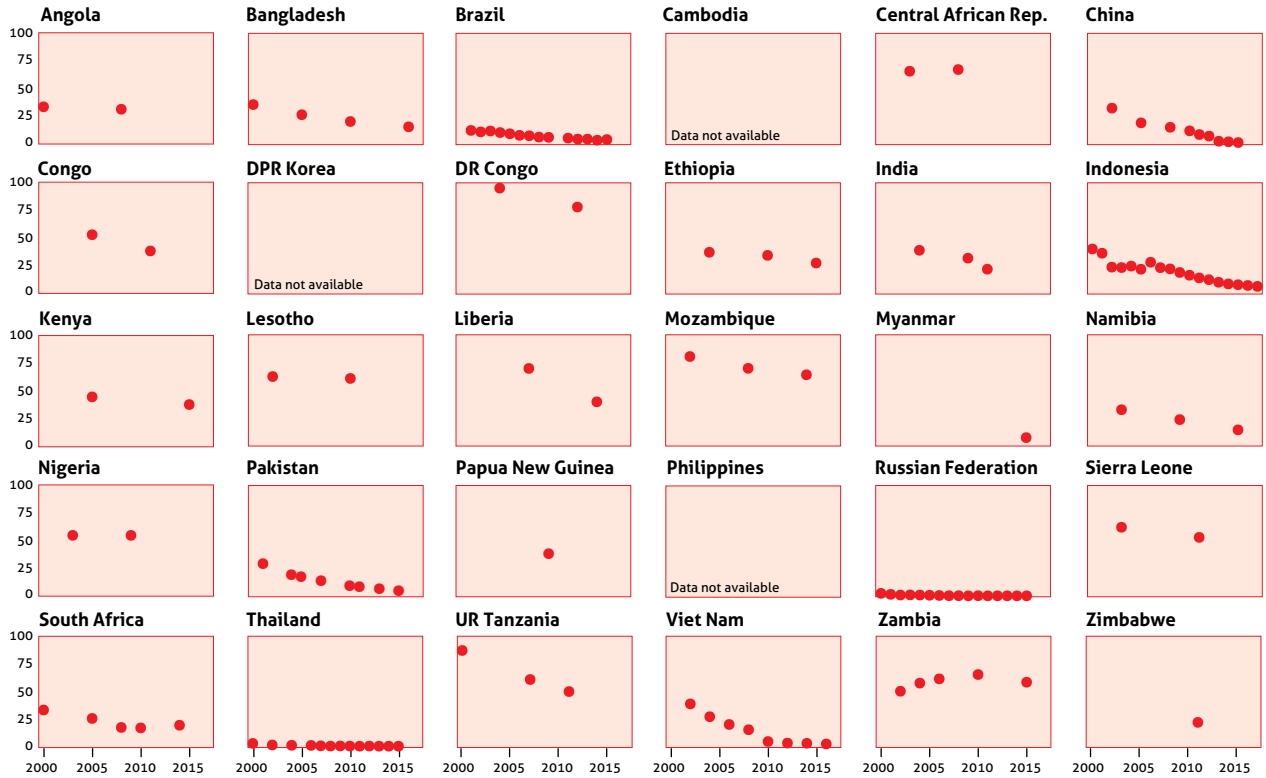
FIG. 7.10 (a, b)

Trends in four indicators associated with TB incidence, 30 high TB burden countries, 2000–2016

(a) GDP per capita (constant 2011 international $)



(b) Population living below the international poverty line (%)

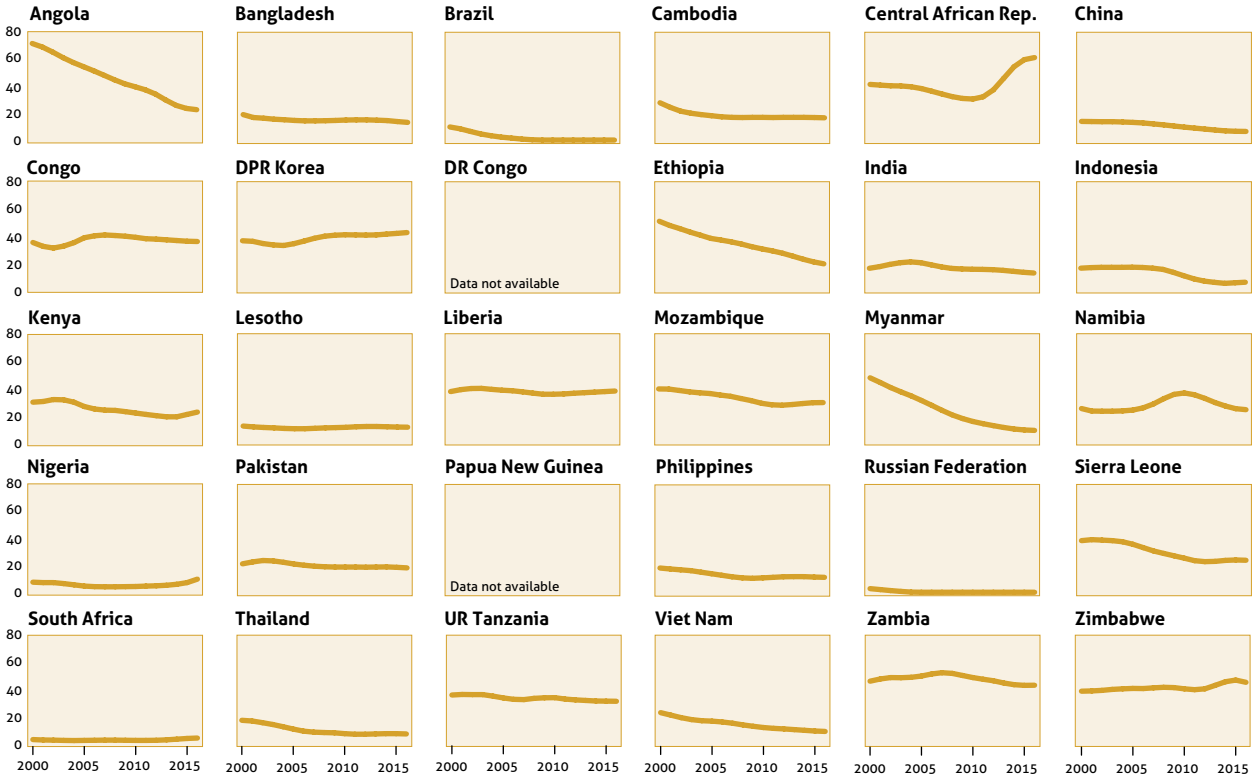


Sources: World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/) and WHO Global Health Observatory (http://www.who.int/gho/en/). Both were accessed on 20 May 2019.

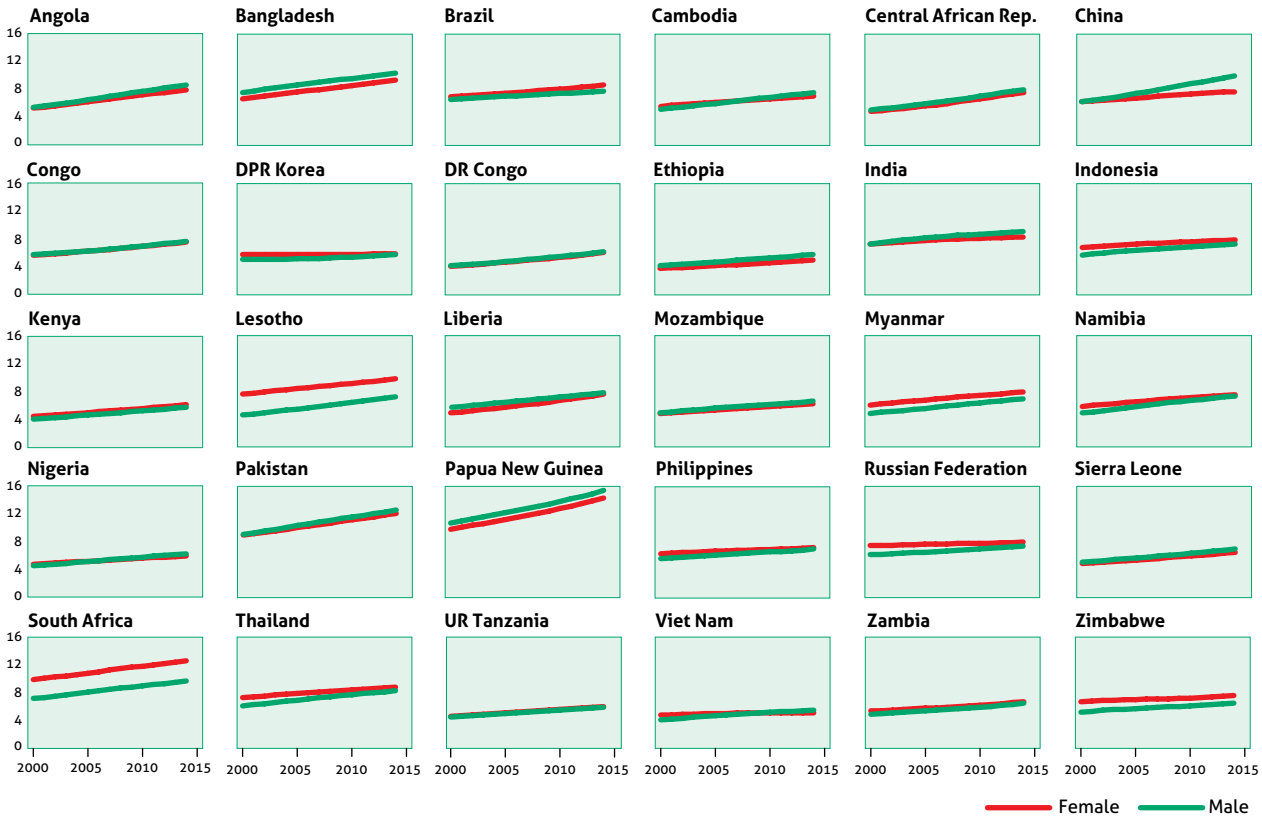
FIG. 7.10 (c, d)

Trends in four indicators associated with TB incidence, 30 high TB burden countries, 2000–2016

(c) Prevalence of undernourishment (% of population)



(d) Diabetes prevalence (% of population aged ≥18 years)



Sources: World Bank Sustainable Development Goals Database (http://datatopics.worldbank.org/sdgs/) and WHO Global Health Observatory (http://www.who.int/gho/en/). Both were accessed on 20 May 2019.

BOX 7.3

Nationwide Direct Benefit Transfer Scheme for TB Patients in India

The Government of India's National Strategic Plan for Tuberculosis Elimination (2017–2025) committed to pursuing several bold and people-centred policies *(13)*. These included providing a direct benefit transfer (DBT) to all TB patients to support improved nutrition and help address the financial burden faced by TB patients and their households, under a national scheme called "Nikshay Poshan Yojana". The scheme was introduced in April 2018 by the Revised National TB Control Programme (RNTCP) in the Ministry of Health and Family Welfare, and guidelines and training have been provided to all states on its implementation. Financing is provided by the Government of India, a World Bank loan and grants from the Global Fund to Fight AIDS, Tuberculosis and Malaria. The DBT provides 500 rupees (about US$7.50) per month to notified TB and multidrug-resistant TB patients for the duration of their treatment. Overall financing for the DBT is estimated at US$ 100 million in 2019.

Enrolment in the DBT scheme is based on the following process *(14)*:

1. A health worker at the facility where the TB patient is diagnosed obtains information from the patient, including the numbers of their bank account, mobile phone and Aadhaar (the latter being a voluntary, unique identification number that is issued to Indian residents and used as the primary identifier for the distribution of various social assistance programmes by the government).
2. The information is entered into the national electronic TB case-based reporting system (Nikshay).
3. Patient information is reviewed and validated by a district TB officer, and Nikshay allows the forwarding of information to the Public Financial Management System (PFMS). The PFMS facilitates the transfer of funds to individual bank accounts for a range of national social benefits. There is further internal validation of the information in the PFMS.
4. For patients without a bank account or proper identification, a blood relative's bank account can be used. Alternatively, the health worker can help the patient to register for the government programme Pradhan Mantri Jan Dhan Yojana, which enables individuals to open a bank account with no fees or minimum balance required. The RNTCP is also facilitating the establishment of linkages with the India Post Payment Bank, which can enable mobile bank accounts with cash receivable at the homes of DBT recipients.

Coverage of the DBT is among the nine core outcome indicators included in the National Strategic Plan of the RNTCP. The indicator is defined as the proportion of notified TB patients who receive the transfer; the target is 90% by 2025. In the first year, more than 2 million patients received at least one instalment of incentives worth US$55 million. Nikshay enables continuous reporting and monitoring of DBT registration, and there are plans to evaluate its implementation and impact.

expenditure and access to social protection) may differ from these general values.

Although some upper- and lower-middle-income countries (e.g. Brazil, China, India, Indonesia, South Africa and Thailand) are performing relatively well, many high TB burden countries, especially those in the low-income category, still face significant challenges to achieving a range of TB-related SDG targets. Furthermore, values for poor populations and vulnerable groups most at risk of developing TB are likely to be worse than national averages. Although it is typically not possible for NTPs to make progress on these issues alone, the UN high-level meeting on TB in September 2018, and adaptation and use of the multisectoral accountability framework for TB (**Chapter 2**), provide a basis for raising awareness and taking action on these issues. An example from India of a national effort to improve the nutritional status of TB patients and address the financial burden on TB-affected households is profiled in **Box 7.3**, and an example from the Philippines of national efforts to implement a multisectoral response to TB is highlighted in **Box 7.4**.

Fig. 7.10 shows trends since 2000 in four SDG-related indicators in the 30 high TB burden countries: (a) GDP per capita, (b) the proportion of the population living below the international poverty line, (c) prevalence of undernourishment and (d) diabetes prevalence. Although rapid growth in GDP per capita has occurred in several countries, many others show slow growth or stagnation. Poverty levels are generally falling, but the proportion of the population living below the international poverty line remains high in many high TB burden countries, especially in the WHO African Region. It is encouraging that the prevalence of undernutrition has fallen substantially in some countries in the past decade (e.g. Angola, Ethiopia, Myanmar and Sierra Leone). However, the trend of increasing undernutrition observed in Central African Republic, Democratic People's Republic of Korea, Kenya and Zimbabwe is concerning, as is the rising prevalence of diabetes prevalence in all countries.

The latest status and recent trends in all of the 14 indicators shown in **Table 7.1** are shown for the 30 high TB burden countries in **Annex 2** (on the second page of each country profile) and for all countries in online profiles.[1]

[1] See http://www.who.int/tb/data/en/.

BOX 7.4

Legal and administrative frameworks to foster multisectoral collaboration to end TB in the Philippines

A whole-of-society response to TB through multisectoral collaboration is the key to the successful implementation of the End TB Strategy. The mix of medical, public health and socioeconomic interventions that are required, combined with research and innovation, represents a portfolio that extends far beyond the remit of NTPs. With high-level support, NTPs need to cultivate and steer the engagement of a wide range of collaborators across relevant sectors within and beyond government. These include governmental departments and ministries (e.g. national development, poverty reduction, social welfare, labour, justice, education, and science and technology), technical and scientific institutions, academia, key affected populations, financial partners and development agencies, civil society and the private sector *(15)*.

Many countries have established frameworks or mechanisms to facilitate multisectoral collaboration in the national TB response. These include public–private coalitions, such as national anti-TB associations that engage a wide range of national stakeholders. These coalitions often play a substantive role in advocacy, communication, fundraising, community engagement and social support, as well as in TB service delivery and coordination. However, although such national coalitions are critical for nurturing national movements against TB, legally or administratively binding mechanisms are also necessary.

The Philippines provides an early example of the use of such mechanisms in a high TB burden country. The Comprehensive and Unified Policy (CUP) for TB was developed in 2003, based on Presidential Executive Order No.187. In 2003, this order mandated 17 government agencies and five private sector organizations to work together to implement harmonized policies for TB prevention and care. The Department of Health developed the core policies in collaboration with the Philippine Coalition Against Tuberculosis (PhilCAT). **Table B7.4.1** summarizes key collaborative activities carried out by the partners within the framework of the CUP.

Under the CUP framework, the National Coordination Committee for public–private collaboration is responsible for coordination and CUP expansion countrywide. There are 17 Regional Coordination Committees, which support activities initiated by local government units in provinces, cities and municipalities. At local level, CUP alliances assess the local epidemic and social determinants, identify the areas and risk groups in which cases are most likely to face barriers to accessing diagnosis and treatment, and take associated action.

In 2016, building on these long-established foundations for multisectoral collaboration in the context of TB, the Government of the Philippines passed the Comprehensive Tuberculosis Elimination Plan Act (Republic Act 10767). This act strengthened the capacity of the National Coordination Committee and the Regional Coordination Committees to coordinate the efforts of all stakeholders in the public and private sectors. The Regional Coordination Committees continue to provide programmatic, financial and technical support to the local government units, and to facilitate collaborative efforts between the public and private sectors. The UN high-level meeting on TB in 2018 provided a further opportunity to enhance the country's multisectoral response, including strengthening coordination mechanisms and the policies and actions of multisectoral partners.

The Philippines provides an excellent example of how to build a robust multisectoral national response to end TB.

TABLE B7.4.1

Key collaborative policies and activities undertaken by multisectoral partners under the CUP in the Philippines

CUP PARTNERS	KEY COLLABORATIVE ACTIVITIES	SDG DOMAIN
Department of Health	■ Provides overall policy guidance for all TB-related policies and activities ■ Provides additional funding grants to CUP members from other government agencies to initiate TB-related actions in their respective sectors	
Philippine Health Insurance Corporation (PhilHealth)	■ Provides an outpatient benefit package for people with drug-susceptible TB	
Philippine Coalition Against Tuberculosis (PhilCAT)	■ Engages a wide range of stakeholders including professional organizations, academia, corporate sector partners and civil society organizations ■ Plays a critical role in implementing the public–private mix approach, including coordination, engagement and improving the quality of TB care ■ Developed clinical practice guidelines in line with NTP policies and the International Standards for TB Care *(16)* ■ Supports the building of local coalitions at subnational levels	
National Economic and Development Authority	■ Strengthens the implementation of multisectoral policies related to TB at national and subnational levels through the Social Development Committee/ Regional Social Development Committees, of which the Department of Health and other agencies are members	

BOX 7.4

Department of Social Welfare and Development	■ Includes TB education sessions in the Pantawid Pamilyang Pilipino Program (also known as the 4Ps), which is a conditional cash transfer programme that provides cash grants to the poorest families ■ Facilitates access to TB services including screening among beneficiaries of the 4Ps through coordination with the Center for Health Development ■ Ensures quality TB care and prevention in institutions for the elderly	
Department of Agriculture Department of Agrarian Reform	■ Promotes TB activities through affiliated agencies covering 750 000 beneficiaries in 1452 communities	
Department of Education	■ Promotes school TB services including training of school health staff ■ Conducts TB-related health education ■ Collaborates with parent–teacher–community associations ■ Conducts TB screening among high-risk students (such as those who are undernourished) in collaboration with local government units	
Bureau of Occupational Safety and Health Centre and Bureau of Working Conditions Department of Labor and Employment	■ Develops policies and programmes for TB care and prevention in the workplace. A total of 2723 affiliated companies drafted a memorandum of action on enhanced monitoring of TB care and prevention in the workplace ■ Promotes a policy of non-discrimination and work accommodation ■ Conducts training on TB awareness and safety for health committees or company health staff, and mandates private companies to report TB cases through a formal system for reporting on occupational health ■ Develops modules for TB care and prevention among miners	
Overseas Workers Welfare Administration	■ Offers a supplemental medical assistance programme to 24 million overseas Filipino workers in cooperation with PhilHealth	
Social Security System Government Service Insurance System	■ Facilitates the provision of compensation and benefits for TB patients enrolled in relevant social insurance schemes	
Employees Compensation Commission	■ Expanded the scope of compensation for TB as an occupational disease	
Department of Sciences and Technologies	■ Contributes research to pilot and scale up innovative approaches in TB prevention, diagnosis and treatment	
National Commission on Indigenous Peoples	■ Provides TB health education for 12 million indigenous people through 12 regional offices, 46 provincial offices and 108 community service centres ■ Implements a collaborative project with the Department of Health to enhance TB case finding and treatment among indigenous people	
Bureau of Corrections, Department of Justice Bureau of Jail Management and Penology, Department of Interior and Local Government	■ Implements TB case-finding activities through entry screening, cough surveillance and periodic mass screening ■ Implements TB case management in correctional and detention facilities in collaboration with the Department of Health, the Philippines Tuberculosis Society, the International Committee of the Red Cross and WHO	
Department of National Defense and the Armed Forces	■ Provides TB diagnosis and treatment services for employees through routine clinic services and annual check-ups ■ Provides intensified TB diagnostic services among veterans	

References

1 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(3):208–12 (https://www.ncbi.nlm.nih.gov/pubmed/11326817, accessed 2 July 2019).

2 Styblo K, Meijer J, Sutherland I. [The transmission of tubercle bacilli: its trend in a human population]. Bull World Health Organ. 1969;41(1):137–78 (https://www.ncbi.nlm.nih.gov/pubmed/5309081, accessed 2 July 2019).

3 Lienhardt C, Glaziou P, Uplekar M, Lönnroth K, Getahun H, Raviglione M. Global tuberculosis control: lessons learnt and future prospects. Nat Rev Microbiol. 2012;10(6):407 (https://www.ncbi.nlm.nih.gov/pubmed/22580364, accessed 2 July 2019).

4 Lönnroth K, Castro KG, Chakaya JM, Chauhan LS, Floyd K, Glaziou P et al. Tuberculosis control and elimination 2010–50: cure, care, and social development. Lancet. 2010;375(9728):1814–29 (https://www.ncbi.nlm.nih.gov/pubmed/20488524, accessed 2 July 2019).

5 Lönnroth K, Jaramillo E, Williams B, Dye C, Raviglione M. Tuberculosis: the role of risk factors and social determinants. In: Blas E & Kurup A (eds.), Equity, social determinants and public health programmes. 2010 (https://apps.who.int/iris/bitstream/handle/10665/44289/9789241563970_eng.pdf;jsessionid=067BC8BA3F7A5366C05BE34404F9D8F6?sequence=1, accessed 2 July 2019).

6 Lönnroth K, Jaramillo E, Williams BG, Dye C, Raviglione M. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. Soc Sci Med. 2009;68(12):2240–6 (https://www.ncbi.nlm.nih.gov/pubmed/19394122, accessed 2 July 2019).

7 World Health Organization/World Bank. Tracking universal health coverage: 2017 global monitoring report. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/259817/9789241513555-eng.pdf, accessed 28 June 2019).

8 World Health Organization. Primary health care on the road to universal health coverage: 2019 monitoring report. Geneva: World Health Organization; 2019.

9 Stenberg K, Hanssen O, Edejer TT, Bertram M, Brindley C, Meshreky A et al. Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. Lancet Glob Health. 2017;5(9):e875–e87 (https://www.ncbi.nlm.nih.gov/pubmed/28728918, accessed 2 July 2019).

10 Tuberculosis patient cost surveys: a handbook. Geneva: World Health Organization; 2017 (https://www.who.int/tb/publications/patient_cost_surveys/en/, accessed 2 July 2019).

11 Global tuberculosis report 2018. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/274453, accessed 2 July 2019).

12 United Nations General Assembly. Resolution 73/3: Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis. United Nations; 2018 (https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/3, accessed 28 June 2019).

13 Khaparde SD. The national strategic plan for tuberculosis step toward ending tuberculosis by 2025. J Mahatma Gandhi Inst Med Sci. 2019;24(1):17 (http://www.jmgims.co.in/article.asp?issn=0971-9903;year=2019;volume=24;issue=1;spage=17;epage=18;aulast=Khaparde, accessed 2 July 2019).

14 Standard operating procedure for DBT payments. India: Government of India; (https://dbtbharat.gov.in/data/documents/SOP%20for%20DBT%20Payments.pdf, accessed 1 July 2019).

15 Implementing the End TB Strategy: the essentials (WHO/HTM/TB/2015.31). Geneva: World Health Organization; 2015 (https://www.who.int/tb/publications/2015/The_Essentials_to_End_TB/en/, accessed 28 June 2019).

16 TB/CTA/CDC/ATS/KNCV/The Union/WHO. International standards for tuberculosis care (ISTC) and the Patients' charter for tuberculosis care. Geneva: World Health Organization; 2006 (https://www.who.int/tb/publications/2006/istc/en/, accessed 2 July 2019).

Video-supported therapy in a clinical TB centre, Russian Federation.

Ivan Safonov/ Voronezh Regional Clinical TB Hospital

Chapter 8

TB research and development

Key facts and messages

Tuberculosis (TB) research and development is essential to achieve the global TB targets set in the Sustainable Development Goals (SDGs) and the End TB Strategy. A major technological breakthrough is required by 2025, so that the rate at which TB incidence falls can be dramatically accelerated compared with historic levels, to an average of 17% per year between 2025 and 2035.

"Intensified research and innovation" is the third pillar of the End TB Strategy, and Target 3b of the SDGs includes supporting research and development related to vaccines and medicines for "communicable and non-communicable diseases that primarily affect developing countries".

Top priorities are the development of a new vaccine or drug treatment to substantially cut the risk of TB disease in the 1.7 billion people already latently infected. Other priorities include rapid diagnostics that can be used at the point of care, and safer, simpler and shorter drug regimens for treating TB disease.

Building on the SDGs and End TB Strategy, the political declarations at the first global ministerial conference on TB held in November 2017 and the first United Nations (UN) high-level meeting on TB held in September 2018 both included commitments to TB research and development.

The political declaration at the high-level meeting included the first global financing target for TB research and development to be agreed by all UN Member States. The target is to mobilize US$ 2 billion annually in the 5-year period 2018–2022, much more than the US$ 772 million that was available in 2017.

The World Health Organization (WHO) has initiated the development of a global strategy for TB research and innovation. The aim is to support Member States to translate research commitments made in 2017 and 2018 into concrete actions.

The diagnostic pipeline appears robust in terms of the number of tests, products or methods in development. However, it is also relatively stagnant – no new technology emerged in 2019. There is still no single rapid, accurate and robust TB diagnostic test suitable for use at the point of care.

Currently, 23 drugs for the treatment of drug-susceptible TB, multidrug-resistant TB (MDR-TB) or latent TB infection are in Phase I, II or III trials. These drugs comprise 13 new compounds (an increase from 11 in August 2018), three other drugs (bedaquiline, delamanid and pretomanid) that have already received regulatory approval, and seven repurposed drugs.

Various combination regimens with new or repurposed drugs are in Phase II or Phase III trials.

Fourteen vaccine candidates are in clinical trials: three in Phase I, eight in Phase II and three in Phase III. They include candidates to prevent the development of latent TB infection and TB disease, and candidates to help improve the outcomes of treatment for TB disease.

Recently, an experimental TB vaccine candidate (M72/AS01$_E$) was found to be significantly protective against TB disease in a Phase IIb trial among individuals with evidence of latent TB infection. If the findings are confirmed in a Phase III trial, this vaccine has the potential to transform global TB prevention efforts.

Further testing and development of M72/AS01$_E$ is conditional on enhanced commitment, investment and collaboration among various partners engaged in TB research and development. WHO is currently undertaking a public health value assessment of new TB vaccines, to help facilitate decision-making by those responsible for the development and adoption of new TB vaccines.

The global TB targets set in the Sustainable Development Goals (SDGs) and the End TB Strategy cannot be achieved without tuberculosis (TB) research and development. The SDG target is to "end the epidemic" by 2030; more specific targets for 2030 set in the End TB Strategy are a 90% reduction in TB deaths and an 80% reduction in TB incidence compared with levels in 2015, with targets for further reductions (95% and 90%, respectively) by 2035. Reaching these targets requires a major technological breakthrough by 2025, so that the rate at which TB incidence falls can be dramatically accelerated compared with historic levels, to an average of 17% per year from 2025 to 2035.[1]

"Intensified research and innovation" is the third pillar of the End TB Strategy, and Target 3b of the SDGs includes supporting research and development related to vaccines and medicines for "communicable and non-communicable diseases that primarily affect developing countries". Building on the SDGs and End TB Strategy, commitments to TB research and development were included in both the Moscow Declaration to End TB at the first global ministerial conference on TB held on 16–17 November 2017 and the political declaration at the first United Nations (UN) high-level meeting on TB held on 26 September 2018 *(1, 2)*. The political declaration at the UN high-level meeting included the first global financing target for TB research and development to be agreed by all UN Member States. The target is to mobilize US$ 2 billion annually in the 5-year period 2018–2022, much more than the US$ 772 million that was available in 2017 *(3)*.

Top priorities for TB research and development are a new vaccine or drug treatment that can substantially cut the risk of TB disease in the 1.7 billion people already latently infected *(5)*. Other priorities include rapid diagnostics that can be used at the point of care; safer, simpler, shorter and more efficacious drug regimens for treating TB disease and infection.[2,3] Recently, a Phase IIb trial of an experimental TB vaccine candidate ($M72/AS01_E$) found that it was significantly protective against TB disease in individuals with evidence of latent TB infection *(6)*. If the findings are confirmed in a Phase III trial, the vaccine has the potential to transform global TB prevention efforts. However, further testing and development is conditional on enhanced commitment and investment from various partners engaged in TB research and development, and close collaboration.

Based on the political commitments made in the Moscow Declaration and the political declaration at the UN high-level meeting, and in response to a request made in a TB resolution passed at the World Health Assembly in May 2018 *(7)*, the World Health Organization (WHO) has initiated the development of a global strategy for TB research and innovation (**Box 8.1**). The aim is to support Member States to translate the research commitments made in the two political declarations into concrete actions.

This chapter is not intended to be an exhaustive overview of current or recently completed TB research. As in previous global TB reports, it focuses on providing an overview of progress in the development of new TB diagnostics (**Section 8.1**), new drugs and regimens for treatment of TB disease (**Section 8.2**) and latent TB infection (**Section 8.3**), and new vaccines (**Section 8.4**). A recent analysis showed that about 60% of total funding for TB research and development is for the development of new tools (the remainder being about 20% for basic research, 10% for operational research and 10% for infrastructure or "unspecified" projects) *(8)*. The chapter describes and discusses the status of the pipelines in August 2019, based on recent publications as well as communications with the secretariats of the relevant working groups of the Stop TB Partnership and other stakeholders.

8.1 New diagnostics for TB

This section starts with an overview of the TB diagnostics pipeline. It then describes diagnostic tests, products and methods related to the detection of TB disease and drug resistance that have been evaluated by WHO in 2019 or are scheduled for assessment within the next year. The last two subsections discuss the status of tests for latent TB infection and the increasing role of DNA-sequencing technologies in the diagnosis of drug-resistant TB.

8.1.1 An overview of the diagnostics pipeline

An overview of the TB diagnostics pipeline in August 2019 is shown in **Fig. 8.1**. It appears robust in terms of the number of tests, products or methods. However, it is also relatively stagnant – no new technology emerged in 2019.

Technologies under development are primarily molecular based, and there remains a significant gap in the development of diagnostics suitable for use at the point of care. There is an urgent need for new technologies to minimize barriers to a timely diagnosis for people with TB, ensure quality testing for difficult-to-diagnose groups, expand the spectrum of drug susceptibility testing (DST), and reduce the costs of diagnostic platforms and their maintenance.

8.1.2 TB diagnostic tests, products and methods evaluated by WHO in 2019 or scheduled for evaluation within the next year

Lateral flow lipoarabinomannan assay

Since 2015, tests based on the detection of the mycobacterial lipoarabinomannan (LAM) antigen in urine have been recommended by WHO to assist in the diagnosis of TB among people who are seriously ill with HIV *(9)*. Urinary LAM assays are unsuitable for use as general screening tests for TB because of suboptimal sensitivity.

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[1] Further details are provided in **Section 2.2** of **Chapter 2**.

[2] Decreasing treatment toxicity and shortening treatment regimens are particularly high priorities for drug-resistant TB.

[3] WHO, in collaboration with partners, has developed target product profiles for TB treatment regimens (referred to as target regimen profiles or TRPs); for further details, see WHO (2016) *(4)*.

BOX 8.1

The development of a global strategy on TB research and innovation

At the World Health Assembly in 2018, Member States passed a TB resolution that included a request to the WHO Director-General to develop a global strategy for TB research and innovation. The rationale for such a strategy was described as "to make further progress in enhancing cooperation and coordination in respect of tuberculosis research and development".

The development of a global strategy for TB research and innovation offers an opportunity for Member States and other relevant stakeholders to translate political commitments on research and innovation included in the Moscow Declaration to End TB (November 2017) and the political declaration at the UN high-level meeting on TB (September 2018) into concrete actions.

Under the leadership of WHO, the strategy is being developed through a consultative process. Thus far, the process has included consultations with the WHO Strategic and Technical Advisory Group for Tuberculosis (STAG-TB); the WHO Global TB Research Task Force; managers of national tuberculosis programmes (NTPs) and other officials from within and beyond ministries of health, including ministries of science and technology; representatives of civil society and affected communities; research funding institutions; and other stakeholders in TB research and innovation. An open web consultation *(10)* resulted in extensive comments on a zero draft of the strategy, and a revised draft document *(11)* was submitted in June for consideration by WHO regional committees later in 2019. Recognizing that a realistic, forward-looking strategy requires an informed understanding of past successes and failures and current realities, the development of the strategy has also been informed by a historical review of the TB research and development landscape *(8)*.

Four major areas for action have been included in the strategy: creating an enabling environment for TB research and innovation; increasing financial investments in TB research and innovation; promoting and improving approaches to data sharing; and promoting equitable access to the benefits of research and innovation. In the spirit of fast-tracking efforts to end TB, a prerequisite for success is that all stakeholders make concerted efforts and collaborate. Hence, the strategy also makes the case for a unified and aligned response in which key national and international partners and affected communities support Member States by undertaking the investments or partnerships (or both) that are necessary for accelerating innovation. The primary audiences for the document are Member States, particularly ministries of health, science and technology, finance and education.

In 2020, the final draft of the strategy will be presented for consideration by the 145th session of the WHO Executive Board (in January) and the 72nd World Health Assembly (in May).

However, compared with traditional diagnostic methods, they have demonstrated improved sensitivity for the diagnosis of TB among individuals coinfected with HIV, especially in patients with low CD4 counts.

In May 2019, WHO commissioned a systematic review of the use of a lateral flow LAM assay (LF-LAM) (Alere) for the diagnosis of TB in people living with HIV, and convened a guideline development group to update the WHO guidance issued in 2015. The key change to the 2015 guidelines is a strengthened indication for the use of LF-LAM among hospitalized HIV-positive patients with signs and symptoms of TB (pulmonary and extrapulmonary); the test is now recommended for all such patients, irrespective of their CD4 count. If the CD4 count is below 100, LF-LAM is recommended even in the absence of TB symptoms. Updated WHO guidelines will be released before the end of 2019.

Centralized high-throughput testing platforms

In July 2019, WHO convened a technical group to assess the performance of four centralized testing platforms based on polymerase chain reaction (PCR), suitable for high laboratory throughput. The platforms reviewed were the RealTime MTB (Abbott, Chicago, IL, United States of America [USA]), the Roche Cobas MTB assay (Roche, Basel, Switzerland), the FluoroType MTBDR assay (Hain Lifescience, Nehren, Germany) and the Max MDR-TB assay (Becton Dickinson, New Jersey, USA).

Each platform underwent a comparative analytical evaluation. A well-defined strain panel was used to test their sensitivity in detecting the *Mycobacterium tuberculosis* complex, and resistance to isoniazid and rifampicin. A well-characterized panel of strains resistant to *M. tuberculosis* (as cultured isolates) was used to test their ability to detect key mutations that confer resistance to rifampicin and isoniazid.

The technical expert group agreed that all four platforms performed sufficiently well in this first testing phase to advance to a second evaluation stage. However, there were concerns that additional studies were needed to verify the specificity of the new assays, since they use multicopy or novel DNA targets (or both) for the detection of TB.

The second phase will test the clinical validity of the assays. This will entail testing of the platforms in two or three national reference laboratories in high TB burden settings, and comparison of results with the reference standards of culture, phenotypic DST and molecular sequencing, as well as with Xpert® MTB/RIF.

National TB programmes (NTPs) are encouraged to generate further evidence on the performance of these platforms, especially if instruments are already being

FIG. 8.1

An overview of progress in the development of TB diagnostics, August 2019

TECHNOLOGIES IN DEVELOPMENT

Molecular detection of TB and drug resistance
- Gendrive MTB/RIF ID, Epistem, UK
- Xpert XDR-TB cartridge, Cepheid, USA
- TruArray MDR-TB, Akkoni, USA
- INFINITIMTB Assay, AutoGenomics, USA
- FluoroType XDR-TB assay, Hain Lifescience, Germany
- MeltPro TB assay, Zeesan Biotech, China
- QuantuMDx, POC, UK

Tests for latent TB infection
- Diaskin test, Generium, Russian Federation
- C-Tb test, Serum Institute of India, India

ON THE MARKET (EVIDENCE FOR USE NOT SUBMITTED TO WHO FOR EVALUATION)

Molecular detection of TB and drug resistance
- iCubate System, iCubate, USA
- Genechip, TB drug resistance array, Capital Bio, China
- EasyNAT TB Diagnostic kit, Ustar Biotechnologies, China

TECHNOLOGIES ENDORSED BY WHO

Molecular detection of TB and drug resistance
- Xpert MTB/RIF and Xpert Ultra as the initial diagnostic test for TB and rifampicin resistance, Cepheid, USA
- Line probe assays for the detection of *Mycobacterium tuberculosis* (MTB), isoniazid and rifampicin resistance in acid-fast bacilli smear positive sputum or MTB cultures (FL-LPA), Hain Lifescience, Germany and Nipro, Japan
- Line probe assays for the detection of resistance to fluoroquinolones and second-line injectable agents (SL-LPA), Hain Lifescience, Germany
- TB LAMP for detection of TB, Eiken, Japan

Non-molecular technologies
- Inteferon gamma release assay (IGRAs) for the diagnosis of latent TB infection (LTBI) Oxford Immunotec, UK; Qiagen, USA

Culture-based technologies
- Commercial liquid culture systems and rapid speciation
- Culture-based phenotypic DST using 1% critical proportion in LJ,7H10,7H11 and MGIT media.

Microscopy
- Light and light-emitting diode microscopy (diagnosis and treatment monitoring)

Biomarker based assays
- Alere Determine TB-LAM, Alere, USA (TB detection in people seriously ill with HIV)

SCHEDULED FOR WHO EVALUATION IN 2019/2020

Molecular detection of TB and drug resistance
- Molecular technologies for genotypic drug resistance testing (including sequencing technologies)
- FluoroType MTBDR, Hain Lifescience, Germany
- *m*2000 RealTi*m*e MTB System, Abbott, USA
- BD Max MDR-TB, Becton Dickinson, USA
- Roche cobas® MTB system, Roche Diagnostics, Basel, Switzerland

Radiology
- Computer aided detection (CAD)

WHO POLICY UPDATES SCHEDULED FOR 2019/2020

Molecular detection of TB and drug resistance
- Xpert MTB/RIF Ultra for detection of TB and rifampicin resistance in pulmonary, extrapulmonary and paediatric samples, Cepheid, USA
- Truelab/Truenat MTB, Molbio/bigtec Diagnostics, India

Culture-based drug susceptibility testing
- Sensititre™ MYCOTBI plate; ThermoFisher Scientific Inc., USA

used to test for HIV or hepatitis C viral load. WHO also encourages the use and further evaluation of these centralized high-throughput testing platforms in programmatic research conditions, to help to generate more evidence that can be used to inform policy guidelines on these platforms.

If sufficient new evidence becomes available, the performance of these platforms could be reassessed by WHO in early 2020.

Rapid tests for the detection of TB disease and drug resistance

In specimens with low numbers of bacilli, the Xpert MTB/RIF Ultra (Ultra) cartridge has shown significantly better performance than the Xpert MTB/RIF cartridge in terms of increased sensitivity in detecting *M. tuberculosis*. This was particularly the case for smear-negative, culture-positive specimens (e.g. those from people living with HIV), extrapulmonary specimens (notably cerebrospinal fluid) and specimens from children *(12)*.

Nonetheless, the transition to this next-generation cartridge has been limited by concerns regarding its specificity (false positive results) in HIV-negative adults, compared with the gold standard method of liquid culture *(13)*. South Africa is the only high TB burden country currently using Ultra as the initial diagnostic test for TB. Updated systematic reviews of the performance of Ultra for use in the diagnosis of pulmonary and extrapulmonary TB in adults and children will be used to support the refinement and updating of WHO policy guidelines on the use of Ultra in December 2019.

Progress is being made with the Cepheid close-to-care platform – GeneXpert® Omni® (Omni). This platform is undergoing field evaluation to assess bioequivalence with the GeneXpert instrument. If equivalence is demonstrated, it will initially be available for testing for TB and rifampicin-resistant TB (RR-TB) using the next-generation Xpert Ultra cartridge.[1] The Omni is expected to complement existing multimodule GeneXpert instruments, including the GeneXpert Edge® (a single-module GeneXpert instrument connected to a tablet device for transfer of data, whose specific features include an auxiliary battery that allows operation in more decentralized settings, at the same level as microscopy). Both the Omni and the Edge have been developed to facilitate wider access to rapid molecular testing for TB and rifampicin resistance, and virology parameters for HIV and hepatitis C virus.

Cepheid is also developing a cartridge to detect resistance to isoniazid, fluoroquinolones and amikacin. There may be sufficient data by 2020 to allow evaluation by WHO.

The Truenat MTB assays® (Molbio Diagnostics, Bangalore, India) are an alternative to the GeneXpert platform that have been developed for use in primary health care

[1] The Omni platform requires cartridges with near-field communication chips; hence, it will not be compatible with the current Xpert MTB/RIF and Ultra cartridges.

facilities. There are two cartridge-based assays: one for TB detection and a second (reflex) assay to test any positive samples for rifampicin resistance. The Foundation for Innovative New Diagnostics (FIND) is performing a multicentre study of the diagnostic accuracy of these assays at the level of peripheral microscopy centres in Ethiopia, India, Papua New Guinea and Peru. Results are expected in November 2019 and will inform a WHO review in December 2019.

Computer-aided detection systems

Chest radiography, or chest X-ray (CXR), is an important tool for TB triaging and screening, and is also a useful aid in the diagnosis of TB. A major limitation of CXR is that it requires experienced interpreters (usually radiologists or technicians) to interpret the images. Even among trained readers, variation between readers is common, which further affects the accuracy of CXR. In many countries, few experienced CXR readers are available. The latest WHO guidance was issued in 2016 *(14)*.

In recent years, computer-aided detection (CAD) systems have been developed that use digital technology to detect physiological and pathological conditions, including TB. These CAD systems incorporate computer algorithms that analyse a digital CXR and produce a standardized interpretation of the image. A score or report is generated that estimates the likelihood that the CXR image is consistent with TB. CAD systems are trained on thousands of images, using machine-learning techniques.

To date, WHO has not been able to provide any positive recommendation related to the use of CAD for TB. A systematic review of five peer-reviewed articles published in 2016 concluded that evidence about its diagnostic accuracy is limited by the small number of studies of the only commercially available CAD software *(15)*. FIND is currently establishing an archive of digital CXRs that could be used to assess the performance of commercially available CAD solutions. If sufficient data become available, WHO plans to evaluate the use of CAD systems for detecting TB in early 2020.

Microbroth dilution method for DST

Genotypic and phenotypic data on about 80 000 strains with geographical and genetic diversity have been generated by the Comprehensive Resistance Prediction for Tuberculosis: An International Consortium (CRyPTIC), which is hosted by the University of Oxford. The phenotypic data are tested using ThermoFisher microbroth dilution plates, which is a low-cost DST method compared with the commercial BACTEC mycobacteria growth indicator tube (MGIT) liquid culture system. WHO plans to assess microbroth dilution plates as an alternative to the gold standard method (i.e. MGIT) in the first half of 2020.

Critical concentrations of anti-TB medicines used for DST

Culture-based phenotypic testing is the current reference method for testing anti-TB medicines. It relies on testing the so-called critical concentrations of drugs; that is, the lowest concentration of an anti-TB medicine that will inhibit the in vitro growth of 99% of phenotypically wild-type strains of *M. tuberculosis*.

In 2018, WHO published a technical manual for performing DST for specific medicines used in the treatment of drug-resistant TB *(16)*. The manual provides procedures for performing DST for second-line anti-TB medicines, including newer medicines (bedaquiline and delamanid) and repurposed medicines (clofazimine and linezolid).

There is emerging evidence that the critical concentrations used to test for resistance to isoniazid and the rifamycins (rifabutin, rifampicin and rifapentine), historically established in solid culture media, may not necessarily apply to commercial liquid culture systems. WHO has commissioned FIND to undertake a systematic review of available data on minimum inhibitory concentrations for phenotypically wild-type and nonwild-type strains. In 2020 the findings of this review will be used to assess whether current recommendations on critical concentrations should be revised.

8.1.3 Tests for latent TB infection

There are currently two methods to test for a latent TB infection: the Mantoux tuberculin skin test (TST) and the gamma interferon (IFN) release assay (IGRA). Both are tests that depend on cell-mediated immunity (memory T-cell response), but neither test can accurately distinguish between TB infection and active TB disease.

TST

The TST is commonly performed using the Mantoux technique, which consists of intradermal placement of two tuberculin units (TU) of RT-23 or five TU of purified protein derivative S (PPD-S); the result is reported as millimetres of induration in the transverse diameter. However, the PPD TST has relatively low specificity, lacks sensitivity in immunosuppressed individuals (e.g. people living with HIV) and requires two clinic visits (one to administer the test and one to read the result). A further challenge is that failure to attend the clinic for evaluation of test results within 48–72 hours renders the results invalid.

IGRA

There are two approaches to IGRA: the enzyme-linked immunosorbent assay (ELISA)-based whole-blood method and the enzyme-linked immunosorbent spot (ELISPOT) assay. The ELISA whole-blood test uses peptides from the RD1 antigens ESAT-6 and CFP-10, and peptides from one additional antigen that is not an RD1 antigen, in an in-tube format. The result is reported as quantification of IFN-gamma in international units (IU) per millilitre.

The ELISPOT assay is performed on separated and counted peripheral blood mononuclear cells (PBMCs) that are incubated with ESAT-6 and CFP-10 peptides. The result is reported as the number of IFN-gamma-producing T cells (spot-forming cells). In contrast to the TST, IGRAs are not affected by bacille Calmette-Guérin (BCG) vaccination status and are thus useful for the evaluation of latent TB infection in BCG-vaccinated individuals, particularly in countries where BCG vaccination is administered after infancy or repeated vaccinations are given. However, the IGRA platforms are more expensive to run, requiring specialized kits, a qualified technician and an accredited laboratory.

Other tests

Newer skin-based tests for infection are starting to emerge; these tests aim to maximize the advantages of current implementation platforms and have the potential to improve uptake of diagnosis and treatment of latent TB infection. They include the C-Tb (Staten Serum Institut) and Diaskin Test (Generium). Both contain recombinant ESAT-6 (dimer) and CFP-10 (monomer) antigens derived from *M. tuberculosis* and could provide performance improvements over TST (particularly with respect to specificity). They may also provide an accurate, acceptable and cheaper alternative to existing IGRA tests. Compared with IGRA, emerging evidence suggests that both assays may have similar specificity, and provide results in children and in HIV-infected cohorts similar to those in adults.

Qiagen, the manufacturer of the IGRA test QuantiFERON-TB Gold Plus, has developed a simplified version of the test that incorporates the same antigens in a single tube but uses a lateral flow type detection system. This has the potential to provide an alternative detection system that is simpler than the current IGRAs.

8.1.4 Scaling up DNA-sequencing technologies for diagnosis of drug-resistant TB

Conventionally, the diagnosis of drug resistance in *M. tuberculosis* strains has relied heavily upon culture and DST in liquid or solid media, in TB containment laboratories. However, phenotypic results are only obtained after weeks to months of incubation, and it is a challenge to establish the stringent laboratory biosafety conditions required for these culture-based methods. Since drug resistance in the *M. tuberculosis* complex is mainly conferred through point mutations in specific gene targets in the bacterial genome, molecular tests are increasingly being used to allow more rapid testing and thus earlier initiation of appropriate treatment for drug-resistant TB.

Compared with the rapid molecular tests that are currently available, DNA sequencing can provide detailed information on resistance across multiple gene regions. Recognizing the added value offered by next-generation sequencing, WHO has released guidance on the role of sequencing for detecting mutations associated with drug resistance in the *M. tuberculosis* complex *(17)*|. WHO has also established a TB sequencing database that curates, standardizes and unifies genotypic and phenotypic DST data, along with metadata on drug-resistant TB *(18)*. The database is regarded as a "living" platform for continuous gathering and interpretation of sequencing, phenotypic and clinical outcome data. With the support of FIND, work is underway to expand its functionalities to inform the development of new TB drugs and regimens, and the development and validation of novel molecular diagnostic tools.

8.2 New drugs and drug regimens to treat TB disease

Current treatment regimens for TB disease require combinations of multiple drugs, ranging from a duration of 6 months for drug-susceptible TB to typically 9–20 months for RR-TB or multidrug-resistant TB (MDR-TB),[1] but possibly longer if there is additional drug resistance, or if clinical and laboratory outcomes at the end of treatment are unsatisfactory. Globally, the latest available data (published in this report) show a treatment success rate of 85% for drug-susceptible TB, 56% for MDR-TB and 39% for extensively drug-resistant TB (XDR-TB).

The main challenges in treatment of TB disease are the duration and complexity of drug regimens, both of which affect adherence; toxic side-effects, especially for the drugs used to treat drug-resistant TB; and the absence or limited availability of paediatric drug formulations for second-line treatment. TB treatment for people living with HIV is further complicated by drug–drug interactions between anti-TB drugs and antiretroviral therapies, and by cumulative drug toxicities that amplify the risk of immune reconstitution inflammatory syndrome. There is a pressing need for regimens that are more effective, more affordable and nontoxic, and that shorten the duration of treatment.

The pipeline for new anti-TB drugs in August 2019 is shown in **Fig. 8.2**. It has expanded in recent months, and 23 drugs are now in Phase I, II or III trials, compared with 20 in August 2018 *(19: p 156)*. There are 13 new compounds, seven of which belong to a new chemical class (BTZ-043, GSK-3036656, macozinone, OPC-167832, Q203, SPR720 and TBA-7371).[2] Three other drugs (bedaquiline, delamanid, and pretomanid[3]) have already received regulatory approval. Seven repurposed drugs are undergoing further testing: clofazimine, linezolid, levofloxacin,

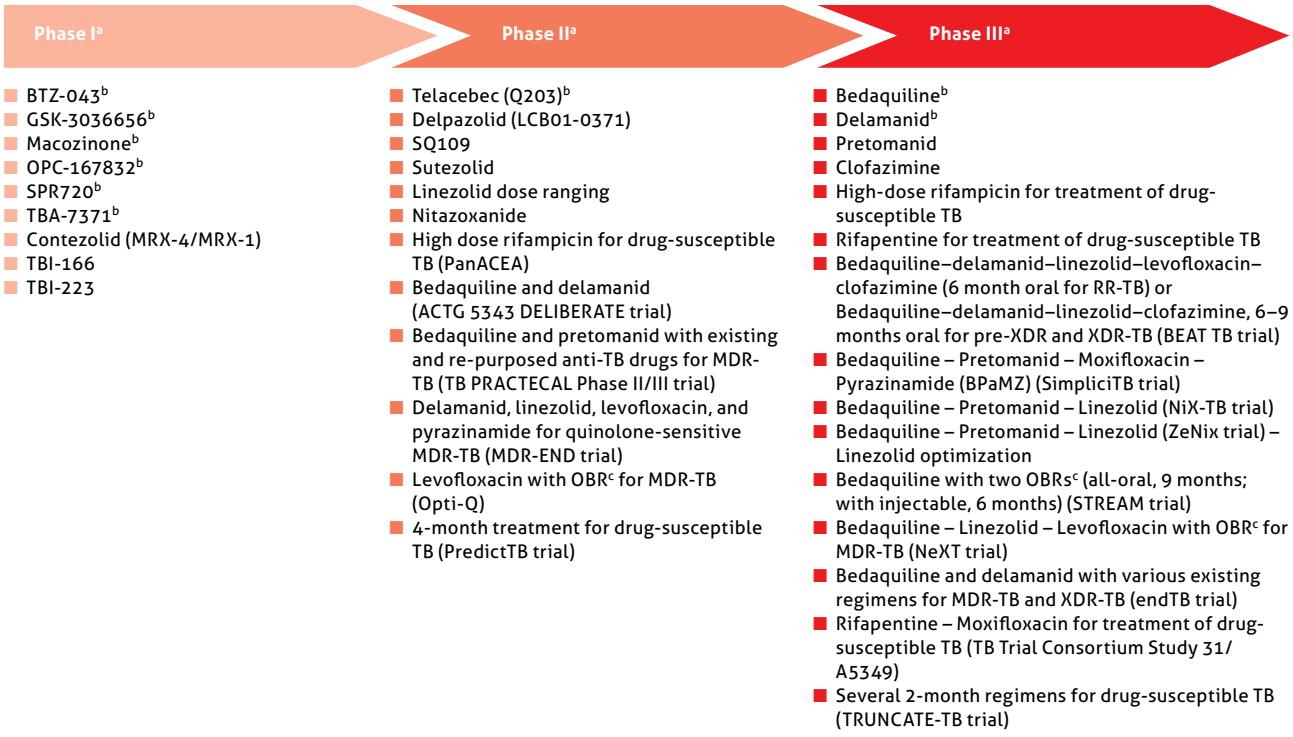
[1] MDR-TB is defined as resistance to at least isoniazid and rifampicin.

[2] Most of the new compounds are being developed by not-for-profit organizations, academic institutions, small businesses or government agencies that lack the secure funding and resources available to major pharmaceutical companies. This makes the process of progression through trials and then registration more uncertain.

[3] US Food and Drug Administration (FDA) has approved the use of pretomanid for treating specific and limited population of TB patients, in combination with bedaquiline and linezolid. See https://www.fda.gov/news-events/press-announcements/fda-approves-new-drug-treatment-resistant-forms-tuberculosis-affects-lungs, accessed 19 August 2019.

FIG. 8.2

The global clinical development pipeline for new anti-TB drugs and regimens, August 2019



[a] New drug compounds are listed first, followed by repurposed drugs and then by regimens.
[b] New chemical class.
[c] Optimized background regimen.

Source: Adapted from the Working Group on New TB Drugs pipeline. More information on these products and other ongoing projects can be found at http://www.newtbdrugs.org/pipeline.php

moxifloxacin, nitazoxanide, rifampicin (high dose) and rifapentine. The 23 compounds are described in more detail in **Section 8.2.1** and **Section 8.2.2**.

New TB regimens are also being tested. These are described in **Section 8.2.3**.

8.2.1 New compounds

Bedaquiline

WHO issued interim policy guidance on the use of bedaquiline for the treatment of adults with MDR-TB in 2013, based on Phase IIb trial results *(20)*. The recommendation to use bedaquiline as part of longer treatment regimens for MDR-TB was conditional upon proper patient selection, a regimen design following WHO recommendations, close monitoring of treatment, active TB drug safety monitoring and management, and informed consent according to local requirements. The recommendation was maintained following a review of data from observational studies in 2016 *(21)*. In 2018, additional data for patients treated with bedaquiline-containing regimens were analysed as part of an update to WHO guidance on the treatment of drug-resistant TB, and bedaquiline was recommended as one of the priority medicines (group A) to design all-oral longer regimens to treat drug-resistant TB (see **Chapter 4**).

The safety and efficacy of bedaquiline when used as part of short MDR-TB regimens (i.e. 6 and 9 months duration) compared with the updated current standard of care recommended by WHO (i.e. a shortened 9-month regimen) is being investigated in the second stage of the Phase III trial Standardised Treatment Regimen of Anti-TB Drugs for Patients with MDR-TB (STREAM) *(22)*. Recruitment started in March 2016, and the first results are expected in 2020. A study on the use of bedaquiline to treat children with MDR-TB is being implemented in the Philippines, the Russian Federation and South Africa. Bedaquiline is also being used in trials of all-oral treatment regimens, and investigation of its use in the treatment of drug-susceptible TB under the bedaquiline, pretomanid, moxifloxacin and pyrazinamide (BPaMZ) trial has started (**Section 8.2.3**).

BTZ-043

BTZ-043 is a benzothiazinone compound that acts by inhibiting the DprE1 enzyme, which is necessary for the synthesis of D-arabinofuranose, a constituent of the *M. tuberculosis* cell wall. A Phase I trial was completed in 2019.

Contezolid (MRX-4/MRX-1)

MRX-4, a prodrug[1] of contezolid (MRX-I), is in a Phase I trial in the USA. MRX-I is an oxazolidinone antibiotic (the same chemical class as linezolid) that is potent against Gram-positive pathogens. Orally administered MRX-I has shown efficacy that is the same or better than linezolid in systemic and local-infection mouse models.

Delamanid

WHO issued interim policy guidance on the use of delamanid for the treatment of adults with MDR-TB in 2014, based on Phase IIb trial results *(24)*. A conditional recommendation was made to use delamanid as part of longer MDR-TB treatment regimens for adults. This recommendation was conditional on proper patient selection, a regimen design following WHO recommendations, close monitoring of treatment, active TB drug safety monitoring and management, and informed consent according to local requirements. Following the release of results for children and adolescents treated for MDR-TB using delamanid in 2016, WHO's guidance on the use of delamanid in adults was expanded to include patients aged 6–17 years *(25)*.

In November 2017, final results from a Phase III trial assessing the safety and efficacy of delamanid as an addition to an optimized background regimen for adults with MDR-TB were reported to WHO by the manufacturer, Otsuka Pharmaceutical, Japan. WHO conducted an expedited external expert review of the new data and in January 2018 issued a position statement *(26)*. This stated that the conditional guidance on delamanid remained valid, but that delamanid should only be added to a longer MDR-TB treatment regimen when the regimen cannot otherwise be composed according to WHO recommendations. In 2018, additional data from the Phase III trial were analysed by WHO alongside data from other studies of patients treated with delamanid-containing regimens, as part of a major update to WHO guidance on the treatment of drug-resistant TB (**Chapter 4**).

As with bedaquiline, delamanid is being used in trials of all-oral treatment regimens (**Section 8.2.3**). The use of delamanid in addition to an optimized background regimen to treat children aged under 6 years is also being investigated in other trials. Studies of its use in the prevention of drug-resistant TB among contacts of people with MDR-TB are planned.

Delpazolid (LCB01–0371)

Delpazolid is a new oxazolidinone developed by LegoChem BioSciences. It entered a Phase II trial in the Republic of Korea in 2017.

GSK-3036656

GSK-3036656 belongs to a new chemical class of oxaborole compounds developed by GlaxoSmithKline. A Phase I trial started in March 2017.

Macozinone

Macozinone (formerly PBTZ169) is a benzothiazinone developed by Nearmedic Plus. A Phase I trial has been completed. A Phase I study with a new formulation was started in 2018 in Switzerland.

OPC-167832

OPC-167832 is a carbostyril derivative developed by Otsuka that is bactericidal against both growing and intracellular bacilli. A single ascending dose study has been completed. A multiple ascending dose and early bactericidal activity study of OPC-167832, alone and in combination with delamanid, is being implemented.

Pretomanid

Pretomanid is a nitroimidazole, developed by the Global Alliance for TB Drug Development (TB Alliance), and recently approved by the US Food and Drug Administration (FDA) for treating a specific and limited population of adult patients with extensively drug resistant, treatment-intolerant or non-responsive MDR-TB, in combination with bedaquiline and linezolid.[2] It is currently being further tested as part of combination regimens for the treatment of both drug-susceptible and drug-resistant TB (**Section 8.2.3**).

Telacebec (Q203)

Telacebec (Q203) is an imidazopyridine that has been developed by Qurient (Republic of Korea). Single doses of various sizes have been tested in Phase I trials, and recruitment has been completed in South Africa as part of a Phase IIa trial assessing its early bactericidal activity in sputum smear-positive patients with drug-susceptible pulmonary TB.

SPR720

SPR720 is an orally administered antibiotic being developed by Spero Therapeutics for the treatment of pulmonary nontuberculous mycobacterial infections. A Phase I trial is ongoing.

SQ109

SQ109 is a novel drug that was discovered by scientists at Sequella Inc (USA) and the US National Institutes of Health (NIH). A Phase IIb/III trial in which the drug was added to a standard regimen for MDR-TB has been completed in seven clinical centres in the Russian Federation, and positive results in terms of safety, efficacy

[1] A prodrug is a derivative of drug molecules that undergo transformation into a pharmacologically active drug once inside the body *(23)*.

[2] See https://www.fda.gov/news-events/press-announcements/fda-approves-new-drug-treatment-resistant-forms-tuberculosis-affects-lungs, accessed 19 August 2019.

and tolerability were reported in a press release in March 2017. A Phase II trial in the USA is in the planning stages.

Sutezolid

Sutezolid (PNU-100480) is an oxazolidinone and an analogue of linezolid. Results from a study of early bactericidal activity presented in 2012 showed a significant reduction in colony-forming unit counts compared with the baseline level after 14 days of treatment. In January 2017, the Medicines Patent Pool announced that it had signed a licence with Johns Hopkins University to facilitate the clinical development of sutezolid in combination with other drugs. On World TB Day 2017, the TB Alliance and the Medicines Patent Pool announced a licensing agreement for the clinical development of sutezolid.

TBA-7371

TBA-7371 is an inhibitor of the enzyme DprE1, which is essential in the synthesis of components of mycobacterial cell walls. This inhibitor has been shown to be active against strains of *M. tuberculosis* resistant to known TB drugs. The TB Alliance has completed a Phase I study in the USA.

TBI-166

TBI-166, which belongs to the same clinical class as clofazamine, was identified through a lead optimization effort by the TB Alliance, in partnership with the Institute of Materia Medica, the Chinese Academy of Medical Sciences and the Peking Union Medical College in Beijing. This riminophenazine compound has improved physicochemical and pharmacokinetic properties (to avoid discoloration of skin), and its efficacy is similar to that of clofazimine. A Phase I trial started in January 2018 in China.

TBI-223

TBI-223 was identified through a lead optimization effort by the TB Alliance, in partnership with the Institute of Materia Medica. This oxazolidinone compound works as a protein synthesis inhibitor, targeting an early step involving the binding of N-formylmethionyl-tRNA to the ribosome. A Phase I trial in the USA is ongoing.

8.2.2 Approved drugs being tested for new purposes

Clofazimine

Clofazimine is a riminophenazine that is used to treat leprosy. Its use in MDR-TB treatment is being explored in preclinical models of TB infection, to better understand its anti-TB effects. Novartis, the company that manufactures the drug, has withdrawn support for Phase II trials; however, clofazimine continues to be tested as part of treatment regimens for MDR-TB in Phase III trials (**Section 8.2.3**).

Levofloxacin

Levofloxacin is being tested in a Phase II study called Opti-Q, which is investigating the best dose of levofloxacin to use for treatment of MDR-TB in adults with smear- and culture-positive pulmonary TB. Four different dosages are being tested as part of an optimized background regimen. Trial enrolment and follow-up (in Peru and South Africa) have been completed and data analysis is underway. Levofloxacin continues to be tested as part of treatment regimens for drug-resistant TB (**Section 8.2.3**).

Linezolid

Linezolid is a marketed oxazolidinone with potent activity against TB. It has been widely used in the treatment of drug-resistant TB, and there is good evidence that it improves culture conversion and cure rates when added to treatment regimens. Since the medicine has a narrow therapeutic window, and the optimal dosing strategy remains unknown, the TB Alliance has implemented a Phase II trial to evaluate the mycobactericidal activity, safety, tolerability and pharmacokinetics of five doses of linezolid in adults with pulmonary TB. Linezolid is also being tested in other Phase II and III trials (**Section 8.2.3**).

Moxifloxacin

Moxifloxacin is included in several trials of new regimens for treatment of both drug-susceptible and drug-resistant TB, including in the BPaMZ, TB-PRACTECAL and TB Trial Consortium (TBTC) Study 31 trials (**Section 8.2.3**).

Nitazoxanide

Nitazoxanide is an anti-parasitic drug. Its activity against *M. tuberculosis* is being tested in a Phase II trial in Haiti.

Rifampicin (high dose)

Findings from the multi-arm, multi-stage TB (MAMS-TB) trial of the Pan-African Consortium for the Evaluation of Antituberculosis Antibiotics (PanACEA) were published in 2017 *(27)*. It was found that 35 mg/kg of rifampicin given over 12 weeks is safe and shortens the time to stable culture conversion from 62 to 48 days. The other trial arms – which included various combinations of 10 mg/kg or 20 mg/kg of rifampicin, moxifloxacin and SQ109 – did not achieve significant improvements compared with the control arm. When all the data were taken into consideration, the trial suggested that a 35 mg/kg dose of rifampicin given for 12 weeks is likely to improve treatment outcomes. This trial is the first multi-arm adaptive trial design to be successfully implemented in multiple sites in countries with a high burden of TB. It may help to pave the way for accelerated testing of new TB treatment regimens at reduced cost.

Rifapentine

The effectiveness of rifapentine in the treatment of drug-susceptible TB is being studied in three trials. The TBTC Study 31/ACTG A5349 is a Phase III trial that is investigating the use of rifapentine, with or without moxifloxacin, to shorten the treatment of drug-susceptible pulmonary TB to 4 months. TBTC Study 35, a Phase II study of the pharmacokinetics of new water-dispersible paediatric formulations of rifapentine, is being implemented in South Africa (**Section 8.3**).

8.2.3 New regimens for the treatment of drug-susceptible or drug-resistant TB disease

New combinations of drugs are being tested in Phase II or Phase III trials.

ACTG A5343 DELIBERATE

The ACTG A5343 DELIBERATE trial is testing the cardiotoxicity of regimens containing delamanid and bedaquiline, alone and in combination, in pharmacokinetic and drug–drug interaction studies. The trial is sponsored by the National Institute of Allergy and Infectious Diseases (NIAID) of NIH.

BEAT TB

BEAT TB is a research programme being implemented in India and South Africa with funding from USAID. It has the overall aim of reducing side-effects and treatment duration for patients with drug-resistant TB. In India, the safety and efficacy of a 6–9 month oral regimen (consisting of bedaquiline, delamanid, linezolid and clofazimine) for treating adults with pre-XDR TB and XDR-TB is being tested. In South Africa, a Phase III trial is assessing the safety and efficacy of a 6-month oral regimen for MDR-TB (consisting of bedaquiline, delamanid, linezolid, levofloxacin and clofazimine) compared with the national standard of care (i.e. a 9-month regimen).

endTB

The endTB trial started in 2017. It is comparing several shorter treatment regimens for MDR-TB or XDR-TB with the current standard-of-care treatment for MDR-TB recommended by WHO. The regimens being tested include bedaquiline or delamanid (or both), moxifloxacin or levofloxacin, and pyrazinamide plus linezolid or clofazimine (or both), in various combinations.

MDR-END

The MDR-END trial is investigating a 9–12 months regimen of delamanid, linezolid, levofloxacin and pyrazinamide for the treatment of MDR-TB among TB patients without resistance to fluoroquinolones.

NeXT

The NeXT trial is testing a 6–9 months injection-free regimen of bedaquiline, ethionamide or high-dose isoniazid, linezolid, levofloxacin and pyrazinamide for patients with MDR-TB, compared with the 21–24 months treatment regimen; it is being undertaken in South Africa.

NiX-TB, ZeNix and BPaMZ

The Phase III NiX-TB trial is investigating the safety and efficacy of a 6-month all-oral regimen combining bedaquiline, pretomanid and linezolid in patients with XDR-TB, and in patients who could not tolerate MDR-TB treatment or for whom this treatment failed. It was implemented by the TB Alliance in South Africa. The primary end-point is bacteriological failure, relapse or clinical failure during a 6-month follow-up period after completion of treatment. A cure rate of 89% has been reported for the first 45 patients. The US Food and Drug Administration (FDA) has recently approved this regimen for use in XDR-TB patients and treatment-intolerant or non-responsive MDR-TB patients. A follow-on trial (called ZeNix) is exploring lower doses and shorter durations of linezolid to minimize toxicity.

A Phase III trial (called SimpliciTB) of BPaMZ, targeting patients with drug-susceptible TB or MDR-TB, is also being implemented. The primary end-point is culture conversion at 2 months, with a secondary end-point of cure 6 months after completion of therapy. A previous Phase IIb study of this BPaMZ regimen showed almost 100% culture conversion at 2 months in patients with MDR-TB.

PredictTB trial

The Phase II PredictTB trial is investigating the possibility of shortening the treatment duration for "less-severe" cases of drug-susceptible TB (as determined by the baseline radiographic extent of disease) to 4 months instead of the standard 6 months of therapy. The primary end-point will be a comparison of the treatment success rate at 18 months between the experimental and standard-of-care cohorts. It is being implemented in China by the NIH/NIAID.

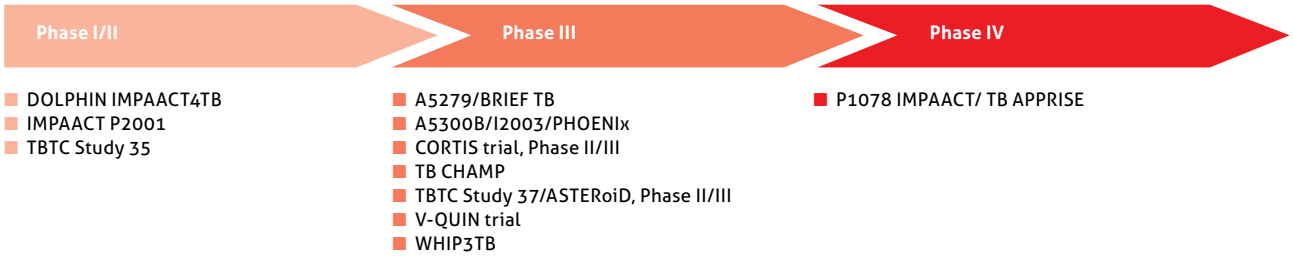
STREAM

STREAM Stage 1 was a Phase III, randomized, non-inferiority trial that compared a standardized 9–11 months regimen for the treatment of MDR-TB with longer regimens of 18–24 months in Ethiopia, Mongolia, South Africa and Viet Nam. The final trial results showed that the shorter regimen was non-inferior to the control (longer) regimen *(28)*. Current consolidated WHO guidelines on the treatment of drug-resistant TB treatment recommend that NTPs and other stakeholders continue to use the shorter MDR-TB regimen under programmatic conditions, as described in the guidance *(29)*.

STREAM Stage 2 is assessing whether an all-oral 40-week regimen including bedaquiline, and a 28-week regimen including both bedaquiline and an injectable agent, are as effective as the 9-month regimen studied in STREAM Stage 1. It is funded by USAID and implemented by the Union.

FIG. 8.3

The global clinical development pipeline for new TB preventive medicines and regimens, August 2019



TB-PRACTECAL

The TB-PRACTECAL trial is a Phase II/III trial to evaluate the safety and efficacy of 6-month regimens that contain bedaquiline, pretomanid and linezolid, with or without moxifloxacin or clofazimine, for the treatment of adults with MDR-TB or XDR-TB. Primary outcomes include 8-week culture conversion, and the development of unfavourable outcomes (treatment failure or recurrence, death, discontinuation or loss to follow-up during a 72-week follow-up period). It is being implemented by Médecins Sans Frontières and other collaborators in Belarus, South Africa and Uzbekistan.

TRUNCATE-TB

The TRUNCATE-TB trial is a Phase II/III randomized, open-label, multi-arm, multi-stage trial to evaluate the safety and efficacy of 2-month regimens (compared with standard care) for the treatment of adults with drug-susceptible TB that contain isoniazid, pyrazinamide ethambutol, linezolid and rifampicin; isoniazid, pyrazinamide, linezolid, rifapentine and levofloxacin; or isoniazid, pyrazinamide, ethambutol, linezolid and bedaquiline. The primary outcome is an unsatisfactory clinical outcome at 96 weeks after randomization, which is defined as an ongoing requirement for TB treatment or ongoing TB disease activity at week 96. It is being implemented by University College London and other collaborators in Indonesia, the Philippines, Singapore and Thailand.

8.3 New drugs and drug regimens to treat latent TB infection to prevent TB disease

Achieving the global target of reaching at least 30 million people with treatment for latent TB infection in the 5-year period 2018–2022 – set in the political declaration at the UN high-level meeting on TB in September 2018 – will require additional efforts in the implementation of new and existing preventive therapies, and widening access to drugs such as rifapentine (see also **Chapter 5**). Other factors that will help to reduce TB incidence to the levels targeted in the End TB Strategy are the discovery of long-acting and safe drug formulations (including for treating latent infections of MDR-TB and XDR-TB), and the discovery, validation and translation of biomarkers (e.g. those that can identify latently infected individuals who are most likely to develop TB disease) into affordable clinical tools. To facilitate progress, WHO has initiated a multistakeholder process to develop target regimen profiles for latent TB infection that can guide the development of new options for preventive treatment.

In 2018, WHO issued consolidated guidelines for the programmatic management of latent TB infection *(30)*. The guidelines included new recommendations for the use of short-course, rifamycin-based regimens to treat latent TB infection in high-burden settings, in accordance with individual clinical and programmatic considerations, patient preferences and epidemiology.

The status of the pipeline in August 2019 for new medicines and regimens to treat latent TB infection and prevent TB disease is shown in **Fig. 8.3**. Four agents are currently used (individually or in combination) in Phase I/II, III and IV trials: delamanid, isoniazid, levofloxacin and rifapentine. Results from some of these trials informed a meeting held in July 2019 to review and update WHO guidance on the programmatic management of latent TB infection (see **Chapter 5**).

8.3.1 Phase I/II trials

DOLPHIN IMPAACT4TB

DOLPHIN is a Phase I/II trial to assess the pharmacokinetics, safety and tolerability of 3 months of a weekly dose of isoniazid and rifapentine (3HP) for people living with HIV taking dolutegravir-based (DTG) antiretroviral treatment. The study is being implemented in South Africa, through the IMPAACT4TB platform.

IMPAACT P2001

The 3HP regimen is currently not recommended for pregnant women or women planning pregnancy during the treatment period. IMPAACT P2001 is a Phase I/II trial designed to evaluate the pharmacokinetics and safety of 3HP among HIV-positive and HIV-negative pregnant and postpartum women with *M. tuberculosis* infection. The study is sponsored by the NIH/NIAID, and is being implemented in Haiti, Kenya, Malawi, Thailand and Zimbabwe.

TBTC Study 35

TBTC Study 35 is a single-arm, open-label Phase I/II dose finding and safety study of 3HP (with rifapentine given as a water-dispersible monolayer or as a fixed-dose combination with isoniazid) for children aged 12 years or under, for whom treatment for latent TB infection is recommended. The study is sponsored by the US Centers for Disease Control and Prevention (CDC).

8.3.2 Phase III/IV trials

A5279/BRIEF TB

The BRIEF TB trial was a multi-site open-label Phase III non-inferiority trial that compared the effectiveness of isoniazid and rifapentine daily for 1 month (1HP) with a 9-month regimen of isoniazid (9H) among people living with HIV in settings with a high incidence of TB, or among people living with HIV with a positive TST or IGRA. The results showed that 1HP was not inferior to 9H and was associated with a higher rate of treatment completion and better safety *(31)*. The study was sponsored by the NIH/NIAID and implemented in 10 countries.

A5300B/I2003/PHOENIx

PHOENIx is a Phase III trial designed to assess the efficacy of 26 weeks of daily delamanid compared with 26 weeks of isoniazid among high-risk household contacts of adults diagnosed with MDR-TB. The study is funded by the NIH/NIAID and is being implemented in Botswana, Brazil and the Philippines.

Correlate of Risk Targeted Intervention Study

Correlate of Risk Targeted Intervention Study (CORTIS) is a Phase II/III trial to assess the efficacy of 3HP compared with standard care (active surveillance) in HIV-negative adults with latent TB infection who are deemed high risk for disease progression. The level of risk is identified by an experimental gene-based signature (COR+). If COR is found to be a good test for diagnosis and prognosis of the risk of developing TB disease, this could open the door for wider and more targeted treatment of latent TB infection. The study is sponsored by the US CDC and is being implemented in South Africa.

TB-CHAMP

TB-CHAMP is a Phase III trial to assess the safety and efficacy of 6 months of daily levofloxacin for the prevention of TB in child contacts of adults with MDR-TB. The study is sponsored by the United Kingdom Department for International Development (DFID) and is being implemented in South Africa.

TBTC Study 37/ASTERoid

TBTC Study 37/ASTERoid is a Phase II/III non-inferiority trial to compare the safety and effectiveness of a short 6-week regimen of daily rifapentine with a comparator arm of 12–16 weeks of rifamycin-based treatment (standard care). The study is sponsored by the US CDC and the United Kingdom Medical Research Council. It is being implemented in the United Kingdom, the USA and other countries with a low to moderate incidence of TB.

V-QUIN trial

V-QUIN is a Phase III trial of 6 months of daily levofloxacin among household contacts of adults with MDR-TB. The trial is sponsored by the Australian Woolcock Institute of Medical Research and is being implemented in Viet Nam.

WHIP3TB

WHIP3TB is a Phase III trial among people living with HIV to assess the impact of periodic 3HP (given once a year for 2 years) on the durability of protection as well as safety and adherence, compared with a single round of 3HP (given once) or 6 months of daily isoniazid (6H). The trial is funded by USAID and is being implemented by the Aurum Institute in South Africa, Ethiopia and Mozambique.

P1078 IMPAACT/ TB APPRISE

P1078 IMPAACT/ TB APPRISE was a Phase IV trial to assess the safety of immediate (antepartum) versus deferred (postpartum) isoniazid preventive therapy among HIV-infected pregnant women. The study was sponsored by the NIH/NIAID and implemented in multiple high TB incidence countries. Analysis of results is underway.

8.4 New TB vaccines

The BCG vaccine, first used in the 1920s, remains the only licensed vaccine for preventing TB. Despite high coverage of BCG vaccination as part of childhood immunization programmes (**Chapter 5**), the slow decline in TB incidence globally highlights the need for a much more effective vaccine that provides protection against all forms of TB in all age groups.

The status of the pipeline for new TB vaccines in August 2019, including the names of vaccine developers, is shown in **Fig. 8.4**. There are 14 vaccines in Phase I, II or III trials; their main characteristics are summarized below.

8.4.1 Phase I trials

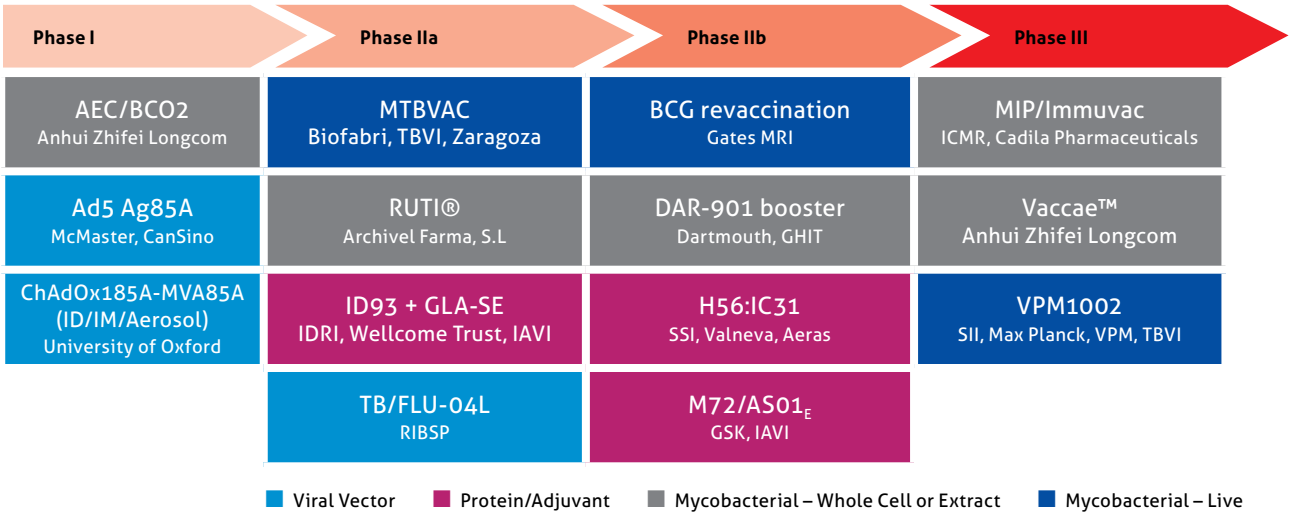
There are currently three vaccine candidates in Phase I trials.

Ad5 Ag85A

Ad5 Ag85A is an adenovirus serotype 5 vector expressing Ag85A. It has been evaluated for safety and immunogenicity in both BCG-naive and previously BCG-immunized healthy volunteers in Canada. Overall, intramuscular administration was found to be safe, well tolerated and immunogenic in both trial groups, with more potent immunogenicity observed in volunteers who had been previously vaccinated with BCG. A safety and immunogenicity study of aerosol administration in BCG-vaccinated healthy volunteers has started.

FIG. 8.4

The global clinical development pipeline for new TB vaccines, August 2019[a]



[a] Information was self-reported by vaccine sponsors, and the Stop TB Partnership Working Group on New TB Vaccines supported the review of their reports.

AEC/BC02

AEC/BC02 is a freeze-dried recombinant vaccine expressing Ag85B and fusion protein ESAT-6 and CFP-10, together with CpG (from BCG) and an alum salt-based adjuvant. A Phase I study assessing safety and immunogenicity is underway in China, with sponsorship from Anhui Zhifei Longcom Biologic Pharmacy Co., Ltd.

ChAdOx185A – MVA85A (ID/IM/Aerosol)

ChAdOx185A is a simian adenovirus and MVA85A is a recombinant pox virus – both express antigen 85A. These candidates are being developed with the overall aim of generating a joint heterologous prime-boost regimen delivered through both systemic and mucosal routes.

A Phase I trial of intramuscular administration of ChAdOx185A in BCG-vaccinated adults in the United Kingdom, both alone and as part of a prime-boost strategy with MVA85A, has been completed. A Phase I trial of aerosol administration of ChAdOx185A in BCG-vaccinated adults is underway in Switzerland. Two studies of aerosol administration of MVA85A in BCG-vaccinated individuals have been completed, as has a further study in people with a latent TB infection. A Phase IIa study of the intramuscular administration of ChAdOx185A and MVA85A among adults and adolescents is due to start in Uganda in 2019.

8.4.2 Phase II and Phase III trials

There are currently 11 vaccines in Phase II or Phase III trials.

BCG revaccination (Gates MRI-TBV01-201)

Gates MRI-TBV01-201 is a Phase IIb trial of the safety, immunogenicity and efficacy of BCG revaccination in healthy adolescents for "prevention of sustained QFT conversion", as a surrogate for sustained infection with *M. tuberculosis*. The study, sponsored by the Bill & Melinda Gates Medical Research Institute, intends to confirm that BCG revaccination protects against sustained *M. tuberculosis* infection; assess the duration of protection 48 months post-revaccination; and identify or validate biomarkers that correlate with risk for or protection against transient or sustained *M. tuberculosis* infection, as assessed by the QuantiFERON-TB Gold Plus (QFT-Plus) assay.

DAR-901 booster

DAR-901 is a whole-cell, heat-inactivated, nontuberculous mycobacterial vaccine booster. It represents a new scalable manufacturing method for SRL172, a candidate vaccine that showed efficacy among adults living with HIV in a Phase III trial in the United Republic of Tanzania. It is now being tested in a Phase IIb prevention of infection trial among BCG-primed adolescents, also in the United Republic of Tanzania. The trial is scheduled for completion in 2020.

H56:IC31

H56:IC31 is an adjuvanted subunit vaccine that combines three *M. tuberculosis* antigens (Ag85B, ESAT-6 and Rv2660c) with the IC31© adjuvant from Valneva Austria GmBH (Vienna, Austria). Three Phase I or I/IIa trials of safety and immunogenicity have been completed. Two of these were in HIV-negative, BCG-vaccinated adults with and without latent TB infection, and without a history or any evidence of TB disease. The other was in HIV-negative pulmonary TB patients who had recently completed treatment. The trials showed that the vaccine had an acceptable safety profile and was immunogenic at all studied doses. Analysis of a Phase Ib trial evaluating the safety

and immunogenicity of H4:IC31, H56:IC31 and BCG revaccination in adolescents is underway. A Phase IIb trial assessing H56:IC31 for prevention of recurrence is ongoing in South Africa and the United Republic of Tanzania, co-sponsored by the Statens Serum Institut (SSI) and the International AIDS Vaccine Initiative (IAVI) with support from the European and Developing Countries Clinical Trials Partnership (EDCTP).

ID93 + GLA-SE

The ID93 + GLA-SE vaccine comprises four *M. tuberculosis* antigens associated with either virulence (Rv2608, Rv3619 and Rv3620) or latency (Rv1813), and the adjuvant GLA-SE. A Phase IIa trial in HIV-negative TB patients who recently completed treatment for pulmonary TB disease has been completed in South Africa, in preparation for two Phase II studies that will establish the safety and immunogenicity of ID93 in TB patients undergoing active therapy. A Phase IIa trial in BCG-vaccinated healthy adult health care workers, to assess prevention of infection, is underway.

M72/AS01$_E$

M72/AS01$_E$ is a subunit vaccine that pairs two *M. tuberculosis* antigens (32A and 39A) with an adjuvant (AS01$_E$). It was tested in a Phase IIb efficacy trial in HIV-negative adults already infected with *M. tuberculosis* in Kenya, South Africa and Zambia, with the primary end-point being the number of incident cases of active pulmonary TB disease not associated with HIV infection. The primary analysis of this trial showed a 54% (90% CI: 14–75; P=0.04) point estimate of vaccine efficacy over about 2 years of follow-up *(6)*.[1] This result is unprecedented in decades of TB vaccine research in terms of the clinical significance and strength of evidence. If the findings are confirmed in a Phase III trial, the vaccine has the potential to transform global TB prevention efforts.

Key questions about M72/AS01$_E$ include whether it could provide protection against TB among uninfected people and people living with HIV, and in other geographical areas. Additional studies are also required to provide a more precise evaluation of impact and to assess generalizability.

Further testing and development of M72/AS01$_E$ is conditional on enhanced commitment and investment from various partners engaged in TB research and development, and close collaboration. Hence, WHO convened a high-level and multistakeholder consultation on advancing the further development of the M72/AS01$_E$ vaccine candidate, on the theme of collaboration, in April 2019 *(32)*. The aim was to create a platform for funders, product development partnerships, high TB burden countries, the pharmaceutical industry, senior scientists and civil society to exchange information about potential processes, strategies and methods to support progress in the development of the M72/AS01$_E$ vaccine, while also supporting ongoing research related to other TB vaccine candidates.

As an outcome of the meeting, participants suggested that WHO should establish and convene working groups to support the further development of the M72/AS01$_E$ vaccine, in a manner that boosts the overall TB vaccine agenda. Examples of priorities agreed for such working groups included:

- defining the evidence that needs to be collected for regulatory and policy decision-making, with a view to informing future clinical development plans and study designs;
- providing guidance on robust, efficient and well-structured clinical trial designs that facilitate regulatory, clinical and health policy decision-making;
- developing an overall public health value assessment of new TB vaccines, to support decision-making by various stakeholders in the research and development cycle;

BOX 8.2

Full public health value assessment of new TB vaccines

Research into new TB vaccines should not be seen merely as a cost, but as an investment with the potential for high-value returns (or benefits) in the form of a sustainable, long-term and large-scale impact on the burden of TB disease.

In the context of the Phase IIb results for the M72/AS01$_E$ vaccine, WHO has initiated a multistakeholder process that aims to appraise the full benefits of developing new TB vaccines. The assessment will include appraisal of:

- health gains; for example, in terms of cases and deaths averted, quality-adjusted life-years (QALYs) gained or disability-adjusted life-years (DALYs) averted;
- health care cost savings; and
- social benefits, such as health improvements in unvaccinated people, potential impact on the emergence and transmission of drug-resistant TB (and overall antibiotic stewardship), equitable distribution of health outcomes and elimination of catastrophic expenditures related to TB.

Productivity gains related to direct health effects, as well as long-term productivity gains resulting from overall well-being, may also be assessed.

It is hoped that the results from the assessment will help to facilitate vaccine development and adoption, by making economic information (in addition to evidence from trials about the safety and efficacy of vaccines with respect to clinical outcomes) available to governments, funding agencies, researchers, industry, international agencies, affected communities and other relevant stakeholders.

[1] Results after 3 years of follow-up are expected in 2019.

- fostering functional collaborative platforms to help implement the required next steps of product development, with an end-to-end perspective – this will require input and contributions from scientists, civil society, research institutions, countries, regulators, funders and other relevant stakeholders in the private, public and philanthropic sectors, also taking into account relevant activities and the strategic value added to existing working groups on new TB vaccines; and
- promoting the development of innovative financing models.

In this context, WHO has initiated a multistakeholder process to develop a full public health value assessment of new TB vaccines to help guide investment decisions (**Box 8.2**). It has also started a consultation on the clinical development pathway of the M72/AS01$_E$ vaccine, with a view to exploring options and priority studies to assure the most efficient pathway to licensure and use. The WHO Secretariat will work with partners and institutions that have effective systems already in place to make progress on both topics.

MTBVAC

MTBVAC vaccine is a live strain of *M. tuberculosis*, attenuated via deletions of the *phoP* and *fadD26* genes. The primary target population is neonates (as a BCG replacement vaccine); the secondary target populations are adolescents and adults (as a booster vaccine). A Phase Ib trial in neonates was completed in 2018. Phase IIa trials in both target populations started in 2019.

RUTI®

RUTI is a non-live, polyantigenic vaccine based on cell-wall fragmented *M. tuberculosis* bacteria. It is intended as a therapeutic vaccine, to be used in conjunction with a short, intensive antibiotic treatment. A Phase I study in healthy volunteers and a Phase II study in people with latent TB infection have demonstrated a good safety profile and found the vaccine to be immunogenic at all studied doses. The main target for RUTI is MDR-TB, and a Phase IIa study in patients with MDR-TB is ongoing.

TB/FLU-04L

TB/FLU-04L is a mucosal-vectored vaccine based on an attenuated replication-deficient influenza virus vector expressing antigens Ag85A and ESAT-6. It was designed as a prophylactic boost vaccine for infants, adolescents and adults. A Phase IIa trial in people with latent TB infection is being implemented.

Vaccae™

Vaccae vaccine is a specified lysate that has been licensed by the China Food and Drug Administration as an immunotherapeutic agent, to help shorten TB treatment for patients with drug-susceptible TB. A Phase III trial to assess its efficacy and safety in preventing TB disease in people with latent TB infection has been completed, and data analysis is underway. It is the largest TB vaccine trial undertaken in the past decade, involving 10 000 people aged 15–65 years.

VPM1002

VPM1002 is a live recombinant vaccine. A Phase II trial is being implemented in South Africa to assess the safety and immunogenicity of the vaccine in HIV-exposed and unexposed neonates, and the preparations for a subsequent Phase III trial are underway. A Phase II/III trial for prevention of TB recurrence in adults is being implemented in India.

MIP/Immuvac

MIP, also known as Immuvac, is a heat-killed *M. indicus pranii* vaccine. It has been approved by the drug controller general of India and the FDA as an immunotherapeutic and immunoprophylactic agent for treating multibacillary leprosy patients (as an adjunct to standard multidrug therapy), and for preventing the development of leprosy among close contacts of leprosy patients. A Phase III trial to assess the efficacy and safety of Immuvac in preventing pulmonary TB among healthy household contacts of sputum smear-positive TB patients is currently being implemented in India by the Indian Council of Medical Research.

References

1 Moscow Declaration to End TB; First WHO global ministerial conference on ending TB in the sustainable development era: a multisectoral response. Geneva: World Health Organization and the Ministry of Health of the Russian Federation; 2017 (https://www.who.int/tb/features_archive/Moscow_Declaration_to_End_TB_final_ENGLISH.pdf?ua=1, accessed 28 June 2019).

2 United Nations General Assembly. Resolution 73/3: Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis. United Nations; 2018 (https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/73/3, accessed 28 June 2019).

3 Treatment Action Group, Stop TB Partnership. Tuberculosis research funding trends 2005–2017. New York: Treatment Action Group; 2018 (http://www.treatmentactiongroup.org/content/tbrd2018, accessed 22 July 2019).

4 Target regimen profiles for TB treatment. Geneva: World Health Organization; 2016 (https://apps.who.int/iris/bitstream/handle/10665/250044/9789241511339-eng.pdf;jsessionid=5F6709C0669BB45006E43153C2B4DF06?sequence=1, accessed 17 July 2019).

5 Houben RM, Dodd PJ. The global burden of latent tuberculosis infection: a re-estimation using mathematical modelling. PLoS Med. 2016;13(10):e1002152 (https://www.ncbi.nlm.nih.gov/pubmed/27780211, accessed 28 June 2019).

6 Van Der Meeren O, Hatherill M, Nduba V, Wilkinson RJ, Muyoyeta M, Van Brakel E et al. Phase 2b controlled trial of M72/AS01$_E$ vaccine to prevent tuberculosis. N Engl J Med. 2018;379(17):1621–34 (https://www.ncbi.nlm.nih.gov/pubmed/30280651, accessed 1 August 2019).

7 Preparation for a high-level meeting of the General Assembly on ending tuberculosis (WHA71.3), Seventy-first World Health Assembly. Geneva: World Health Organization; 2018 (https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R3-en.pdf, accessed 11 July 2018).

8 Global investments in tuberculosis research and development past, present, and future. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/259412/9789241513326-eng.pdf, accessed 24 June 2019).

9 The use of lateral flow urine lipoarabinomannan assay (LF-LAM) for the diagnosis and screening of active tuberculosis in people living with HIV: policy guidance (WHO/HTM/TB/2015.25). Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/10665/193633/1/9789241509633_eng.pdf?ua=1&ua=1, accessed 1 May 2018).

10 Process overview: development of a global strategy for TB research and innovation [website]. Geneva: World Health Organization (https://www.who.int/tb/features_archive/Process-Global-strategy-for-TB-research-innovation/en/, accessed 7 June 2019).

11 A Draft Global Strategy for TB Research and Innovation. Geneva: World Health Organization; 2019 (https://www.who.int/tb/features_archive/Revised_draft_Researchstrategy_based_on_public_comments.pdf?ua=1, accessed 7 June 2019).

12 WHO meeting report of a technical expert consultation: non-inferiority analysis of Xpert MTB/RIF Ultra compared to Xpert MTB/RIF (WHO/HTM/TB/2017.04). Geneva: World Health Organization; 2017 (https://www.who.int/tb/publications/2017/XpertUltra/en/, accessed 1 May 2018).

13 Horne DJ, Kohli M, Zifodya JS, Schiller I, Dendukuri N, Tollefson D et al. Xpert MTB/RIF and Xpert MTB/RIF Ultra for pulmonary tuberculosis and rifampicin resistance in adults. Cochrane Database Syst Rev. 2019;6:Cd009593 (https://www.ncbi.nlm.nih.gov/pubmed/31173647, accessed 17 July 2019).

14 Chest radiography in tuberculosis detection: summary of current WHO recommendations and guidance on programmatic approaches. Geneva: World Health Organization; 2016 (https://www.who.int/tb/publications/chest-radiography/en/, accessed 1 August 2019).

15 Ahmad Khan F, Pande T, Tessema B, Song R, Benedetti A, Pai M et al. Computer-aided reading of tuberculosis chest radiography: Moving the research agenda forward to inform policy. Eur Respir J. 2017;50(1) (https://www.ncbi.nlm.nih.gov/pubmed/28705949, accessed 1 August 2019).

16 Technical manual for drug susceptibility testing of medicines used in the treatment of tuberculosis. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/275469/9789241514842-eng.pdf?ua=1, accessed 17 July 2019).

17 The use of next-generation sequencing technologies for the detection of mutations associated with drug resistance in *Mycobacterium tuberculosis* complex: technical guide. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/274443/WHO-CDS-TB-2018.19-eng.pdf, accessed 17 July 2019).

18 Relational Sequencing TB Knowledgebase (ReSeqTB) [website] (http://reseqtb.org, accessed 17 July 2019).

19 Global tuberculosis report 2018 (WHO/CDS/TB/2018.20). Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/274453, accessed 2 July 2019, accessed 21 June 2018).

20 The use of bedaquiline in the treatment of multidrug-resistant tuberculosis: interim policy guidance (WHO/HTM/TB/2013.6). Geneva: World Health Organization; 2013 (https://apps.who.int/iris/bitstream/10665/84879/1/9789241505482_eng.pdf, accessed 12 June 2018).

21 Report of the Guideline Development Group Meeting on the use of bedaquiline in the treatment of multidrug-resistant tuberculosis, 2016 revision (WHO/HTM/TB/2017.01). Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/10665/254712/1/WHO-HTM-TB-2017.01-eng.pdf, accessed 9 July 2018).

22 Moodley R, Godec TR, Team ST. Short-course treatment for multidrug-resistant tuberculosis: the STREAM trials. Eur Respir Rev. 2016;25(139):29–35 (https://www.ncbi.nlm.nih.gov/pubmed/26929418, accessed 12 June 2018).

23 Rautio J, Kumpulainen H, Heimbach T, Oliyai R, Oh D, Jarvinen T et al. Prodrugs: design and clinical applications. Nat Rev Drug Discov. 2008;7(3):255–70 (https://www.ncbi.nlm.nih.gov/pubmed/18219308, accessed 9 July 2018).

24 The use of delamanid in the treatment of multidrug-resistant tuberculosis: interim policy guidance (WHO/HTM/TB/2014.23). Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/10665/137334/1/WHO_HTM_TB_2014.23_eng.pdf, accessed 12 June 2018).

25 The use of delamanid in the treatment of multidrug-resistant tuberculosis in children and adolescents: interim policy guidance (WHO/HTM/TB/2016.14). Geneva: World Health Organization; 2016 (https://apps.who.int/iris/bitstream/10665/250614/1/9789241549899-eng.pdf, accessed 12 June 2018).

26 WHO position statement on the use of delamanid for multidrug-resistant tuberculosis (WHO/CDS/TB/2018.1). Geneva: World Health Organization; 2018 (https://www.who.int/tb/publications/2018/WHOPositionStatementDelamanidUse.pdf, accessed 21 June 2018).

27 Boeree MJ, Heinrich N, Aarnoutse R, Diacon AH, Dawson R, Rehal S et al. High-dose rifampicin, moxifloxacin, and SQ109 for treating tuberculosis: a multi-arm, multi-stage randomised controlled trial. Lancet Infect Dis. 2017;17(1):39–49 (https://www.ncbi.nlm.nih.gov/pubmed/28100438, accessed 12 June 2018).

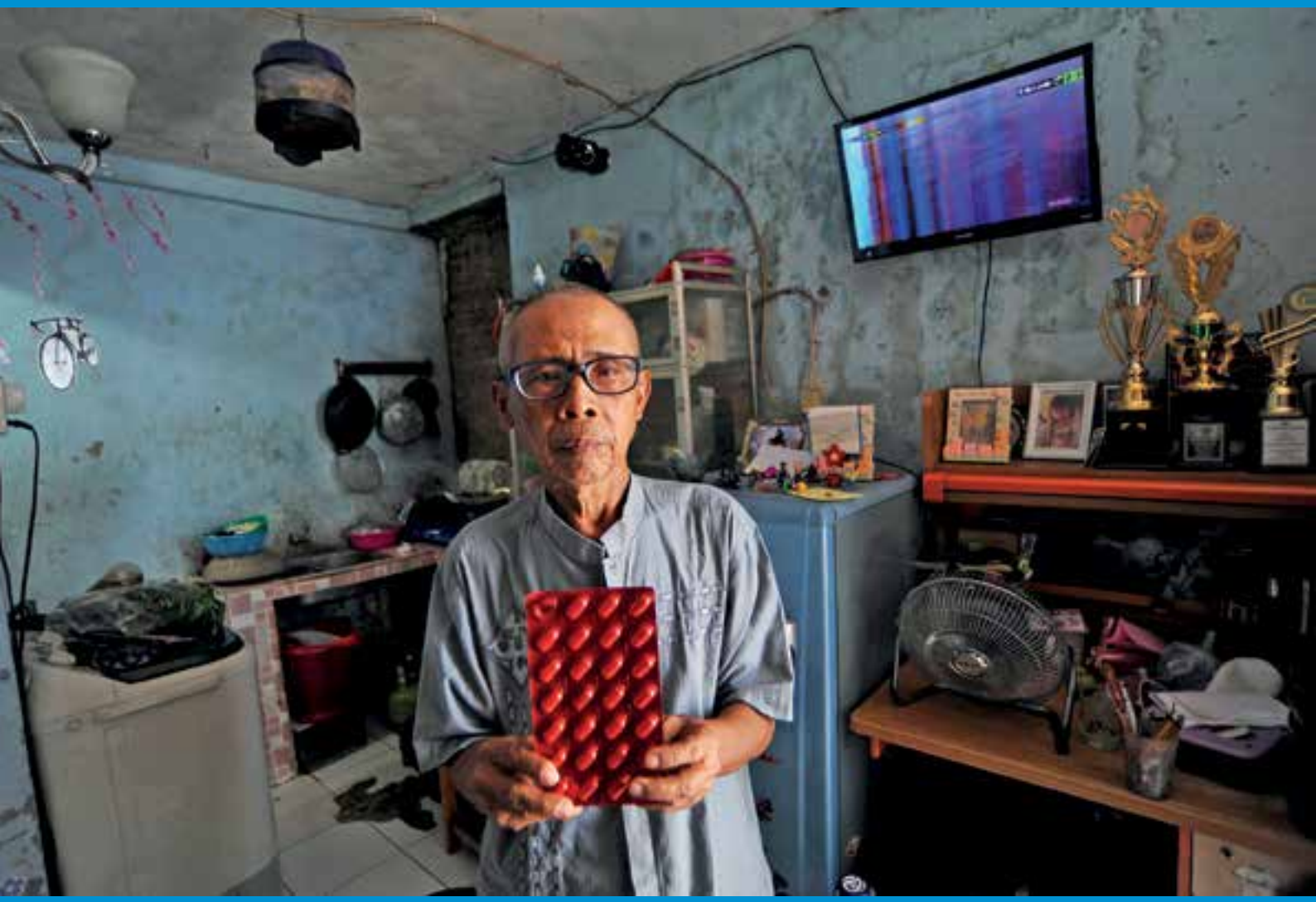
28 Nunn AJ, Rusen ID, Van Deun A, Torrea G, Phillips PP, Chiang CY et al. Evaluation of a standardized treatment regimen of anti-tuberculosis drugs for patients with multi-drug-resistant tuberculosis (STREAM): Study protocol for a randomized controlled trial. Trials. 2014;15:353 (https://www.ncbi.nlm.nih.gov/pubmed/30865791, accessed 17 July 2019).

29 WHO consolidated guidelines on drug-resistant tuberculosis treatment. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/consolidated-guidelines-drug-resistant-TB-treatment/en/, accessed 17 July 2019).

30 Latent tuberculosis infection: updated and consolidated guidelines for programmatic management. Geneva: World Health Organization; 2018 (https://www.who.int/tb/publications/2018/latent-tuberculosis-infection/en/, accessed 26 July 2018).

31 Swindells S, Ramchandani R, Gupta A, Benson CA, Leon-Cruz J, Mwelase N et al. One month of rifapentine plus isoniazid to prevent HIV-related tuberculosis. N Engl J Med. 2019;380(11):1001–11 (https://www.ncbi.nlm.nih.gov/pubmed/30865794, accessed 17 July 2019).

32 Report of the high-level consultation on accelerating the development of the M72/AS01$_E$ tuberculosis vaccine candidate. Geneva: World Health Organization; 2019 (https://www.who.int/tb/areas-of-work/research/meeting_report_m72_vaccine.pdf?ua=1, accessed 1 August 2019).



A TB patient has a medical checkup at the Indonesian Association Against Tuberculosis (PPTI) – a foundation that helps people with TB – in Jakarta, Indonesia.

Jefri Tarigan/Anadolu Agendy/ Getty Images

Annex 1

The WHO global TB database

A.1 Database contents

The 2019 global TB report is based on data collected annually from 216 countries and territories, including all 194 WHO Member States. These data are stored in a global TB database that is managed by the TB monitoring and evaluation unit of the Global TB Programme, at WHO headquarters.

In 2019, data were collected on the following topics: TB case notifications and treatment outcomes, including breakdowns by TB case type, age, sex, HIV status and drug resistance; laboratory diagnostic services; monitoring and evaluation, including surveillance and surveys specifically related to drug-resistant TB; TB preventive therapy; zoonotic TB; digital systems; TB infection control; palliative care; engagement of all public and private care providers in TB prevention and care; community engagement; the budgets of national TB control programmes (NTPs); utilization of general health services (hospitalization and outpatient visits) during treatment; and NTP expenditures. A shortened version of the online questionnaire was used for high-income countries (that is, countries with a gross national income per capita of ≥ US$ 12 056 in 2017, as defined by the World Bank)[1] and/or low-incidence countries (defined as countries with an incidence rate of <20 cases per 100 000 population or <10 cases in total in 2017).

Countries reported data using a dedicated website (**https://extranet.who.int/tme**), which was opened for reporting in April 2019. Countries in the European Union submitted data on notifications and treatment outcomes to the TESSy system managed by the European Centre for Disease Prevention and Control (ECDC). Data from TESSy were uploaded into the global TB database.

Additional data about the provision of treatment for latent TB infection to people newly enrolled in HIV care and antiretroviral therapy for HIV-positive TB patients were collected by the Joint United Nations Programme on HIV/AIDS (UNAIDS). These data were jointly validated by UNAIDS and the WHO's Global TB Programme and HIV department, and uploaded into the global TB database.

Following review and follow-up with countries, the data used for the main part of this report were those data available on **12 August 2019**. Table A1.1 shows the number of countries and territories that had reported data by 12 August 2019.

TABLE A1.1

Reporting of data in the 2019 round of global TB data collection

	COUNTRIES AND TERRITORIES		WHO MEMBER STATES	
	NUMBER	NUMBER THAT REPORTED DATA	NUMBER	NUMBER THAT REPORTED DATA
African Region	47	46	47	46
Region of the Americas	46	43	35	34
Eastern Mediterranean Region	22	22	21	21
European Region	54	45	53	44
South-East Asia Region	11	11	11	11
Western Pacific Region	36	35	27	27
Global	**216**	**202**	**194**	**183**

Indicators in the Sustainable Development Goals associated with TB incidence were imported into the global TB database on **20 May 2019**. Indicators 3.8.1 and 3.8.2 were updated in August 2019. Table A1.2 shows the data sources used.

A.2 Accessing TB data using the WHO Global TB Programme website

Most of the data held in the global TB database can be found by going to **www.who.int/tb/data**. This web page provides access to country profiles, comma-separated value (CSV) data files and data visualisations.

A2.1 Country profiles

Profiles can be viewed and downloaded for all 216 countries and territories that report TB data to WHO each year, and not just the 30 high burden countries shown in the printed version of the global TB report. The profiles can be generated on-demand directly from the global TB database and therefore may include updates received after publication of the global TB report.

TB financial profiles can be viewed and downloaded for over 100 countries and territories that report detailed TB financial data to WHO.

[1] http://data.worldbank.org/about/country-classifications

TABLE A1.2

Data sources for indicators in the Sustainable Development Goals associated with TB incidence

SDG INDICATOR	DISPLAY NAME IN PROFILE	DATA SOURCE	NAME AT SOURCE	SOURCE URL
1.1.1	Population living below the international poverty line (% of population)	UN SDG database	Proportion of population below the international poverty line	https://unstats.un.org/sdgs/indicators/database/?indicator=1.1.1
1.3.1	Population covered by social protection floors/systems (% of population)	World Bank	Coverage of social protection and labor programs (% of population)	http://data.worldbank.org/indicator/per_allsp.cov_pop_tot
2.1.1	Prevalence of undernourishment (% of population)	World Bank	Prevalence of undernourishment (% of population)	http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS
3.3.1 (*alternative*)	HIV prevalence (% of population aged 15–49 years)	World Bank	Prevalence of HIV, total (% of population aged 15–49)	http://data.worldbank.org/indicator/SH.DYN.AIDS.ZS
3.4.1 (*alternative*)	Diabetes prevalence (% of population aged ≥18 years)	WHO-GHO	Raised fasting blood glucose (≥ 7.0 mmol/L or on medication) (age-standardized estimate)	http://apps.who.int/gho/data/node.main.NCDRGLUCA?lang=en Direct link to CSV file: http://apps.who.int/gho/athena/data/data-coded.csv?target=GHO/NCD_GLUC_04&filter=AGEGROUP:*;COUNTRY:*;SEX:*
3.5.2 (*alternative*)	Alcohol use disorders, 12 month prevalence (% in population aged ≥15 years)	WHO-GHO	Alcohol use disorders (15+), 12 month prevalence (%)	http://apps.who.int/gho/data/view.main.53040 Direct link to CSV file: http://apps.who.int/gho/athena/data/data-coded.csv?target=GHO/SA_0000001462&filter=COUNTRY:*;SEX:*
3.a.1 (*alternative*)	Smoking prevalence (% aged ≥15 years)	World Bank	Smoking prevalence, females (% of adults) and Smoking prevalence, males (% of adults)	http://data.worldbank.org/indicator/SH.PRV.SMOK.FE and http://data.worldbank.org/indicator/SH.PRV.SMOK.MA
3.8.1	UHC Index of essential service coverage (%, based on 16 tracer indicators including TB treatment)	WHO-GHO	UHC Index of essential service coverage (%)	http://apps.who.int/gho/data/node.main.INDEXOFESSENTIALSERVICECOVERAGE Direct link to CSV file: http://apps.who.int/gho/athena/data/data-coded.csv?target=GHO/UHC_INDEX_REPORTED&filter=COUNTRY:*
3.8.2	Greater than 10% of total household expenditure or income on health (% of population)	WHO-GHO	Population with household expenditures on health greater than 10% of total household expenditure or income (%)	http://apps.who.int/gho/data/view.main.UHCFINANCIALPROTECTION01v Direct link to CSV file: https://apps.who.int/gho/athena/data/data-coded.csv?target=GHO/FINPROTECTION_CATA_TOT_10_POP&filter=COUNTRY:*;REGION:*
3.c (*alternative*)	Health expenditure per capita, PPP (current international $)	World Bank	Current health expenditure per capita, PPP (current international $)	http://data.worldbank.org/indicator/SH.XPD.CHEX.PP.CD
7.1.2	Access to clean fuels and technologies for cooking (% of population)	World Bank	Access to clean fuels and technologies for cooking (% of population)	http://data.worldbank.org/indicator/EG.CFT.ACCS.ZS
8.1.1 (*alternative*)	GDP per capita, PPP (constant 2011 international $)	World Bank	GDP per capita, PPP (constant 2011 international $)	http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD
10.1.1 (*alternative*)	GINI index (0=perfect equality, 100=perfect inequality)	World Bank	GINI index (World Bank estimate)	http://data.worldbank.org/indicator/SI.POV.GINI
11.1.1	Population living in slums (% of urban population)	World Bank	Population living in slums (% of urban population)	http://data.worldbank.org/indicator/EN.POP.SLUM.UR.ZS

A2.2 CSV data files

These files are the primary resource for anyone interested in conducting their own analyses of the records in the global TB database. Data reported by countries, such as time series for case notifications and treatment outcomes and WHO's estimates of TB disease burden, can be downloaded as comma-separated value (CSV) files covering all years for which data are available. These CSV files can be imported into many spreadsheet, statistical analysis and database packages.

A data dictionary that defines each of the variables available in the CSV files is also available and can be downloaded.

The CSV files are generated on-demand directly from the global TB database, and therefore may include updates received after publication of the global TB report.

A2.3 Data visualisations

There are several interactive web pages that can be used to view maps, graphs and underlying data on TB case notifications, drug-resistant TB cases, treatment outcomes and WHO estimates of TB incidence and mortality.

A.3 Accessing TB data using the WHO Global Health Observatory

The WHO Global Health Observatory (GHO) at **www.who.int/gho/** is WHO's portal, providing access to data and analyses for monitoring the global health situation. It includes a data repository.

Data from WHO's global TB database can be viewed, filtered, aggregated and downloaded from within the GHO Data Repository at **http://apps.who.int/gho/data/node.main.1315**

The GHO data table headers include links to variable and indicator definitions. The data can be downloaded in many formats, including as CSV and Excel files.

There is also an Application Programme Interface (API) for analysts and programmers to use GHO data directly in their software applications. See **http://apps.who.int/gho/data/node.resources**

Community health workers in Nyamirama, Rwanda. The country has more than 30 000 community health workers (at least two for every village); in some areas, they have received training about TB treatment from Partners In Health.

William Campbell/Corbis via Getty images

Annex 2

Country profiles

FOR 30 HIGH TB BURDEN COUNTRIES

20 high TB burden countries based on absolute number of incident cases

10 high TB burden countries based on severity of disease burden (incidence per capita)

Angola

POPULATION 2018 **31 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	109 (71–156)	355 (230–507)
HIV-positive TB incidence	11 (6.8–15)	34 (22–49)
MDR/RR-TB incidence[b]	3.9 (1.7–7.1)	13 (5.4–23)
HIV-negative TB mortality	19 (11–28)	60 (36–91)
HIV-positive TB mortality	3.7 (2.4–5.3)	12 (7.9–17)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.4% (1.1–4.2)
Previously treated cases	15% (11–19)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	66 189
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	68%
– % pulmonary	94%
– % bacteriologically confirmed[c]	54%
– % children aged 0–14 years	
– % women	
– % men	
Total cases notified	70 362

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	61% (42–94)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	21% (11–33)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	4 327	10%
– on antiretroviral therapy	2 101	49%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	<1%
– Previously treated cases	9%
Laboratory-confirmed cases[d]	MDR/RR-TB: 649, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 649, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	0

TREATMENT SUCCESS RATE AND COHORT SIZE

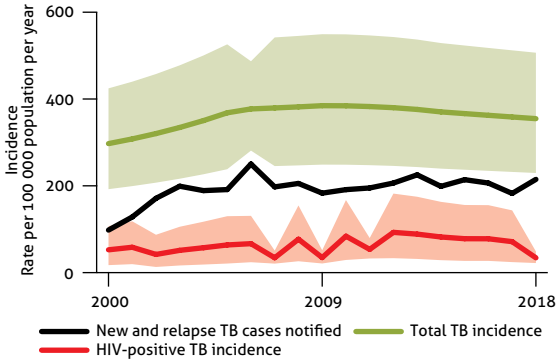
	SUCCESS	COHORT
New and relapse cases registered in 2017	25%	57 877
Previously treated cases, excluding relapse, registered in 2017		
HIV-positive TB cases registered in 2017		
MDR/RR-TB cases started on second-line treatment in 2016	4%	175
XDR-TB cases started on second-line treatment in 2016		0

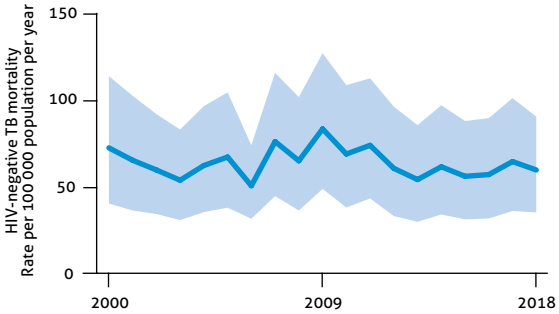
TB PREVENTIVE TREATMENT, 2018

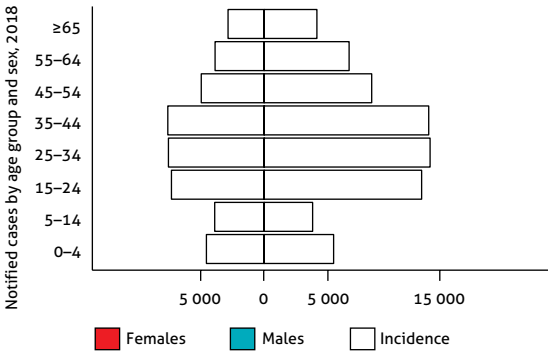
% of HIV-positive people (newly enrolled in care) on preventive treatment	42%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

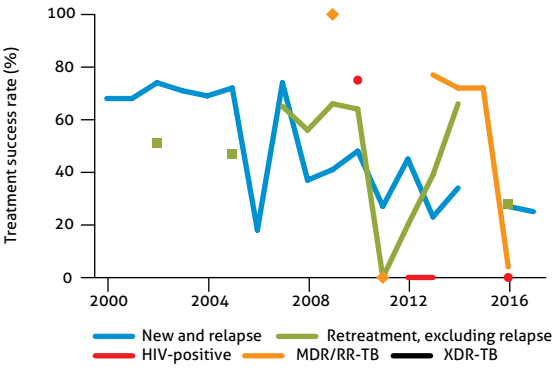
TB FINANCING, 2019

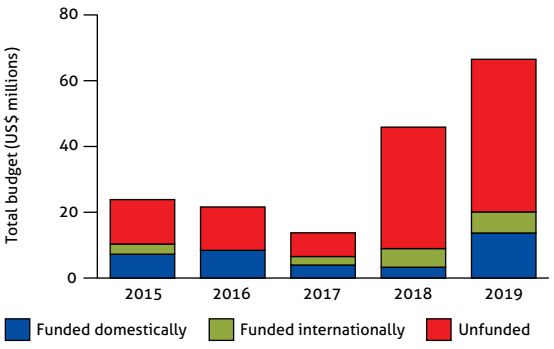
National TB budget (US$ millions)	67
Funding source:	21% domestic, 10% international, 70% unfunded









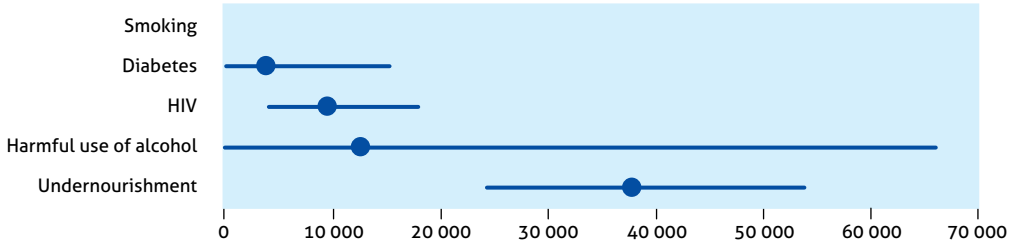


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

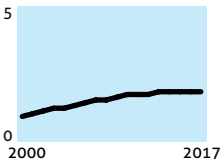
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

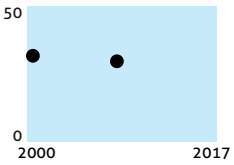


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

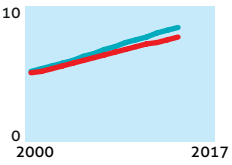
HIV prevalence
(% of population aged 15–49 years)



Population living below the international poverty line
(% of population)

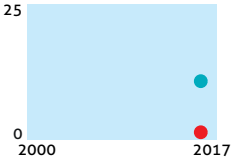


Diabetes prevalence
(% of population aged ≥18 years)
● females ● males

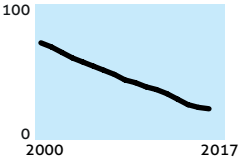


Population covered by social protection floors/systems
(% of population)

Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males

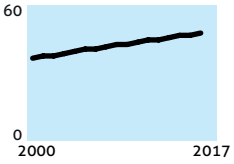


Prevalence of undernourishment
(% of population)

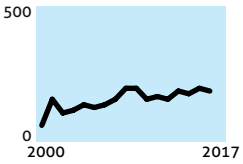


Smoking prevalence
(% of population aged ≥15 years)
● females ● males

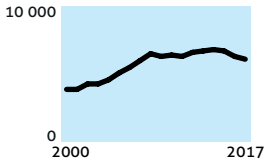
Access to clean fuels and technologies for cooking
(% of population)



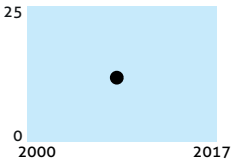
Health expenditure per capita, PPP[b]
(current international $)



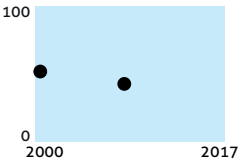
GDP per capita, PPP[b]
(constant 2011 international $)



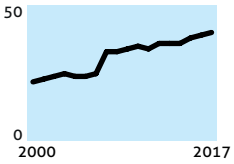
Greater than 10% of total household expenditure or income on health
(% of population)



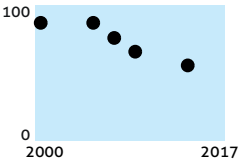
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Bangladesh

POPULATION 2018 **161 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	357 (260–469)	221 (161–291)
HIV-positive TB incidence	0.73 (0.36–1.2)	0.45 (0.23–0.76)
MDR/RR-TB incidence[b]	5.9 (3.2–9.6)	3.7 (2–5.9)
HIV-negative TB mortality	47 (30–67)	29 (18–42)
HIV-positive TB mortality	0.19 (0.094–0.32)	0.12 (0.06–0.2)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.5% (0.9–2.3)
Previously treated cases	4.9% (3–7.9)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	267 143
– % tested with rapid diagnostics at time of diagnosis	18%
– % with known HIV status	1%
– % pulmonary	81%
– % bacteriologically confirmed[c]	72%
– % children aged 0–14 years	4%
– % women	41%
– % men	55%
Total cases notified	268 596

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	75% (57–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	13% (8–21)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	67	2%
– on antiretroviral therapy	63	94%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	24%
– Previously treated cases	98%
Laboratory-confirmed cases[d]	MDR/RR-TB: 1 228, XDR-TB: 6
Patients started on treatment[d,e]	MDR/RR-TB: 1 147, XDR-TB: 6
MDR/RR-TB cases tested for resistance to second-line drugs	853

TREATMENT SUCCESS RATE AND COHORT SIZE

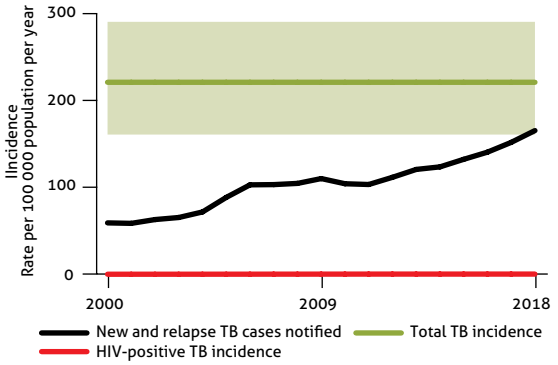
	SUCCESS	COHORT
New and relapse cases registered in 2017	94%	242 640
Previously treated cases, excluding relapse, registered in 2017	86%	1 561
HIV-positive TB cases registered in 2017	67%	89
MDR/RR-TB cases started on second-line treatment in 2016	78%	918
XDR-TB cases started on second-line treatment in 2016	63%	8

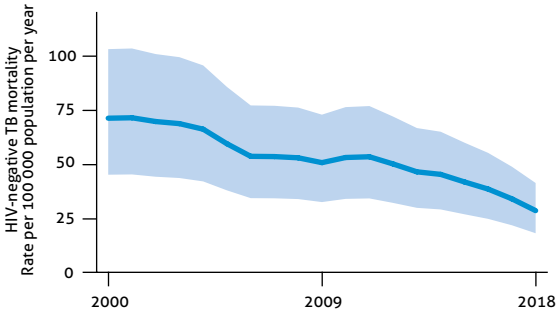
TB PREVENTIVE TREATMENT, 2018

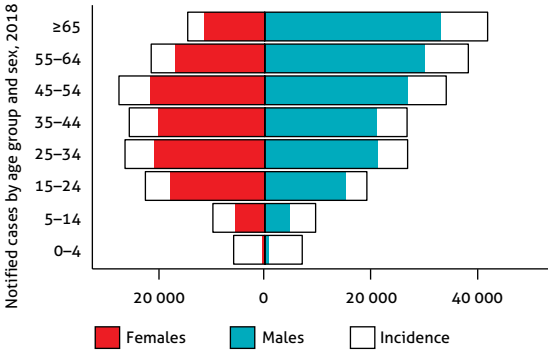
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	43% (40–47)

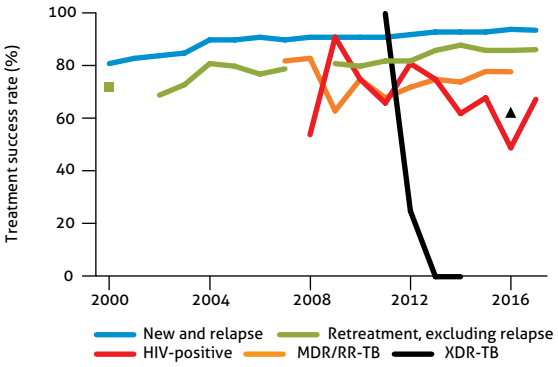
TB FINANCING, 2019

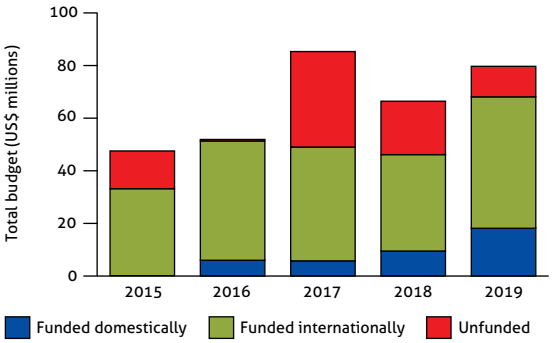
National TB budget (US$ millions)	80
Funding source:	23% domestic, 63% international, 15% unfunded









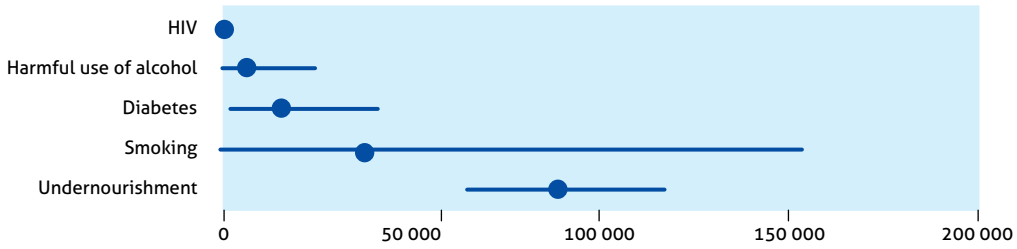


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

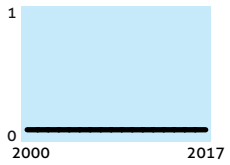
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

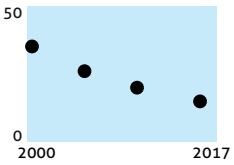


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

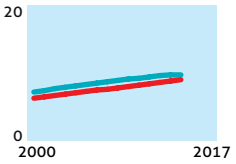
HIV prevalence
(% of population aged 15–49 years)



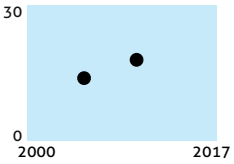
Population living below the international poverty line
(% of population)



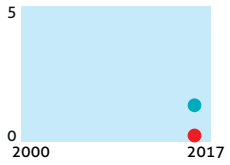
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



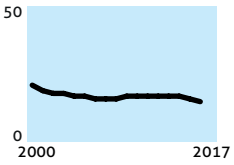
Population covered by social protection floors/systems
(% of population)



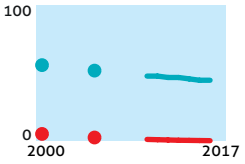
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



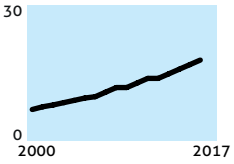
Prevalence of undernourishment
(% of population)



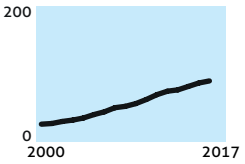
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



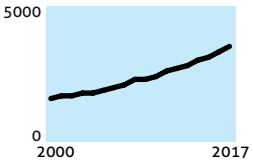
Access to clean fuels and technologies for cooking
(% of population)



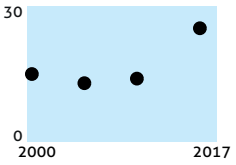
Health expenditure per capita, PPP[b]
(current international $)



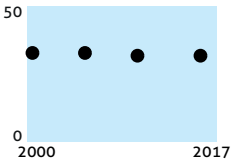
GDP per capita, PPP[b]
(constant 2011 international $)



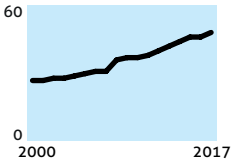
Greater than 10% of total household expenditure or income on health
(% of population)



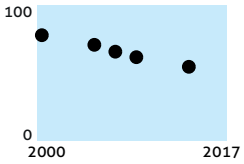
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Brazil

POPULATION 2018 **209 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	95 (81–110)	45 (39–52)
HIV-positive TB incidence	11 (9.3–13)	5.2 (4.4–6)
MDR/RR-TB incidence[b]	2.5 (1.9–3.2)	1.2 (0.89–1.5)
HIV-negative TB mortality	4.8 (4.6–5)	2.3 (2.2–2.4)
HIV-positive TB mortality	1.9 (1.4–2.4)	0.88 (0.66–1.1)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.5% (1.1–2)
Previously treated cases	8% (6–10)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	82 409
– % tested with rapid diagnostics at time of diagnosis	34%
– % with known HIV status	79%
– % pulmonary	87%
– % bacteriologically confirmed[c]	74%
– % children aged 0–14 years	3%
– % women	29%
– % men	68%
Total cases notified	90 527

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	87% (75–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	7% (6–8)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	7 445	11%
– on antiretroviral therapy	3 776	51%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	43%
– Previously treated cases	48%
Laboratory-confirmed cases[d]	MDR/RR-TB: 1 119, XDR-TB: 26
Patients started on treatment[d,e]	MDR/RR-TB: 746, XDR-TB: 26
MDR/RR-TB cases tested for resistance to second-line drugs	141

TREATMENT SUCCESS RATE AND COHORT SIZE

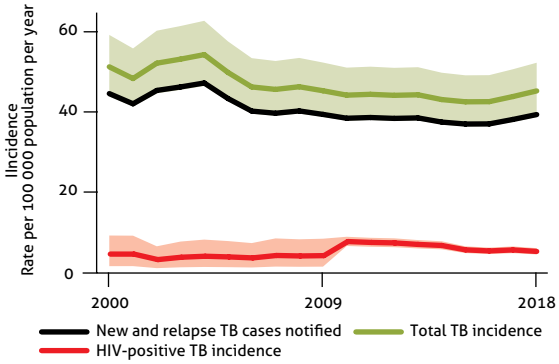
	SUCCESS	COHORT
New and relapse cases registered in 2017	71%	78 652
Previously treated cases, excluding relapse, registered in 2017	39%	7 350
HIV-positive TB cases registered in 2017	51%	7 617
MDR/RR-TB cases started on second-line treatment in 2016	61%	546
XDR-TB cases started on second-line treatment in 2016	41%	17

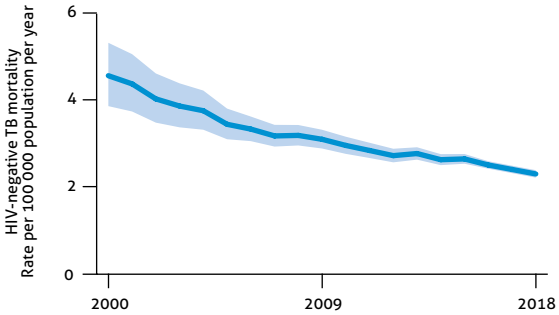
TB PREVENTIVE TREATMENT, 2018

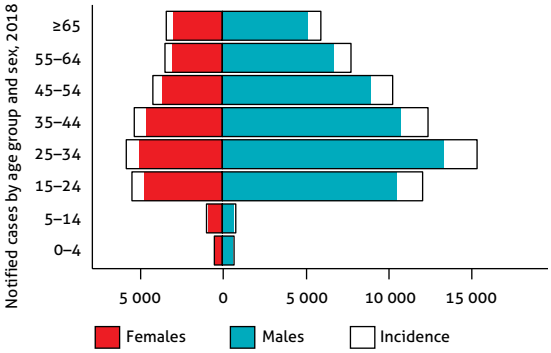
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

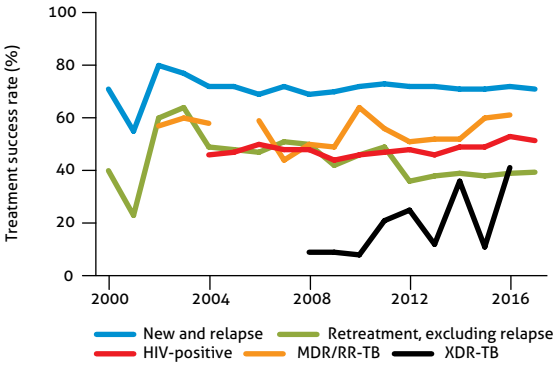
TB FINANCING, 2019

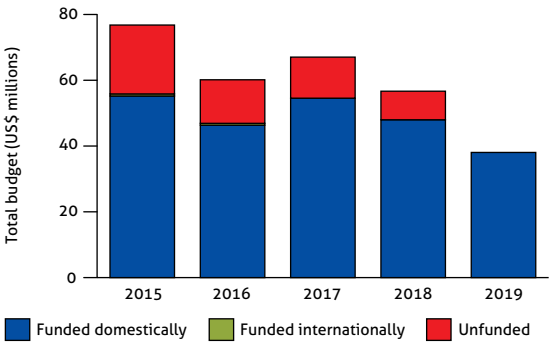
National TB budget (US$ millions)	38
Funding source:	100% domestic, <1% international, 0% unfunded









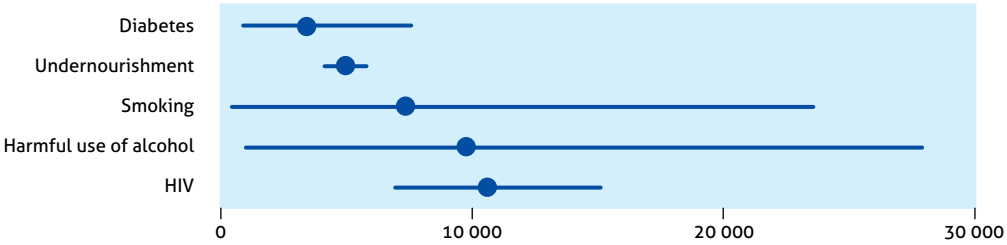


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

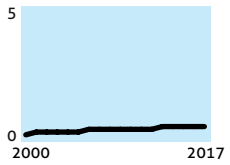
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

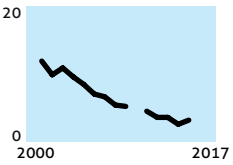


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

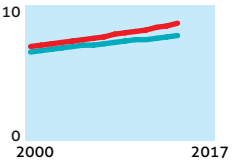
HIV prevalence
(% of population aged 15–49 years)



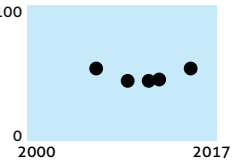
Population living below the international poverty line
(% of population)



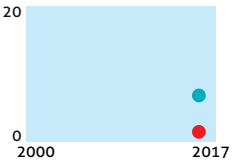
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



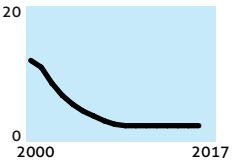
Population covered by social protection floors/systems
(% of population)



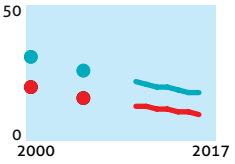
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



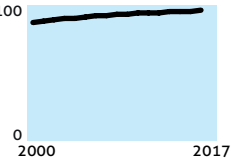
Prevalence of undernourishment
(% of population)



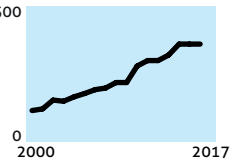
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



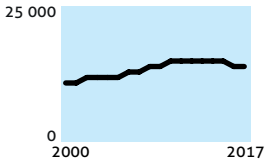
Access to clean fuels and technologies for cooking
(% of population)



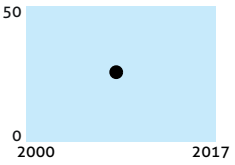
Health expenditure per capita, PPP[b]
(current international $)



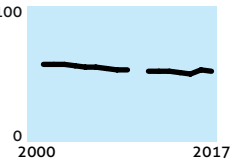
GDP per capita, PPP[b]
(constant 2011 international $)



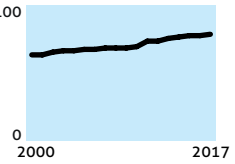
Greater than 10% of total household expenditure or income on health
(% of population)



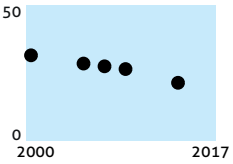
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

China

POPULATION 2018 **1 428 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	866 (740–1 000)	61 (52–70)
HIV-positive TB incidence	18 (9.8–28)	1.2 (0.69–2)
MDR/RR-TB incidence[b]	66 (50–85)	4.6 (3.5–6)
HIV-negative TB mortality	37 (34–41)	2.6 (2.4–2.9)
HIV-positive TB mortality	2.4 (1.2–4)	0.17 (0.08–0.28)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	7.1% (5.6–8.7)
Previously treated cases	21% (21–21)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	795 245
– % tested with rapid diagnostics at time of diagnosis	15%
– % with known HIV status	60%
– % pulmonary	95%
– % bacteriologically confirmed[c]	37%
– % children aged 0-14 years	1%
– % women	31%
– % men	68%
Total cases notified	801 532

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	92% (79–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	5% (4–6)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	7 935	2%
– on antiretroviral therapy	6 915	87%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	58%
– Previously treated cases	100%
Laboratory-confirmed cases[d,e]	MDR/RR-TB: 14 636, XDR-TB: 430
Patients started on treatment[d,f]	MDR/RR-TB: 8 965, XDR-TB:
MDR/RR-TB cases tested for resistance to second-line drugs	

TREATMENT SUCCESS RATE AND COHORT SIZE

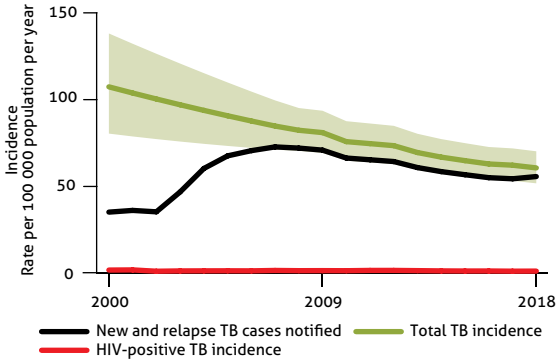
	SUCCESS	COHORT
New and relapse cases registered in 2017	93%	764 701
Previously treated cases, excluding relapse, registered in 2017	83%	5 077
HIV-positive TB cases registered in 2017	87%	5 308
MDR/RR-TB cases started on second-line treatment in 2016	52%	5 405
XDR-TB cases started on second-line treatment in 2016		

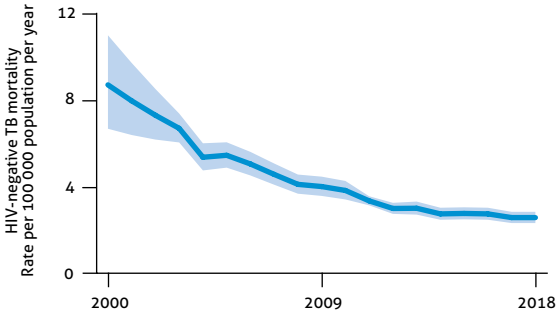
TB PREVENTIVE TREATMENT, 2018

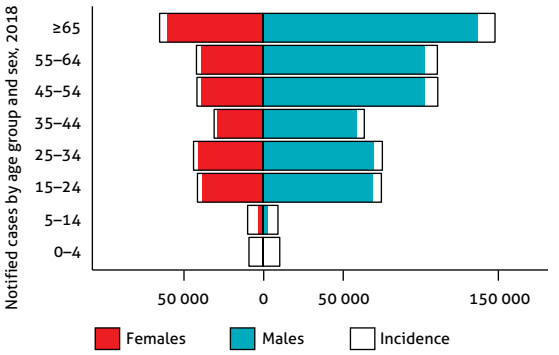
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment

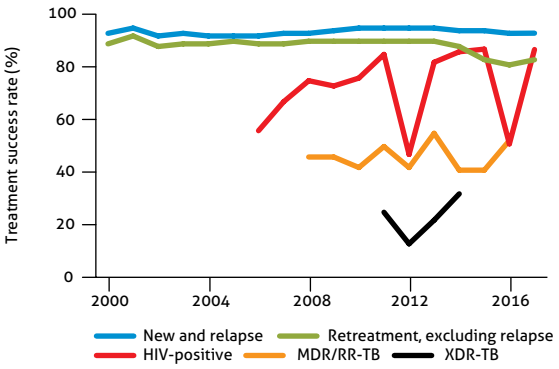
TB FINANCING, 2019

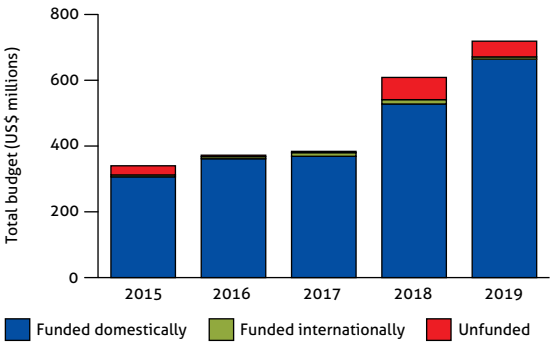
National TB budget (US$ millions)	719
Funding source:	92% domestic, <1% international, 7% unfunded









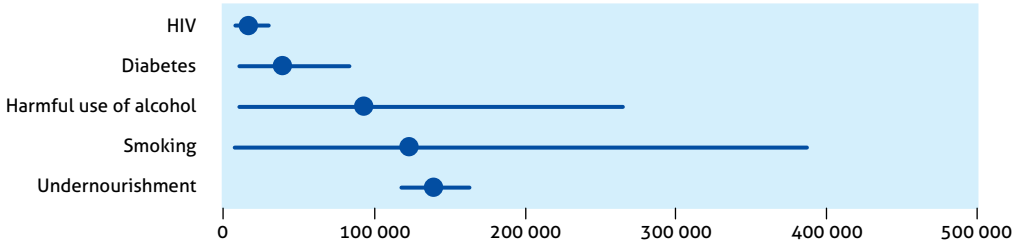


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] The number of cases detected was 59% (range, 50–70%) of the 25 000 (range, 21 000–29 000) cases of MDR/RR-TB estimated to exist among patients with bacteriologically confirmed pulmonary TB.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

Data for all countries and years can be downloaded from www.who.int/tb/data

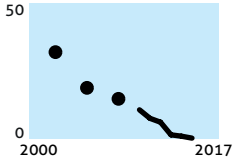
NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018



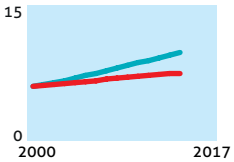
INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

HIV prevalence
(% of population aged 15–49 years)

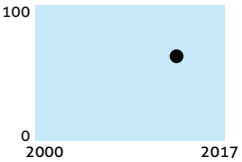
Population living below the international poverty line
(% of population)



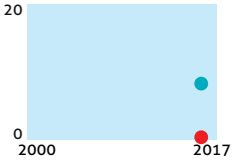
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



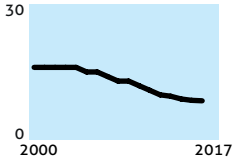
Population covered by social protection floors/systems
(% of population)



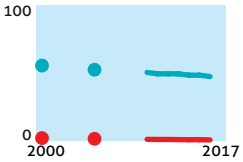
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



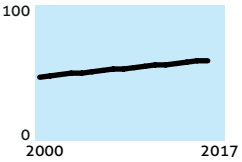
Prevalence of undernourishment
(% of population)



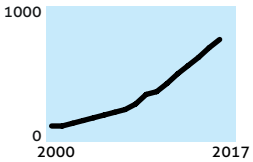
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



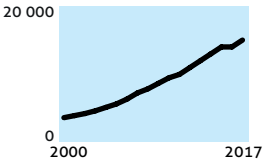
Access to clean fuels and technologies for cooking
(% of population)



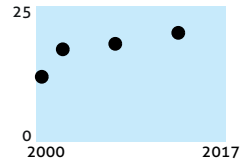
Health expenditure per capita, PPP[b]
(current international $)



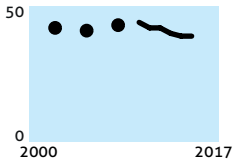
GDP per capita, PPP[b]
(constant 2011 international $)



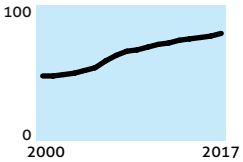
Greater than 10% of total household expenditure or income on health
(% of population)



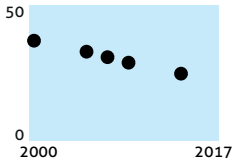
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Democratic People's Republic of Korea POPULATION 2018 **26 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	131 (114–149)	513 (446–584)
HIV-positive TB incidence	0.22 (0.12–0.36)	0.87 (0.47–1.4)
MDR/RR-TB incidence[b]	5.2 (2.5–8.8)	20 (10–34)
HIV-negative TB mortality	20 (14–27)	80 (56–107)
HIV-positive TB mortality	0.068 (0.035–0.11)	0.27 (0.14–0.44)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.2% (0.82–4.2)
Previously treated cases	16% (9.1–25)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	89 939
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	0%
– % pulmonary	80%
– % bacteriologically confirmed[c]	50%
– % children aged 0–14 years	5%
– % women	34%
– % men	61%
Total cases notified	95 245

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	69% (60–79)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	16% (11–21)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	0	
– on antiretroviral therapy	0	

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	
– Previously treated cases	20%
Laboratory-confirmed cases[d]	MDR/RR-TB: 1 782, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 1 487, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	0

TREATMENT SUCCESS RATE AND COHORT SIZE

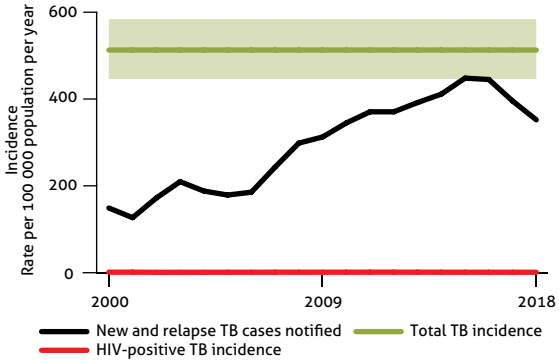
	SUCCESS	COHORT
New and relapse cases registered in 2017	83%	100 553
Previously treated cases, excluding relapse, registered in 2017		
HIV-positive TB cases registered in 2017		
MDR/RR-TB cases started on second-line treatment in 2016	80%	814
XDR-TB cases started on second-line treatment in 2016		

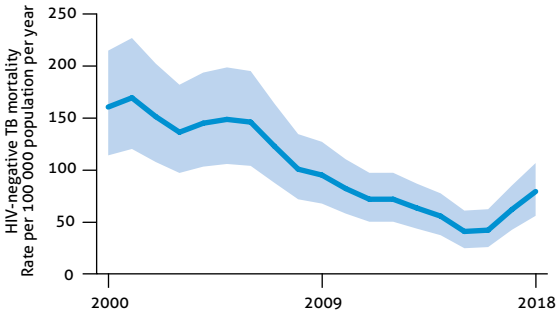
TB PREVENTIVE TREATMENT, 2018

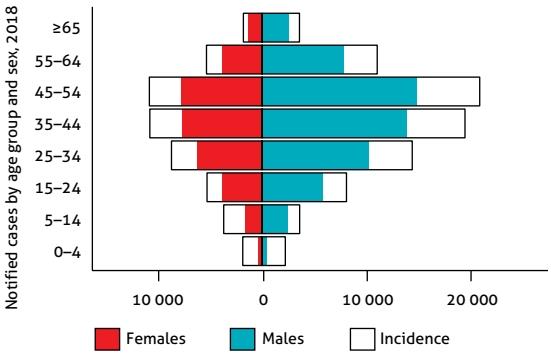
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	100%

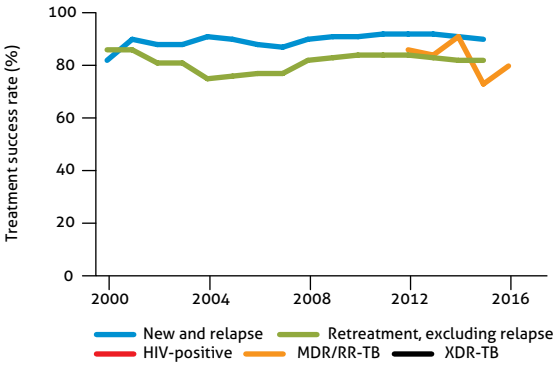
TB FINANCING, 2019

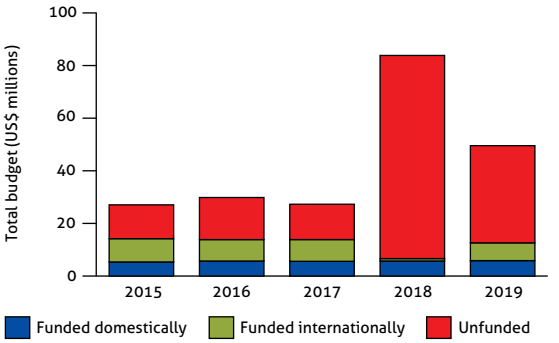
National TB budget (US$ millions)	50
Funding source:	12% domestic, 14% international, 75% unfunded









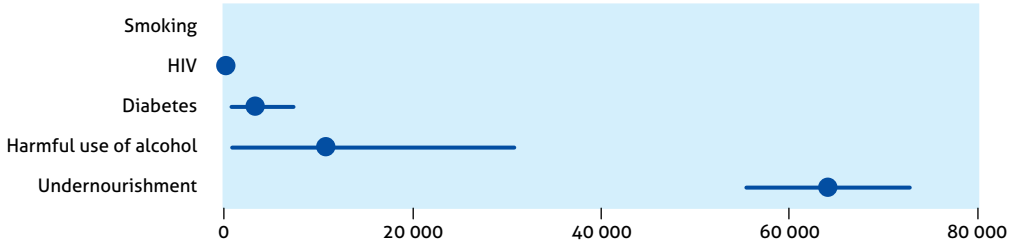


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

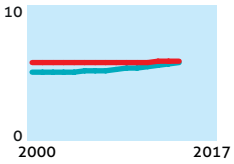


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

HIV prevalence
(% of population aged 15–49 years)

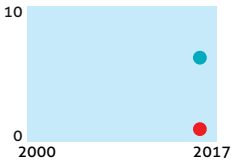
Population living below the international poverty line
(% of population)

Diabetes prevalence
(% of population aged ≥18 years)
● females ● males

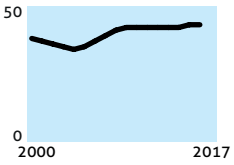


Population covered by social protection floors/systems
(% of population)

Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males

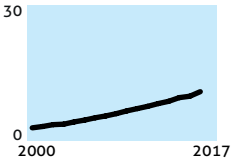


Prevalence of undernourishment
(% of population)



Smoking prevalence
(% of population aged ≥15 years)
● females ● males

Access to clean fuels and technologies for cooking
(% of population)



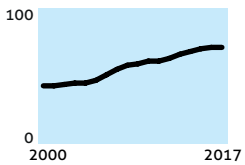
Health expenditure per capita, PPP[b]
(current international $)

GDP per capita, PPP[b]
(constant 2011 international $)

Greater than 10% of total household expenditure or income on health
(% of population)

GINI index
(0 = perfect equality, 100 = perfect inequality)

UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)

[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Democratic Republic of the Congo

POPULATION 2018 **84 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	270 (175–385)	321 (208–458)
HIV-positive TB incidence	31 (9.4–65)	37 (11–77)
MDR/RR-TB incidence[b]	6 (3–10)	7.2 (3.6–12)
HIV-negative TB mortality	43 (25–65)	51 (30–77)
HIV-positive TB mortality	10 (3.2–22)	12 (3.8–26)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.7% (1.1–2.6)
Previously treated cases	9.5% (8.8–10)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	169 748
– % tested with rapid diagnostics at time of diagnosis	7%
– % with known HIV status	60%
– % pulmonary	83%
– % bacteriologically confirmed[ooo]	77%
– % children aged 0–14 years	11%
– % women	39%
– % men	50%
Total cases notified	171 682

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	63% (44–97)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	20% (10–33)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	9 758	9%
– on antiretroviral therapy	8 481	87%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	2%
– Previously treated cases	66%
Laboratory-confirmed cases[d]	MDR/RR-TB: 765, XDR-TB: 22
Patients started on treatment[d,e]	MDR/RR-TB: 690, XDR-TB: 15
MDR/RR-TB cases tested for resistance to second-line drugs	328

TREATMENT SUCCESS RATE AND COHORT SIZE

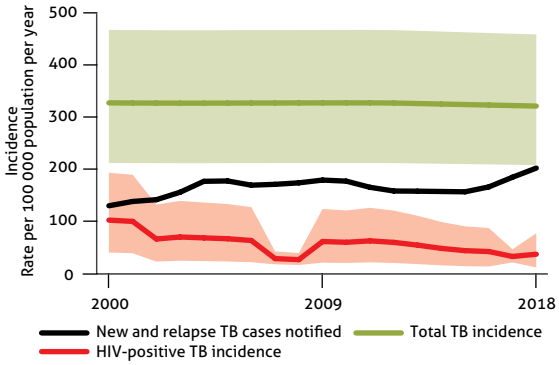
	SUCCESS	COHORT
New and relapse cases registered in 2017	90%	149 657
Previously treated cases, excluding relapse, registered in 2017	70%	1 593
HIV-positive TB cases registered in 2017	78%	9 688
MDR/RR-TB cases started on second-line treatment in 2016	86%	634
XDR-TB cases started on second-line treatment in 2016	39%	18

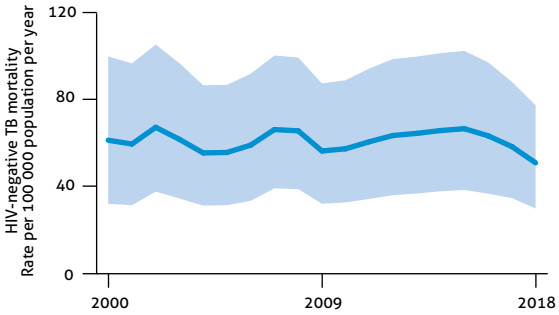
TB PREVENTIVE TREATMENT, 2018

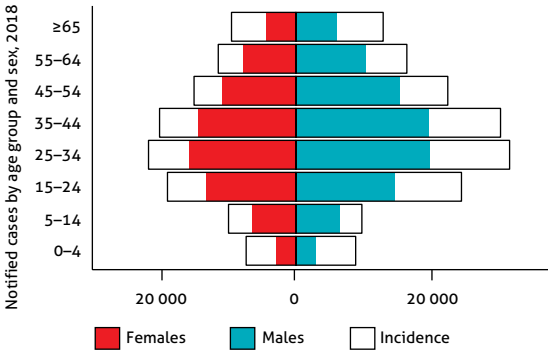
% of HIV-positive people (newly enrolled in care) on preventive treatment	39%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	24% (22–26)

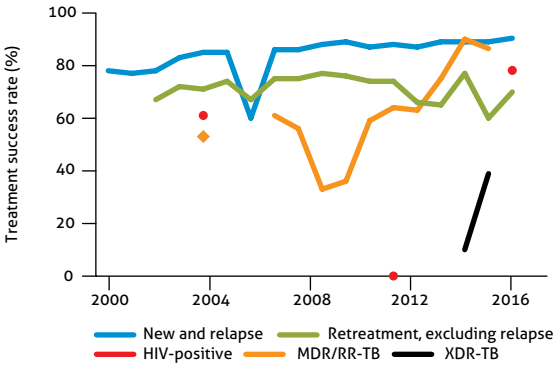
TB FINANCING, 2019

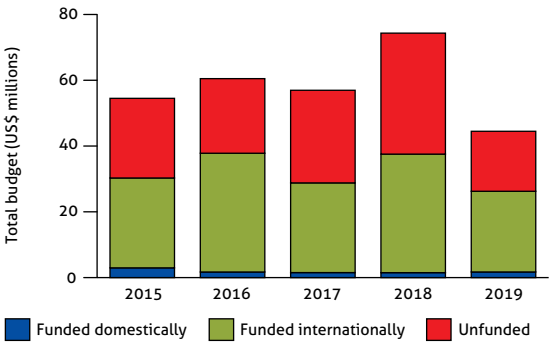
National TB budget (US$ millions)	44
Funding source:	4% domestic, 55% international, 41% unfunded









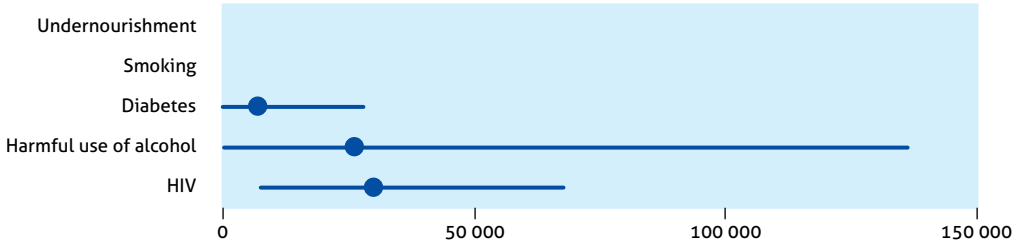


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

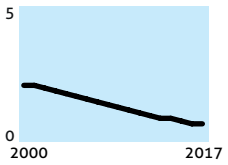
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

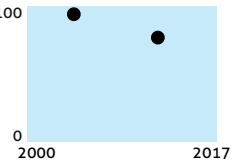


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

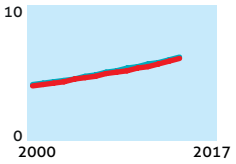
HIV prevalence
(% of population aged 15–49 years)



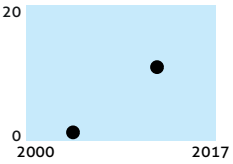
Population living below the international poverty line
(% of population)



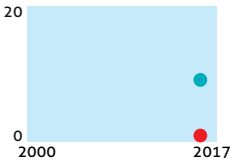
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



Population covered by social protection floors/systems
(% of population)



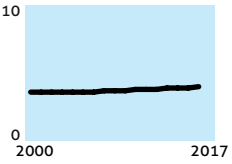
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



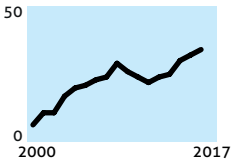
Prevalence of undernourishment
(% of population)

Smoking prevalence
(% of population aged ≥15 years)
● females ● males

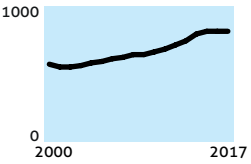
Access to clean fuels and technologies for cooking
(% of population)



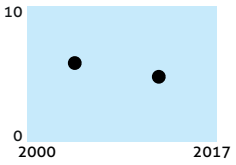
Health expenditure per capita, PPP[b]
(current international $)



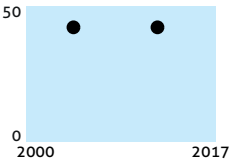
GDP per capita, PPP[b]
(constant 2011 international $)



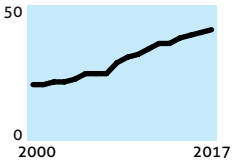
Greater than 10% of total household expenditure or income on health
(% of population)



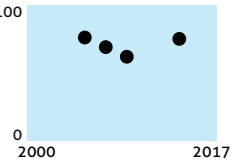
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Ethiopia

POPULATION 2018 **109 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	165 (116–223)	151 (107–204)
HIV-positive TB incidence	7.6 (5.3–10)	7 (4.9–9.4)
MDR/RR-TB incidence[b]	1.6 (1–2.2)	1.4 (0.96–2)
HIV-negative TB mortality	24 (15–36)	22 (14–33)
HIV-positive TB mortality	2.2 (1.5–3)	2 (1.4–2.8)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	0.71% (0.62–0.8)
Previously treated cases	16% (14–17)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	113 613
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	92%
– % pulmonary	69%
– % bacteriologically confirmed[c]	62%
– % children aged 0–14 years	10%
– % women	40%
– % men	50%
Total cases notified	114 233

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	69% (51–98)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	17% (9–25)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	4 816	5%
– on antiretroviral therapy	4 393	91%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	80%
– Previously treated cases	100%
Laboratory-confirmed cases[d]	MDR/RR-TB: 741, XDR-TB: 3
Patients started on treatment[d,e]	MDR/RR-TB: 747, XDR-TB: 3
MDR/RR-TB cases tested for resistance to second-line drugs	360

TREATMENT SUCCESS RATE AND COHORT SIZE

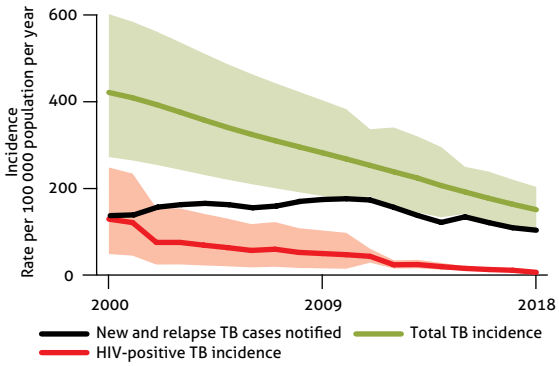
	SUCCESS	COHORT
New cases registered in 2017	96%	113 690
Previously treated cases registered in 2017		
HIV-positive TB cases registered in 2017		
MDR/RR-TB cases started on second-line treatment in 2016	72%	703
XDR-TB cases started on second-line treatment in 2016		

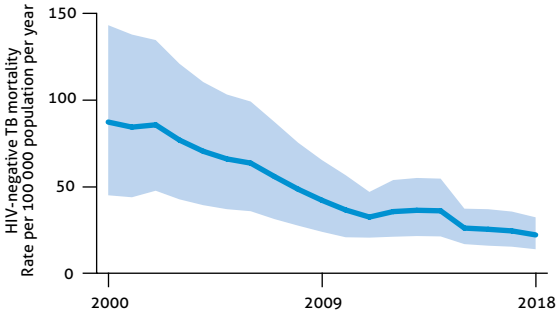
TB PREVENTIVE TREATMENT, 2018

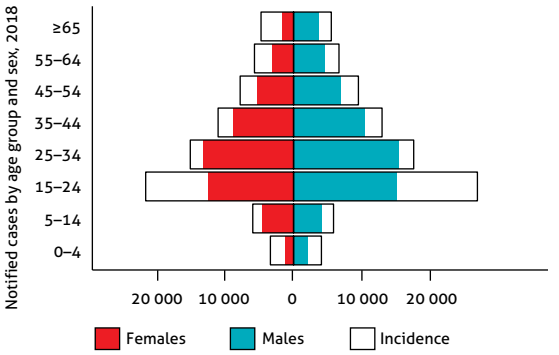
% of HIV-positive people (newly enrolled in care) on preventive treatment	49%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	22% (20–24)

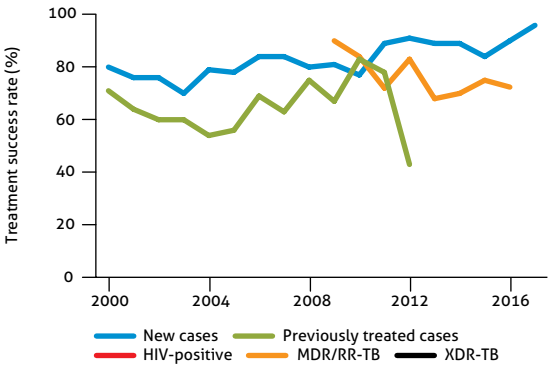
TB FINANCING, 2019

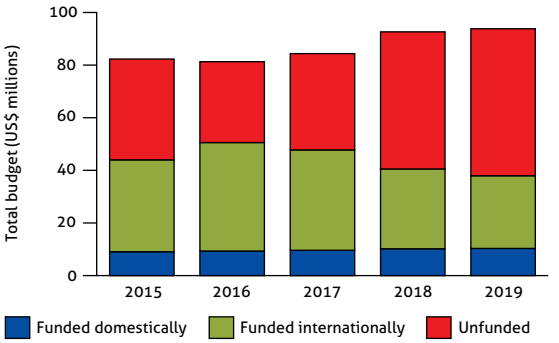
National TB budget (US$ millions)	94
Funding source:	11% domestic, 29% international, 60% unfunded









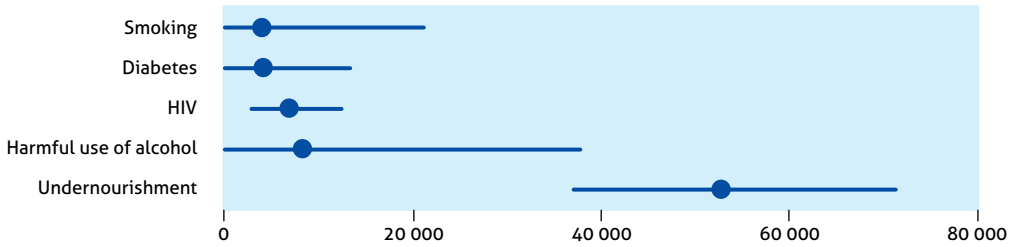


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

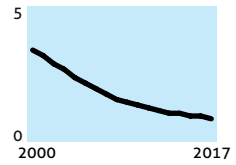
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

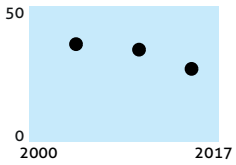


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

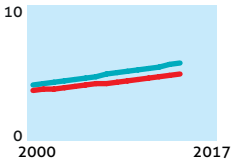
HIV prevalence
(% of population aged 15–49 years)



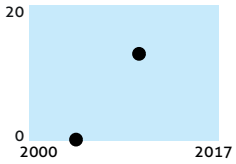
Population living below the international poverty line
(% of population)



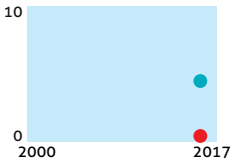
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



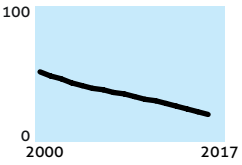
Population covered by social protection floors/systems
(% of population)



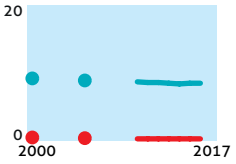
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



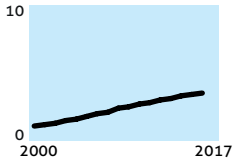
Prevalence of undernourishment
(% of population)



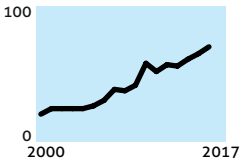
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



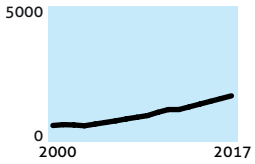
Access to clean fuels and technologies for cooking
(% of population)



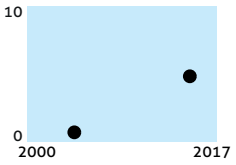
Health expenditure per capita, PPP[b]
(current international $)



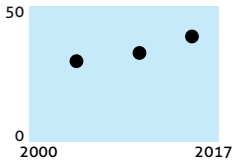
GDP per capita, PPP[b]
(constant 2011 international $)



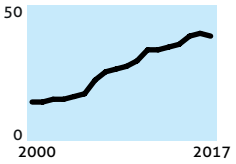
Greater than 10% of total household expenditure or income on health
(% of population)



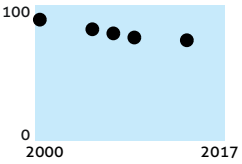
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

India

POPULATION 2018 **1 353 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	2 690 (1 840–3 700)	199 (136–273)
HIV-positive TB incidence	92 (63–126)	6.8 (4.6–9.3)
MDR/RR-TB incidence[b]	130 (77–198)	9.6 (5.7–15)
HIV-negative TB mortality	440 (408–472)	32 (30–35)
HIV-positive TB mortality	9.7 (5.7–15)	0.72 (0.42–1.1)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.8% (2.3–3.5)
Previously treated cases	14% (14–14)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	1 994 000
– % tested with rapid diagnostics at time of diagnosis	50%
– % with known HIV status	72%
– % pulmonary	82%
– % bacteriologically confirmed[c]	57%
– % children aged 0–14 years	6%
– % women	34%
– % men	60%
Total cases notified	2 155 894

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	74% (54–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	17% (12–24)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	49 047	3%
– on antiretroviral therapy	44 080	90%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	46%
– Previously treated cases	91%
Laboratory-confirmed cases[d]	MDR/RR-TB: 58 347, XDR-TB: 3 400
Patients started on treatment[d,e]	MDR/RR-TB: 46 569, XDR-TB: 2 724
MDR/RR-TB cases tested for resistance to second-line drugs	38 236

TREATMENT SUCCESS RATE AND COHORT SIZE

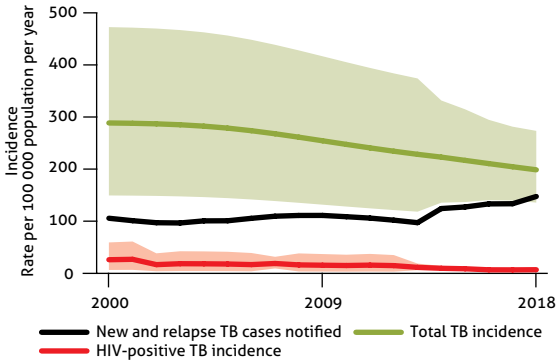
	SUCCESS	COHORT
New and relapse cases registered in 2017	81%	1 568 392
Previously treated cases, excluding relapse, registered in 2017	56%	146 982
HIV-positive TB cases registered in 2017	71%	31 213
MDR/RR-TB cases started on second-line treatment in 2016	48%	33 197
XDR-TB cases started on second-line treatment in 2016	30%	2 464

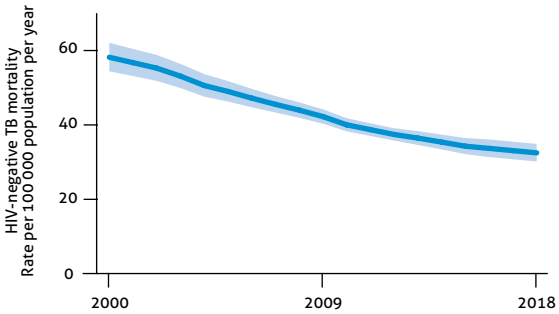
TB PREVENTIVE TREATMENT, 2018

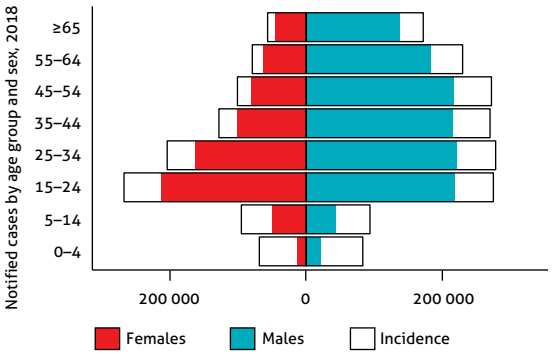
% of HIV-positive people (newly enrolled in care) on preventive treatment	17%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	26% (24–28)

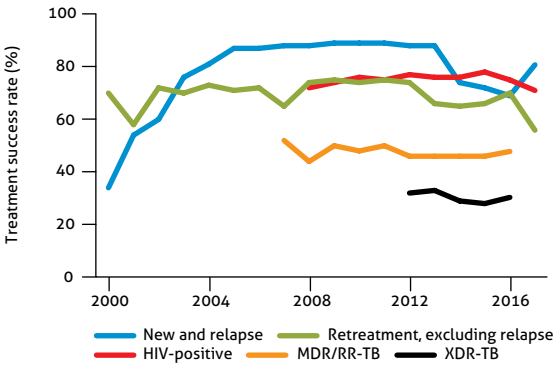
TB FINANCING, 2019

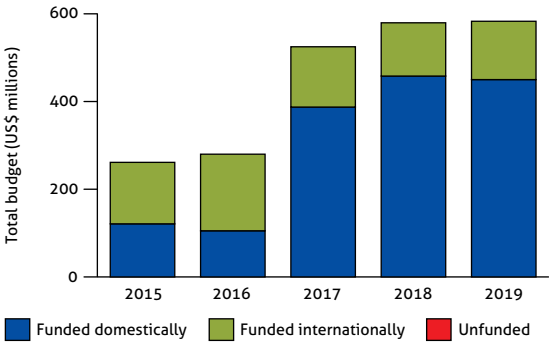
National TB budget (US$ millions)	583
Funding source:	77% domestic, 23% international, 0% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates of TB incidence and mortality for India are interim in nature, pending results from the national TB prevalence survey planned for 2019/2020.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
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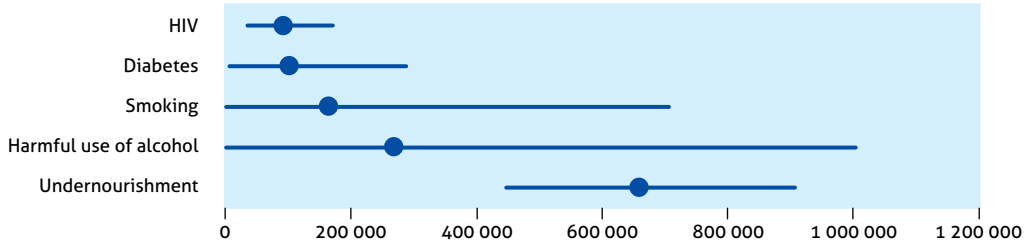
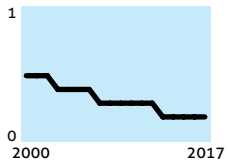
NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

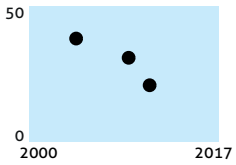


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

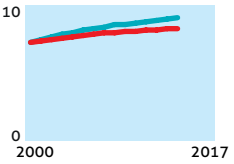
HIV prevalence
(% of population aged 15–49 years)



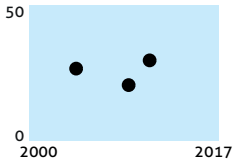
Population living below the international poverty line
(% of population)



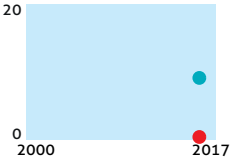
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



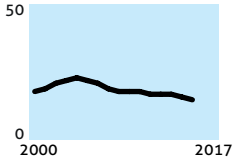
Population covered by social protection floors/systems
(% of population)



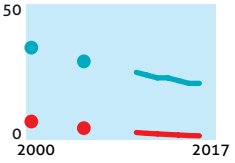
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



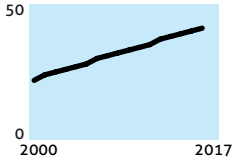
Prevalence of undernourishment
(% of population)



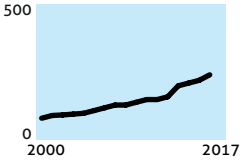
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



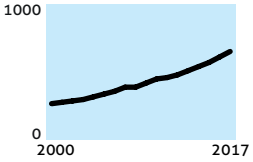
Access to clean fuels and technologies for cooking
(% of population)



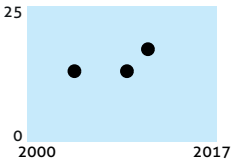
Health expenditure per capita, PPP[b]
(current international $)



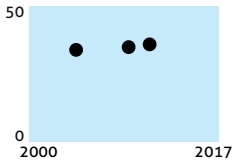
GDP per capita, PPP[b]
(constant 2011 international $)



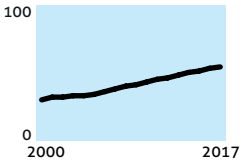
Greater than 10% of total household expenditure or income on health
(% of population)



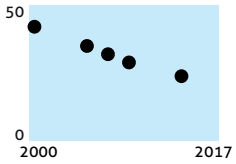
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Indonesia

POPULATION 2018 **268 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	845 (770–923)	316 (288–345)
HIV-positive TB incidence	21 (8.9–38)	7.9 (3.3–14)
MDR/RR-TB incidence[b]	24 (17–32)	8.8 (6.2–12)
HIV-negative TB mortality	93 (87–99)	35 (33–37)
HIV-positive TB mortality	5.3 (2.1–9.8)	2 (0.79–3.7)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.4% (1.8–3.3)
Previously treated cases	13% (9–18)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	563 879
– % tested with rapid diagnostics at time of diagnosis	12%
– % with known HIV status	37%
– % pulmonary	88%
– % bacteriologically confirmed[c]	50%
– % children aged 0–14 years	11%
– % women	37%
– % men	52%
Total cases notified	570 289

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	67% (61–73)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	12% (10–13)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	10 174	5%
– on antiretroviral therapy	4 082	40%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	33%
– Previously treated cases	127%
Laboratory-confirmed cases[d]	MDR/RR-TB: 9 038, XDR-TB: 80
Patients started on treatment[d,e]	MDR/RR-TB: 4 194, XDR-TB: 59
MDR/RR-TB cases tested for resistance to second-line drugs	2 526

TREATMENT SUCCESS RATE AND COHORT SIZE

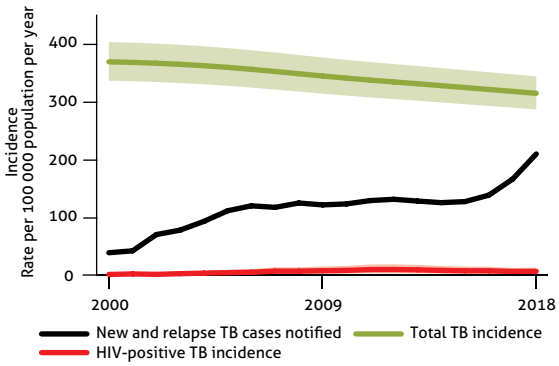
	SUCCESS	COHORT
New and relapse cases registered in 2017	85%	425 819
Previously treated cases, excluding relapse, registered in 2017	73%	4 934
HIV-positive TB cases registered in 2017	69%	7 966
MDR/RR-TB cases started on second-line treatment in 2016	48%	1 905
XDR-TB cases started on second-line treatment in 2016	21%	61

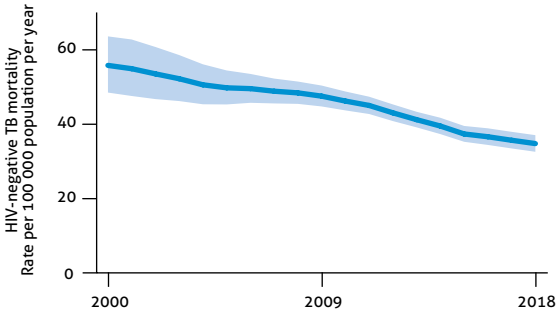
TB PREVENTIVE TREATMENT, 2018

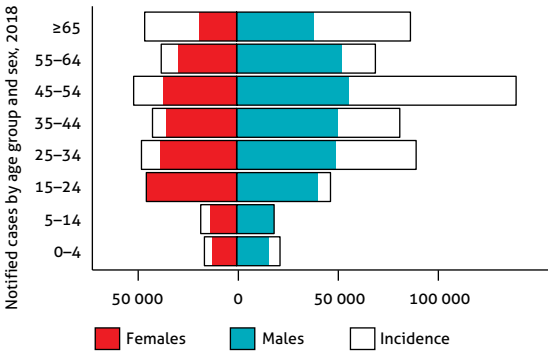
% of HIV-positive people (newly enrolled in care) on preventive treatment	10%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	10% (9.3–11)

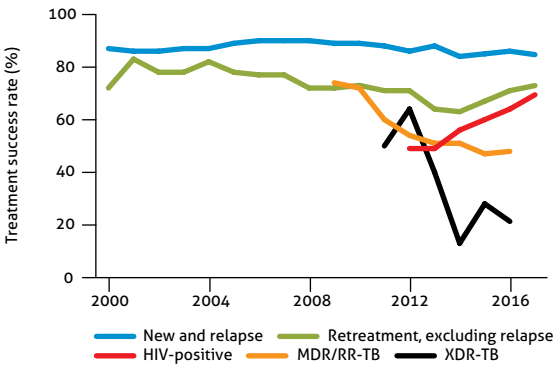
TB FINANCING, 2019

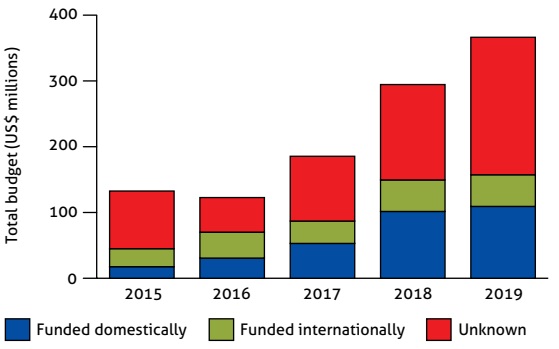
National TB budget (US$ millions)	366
Funding source:	30% domestic,[f] 13% international, 57% unknown









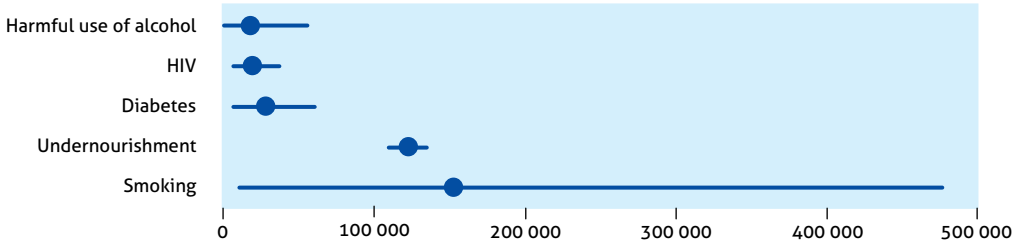


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[f] Funding from provincial and district budgets are not known at national level.

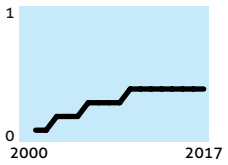
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

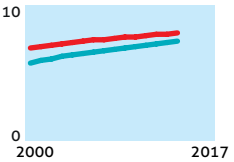


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

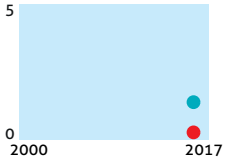
HIV prevalence
(% of population aged 15–49 years)



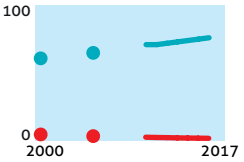
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



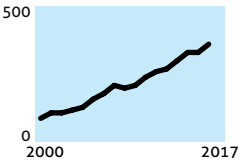
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



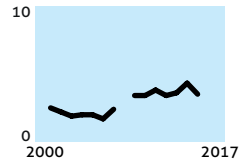
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



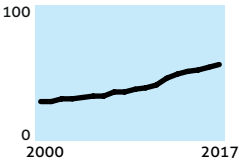
Health expenditure per capita, PPP[b]
(current international $)



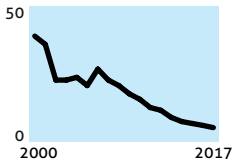
Greater than 10% of total household expenditure or income on health
(% of population)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)

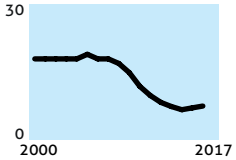


Population living below the international poverty line
(% of population)

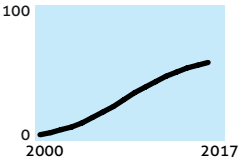


Population covered by social protection floors/systems
(% of population)

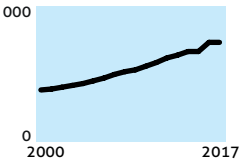
Prevalence of undernourishment
(% of population)



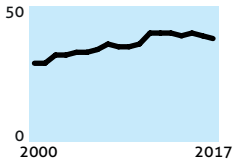
Access to clean fuels and technologies for cooking
(% of population)



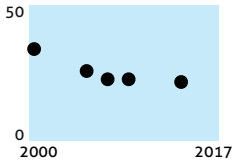
GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Kenya

POPULATION 2018 **51 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	150 (92–222)	292 (179–432)
HIV-positive TB incidence	40 (25–60)	79 (48–117)
MDR/RR-TB incidence[b]	2.3 (1.1–4.1)	4.5 (2.1–7.9)
HIV-negative TB mortality	19 (11–30)	38 (22–59)
HIV-positive TB mortality	13 (8.1–20)	26 (16–38)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.3% (0.74–2)
Previously treated cases	4.4% (3.7–5.2)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	94 534
– % tested with rapid diagnostics at time of diagnosis	47%
– % with known HIV status	98%
– % pulmonary	85%
– % bacteriologically confirmed[c]	58%
– % children aged 0–14 years	10%
– % women	32%
– % men	58%
Total cases notified	96 478

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	63% (43–100)
TB patients facing catastrophic total costs, 2017	27% (21–32)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	23% (12–36)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	24 950	27%
– on antiretroviral therapy	24 186	97%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	64%
– Previously treated cases	79%
Laboratory-confirmed cases[d]	MDR/RR-TB: 465, XDR-TB: 1
Patients started on treatment[d,e]	MDR/RR-TB: 470, XDR-TB: 1
MDR/RR-TB cases tested for resistance to second-line drugs	125

TREATMENT SUCCESS RATE AND COHORT SIZE

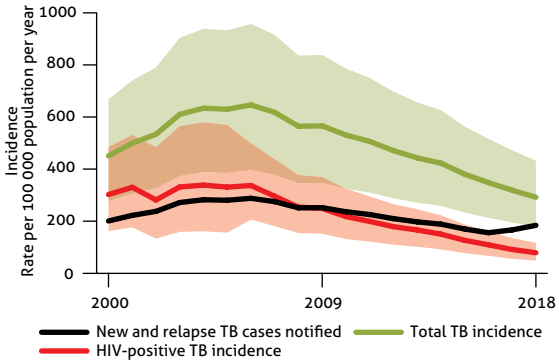
	SUCCESS	COHORT
New and relapse cases registered in 2017	83%	83 088
Previously treated cases, excluding relapse, registered in 2017	72%	1 583
HIV-positive TB cases registered in 2017	78%	23 060
MDR/RR-TB cases started on second-line treatment in 2016	68%	308
XDR-TB cases started on second-line treatment in 2016		0

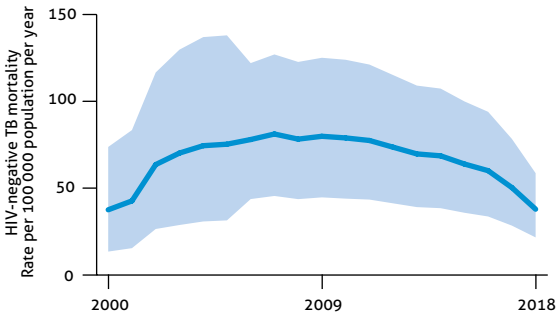
TB PREVENTIVE TREATMENT, 2018

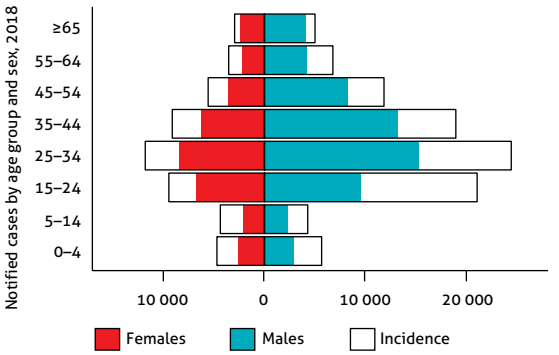
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	34% (31–37)

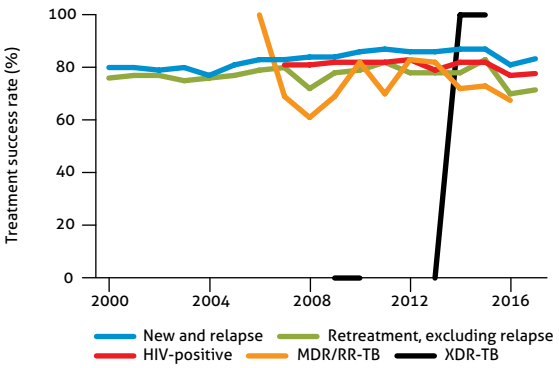
TB FINANCING, 2019

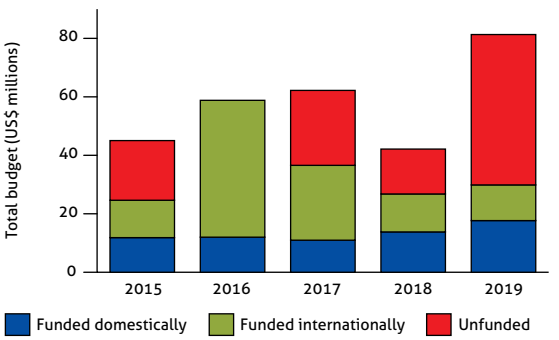
National TB budget (US$ millions)	81
Funding source:	22% domestic, 15% international, 63% unfunded









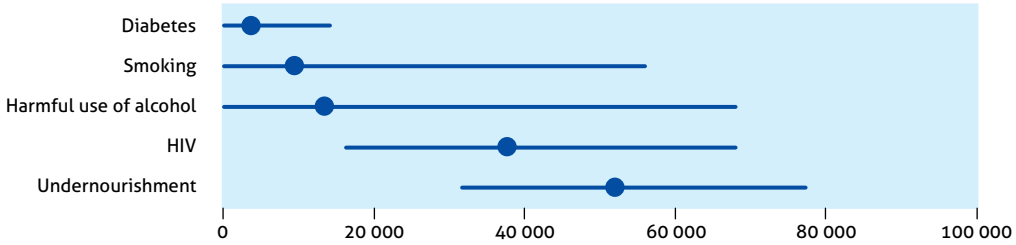


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

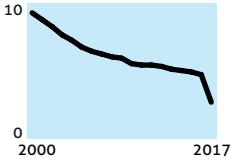
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

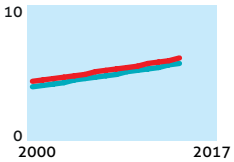


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

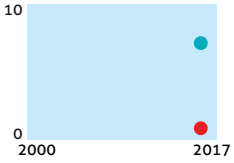
HIV prevalence
(% of population aged 15–49 years)



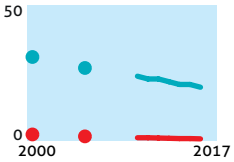
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



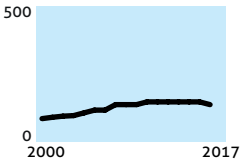
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



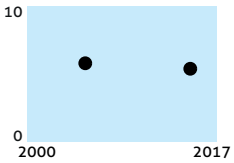
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



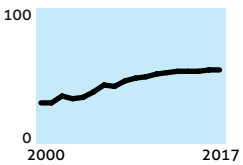
Health expenditure per capita, PPP[b]
(current international $)



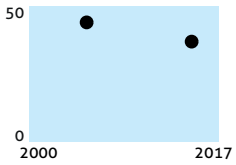
Greater than 10% of total household expenditure or income on health
(% of population)



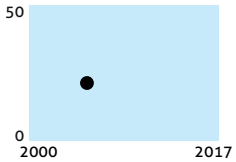
UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



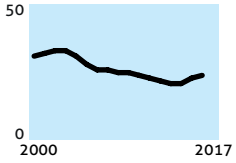
Population living below the international poverty line
(% of population)



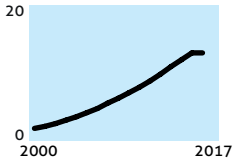
Population covered by social protection floors/systems
(% of population)



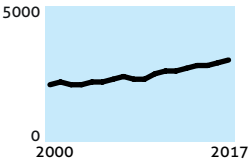
Prevalence of undernourishment
(% of population)



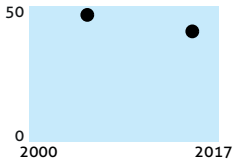
Access to clean fuels and technologies for cooking
(% of population)



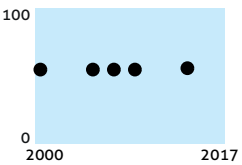
GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Mozambique

POPULATION 2018 **29 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	162 (105–232)	551 (356–787)
HIV-positive TB incidence	58 (38–83)	197 (127–281)
MDR/RR-TB incidence[b]	8.3 (4.4–14)	28 (15–46)
HIV-negative TB mortality	21 (13–32)	72 (43–109)
HIV-positive TB mortality	22 (14–31)	73 (46–106)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.7% (2.5–5.2)
Previously treated cases	20% (5.2–40)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	92 381
– % tested with rapid diagnostics at time of diagnosis	41%
– % with known HIV status	98%
– % pulmonary	93%
– % bacteriologically confirmed[c]	39%
– % children aged 0–14 years	13%
– % women	42%
– % men	45%
Total cases notified	93 546

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	57% (40–88)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	27% (15–41)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	32 641	36%
– on antiretroviral therapy	31 440	96%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	44%
– Previously treated cases	66%
Laboratory-confirmed cases[d]	MDR/RR-TB: 1 158, XDR-TB: 45
Patients started on treatment[d,e]	MDR/RR-TB: 1 134, XDR-TB: 45
MDR/RR-TB cases tested for resistance to second-line drugs	472

TREATMENT SUCCESS RATE AND COHORT SIZE

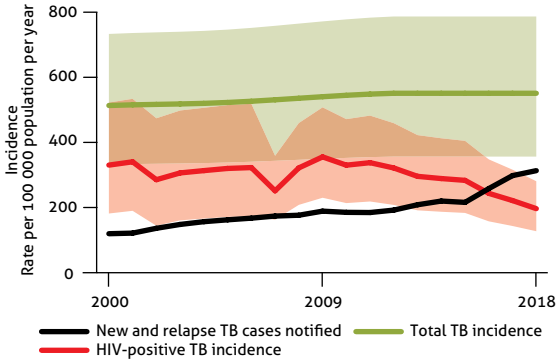
	SUCCESS	COHORT
New and relapse cases registered in 2017	90%	82 674
Previously treated cases, excluding relapse, registered in 2017	79%	1 139
HIV-positive TB cases registered in 2017	85%	34 056
MDR/RR-TB cases started on second-line treatment in 2016	50%	854
XDR-TB cases started on second-line treatment in 2016	32%	25

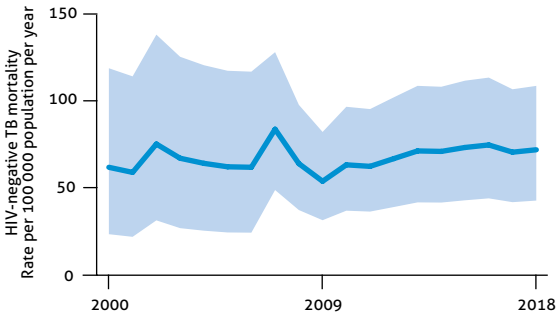
TB PREVENTIVE TREATMENT, 2018

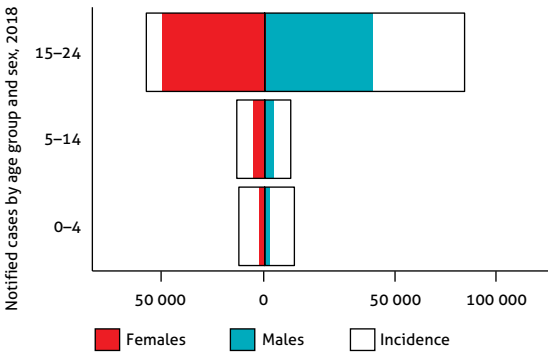
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	100%

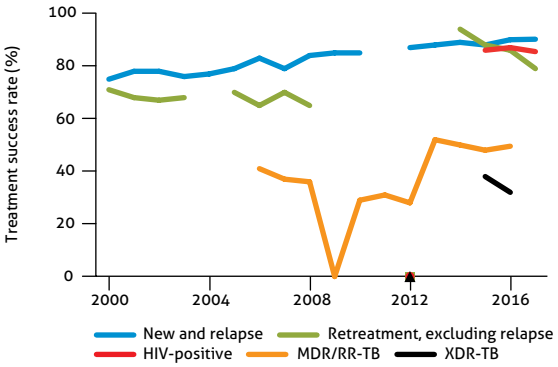
TB FINANCING, 2019

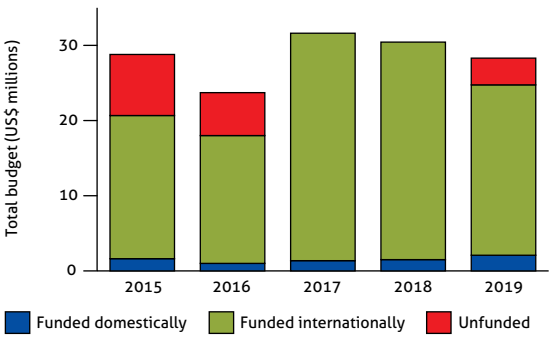
National TB budget (US$ millions)	28
Funding source:	7% domestic, 80% international, 13% unfunded









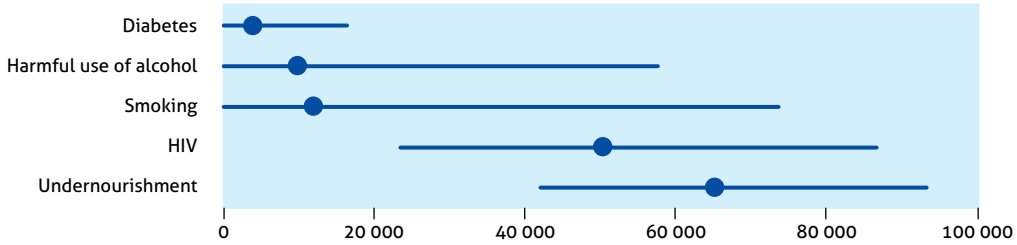


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates of TB incidence and mortality for Mozambique will be reviewed after final results from the national TB prevalence survey are available in 2020.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

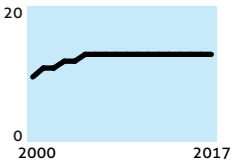
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

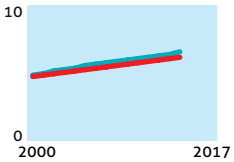


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

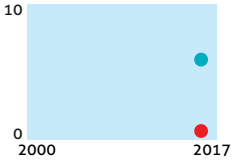
HIV prevalence
(% of population aged 15–49 years)



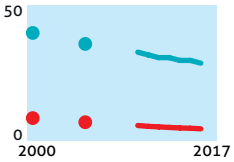
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



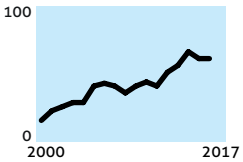
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



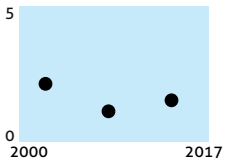
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



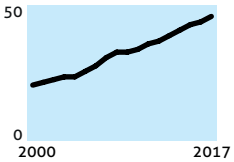
Health expenditure per capita, PPP[b]
(current international $)



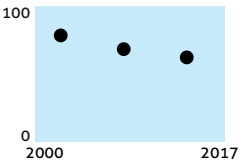
Greater than 10% of total household expenditure or income on health
(% of population)



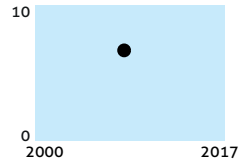
UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



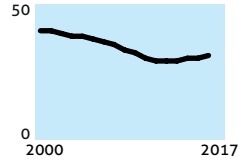
Population living below the international poverty line
(% of population)



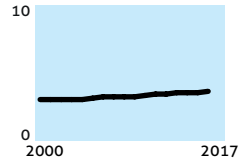
Population covered by social protection floors/systems
(% of population)



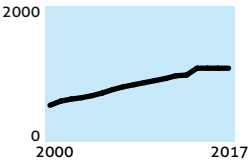
Prevalence of undernourishment
(% of population)



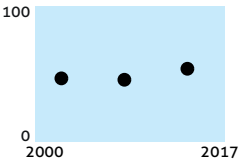
Access to clean fuels and technologies for cooking
(% of population)



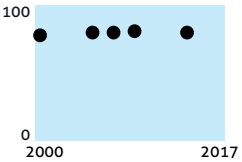
GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Myanmar

POPULATION 2018 **54 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	181 (119–256)	338 (222–477)
HIV-positive TB incidence	15 (10–22)	29 (19–41)
MDR/RR-TB incidence[b]	11 (7.4–16)	21 (14–30)
HIV-negative TB mortality	21 (12–31)	39 (23–58)
HIV-positive TB mortality	3.7 (2.5–5.2)	6.9 (4.6–9.7)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4.9% (4.7–5.1)
Previously treated cases	20% (19–21)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	137 972
– % tested with rapid diagnostics at time of diagnosis	42%
– % with known HIV status	89%
– % pulmonary	91%
– % bacteriologically confirmed[c]	44%
– % children aged 0–14 years	19%
– % women	29%
– % men	52%
Total cases notified	139 518

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	76% (54–120)
TB patients facing catastrophic total costs, 2015	60% (56–63)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	14% (8–22)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	10 516	9%
– on antiretroviral therapy	7 464	71%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	92%
– Previously treated cases	84%
Laboratory-confirmed cases[d]	MDR/RR-TB: 3 479, XDR-TB: 35
Patients started on treatment[d,e]	MDR/RR-TB: 2 650, XDR-TB: 29
MDR/RR-TB cases tested for resistance to second-line drugs	927

TREATMENT SUCCESS RATE AND COHORT SIZE

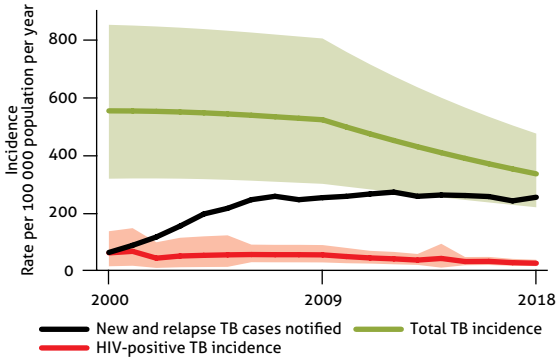
	SUCCESS	COHORT
New and relapse cases registered in 2017	87%	126 746
Previously treated cases, excluding relapse, registered in 2017	78%	1 638
HIV-positive TB cases registered in 2017	73%	10 294
MDR/RR-TB cases started on second-line treatment in 2016	79%	2 512
XDR-TB cases started on second-line treatment in 2016	63%	8

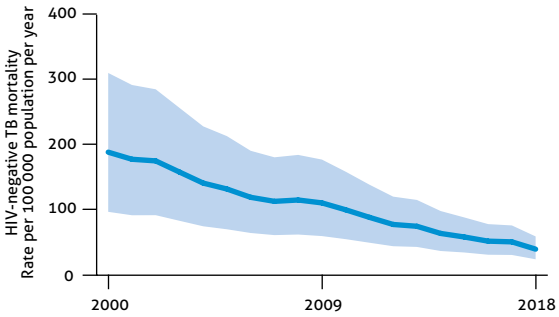
TB PREVENTIVE TREATMENT, 2018

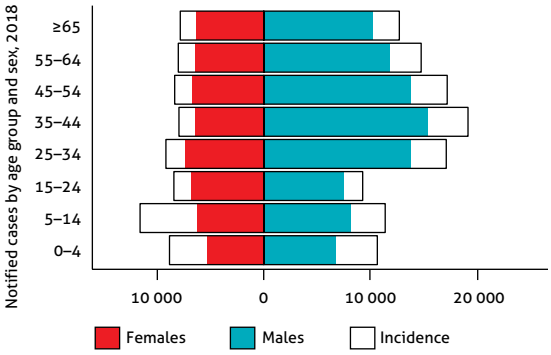
% of HIV-positive people (newly enrolled in care) on preventive treatment	15%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	3.1% (2.8–3.4)

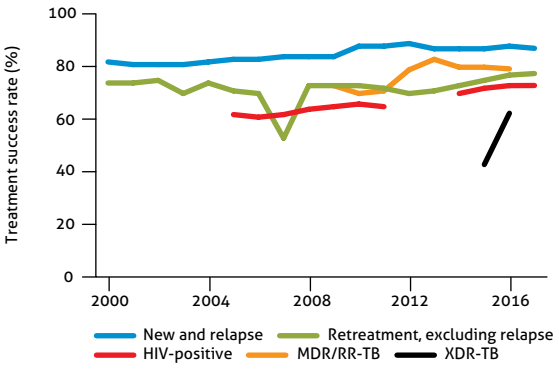
TB FINANCING, 2019

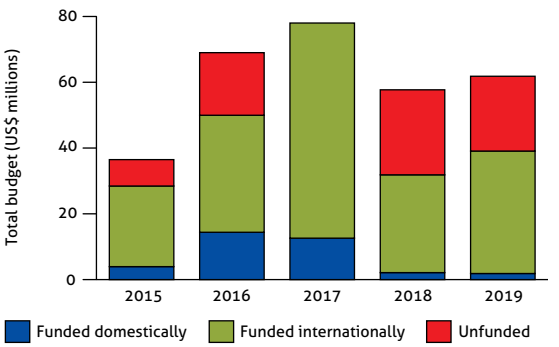
National TB budget (US$ millions)	62
Funding source:	3% domestic, 60% international, 37% unfunded









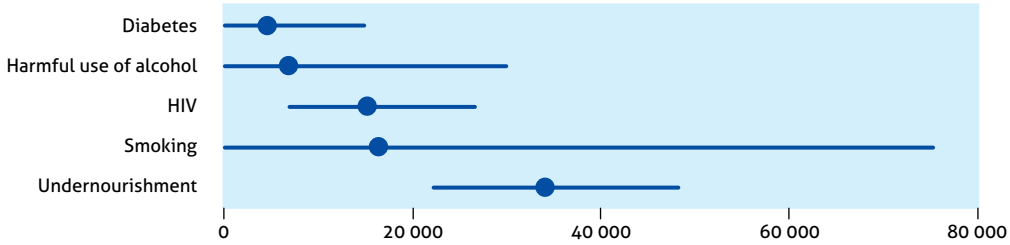


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

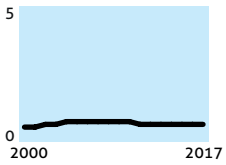
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

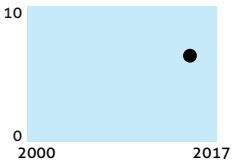


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

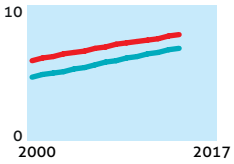
HIV prevalence
(% of population aged 15–49 years)



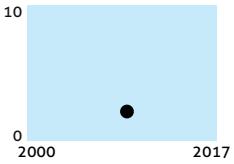
Population living below the international poverty line
(% of population)



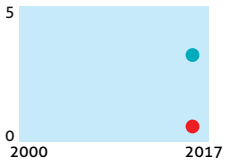
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



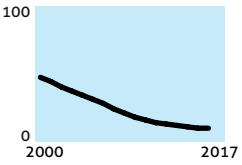
Population covered by social protection floors/systems
(% of population)



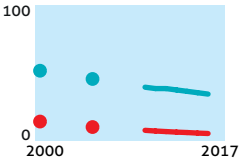
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



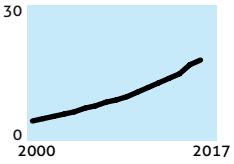
Prevalence of undernourishment
(% of population)



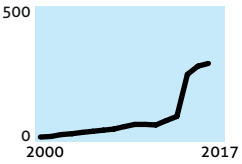
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



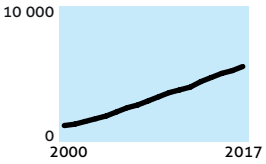
Access to clean fuels and technologies for cooking
(% of population)



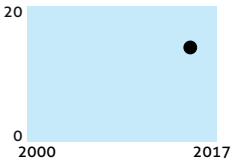
Health expenditure per capita, PPP[b]
(current international $)



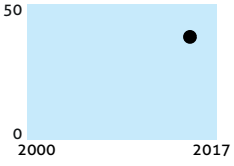
GDP per capita, PPP[b]
(constant 2011 international $)



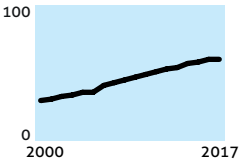
Greater than 10% of total household expenditure or income on health
(% of population)



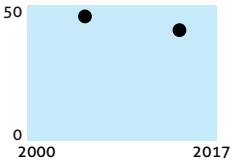
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Nigeria

POPULATION 2018 **196 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	429 (280–609)	219 (143–311)
HIV-positive TB incidence	53 (34–75)	27 (17–38)
MDR/RR-TB incidence[b]	21 (13–32)	11 (6.4–16)
HIV-negative TB mortality	125 (73–192)	64 (37–98)
HIV-positive TB mortality	32 (20–47)	16 (10–24)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4.3% (3.2–5.5)
Previously treated cases	15% (11–19)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	103 921
– % tested with rapid diagnostics at time of diagnosis	54%
– % with known HIV status	100%
– % pulmonary	96%
– % bacteriologically confirmed[c]	77%
– % children aged 0–14 years	8%
– % women	34%
– % men	58%
Total cases notified	106 533

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	24% (17–37)
TB patients facing catastrophic total costs, 2017	71% (68–73)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	38% (19–59)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	12 700	12%
– on antiretroviral therapy	11 032	87%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	65%
– Previously treated cases	88%
Laboratory-confirmed cases[d]	MDR/RR-TB: 2 275, XDR-TB: 31
Patients started on treatment[d,e]	MDR/RR-TB: 1 895, XDR-TB: 14
MDR/RR-TB cases tested for resistance to second-line drugs	1 895

TREATMENT SUCCESS RATE AND COHORT SIZE

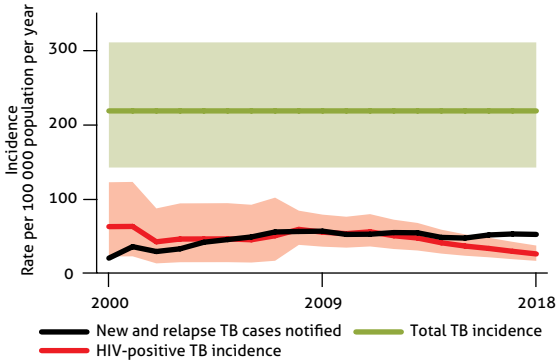
	SUCCESS	COHORT
New and relapse cases registered in 2017	86%	101 734
Previously treated cases, excluding relapse, registered in 2017	82%	2 781
HIV-positive TB cases registered in 2017	76%	13 851
MDR/RR-TB cases started on second-line treatment in 2016	77%	1 251
XDR-TB cases started on second-line treatment in 2016		

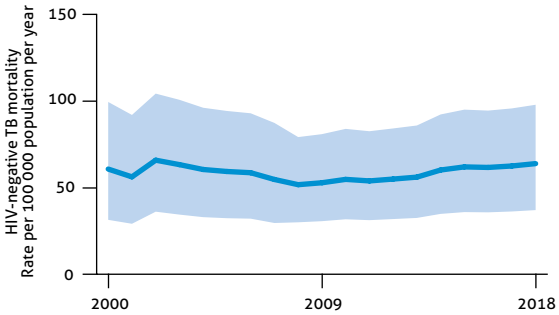
TB PREVENTIVE TREATMENT, 2018

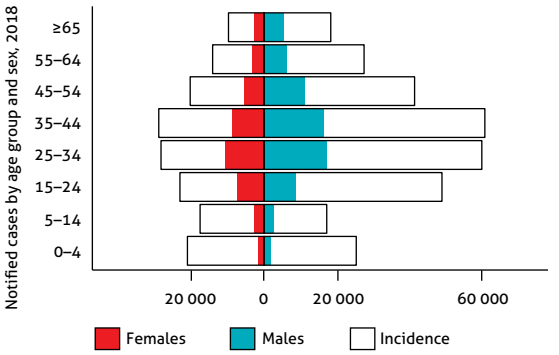
% of HIV-positive people (newly enrolled in care) on preventive treatment	62%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	19% (17–21)

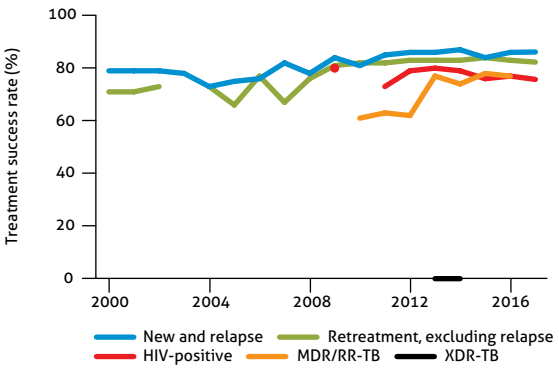
TB FINANCING, 2019

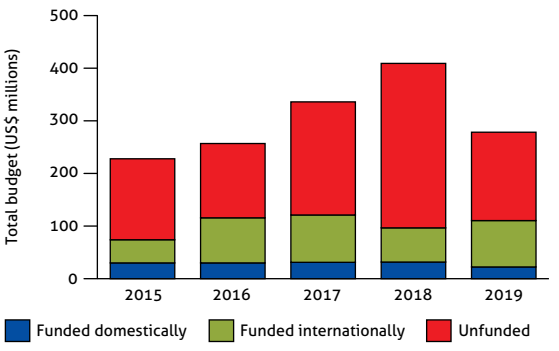
National TB budget (US$ millions)	278
Funding source:	8% domestic, 32% international, 60% unfunded









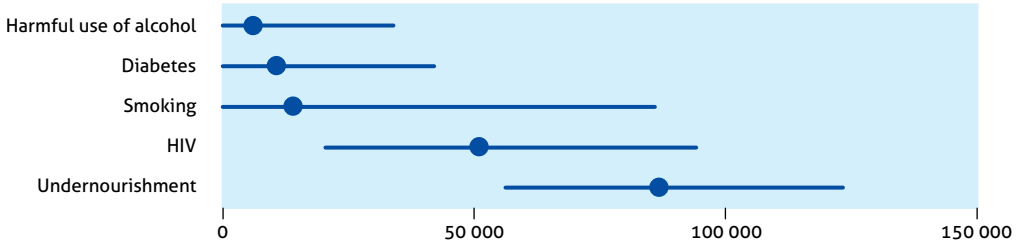


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

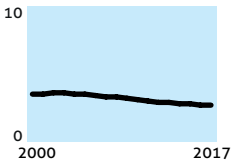
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

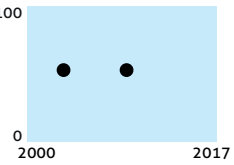


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

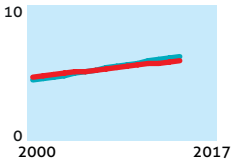
HIV prevalence
(% of population aged 15–49 years)



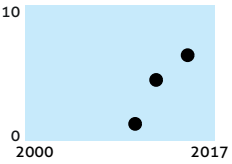
Population living below the international poverty line
(% of population)



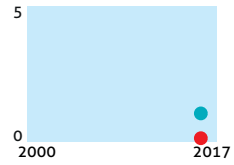
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



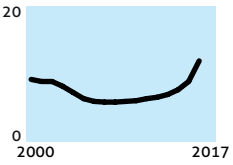
Population covered by social protection floors/systems
(% of population)



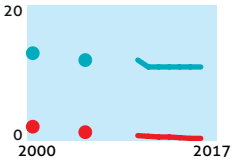
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



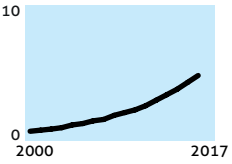
Prevalence of undernourishment
(% of population)



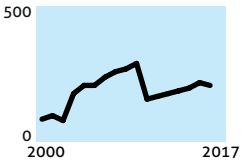
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



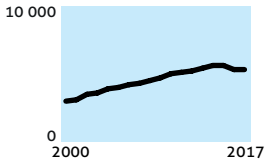
Access to clean fuels and technologies for cooking
(% of population)



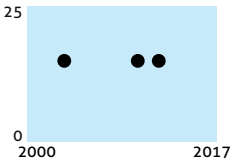
Health expenditure per capita, PPP[b]
(current international $)



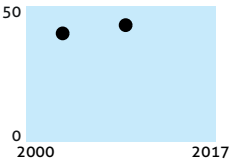
GDP per capita, PPP[b]
(constant 2011 international $)



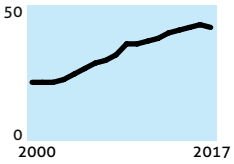
Greater than 10% of total household expenditure or income on health
(% of population)



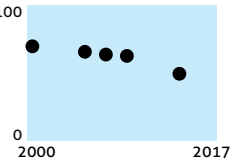
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Pakistan

POPULATION 2018 **212 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	562 (399–754)	265 (188–355)
HIV-positive TB incidence	3.8 (2.5–5.4)	1.8 (1.2–2.5)
MDR/RR-TB incidence[b]	28 (18–40)	13 (8.4–19)
HIV-negative TB mortality	43 (35–52)	20 (16–25)
HIV-positive TB mortality	1.3 (0.83–1.8)	0.6 (0.39–0.86)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4.2% (3.2–5.3)
Previously treated cases	16% (15–17)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	360 472
– % tested with rapid diagnostics at time of diagnosis	22%
– % with known HIV status	20%
– % pulmonary	80%
– % bacteriologically confirmed[c]	48%
– % children aged 0–14 years	13%
– % women	42%
– % men	45%
Total cases notified	369 548

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	64% (48–90)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	8% (5–11)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	636	<1%
– on antiretroviral therapy	417	66%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	45%
– Previously treated cases	79%
Laboratory-confirmed cases[d]	MDR/RR-TB: 3 824, XDR-TB: 95
Patients started on treatment[d,e]	MDR/RR-TB: 3 106, XDR-TB: 71
MDR/RR-TB cases tested for resistance to second-line drugs	2 893

TREATMENT SUCCESS RATE AND COHORT SIZE

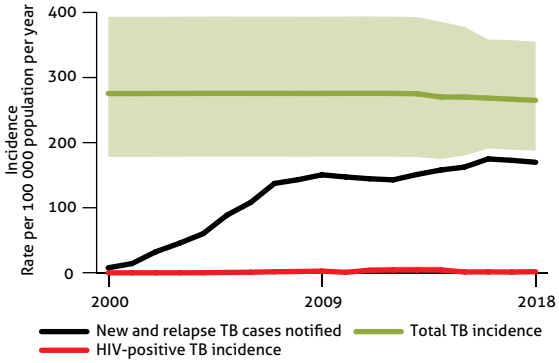
	SUCCESS	COHORT
New and relapse cases registered in 2017	93%	358 730
Previously treated cases, excluding relapse, registered in 2017	79%	9 673
HIV-positive TB cases registered in 2017		
MDR/RR-TB cases started on second-line treatment in 2016	64%	2 804
XDR-TB cases started on second-line treatment in 2016	35%	77

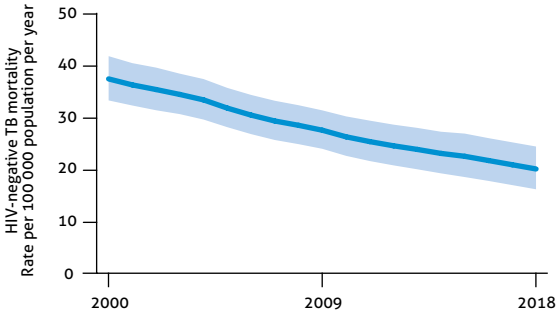
TB PREVENTIVE TREATMENT, 2018

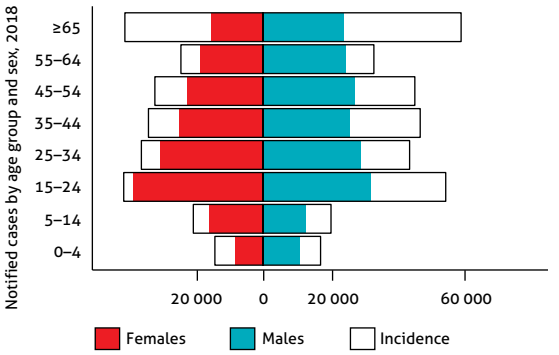
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	5.7% (5.2–6.3)

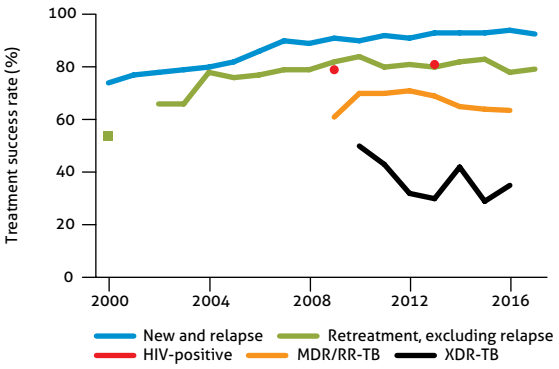
TB FINANCING, 2019

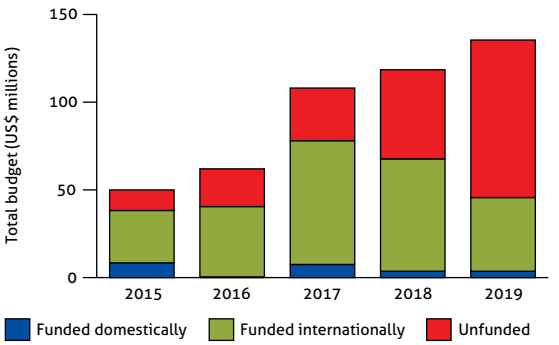
National TB budget (US$ millions)	135
Funding source:	3% domestic, 31% international, 66% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
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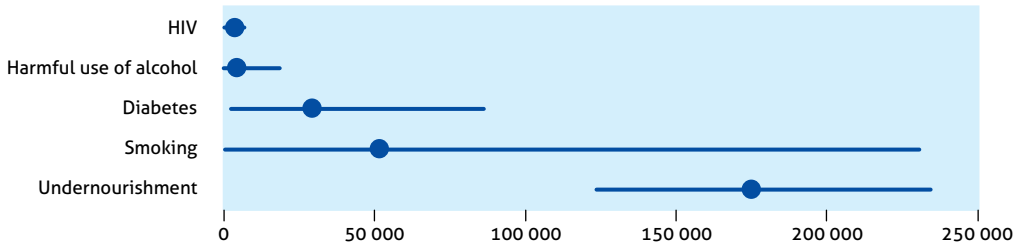
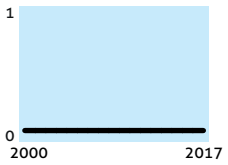
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

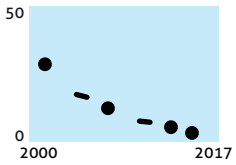


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

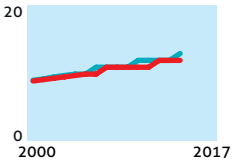
HIV prevalence
(% of population aged 15–49 years)



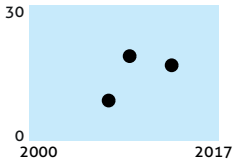
Population living below the international poverty line
(% of population)



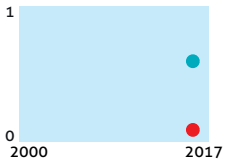
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



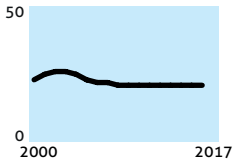
Population covered by social protection floors/systems
(% of population)



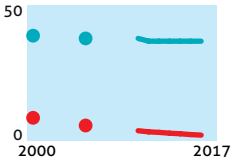
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



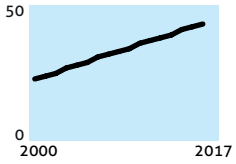
Prevalence of undernourishment
(% of population)



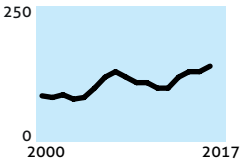
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



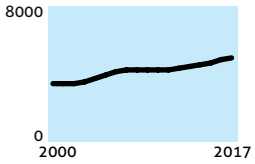
Access to clean fuels and technologies for cooking
(% of population)



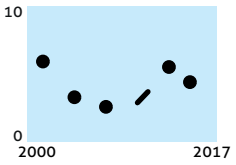
Health expenditure per capita, PPP[b]
(current international $)



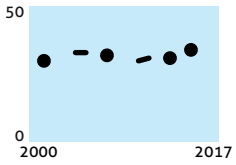
GDP per capita, PPP[b]
(constant 2011 international $)



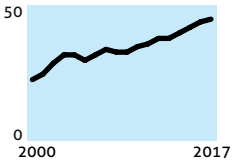
Greater than 10% of total household expenditure or income on health
(% of population)



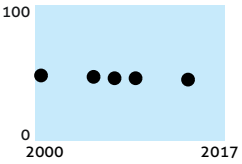
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Philippines

POPULATION 2018 **107 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	591 (332–924)	554 (311–866)
HIV-positive TB incidence	10 (4.1–19)	9.4 (3.8–17)
MDR/RR-TB incidence[b]	18 (7.7–32)	17 (7.3–30)
HIV-negative TB mortality	26 (22–30)	24 (20–28)
HIV-positive TB mortality	0.6 (0–4.2)	0.57 (0–4)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.7% (1.1–2.5)
Previously treated cases	16% (13–20)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	371 668
– % tested with rapid diagnostics at time of diagnosis	36%
– % with known HIV status	27%
– % pulmonary	98%
– % bacteriologically confirmed[c]	36%
– % children aged 0–14 years	12%
– % women	30%
– % men	58%
Total cases notified	382 543

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	63% (40–110)
TB patients facing catastrophic total costs, 2017	35% (33–37)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	5% (3–7)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	1 477	1%
– on antiretroviral therapy	1 350	91%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	<1%
– Previously treated cases	24%
Laboratory-confirmed cases[d]	MDR/RR-TB: 7 276, XDR-TB: 52
Patients started on treatment[d,e]	MDR/RR-TB: 6 125, XDR-TB: 52
MDR/RR-TB cases tested for resistance to second-line drugs	2 095

TREATMENT SUCCESS RATE AND COHORT SIZE

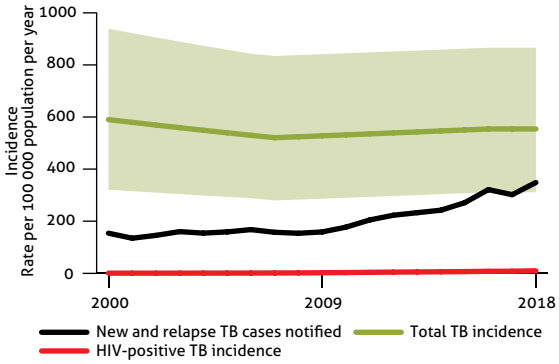
	SUCCESS	COHORT
New and relapse cases registered in 2017	91%	315 923
Previously treated cases, excluding relapse, registered in 2017	82%	9 486
HIV-positive TB cases registered in 2017	83%	1 258
MDR/RR-TB cases started on second-line treatment in 2016	58%	5 071
XDR-TB cases started on second-line treatment in 2016	20%	10

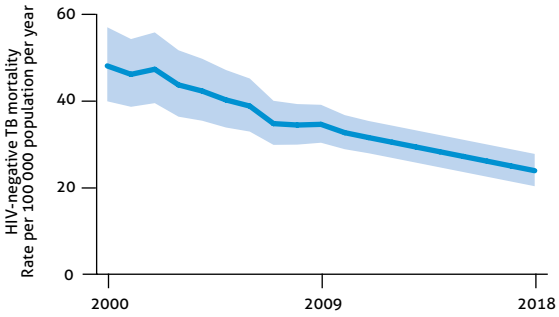
TB PREVENTIVE TREATMENT, 2018

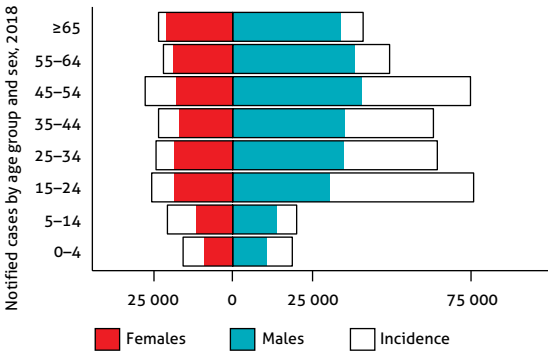
% of HIV-positive people (newly enrolled in care) on preventive treatment	52%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	9.4% (8.7–10)

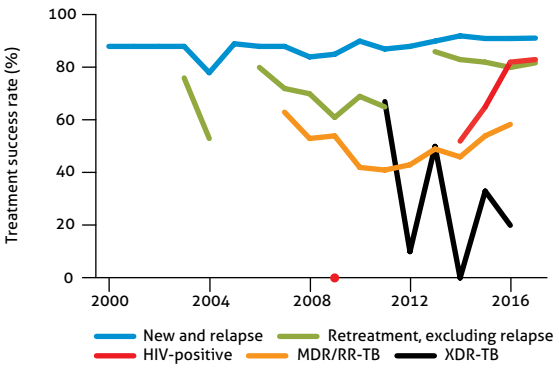
TB FINANCING, 2019

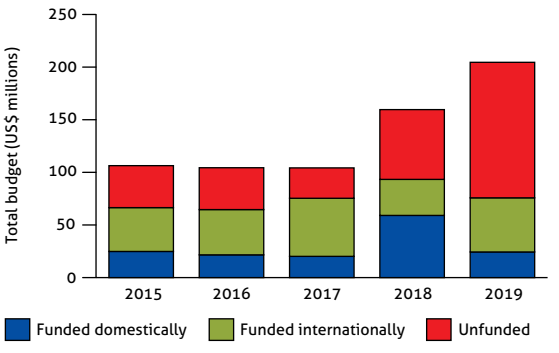
National TB budget (US$ millions)	205
Funding source:	12% domestic, 25% international, 63% unfunded









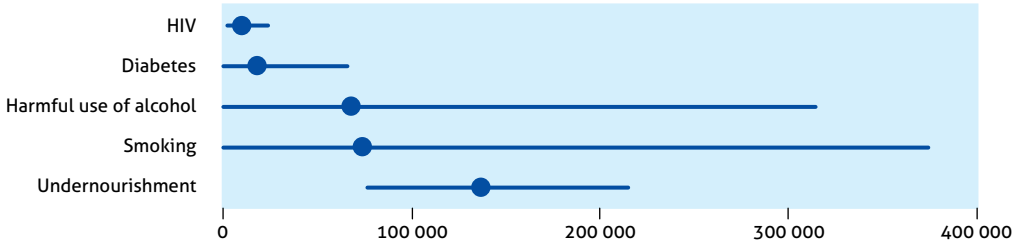


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

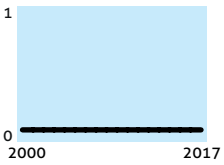
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

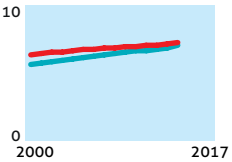


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

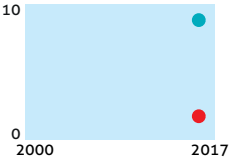
HIV prevalence
(% of population aged 15–49 years)



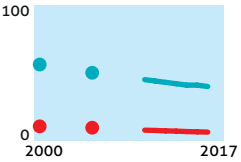
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



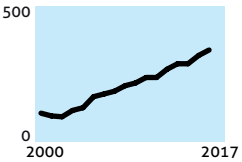
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



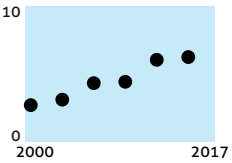
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



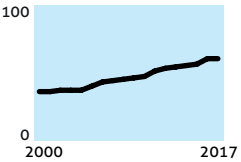
Health expenditure per capita, PPP[b]
(current international $)



Greater than 10% of total household expenditure or income on health
(% of population)

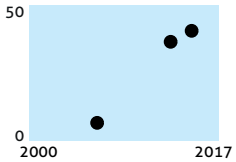


UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)

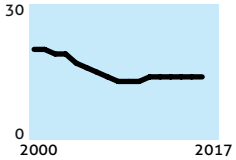


Population living below the international poverty line
(% of population)

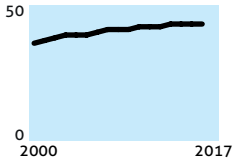
Population covered by social protection floors/systems
(% of population)



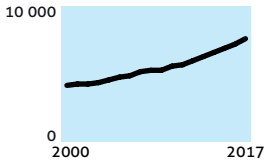
Prevalence of undernourishment
(% of population)



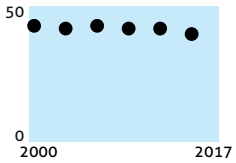
Access to clean fuels and technologies for cooking
(% of population)



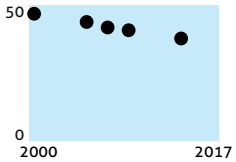
GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Russian Federation

POPULATION 2018[a] **146 MILLION**

ESTIMATES OF TB BURDEN,[b] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	79 (51–112)	54 (35–77)
HIV-positive TB incidence	16 (10–22)	11 (7–15)
MDR/RR-TB incidence[c]	41 (26–59)	28 (18–40)
HIV-negative TB mortality	9.2 (8.3–10)	6.3 (5.7–7)
HIV-positive TB mortality	1.3 (0.57–2.2)	0.86 (0.39–1.5)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	35% (34–35)
Previously treated cases	71% (70–71)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	78 258
– % tested with rapid diagnostics at time of diagnosis[d]	73%
– % with known HIV status	95%
– % pulmonary	92%
– % bacteriologically confirmed[e]	54%
– % children aged 0–14 years	3%
– % women	29%
– % men	68%
Total cases notified	106 913

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	99% (70–150)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	14% (9–20)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	14 797	20%
– on antiretroviral therapy	10 077	68%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[e]	
– New cases	88%
– Previously treated cases	95%
Laboratory-confirmed cases[f]	MDR/RR-TB: 27 438, XDR-TB: 5 112
Patients started on treatment[f,g]	MDR/RR-TB: 27 014, XDR-TB: 4 140
MDR/RR-TB cases tested for resistance to second-line drugs	24 601

TREATMENT SUCCESS RATE AND COHORT SIZE

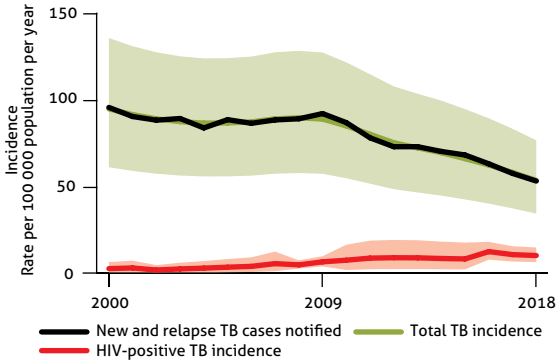
	SUCCESS	COHORT
New and relapse cases registered in 2017	69%	67 593
Previously treated cases, excluding relapse, registered in 2017	50%	9 339
HIV-positive TB cases registered in 2017	43%	9 655
MDR/RR-TB cases started on second-line treatment in 2016	54%	22 593
XDR-TB cases started on second-line treatment in 2016	38%	2 909

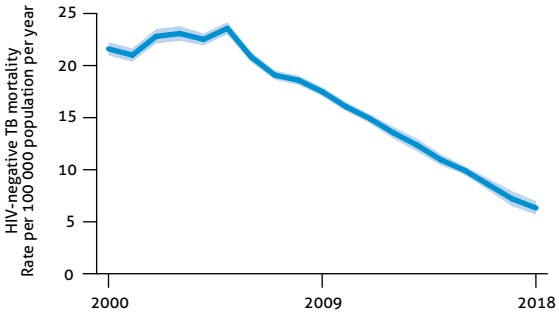
TB PREVENTIVE TREATMENT, 2018

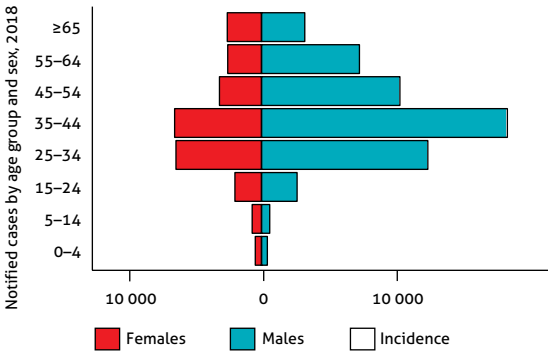
% of HIV-positive people (newly enrolled in care) on preventive treatment	97%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	100%

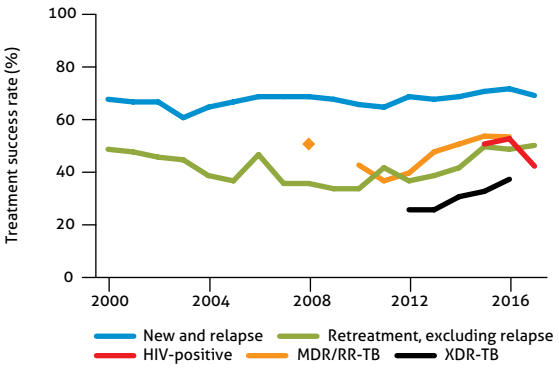
TB FINANCING, 2019

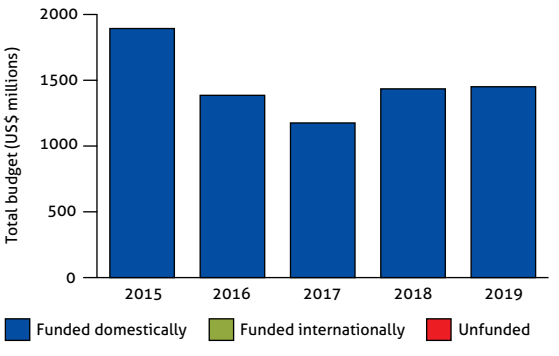
National TB budget (US$ millions)	1 451
Funding source:	100% domestic, 0% international, 0% unfunded









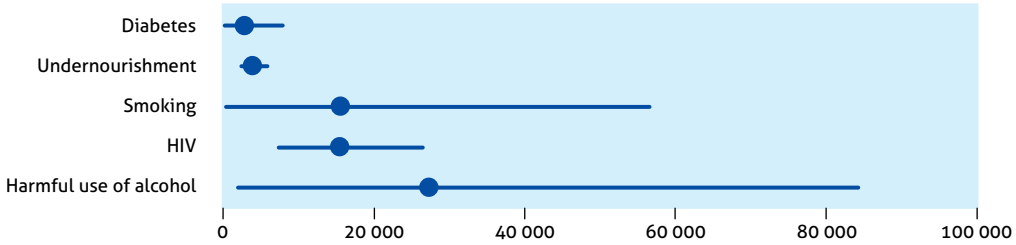


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] UN Population Division estimates are lower than the population registered by the Federal State Statistics Service of the Russian Federation.
[b] Ranges represent uncertainty intervals.
[c] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[d] Includes coverage by all molecular genetic methods, including those developed in the Russian Federation
[e] Calculated for pulmonary cases only.
[f] Includes cases with unknown previous TB treatment history.
[g] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

Data for all countries and years can be downloaded from www.who.int/tb/data

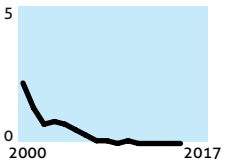
NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018



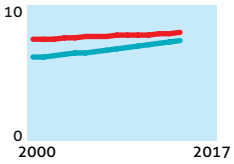
INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

HIV prevalence
(% of population aged 15–49 years)

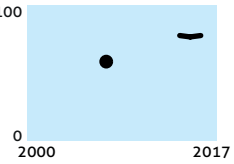
Population living below the international poverty line
(% of population)



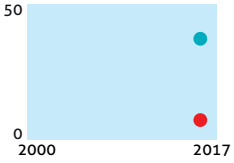
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



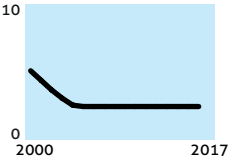
Population covered by social protection floors/systems
(% of population)



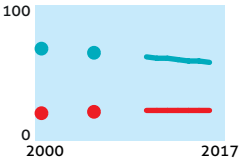
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



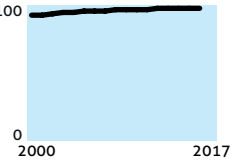
Prevalence of undernourishment
(% of population)



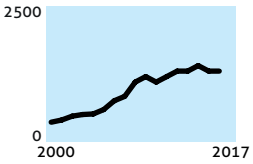
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



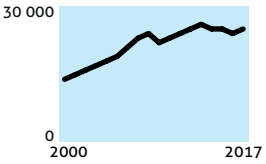
Access to clean fuels and technologies for cooking
(% of population)



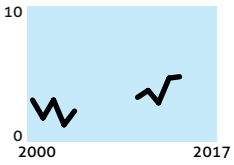
Health expenditure per capita, PPP[b]
(current international $)



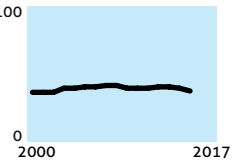
GDP per capita, PPP[b]
(constant 2011 international $)



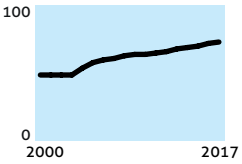
Greater than 10% of total household expenditure or income on health
(% of population)



GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)

[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

South Africa

POPULATION 2018 **58 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	301 (215–400)	520 (373–691)
HIV-positive TB incidence	177 (127–235)	306 (219–406)
MDR/RR-TB incidence[b]	11 (7.2–16)	19 (12–28)
HIV-negative TB mortality	21 (20–23)	37 (35–39)
HIV-positive TB mortality	42 (30–57)	73 (51–99)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.4% (2.5–4.3)
Previously treated cases	7.1% (4.8–9.5)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	227 999
– % tested with rapid diagnostics at time of diagnosis	71%
– % with known HIV status	90%
– % pulmonary	89%
– % bacteriologically confirmed[c]	70%
– % children aged 0–14 years	7%
– % women	37%
– % men	56%
Total cases notified	235 652

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	76% (57–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	22% (14–30)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	120 862	59%
– on antiretroviral therapy	104 625	87%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	92%
– Previously treated cases	94%
Laboratory-confirmed cases[d]	MDR/RR-TB: 13 199, XDR-TB: 553
Patients started on treatment[d,e]	MDR/RR-TB: 9 558, XDR-TB: 539
MDR/RR-TB cases tested for resistance to second-line drugs	7 469

TREATMENT SUCCESS RATE AND COHORT SIZE

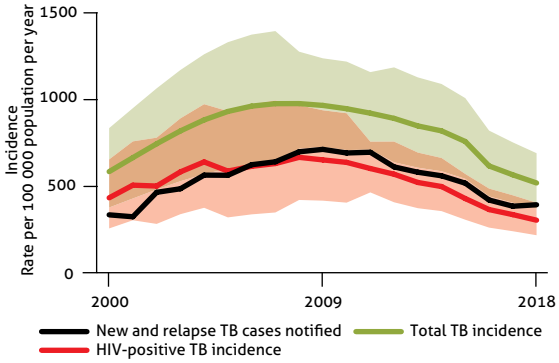
	SUCCESS	COHORT
New and relapse cases registered in 2017	77%	240 332
Previously treated cases, excluding relapse, registered in 2017	59%	6 508
HIV-positive TB cases registered in 2017	75%	134 672
MDR/RR-TB cases started on second-line treatment in 2016	54%	11 159
XDR-TB cases started on second-line treatment in 2016	58%	601

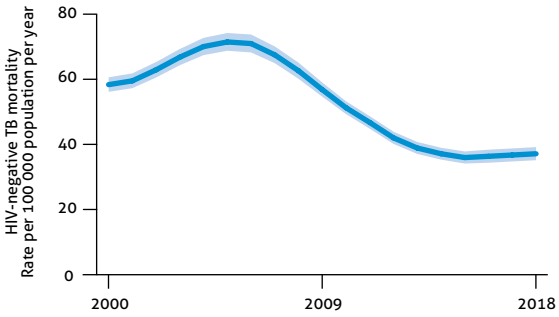
TB PREVENTIVE TREATMENT, 2018

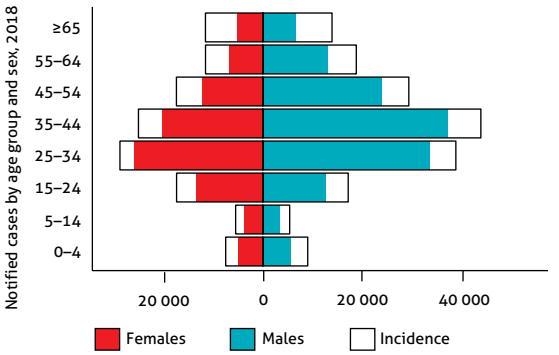
% of HIV-positive people (newly enrolled in care) on preventive treatment	65%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	59% (54–65)

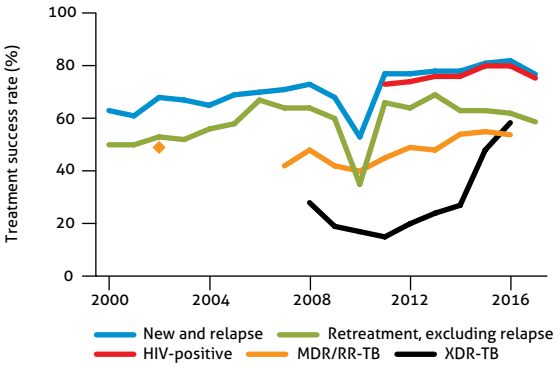
TB FINANCING, 2019

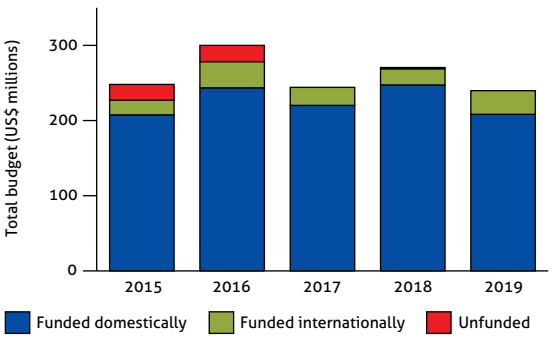
National TB budget (US$ millions)	240
Funding source:	87% domestic, 13% international, 0% unfunded









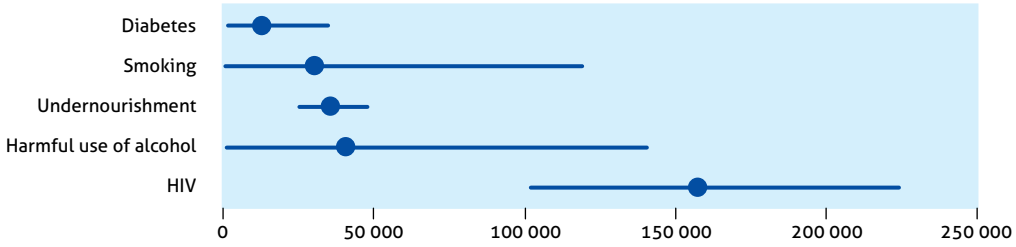


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates of TB incidence and mortality for South Africa will be reviewed after final results from the national TB prevalence survey are available in 2020.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

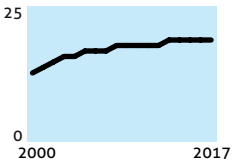
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

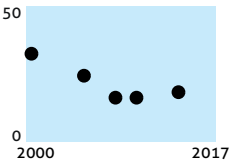


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

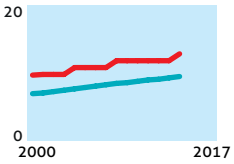
HIV prevalence
(% of population aged 15–49 years)



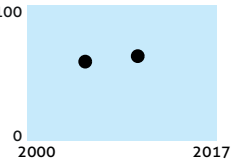
Population living below the international poverty line
(% of population)



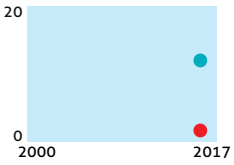
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



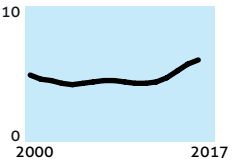
Population covered by social protection floors/systems
(% of population)



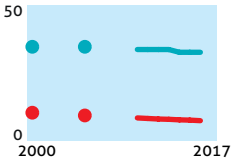
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



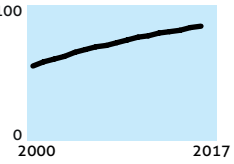
Prevalence of undernourishment
(% of population)



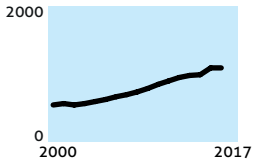
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



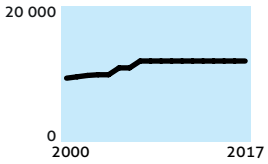
Access to clean fuels and technologies for cooking
(% of population)



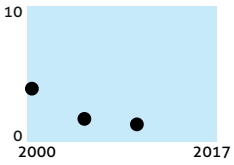
Health expenditure per capita, PPP[b]
(current international $)



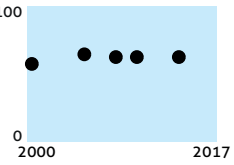
GDP per capita, PPP[b]
(constant 2011 international $)



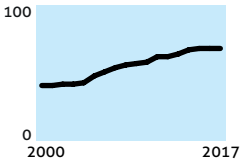
Greater than 10% of total household expenditure or income on health
(% of population)



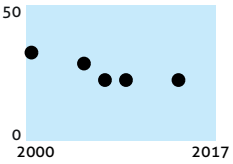
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Thailand

POPULATION 2018 **69 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	106 (81–136)	153 (116–195)
HIV-positive TB incidence	11 (8.2–14)	15 (12–20)
MDR/RR-TB incidence[b]	4 (2.3–6.1)	5.7 (3.3–8.8)
HIV-negative TB mortality	9.2 (6.9–12)	13 (9.9–17)
HIV-positive TB mortality	2.3 (1.7–3)	3.3 (2.4–4.4)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.3% (1.3–3.4)
Previously treated cases	24% (18–31)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	85 029
– % tested with rapid diagnostics at time of diagnosis	19%
– % with known HIV status	79%
– % pulmonary	85%
– % bacteriologically confirmed[c]	59%
– % children aged 0–14 years	1%
– % women	31%
– % men	68%
Total cases notified	86 949

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	80% (63–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	11% (8–15)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	6 780	10%
– on antiretroviral therapy	5 391	80%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	30%
– Previously treated cases	62%
Laboratory-confirmed cases[d]	MDR/RR-TB: 1 312, XDR-TB: 29
Patients started on treatment[d,e]	MDR/RR-TB: 910, XDR-TB: 21
MDR/RR-TB cases tested for resistance to second-line drugs	665

TREATMENT SUCCESS RATE AND COHORT SIZE

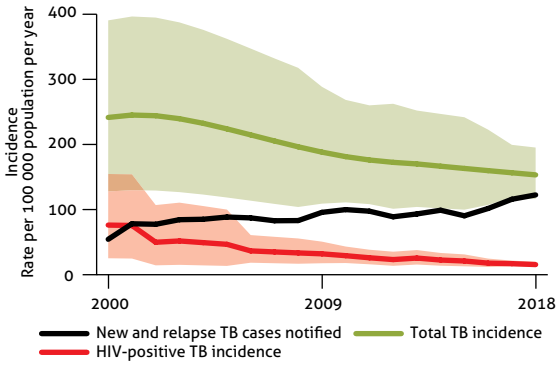
	SUCCESS	COHORT
New and relapse cases registered in 2017	84%	80 160
Previously treated cases, excluding relapse, registered in 2017	55%	1 848
HIV-positive TB cases registered in 2017	73%	7 130
MDR/RR-TB cases started on second-line treatment in 2016	61%	952
XDR-TB cases started on second-line treatment in 2016	75%	8

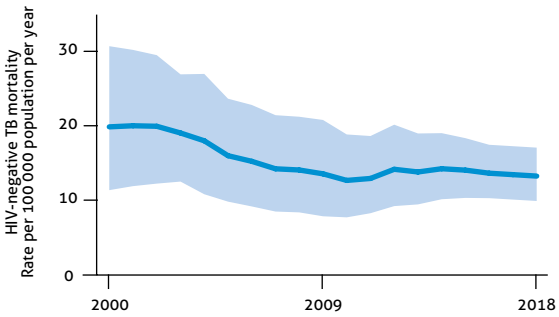
TB PREVENTIVE TREATMENT, 2018

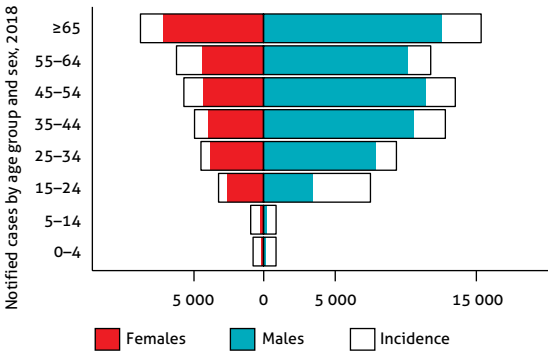
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	6.4% (5.9–7.1)

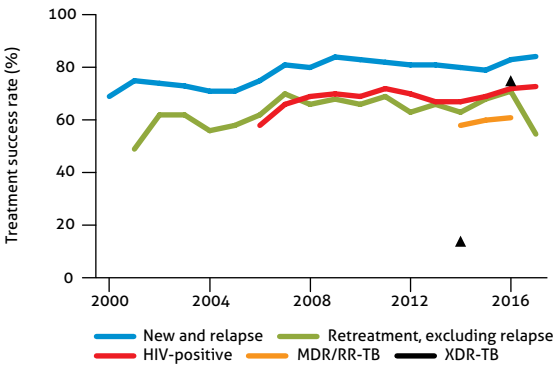
TB FINANCING, 2019

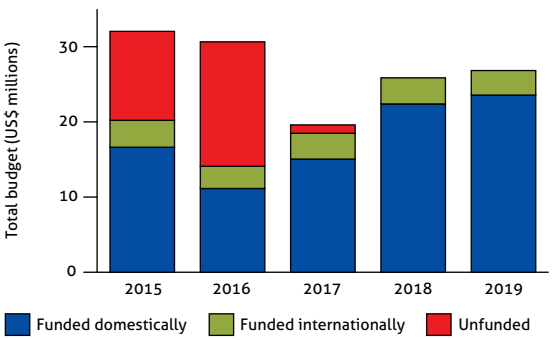
National TB budget (US$ millions)	27
Funding source:	88% domestic, 12% international, 0% unfunded









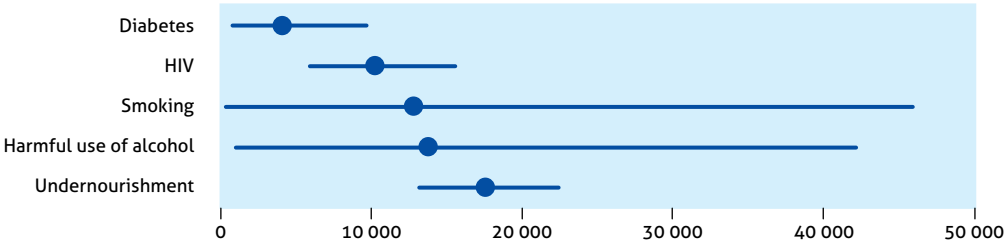


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

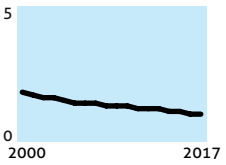
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

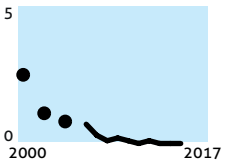


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

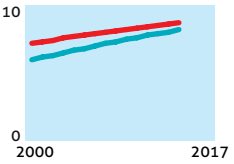
HIV prevalence
(% of population aged 15–49 years)



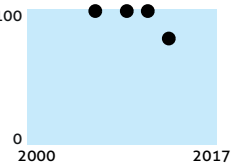
Population living below the international poverty line
(% of population)



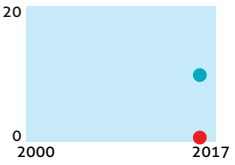
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



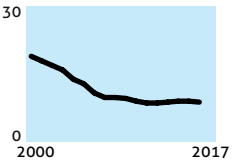
Population covered by social protection floors/systems
(% of population)



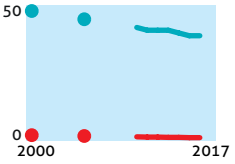
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



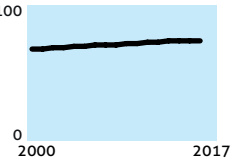
Prevalence of undernourishment
(% of population)



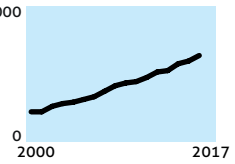
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



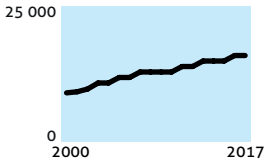
Access to clean fuels and technologies for cooking
(% of population)



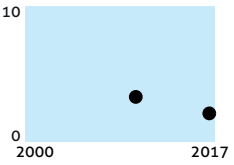
Health expenditure per capita, PPP[b]
(current international $)



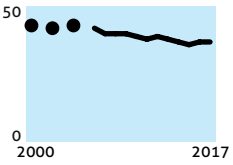
GDP per capita, PPP[b]
(constant 2011 international $)



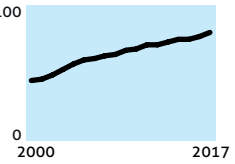
Greater than 10% of total household expenditure or income on health
(% of population)



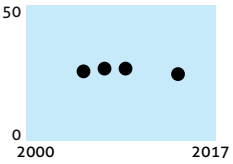
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

United Republic of Tanzania

POPULATION 2018 **56 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	142 (67–245)	253 (119–435)
HIV-positive TB incidence	40 (19–69)	71 (34–122)
MDR/RR-TB incidence[b]	1.9 (0.67–3.7)	3.3 (1.2–6.6)
HIV-negative TB mortality	22 (10–40)	40 (18–70)
HIV-positive TB mortality	16 (7.8–27)	29 (14–49)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	0.97% (0.4–1.6)
Previously treated cases	13% (11–15)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	74 692
– % tested with rapid diagnostics at time of diagnosis	18%
– % with known HIV status	99%
– % pulmonary	79%
– % bacteriologically confirmed[ooo]	48%
– % children aged 0–14 years	14%
– % women	33%
– % men	53%
Total cases notified	75 828

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	53% (30–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	30% (11–53)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	20 695	28%
– on antiretroviral therapy	20 337	98%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	70%
– Previously treated cases	81%
Laboratory-confirmed cases[d]	MDR/RR-TB: 449, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 409, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	62

TREATMENT SUCCESS RATE AND COHORT SIZE

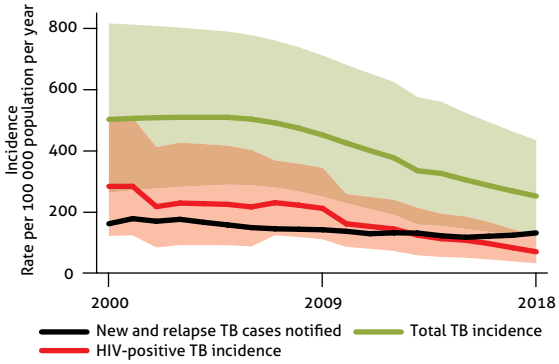
	SUCCESS	COHORT
New and relapse cases registered in 2017	90%	68 278
Previously treated cases, excluding relapse, registered in 2017	84%	1 250
HIV-positive TB cases registered in 2017	80%	21 349
MDR/RR-TB cases started on second-line treatment in 2016	80%	158
XDR-TB cases started on second-line treatment in 2016		0

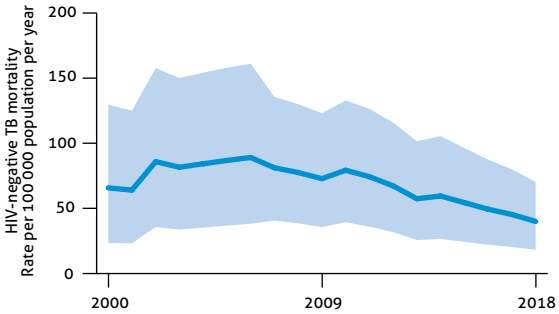
TB PREVENTIVE TREATMENT, 2018

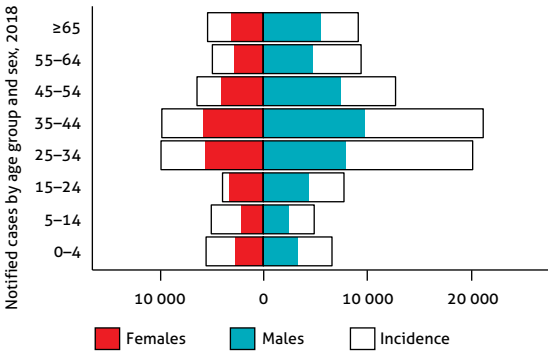
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	22% (20–24)

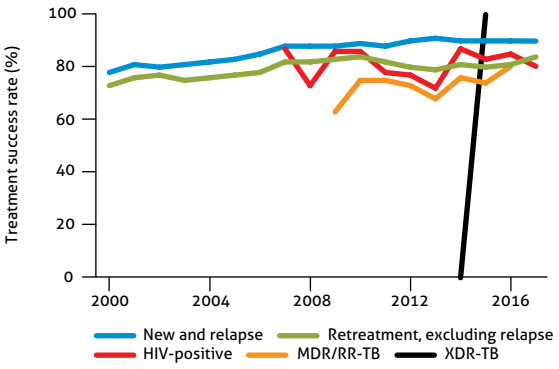
TB FINANCING, 2019

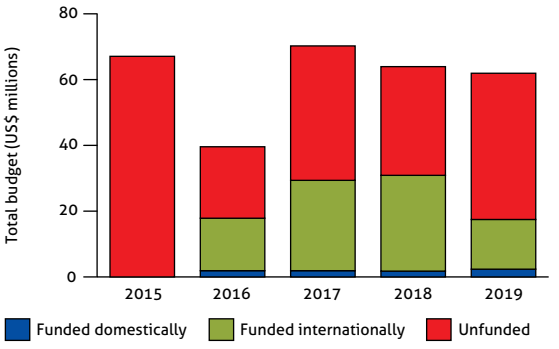
National TB budget (US$ millions)	62
Funding source:	4% domestic, 24% international, 72% unfunded









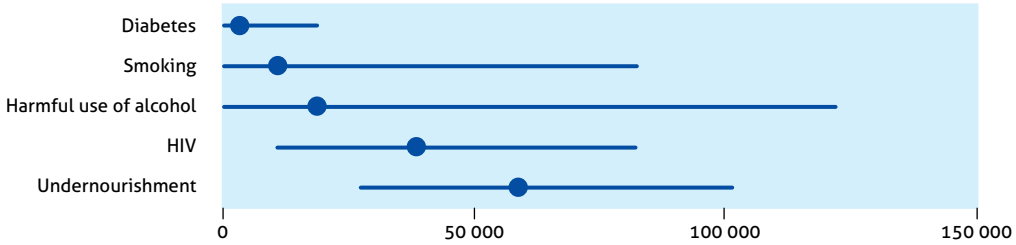


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

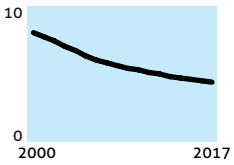
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

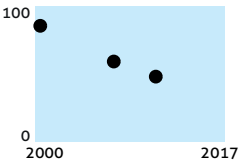


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

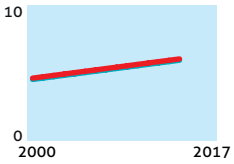
HIV prevalence
(% of population aged 15–49 years)



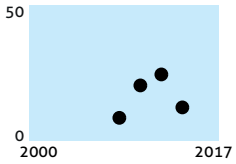
Population living below the international poverty line
(% of population)



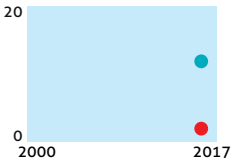
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



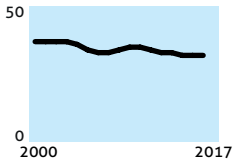
Population covered by social protection floors/systems
(% of population)



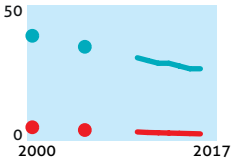
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



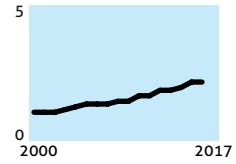
Prevalence of undernourishment
(% of population)



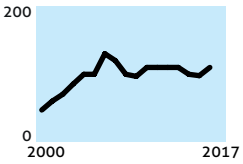
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



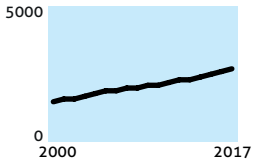
Access to clean fuels and technologies for cooking
(% of population)



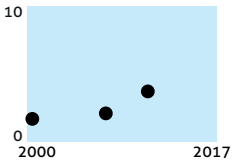
Health expenditure per capita, PPP[b]
(current international $)



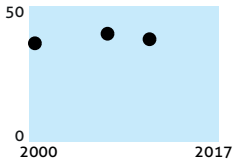
GDP per capita, PPP[b]
(constant 2011 international $)



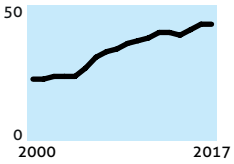
Greater than 10% of total household expenditure or income on health
(% of population)



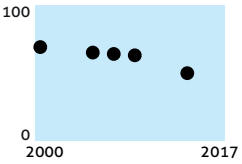
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Viet Nam

POPULATION 2018 **96 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	174 (111–251)	182 (116–263)
HIV-positive TB incidence	6 (3.8–8.6)	6.2 (4–9)
MDR/RR-TB incidence[b]	8.6 (5.4–13)	9.1 (5.7–13)
HIV-negative TB mortality	11 (6.7–15)	11 (7–16)
HIV-positive TB mortality	2.2 (1.4–3.2)	2.3 (1.5–3.4)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.6% (3.4–3.8)
Previously treated cases	17% (17–18)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	99 658
– % tested with rapid diagnostics at time of diagnosis	20%
– % with known HIV status	85%
– % pulmonary	80%
– % bacteriologically confirmed[c]	70%
– % children aged 0–14 years	2%
– % women	27%
– % men	71%
Total cases notified	102 171

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	57% (40–90)
TB patients facing catastrophic total costs, 2016	63% (58–67)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	8% (4–12)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	2 902	3%
– on antiretroviral therapy	2 705	93%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	82%
– Previously treated cases	100%
Laboratory-confirmed cases[d]	MDR/RR-TB: 3 126, XDR-TB: 61
Patients started on treatment[d,e]	MDR/RR-TB: 3 110, XDR-TB: 198
MDR/RR-TB cases tested for resistance to second-line drugs	1 922

TREATMENT SUCCESS RATE AND COHORT SIZE

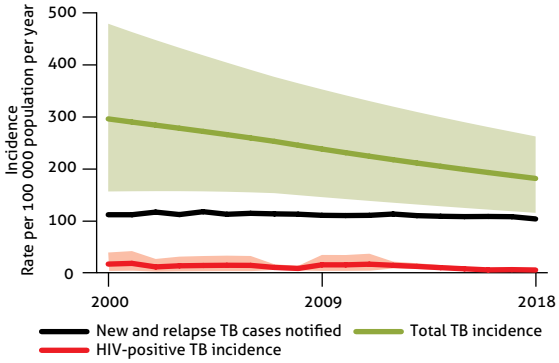
	SUCCESS	COHORT
New and relapse cases registered in 2017	92%	102 193
Previously treated cases, excluding relapse, registered in 2017	87%	2 983
HIV-positive TB cases registered in 2017	79%	3 002
MDR/RR-TB cases started on second-line treatment in 2016	68%	2 450
XDR-TB cases started on second-line treatment in 2016	68%	28

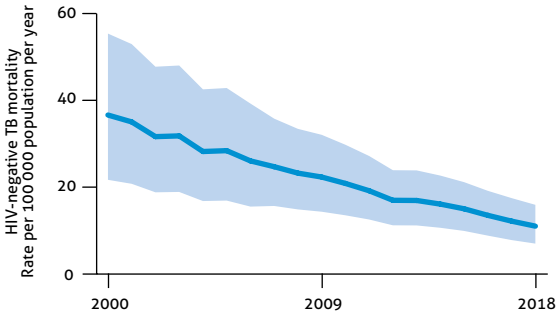
TB PREVENTIVE TREATMENT, 2018

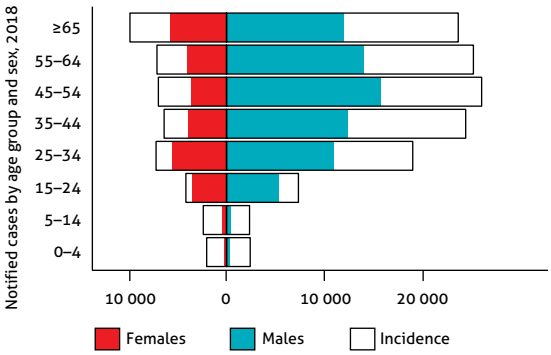
% of HIV-positive people (newly enrolled in care) on preventive treatment	39%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	22% (21–25)

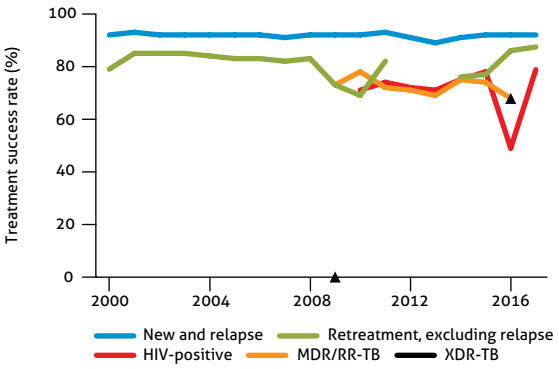
TB FINANCING, 2019

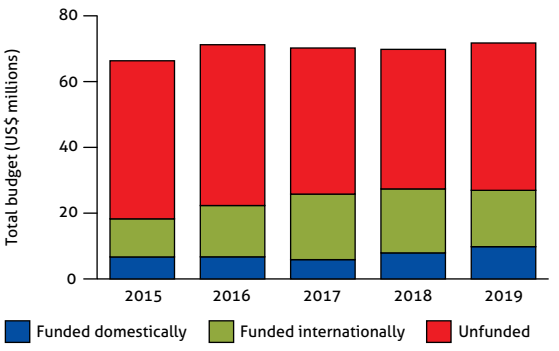
National TB budget (US$ millions)	72
Funding source:	14% domestic, 24% international, 62% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
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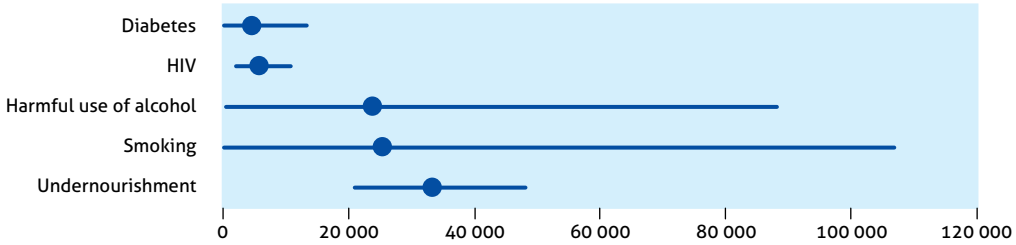
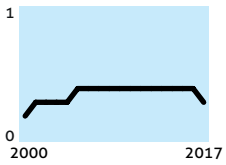
NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

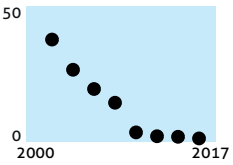


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

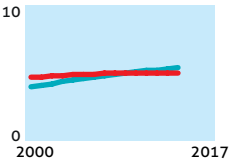
HIV prevalence
(% of population aged 15–49 years)



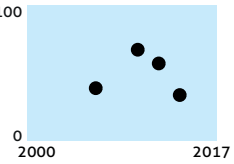
Population living below the international poverty line
(% of population)



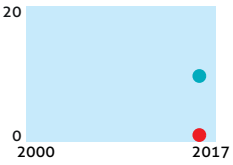
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



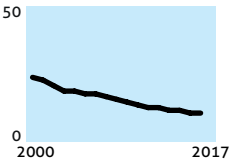
Population covered by social protection floors/systems
(% of population)



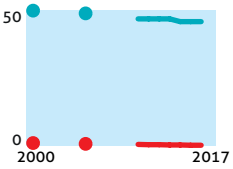
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



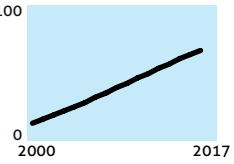
Prevalence of undernourishment
(% of population)



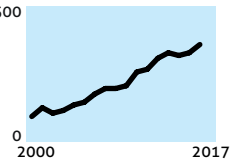
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



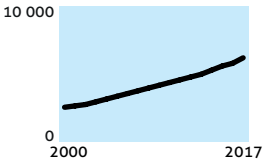
Access to clean fuels and technologies for cooking
(% of population)



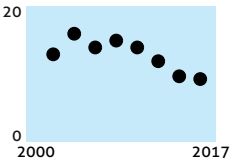
Health expenditure per capita, PPP[b]
(current international $)



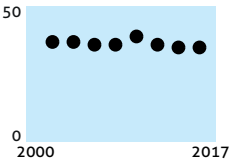
GDP per capita, PPP[b]
(constant 2011 international $)



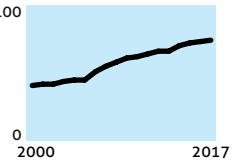
Greater than 10% of total household expenditure or income on health
(% of population)



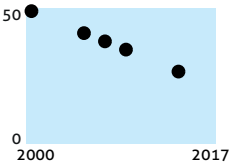
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Cambodia

POPULATION 2018 **16 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	49 (27–77)	302 (169–473)
HIV-positive TB incidence	1.1 (0.59–1.7)	6.5 (3.6–10)
MDR/RR-TB incidence[b]	1 (0.46–1.9)	6.4 (2.8–11)
HIV-negative TB mortality	3 (1.9–4.3)	18 (12–26)
HIV-positive TB mortality	0.38 (0.21–0.6)	2.3 (1.3–3.7)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	1.8% (1.2–2.8)
Previously treated cases	8.2% (4–16)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	28 620
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	94%
– % pulmonary	65%
– % bacteriologically confirmed[c]	53%
– % children aged 0-14 years	19%
– % women	36%
– % men	45%
Total cases notified	28 757

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	58% (37–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	7% (4–12)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	580	2%
– on antiretroviral therapy	580	100%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	
– Previously treated cases	
Laboratory-confirmed cases[d]	MDR/RR-TB: 128, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 128, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	125

TREATMENT SUCCESS RATE AND COHORT SIZE

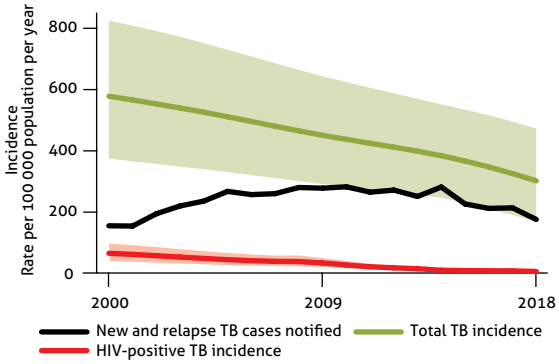
	SUCCESS	COHORT
New and relapse cases registered in 2017	94%	34 238
Previously treated cases, excluding relapse, registered in 2017	79%	229
HIV-positive TB cases registered in 2017		
MDR/RR-TB cases started on second-line treatment in 2016	64%	101
XDR-TB cases started on second-line treatment in 2016		

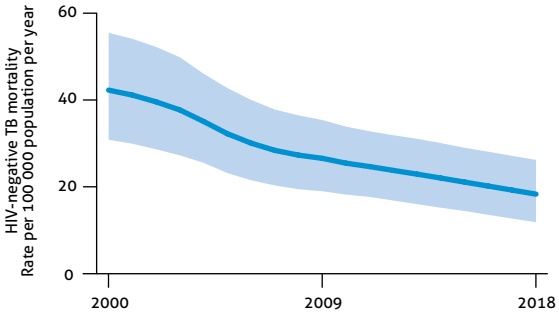
TB PREVENTIVE TREATMENT, 2018

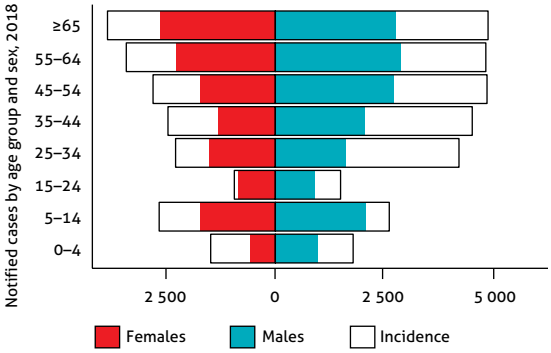
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

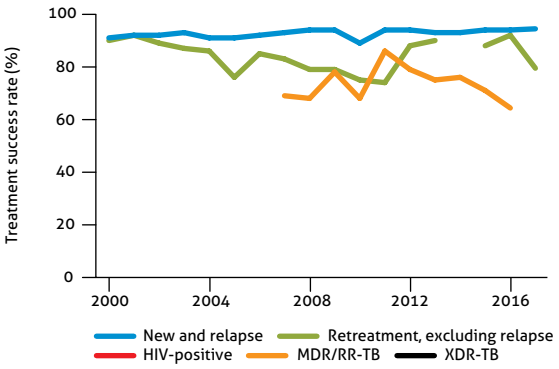
TB FINANCING, 2019

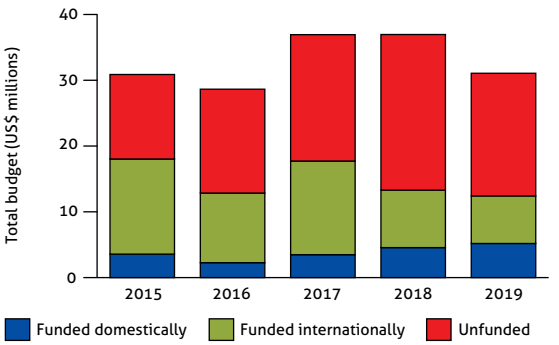
National TB budget (US$ millions)	31
Funding source:	17% domestic, 23% international, 60% unfunded









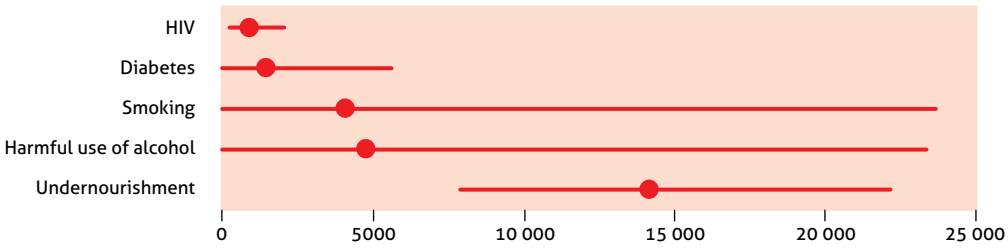


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

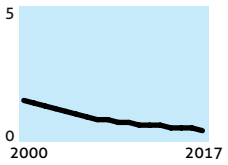
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

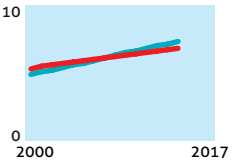


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

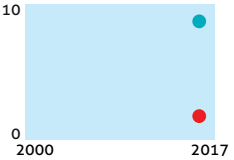
HIV prevalence
(% of population aged 15–49 years)



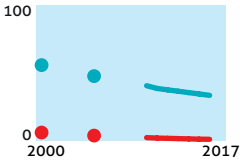
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



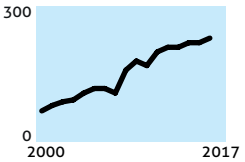
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



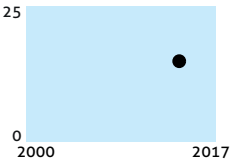
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



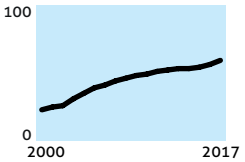
Health expenditure per capita, PPP[b]
(current international $)



Greater than 10% of total household expenditure or income on health
(% of population)

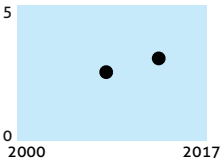


UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)

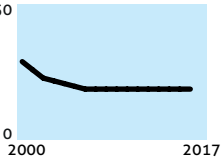


Population living below the international poverty line
(% of population)

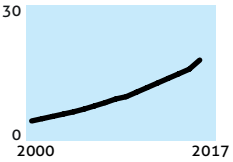
Population covered by social protection floors/systems
(% of population)



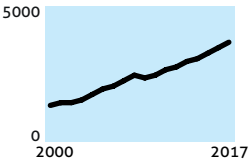
Prevalence of undernourishment
(% of population)



Access to clean fuels and technologies for cooking
(% of population)

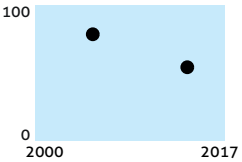


GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)

Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Central African Republic

POPULATION 2018 **4.7 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	25 (16–36)	540 (349–771)
HIV-positive TB incidence	6.6 (4.2–9.4)	141 (91–201)
MDR/RR-TB incidence[b]	0.18 (0.1–0.27)	3.8 (2.2–5.9)
HIV-negative TB mortality	4.8 (2.8–7.3)	103 (60–157)
HIV-positive TB mortality	3.1 (2–4.5)	67 (42–97)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	0.4% (0–2.2)
Previously treated cases	15% (11–19)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	10 881
– % tested with rapid diagnostics at time of diagnosis	<1%
– % with known HIV status	79%
– % pulmonary	79%
– % bacteriologically confirmed[c]	64%
– % children aged 0–14 years	17%
– % women	35%
– % men	48%
Total cases notified	11 032

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	43% (30–67)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	33% (18–50)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	2 274	26%
– on antiretroviral therapy	1 923	85%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	<1%
– Previously treated cases	55%
Laboratory-confirmed cases[d]	MDR/RR-TB: 58, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 60, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	0

TREATMENT SUCCESS RATE AND COHORT SIZE

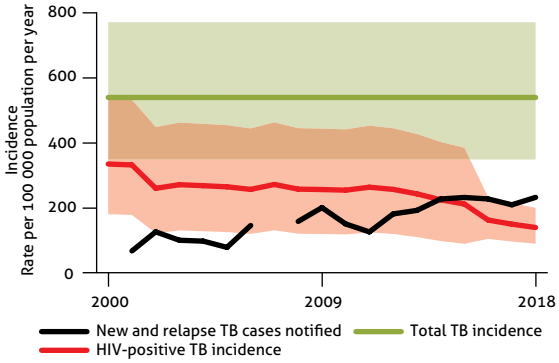
	SUCCESS	COHORT
New and relapse cases registered in 2017	78%	9 302
Previously treated cases, excluding relapse, registered in 2017	73%	147
HIV-positive TB cases registered in 2017	74%	2 137
MDR/RR-TB cases started on second-line treatment in 2016	59%	41
XDR-TB cases started on second-line treatment in 2016		0

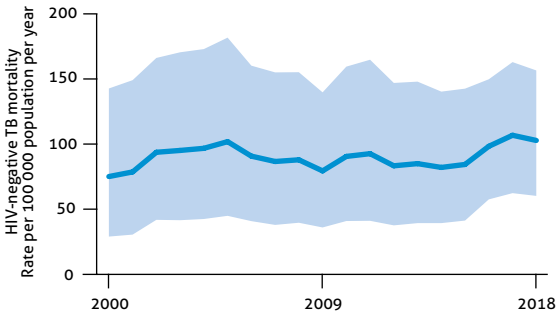
TB PREVENTIVE TREATMENT, 2018

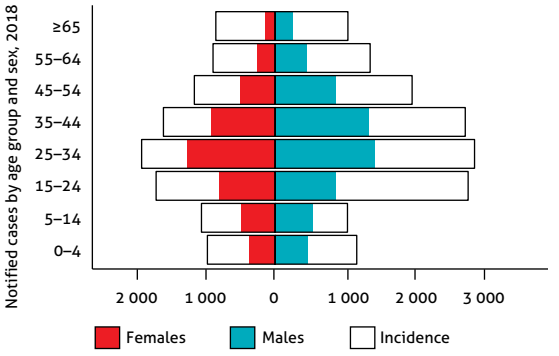
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	100%

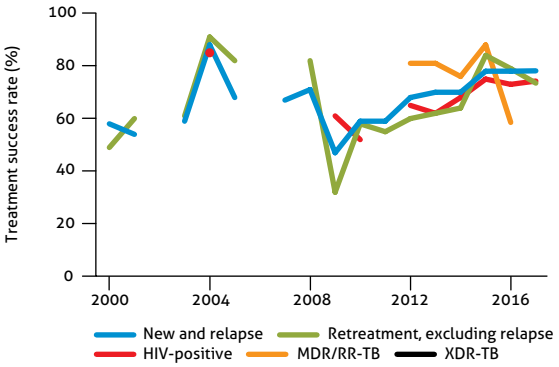
TB FINANCING, 2019

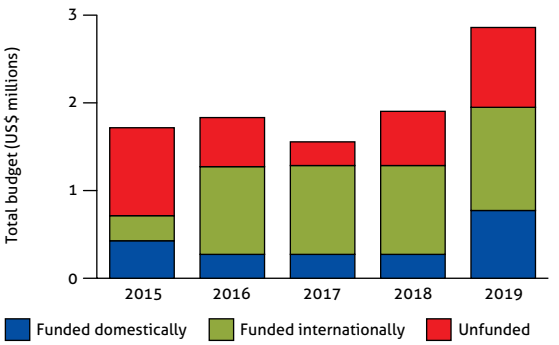
National TB budget (US$ millions)	2.9
Funding source:	27% domestic, 41% international, 32% unfunded









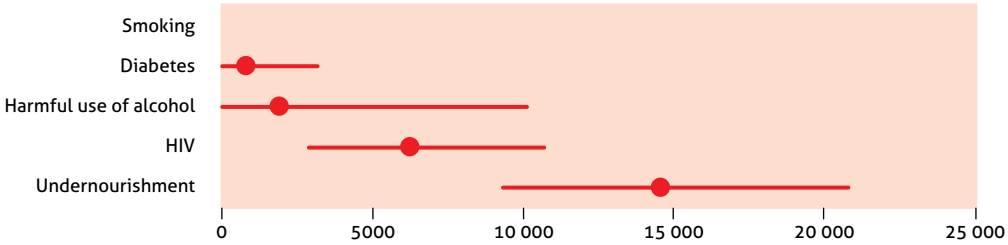


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

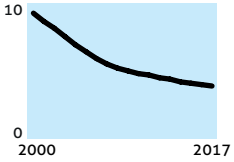
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

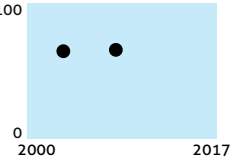


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

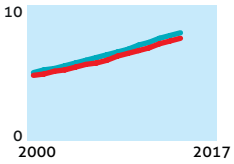
HIV prevalence
(% of population aged 15–49 years)



Population living below the international poverty line
(% of population)

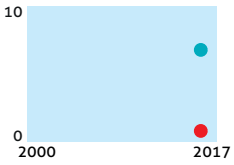


Diabetes prevalence
(% of population aged ≥18 years)
● females ● males

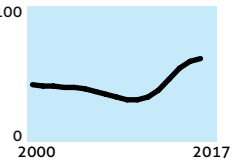


Population covered by social protection floors/systems
(% of population)

Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males

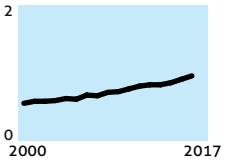


Prevalence of undernourishment
(% of population)

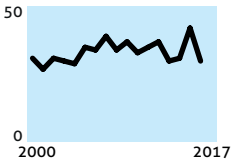


Smoking prevalence
(% of population aged ≥15 years)
● females ● males

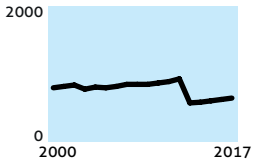
Access to clean fuels and technologies for cooking
(% of population)



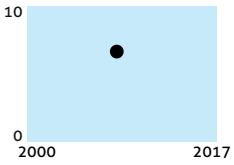
Health expenditure per capita, PPP[b]
(current international $)



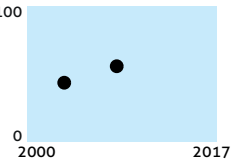
GDP per capita, PPP[b]
(constant 2011 international $)



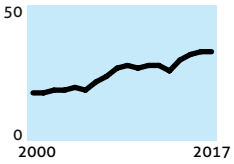
Greater than 10% of total household expenditure or income on health
(% of population)



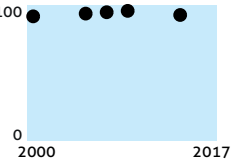
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Congo

POPULATION 2018 **5.2 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	20 (12–28)	375 (238–543)
HIV-positive TB incidence	5.7 (2.9–9.4)	108 (55–179)
MDR/RR-TB incidence[b]	0.56 (0.23–1)	11 (4.5–20)
HIV-negative TB mortality	3 (1.7–4.6)	57 (32–89)
HIV-positive TB mortality	2.3 (1.2–3.8)	43 (22–72)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.4% (1.1–4.2)
Previously treated cases	12% (8.7–16)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	10 706
– % tested with rapid diagnostics at time of diagnosis	9%
– % with known HIV status	19%
– % pulmonary	77%
– % bacteriologically confirmed[c]	49%
– % children aged 0–14 years	8%
– % women	40%
– % men	52%
Total cases notified	10 981

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	54% (38–86)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	28% (14–44)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	553	28%
– on antiretroviral therapy	273	49%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	15%
– Previously treated cases	100%
Laboratory-confirmed cases[d]	MDR/RR-TB: 61, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 47, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	0

TREATMENT SUCCESS RATE AND COHORT SIZE

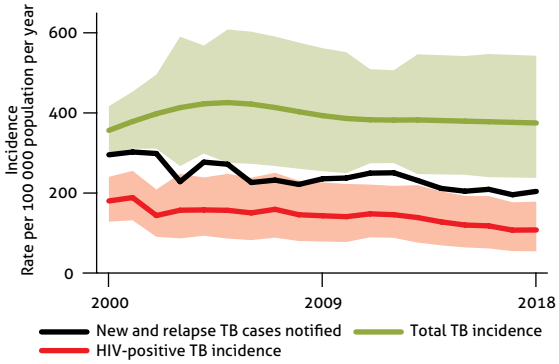
	SUCCESS	COHORT
New and relapse cases registered in 2017	66%	10 005
Previously treated cases, excluding relapse, registered in 2017	41%	258
HIV-positive TB cases registered in 2017	25%	374
MDR/RR-TB cases started on second-line treatment in 2016		0
XDR-TB cases started on second-line treatment in 2016		0

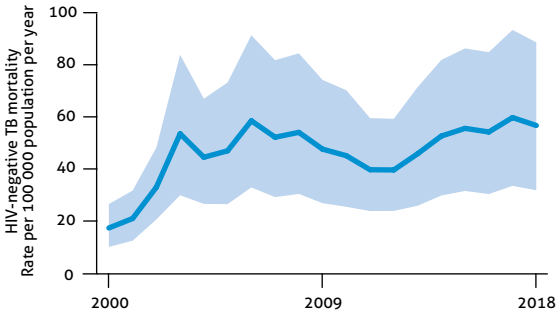
TB PREVENTIVE TREATMENT, 2018

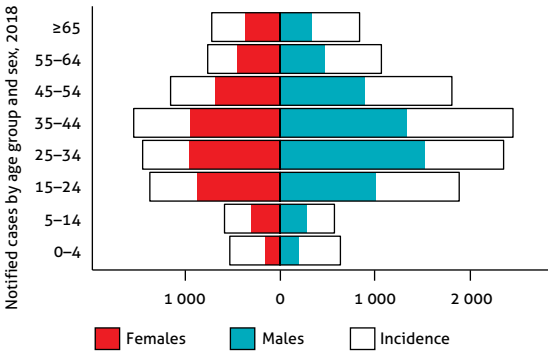
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

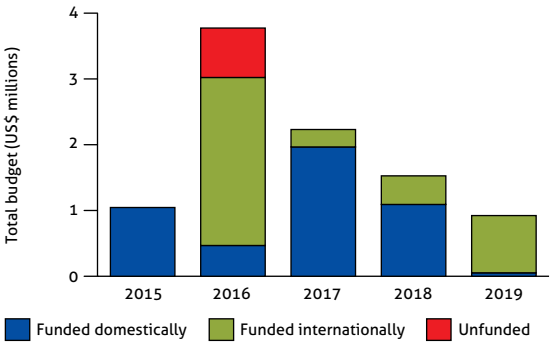
TB FINANCING, 2019

National TB budget (US$ millions)	<1
Funding source:	6% domestic, 94% international, 0% unfunded









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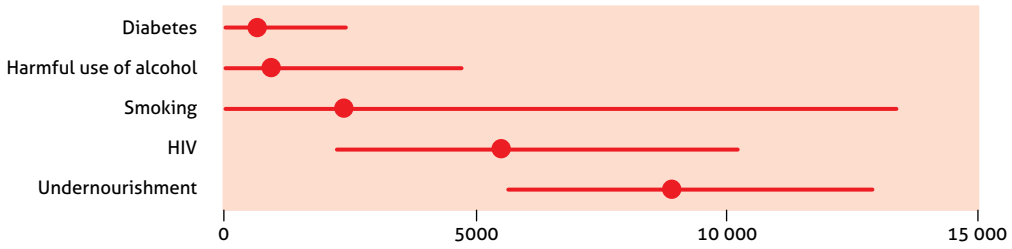
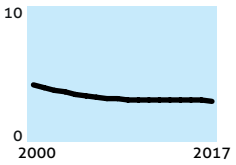
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

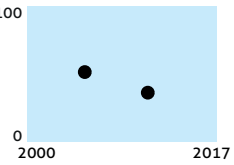


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

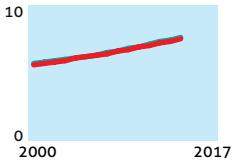
HIV prevalence
(% of population aged 15–49 years)



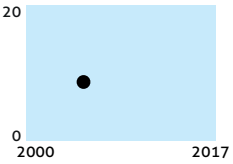
Population living below the international poverty line
(% of population)



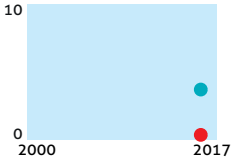
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



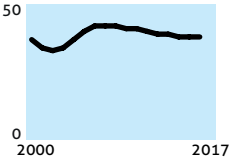
Population covered by social protection floors/systems
(% of population)



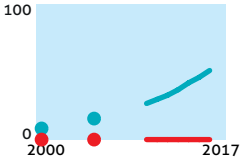
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



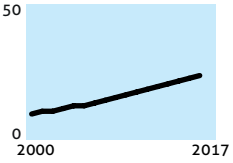
Prevalence of undernourishment
(% of population)



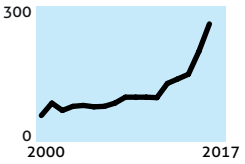
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



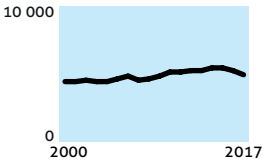
Access to clean fuels and technologies for cooking
(% of population)



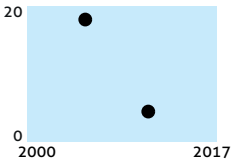
Health expenditure per capita, PPP[b]
(current international $)



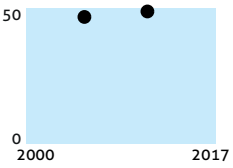
GDP per capita, PPP[b]
(constant 2011 international $)



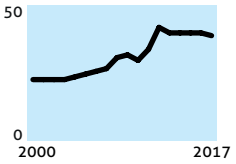
Greater than 10% of total household expenditure or income on health
(% of population)



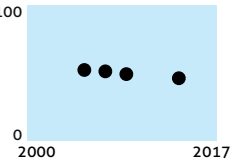
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Lesotho

POPULATION 2018 **2.1 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	13 (8.3–18)	611 (395–872)
HIV-positive TB incidence	8.4 (5.4–12)	398 (257–568)
MDR/RR-TB incidence[b]	0.8 (0.47–1.2)	38 (22–58)
HIV-negative TB mortality	0.95 (0.56–1.4)	45 (27–68)
HIV-positive TB mortality	3.3 (2.1–4.7)	155 (98–223)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4.8% (3.7–6)
Previously treated cases	14% (9.5–18)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	7 027
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	97%
– % pulmonary	90%
– % bacteriologically confirmed[c]	67%
– % children aged 0–14 years	4%
– % women	34%
– % men	62%
Total cases notified	7 128

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	55% (38–84)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	34% (18–52)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	4 435	65%
– on antiretroviral therapy	4 077	92%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	70%
– Previously treated cases	65%
Laboratory-confirmed cases[d]	MDR/RR-TB: 243, XDR-TB: 5
Patients started on treatment[d,e]	MDR/RR-TB: 186, XDR-TB: 5
MDR/RR-TB cases tested for resistance to second-line drugs	191

TREATMENT SUCCESS RATE AND COHORT SIZE

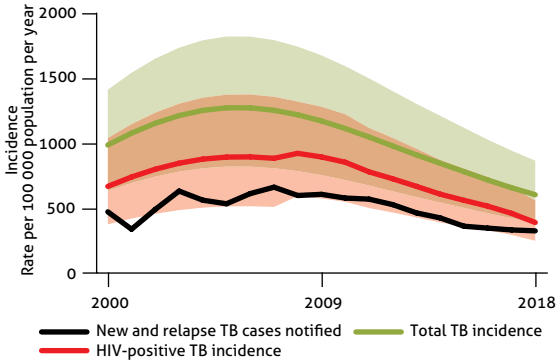
	SUCCESS	COHORT
New and relapse cases registered in 2017	76%	7 305
Previously treated cases, excluding relapse, registered in 2017	73%	121
HIV-positive TB cases registered in 2017	75%	4 949
MDR/RR-TB cases started on second-line treatment in 2016	77%	222
XDR-TB cases started on second-line treatment in 2016		0

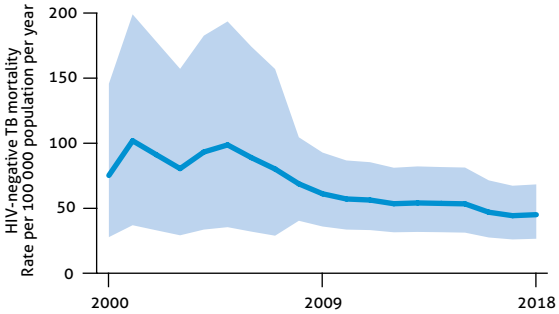
TB PREVENTIVE TREATMENT, 2018

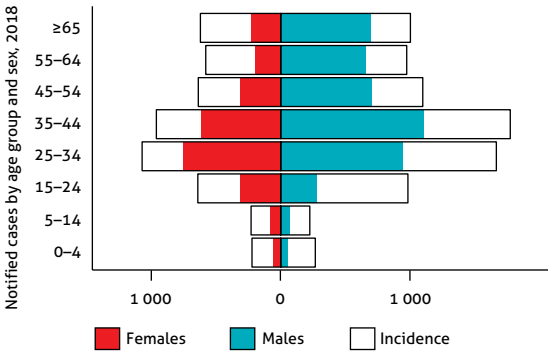
% of HIV-positive people (newly enrolled in care) on preventive treatment	33%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	51% (47–56)

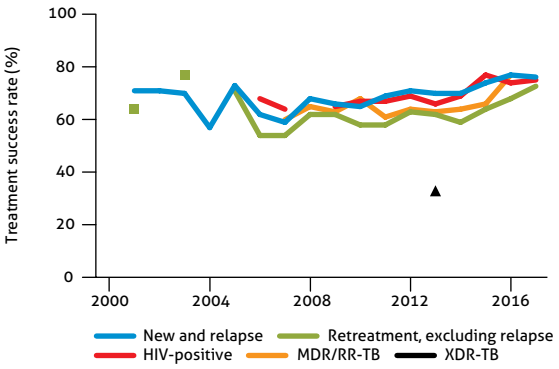
TB FINANCING, 2019

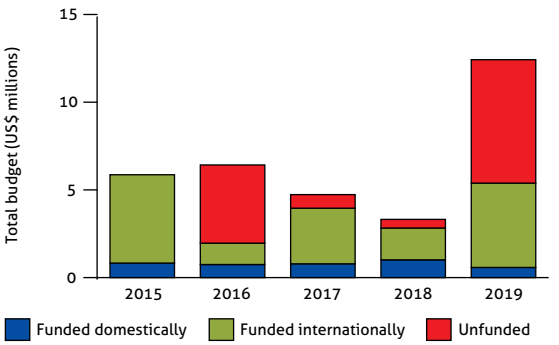
National TB budget (US$ millions)	12
Funding source:	5% domestic, 39% international, 57% unfunded









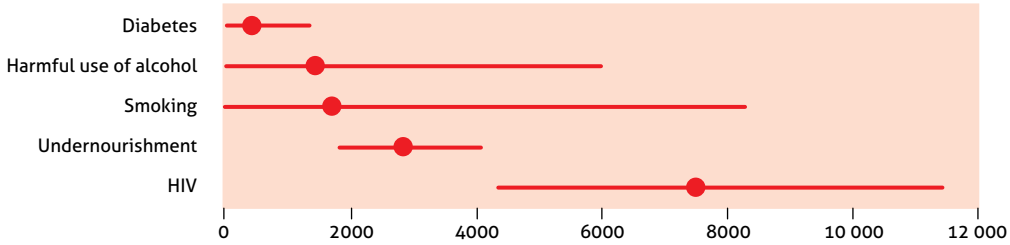


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding. Estimates of TB incidence and mortality for Lesotho will be reviewed after final results from the national TB prevalence survey are available in 2020.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

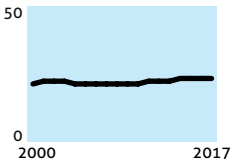
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

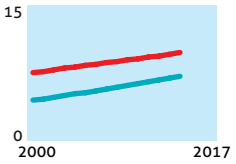


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

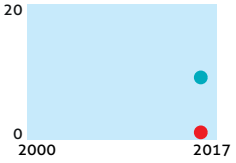
HIV prevalence
(% of population aged 15–49 years)



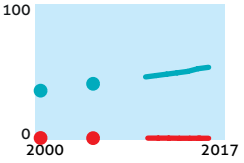
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



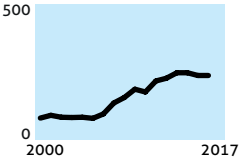
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



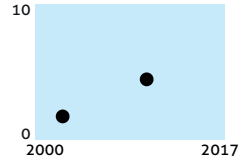
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



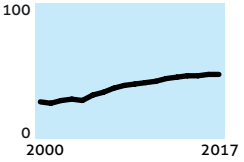
Health expenditure per capita, PPP[b]
(current international $)



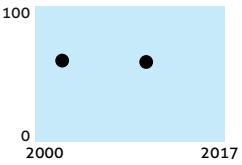
Greater than 10% of total household expenditure or income on health
(% of population)



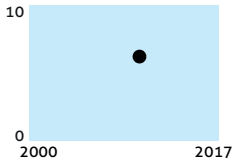
UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



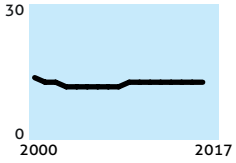
Population living below the international poverty line
(% of population)



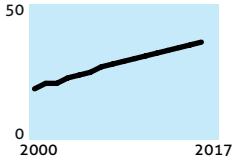
Population covered by social protection floors/systems
(% of population)



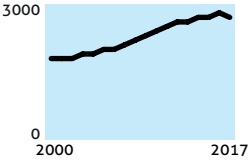
Prevalence of undernourishment
(% of population)



Access to clean fuels and technologies for cooking
(% of population)



GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
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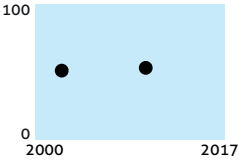
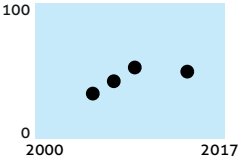


Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Liberia

POPULATION 2018 **4.8 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	15 (9.6–21)	308 (199–440)
HIV-positive TB incidence	2.6 (1.7–3.7)	53 (34–76)
MDR/RR-TB incidence[b]	0.39 (0.15–0.72)	8 (3.2–15)
HIV-negative TB mortality	2.7 (1.6–4.1)	56 (33–85)
HIV-positive TB mortality	1 (0.67–1.5)	22 (14–31)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.4% (1.1–4.2)
Previously treated cases	15% (11–19)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	7 808
– % tested with rapid diagnostics at time of diagnosis	9%
– % with known HIV status	77%
– % pulmonary	66%
– % bacteriologically confirmed[c]	60%
– % children aged 0-14 years	15%
– % women	37%
– % men	48%
Total cases notified	7 824

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	53% (37–81)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	26% (14–41)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	1 035	17%
– on antiretroviral therapy	686	66%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	23%
– Previously treated cases	52%
Laboratory-confirmed cases[d]	MDR/RR-TB: 73, XDR-TB:
Patients started on treatment[d,e]	MDR/RR-TB: 53, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	

TREATMENT SUCCESS RATE AND COHORT SIZE

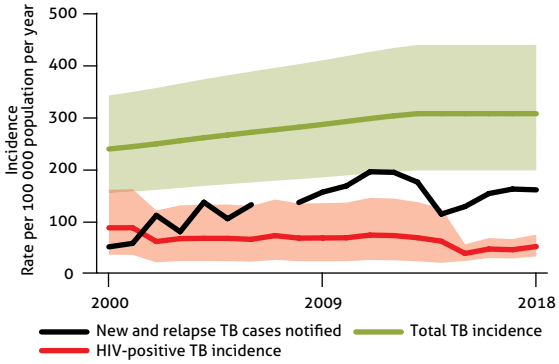
	SUCCESS	COHORT
New and relapse cases registered in 2017	77%	6 907
Previously treated cases, excluding relapse, registered in 2017	69%	16
HIV-positive TB cases registered in 2017	63%	833
MDR/RR-TB cases started on second-line treatment in 2016	73%	74
XDR-TB cases started on second-line treatment in 2016		

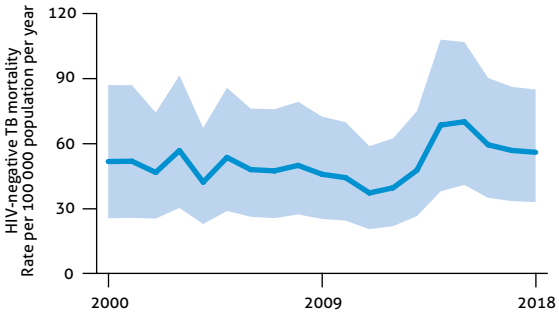
TB PREVENTIVE TREATMENT, 2018

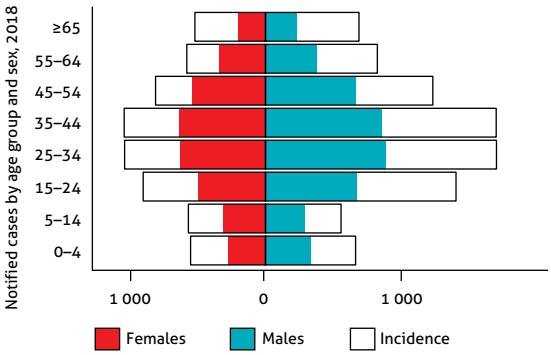
% of HIV-positive people (newly enrolled in care) on preventive treatment	21%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	2% (1.9–2.3)

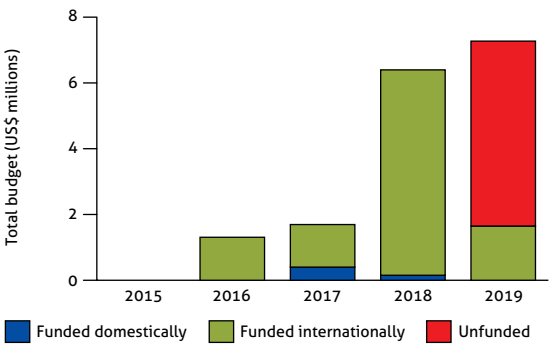
TB FINANCING, 2019

National TB budget (US$ millions)	7.3
Funding source:	0% domestic, 23% international, 77% unfunded







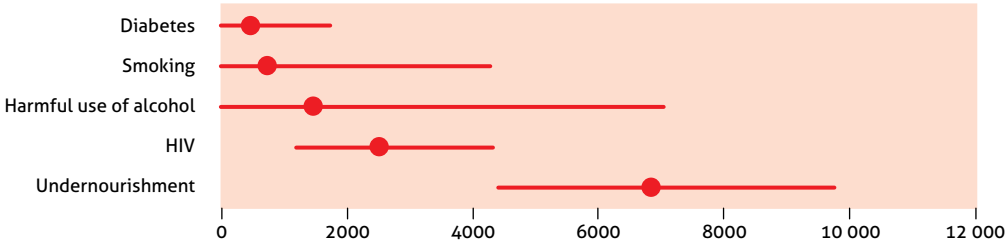


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

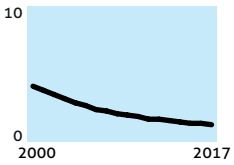
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

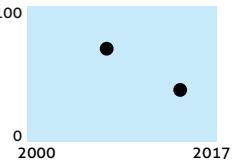


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

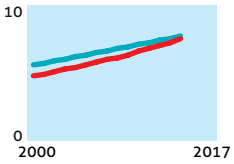
HIV prevalence
(% of population aged 15–49 years)



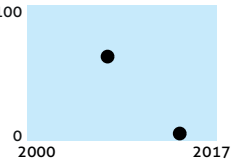
Population living below the international poverty line
(% of population)



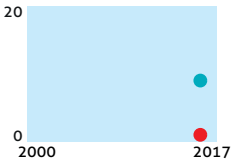
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



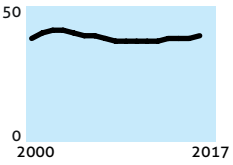
Population covered by social protection floors/systems
(% of population)



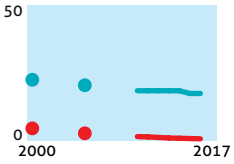
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



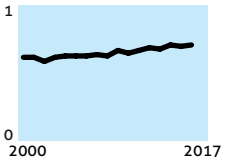
Prevalence of undernourishment
(% of population)



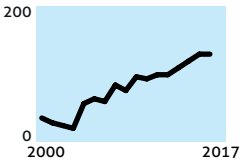
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



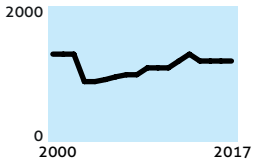
Access to clean fuels and technologies for cooking
(% of population)



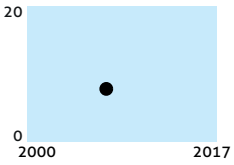
Health expenditure per capita, PPP[b]
(current international $)



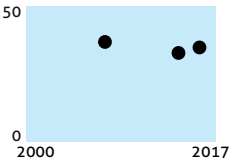
GDP per capita, PPP[b]
(constant 2011 international $)



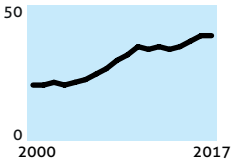
Greater than 10% of total household expenditure or income on health
(% of population)



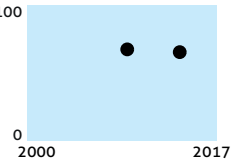
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Namibia

POPULATION 2018 **2.4 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	13 (9.2–17)	524 (375–697)
HIV-positive TB incidence	4.5 (3.2–5.9)	182 (130–242)
MDR/RR-TB incidence[b]	0.9 (0.62–1.2)	37 (25–50)
HIV-negative TB mortality	1.6 (1–2.3)	64 (41–92)
HIV-positive TB mortality	1.5 (1.1–2.1)	62 (43–85)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	5.8% (5–6.5)
Previously treated cases	12% (9.4–14)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	7 808
– % tested with rapid diagnostics at time of diagnosis	60%
– % with known HIV status	99%
– % pulmonary	81%
– % bacteriologically confirmed[c]	84%
– % children aged 0–14 years	9%
– % women	34%
– % men	57%
Total cases notified	8 100

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	61% (46–85)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	25% (16–35)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	2 768	35%
– on antiretroviral therapy	2 675	97%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	88%
– Previously treated cases	73%
Laboratory-confirmed cases[d]	MDR/RR-TB: 323, XDR-TB: 19
Patients started on treatment[d,e]	MDR/RR-TB: 311, XDR-TB: 19
MDR/RR-TB cases tested for resistance to second-line drugs	200

TREATMENT SUCCESS RATE AND COHORT SIZE

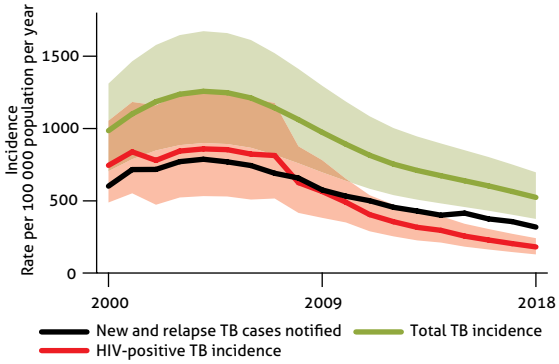
	SUCCESS	COHORT
New and relapse cases registered in 2017	86%	8 559
Previously treated cases, excluding relapse, registered in 2017	64%	292
HIV-positive TB cases registered in 2017	82%	2 983
MDR/RR-TB cases started on second-line treatment in 2016	71%	348
XDR-TB cases started on second-line treatment in 2016	50%	10

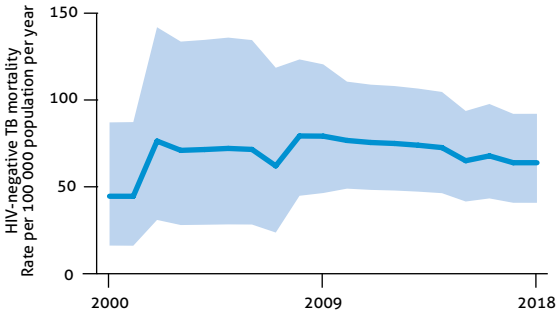
TB PREVENTIVE TREATMENT, 2018

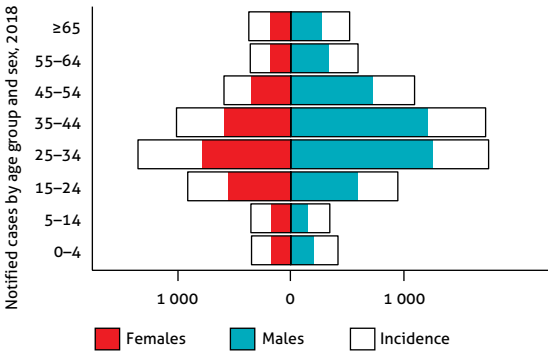
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	44% (40–48)

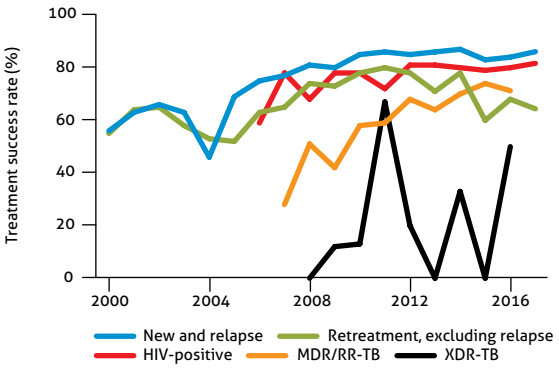
TB FINANCING, 2019

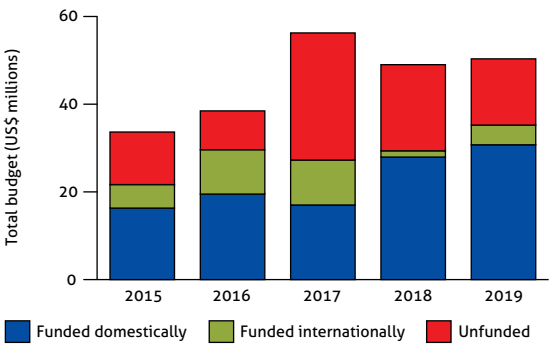
National TB budget (US$ millions)	50
Funding source:	61% domestic, 9% international, 30% unfunded









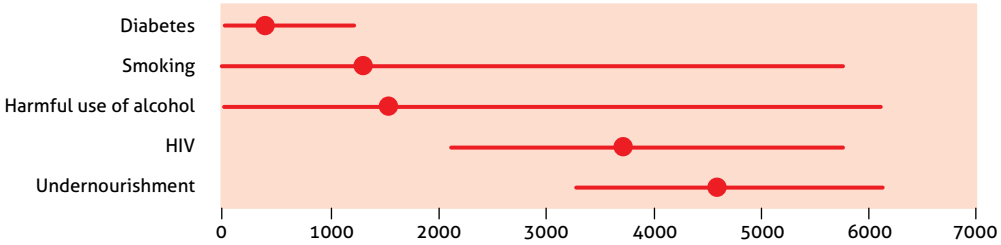


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

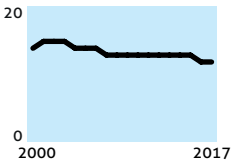
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

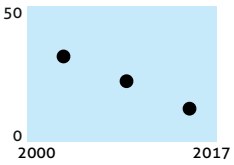


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

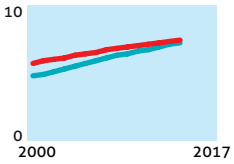
HIV prevalence
(% of population aged 15–49 years)



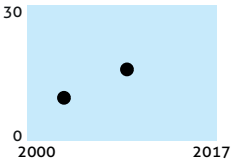
Population living below the international poverty line
(% of population)



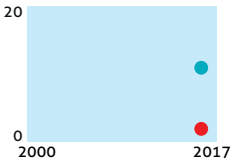
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



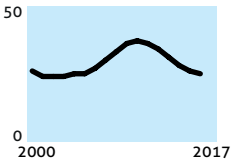
Population covered by social protection floors/systems
(% of population)



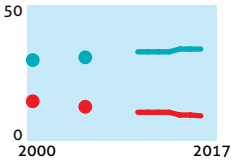
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



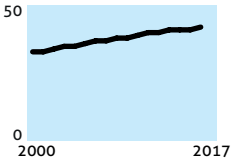
Prevalence of undernourishment
(% of population)



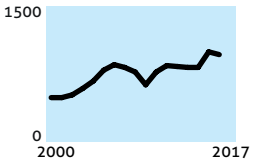
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



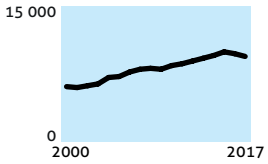
Access to clean fuels and technologies for cooking
(% of population)



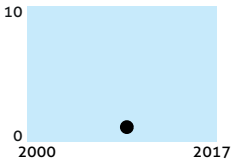
Health expenditure per capita, PPP[b]
(current international $)



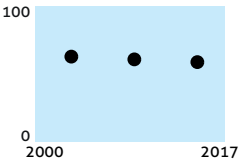
GDP per capita, PPP[b]
(constant 2011 international $)



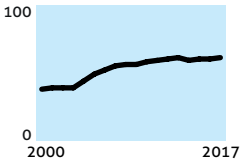
Greater than 10% of total household expenditure or income on health
(% of population)



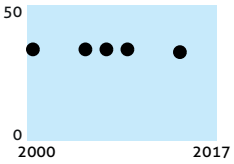
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Papua New Guinea

POPULATION 2018 **8.6 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	37 (30–45)	432 (352–521)
HIV-positive TB incidence	2.7 (2.2–3.3)	32 (26–38)
MDR/RR-TB incidence[b]	2 (1.2–2.9)	23 (14–33)
HIV-negative TB mortality	4.5 (3–6.2)	52 (35–72)
HIV-positive TB mortality	0.25 (0.1–0.45)	2.8 (1.2–5.2)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.4% (1.7–5)
Previously treated cases	26% (15–36)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	27 887
– % tested with rapid diagnostics at time of diagnosis	
– % with known HIV status	52%
– % pulmonary	56%
– % bacteriologically confirmed[c]	30%
– % children aged 0–14 years	24%
– % women	36%
– % men	40%
Total cases notified	29 364

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	75% (62–92)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	13% (8–18)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	1 124	7%
– on antiretroviral therapy	909	81%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	
– Previously treated cases	
Laboratory-confirmed cases[d]	MDR/RR-TB: 433, XDR-TB: 8
Patients started on treatment[d,e]	MDR/RR-TB: 401, XDR-TB: 8
MDR/RR-TB cases tested for resistance to second-line drugs	252

TREATMENT SUCCESS RATE AND COHORT SIZE

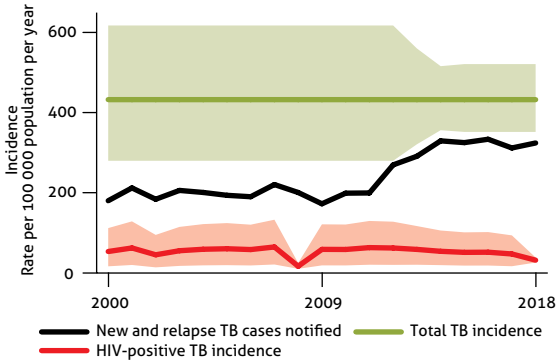
	SUCCESS	COHORT
New cases registered in 2017	68%	26 954
Previously treated cases registered in 2017	56%	983
HIV-positive TB cases registered in 2017	66%	835
MDR/RR-TB cases started on second-line treatment in 2016	75%	236
XDR-TB cases started on second-line treatment in 2016	63%	8

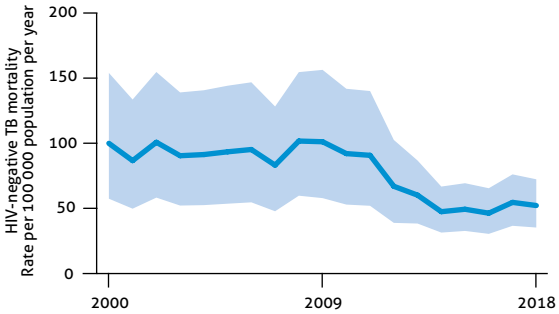
TB PREVENTIVE TREATMENT, 2018

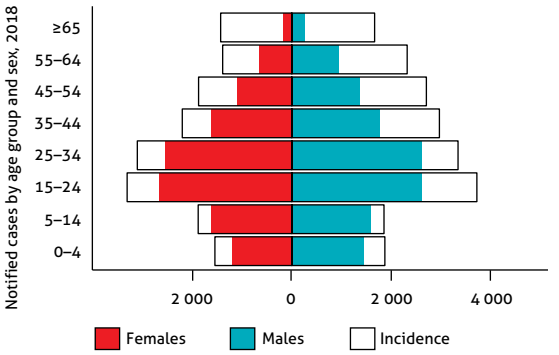
% of HIV-positive people (newly enrolled in care) on preventive treatment	21%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	27% (25–30)

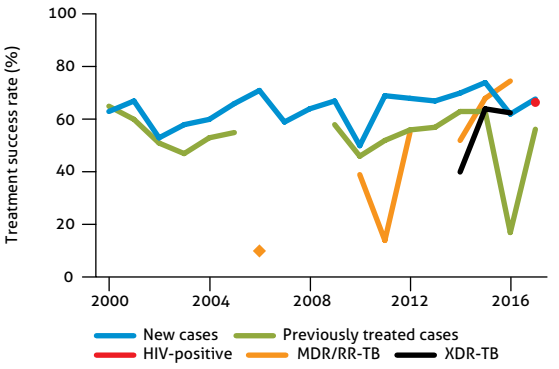
TB FINANCING, 2019

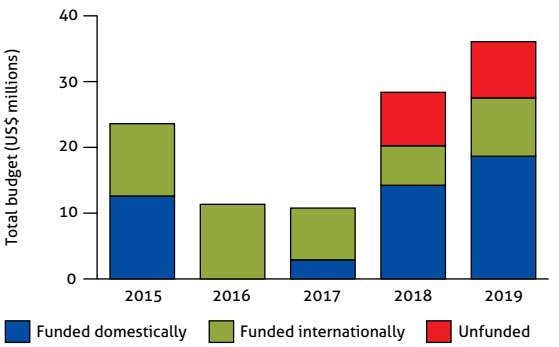
National TB budget (US$ millions)	36
Funding source:	52% domestic, 25% international, 24% unfunded









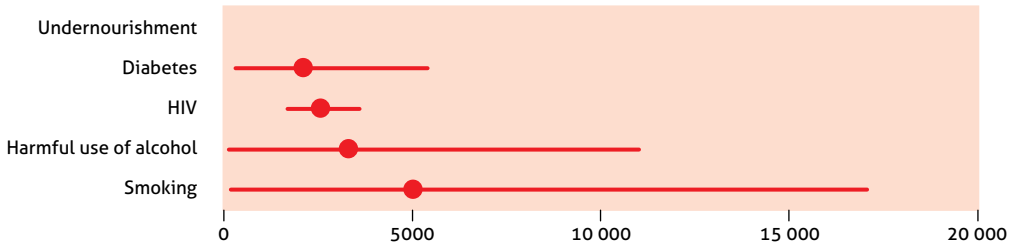


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

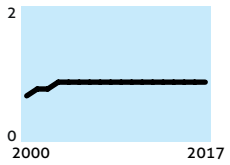
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

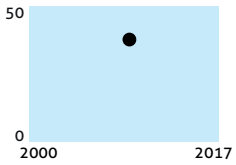


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

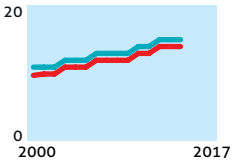
HIV prevalence
(% of population aged 15–49 years)



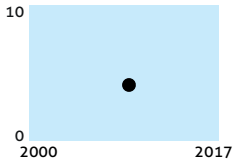
Population living below the international poverty line
(% of population)



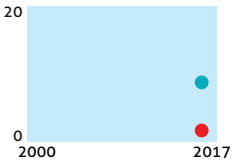
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



Population covered by social protection floors/systems
(% of population)

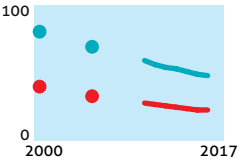


Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males

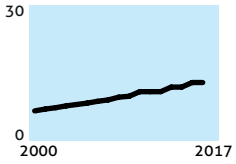


Prevalence of undernourishment
(% of population)

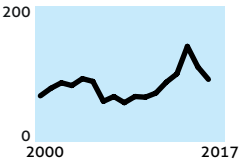
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



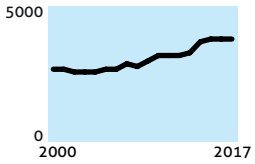
Access to clean fuels and technologies for cooking
(% of population)



Health expenditure per capita, PPP[b]
(current international $)

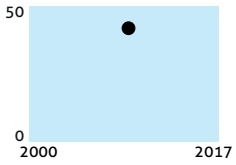


GDP per capita, PPP[b]
(constant 2011 international $)

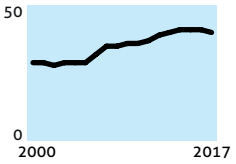


Greater than 10% of total household expenditure or income on health
(% of population)

GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)

[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Sierra Leone

POPULATION 2018 **7.7 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	23 (15–33)	298 (191–427)
HIV-positive TB incidence	2.9 (1.9–4.2)	38 (25–55)
MDR/RR-TB incidence[b]	0.64 (0.26–1.2)	8.3 (3.4–15)
HIV-negative TB mortality	2.6 (1.5–3.9)	33 (20–51)
HIV-positive TB mortality	0.7 (0.44–1)	9.2 (5.8–13)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.4% (1.1–4.2)
Previously treated cases	15% (11–19)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	17 144
– % tested with rapid diagnostics at time of diagnosis	5%
– % with known HIV status	98%
– % pulmonary	92%
– % bacteriologically confirmed[c]	65%
– % children aged 0–14 years	14%
– % women	33%
– % men	53%
Total cases notified	17 169

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	75% (53–120)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	15% (8–23)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	2 168	13%
– on antiretroviral therapy	2 167	100%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	
– Previously treated cases	
Laboratory-confirmed cases[d]	MDR/RR-TB: 166, XDR-TB: 0
Patients started on treatment[d,e]	MDR/RR-TB: 120, XDR-TB: 0
MDR/RR-TB cases tested for resistance to second-line drugs	120

TREATMENT SUCCESS RATE AND COHORT SIZE

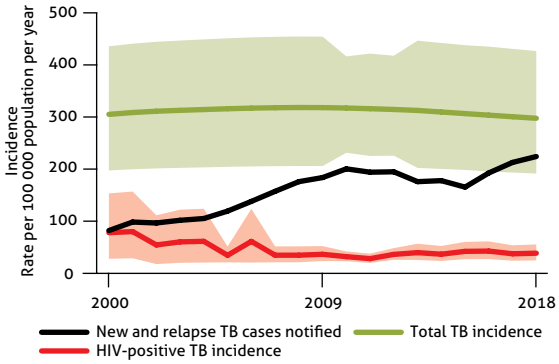
	SUCCESS	COHORT
New and relapse cases registered in 2017	90%	15 935
Previously treated cases, excluding relapse, registered in 2017	63%	207
HIV-positive TB cases registered in 2017	82%	1 936
MDR/RR-TB cases started on second-line treatment in 2016		
XDR-TB cases started on second-line treatment in 2016		

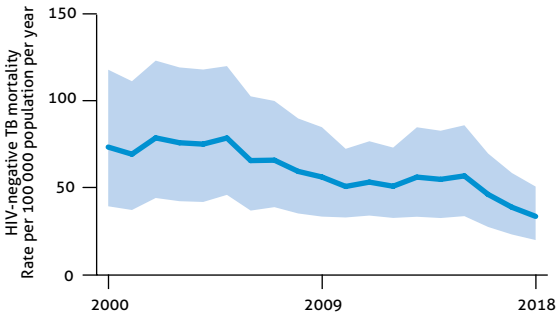
TB PREVENTIVE TREATMENT, 2018

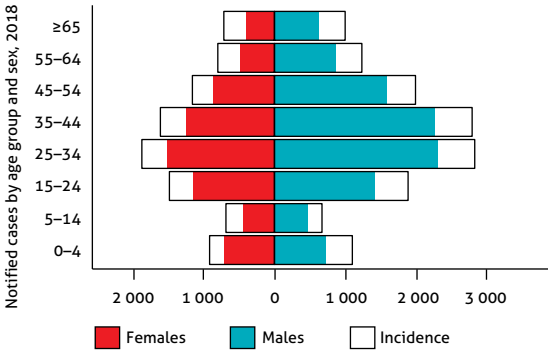
% of HIV-positive people (newly enrolled in care) on preventive treatment	57%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

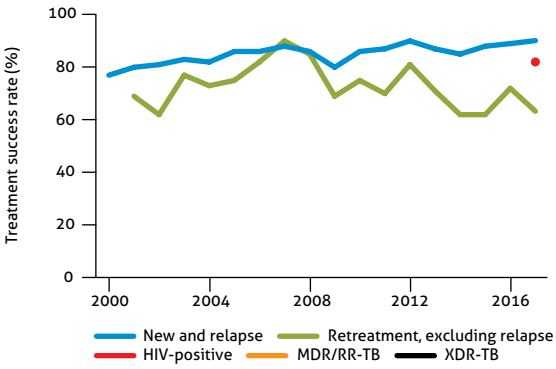
TB FINANCING, 2019

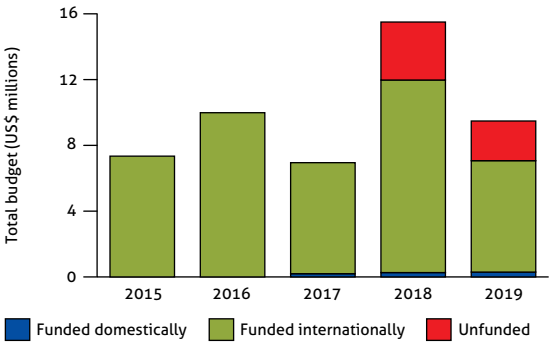
National TB budget (US$ millions)	9.5
Funding source:	3% domestic, 71% international, 25% unfunded









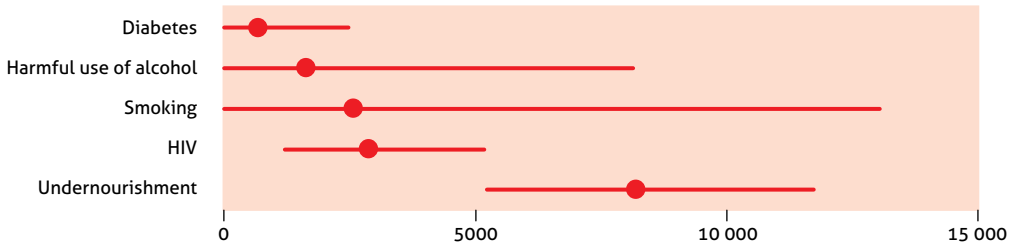


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

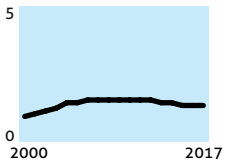
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

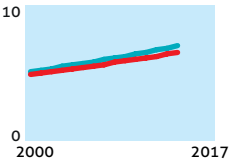


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

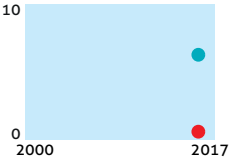
HIV prevalence
(% of population aged 15–49 years)



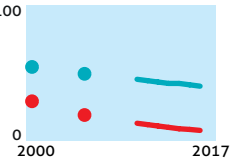
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



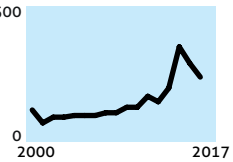
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



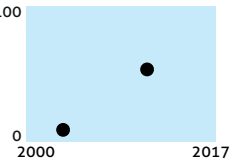
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



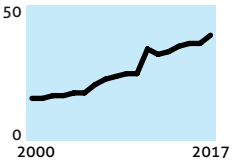
Health expenditure per capita, PPP[b]
(current international $)



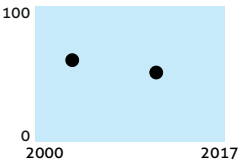
Greater than 10% of total household expenditure or income on health
(% of population)



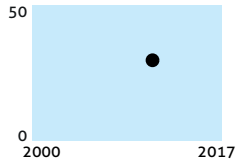
UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



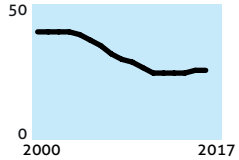
Population living below the international poverty line
(% of population)



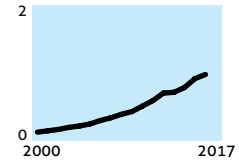
Population covered by social protection floors/systems
(% of population)



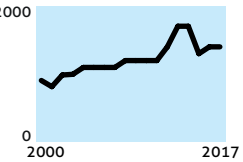
Prevalence of undernourishment
(% of population)



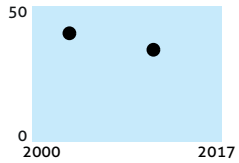
Access to clean fuels and technologies for cooking
(% of population)



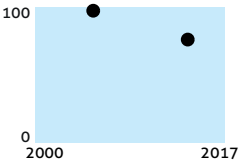
GDP per capita, PPP[b]
(constant 2011 international $)



GINI index
(0 = perfect equality, 100 = perfect inequality)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Data for all countries and years can be downloaded from www.who.int/tb/data

Zambia

POPULATION 2018 **17 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	60 (39–86)	346 (225–493)
HIV-positive TB incidence	36 (23–51)	205 (133–293)
MDR/RR-TB incidence[b]	3.1 (1.6–5)	18 (9.4–29)
HIV-negative TB mortality	4.8 (2.9–7.3)	28 (16–42)
HIV-positive TB mortality	13 (8.3–19)	74 (48–107)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.8% (2.5–3.1)
Previously treated cases	18% (12–26)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	35 071
– % tested with rapid diagnostics at time of diagnosis	46%
– % with known HIV status	95%
– % pulmonary	87%
– % bacteriologically confirmed[c]	56%
– % children aged 0–14 years	6%
– % women	32%
– % men	62%
Total cases notified	35 922

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	58% (41–90)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	31% (17–46)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	20 202	59%
– on antiretroviral therapy	18 421	91%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	98%
– Previously treated cases	54%
Laboratory-confirmed cases[d]	MDR/RR-TB: 627, XDR-TB: 1
Patients started on treatment[d,e]	MDR/RR-TB: 506, XDR-TB: 1
MDR/RR-TB cases tested for resistance to second-line drugs	150

TREATMENT SUCCESS RATE AND COHORT SIZE

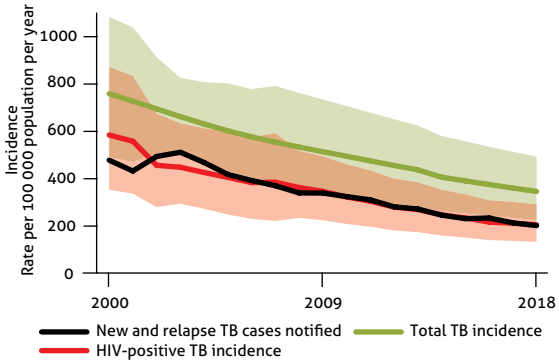
	SUCCESS	COHORT
New and relapse cases registered in 2017	90%	36 010
Previously treated cases, excluding relapse, registered in 2017	83%	1 193
HIV-positive TB cases registered in 2017	86%	20 362
MDR/RR-TB cases started on second-line treatment in 2016	71%	136
XDR-TB cases started on second-line treatment in 2016		0

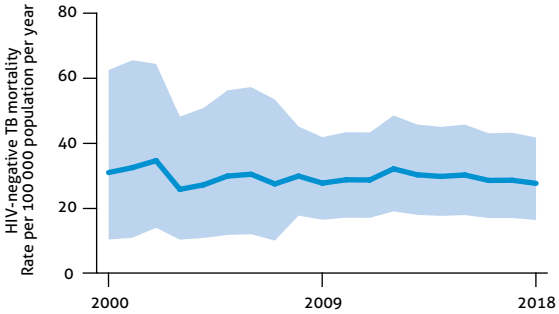
TB PREVENTIVE TREATMENT, 2018

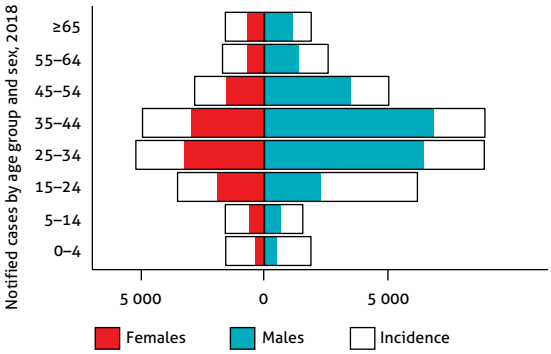
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	

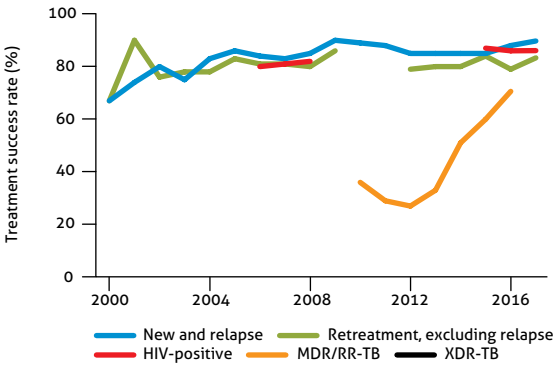
TB FINANCING, 2019

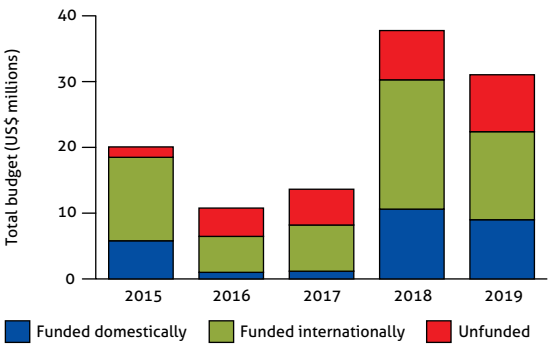
National TB budget (US$ millions)	31
Funding source:	29% domestic, 43% international, 28% unfunded











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[a] Ranges represent uncertainty intervals.
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[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

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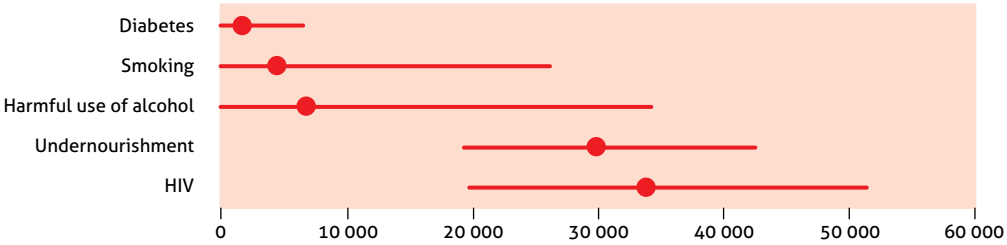
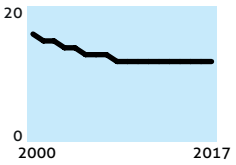
NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

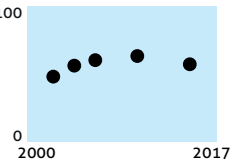


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

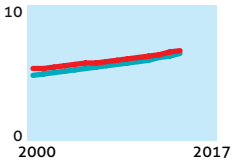
HIV prevalence
(% of population aged 15–49 years)



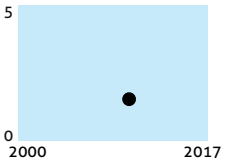
Population living below the international poverty line
(% of population)



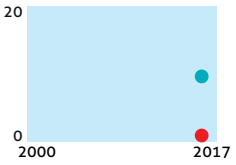
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



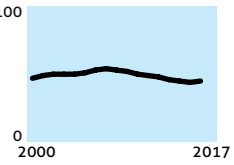
Population covered by social protection floors/systems
(% of population)



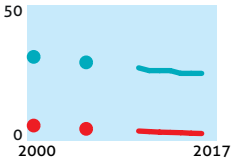
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



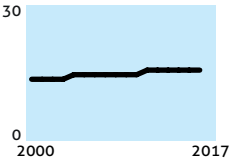
Prevalence of undernourishment
(% of population)



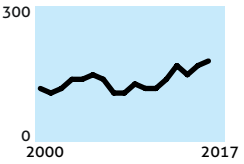
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



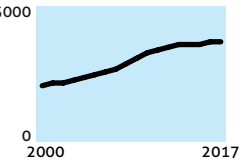
Access to clean fuels and technologies for cooking
(% of population)



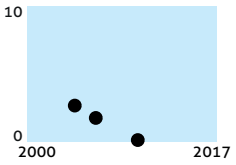
Health expenditure per capita, PPP[b]
(current international $)



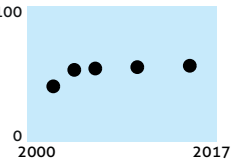
GDP per capita, PPP[b]
(constant 2011 international $)



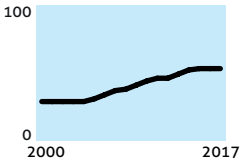
Greater than 10% of total household expenditure or income on health
(% of population)



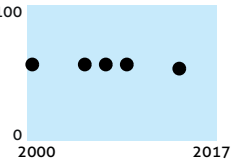
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

Zimbabwe

POPULATION 2018 **14 MILLION**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	30 (22–39)	210 (155–272)
HIV-positive TB incidence	19 (14–24)	130 (96–169)
MDR/RR-TB incidence[b]	1.5 (1.1–2)	10 (7.4–14)
HIV-negative TB mortality	1.1 (0.69–1.7)	7.7 (4.8–11)
HIV-positive TB mortality	3.5 (2.4–4.8)	24 (16–33)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.9% (3.5–4.3)
Previously treated cases	14% (8.9–20)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	25 204
– % tested with rapid diagnostics at time of diagnosis	87%
– % with known HIV status	94%
– % pulmonary	89%
– % bacteriologically confirmed[c]	54%
– % children aged 0–14 years	6%
– % women	36%
– % men	58%
Total cases notified	25 775

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	83% (64–110)
TB patients facing catastrophic total costs, 2018	80% (74–85)
TB case fatality ratio (estimated mortality/estimated incidence), 2018	15% (10–22)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)
Patients with known HIV-status who are HIV-positive	15 062	62%
– on antiretroviral therapy	13 636	91%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	91%
– Previously treated cases	97%
Laboratory-confirmed cases[d]	MDR/RR-TB: 406, XDR-TB: 7
Patients started on treatment[d,e]	MDR/RR-TB: 381, XDR-TB: 3
MDR/RR-TB cases tested for resistance to second-line drugs	

TREATMENT SUCCESS RATE AND COHORT SIZE

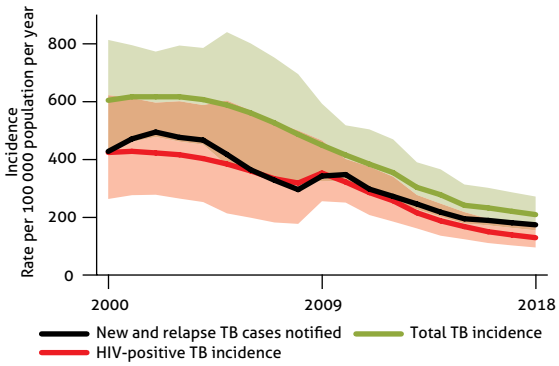
	SUCCESS	COHORT
New and relapse cases registered in 2017	83%	25 848
Previously treated cases, excluding relapse, registered in 2017	83%	553
HIV-positive TB cases registered in 2017	82%	16 602
MDR/RR-TB cases started on second-line treatment in 2016	57%	488
XDR-TB cases started on second-line treatment in 2016	0%	5

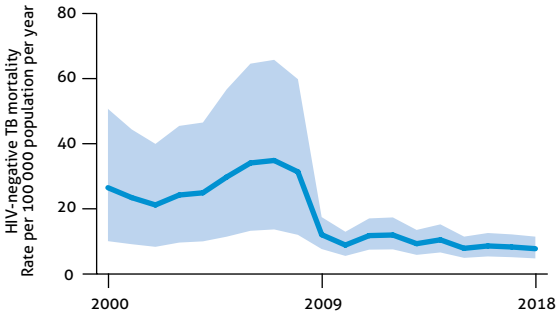
TB PREVENTIVE TREATMENT, 2018

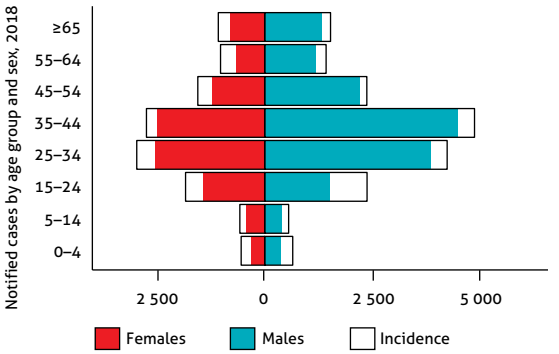
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	30% (27–33)

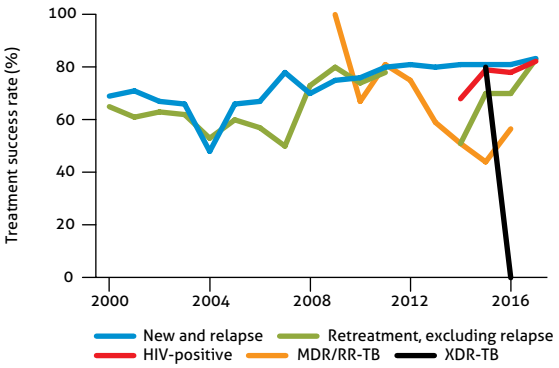
TB FINANCING, 2019

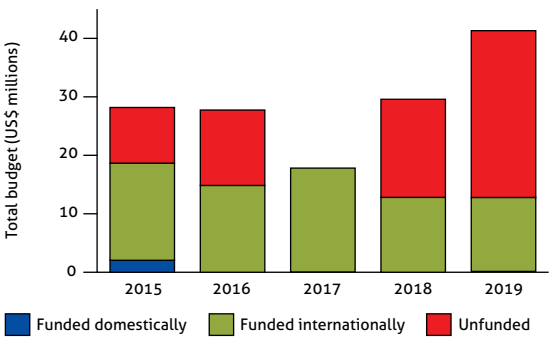
National TB budget (US$ millions)	41
Funding source:	<1% domestic, 31% international, 69% unfunded









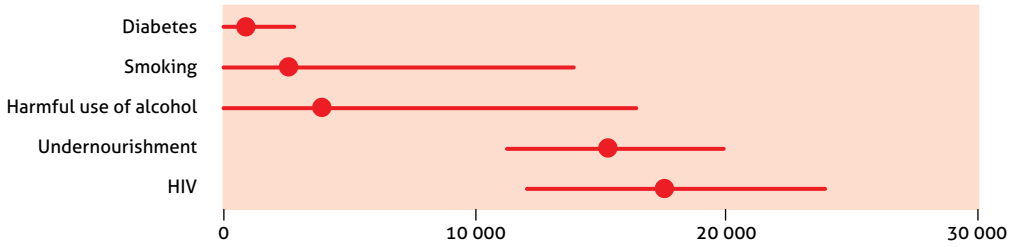


Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Includes cases with unknown previous TB treatment history.
[e] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.

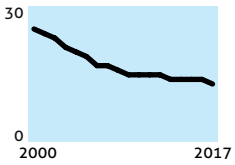
Data for all countries and years can be downloaded from www.who.int/tb/data

NUMBER OF TB CASES ATTRIBUTABLE TO FIVE RISK FACTORS, 2018

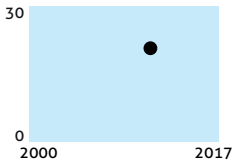


INDICATORS IN THE SUSTAINABLE DEVELOPMENT GOALS ASSOCIATED WITH TB INCIDENCE[a]

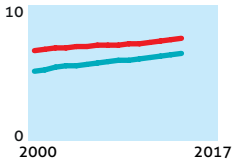
HIV prevalence
(% of population aged 15–49 years)



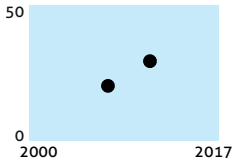
Population living below the international poverty line
(% of population)



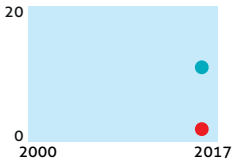
Diabetes prevalence
(% of population aged ≥18 years)
● females ● males



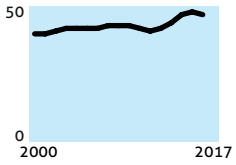
Population covered by social protection floors/systems
(% of population)



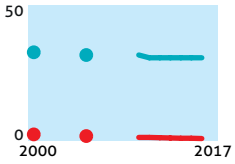
Alcohol use disorders, 12 month prevalence
(% of population aged ≥15 years)
● females ● males



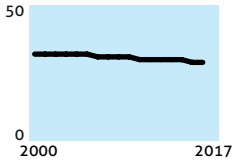
Prevalence of undernourishment
(% of population)



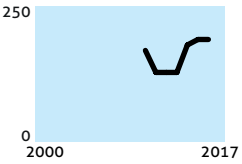
Smoking prevalence
(% of population aged ≥15 years)
● females ● males



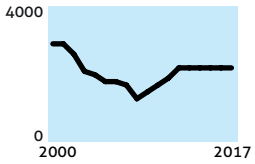
Access to clean fuels and technologies for cooking
(% of population)



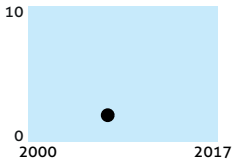
Health expenditure per capita, PPP[b]
(current international $)



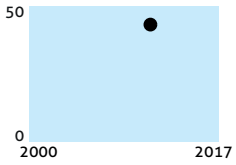
GDP per capita, PPP[b]
(constant 2011 international $)



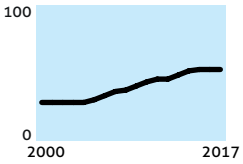
Greater than 10% of total household expenditure or income on health
(% of population)



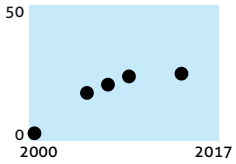
GINI index
(0 = perfect equality, 100 = perfect inequality)



UHC index of essential service coverage[b]
(based on 16 tracer indicators including TB treatment)



Population living in slums
(% of urban population)



[a] Data sources: SDG indicators database, The World Bank, World Health Organization. Missing values and empty boxes indicate data not available in these data sources.
[b] GDP = gross domestic product; PPP = purchasing power parity; UHC = universal health coverage

A doctor sees a patient with presumptive TB on a ward in the Department of Pulmonology, Lady Reading Hospital in Peshawar, Pakistan.

J. Tanner

Annex 3

Regional and global profiles

WHO African Region

POPULATION 2018 **1 064 MILLION**

WHO Member States 47

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (THOUSANDS)	RATE (per 100 000 population)
Total TB incidence	2 450 (2 190–2 730)	231 (206–257)
HIV-positive TB incidence	615 (539–697)	58 (51–66)
MDR/RR-TB incidence[b]	77 (65–91)	7.3 (6.1–8.5)
HIV-negative TB mortality	397 (331–468)	37 (31–44)
HIV-positive TB mortality	211 (184–239)	20 (17–22)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.5% (1.6–3.6)
Previously treated cases	12% (0.55–39)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	1 372 748
– % tested with rapid diagnostics at time of diagnosis	32%
– % with known HIV status	87%
– % pulmonary	85%
– % bacteriologically confirmed[c]	65%
– % children aged 0–14 years[d]	9%
– % women[d]	36%
– % men[d]	55%
Total cases notified	1 402 743

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	56% (50–63)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	25% (21–29)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	339 050	29%
– on antiretroviral therapy	304 474	90%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	51%
– Previously treated cases	72%
Laboratory-confirmed cases[e]	MDR/RR-TB: 24 712, XDR-TB: 727
Patients started on treatment[e,f]	MDR/RR-TB: 19 730, XDR-TB: 682
MDR/RR-TB cases tested for resistance to second-line drugs	12 276

TREATMENT SUCCESS RATE AND COHORT SIZE

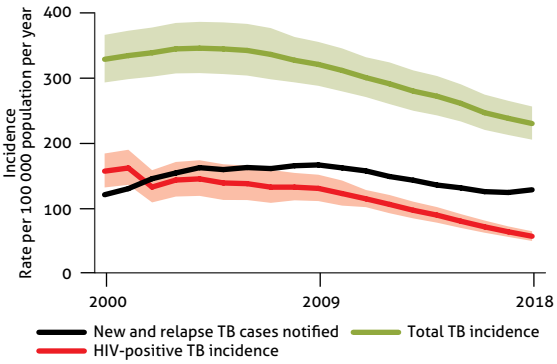
	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	82%	1 278 013
Previously treated cases, excluding relapse, registered in 2017	71%	25 932
HIV-positive TB cases registered in 2017	78%	340 993
MDR/RR-TB cases started on second-line treatment in 2016	60%	18 571
XDR-TB cases started on second-line treatment in 2016	56%	707

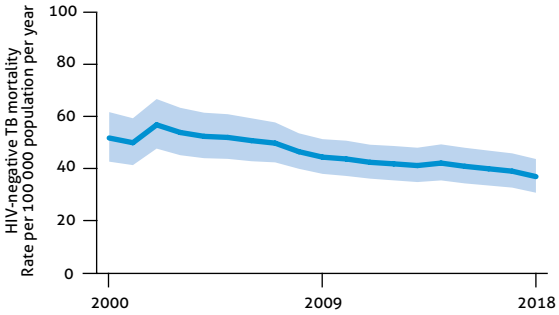
TB PREVENTIVE TREATMENT, 2018

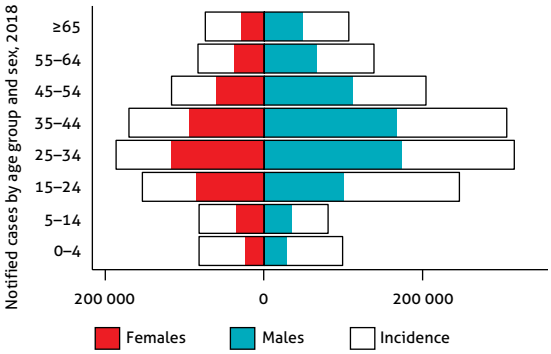
% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	60%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	29% (29–30)

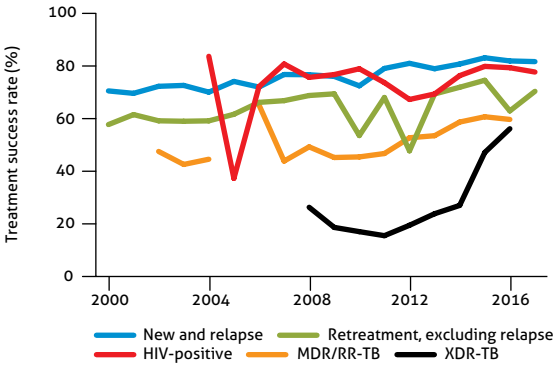
TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

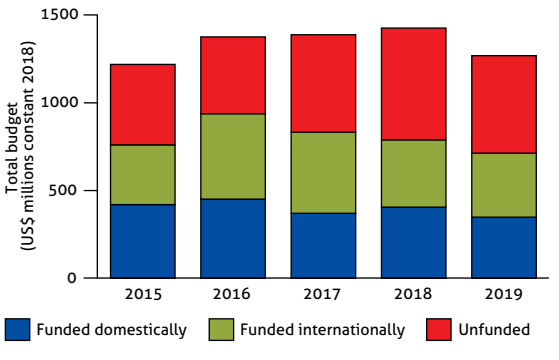
National TB budget (US$ millions)	1 269
Funding source:	27% domestic, 29% international, 44% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
[i] Data are not collected from all Member States. Financing indicators exclude funding for general healthcare services provided outside NTPs.

Data for all countries and years can be downloaded from www.who.int/tb/data

WHO/PAHO Region of the Americas

POPULATION 2018 **1 005 MILLION**

WHO Member States	**35**
Other countries and territories	**11**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	289 (268–310)	29 (27–31)
HIV-positive TB incidence	29 (27–31)	2.9 (2.6–3.1)
MDR/RR-TB incidence[b]	11 (9–12)	1 (0.92–1.2)
HIV-negative TB mortality	17 (16–19)	1.7 (1.6–1.8)
HIV-positive TB mortality	6 (5–7)	0.59 (0.52–0.66)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.5% (1.5–3.8)
Previously treated cases	12% (4–24)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	233 549
– % tested with rapid diagnostics at time of diagnosis	18%
– % with known HIV status	82%
– % pulmonary	85%
– % bacteriologically confirmed[c]	79%
– % children aged 0–14 years[d]	5%
– % women[d]	32%
– % men[d]	63%
Total cases notified	248 135

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	81% (75–87)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	8% (7–9)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	19 899	10%
– on antiretroviral therapy	12 028	63%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	38%
– Previously treated cases	47%
Laboratory-confirmed cases[e]	MDR/RR-TB: 4 759, XDR-TB: 149
Patients started on treatment[e,f]	MDR/RR-TB: 4 548, XDR-TB: 112
MDR/RR-TB cases tested for resistance to second-line drugs	2 117

TREATMENT SUCCESS RATE AND COHORT SIZE

	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	76%	224 460
Previously treated cases, excluding relapse, registered in 2017	48%	13 555
HIV-positive TB cases registered in 2017	56%	19 541
MDR/RR-TB cases started on second-line treatment in 2016	59%	2 966
XDR-TB cases started on second-line treatment in 2016	62%	120

TB PREVENTIVE TREATMENT, 2018

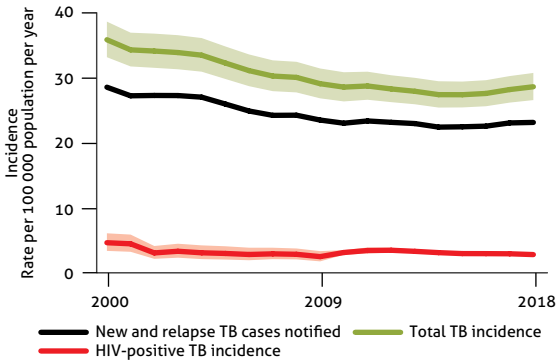
% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	9.3%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	55% (52–58)

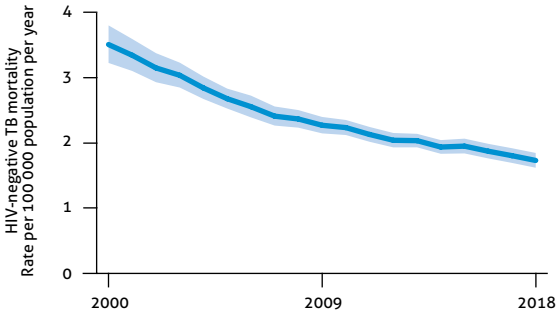
TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

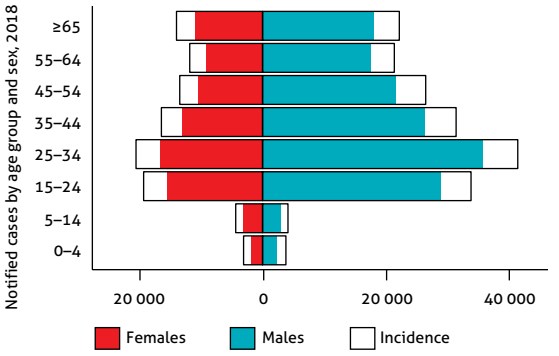
National TB budget (US$ millions)	308
Funding source:	76% domestic, 10% international, 14% unfunded

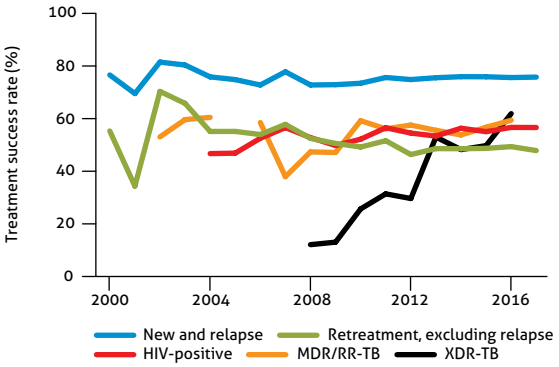
Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

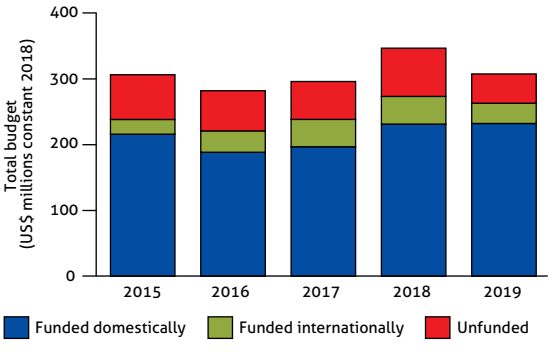
[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
[i] Data are not collected from all Member States. Financing indicators exclude funding for general healthcare services provided outside NTPs.











WHO Eastern Mediterranean Region

POPULATION 2018 **704 MILLION**

WHO Member States	**21**
Other countries and territories	**1**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	810 (639–1 000)	115 (91–142)
HIV-positive TB incidence	7 (5–9)	0.99 (0.75–1.3)
MDR/RR-TB incidence[b]	38 (28–50)	5.5 (4–7.2)
HIV-negative TB mortality	77 (66–89)	11 (9.4–13)
HIV-positive TB mortality	2 (2–3)	0.31 (0.23–0.4)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4% (2.8–5.4)
Previously treated cases	16% (2.2–41)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	526 379
– % tested with rapid diagnostics at time of diagnosis	21%
– % with known HIV status	30%
– % pulmonary	76%
– % bacteriologically confirmed[c]	53%
– % children aged 0–14 years[d]	13%
– % women[d]	41%
– % men[d]	46%
Total cases notified	537 761

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	65% (53–82)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	10% (7–13)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	1 749	1.1%
– on antiretroviral therapy	1 332	78%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	43%
– Previously treated cases	83%
Laboratory-confirmed cases[e]	MDR/RR-TB: 5 584, XDR-TB: 122
Patients started on treatment[e,f]	MDR/RR-TB: 4 566, XDR-TB: 100
MDR/RR-TB cases tested for resistance to second-line drugs	3 627

TREATMENT SUCCESS RATE AND COHORT SIZE

	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	91%	521 722
Previously treated cases, excluding relapse, registered in 2017	75%	12 770
HIV-positive TB cases registered in 2017	74%	881
MDR/RR-TB cases started on second-line treatment in 2016	65%	3 986
XDR-TB cases started on second-line treatment in 2016	37%	90

TB PREVENTIVE TREATMENT, 2018

% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	13%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	23% (21–24)

TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

National TB budget (US$ millions)	254
Funding source:	18% domestic, 30% international, 52% unfunded

Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
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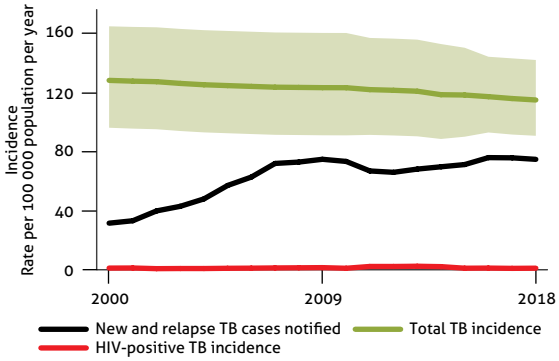
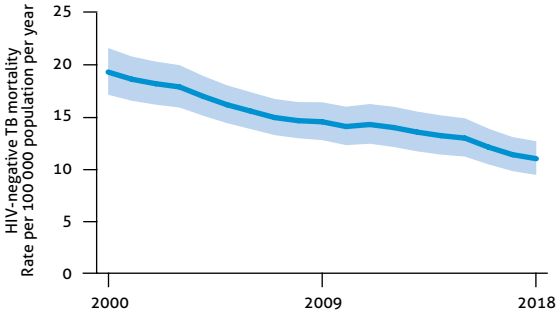
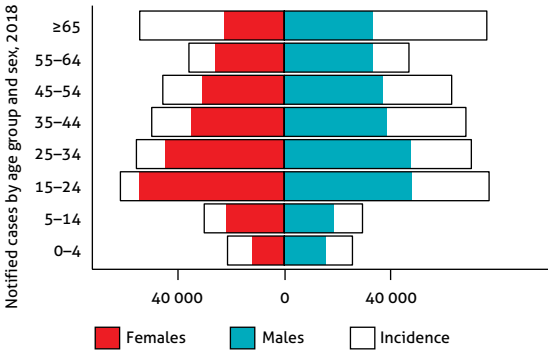
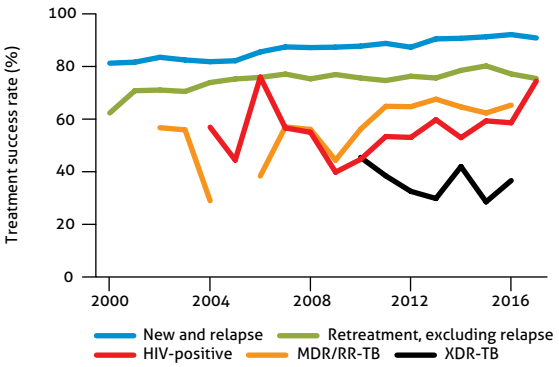
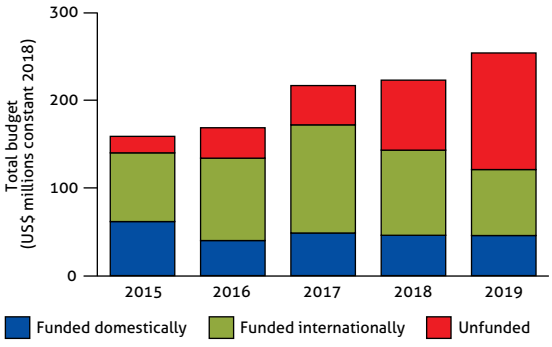










Data for all countries and years can be downloaded from www.who.int/tb/data

WHO European Region

POPULATION 2018 **927 MILLION**

WHO Member States 53

Other countries and territories 1

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	259 (225–296)	28 (24–32)
HIV-positive TB incidence	30 (23–37)	3.2 (2.5–4)
MDR/RR-TB incidence[b]	77 (60–95)	8.3 (6.5–10)
HIV-negative TB mortality	23 (22–24)	2.5 (2.4–2.6)
HIV-positive TB mortality	4 (3–6)	0.47 (0.36–0.6)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	18% (16–19)
Previously treated cases	54% (47–61)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	218 090
– % tested with rapid diagnostics at time of diagnosis	53%
– % with known HIV status	92%
– % pulmonary	84%
– % bacteriologically confirmed[c]	66%
– % children aged 0–14 years[d]	4%
– % women[d]	32%
– % men[d]	64%
Total cases notified	260 331

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	84% (74–97)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	11% (9–12)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	24 081	13%
– on antiretroviral therapy	17 436	73%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	91%
– Previously treated cases	93%
Laboratory-confirmed cases[e]	MDR/RR-TB: 48 739, XDR-TB: 7 899
Patients started on treatment[e,f]	MDR/RR-TB: 49 696, XDR-TB: 7 351
MDR/RR-TB cases tested for resistance to second-line drugs	42 425

TREATMENT SUCCESS RATE AND COHORT SIZE

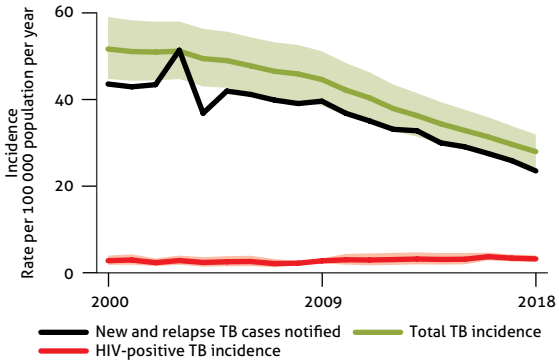
	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	78%	178 156
Previously treated cases, excluding relapse, registered in 2017	59%	20 159
HIV-positive TB cases registered in 2017	51%	15 465
MDR/RR-TB cases started on second-line treatment in 2016	57%	45 239
XDR-TB cases started on second-line treatment in 2016	39%	5 686

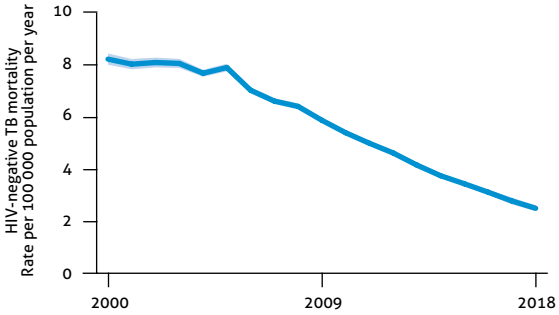
TB PREVENTIVE TREATMENT, 2018

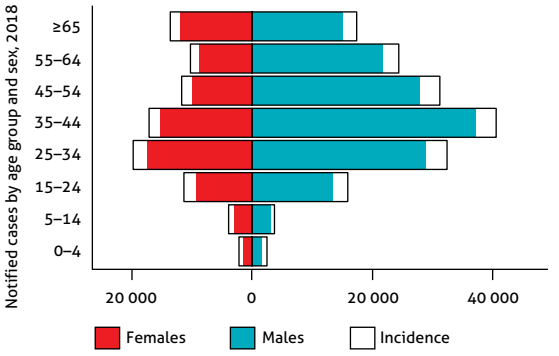
% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	69%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	122% (117–129)

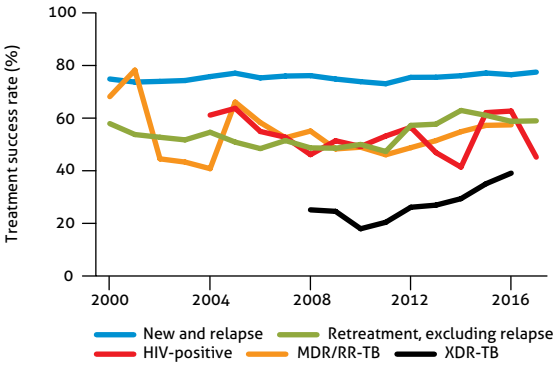
TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

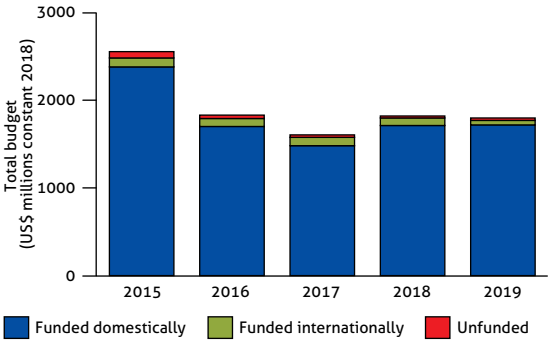
National TB budget (US$ millions)	1 797
Funding source:	96% domestic, 2.9% international, 1.5% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
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WHO South-East Asia Region

POPULATION 2018 **1 982 MILLION**

WHO Member States 11

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	4 370 (3 480–5 370)	220 (175–271)
HIV-positive TB incidence	140 (107–178)	7.1 (5.4–9)
MDR/RR-TB incidence[b]	182 (126–249)	9.2 (6.3–13)
HIV-negative TB mortality	637 (598–677)	32 (30–34)
HIV-positive TB mortality	21 (16–28)	1.1 (0.79–1.4)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	2.6% (2–3.4)
Previously treated cases	14% (7.7–23)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	3 183 255
– % tested with rapid diagnostics at time of diagnosis	37%
– % with known HIV status	61%
– % pulmonary	83%
– % bacteriologically confirmed[c]	56%
– % children aged 0–14 years[d]	7%
– % women[d]	35%
– % men[d]	58%
Total cases notified	3 362 783

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	73% (59–92)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	15% (12–19)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	76 858	4.1%
– on antiretroviral therapy	61 344	80%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	42%
– Previously treated cases	89%
Laboratory-confirmed cases[e]	MDR/RR-TB: 75 964, XDR-TB: 3 580
Patients started on treatment[e,f]	MDR/RR-TB: 57 447, XDR-TB: 2 860
MDR/RR-TB cases tested for resistance to second-line drugs	43 684

TREATMENT SUCCESS RATE AND COHORT SIZE

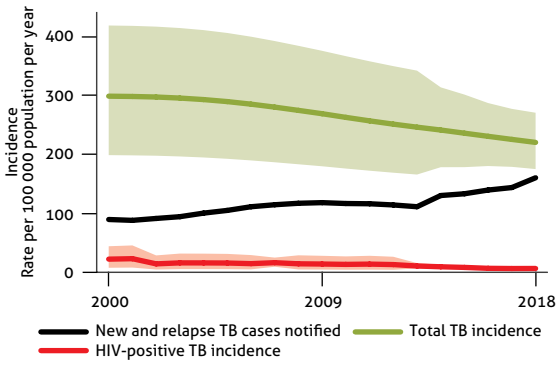
	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	83%	2 588 327
Previously treated cases, excluding relapse, registered in 2017	57%	157 696
HIV-positive TB cases registered in 2017	71%	56 872
MDR/RR-TB cases started on second-line treatment in 2016	52%	40 725
XDR-TB cases started on second-line treatment in 2016	31%	2 567

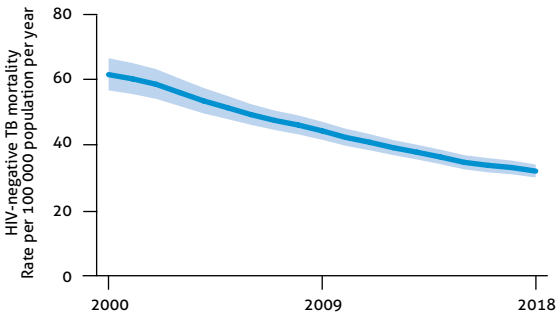
TB PREVENTIVE TREATMENT, 2018

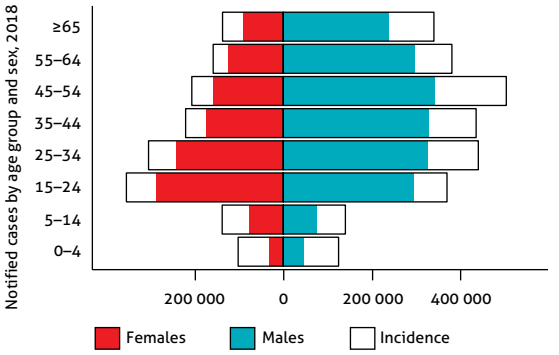
% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	15%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	26% (24–28)

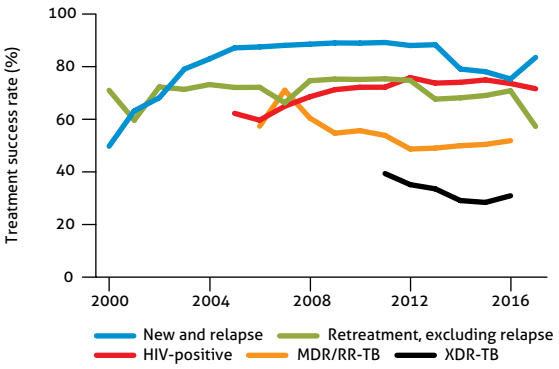
TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

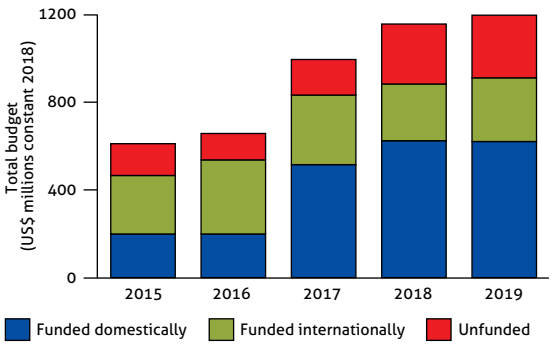
National TB budget (US$ millions)	1 197
Funding source:	52% domestic, 24% international, 24% unfunded











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[a] Ranges represent uncertainty intervals.
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[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
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Data for all countries and years can be downloaded from www.who.int/tb/data

WHO Western Pacific Region

POPULATION 2018 **1 922 MILLION**

WHO Member States 27

Other countries and territories 9

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	1 840 (1 520–2 180)	96 (79–114)
HIV-positive TB incidence	41 (30–53)	2.1 (1.5–2.8)
MDR/RR-TB incidence[b]	99 (79–122)	5.2 (4.1–6.4)
HIV-negative TB mortality	90 (83–98)	4.7 (4.3–5.1)
HIV-positive TB mortality	7 (5–8)	0.34 (0.25–0.43)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	4.6% (3.5–5.9)
Previously treated cases	16% (7.4–28)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	1 416 729
– % tested with rapid diagnostics at time of diagnosis	20%
– % with known HIV status	54%
– % pulmonary	92%
– % bacteriologically confirmed[c]	41%
– % children aged 0–14 years[d]	5%
– % women[d]	31%
– % men[d]	64%
Total cases notified	1 441 363

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	77% (65–93)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	5% (4–6)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	15 824	2.1%
– on antiretroviral therapy	13 156	84%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	47%
– Previously treated cases	74%
Laboratory-confirmed cases[e]	MDR/RR-TB: 27 014, XDR-TB: 591
Patients started on treatment[e,f]	MDR/RR-TB: 20 084, XDR-TB: 298
MDR/RR-TB cases tested for resistance to second-line drugs	5 570

TREATMENT SUCCESS RATE AND COHORT SIZE

	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	91%	1 337 685
Previously treated cases, excluding relapse, registered in 2017	79%	22 820
HIV-positive TB cases registered in 2017	79%	12 170
MDR/RR-TB cases started on second-line treatment in 2016	59%	14 602
XDR-TB cases started on second-line treatment in 2016	58%	88

TB PREVENTIVE TREATMENT, 2018

% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	39%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	12% (11–13)

TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

National TB budget (US$ millions)	1 092
Funding source:	68% domestic, 8.9% international, 23% unfunded

Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
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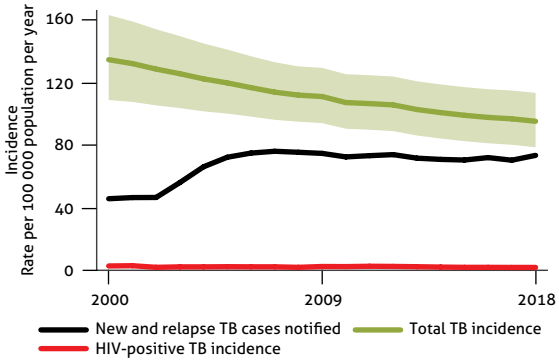
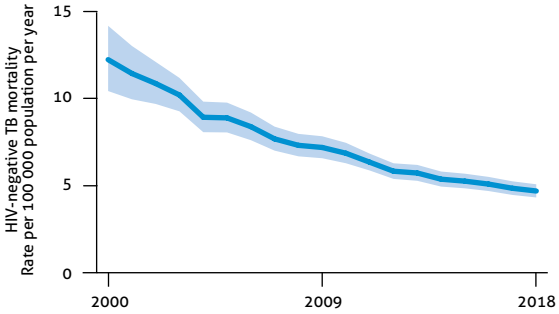
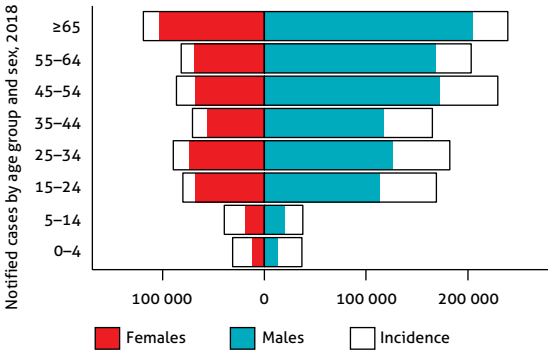
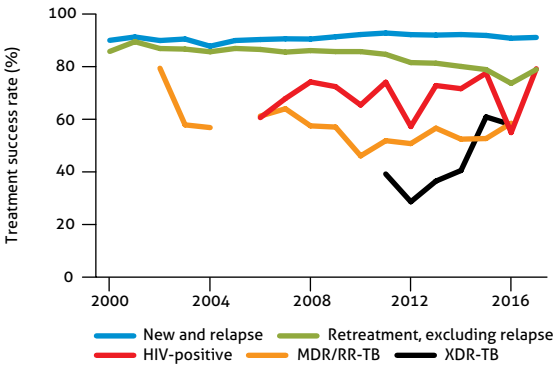
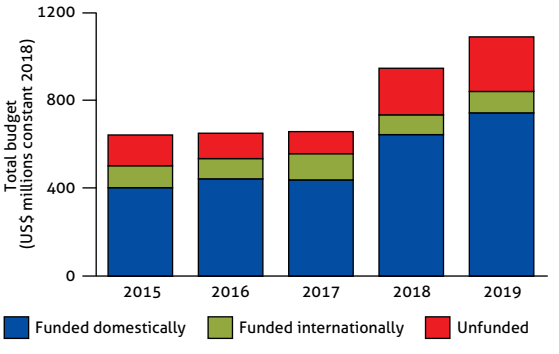










Global

POPULATION 2018 **7 604 MILLION**

WHO Member States	**194**
Other countries and territories	**22**

ESTIMATES OF TB BURDEN,[a] 2018

	NUMBER (thousands)	RATE (per 100 000 population)
Total TB incidence	10 000 (8 990–11 100)	132 (118–146)
HIV-positive TB incidence	862 (776–952)	11 (10–13)
MDR/RR-TB incidence[b]	484 (417–556)	6.4 (5.5–7.3)
HIV-negative TB mortality	1 240 (1 160–1 320)	16 (15–17)
HIV-positive TB mortality	251 (224–280)	3.3 (2.9–3.7)

ESTIMATED PROPORTION OF TB CASES WITH MDR/RR-TB, 2018

New cases	3.4% (2.5–4.4)
Previously treated cases	18% (7.6–31)

TB CASE NOTIFICATIONS, 2018

Total new and relapse	6 950 750
– % tested with rapid diagnostics at time of diagnosis	31%
– % with known HIV status	64%
– % pulmonary	85%
– % bacteriologically confirmed[c]	55%
– % children aged 0–14 years[d]	8%
– % women[d]	34%
– % men[d]	58%
Total cases notified	7 253 116

UNIVERSAL HEALTH COVERAGE AND SOCIAL PROTECTION

TB treatment coverage (notified/estimated incidence), 2018	69% (63–77)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2018	15% (13–17)

TB/HIV CARE IN NEW AND RELAPSE TB PATIENTS, 2018

	NUMBER	(%)[h]
Patients with known HIV-status who are HIV-positive	477 461	11%
– on antiretroviral therapy	409 770	86%

DRUG-RESISTANT TB CARE, 2018

% of bacteriologically confirmed TB cases tested for rifampicin resistance[c]	
– New cases	46%
– Previously treated cases	83%
Laboratory-confirmed cases[e]	MDR/RR-TB: 186 772, XDR-TB: 13 068
Patients started on treatment[e,f]	MDR/RR-TB: 156 071, XDR-TB: 11 403
MDR/RR-TB cases tested for resistance to second-line drugs	109 699

TREATMENT SUCCESS RATE AND COHORT SIZE

	SUCCESS	COHORT
New and relapse[g] cases registered in 2017	85%	6 128 363
Previously treated cases, excluding relapse, registered in 2017	61%	252 932
HIV-positive TB cases registered in 2017	75%	445 922
MDR/RR-TB cases started on second-line treatment in 2016	56%	126 089
XDR-TB cases started on second-line treatment in 2016	39%	9 258

TB PREVENTIVE TREATMENT, 2018

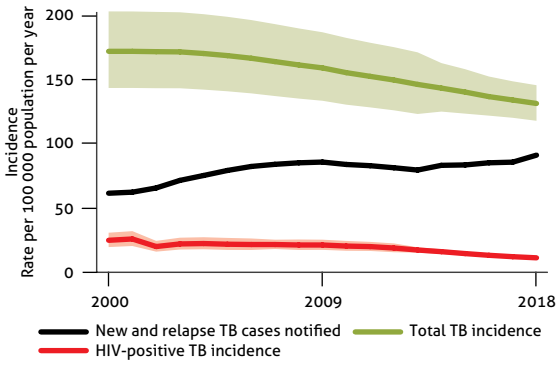
% of HIV-positive people (newly enrolled in care) on preventive treatment[h]	49%
% of children (aged <5) household contacts of bacteriologically confirmed TB cases on preventive treatment	27% (27–28)

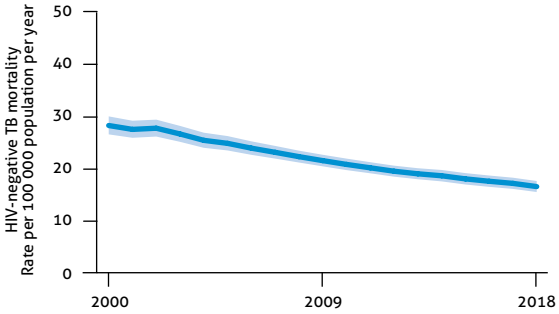
TB FINANCING (LOW- AND MIDDLE-INCOME COUNTRIES),[i] 2019

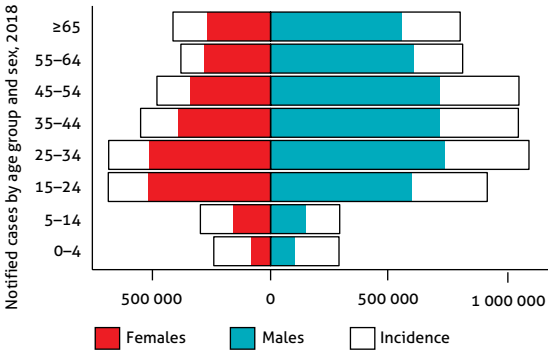
National TB budget (US$ millions)	5 916
Funding source:	63% domestic, 15% international, 22% unfunded

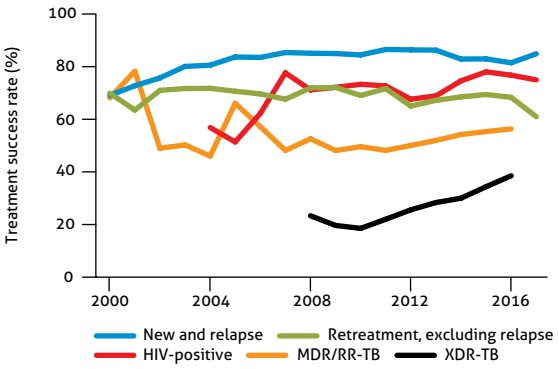
Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

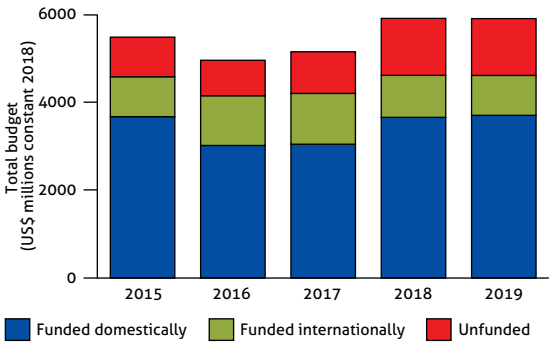
[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Calculated for pulmonary cases only.
[d] Restricted to notifications for which age-sex disaggregation was reported.
[e] Includes cases with unknown previous TB treatment history.
[f] Includes patients diagnosed before 2018 and patients who were not laboratory-confirmed.
[g] Some countries reported on new cases only.
[h] Calculations exclude countries with missing numerators or denominators.
[i] Data are not collected from all Member States. Financing indicators exclude funding for general healthcare services provided outside NTPs.











Data for all countries and years can be downloaded from www.who.int/tb/data

A peer-support counsellor for the endTB clinical trial in Khayelitsha, Cape Town. The counsellor is a former patient who recovered from extensively drug-resistant TB.

Sydelle Willow Smith/Bhekisisa Centre for Health Journalism (Mail & Guardian), South Africa

Annex 4

TB burden estimates, notifications and treatment outcomes

FOR INDIVIDUAL COUNTRIES AND TERRITORIES, WHO REGIONS AND THE WORLD

Estimates of incidence and mortality

Estimated values are shown as best estimates followed by lower and upper bounds. The lower and upper bounds are defined as the 2.5th and 97.5th centiles of outcome distributions produced in simulations. For details about the methods used to produce these estimates see the technical appendix at http://www.who.int/tb/publications/global_report/. Estimates are shown rounded to three significant figures unless the displayed value is under 100, in which case it is shown rounded to two significant figures.

Data source

Data shown in this file were taken from the WHO global TB database on **4 October 2019**. Data shown in the main part of the report were taken from the database on **12 August 2019**. As a result, data in this annex may differ slightly from those in the main part of the report.

Downloadable data

This annex is provided as a reference for looking up figures when needed. It is not suitable for conducting analyses or producing graphs and tables. Instead, download data for all countries and all years as comma-separated value (CSV) files from the WHO global TB database at www.who.int/tb/data/. See **Annex 1** for more details.

Country notes

Caribbean Islands

Data collection from Caribbean Islands that are not Member States of WHO was resumed in 2011 after a break of a few years. This includes Aruba, Curaçao, Puerto Rico and Sint Maarten, which are Associate Members of the Pan American Health Organization, plus the territories of Anguilla, Bermuda, Bonaire, Saint Eustatius and Saba, British Virgin Islands, Cayman Islands, Montserrat and Turks and Caicos Islands.

Denmark

Data for Denmark exclude Greenland.

Eswatini, Lesotho, Mozambique, Nepal and South Africa

Estimates of TB incidence and mortality for Eswatini, Lesotho, Mozambique, Nepal and South Africa will be reviewed after final results from their respective national TB prevalence surveys are available in 2020.

European Union/ European Economic Area countries

Notification and treatment outcome data for European Union and European Economic Area countries are provisional.

France

Data from France include data from 5 overseas departments (French Guiana, Guadeloupe, Martinique, Mayotte and Réunion) and exclude French territories of the Pacific.

India

Estimates of TB incidence and mortality for India are interim, pending results from the national TB prevalence survey planned for 2019/2020.

Russian Federation

UN Population Division estimates are lower than the population registered by the Federal State Statistics Service of the Russian Federation.

United States of America

In addition to the 51 reporting areas, the USA includes territories that report separately to WHO. The data for these territories are not included in the data reported by the USA. Definitions of case types and outcomes do not exactly match those used by WHO.

TABLE A4.1

TB incidence estimates, 2018

		Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Afghanistan	37	70 (45–100)	189 (122–270)	0.32 (0.12–0.64)	0.87 (0.31–1.7)	2.5 (1.0–4.7)	6.8 (2.8–13)
Albania	3	0.51 (0.43–0.58)	18 (15–20)	<0.01 (<0.01–0.013)	0.28 (0.16–0.44)	0.014 (<0.01–0.028)	0.47 (0.14–0.98)
Algeria	42	29 (22–37)	69 (53–88)	0.26 (0.15–0.40)	0.62 (0.36–0.95)	0.78 (0.35–1.4)	1.8 (0.83–3.3)
American Samoa	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Andorra	< 1	<0.01 (<0.01–<0.01)	3 (2.6–3.5)			<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Angola	31	109 (71–156)	355 (230–507)	11 (6.8–15)	34 (22–49)	3.9 (1.7–7.1)	13 (5.4–23)
Anguilla	< 1	<0.01 (<0.01–<0.01)	22 (14–31)			<0.01 (<0.01–<0.01)	2.4 (0.46–5.8)
Antigua and Barbuda	< 1	<0.01 (<0.01–<0.01)	6 (5.1–6.9)	0 (0–<0.01)	0 (0–1.6)	<0.01 (<0.01–<0.01)	0.19 (<0.1–0.50)
Argentina	44	12 (10–14)	27 (23–31)	0.83 (0.47–1.3)	1.9 (1.1–2.9)	0.56 (0.36–0.80)	1.3 (0.81–1.8)
Armenia	3	0.92 (0.70–1.2)	31 (24–39)	0.095 (0.066–0.13)	3.2 (2.2–4.4)	0.24 (0.16–0.33)	8.2 (5.5–11)
Aruba	< 1	<0.01 (<0.01–<0.01)	5.4 (4.6–6.3)			<0.01 (<0.01–<0.01)	0.17 (<0.1–0.32)
Australia	25	1.7 (1.4–1.9)	6.6 (5.7–7.7)	0.03 (0.019–0.044)	0.12 (<0.1–0.18)	0.061 (0.038–0.089)	0.24 (0.15–0.36)
Austria	9	0.63 (0.54–0.73)	7.1 (6.1–8.2)	0.014 (<0.01–0.021)	0.15 (<0.1–0.24)	0.019 (<0.01–0.034)	0.21 (<0.1–0.38)
Azerbaijan	10	6.3 (4.8–8.0)	63 (48–80)	0.085 (0.057–0.12)	0.85 (0.58–1.2)	1.3 (0.94–1.6)	13 (9.5–16)
Bahamas	< 1	0.054 (0.046–0.062)	14 (12–16)	0.012 (<0.01–0.020)	3.1 (1.6–5.2)	<0.01 (<0.01–0.011)	0.88 (<0.1–2.9)
Bahrain	2	0.18 (0.15–0.20)	11 (9.7–13)	<0.01 (0–<0.01)	<0.1 (<0.1–0.12)	<0.01 (<0.01–0.019)	0.56 (0.15–1.2)
Bangladesh	161	357 (260–469)	221 (161–291)	0.73 (0.36–1.2)	0.45 (0.23–0.76)	5.9 (3.2–9.6)	3.7 (2.0–5.9)
Barbados	< 1	<0.01 (<0.01–<0.01)	0.4 (0.34–0.46)	0 (0–0)	<0.1 (<0.1–0.15)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Belarus	9	2.9 (2.3–3.7)	31 (24–39)	0.23 (0.17–0.30)	2.4 (1.8–3.1)	1.4 (1.0–1.7)	14 (11–18)
Belgium	11	1 (0.88–1.2)	9 (7.7–10)	0.04 (0.013–0.081)	0.35 (0.11–0.70)	0.026 (0.012–0.045)	0.23 (0.11–0.39)
Belize	< 1	0.11 (0.097–0.13)	30 (25–34)	0.037 (0.026–0.050)	9.7 (6.8–13)	0.011 (<0.01–0.036)	2.8 (0.14–9.3)
Benin	11	6.5 (4.2–9.3)	56 (37–81)	0.94 (0.61–1.4)	8.2 (5.3–12)	0.1 (0.020–0.25)	0.89 (0.18–2.2)
Bermuda	< 1	<0.01 (<0.01–<0.01)	3.7 (3.1–4.2)	0 (0–<0.01)	0 (0–1.5)	<0.01 (<0.01–<0.01)	0.2 (0.12–0.31)
Bhutan	< 1	1.1 (0.86–1.4)	149 (114–188)	<0.01 (0–<0.01)	0.34 (<0.1–1.1)	0.15 (0.10–0.21)	20 (13–28)
Bolivia (Plurinational State of)	11	12 (8.0–17)	108 (71–154)	0.54 (0.34–0.77)	4.7 (3.0–6.8)	0.35 (0.11–0.74)	3.1 (0.95–6.5)
Bonaire, Saint Eustatius and Saba	< 1	<0.01 (<0.01–<0.01)	3.4 (2.9–3.9)			<0.01 (<0.01–<0.01)	0.23 (0.13–0.36)
Bosnia and Herzegovina	3	0.83 (0.64–1.1)	25 (19–32)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.10)	<0.01 (<0.01–0.011)	0.11 (<0.1–0.32)
Botswana	2	6.2 (4.8–7.8)	275 (213–345)	3.3 (2.6–4.2)	148 (114–186)	0.3 (0.18–0.45)	13 (8.1–20)
Brazil	209	95 (81–110)	45 (39–52)	11 (9.3–13)	5.2 (4.4–6.0)	2.5 (1.9–3.2)	1.2 (0.89–1.5)
British Virgin Islands	< 1	<0.01 (<0.01–<0.01)	3.9 (3.3–4.5)			<0.01 (<0.01–<0.01)	0.42 (0.10–0.99)
Brunei Darussalam	< 1	0.29 (0.25–0.33)	68 (58–78)	<0.01 (0–<0.01)	0.8 (0.10–2.2)	0 (0–0)	0 (0–0)
Bulgaria	7	1.6 (1.2–2.0)	22 (17–28)	0.019 (<0.01–0.040)	0.27 (<0.1–0.57)	0.036 (0.017–0.063)	0.52 (0.24–0.89)
Burkina Faso	20	9.5 (6.2–14)	48 (31–69)	0.93 (0.60–1.3)	4.7 (3.0–6.8)	0.29 (0.16–0.47)	1.5 (0.80–2.4)
Burundi	11	12 (8.0–18)	111 (72–158)	1.3 (0.85–1.9)	12 (7.6–17)	0.37 (0.15–0.69)	3.3 (1.4–6.1)
Cabo Verde	< 1	0.25 (0.19–0.32)	46 (35–58)	0.035 (0.021–0.052)	6.5 (3.9–9.6)	<0.01 (<0.01–0.016)	1.7 (0.78–2.9)
Cambodia	16	49 (27–77)	302 (169–473)	1.1 (0.59–1.7)	6.5 (3.6–10)	1 (0.46–1.9)	6.4 (2.8–11)
Cameroon	25	47 (30–67)	186 (121–266)	13 (8.7–19)	53 (34–76)	0.89 (0.43–1.5)	3.5 (1.7–6.0)
Canada	37	2.1 (1.8–2.4)	5.6 (4.8–6.4)	0.086 (0.028–0.18)	0.23 (<0.1–0.47)	0.025 (0.012–0.044)	<0.1 (<0.1–0.12)
Cayman Islands	< 1	<0.01 (<0.01–<0.01)	5.4 (4.6–6.2)	0 (0–<0.01)	0 (0–1.9)	<0.01 (<0.01–<0.01)	0.15 (<0.1–0.23)
Central African Republic	5	25 (16–36)	540 (349–771)	6.6 (4.2–9.4)	141 (91–201)	0.18 (0.10–0.27)	3.8 (2.2–5.9)
Chad	15	22 (14–31)	142 (92–203)	3.7 (2.4–5.3)	24 (16–35)	0.71 (0.31–1.3)	4.6 (2.0–8.2)
Chile	19	3.4 (2.9–3.9)	18 (15–21)	0.36 (0.29–0.42)	1.9 (1.6–2.3)	0.095 (0.066–0.13)	0.51 (0.35–0.68)
China	1 428	866 (740–1 000)	61 (52–70)	18 (9.8–28)	1.2 (0.69–2.0)	66 (50–85)	4.6 (3.5–6.0)
China, Hong Kong SAR	7	4.9 (4.2–5.7)	67 (57–77)	0.033 (0.018–0.051)	0.44 (0.25–0.69)	0.085 (0.058–0.12)	1.2 (0.78–1.6)
China, Macao SAR	< 1	0.38 (0.32–0.43)	60 (51–69)	<0.01 (<0.01–0.010)	0.6 (0.10–1.5)	0.01 (<0.01–0.022)	1.6 (0.44–3.5)
Colombia	50	16 (12–21)	33 (25–41)	2.1 (1.6–2.7)	4.2 (3.2–5.3)	0.58 (0.37–0.85)	1.2 (0.74–1.7)
Comoros	< 1	0.29 (0.19–0.41)	35 (22–50)	<0.01 (0–<0.01)	0.12 (<0.1–0.32)	0.026 (<0.01–0.083)	3.1 (0.18–10)
Congo	5	20 (12–28)	375 (238–543)	5.7 (2.9–9.4)	108 (55–179)	0.56 (0.23–1.0)	11 (4.5–20)
Cook Islands	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Costa Rica	5	0.5 (0.38–0.63)	10 (7.7–13)	0.054 (0.035–0.077)	1.1 (0.71–1.5)	0.011 (<0.01–0.021)	0.21 (<0.1–0.41)
Côte d'Ivoire	25	36 (23–51)	142 (92–204)	7.1 (4.5–10)	28 (18–40)	2.2 (1.1–3.6)	8.6 (4.2–15)
Croatia	4	0.35 (0.30–0.40)	8.4 (7.2–9.7)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.12)	0 (0–0)	0 (0–0)
Cuba	11	0.82 (0.70–0.94)	7.2 (6.2–8.3)	0.09 (0.068–0.11)	0.79 (0.60–1.0)	0.039 (0.019–0.067)	0.35 (0.17–0.59)
Curaçao	< 1	0.01 (<0.01–0.012)	6.4 (5.5–7.4)			<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Cyprus	1	0.065 (0.055–0.075)	5.4 (4.7–6.3)			<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Czechia	11	0.58 (0.50–0.67)	5.4 (4.6–6.3)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.017 (<0.01–0.031)	0.16 (<0.1–0.30)
Democratic People's Republic of Korea	26	131 (114–149)	513 (446–584)	0.22 (0.12–0.36)	0.87 (0.47–1.4)	5.2 (2.5–8.8)	20 (10–34)
Democratic Republic of the Congo	84	270 (175–385)	321 (208–458)	31 (9.4–65)	37 (11–77)	6 (3.0–10)	7.2 (3.6–12)
Denmark	6	0.31 (0.27–0.36)	5.4 (4.6–6.2)	<0.01 (<0.01–0.016)	0.14 (<0.1–0.28)	<0.01 (<0.01–0.016)	0.12 (<0.1–0.28)
Djibouti	< 1	2.5 (1.9–3.2)	260 (199–329)	0.09 (0.062–0.12)	9.4 (6.5–13)	0.12 (0.063–0.21)	13 (6.6–22)
Dominica	< 1	<0.01 (<0.01–<0.01)	6.4 (5.5–7.4)			<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Dominican Republic	11	4.8 (3.7–6.1)	45 (35–57)	1.2 (0.92–1.5)	11 (8.6–14)	0.23 (0.11–0.38)	2.1 (1.0–3.6)
Ecuador	17	7.4 (5.7–9.4)	44 (33–55)	1 (0.76–1.3)	5.9 (4.4–7.5)	0.22 (0.089–0.42)	1.3 (0.52–2.4)
Egypt	98	12 (11–14)	12 (11–14)	0.1 (0.049–0.17)	0.1 (<0.1–0.18)	0.28 (0.20–0.38)	0.29 (0.21–0.38)
El Salvador	6	4.5 (3.5–5.7)	70 (54–89)	0.26 (0.19–0.34)	4.1 (3.0–5.4)	0.1 (0.032–0.21)	1.6 (0.49–3.3)
Equatorial Guinea	1	2.6 (2.3–3.0)	201 (176–228)	0.95 (0.82–1.1)	73 (62–84)	0.097 (0.052–0.16)	7.4 (3.9–12)

[a] Rates are per 100 000 population.

TABLE A4.1

TB incidence estimates, 2018

		Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Eritrea	3	3.1 (1.4–5.4)	89 (41–156)	0.14 (0.059–0.25)	4 (1.7–7.1)	0.066 (0.020–0.14)	1.9 (0.57–4.1)
Estonia	1	0.17 (0.14–0.19)	13 (11–15)	0.015 (<0.01–0.025)	1.1 (0.57–1.9)	0.045 (0.029–0.064)	3.4 (2.2–4.8)
Eswatini	1	3.7 (2.9–4.7)	329 (252–416)	2.5 (1.9–3.1)	217 (166–275)	0.36 (0.25–0.50)	32 (22–44)
Ethiopia	109	165 (116–223)	151 (107–204)	7.6 (5.3–10)	7 (4.9–9.4)	1.6 (1.0–2.2)	1.4 (0.96–2.0)
Fiji	< 1	0.48 (0.37–0.61)	54 (42–69)	0.025 (0.014–0.040)	2.9 (1.6–4.5)	<0.01 (<0.01–<0.01)	0.35 (0.20–0.54)
Finland	6	0.26 (0.22–0.30)	4.7 (4.0–5.5)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.13)	0.013 (<0.01–0.026)	0.23 (<0.1–0.47)
France	65	5.8 (5.1–6.5)	8.9 (7.8–10)	0.36 (0.28–0.45)	0.56 (0.43–0.69)	0.11 (0.076–0.14)	0.16 (0.12–0.22)
French Polynesia	< 1	0.062 (0.053–0.072)	22 (19–26)	0 (0–<0.01)	0 (0–0.74)	<0.01 (<0.01–<0.01)	0.61 (0.35–0.95)
Gabon	2	11 (7.2–16)	525 (340–750)	4.1 (1.7–7.6)	193 (79–357)	0.45 (0.21–0.77)	21 (10–36)
Gambia	2	4 (3.0–5.0)	174 (132–221)	0.79 (0.59–1.0)	34 (26–44)	0.12 (0.050–0.21)	5.1 (2.2–9.1)
Georgia	4	3.2 (2.7–3.8)	80 (67–94)	0.066 (0.046–0.090)	1.6 (1.1–2.3)	0.57 (0.45–0.70)	14 (11–18)
Germany	83	6.1 (5.2–7.0)	7.3 (6.2–8.4)	0.15 (0.079–0.23)	0.18 (0.10–0.28)	0.19 (0.089–0.33)	0.23 (0.11–0.39)
Ghana	30	44 (21–75)	148 (72–251)	8.6 (4.1–15)	29 (14–49)	0.87 (0.41–1.5)	2.9 (1.4–5.0)
Greece	11	0.47 (0.40–0.55)	4.5 (3.8–5.2)	0.016 (<0.01–0.026)	0.16 (<0.1–0.25)	0.01 (<0.01–0.030)	0.1 (<0.1–0.29)
Greenland	< 1	0.056 (0.048–0.065)	100 (85–115)	<0.01 (0–<0.01)	2 (0–9.8)	0 (0–0)	0 (0–0)
Grenada	< 1	<0.01 (<0.01–<0.01)	2.1 (1.8–2.4)			<0.01 (<0.01–<0.01)	0.13 (<0.1–0.41)
Guam	< 1	0.082 (0.070–0.094)	49 (42–57)	0 (0–<0.01)	0 (0–1.3)	0 (0–0)	0 (0–0)
Guatemala	17	4.5 (3.4–5.6)	26 (20–33)	0.31 (0.23–0.40)	1.8 (1.3–2.3)	0.12 (0.042–0.24)	0.71 (0.25–1.4)
Guinea	12	22 (14–31)	176 (114–251)	5.4 (3.5–7.7)	43 (28–62)	0.68 (0.29–1.2)	5.5 (2.3–10)
Guinea-Bissau	2	6.8 (4.4–9.7)	361 (234–516)	2.4 (1.5–3.4)	128 (82–183)	0.18 (0.073–0.34)	9.6 (3.9–18)
Guyana	< 1	0.64 (0.49–0.82)	83 (63–105)	0.12 (0.086–0.16)	15 (11–21)	0.032 (0.015–0.055)	4.1 (1.9–7.1)
Haiti	11	20 (15–25)	176 (135–222)	2.9 (2.3–3.7)	27 (20–34)	0.57 (0.20–1.1)	5.1 (1.8–10)
Honduras	10	3.5 (2.7–4.5)	37 (28–47)	0.23 (0.17–0.30)	2.4 (1.7–3.1)	0.081 (0.032–0.15)	0.84 (0.34–1.6)
Hungary	10	0.62 (0.53–0.72)	6.4 (5.5–7.4)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.022 (0.013–0.034)	0.23 (0.13–0.35)
Iceland	< 1	<0.01 (<0.01–0.011)	2.7 (2.3–3.2)	0 (0–0)	<0.1 (<0.1–0.13)	0 (0–0)	0 (0–0)
India	1 353	2 690 (1 840–3 700)	199 (136–273)	92 (63–126)	6.8 (4.6–9.3)	130 (77–198)	9.6 (5.7–15)
Indonesia	268	845 (770–923)	316 (288–345)	21 (8.9–38)	7.9 (3.3–14)	24 (17–32)	8.8 (6.2–12)
Iran (Islamic Republic of)	82	11 (8.5–14)	14 (10–17)	0.38 (0.29–0.50)	0.47 (0.35–0.61)	0.19 (0.10–0.31)	0.23 (0.12–0.38)
Iraq	38	16 (14–18)	42 (37–47)	0 (0–<0.01)	0 (0–<0.1)	1.1 (0.80–1.5)	2.9 (2.1–3.9)
Ireland	5	0.34 (0.29–0.39)	7 (6.0–8.1)	0.012 (<0.01–0.018)	0.24 (0.13–0.38)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.10)
Israel	8	0.34 (0.29–0.39)	4 (3.4–4.6)	0.014 (<0.01–0.024)	0.16 (<0.1–0.28)	0.031 (0.017–0.048)	0.36 (0.20–0.58)
Italy	61	4.3 (3.7–4.9)	7 (6.0–8.1)	0.2 (0.11–0.32)	0.34 (0.19–0.53)	0.17 (0.11–0.25)	0.28 (0.18–0.41)
Jamaica	3	0.086 (0.066–0.11)	2.9 (2.3–3.7)	0.02 (0.011–0.031)	0.67 (0.36–1.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Japan	127	18 (15–21)	14 (12–16)	0.1 (0.031–0.21)	<0.1 (<0.1–0.17)	0.51 (0.22–0.93)	0.4 (0.17–0.73)
Jordan	10	0.5 (0.38–0.63)	5 (3.8–6.3)	<0.01 (<0.01–0.011)	<0.1 (<0.1–0.11)	0.036 (0.014–0.068)	0.36 (0.14–0.68)
Kazakhstan	18	12 (8.1–18)	68 (44–97)	0.73 (0.47–1.0)	4 (2.6–5.7)	4.8 (3.0–6.9)	26 (16–38)
Kenya	51	150 (92–222)	292 (179–432)	40 (25–60)	79 (48–117)	2.3 (1.1–4.1)	4.5 (2.1–7.9)
Kiribati	< 1	0.4 (0.31–0.51)	349 (267–441)			0.01 (<0.01–0.025)	8.9 (1.9–21)
Kuwait	4	0.94 (0.81–1.1)	23 (20–26)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.18)	0.017 (<0.01–0.032)	0.41 (0.17–0.77)
Kyrgyzstan	6	7.3 (6.2–8.4)	116 (99–134)	0.22 (0.17–0.26)	3.4 (2.7–4.2)	3 (2.4–3.6)	47 (39–57)
Lao People's Democratic Republic	7	11 (7.4–16)	162 (105–231)	0.72 (0.46–1.0)	10 (6.5–15)	0.16 (0.065–0.28)	2.2 (0.92–4.0)
Latvia	2	0.56 (0.48–0.65)	29 (25–33)	0.035 (0.012–0.070)	1.8 (0.61–3.7)	0.063 (0.042–0.089)	3.3 (2.2–4.6)
Lebanon	7	0.75 (0.65–0.87)	11 (9.4–13)	<0.01 (<0.01–0.016)	0.11 (<0.1–0.23)	<0.01 (<0.01–0.020)	0.13 (<0.1–0.29)
Lesotho	2	13 (8.3–18)	611 (395–872)	8.4 (5.4–12)	398 (257–568)	0.8 (0.47–1.2)	38 (22–58)
Liberia	5	15 (9.6–21)	308 (199–440)	2.6 (1.7–3.7)	53 (34–76)	0.39 (0.15–0.72)	8 (3.2–15)
Libya	7	2.7 (1.7–3.9)	40 (25–58)	0.033 (0.016–0.055)	0.49 (0.24–0.83)	0.099 (0.042–0.18)	1.5 (0.63–2.7)
Lithuania	3	1.2 (1.0–1.4)	44 (37–50)	0.039 (0.026–0.055)	1.4 (0.91–2.0)	0.23 (0.18–0.29)	8.3 (6.5–10)
Luxembourg	< 1	0.048 (0.041–0.056)	8 (6.8–9.2)	<0.01 (<0.01–<0.01)	0.35 (0.19–0.55)	<0.01 (<0.01–<0.01)	0.28 (0.16–0.43)
Madagascar	26	61 (40–87)	233 (151–333)	0.96 (0.61–1.4)	3.6 (2.3–5.2)	0.43 (0.082–1.1)	1.6 (0.31–4.0)
Malawi	18	33 (20–48)	181 (113–265)	16 (9.9–23)	88 (55–129)	0.42 (0.11–0.93)	2.3 (0.63–5.1)
Malaysia	32	29 (25–33)	92 (79–106)	1.9 (1.6–2.2)	5.9 (5.0–6.9)	0.48 (0.36–0.62)	1.5 (1.1–2.0)
Maldives	< 1	0.17 (0.13–0.22)	33 (26–42)	<0.01 (0–<0.01)	0.24 (0–1.2)	<0.01 (<0.01–0.012)	0.73 (<0.1–2.3)
Mali	19	10 (6.7–14)	53 (35–76)	1 (0.67–1.5)	5.4 (3.5–7.7)	0.33 (0.15–0.58)	1.7 (0.76–3.0)
Malta	< 1	0.06 (0.051–0.069)	14 (12–16)	0.01 (<0.01–0.017)	2.2 (0.95–3.9)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Marshall Islands	< 1	0.25 (0.19–0.32)	434 (332–549)			<0.01 (<0.01–<0.01)	11 (6.3–17)
Mauritania	4	4.1 (2.7–5.9)	93 (60–133)	0.12 (0.033–0.27)	2.8 (0.75–6.2)	0.13 (0.054–0.23)	2.9 (1.2–5.3)
Mauritius	1	0.16 (0.13–0.21)	13 (9.9–16)	0.036 (0.022–0.053)	2.8 (1.8–4.1)	<0.01 (<0.01–<0.01)	0.11 (<0.1–0.16)
Mexico	126	29 (22–37)	23 (18–29)	2.8 (2.1–3.6)	2.2 (1.7–2.8)	0.95 (0.70–1.2)	0.75 (0.56–0.98)
Micronesia (Federated States of)	< 1	0.12 (0.093–0.15)	108 (82–136)			<0.01 (<0.01–<0.01)	0.8 (0.45–1.2)
Monaco	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Mongolia	3	14 (7.0–22)	428 (220–703)	0.015 (<0.01–0.039)	0.48 (<0.1–1.2)	0.72 (0.34–1.2)	23 (11–39)
Montenegro	< 1	0.097 (0.083–0.11)	15 (13–18)	<0.01 (0–<0.01)	0.24 (<0.1–0.49)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Montserrat	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Morocco	36	36 (30–41)	99 (85–114)	0.5 (0.15–1.1)	1.4 (0.42–3.0)	0.53 (0.25–0.90)	1.5 (0.70–2.5)
Mozambique	29	162 (105–232)	551 (356–787)	58 (38–83)	197 (127–281)	8.3 (4.4–14)	28 (15–46)
Myanmar	54	181 (119–256)	338 (222–477)	15 (10–22)	29 (19–41)	11 (7.4–16)	21 (14–30)

[a] Rates are per 100 000 population.

TABLE A4.1

TB incidence estimates, 2018

	Population (millions)	Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
		Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Namibia	2	13 (9.2–17)	524 (375–697)	4.5 (3.2–5.9)	182 (130–242)	0.9 (0.62–1.2)	37 (25–50)
Nauru	< 1	<0.01 (<0.01–<0.01)	54 (46–62)			<0.01 (<0.01–<0.01)	1.5 (0.66–2.8)
Nepal	28	42 (37–48)	151 (133–170)	0.38 (0.32–0.45)	1.4 (1.1–1.6)	1.4 (0.77–2.3)	5 (2.8–8.0)
Netherlands	17	0.91 (0.78–1.1)	5.3 (4.6–6.2)	0.036 (0.023–0.051)	0.21 (0.14–0.30)	<0.01 (<0.01–0.023)	<0.1 (<0.1–0.13)
New Caledonia	< 1	0.043 (0.036–0.049)	15 (13–18)			0 (0–0)	0 (0–0)
New Zealand	5	0.35 (0.30–0.40)	7.3 (6.3–8.5)	<0.01 (<0.01–0.013)	0.13 (<0.1–0.28)	0.01 (<0.01–0.022)	0.22 (<0.1–0.47)
Nicaragua	6	2.6 (2.0–3.3)	41 (31–52)	0.14 (0.10–0.19)	2.2 (1.6–2.9)	0.04 (<0.01–0.096)	0.61 (0.12–1.5)
Niger	22	19 (13–28)	87 (56–124)	0.8 (0.51–1.1)	3.6 (2.3–5.1)	0.6 (0.26–1.1)	2.7 (1.1–4.8)
Nigeria	196	429 (280–609)	219 (143–311)	53 (34–75)	27 (17–38)	21 (13–32)	11 (6.4–16)
Niue	< 1	<0.01 (<0.01–<0.01)	71 (61–82)	0 (0–0)	0.71 (0.54–0.90)	<0.01 (<0.01–<0.01)	6.3 (1.4–15)
North Macedonia	2	0.27 (0.21–0.34)	13 (10–16)			0 (0–0)	0 (0–0)
Northern Mariana Islands	< 1	0.054 (0.046–0.062)	95 (81–110)	<0.01 (0–<0.01)	2 (0–9.8)	<0.01 (<0.01–0.013)	6.5 (0.24–23)
Norway	5	0.22 (0.19–0.25)	4.1 (3.5–4.7)	<0.01 (<0.01–0.016)	0.16 (<0.1–0.30)	0.011 (<0.01–0.022)	0.21 (<0.1–0.42)
Oman	5	0.28 (0.24–0.33)	5.9 (5.0–6.8)	<0.01 (<0.01–0.014)	0.15 (<0.1–0.30)	<0.01 (<0.01–0.017)	0.16 (<0.1–0.35)
Pakistan	212	562 (399–754)	265 (188–355)	3.8 (2.5–5.4)	1.8 (1.2–2.5)	28 (18–40)	13 (8.4–19)
Palau	< 1	0.02 (0.017–0.023)	109 (93–126)	0 (0–<0.01)	0 (0–11)	<0.01 (<0.01–<0.01)	9.3 (0.35–32)
Panama	4	2.2 (1.6–2.7)	52 (39–65)	0.4 (0.30–0.51)	9.5 (7.1–12)	0.075 (0.031–0.14)	1.8 (0.75–3.3)
Papua New Guinea	9	37 (30–45)	432 (352–521)	2.7 (2.2–3.3)	32 (26–38)	2 (1.2–2.9)	23 (14–33)
Paraguay	7	3 (2.5–3.4)	43 (37–49)	0.26 (0.21–0.31)	3.7 (3.0–4.5)	0.069 (0.022–0.14)	0.99 (0.32–2.0)
Peru	32	39 (30–50)	123 (94–155)	2.4 (1.8–3.0)	7.4 (5.6–9.4)	3.2 (2.4–4.1)	10 (7.6–13)
Philippines	107	591 (332–924)	554 (311–866)	10 (4.1–19)	9.4 (3.8–17)	18 (7.7–32)	17 (7.3–30)
Poland	38	6 (5.1–6.9)	16 (13–18)	0.075 (0.041–0.12)	0.2 (0.11–0.31)	0.09 (0.063–0.12)	0.24 (0.17–0.32)
Portugal	10	2.4 (2.1–2.8)	24 (20–27)	0.21 (0.074–0.43)	2.1 (0.72–4.2)	0.032 (0.017–0.051)	0.31 (0.17–0.49)
Puerto Rico	3	0.029 (0.025–0.033)	0.95 (0.81–1.1)	<0.01 (<0.01–<0.01)	0.12 (<0.1–0.29)	0 (0–0)	0 (0–0)
Qatar	3	0.86 (0.74–1.0)	31 (27–36)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.14)	<0.01 (<0.01–0.025)	0.27 (<0.1–0.89)
Republic of Korea	51	34 (31–36)	66 (61–71)	0.32 (0.18–0.51)	0.63 (0.36–0.99)	1.5 (1.3–1.7)	2.9 (2.6–3.3)
Republic of Moldova	4	3.5 (3.0–4.0)	86 (73–99)	0.3 (0.24–0.36)	7.4 (6.0–8.8)	1.4 (1.1–1.6)	34 (28–40)
Romania	20	13 (11–15)	68 (58–79)	0.32 (0.26–0.38)	1.6 (1.3–2.0)	0.71 (0.56–0.88)	3.6 (2.9–4.5)
Russian Federation	146	79 (51–112)	54 (35–77)	16 (10–22)	11 (7.0–15)	41 (26–59)	28 (18–40)
Rwanda	12	7.3 (5.6–9.2)	59 (45–75)	1.5 (1.1–1.9)	12 (9.3–15)	0.18 (0.13–0.24)	1.5 (1.0–2.0)
Saint Kitts and Nevis	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Saint Lucia	< 1	<0.01 (<0.01–<0.01)	3.2 (2.7–3.7)	<0.01 (0–<0.01)	0.63 (<0.1–2.2)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Saint Vincent and the Grenadines	< 1	<0.01 (<0.01–<0.01)	6.3 (5.4–7.2)	0 (0–<0.01)	0 (0–1.4)	<0.01 (<0.01–<0.01)	0.1 (<0.1–0.16)
Samoa	< 1	0.013 (0.011–0.015)	6.4 (5.5–7.5)	0 (0–<0.01)	0 (0–0.92)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
San Marino	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
Sao Tome and Principe	< 1	0.26 (0.10–0.49)	124 (49–232)	0.038 (0.013–0.078)	18 (6.0–37)	0.021 (<0.01–0.070)	9.8 (0.48–33)
Saudi Arabia	34	3.4 (2.9–3.9)	10 (8.7–12)	0.049 (0.033–0.067)	0.14 (0.10–0.20)	0.087 (0.064–0.11)	0.26 (0.19–0.33)
Senegal	16	19 (13–25)	118 (84–158)	0.91 (0.64–1.2)	5.7 (4.0–7.7)	0.24 (0.095–0.44)	1.5 (0.60–2.8)
Serbia	9	1.5 (1.3–1.8)	17 (15–20)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.022 (<0.01–0.039)	0.25 (0.11–0.45)
Seychelles	< 1	0.017 (0.015–0.020)	18 (15–21)	<0.01 (0–<0.01)	1.2 (<0.1–5.2)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.10)
Sierra Leone	8	23 (15–33)	298 (191–427)	2.9 (1.9–4.2)	38 (25–55)	0.64 (0.26–1.2)	8.3 (3.4–15)
Singapore	6	2.7 (2.3–3.1)	47 (40–54)	0.035 (0.022–0.050)	0.6 (0.39–0.87)	0.046 (0.027–0.071)	0.81 (0.47–1.2)
Sint Maarten (Dutch part)	< 1	<0.01 (<0.01–<0.01)	19 (16–22)			<0.01 (<0.01–<0.01)	1.8 (0.32–4.6)
Slovakia	5	0.31 (0.27–0.36)	5.8 (4.9–6.7)	<0.01 (0–<0.01)	<0.1 (0–0.11)	<0.01 (<0.01–0.016)	0.1 (<0.1–0.29)
Slovenia	2	0.11 (0.095–0.13)	5.3 (4.6–6.2)	<0.01 (0–<0.01)	<0.1 (<0.1–0.14)	0 (0–0)	0 (0–0)
Solomon Islands	< 1	0.48 (0.37–0.61)	74 (57–94)			0.011 (<0.01–0.021)	1.6 (0.61–3.2)
Somalia	15	39 (25–56)	262 (169–374)	0.47 (0.29–0.69)	3.1 (2.0–4.6)	4 (2.2–6.3)	27 (15–42)
South Africa	58	301 (215–400)	520 (373–691)	177 (127–235)	306 (219–406)	11 (7.2–16)	19 (12–28)
South Sudan	11	16 (10–23)	146 (95–209)	1.9 (1.2–2.8)	18 (11–25)	0.53 (0.24–0.95)	4.8 (2.1–8.6)
Spain	47	4.4 (3.8–5.1)	9.4 (8.1–11)	0.31 (0.11–0.63)	0.67 (0.23–1.4)	0.24 (0.17–0.33)	0.52 (0.36–0.71)
Sri Lanka	21	14 (10–18)	64 (47–83)	0.056 (0.034–0.084)	0.27 (0.16–0.40)	0.026 (<0.01–0.079)	0.12 (<0.1–0.37)
Sudan	42	30 (21–41)	71 (49–98)	0.97 (0.30–2.0)	2.3 (0.72–4.8)	1.1 (0.61–1.7)	2.6 (1.5–4.1)
Suriname	< 1	0.22 (0.17–0.28)	38 (29–48)	0.032 (0.019–0.049)	5.6 (3.4–8.4)	0.027 (0.014–0.045)	4.7 (2.4–7.7)
Sweden	10	0.55 (0.47–0.63)	5.5 (4.7–6.4)	0.012 (<0.01–0.019)	0.12 (<0.1–0.19)	0.017 (<0.01–0.030)	0.17 (<0.1–0.30)
Switzerland	9	0.54 (0.47–0.63)	6.4 (5.5–7.4)	0.026 (0.015–0.040)	0.3 (0.17–0.47)	0.018 (<0.01–0.035)	0.21 (<0.1–0.41)
Syrian Arab Republic	17	3.3 (2.5–4.2)	19 (15–25)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.13 (0.061–0.22)	0.76 (0.36–1.3)
Tajikistan	9	7.6 (5.9–9.6)	84 (64–105)	0.31 (0.23–0.40)	3.4 (2.5–4.4)	1.9 (1.4–2.4)	20 (15–26)
Thailand	69	106 (81–136)	153 (116–195)	11 (8.2–14)	15 (12–20)	4 (2.3–6.1)	5.7 (3.3–8.8)
Timor-Leste	1	6.3 (4.1–9.0)	498 (322–711)	0.077 (0.044–0.12)	6.1 (3.5–9.5)	0.24 (0.082–0.48)	19 (6.4–38)
Togo	8	2.8 (2.3–3.4)	36 (29–43)	0.49 (0.39–0.60)	6.2 (4.9–7.6)	0.048 (0.024–0.081)	0.61 (0.30–1.0)
Tokelau	< 1	0 (0–<0.01)	31 (23–39)			<0.01 (<0.01–<0.01)	2.7 (0.58–6.4)
Tonga	< 1	0.01 (<0.01–0.012)	10 (8.6–12)	0 (0–<0.01)	0 (0–1.7)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Trinidad and Tobago	1	0.29 (0.25–0.34)	21 (18–24)	0.044 (0.030–0.060)	3.2 (2.2–4.3)	<0.01 (<0.01–<0.01)	0.11 (<0.1–0.16)
Tunisia	12	4 (3.1–5.1)	35 (27–44)	0.038 (0.023–0.057)	0.33 (0.20–0.50)	0.053 (0.027–0.089)	0.46 (0.23–0.77)
Turkey	82	13 (11–15)	16 (14–19)	0.11 (0.082–0.14)	0.13 (0.10–0.17)	0.55 (0.44–0.67)	0.67 (0.53–0.82)
Turkmenistan	6	2.7 (2.1–3.4)	46 (35–58)	0.65 (0.33–1.1)	11 (5.7–19)	0.8 (0.59–1.0)	14 (10–18)

[a] Rates are per 100 000 population.

TABLE A4.1

TB incidence estimates, 2018

	Population (millions)	Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
		Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Turks and Caicos Islands	< 1	<0.01 (<0.01–<0.01)	6.1 (5.2–7.1)			<0.01 (<0.01–<0.01)	0.3 (0.17–0.46)
Tuvalu	< 1	0.031 (0.027–0.036)	270 (231–312)	0 (0–<0.01)	0 (0–17)	<0.01 (<0.01–<0.01)	2.5 (1.4–3.9)
Uganda	43	86 (50–130)	200 (118–304)	34 (20–52)	81 (47–123)	1.5 (0.82–2.3)	3.5 (1.9–5.4)
Ukraine	44	36 (23–51)	80 (52–115)	8.2 (5.3–12)	18 (12–26)	13 (8.1–18)	29 (18–41)
United Arab Emirates	10	0.099 (0.085–0.11)	1 (0.88–1.2)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	<0.01 (<0.01–0.013)	<0.1 (<0.1–0.13)
United Kingdom of Great Britain and Northern Ireland	67	5.4 (4.8–5.9)	8 (7.2–8.8)	0.15 (0.12–0.18)	0.23 (0.18–0.27)	0.093 (0.062–0.13)	0.14 (<0.1–0.19)
United Republic of Tanzania	56	142 (67–245)	253 (119–435)	40 (19–69)	71 (34–122)	1.9 (0.67–3.7)	3.3 (1.2–6.6)
United States of America	327	9.8 (8.4–11)	3 (2.6–3.5)	0.5 (0.42–0.60)	0.15 (0.13–0.18)	0.21 (0.16–0.27)	<0.1 (<0.1–<0.1)
Uruguay	3	1.2 (0.99–1.3)	33 (29–39)	0.19 (0.15–0.23)	5.5 (4.4–6.6)	<0.01 (<0.01–0.011)	0.12 (<0.1–0.33)
Uzbekistan	32	23 (16–31)	70 (49–95)	1 (0.70–1.4)	3.1 (2.2–4.3)	4.7 (3.2–6.6)	15 (9.9–20)
Vanuatu	< 1	0.13 (0.10–0.17)	46 (35–59)	0 (0–<0.01)	0 (0–0.93)	<0.01 (<0.01–0.019)	2.3 (0.28–6.3)
Venezuela (Bolivarian Republic of)	29	14 (11–17)	48 (37–60)	1.2 (0.41–2.5)	4.2 (1.4–8.6)	0.4 (0.15–0.77)	1.4 (0.52–2.7)
Viet Nam	96	174 (111–251)	182 (116–263)	6 (3.8–8.6)	6.2 (4.0–9.0)	8.6 (5.4–13)	9.1 (5.7–13)
Wallis and Futuna Islands	< 1	0 (0–0)	0 (0–0)			0 (0–0)	0 (0–0)
West Bank and Gaza Strip	5	0.038 (0.029–0.047)	0.77 (0.59–0.98)	0 (0–<0.01)	0 (0–<0.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Yemen	28	14 (12–15)	48 (42–54)	0.12 (0.050–0.23)	0.43 (0.18–0.80)	0.36 (0.18–0.61)	1.3 (0.62–2.1)
Zambia	17	60 (39–86)	346 (225–493)	36 (23–51)	205 (133–293)	3.1 (1.6–5.0)	18 (9.4–29)
Zimbabwe	14	30 (22–39)	210 (155–272)	19 (14–24)	130 (96–169)	1.5 (1.1–2.0)	10 (7.4–14)
WHO regions							
African Region	1 064	2 450 (2 190–2 730)	231 (206–257)	615 (539–697)	58 (51–66)	77 (65–91)	7.3 (6.1–8.5)
Region of the Americas	1 005	289 (268–310)	29 (27–31)	29 (27–31)	2.9 (2.6–3.1)	11 (9.2–12)	1 (0.92–1.2)
Eastern Mediterranean Region	704	810 (639–1 000)	115 (91–142)	6.9 (5.3–8.8)	0.99 (0.75–1.3)	38 (28–50)	5.5 (4.0–7.2)
European Region	927	259 (225–296)	28 (24–32)	30 (23–37)	3.2 (2.5–4.0)	77 (60–95)	8.3 (6.5–10)
South-East Asia Region	1 982	4 370 (3 480–5 370)	220 (175–271)	140 (107–178)	7.1 (5.4–9.0)	182 (126–249)	9.2 (6.3–13)
Western Pacific Region	1 922	1 840 (1 520–2 180)	96 (79–114)	41 (30–53)	2.1 (1.5–2.8)	99 (79–122)	5.2 (4.1–6.4)
Global	7 604	10 000 (8 990–11 100)	132 (118–146)	862 (776–952)	11 (10–13)	484 (417–556)	6.4 (5.5–7.3)

[a] Rates are per 100 000 population.

TABLE A4.2

Estimates of TB mortality, 2018. Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the *International Classification of Diseases.*

		Mortality (HIV-negative people)		Mortality (HIV-positive people)		Mortality (HIV-negative and HIV-positive people)[b]	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Afghanistan	37	11 (6.4–16)	29 (17–44)	0.098 (0.036–0.19)	0.26 (0.10–0.52)	11 (6.5–16)	29 (17–44)
Albania	3	<0.01 (<0.01–0.014)	0.29 (0.15–0.48)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.01 (<0.01–0.015)	0.34 (0.19–0.52)
Algeria	42	3.2 (2.1–4.6)	7.6 (4.9–11)	0.053 (0.028–0.085)	0.13 (<0.1–0.20)	3.3 (2.1–4.6)	7.7 (5.0–11)
American Samoa	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Andorra	< 1	0 (0–0)	0.25 (0.15–0.36)	0 (0–0)	0 (0–0)	0 (0–0)	0.25 (0.15–0.36)
Angola	31	19 (11–28)	60 (36–91)	3.7 (2.4–5.3)	12 (7.9–17)	22 (14–32)	72 (47–103)
Anguilla	< 1	<0.01 (<0.01–<0.01)	9.3 (5.3–14)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	9.3 (5.3–14)
Antigua and Barbuda	< 1	<0.01 (<0.01–<0.01)	1.2 (1.1–1.3)	0 (0–0)	0 (0–0.24)	<0.01 (<0.01–<0.01)	1.2 (1.1–1.3)
Argentina	44	0.64 (0.62–0.66)	1.4 (1.4–1.5)	0.15 (0.076–0.24)	0.33 (0.17–0.54)	0.79 (0.71–0.87)	1.8 (1.6–2.0)
Armenia	3	0.018 (0.018–0.019)	0.62 (0.61–0.64)	0.02 (0.013–0.028)	0.66 (0.43–0.94)	0.038 (0.031–0.046)	1.3 (1.0–1.6)
Aruba	< 1	0 (0–<0.01)	0.45 (0.27–0.66)	0 (0–0)	0 (0–0)	0 (0–<0.01)	0.45 (0.27–0.66)
Australia	25	0.05 (0.050–0.051)	0.2 (0.20–0.20)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.055 (0.052–0.057)	0.22 (0.21–0.23)
Austria	9	0.035 (0.034–0.036)	0.39 (0.39–0.40)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.037 (0.036–0.039)	0.42 (0.40–0.43)
Azerbaijan	10	1 (0.96–1.1)	10 (9.6–11)	0.018 (0.011–0.025)	0.18 (0.11–0.25)	1 (0.97–1.1)	10 (9.8–11)
Bahamas	< 1	<0.01 (<0.01–<0.01)	0.16 (0.14–0.19)	<0.01 (<0.01–<0.01)	0.48 (0.21–0.86)	<0.01 (<0.01–<0.01)	0.65 (0.36–1.0)
Bahrain	2	<0.01 (<0.01–<0.01)	0.51 (0.48–0.54)	0 (0–0)	<0.1 (0–<0.1)	<0.01 (<0.01–<0.01)	0.52 (0.48–0.55)
Bangladesh	161	47 (30–67)	29 (18–42)	0.19 (0.094–0.32)	0.12 (<0.1–0.20)	47 (30–67)	29 (19–42)
Barbados	< 1	<0.01 (<0.01–<0.01)	0.9 (0.78–1.0)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	0.91 (0.79–1.0)
Belarus	9	0.51 (0.48–0.55)	5.4 (5.0–5.8)	0.047 (0.032–0.065)	0.5 (0.34–0.69)	0.56 (0.52–0.60)	5.9 (5.5–6.3)
Belgium	11	0.033 (0.032–0.035)	0.29 (0.28–0.30)	<0.01 (<0.01–0.013)	<0.1 (<0.1–0.11)	0.039 (0.033–0.045)	0.34 (0.29–0.40)
Belize	< 1	<0.01 (<0.01–<0.01)	2.3 (2.1–2.4)	<0.01 (<0.01–<0.01)	1.5 (0.94–2.3)	0.015 (0.012–0.017)	3.8 (3.1–4.5)
Benin	11	1 (0.60–1.5)	8.8 (5.2–13)	0.32 (0.20–0.46)	2.8 (1.8–4.0)	1.3 (0.89–1.9)	12 (7.8–16)
Bermuda	< 1	0 (0–0)	0.3 (0.15–0.51)	0 (0–0)	0 (0–0.24)	0 (0–0)	0.3 (0.15–0.51)
Bhutan	< 1	0.12 (0.079–0.18)	16 (10–23)	<0.01 (0–<0.01)	<0.1 (0–0.23)	0.12 (0.079–0.18)	16 (11–24)
Bolivia (Plurinational State of)	11	1.2 (0.88–1.6)	11 (7.8–14)	0.19 (0.12–0.27)	1.7 (1.1–2.4)	1.4 (1.1–1.8)	12 (9.3–16)
Bonaire, Saint Eustatius and Saba	< 1	0 (0–0)	0.28 (0.17–0.41)	0 (0–0)	0 (0–0)	0 (0–0)	0.28 (0.17–0.41)
Bosnia and Herzegovina	3	0.1 (0.094–0.11)	3 (2.8–3.2)	0 (0–<0.01)	<0.1 (<0.1–<0.1)	0.1 (0.094–0.11)	3 (2.8–3.3)
Botswana	2	0.56 (0.37–0.78)	25 (17–35)	1.2 (0.88–1.6)	53 (39–70)	1.8 (1.4–2.2)	78 (61–97)
Brazil	209	4.8 (4.6–5.0)	2.3 (2.2–2.4)	1.9 (1.4–2.4)	0.88 (0.66–1.1)	6.7 (6.1–7.2)	3.2 (2.9–3.4)
British Virgin Islands	< 1	0 (0–0)	0.32 (0.19–0.47)	0 (0–0)	0 (0–0)	0 (0–0)	0.32 (0.19–0.47)
Brunei Darussalam	< 1	0.016 (0.015–0.016)	3.6 (3.6–3.7)	<0.01 (0–<0.01)	0.12 (<0.1–0.35)	0.016 (0.015–0.017)	3.8 (3.6–4.0)
Bulgaria	7	0.071 (0.069–0.072)	1 (0.97–1.0)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.12)	0.074 (0.070–0.079)	1.1 (1.0–1.1)
Burkina Faso	20	1.5 (0.91–2.3)	7.8 (4.6–12)	0.31 (0.20–0.44)	1.6 (1.0–2.2)	1.8 (1.2–2.6)	9.3 (6.1–13)
Burundi	11	2.2 (1.3–3.3)	19 (12–29)	0.48 (0.30–0.69)	4.3 (2.7–6.2)	2.6 (1.7–3.8)	24 (15–34)
Cabo Verde	< 1	0.022 (0.020–0.024)	4.1 (3.7–4.5)	<0.01 (<0.01–0.011)	1.3 (0.78–2.1)	0.029 (0.025–0.034)	5.4 (4.7–6.2)
Cambodia	16	3 (1.9–4.3)	18 (12–26)	0.38 (0.21–0.60)	2.3 (1.3–3.7)	3.4 (2.3–4.6)	21 (14–29)
Cameroon	25	7.7 (4.6–12)	31 (18–47)	5.7 (3.6–8.2)	23 (14–33)	13 (9.5–18)	53 (38–72)
Canada	37	0.12 (0.12–0.12)	0.33 (0.33–0.33)	0.013 (<0.01–0.028)	<0.1 (<0.1–<0.1)	0.14 (0.12–0.15)	0.36 (0.33–0.40)
Cayman Islands	< 1	0 (0–0)	0.44 (0.23–0.73)	0 (0–0)	0 (0–0.30)	0 (0–0)	0.44 (0.23–0.73)
Central African Republic	5	4.8 (2.8–7.3)	103 (60–157)	3.1 (2.0–4.5)	67 (42–97)	7.9 (5.5–11)	169 (118–229)
Chad	15	3.5 (2.1–5.3)	23 (14–34)	1.4 (0.90–2.0)	8.9 (5.8–13)	4.9 (3.3–6.8)	32 (22–44)
Chile	19	0.41 (0.39–0.43)	2.2 (2.1–2.3)	0.058 (0.042–0.077)	0.31 (0.22–0.41)	0.47 (0.44–0.49)	2.5 (2.4–2.6)
China	1 428	37 (34–41)	2.6 (2.4–2.9)	2.4 (1.2–4.0)	0.17 (<0.1–0.28)	40 (36–44)	2.8 (2.5–3.1)
China, Hong Kong SAR	7	0.15 (0.15–0.16)	2.1 (2.0–2.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.12)	0.16 (0.15–0.16)	2.1 (2.1–2.2)
China, Macao SAR	< 1	0.031 (0.019–0.045)	4.8 (3.0–7.2)	<0.01 (0–<0.01)	0.1 (<0.1–0.26)	0.031 (0.019–0.046)	4.9 (3.1–7.3)
Colombia	50	1.3 (1.1–1.5)	2.6 (2.2–3.0)	0.45 (0.33–0.59)	0.91 (0.67–1.2)	1.7 (1.5–2.0)	3.5 (3.1–4.0)
Comoros	< 1	0.073 (0.043–0.11)	8.7 (5.1–13)	0 (0–<0.01)	<0.1 (<0.1–0.15)	0.073 (0.043–0.11)	8.8 (5.2–13)
Congo	5	3 (1.7–4.6)	57 (32–89)	2.3 (1.2–3.8)	43 (22–72)	5.3 (3.4–7.4)	100 (66–142)
Cook Islands	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Costa Rica	5	0.039 (0.035–0.044)	0.79 (0.71–0.88)	0.011 (<0.01–0.017)	0.22 (0.14–0.33)	0.051 (0.044–0.057)	1 (0.89–1.1)
Côte d'Ivoire	25	5.6 (3.3–8.4)	22 (13–34)	2.5 (1.6–3.6)	10 (6.4–15)	8.1 (5.6–11)	32 (22–44)
Croatia	4	0.034 (0.034–0.035)	0.83 (0.82–0.83)	0 (0–<0.01)	<0.1 (<0.1–<0.1)	0.035 (0.034–0.035)	0.84 (0.83–0.85)
Cuba	11	0.042 (0.042–0.042)	0.37 (0.37–0.37)	0.014 (<0.01–0.020)	0.12 (<0.1–0.18)	0.056 (0.050–0.062)	0.49 (0.44–0.55)
Curaçao	< 1	<0.01 (<0.01–<0.01)	0.53 (0.32–0.78)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	0.53 (0.32–0.78)
Cyprus	1	<0.01 (<0.01–<0.01)	0.26 (0.20–0.33)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	0.26 (0.20–0.33)
Czechia	11	0.037 (0.036–0.037)	0.34 (0.34–0.35)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.037 (0.037–0.038)	0.35 (0.35–0.36)
Democratic People's Republic of Korea	26	20 (14–27)	80 (56–107)	0.068 (0.035–0.11)	0.27 (0.14–0.44)	20 (14–27)	80 (56–107)
Democratic Republic of the Congo	84	43 (25–65)	51 (30–77)	10 (3.2–22)	12 (3.8–26)	53 (33–77)	63 (39–92)
Denmark	6	0.018 (0.017–0.018)	0.31 (0.29–0.32)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.019 (0.017–0.020)	0.33 (0.30–0.35)
Djibouti	< 1	0.26 (0.17–0.38)	28 (18–40)	0.019 (0.013–0.027)	2 (1.3–2.8)	0.28 (0.19–0.40)	30 (20–42)
Dominica	< 1	<0.01 (<0.01–<0.01)	4.1 (4.0–4.3)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	4.1 (4.0–4.3)
Dominican Republic	11	0.25 (0.11–0.46)	2.4 (0.99–4.4)	0.26 (0.19–0.34)	2.5 (1.8–3.2)	0.51 (0.34–0.73)	4.8 (3.2–6.8)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

TABLE A4.2

Estimates of TB mortality, 2018. Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the *International Classification of Diseases.*

		Mortality (HIV-negative people)		Mortality (HIV-positive people)		Mortality (HIV-negative and HIV-positive people)[b]	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Ecuador	17	0.46 (0.36–0.56)	2.7 (2.1–3.3)	0.21 (0.15–0.28)	1.2 (0.88–1.6)	0.67 (0.55–0.79)	3.9 (3.2–4.6)
Egypt	98	0.42 (0.38–0.47)	0.43 (0.39–0.48)	0.031 (0.014–0.054)	<0.1 (<0.1–<0.1)	0.45 (0.41–0.50)	0.46 (0.41–0.51)
El Salvador	6	0.078 (0.062–0.097)	1.2 (0.96–1.5)	0.055 (0.038–0.075)	0.86 (0.60–1.2)	0.13 (0.11–0.16)	2.1 (1.7–2.5)
Equatorial Guinea	1	0.38 (0.27–0.51)	29 (21–39)	0.4 (0.32–0.50)	31 (24–38)	0.79 (0.64–0.94)	60 (49–72)
Eritrea	3	0.55 (0.25–0.98)	16 (7.2–28)	0.047 (0.021–0.083)	1.4 (0.62–2.4)	0.6 (0.29–1.0)	17 (8.4–30)
Estonia	1	0.01 (0.010–0.011)	0.76 (0.72–0.80)	<0.01 (<0.01–<0.01)	0.18 (<0.1–0.31)	0.012 (0.011–0.014)	0.94 (0.82–1.1)
Eswatini	1	0.14 (0.089–0.20)	12 (7.8–18)	0.51 (0.35–0.69)	45 (31–61)	0.64 (0.48–0.84)	57 (42–74)
Ethiopia	109	24 (15–36)	22 (14–33)	2.2 (1.5–3.0)	2 (1.4–2.8)	27 (18–38)	24 (16–34)
Fiji	< 1	0.038 (0.037–0.038)	4.2 (4.2–4.3)	<0.01 (<0.01–<0.01)	0.6 (0.31–0.97)	0.043 (0.040–0.046)	4.8 (4.5–5.2)
Finland	6	0.019 (0.019–0.019)	0.34 (0.34–0.34)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.019 (0.019–0.020)	0.35 (0.34–0.36)
France	65	0.31 (0.29–0.33)	0.48 (0.44–0.51)	0.067 (0.044–0.094)	0.1 (<0.1–0.14)	0.38 (0.34–0.41)	0.58 (0.53–0.63)
French Polynesia	< 1	<0.01 (<0.01–<0.01)	1.8 (1.1–2.7)	0 (0–0)	0 (0–0.12)	<0.01 (<0.01–<0.01)	1.8 (1.1–2.7)
Gabon	2	1.6 (0.79–2.6)	75 (37–125)	0.58 (<0.01–2.4)	27 (0.29–111)	2.2 (1.3–3.2)	102 (61–153)
Gambia	2	0.6 (0.40–0.84)	26 (17–37)	0.28 (0.20–0.37)	12 (8.8–16)	0.88 (0.66–1.1)	38 (29–50)
Georgia	4	0.16 (0.15–0.18)	4 (3.6–4.4)	0.017 (0.011–0.025)	0.43 (0.28–0.61)	0.18 (0.16–0.19)	4.4 (4.0–4.8)
Germany	83	0.3 (0.29–0.31)	0.36 (0.35–0.37)	0.023 (0.011–0.039)	<0.1 (<0.1–<0.1)	0.32 (0.31–0.34)	0.39 (0.37–0.41)
Ghana	30	11 (4.8–19)	36 (16–64)	4.8 (2.3–8.1)	16 (7.7–27)	16 (8.8–24)	52 (30–81)
Greece	11	0.048 (0.046–0.051)	0.46 (0.44–0.48)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.051 (0.048–0.054)	0.48 (0.46–0.51)
Greenland	< 1	<0.01 (<0.01–<0.01)	8 (4.9–12)	0 (0–<0.01)	0.32 (0–1.6)	<0.01 (<0.01–<0.01)	8.3 (5.2–12)
Grenada	< 1	<0.01 (<0.01–<0.01)	1.5 (1.5–1.5)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	1.5 (1.5–1.5)
Guam	< 1	<0.01 (<0.01–0.010)	4 (2.5–6.0)	0 (0–0)	0 (0–0.20)	<0.01 (<0.01–0.010)	4 (2.5–6.0)
Guatemala	17	0.31 (0.28–0.33)	1.8 (1.7–1.9)	0.064 (0.043–0.088)	0.37 (0.25–0.51)	0.37 (0.34–0.40)	2.1 (2.0–2.3)
Guinea	12	2.8 (1.7–4.2)	22 (13–34)	1.7 (1.1–2.4)	14 (8.8–19)	4.5 (3.1–6.0)	36 (25–48)
Guinea-Bissau	2	1.4 (0.79–2.1)	72 (42–111)	1.4 (0.85–2.0)	73 (45–106)	2.7 (1.9–3.7)	145 (102–195)
Guyana	< 1	0.12 (0.11–0.12)	15 (14–16)	0.025 (0.017–0.035)	3.3 (2.2–4.5)	0.14 (0.13–0.15)	18 (17–20)
Haiti	11	1 (0.69–1.4)	9.2 (6.2–13)	0.86 (0.63–1.1)	7.7 (5.7–10)	1.9 (1.5–2.4)	17 (13–21)
Honduras	10	0.43 (0.35–0.51)	4.4 (3.7–5.3)	0.047 (0.032–0.065)	0.49 (0.33–0.68)	0.47 (0.40–0.55)	4.9 (4.2–5.8)
Hungary	10	0.043 (0.043–0.043)	0.44 (0.44–0.44)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.044 (0.043–0.044)	0.45 (0.44–0.46)
Iceland	< 1	<0.01 (<0.01–<0.01)	0.4 (0.40–0.40)	0 (0–0)	<0.1 (0–<0.1)	<0.01 (<0.01–<0.01)	0.41 (0.40–0.42)
India	1 353	440 (408–472)	32 (30–35)	9.7 (5.7–15)	0.72 (0.42–1.1)	449 (418–482)	33 (31–36)
Indonesia	268	93 (87–99)	35 (33–37)	5.3 (2.1–9.8)	2 (0.79–3.7)	98 (91–106)	37 (34–39)
Iran (Islamic Republic of)	82	0.87 (0.81–0.93)	1.1 (0.99–1.1)	0.08 (0.056–0.11)	0.1 (<0.1–0.13)	0.95 (0.88–1.0)	1.2 (1.1–1.2)
Iraq	38	0.86 (0.78–0.94)	2.2 (2.0–2.5)	0 (0–<0.01)	0 (0–0)	0.86 (0.78–0.94)	2.2 (2.0–2.5)
Ireland	5	0.019 (0.019–0.019)	0.39 (0.39–0.39)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.02 (0.019–0.022)	0.42 (0.40–0.45)
Israel	8	0.016 (0.015–0.016)	0.19 (0.18–0.19)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.018 (0.016–0.019)	0.21 (0.19–0.23)
Italy	61	0.34 (0.34–0.34)	0.56 (0.55–0.57)	0.031 (0.015–0.054)	<0.1 (<0.1–<0.1)	0.37 (0.35–0.39)	0.61 (0.58–0.65)
Jamaica	3	<0.01 (<0.01–<0.01)	0.26 (0.25–0.26)	<0.01 (<0.01–<0.01)	0.15 (<0.1–0.24)	0.012 (0.010–0.015)	0.41 (0.33–0.50)
Japan	127	2.8 (2.6–2.9)	2.2 (2.1–2.3)	0.016 (<0.01–0.034)	<0.1 (0–<0.1)	2.8 (2.7–2.9)	2.2 (2.1–2.3)
Jordan	10	0.012 (<0.01–0.017)	0.12 (<0.1–0.17)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.013 (<0.01–0.018)	0.13 (<0.1–0.18)
Kazakhstan	18	0.43 (0.35–0.51)	2.3 (1.9–2.8)	0.048 (0.014–0.10)	0.26 (<0.1–0.56)	0.48 (0.39–0.57)	2.6 (2.1–3.1)
Kenya	51	19 (11–30)	38 (22–59)	13 (8.1–20)	26 (16–38)	33 (22–45)	64 (44–87)
Kiribati	< 1	0.043 (0.036–0.050)	37 (31–43)	0 (0–0)	0 (0–0)	0.043 (0.036–0.050)	37 (31–43)
Kuwait	4	0.015 (0.010–0.020)	0.36 (0.25–0.48)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.015 (0.011–0.020)	0.37 (0.27–0.49)
Kyrgyzstan	6	0.39 (0.36–0.42)	6.2 (5.8–6.7)	0.035 (0.025–0.047)	0.56 (0.40–0.75)	0.43 (0.40–0.46)	6.8 (6.3–7.3)
Lao People's Democratic Republic	7	2.1 (1.3–3.2)	30 (18–46)	0.27 (0.17–0.39)	3.8 (2.4–5.5)	2.4 (1.5–3.5)	34 (22–50)
Latvia	2	0.051 (0.051–0.052)	2.7 (2.6–2.7)	<0.01 (<0.01–0.011)	0.28 (<0.1–0.59)	0.057 (0.052–0.062)	2.9 (2.7–3.2)
Lebanon	7	0.061 (0.038–0.091)	0.89 (0.55–1.3)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.063 (0.039–0.092)	0.91 (0.57–1.3)
Lesotho	2	0.95 (0.56–1.4)	45 (27–68)	3.3 (2.1–4.7)	155 (98–223)	4.2 (2.9–5.7)	200 (139–271)
Liberia	5	2.7 (1.6–4.1)	56 (33–85)	1 (0.67–1.5)	22 (14–31)	3.8 (2.5–5.2)	78 (53–108)
Libya	7	0.42 (0.24–0.63)	6.2 (3.6–9.5)	<0.01 (<0.01–0.016)	0.14 (<0.1–0.24)	0.43 (0.25–0.64)	6.4 (3.8–9.6)
Lithuania	3	0.15 (0.15–0.15)	5.4 (5.3–5.4)	<0.01 (<0.01–<0.01)	0.21 (0.12–0.34)	0.16 (0.15–0.16)	5.6 (5.5–5.7)
Luxembourg	< 1	<0.01 (<0.01–<0.01)	0.18 (0.18–0.18)	0 (0–<0.01)	<0.1 (<0.1–0.10)	<0.01 (<0.01–<0.01)	0.24 (0.21–0.28)
Madagascar	26	13 (7.5–19)	48 (28–73)	0.38 (0.24–0.54)	1.4 (0.92–2.1)	13 (7.8–19)	49 (30–74)
Malawi	18	4.1 (2.3–6.3)	22 (13–35)	7 (4.3–10)	38 (23–57)	11 (7.7–15)	61 (42–82)
Malaysia	32	1.2 (1.1–1.4)	3.9 (3.5–4.3)	0.32 (0.24–0.42)	1 (0.75–1.3)	1.5 (1.4–1.7)	4.9 (4.4–5.4)
Maldives	< 1	<0.01 (0–<0.01)	0.15 (<0.1–0.36)	0 (0–<0.01)	0 (0–0.14)	<0.01 (0–<0.01)	0.15 (<0.1–0.36)
Mali	19	1.5 (0.88–2.2)	7.7 (4.6–11)	0.31 (0.20–0.44)	1.6 (1.1–2.3)	1.8 (1.2–2.5)	9.3 (6.1–13)
Malta	< 1	<0.01 (<0.01–<0.01)	0.45 (0.45–0.45)	<0.01 (<0.01–<0.01)	0.33 (0.13–0.64)	<0.01 (<0.01–<0.01)	0.79 (0.55–1.1)
Marshall Islands	< 1	0.028 (0.018–0.040)	48 (31–69)	0 (0–0)	0 (0–0)	0.028 (0.018–0.040)	48 (31–69)
Mauritania	4	0.78 (0.46–1.2)	18 (10–27)	0.046 (0.013–0.10)	1.1 (0.28–2.3)	0.82 (0.50–1.2)	19 (11–28)
Mauritius	1	0.02 (0.020–0.020)	1.6 (1.5–1.6)	<0.01 (<0.01–0.012)	0.61 (0.37–0.91)	0.028 (0.024–0.031)	2.2 (1.9–2.5)
Mexico	126	1.9 (1.9–1.9)	1.5 (1.5–1.5)	0.59 (0.43–0.78)	0.47 (0.34–0.62)	2.5 (2.3–2.7)	2 (1.8–2.1)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

TABLE A4.2

Estimates of TB mortality, 2018. Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the *International Classification of Diseases.*

		Mortality (HIV-negative people)		Mortality (HIV-positive people)		Mortality (HIV-negative and HIV-positive people)[b]	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Micronesia (Federated States of)	< 1	0.013 (<0.01–0.019)	12 (7.6–17)	0 (0–0)	0 (0–0)	0.013 (<0.01–0.019)	12 (7.6–17)
Monaco	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Mongolia	3	0.33 (0.29–0.37)	10 (9.1–12)	<0.01 (<0.01–0.022)	0.27 (<0.1–0.71)	0.34 (0.30–0.38)	11 (9.4–12)
Montenegro	< 1	<0.01 (<0.01–<0.01)	0.2 (0.18–0.22)	0 (0–<0.01)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	0.24 (0.20–0.29)
Montserrat	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Morocco	36	2.9 (1.8–4.3)	8 (4.9–12)	0.082 (0.023–0.18)	0.23 (<0.1–0.50)	3 (1.8–4.4)	8.2 (5.1–12)
Mozambique	29	21 (13–32)	72 (43–109)	22 (14–31)	73 (46–106)	43 (31–57)	145 (104–193)
Myanmar	54	21 (12–31)	39 (23–58)	3.7 (2.5–5.2)	6.9 (4.6–9.7)	25 (16–35)	46 (30–65)
Namibia	2	1.6 (1.0–2.3)	64 (41–92)	1.5 (1.1–2.1)	62 (43–85)	3.1 (2.3–4.0)	126 (95–162)
Nauru	< 1	0 (0–<0.01)	4.4 (2.7–6.6)	0 (0–0)	0 (0–0)	0 (0–<0.01)	4.4 (2.7–6.6)
Nepal	28	5.4 (3.8–7.3)	19 (13–26)	0.093 (0.071–0.12)	0.33 (0.25–0.42)	5.5 (3.9–7.4)	20 (14–26)
Netherlands	17	0.03 (0.030–0.031)	0.18 (0.17–0.18)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.036 (0.034–0.039)	0.21 (0.20–0.23)
New Caledonia	< 1	<0.01 (<0.01–<0.01)	1.2 (0.76–1.8)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	1.2 (0.76–1.8)
New Zealand	5	0.013 (0.013–0.013)	0.28 (0.28–0.28)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.014 (0.013–0.015)	0.3 (0.28–0.32)
Nicaragua	6	0.14 (0.11–0.16)	2.1 (1.7–2.5)	0.03 (0.020–0.041)	0.46 (0.31–0.64)	0.17 (0.14–0.20)	2.6 (2.1–3.0)
Niger	22	4 (2.3–6.0)	18 (10–27)	0.31 (0.20–0.45)	1.4 (0.88–2.0)	4.3 (2.6–6.3)	19 (12–28)
Nigeria	196	125 (73–192)	64 (37–98)	32 (20–47)	16 (10–24)	157 (102–224)	80 (52–114)
Niue	< 1	0 (0–0)	5.8 (3.5–8.6)	0 (0–0)	0.13 (<0.1–0.18)	0 (0–0)	5.9 (3.7–8.7)
North Macedonia	2	0.02 (0.020–0.021)	0.98 (0.94–1.0)	0 (0–0)	0 (0–0)	0.02 (0.020–0.021)	0.98 (0.94–1.0)
Northern Mariana Islands	< 1	<0.01 (<0.01–<0.01)	7.6 (4.7–11)	0 (0–<0.01)	0.31 (0–1.5)	<0.01 (<0.01–<0.01)	8 (4.9–12)
Norway	5	0.018 (0.018–0.019)	0.34 (0.33–0.36)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.02 (0.018–0.021)	0.37 (0.35–0.39)
Oman	5	0.018 (0.013–0.023)	0.37 (0.28–0.48)	<0.01 (0–<0.01)	<0.1 (<0.1–<0.1)	0.019 (0.014–0.025)	0.4 (0.30–0.51)
Pakistan	212	43 (35–52)	20 (16–25)	1.3 (0.83–1.8)	0.6 (0.39–0.86)	44 (36–53)	21 (17–25)
Palau	< 1	<0.01 (<0.01–<0.01)	9 (5.4–13)	0 (0–0)	0 (0–1.7)	<0.01 (<0.01–<0.01)	9 (5.4–13)
Panama	4	0.22 (0.21–0.24)	5.4 (5.1–5.7)	0.082 (0.056–0.11)	2 (1.3–2.7)	0.31 (0.28–0.34)	7.3 (6.6–8.1)
Papua New Guinea	9	4.5 (3.0–6.2)	52 (35–72)	0.25 (0.10–0.45)	2.8 (1.2–5.2)	4.7 (3.3–6.5)	55 (38–75)
Paraguay	7	0.28 (0.24–0.32)	4 (3.5–4.6)	0.042 (0.029–0.056)	0.6 (0.42–0.81)	0.32 (0.28–0.37)	4.6 (4.0–5.3)
Peru	32	2.1 (1.3–3.2)	6.7 (4.0–10)	0.51 (0.38–0.67)	1.6 (1.2–2.1)	2.7 (1.8–3.7)	8.3 (5.6–12)
Philippines	107	26 (22–30)	24 (20–28)	0.6 (0–4.2)	0.57 (0–4.0)	26 (22–30)	25 (21–28)
Poland	38	0.47 (0.44–0.50)	1.2 (1.2–1.3)	0.012 (<0.01–0.020)	<0.1 (<0.1–<0.1)	0.48 (0.45–0.51)	1.3 (1.2–1.3)
Portugal	10	0.19 (0.18–0.19)	1.8 (1.8–1.9)	0.033 (0.010–0.070)	0.32 (0.10–0.68)	0.22 (0.19–0.25)	2.2 (1.9–2.5)
Puerto Rico	3	0.012 (0.012–0.012)	0.4 (0.40–0.41)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.013 (0.012–0.014)	0.42 (0.40–0.45)
Qatar	3	<0.01 (<0.01–0.010)	0.29 (0.23–0.36)	0 (0–<0.01)	<0.1 (0–<0.1)	<0.01 (<0.01–0.010)	0.3 (0.24–0.37)
Republic of Korea	51	2.4 (2.3–2.5)	4.7 (4.4–4.9)	0.035 (0.014–0.065)	<0.1 (<0.1–0.13)	2.4 (2.3–2.6)	4.8 (4.5–5.0)
Republic of Moldova	4	0.21 (0.18–0.23)	5.1 (4.5–5.8)	0.049 (0.036–0.065)	1.2 (0.88–1.6)	0.26 (0.23–0.29)	6.3 (5.6–7.1)
Romania	20	0.86 (0.86–0.87)	4.4 (4.4–4.4)	0.052 (0.037–0.070)	0.27 (0.19–0.36)	0.91 (0.90–0.93)	4.7 (4.6–4.8)
Russian Federation	146	9.2 (8.3–10)	6.3 (5.7–7.0)	1.3 (0.57–2.2)	0.86 (0.39–1.5)	10 (9.3–12)	7.2 (6.4–8.1)
Rwanda	12	0.64 (0.41–0.91)	5.2 (3.3–7.4)	0.31 (0.22–0.42)	2.5 (1.8–3.4)	0.94 (0.69–1.2)	7.7 (5.6–10)
Saint Kitts and Nevis	< 1	<0.01 (<0.01–<0.01)	2.2 (2.0–2.3)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	2.2 (2.0–2.3)
Saint Lucia	< 1	<0.01 (<0.01–<0.01)	2.2 (2.2–2.3)	0 (0–<0.01)	0.1 (0–0.34)	<0.01 (<0.01–<0.01)	2.3 (2.2–2.5)
Saint Vincent and the Grenadines	< 1	<0.01 (<0.01–<0.01)	1.9 (1.8–1.9)	0 (0–0)	0 (0–0.23)	<0.01 (<0.01–<0.01)	1.9 (1.8–1.9)
Samoa	< 1	<0.01 (<0.01–<0.01)	0.53 (0.31–0.80)	0 (0–0)	0 (0–0.14)	<0.01 (<0.01–<0.01)	0.53 (0.31–0.80)
San Marino	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Sao Tome and Principe	< 1	0.045 (0.018–0.084)	21 (8.3–40)	0.014 (<0.01–0.028)	6.7 (2.3–13)	0.059 (0.029–0.10)	28 (14–47)
Saudi Arabia	34	0.78 (0.58–1.0)	2.3 (1.7–3.0)	<0.01 (<0.01–0.012)	<0.1 (<0.1–<0.1)	0.79 (0.59–1.0)	2.3 (1.7–3.0)
Senegal	16	2.6 (1.7–3.8)	17 (10–24)	0.25 (0.17–0.34)	1.6 (1.1–2.2)	2.9 (1.9–4.0)	18 (12–25)
Serbia	9	0.055 (0.050–0.061)	0.63 (0.57–0.69)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.056 (0.051–0.062)	0.64 (0.58–0.70)
Seychelles	< 1	0 (0–0)	0.14 (<0.1–0.22)	0 (0–<0.01)	0.18 (0–0.82)	0 (0–0)	0.32 (0.21–0.45)
Sierra Leone	8	2.6 (1.5–3.9)	33 (20–51)	0.7 (0.44–1.0)	9.2 (5.8–13)	3.3 (2.2–4.6)	43 (28–60)
Singapore	6	0.051 (0.037–0.067)	0.89 (0.64–1.2)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.15)	0.057 (0.042–0.073)	0.98 (0.73–1.3)
Sint Maarten (Dutch part)	< 1	<0.01 (0–<0.01)	1.6 (0.97–2.3)	0 (0–0)	0 (0–0)	<0.01 (0–<0.01)	1.6 (0.97–2.3)
Slovakia	5	0.035 (0.035–0.035)	0.64 (0.63–0.65)	0 (0–<0.01)	0 (0–<0.1)	0.035 (0.035–0.036)	0.64 (0.63–0.66)
Slovenia	2	0.012 (0.012–0.012)	0.57 (0.56–0.57)	0 (0–0)	<0.1 (0–<0.1)	0.012 (0.012–0.012)	0.58 (0.57–0.59)
Solomon Islands	< 1	0.053 (0.034–0.076)	8.2 (5.2–12)	0 (0–0)	0 (0–0)	0.053 (0.034–0.076)	8.2 (5.2–12)
Somalia	15	10 (5.9–15)	67 (40–103)	0.23 (0.14–0.34)	1.5 (0.93–2.2)	10 (6.1–16)	69 (41–104)
South Africa	58	21 (20–23)	37 (35–39)	42 (30–57)	73 (51–99)	64 (51–78)	110 (88–136)
South Sudan	11	0.93 (0.46–1.6)	8.4 (4.2–14)	0.25 (0.15–0.38)	2.3 (1.3–3.5)	1.2 (0.68–1.8)	11 (6.2–16)
Spain	47	0.26 (0.26–0.27)	0.56 (0.55–0.57)	0.048 (0.014–0.10)	0.1 (<0.1–0.22)	0.31 (0.26–0.36)	0.66 (0.57–0.76)
Sri Lanka	21	0.81 (0.66–0.98)	3.8 (3.1–4.6)	0.018 (0.011–0.028)	<0.1 (<0.1–0.13)	0.83 (0.68–1.0)	3.9 (3.2–4.7)
Sudan	42	4.6 (2.9–6.8)	11 (6.9–16)	0.3 (0.093–0.63)	0.72 (0.22–1.5)	4.9 (3.1–7.1)	12 (7.5–17)
Suriname	< 1	0.016 (0.013–0.019)	2.8 (2.3–3.3)	<0.01 (<0.01–0.010)	1.2 (0.67–1.8)	0.023 (0.019–0.027)	4 (3.2–4.7)
Sweden	10	0.026 (0.026–0.027)	0.26 (0.26–0.27)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.028 (0.027–0.029)	0.28 (0.27–0.29)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

TABLE A4.2

Estimates of TB mortality, 2018. Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the *International Classification of Diseases.*

	Population (millions)	Mortality (HIV-negative people)		Mortality (HIV-positive people)		Mortality (HIV-negative and HIV-positive people)[b]	
		Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Switzerland	9	0.027 (0.025–0.028)	0.31 (0.30–0.33)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.031 (0.028–0.033)	0.36 (0.33–0.39)
Syrian Arab Republic	17	0.043 (0.035–0.051)	0.25 (0.21–0.30)	<0.01 (0–<0.01)	0 (0–<0.1)	0.043 (0.036–0.052)	0.26 (0.21–0.30)
Tajikistan	9	0.74 (0.67–0.82)	8.2 (7.3–9.1)	0.076 (0.054–0.10)	0.84 (0.60–1.1)	0.82 (0.74–0.91)	9 (8.1–9.9)
Thailand	69	9.2 (6.9–12)	13 (9.9–17)	2.3 (1.7–3.0)	3.3 (2.4–4.4)	11 (9.1–14)	17 (13–20)
Timor-Leste	1	1.2 (0.71–1.8)	94 (56–142)	<0.01 (0–0.025)	0.39 (0–2.0)	1.2 (0.71–1.8)	94 (56–142)
Togo	8	0.21 (0.13–0.31)	2.7 (1.7–3.9)	0.082 (0.055–0.11)	1 (0.70–1.5)	0.29 (0.21–0.39)	3.7 (2.6–5.0)
Tokelau	< 1	0 (0–0)	3.4 (2.2–4.8)	0 (0–0)	0 (0–0)	0 (0–0)	3.4 (2.2–4.8)
Tonga	< 1	<0.01 (0–<0.01)	0.82 (0.48–1.3)	0 (0–0)	0 (0–0.26)	<0.01 (0–<0.01)	0.82 (0.48–1.3)
Trinidad and Tobago	1	0.022 (0.019–0.025)	1.6 (1.4–1.8)	<0.01 (<0.01–0.011)	0.54 (0.34–0.78)	0.029 (0.025–0.034)	2.1 (1.8–2.4)
Tunisia	12	0.14 (0.10–0.18)	1.2 (0.89–1.6)	<0.01 (<0.01–0.012)	<0.1 (<0.1–0.11)	0.15 (0.11–0.19)	1.3 (0.96–1.6)
Turkey	82	0.4 (0.37–0.44)	0.49 (0.45–0.53)	0.018 (0.012–0.025)	<0.1 (<0.1–<0.1)	0.42 (0.39–0.46)	0.51 (0.47–0.55)
Turkmenistan	6	0.61 (0.54–0.70)	11 (9.2–12)	0.13 (0.063–0.23)	2.3 (1.1–3.9)	0.75 (0.64–0.87)	13 (11–15)
Turks and Caicos Islands	< 1	0 (0–0)	0.5 (0.31–0.74)	0 (0–0)	0 (0–0)	0 (0–0)	0.5 (0.31–0.74)
Tuvalu	< 1	<0.01 (<0.01–<0.01)	22 (13–33)	0 (0–0)	0 (0–2.7)	<0.01 (<0.01–<0.01)	22 (13–33)
Uganda	43	8.6 (4.8–14)	20 (11–32)	11 (6.4–16)	25 (15–38)	19 (13–27)	45 (31–62)
Ukraine	44	3.7 (3.2–4.1)	8.3 (7.3–9.3)	2 (1.3–2.9)	4.6 (3.0–6.5)	5.7 (4.8–6.6)	13 (11–15)
United Arab Emirates	10	0.065 (0.037–0.099)	0.67 (0.39–1.0)	0 (0–<0.01)	0 (0–<0.1)	0.065 (0.038–0.10)	0.68 (0.39–1.0)
United Kingdom of Great Britain and Northern Ireland	67	0.3 (0.30–0.31)	0.45 (0.45–0.46)	0.023 (0.015–0.031)	<0.1 (<0.1–<0.1)	0.33 (0.32–0.34)	0.49 (0.47–0.50)
United Republic of Tanzania	56	22 (10–40)	40 (18–70)	16 (7.8–27)	29 (14–49)	39 (23–58)	69 (41–104)
United States of America	327	0.58 (0.57–0.59)	0.18 (0.17–0.18)	0.077 (0.050–0.11)	<0.1 (<0.1–<0.1)	0.66 (0.63–0.69)	0.2 (0.19–0.21)
Uruguay	3	0.073 (0.070–0.076)	2.1 (2.0–2.2)	0.031 (0.022–0.041)	0.89 (0.63–1.2)	0.1 (0.094–0.11)	3 (2.7–3.3)
Uzbekistan	32	1.7 (1.6–1.8)	5.2 (4.8–5.5)	0.27 (0.19–0.38)	0.84 (0.57–1.2)	2 (1.8–2.1)	6 (5.6–6.5)
Vanuatu	< 1	0.022 (0.014–0.031)	7.5 (4.9–11)	0 (0–<0.01)	0 (0–0.30)	0.022 (0.014–0.031)	7.5 (4.9–11)
Venezuela (Bolivarian Republic of)	29	0.73 (0.69–0.78)	2.5 (2.4–2.7)	0.27 (0.088–0.55)	0.94 (0.30–1.9)	1 (0.78–1.3)	3.5 (2.7–4.4)
Viet Nam	96	11 (6.7–15)	11 (7.0–16)	2.2 (1.4–3.2)	2.3 (1.5–3.4)	13 (8.7–17)	13 (9.1–18)
Wallis and Futuna Islands	< 1	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
West Bank and Gaza Strip	5	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.12)	0 (0–<0.01)	0 (0–<0.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.12)
Yemen	28	2 (1.4–2.6)	6.9 (4.8–9.2)	0.035 (0.014–0.067)	0.12 (<0.1–0.24)	2 (1.4–2.7)	7 (4.9–9.4)
Zambia	17	4.8 (2.9–7.3)	28 (16–42)	13 (8.3–19)	74 (48–107)	18 (13–24)	102 (72–137)
Zimbabwe	14	1.1 (0.69–1.7)	7.7 (4.8–11)	3.5 (2.4–4.8)	24 (16–33)	4.6 (3.4–6.0)	32 (23–41)
WHO regions							
African Region	1 064	397 (331–468)	37 (31–44)	211 (184–239)	20 (17–22)	608 (536–684)	57 (50–64)
Region of the Americas	1 005	17 (16–19)	1.7 (1.6–1.8)	5.9 (5.3–6.6)	0.59 (0.52–0.66)	23 (22–25)	2.3 (2.2–2.5)
Eastern Mediterranean Region	704	77 (66–89)	11 (9.4–13)	2.2 (1.6–2.8)	0.31 (0.23–0.40)	79 (69–91)	11 (9.7–13)
European Region	927	23 (22–24)	2.5 (2.4–2.6)	4.4 (3.3–5.6)	0.47 (0.36–0.60)	27 (26–29)	3 (2.8–3.1)
South-East Asia Region	1 982	637 (598–677)	32 (30–34)	21 (16–28)	1.1 (0.79–1.4)	659 (619–699)	33 (31–35)
Western Pacific Region	1 922	90 (83–98)	4.7 (4.3–5.1)	6.5 (4.9–8.4)	0.34 (0.25–0.43)	97 (90–105)	5 (4.7–5.4)
Global	7 604	1 240 (1 160–1 320)	16 (15–17)	251 (224–280)	3.3 (2.9–3.7)	1 490 (1 410–1 580)	20 (19–21)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

TABLE A4.3

Measured percentage of TB cases with MDR/RR-TB,[a] most recent year available

	New TB cases				Previously treated TB cases			
	Year	Source	Coverage	Percentage	Year	Source	Coverage	Percentage
Afghanistan					2018	Surveillance	National	12 (11–14)
Albania	2012	Surveillance	National	2.3 (0.64–5.8)	2012	Surveillance	National	6.7 (0.17–32)
Algeria								
American Samoa					2018	Surveillance	National	100 (2.0–100)
Andorra	2017	Surveillance	National	0 (0–98)	2017	Surveillance	National	11 (7.4–16)
Angola								
Anguilla								
Antigua and Barbuda								
Argentina	2005	Survey	National	2.3 (1.3–3.8)	2005	Survey	National	18 (12–26)
Armenia	2018	Surveillance	National	20 (16–26)	2017	Surveillance	National	44 (35–54)
Aruba								
Australia	2018	Surveillance	National	3.4 (2.2–5.0)	2018	Surveillance	National	9.8 (2.7–23)
Austria	2015	Surveillance	National	2.3 (0.84–4.9)	2016	Surveillance	National	18 (3.8–43)
Azerbaijan	2018	Surveillance	National	12 (11–13)	2018	Surveillance	National	26 (24–27)
Bahamas	2018	Surveillance	National	5.6 (0.14–27)	2017	Surveillance	National	14 (9.3–19)
Bahrain	2018	Surveillance	National	5.1 (1.4–12)	2018	Surveillance	National	0 (0–98)
Bangladesh	2019	Survey	National	1.5 (0.90–2.3)	2019	Survey	National	4.9 (3.0–7.9)
Barbados	2014	Surveillance	National	0 (0–71)	2014	Surveillance	National	14 (9.3–19)
Belarus	2018	Surveillance	National	37 (34–39)	2018	Surveillance	National	69 (66–73)
Belgium	2015	Surveillance	National	1.6 (0.66–3.3)	2015	Surveillance	National	8.8 (1.9–24)
Belize	2018	Surveillance	National	0 (0–6.5)	2013	Surveillance	National	100 (29–100)
Benin	2010	Survey	National	1.2 (0.21–3.0)	2018	Surveillance	National	8.1 (4.9–12)
Bermuda	2018	Surveillance	National	0 (0–85)	2017	Surveillance	National	14 (9.3–19)
Bhutan	2018	Surveillance	National	12 (8.8–16)	2017	Surveillance	National	33 (7.5–70)
Bolivia (Plurinational State of)					2018	Surveillance	National	14 (10–18)
Bonaire, Saint Eustatius and Saba	2016	Surveillance	National	0 (0–98)	2016	Surveillance	National	14 (9.3–19)
Bosnia and Herzegovina	2018	Surveillance	National	0.5 (<0.1–1.8)	2017	Surveillance	National	0 (0–8.2)
Botswana	2008	Survey	National	3.6 (2.5–4.9)	2008	Survey	National	13 (7.9–20)
Brazil	2008	Survey	Sub-national	1.5 (1.1–2.0)	2008	Survey	Sub-national	8 (6.0–10)
British Virgin Islands								
Brunei Darussalam	2018	Surveillance	National	0 (0–1.9)	2018	Surveillance	National	0 (0–60)
Bulgaria	2016	Surveillance	National	1.2 (0.49–2.5)	2016	Surveillance	National	19 (11–29)
Burkina Faso	2017	Survey	National	2.1 (1.2–3.0)	2017	Survey	National	14 (8.5–20)
Burundi					2018	Surveillance	National	21 (16–26)
Cabo Verde								
Cambodia	2018	Survey	National	1.8 (1.2–2.8)	2018	Survey	National	8.2 (4.0–16)
Cameroon	2017	Survey	National	1.6 (0.90–2.5)	2018	Surveillance	National	6.6 (5.2–8.3)
Canada	2015	Surveillance	National	0.82 (0.33–1.7)	2015	Surveillance	National	6.3 (1.7–15)
Cayman Islands	2018	Surveillance	National	0 (0–71)	2017	Surveillance	National	14 (9.3–19)
Central African Republic	2009	Survey	Sub-national	0.4 (0–2.2)				
Chad								
Chile	2018	Surveillance	National	2.5 (1.8–3.3)	2017	Surveillance	National	5.9 (2.2–12)
China	2013	Survey	National	7.1 (5.6–8.7)	2018	Surveillance	National	21 (21–21)
China, Hong Kong SAR	2018	Surveillance	National	1.5 (1.0–2.0)	2017	Surveillance	National	4.6 (2.1–8.6)
China, Macao SAR	2018	Surveillance	National	2 (0.54–5.0)	2018	Surveillance	National	12 (2.5–31)
Colombia	2005	Survey	National	2.4 (1.5–3.5)	2012	Surveillance	National	14 (11–18)
Comoros								
Congo					2018	Surveillance	National	12 (8.7–16)
Cook Islands	2016	Surveillance	National	0 (0–85)	2016	Surveillance	National	11 (6.1–17)
Costa Rica	2018	Surveillance	National	2.2 (0.91–4.6)	2017	Surveillance	National	0 (0–52)
Côte d'Ivoire	2017	Survey	National	4.6 (2.4–6.8)	2018	Surveillance	National	30 (27–33)
Croatia	2015	Surveillance	National	0 (0–1.4)	2015	Surveillance	National	0 (0–16)
Cuba	2012	Surveillance	National	2.2 (0.82–4.8)	2018	Surveillance	National	31 (21–44)
Curaçao	2017	Surveillance	National	0 (0–37)	2017	Surveillance	National	14 (9.3–19)
Cyprus	2015	Surveillance	National	0 (0–10)	2015	Surveillance	National	11 (7.4–16)
Czechia	2015	Surveillance	National	2.2 (0.90–4.6)	2015	Surveillance	National	12 (2.4–30)
Democratic People's Republic of Korea	2014	Survey	Sub-national	2.2 (0.82–4.2)	2014	Survey	Sub-national	16 (9.1–25)
Democratic Republic of the Congo	2017	Survey	National	1.7 (1.1–2.6)	2017	Surveillance	National	9.5 (8.8–10)
Denmark	2018	Surveillance	National	2.5 (0.70–6.4)	2018	Surveillance	National	0 (0–25)
Djibouti	2015	Survey	National	4.7 (2.8–7.7)	2018	Surveillance	National	9.7 (4.5–18)
Dominica	2013	Surveillance	National	0 (0–98)	2013	Surveillance	National	14 (9.3–19)
Dominican Republic					2016	Surveillance	National	34 (28–41)

[a] Empty rows indicate an absence of high-quality survey or surveillance data. In the absence of high-quality national data, high-quality sub-national data are used.

TABLE A4.3

Measured percentage of TB cases with MDR/RR-TB,[a] most recent year available

	New TB cases				Previously treated TB cases			
	Year	Source	Coverage	Percentage	Year	Source	Coverage	Percentage
Ecuador					2012	Surveillance	National	28 (25–31)
Egypt	2018	Surveillance	National	1.4 (1.0–1.8)	2018	Surveillance	National	23 (19–28)
El Salvador					2014	Surveillance	National	4.1 (1.3–9.2)
Equatorial Guinea					2018	Surveillance	National	20 (12–29)
Eritrea	2018	Survey	National	2 (1.0–3.6)	2018	Surveillance	National	4.1 (0.84–11)
Estonia	2018	Surveillance	National	22 (15–31)	2018	Surveillance	National	50 (27–73)
Eswatini	2018	Survey	National	8.6 (6.7–11)	2018	Survey	National	18 (11–25)
Ethiopia	2018	Surveillance	National	0.71 (0.62–0.80)	2018	Surveillance	National	16 (14–17)
Fiji	2018	Surveillance	National	0.68 (<0.1–3.7)	2018	Surveillance	National	0 (0–34)
Finland	2018	Surveillance	National	3.2 (0.88–8.0)	2017	Surveillance	National	67 (9.4–99)
France	2014	Surveillance	National	1 (0.65–1.5)	2014	Surveillance	National	10 (7.1–15)
French Polynesia	2018	Surveillance	National	3.1 (<0.1–16)	2018	Surveillance	National	0 (0–41)
Gabon					2018	Surveillance	National	16 (12–21)
Gambia								
Georgia	2018	Surveillance	National	12 (10–14)	2018	Surveillance	National	31 (27–35)
Germany	2015	Surveillance	National	2.2 (0.82–4.8)	2015	Surveillance	National	23 (16–30)
Ghana	2018	Surveillance	National	1.3 (1.0–1.6)	2018	Surveillance	National	16 (14–19)
Greece	2010	Surveillance	National	1.5 (<0.1–8.0)	2010	Surveillance	National	9.1 (0.23–41)
Greenland	2018	Surveillance	National	0 (0–12)	2018	Surveillance	National	0 (0–52)
Grenada								
Guam	2018	Surveillance	National	0 (0–8.0)	2018	Surveillance	National	0 (0–60)
Guatemala								
Guinea					2018	Surveillance	National	34 (30–38)
Guinea-Bissau								
Guyana	2017	Surveillance	National	2.5 (0.92–5.3)	2017	Surveillance	National	12 (5.8–22)
Haiti								
Honduras	2004	Survey	National	2.2 (0.93–4.0)	2018	Surveillance	National	3.2 (1.3–6.4)
Hungary	2010	Surveillance	National	2.9 (1.6–4.8)	2010	Surveillance	National	8.1 (3.3–16)
Iceland	2017	Surveillance	National	0 (0–41)	2017	Surveillance	National	0 (0–98)
India	2016	Survey	National	2.8 (2.3–3.5)	2018	Surveillance	National	14 (14–14)
Indonesia	2018	Survey	National	2.4 (1.8–3.3)	2018	Survey	National	13 (9.0–18)
Iran (Islamic Republic of)	2014	Survey	National	1.3 (0.69–2.1)	2016	Surveillance	National	8.3 (5.9–11)
Iraq	2013	Survey	National	6.1 (4.5–8.0)	2018	Surveillance	National	18 (13–23)
Ireland	2015	Surveillance	National	1.1 (<0.1–5.8)	2015	Surveillance	National	0 (0–31)
Israel	2018	Surveillance	National	9.7 (5.6–16)	2018	Surveillance	National	0 (0–46)
Italy	2015	Surveillance	National	2.8 (1.8–4.3)	2015	Surveillance	National	13 (7.7–21)
Jamaica	2018	Surveillance	National	0 (0–7.9)	2013	Surveillance	National	14 (9.3–19)
Japan								
Jordan	2009	Surveillance	National	6.3 (2.4–13)	2009	Surveillance	National	29 (3.7–71)
Kazakhstan	2018	Surveillance	National	27 (26–28)	2018	Surveillance	National	64 (63–66)
Kenya	2014	Survey	National	1.3 (0.74–2.0)	2017	Surveillance	National	4.4 (3.7–5.2)
Kiribati	2018	Surveillance	National	1.9 (0.39–5.4)	2018	Surveillance	National	25 (0.63–81)
Kuwait	2018	Surveillance	National	1.5 (0.49–3.5)	2017	Surveillance	National	16 (11–22)
Kyrgyzstan	2018	Surveillance	National	29 (27–31)	2018	Surveillance	National	68 (66–71)
Lao People's Democratic Republic	2018	Survey	National	1.2 (0.50–2.0)	2018	Survey	National	4.1 (0–9.6)
Latvia	2017	Surveillance	National	8 (5.4–11)	2017	Surveillance	National	31 (19–44)
Lebanon	2018	Surveillance	National	0.99 (0.20–2.9)	2018	Surveillance	National	8.3 (0.21–38)
Lesotho	2014	Survey	National	4.8 (3.7–6.0)	2014	Survey	National	14 (9.5–18)
Liberia								
Libya								
Lithuania	2018	Surveillance	National	13 (10–15)	2018	Surveillance	National	42 (36–49)
Luxembourg	2014	Surveillance	National	2.6 (1.4–4.2)	2014	Surveillance	National	11 (7.4–16)
Madagascar	2007	Survey	National	0.49 (<0.1–1.2)	2007	Survey	National	5.9 (0.59–17)
Malawi	2011	Survey	National	0.75 (0.16–1.8)	2011	Survey	National	6.4 (4.0–9.2)
Malaysia	2014	Surveillance	National	1.5 (1.2–1.9)	2014	Surveillance	National	3.1 (1.3–5.9)
Maldives	2016	Surveillance	National	1.7 (<0.1–9.1)	2016	Surveillance	National	15 (7.8–23)
Mali								
Malta	2017	Surveillance	National	0 (0–15)	2017	Surveillance	National	11 (7.4–16)
Marshall Islands	2018	Surveillance	National	1.5 (<0.1–8.3)	2018	Surveillance	National	33 (0.84–91)
Mauritania					2018	Surveillance	National	40 (26–56)
Mauritius	2018	Surveillance	National	0.85 (<0.1–4.6)	2017	Surveillance	National	0 (0–52)
Mexico	2009	Survey	National	2.6 (2.3–3.0)	2009	Survey	National	11 (9.2–13)

[a] Empty rows indicate an absence of high-quality survey or surveillance data. In the absence of high-quality national data, high-quality sub-national data are used.

TABLE A4.3

Measured percentage of TB cases with MDR/RR-TB,[a] most recent year available

	New TB cases				Previously treated TB cases			
	Year	Source	Coverage	Percentage	Year	Source	Coverage	Percentage
Micronesia (Federated States of)	2018	Surveillance	National	0 (0–14)				
Monaco								
Mongolia	2018	Surveillance	National	4.3 (3.3–5.6)	2017	Surveillance	National	11 (8.2–14)
Montenegro	2018	Surveillance	National	0 (0–6.0)	2018	Surveillance	National	33 (0.84–91)
Montserrat								
Morocco	2014	Survey	National	1 (0.42–1.8)	2018	Surveillance	National	10 (8.8–12)
Mozambique	2007	Survey	National	3.7 (2.5–5.2)	2007	Survey	National	20 (5.2–40)
Myanmar	2018	Surveillance	National	4.9 (4.7–5.1)	2018	Surveillance	National	20 (19–21)
Namibia	2018	Surveillance	National	5.8 (5.0–6.5)	2015	Survey	National	12 (9.4–14)
Nauru								
Nepal	2011	Survey	National	2.2 (1.1–3.6)	2011	Survey	National	15 (9.6–22)
Netherlands	2018	Surveillance	National	0.92 (0.19–2.7)	2017	Surveillance	National	6.3 (0.16–30)
New Caledonia	2018	Surveillance	National	0 (0–15)	2018	Surveillance	National	0 (0–98)
New Zealand	2014	Surveillance	National	2.6 (0.70–6.4)	2014	Surveillance	National	20 (0.50–72)
Nicaragua	2006	Survey	National	0.94 (<0.1–2.7)	2010	Surveillance	National	12 (7.3–18)
Niger					2018	Surveillance	National	16 (13–20)
Nigeria	2010	Survey	National	4.3 (3.2–5.5)	2018	Surveillance	National	15 (11–19)
Niue								
North Macedonia	2018	Surveillance	National	0 (0–2.8)	2018	Surveillance	National	0 (0–29)
Northern Mariana Islands	2018	Surveillance	National	6.7 (0.17–32)	2017	Surveillance	National	11 (6.1–17)
Norway	2018	Surveillance	National	6.1 (2.3–13)	2018	Surveillance	National	0 (0–29)
Oman	2018	Surveillance	National	2.9 (0.94–6.6)	2018	Surveillance	National	0 (0–85)
Pakistan	2013	Survey	National	4.2 (3.2–5.3)	2015	Surveillance	National	16 (15–17)
Palau	2018	Surveillance	National	8.3 (0.21–38)	2017	Surveillance	National	11 (6.1–17)
Panama					2016	Surveillance	National	17 (8.9–29)
Papua New Guinea	2014	Survey	Sub-national	3.4 (1.7–5.0)	2014	Survey	Sub-national	26 (15–36)
Paraguay	2008	Survey	National	0.9 (<0.1–2.7)	2008	Survey	National	15 (5.6–27)
Peru	2016	Surveillance	National	6.3 (5.9–6.7)	2017	Surveillance	National	20 (19–22)
Philippines	2019	Survey	National	1.7 (1.1–2.5)	2019	Survey	National	16 (13–20)
Poland	2018	Surveillance	National	1.2 (0.83–1.6)	2018	Surveillance	National	4.2 (2.5–6.5)
Portugal	2012	Surveillance	National	0.98 (0.51–1.7)	2012	Surveillance	National	6.9 (2.8–14)
Puerto Rico	2018	Surveillance	National	0 (0–20)	2018	Surveillance	National	0 (0–85)
Qatar	2018	Surveillance	National	0.9 (0.19–2.6)	2018	Surveillance	National	0 (0–98)
Republic of Korea	2018	Surveillance	National	3.2 (2.9–3.5)	2018	Surveillance	National	9.2 (8.2–10)
Republic of Moldova	2018	Surveillance	National	29 (26–31)	2018	Surveillance	National	60 (56–64)
Romania	2018	Surveillance	National	2.7 (2.3–3.2)	2018	Surveillance	National	15 (13–16)
Russian Federation	2018	Surveillance	National	35 (34–35)	2018	Surveillance	National	71 (70–71)
Rwanda	2018	Surveillance	National	2.2 (1.7–2.7)	2018	Surveillance	National	5.2 (3.3–7.7)
Saint Kitts and Nevis	2017	Surveillance	National	0 (0–98)				
Saint Lucia	2018	Surveillance	National	0 (0–52)	2013	Surveillance	National	14 (9.3–19)
Saint Vincent and the Grenadines					2014	Surveillance	National	0 (0–98)
Samoa	2017	Surveillance	National	0 (0–25)	2016	Surveillance	National	11 (6.1–17)
San Marino								
Sao Tome and Principe					2012	Surveillance	National	88 (47–100)
Saudi Arabia	2010	Survey	National	2.6 (2.0–3.2)	2018	Surveillance	National	1.7 (0.21–6.1)
Senegal	2014	Survey	National	0.9 (0.36–1.7)	2017	Surveillance	National	6.2 (4.8–7.9)
Serbia	2013	Surveillance	National	1.1 (0.49–2.2)	2013	Surveillance	National	4.7 (1.3–11)
Seychelles	2018	Surveillance	National	0 (0–22)	2017	Surveillance	National	15 (11–19)
Sierra Leone								
Singapore	2018	Surveillance	National	1.6 (0.95–2.5)	2018	Surveillance	National	3.5 (0.73–9.9)
Sint Maarten (Dutch part)								
Slovakia	2018	Surveillance	National	0.86 (<0.1–4.7)	2018	Surveillance	National	13 (1.7–40)
Slovenia	2016	Surveillance	National	0 (0–3.9)	2016	Surveillance	National	0 (0–71)
Solomon Islands					2013	Surveillance	National	0 (0–41)
Somalia	2011	Survey	National	8.7 (6.1–12)	2011	Survey	National	47 (29–65)
South Africa	2014	Survey	National	3.4 (2.5–4.3)	2014	Survey	National	7.1 (4.8–9.5)
South Sudan								
Spain	2015	Surveillance	National	4.2 (2.9–5.8)	2015	Surveillance	National	18 (9.4–30)
Sri Lanka	2018	Survey	National	0.1 (0–0.50)	2018	Surveillance	National	3.3 (1.8–5.5)
Sudan	2017	Survey	National	2.9 (1.7–4.1)	2017	Survey	National	13 (8.6–17)
Suriname	2018	Surveillance	National	12 (6.6–21)	2018	Surveillance	National	13 (0.31–53)
Sweden	2018	Surveillance	National	2.2 (0.79–4.6)	2018	Surveillance	National	18 (2.3–52)

[a] Empty rows indicate an absence of high-quality survey or surveillance data. In the absence of high-quality national data, high-quality sub-national data are used.

TABLE A4.3

Measured percentage of TB cases with MDR/RR-TB,[a] most recent year available

	New TB cases				Previously treated TB cases			
	Year	Source	Coverage	Percentage	Year	Source	Coverage	Percentage
Switzerland	2018	Surveillance	National	1.1 (0.24–3.3)	2015	Surveillance	National	26 (9.1–51)
Syrian Arab Republic					2018	Surveillance	National	19 (11–30)
Tajikistan	2017	Survey	National	21 (19–24)	2018	Surveillance	National	38 (34–42)
Thailand	2018	Survey	National	2.3 (1.3–3.4)	2012	Survey	National	24 (18–31)
Timor-Leste								
Togo	2018	Survey	National	1.5 (0.80–2.6)	2018	Surveillance	National	4.2 (1.9–7.8)
Tokelau								
Tonga	2018	Surveillance	National	0 (0–41)	2017	Surveillance	National	11 (6.1–17)
Trinidad and Tobago	2018	Surveillance	National	0 (0–2.4)	2018	Surveillance	National	4.8 (0.12–24)
Tunisia	2018	Surveillance	National	1 (0.52–1.9)	2018	Surveillance	National	27 (12–46)
Turkey	2018	Surveillance	National	3.5 (3.0–4.0)	2018	Surveillance	National	12 (9.0–15)
Turkmenistan	2018	Survey	National	23 (21–26)	2018	Survey	National	54 (48–60)
Turks and Caicos Islands								
Tuvalu	2018	Surveillance	National	0 (0–25)	2018	Surveillance	National	25 (0.63–81)
Uganda	2018	Surveillance	National	1 (0.91–1.2)	2011	Survey	National	12 (6.5–19)
Ukraine	2018	Surveillance	National	29 (28–30)	2018	Surveillance	National	46 (45–48)
United Arab Emirates					2018	Surveillance	National	100 (2.0–100)
United Kingdom of Great Britain and Northern Ireland	2018	Surveillance	National	1.2 (0.80–1.8)	2018	Surveillance	National	5.3 (2.3–10)
United Republic of Tanzania	2018	Survey	National	0.97 (0.40–1.6)	2018	Surveillance	National	13 (11–15)
United States of America	2018	Surveillance	National	1.5 (1.2–1.9)	2018	Surveillance	National	7.4 (4.5–12)
Uruguay	2018	Surveillance	National	0.39 (<0.1–1.4)	2018	Surveillance	National	0 (0–4.5)
Uzbekistan	2018	Surveillance	National	15 (14–16)	2018	Surveillance	National	34 (32–36)
Vanuatu	2018	Surveillance	National	4.9 (0.60–17)	2017	Surveillance	National	11 (6.1–17)
Venezuela (Bolivarian Republic of)								
Viet Nam	2018	Surveillance	National	3.6 (3.4–3.8)	2018	Surveillance	National	17 (17–18)
Wallis and Futuna Islands								
West Bank and Gaza Strip								
Yemen	2011	Survey	National	2.3 (1.1–3.9)	2011	Survey	National	18 (11–26)
Zambia	2018	Surveillance	National	2.8 (2.5–3.1)	2008	Survey	National	18 (12–26)
Zimbabwe	2018	Surveillance	National	3.9 (3.5–4.3)	2016	Survey	National	14 (8.9–20)

[a] Empty rows indicate an absence of high-quality survey or surveillance data. In the absence of high-quality national data, high-quality sub-national data are used.

TABLE A4.4

TB case notifications, 2018

		New and relapse cases[a]							
	Total cases notified	Notified	% tested with rapid diagnostics at time of diagnosis	% with known HIV status	% pulmonary	% bacteriologically confirmed among pulmonary	% children aged 0-14 years[b]	% women[b]	% men[b]
Afghanistan	48 800	48 420	24	53	71	64	21	46	33
Albania	440	440		49	75	63	1	26	73
Algeria	23 590	23 465			32	86	1	40	59
American Samoa	1	0							
Andorra	2	2	100	0	100	100	0	0	100
Angola	70 362	66 189		68	94	54			
Anguilla	0	0							
Antigua and Barbuda	6	5		100	100	40	20	40	40
Argentina	11 517	10 320	1.3	25	87	71	10	38	52
Armenia	796	734	84	95	77	52	5	21	74
Aruba	5	5			100	100	0	20	80
Australia	1 438	1 438		88	64	88	4	46	50
Austria	482	470	80		75	90	6	38	56
Azerbaijan	6 896	5 038	69	94*	80	75	6	31	63
Bahamas	47	47		96	98	39	11	34	55
Bahrain	154	154	58	58	60	87	0	40	60
Bangladesh	268 596	267 143	18	1.0*	81	72	4	41	55
Barbados	1	1	100	0	100	100	0	0	100
Belarus	2 542	2 359	93	100	91	92	1	26	73
Belgium	981	913	57	55	71	85	6	31	63
Belize	104	99	58	96	100	58	0	37	63
Benin	4 096	4 003		98	92	89	5	32	63
Bermuda	2	2	0	100	100	100	0	100	0
Bhutan	918	898	31	98	59	81	3	49	48
Bolivia (Plurinational State of)	7 755	7 597	19	84*	80	92	4	35	61
Bonaire, Saint Eustatius and Saba									
Bosnia and Herzegovina	669	666			90	75	1	39	60
Botswana	3 714	3 650	32	82	83	26	6	39	55
Brazil	90 527	82 409	34	79	87	74	3	29	68
British Virgin Islands	1	1	0		100		0	0	100
Brunei Darussalam	252	252		100	81	98	2	41	57
Bulgaria	1 358	1 290	0.54	87	78	61	5	31	64
Burkina Faso	6 166	5 995	42	84	86	80	3	27	70
Burundi	7 202	7 202	7.7	98	73	82	6	33	61
Cabo Verde	206	200	54	100	88	87	2	24	74
Cambodia	28 757	28 620		94	65	53	19	36	45
Cameroon	23 757	23 403	56	95*	84	73	5	37	58
Canada	1 796	1 796		67	68	89	5	44	51
Cayman Islands	3	3	100	100	100	100	0	100	0
Central African Republic	11 032	10 881	0.32	79*	79	64	17	35	48
Chad	13 306	13 078	8.4	71*	88	47	7	31	62
Chile	3 050	2 947	8.2	85	79	92	3	34	63
China	801 532	795 245	15	60	95	37	1	31	68
China, Hong Kong SAR	4 286	4 286	32	78	80	88	1	36	63
China, Macao SAR	328	327	68	92	85	86	1	34	65
Colombia	13 756	13 025	16	91	83	95	4	32	64
Comoros									
Congo	10 981	10 706	8.6	19	77	49	8	40	52
Cook Islands	0	0							
Costa Rica	408	401	0	95	85	99	3	33	64
Côte d'Ivoire	21 303	21 034		99	81	84	4	35	61
Croatia	372	364	0		90	91	2	36	62
Cuba	749	710	37	100	89	83	2	22	76
Curaçao									
Cyprus	52	51	33		80	85	2	49	49
Czechia	444	435	63	43*	89	88	1	30	69

[a] Includes cases for which the treatment history is unknown.
[b] Restricted to notifcations for which age-sex disaggregation was reported.
* Among all notified cases, not just new and relapse cases.

TABLE A4.4

TB case notifications, 2018

		New and relapse cases[a]							
	Total cases notified	Notified	% tested with rapid diagnostics at time of diagnosis	% with known HIV status	% pulmonary	% bacteriologically confirmed among pulmonary	% children aged 0-14 years[b]	% women[b]	% men[b]
Democratic People's Republic of Korea	95 245	89 939			80	50	5	34	61
Democratic Republic of the Congo	171 682	169 748	7.4	60*	83	77	11	39	50
Denmark	291	270	97		77	79	4	37	59
Djibouti	2 011	1 997		90	64	82	5	35	60
Dominica	4	4		50	50	100	0	25	75
Dominican Republic	4 124	3 857	6.6	86	90	60	3	34	63
Ecuador	6 094	5 960		83	81	92	3	28	69
Egypt	8 448	8 280	32	41	54	94	6	35	59
El Salvador	3 624	3 615	52	99	89	90	4	17	79
Equatorial Guinea	1 366	1 328	8.1	92	91	67	6	40	54
Eritrea	1 892	1 872	23	100	62	62	16	40	44
Estonia	147	145	86	93	94	90	2	28	70
Eswatini	3 151	2 987	75	99*	88	72	6	40	54
Ethiopia	114 233	113 613		92*	69	62	10	40	50
Fiji	389	385	95	89	68	55	20	34	46
Finland	230	229	46	*	68	93	<1	34	66
France	5 092	4 779	0		70	72	5	31	64
French Polynesia	54	54	63	85	81	89	4	46	50
Gabon	5 961	5 689	44	48	91	49	5	36	59
Gambia	2 394	2 394		86	94	66	6	34	60
Georgia	2 590	2 316	84	94	80	87	4	30	66
Germany	5 429	5 265	83		73	87	5	31	64
Ghana	14 289	13 874	60	93	92	66	6	30	64
Greece	432	406	45		86	76	1	24	75
Greenland	52	49	69	100	88	79	10	35	55
Grenada	2	2	0	50	100	50		50	50
Guam	71	71	69	96	99	69	12	34	54
Guatemala	3 623	3 568	20	99	92	81	14	36	50
Guinea	14 476	14 250	10	81*	79	74	6	35	59
Guinea-Bissau	2 068	2 031		90*	96	82	7	32	61
Guyana	586	516	72	87	93	79	2	26	72
Haiti	13 713	13 383	35	92	90	79	10	39	51
Honduras	2 866	2 838	3.5	98	89	92	2	38	60
Hungary	640	602	0	3.2	97	59	<1	36	64
Iceland	8	8	100		75	50	0	50	50
India	2 155 894	1 994 000	50	72	82	57	6	34	60
Indonesia	570 289	563 879	12	37	88	50	11	37	52
Iran (Islamic Republic of)	9 086	8 906		92	75	74	3	44	53
Iraq	7 142	7 104	60	70	53	59	8	49	43
Ireland	314	294	46	46	73	82	3	39	58
Israel	292	292		100	77	71	5	32	63
Italy	3 912	3 777	0		71	80	4	31	65
Jamaica	69	69	68	64	99	69	12	17	71
Japan	15 590	15 590		8.3	77	86	1	40	59
Jordan	404	396	25	86	71	46	9	46	45
Kazakhstan	13 361	12 832	89	95	91	88	2	38	60
Kenya	96 478	94 534	47	98	85	58	10	32	58
Kiribati	323	323	50	51	76	66	14	45	41
Kuwait	820	820	52	37	74	55	1	32	67
Kyrgyzstan	7 585	6 338	62	100	79	61	4	39	57
Lao People's Democratic Republic	6 729	6 548	63	81	92	65	2	36	62
Latvia									
Lebanon	668	656	60	91	62	80	6	59	35
Lesotho	7 128	7 027		97	90	67	4	34	62
Liberia	7 824	7 808	9.1	77	66	60	15	37	48
Libya	1 815	1 815		99	61	63	5	36	59

[a] Includes cases for which the treatment history is unknown.
[b] Restricted to notifcations for which age-sex disaggregation was reported.
* Among all notified cases, not just new and relapse cases.

TABLE A4.4

TB case notifications, 2018

		New and relapse cases[a]							
	Total cases notified	Notified	% tested with rapid diagnostics at time of diagnosis	% with known HIV status	% pulmonary	% bacteriologically confirmed among pulmonary	% children aged 0-14 years[b]	% women[b]	% men[b]
Lithuania	1 142	1 063	0	83	93	90	1	27	72
Luxembourg	42	42	0	17	76	91	0	21	79
Madagascar	34 191	33 786		64	79	86	7	37	56
Malawi	15 892	15 632		99	66	62	8	35	57
Malaysia	25 837	25 173		81	85	73	2	35	63
Maldives	138	138	68	100	76	100	5	22	73
Mali	7 084	6 889		71*	81	84	4	33	63
Malta	55	55	0	80	71	74	1	24	75
Marshall Islands	429	429	77	22	91	17	32	33	35
Mauritania	2 412	2 403	29	0	74	69	5	32	63
Mauritius	133	131	92	98	92	100	2	37	61
Mexico	24 096	23 271	<0.1	89	80	83	3	36	61
Micronesia (Federated States of)	125	97		0*	82	35	28	34	38
Monaco									
Mongolia	4 065	3 880	39	70	62	74	7	40	53
Montenegro	84	84	76	51	88	86	3	33	64
Montserrat	0	0							
Morocco	31 712	30 977	5.2	43	52	85	7	36	57
Mozambique	93 546	92 381	41	98*	93	39	13	42	45
Myanmar	139 518	137 972	42	89	91	44	19	29	52
Namibia	8 100	7 808	60	99*	81	84	9	34	57
Nauru	5	5		0	100	100	0	40	60
Nepal	32 474	31 855		69*	71	80	5	34	61
Netherlands	806	791	70	68	57	85	2	37	61
New Caledonia	37	37	5.4	30	70	92	6	32	62
New Zealand	309	302		0.33	56	96	3	47	50
Nicaragua	2 186	2 109	3.5	94	89	83	7	36	57
Niger	10 838	10 639		81*	87	92	4	26	70
Nigeria	106 533	103 921	54	100	96	77	8	34	58
Niue	1	1		0*	100	0	0	0	100
North Macedonia	217	217	68	58	76	88	5	32	63
Northern Mariana Islands	47	47	32	100*	94	34	13	36	51
Norway	209	189	80	96	60	91	4	48	48
Oman	246	246	84	98	74	97	3	35	62
Pakistan	369 548	360 472	22	20*	80	48	13	42	45
Palau	17	17	88	94	88	80	6	41	53
Panama	1 837	1 723	49	99	84	71	7	33	60
Papua New Guinea	29 364	27 887		52*	56	30	24	36	40
Paraguay	2 822	2 589	22	86	89	76	6	25	69
Peru	32 642	31 421	2.5	94	81	77	5	33	62
Philippines	382 543	371 668	36	27	98	36	12	30	58
Poland	5 487	5 196	20		95	77	1	29	70
Portugal	2 137	2 111	57	52*	76	91	3	32	65
Puerto Rico	28	25	44	92	88	77	4	28	68
Qatar	750	750	98	0.13	47	96	1	19	80
Republic of Korea	33 796	31 534	26		80	78	<1	40	60
Republic of Moldova	3 465	3 022	95	96	91	67	3	25	72
Romania	12 205	11 586	24	79*	85	83	4	28	68
Russian Federation	106 913	78 258	73	95	92	54	3	29	68
Rwanda	5 960	5 822	47	100	85	85	6	29	65
Saint Kitts and Nevis	0	0							
Saint Lucia	5	5	100	100	100	100	0	20	80
Saint Vincent and the Grenadines	6	6	100	100	100	100	0	0	100
Samoa	11	11		100	73	88	19	45	36
San Marino	0	0							
Sao Tome and Principe	152	149	24	100	83	42	4	41	55

[a] Includes cases for which the treatment history is unknown.
[b] Restricted to notifcations for which age-sex disaggregation was reported.
* Among all notified cases, not just new and relapse cases.

TABLE A4.4

TB case notifications, 2018

	Total cases notified	New and relapse cases[a]							
		Notified	% tested with rapid diagnostics at time of diagnosis	% with known HIV status	% pulmonary	% bacteriologically confirmed among pulmonary	% children aged 0-14 years[b]	% women[b]	% men[b]
Saudi Arabia	3 035	2 963	48	73	72	99	3	22	75
Senegal	13 663	13 250	14	90*	88	89	5	29	66
Serbia	1 358	1 330		4.2	81	72	2	45	53
Serbia (without Kosovo)	*656*	*641*							
Kosovo	*702*	*689*							
Seychelles	15	15	100	100	100	100	0	20	80
Sierra Leone	17 169	17 144	5.3	98	92	65	14	33	53
Singapore	2 334	2 331	60	89	85	62	<1	39	61
Sint Maarten (Dutch part)	10	7		0	100	43		29	71
Slovakia	281	273	24	69	86	68	14	37	49
Slovenia	99	98	83		85	95	1	34	65
Solomon Islands	391	387	27	28	72	65	17	41	42
Somalia	16 673	16 614	18	90	73	61	22	31	47
South Africa	235 652	227 999	71	90	89	70	7	37	56
South Sudan	14 964	14 603	1	90	82	59	18	30	52
Spain	4 648	4 500	26		72	85	7	34	59
Sri Lanka	8 856	8 620	2.1	92*	71	73	3	34	63
Sudan	20 638	20 117	18	34*	73	50	10	33	57
Suriname	179	174	66	97	84	76	12	20	68
Sweden	491	477	68		68	89	7	41	52
Switzerland	516	473			71	94	5	37	58
Syrian Arab Republic	2 685	2 631	17	18*	54	72	9	41	50
Tajikistan	5 975	5 726	74	93*	73	69	6	43	51
Thailand	86 949	85 029	19	79	85	59	1	31	68
Timor-Leste	3 906	3 782	1	77*	83	55	8	39	53
Togo	2 501	2 413	35	98*	88	95	3	34	63
Tokelau									
Tonga	9	9	89	100	89	88	0	33	67
Trinidad and Tobago	272	253	63	97	94	68	2	28	70
Tunisia	3 226	3 202	33	72	39	83	7	49	44
Turkey	11 786	11 576		71	65	78	6	40	54
Turkmenistan	2 636	2 157	75		75	49	2	39	59
Turks and Caicos Islands	2	2		50	50	100	0	0	100
Tuvalu	32	27	74	100	63	82	19	44	37
Uganda	57 756	55 835	46	98	93	56	12	31	57
Ukraine	30 378	26 512		99	91	69	2	29	69
United Arab Emirates	86	86	43	78	65	91	3	34	63
United Kingdom of Great Britain and Northern Ireland	5 075	4 775	7.7	85	58	78	3	40	57
United Republic of Tanzania	75 828	74 692	18	99	79	48	14	33	53
United States of America	8 977	8 561		87	79	86	4	37	59
Uruguay	1 043	1 002	23	95	88	73	5	28	67
Uzbekistan	18 496	16 413	88	100	66	55	12	40	48
Vanuatu	90	90	46	69	60	76	26	34	40
Venezuela (Bolivarian Republic of)	11 394	11 017		58	87	76	6	30	64
Viet Nam	102 171	99 658	20	85	80	70	2	27	71
Wallis and Futuna Islands	0	0							
West Bank and Gaza Strip	30	30		100	60	100	10	33	57
Yemen	9 784	9 743		7.5	64	49	12	44	44
Zambia	35 922	35 071	46	95*	87	56	6	32	62
Zimbabwe	25 775	25 204	87	94*	89	54	6	36	58
WHO regions									
African Region	1 402 743	1 372 748		87	85	65	9	36	55
Region of the Americas	249 931	235 345		82	85	79	5	32	63
Eastern Mediterranean Region	537 761	526 379		30	76	53	13	41	46
European Region	269 910	227 288		91	84	67	4	32	64
South-East Asia Region	3 362 783	3 183 255		61	83	56	7	35	58
Western Pacific Region	1 441 363	1 416 729		54	92	41	5	31	64
Global	7 264 491	6 961 744		64	85	55	8	34	58

[a] Includes cases for which the treatment history is unknown.
[b] Restricted to notifcations for which age-sex disaggregation was reported.
* Among all notified cases, not just new and relapse cases.

TABLE A4.5

Treatment outcomes by TB case type, 2017 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2016

	New and relapse, 2017 cohort		Previously treated, excluding relapse, 2017 cohort		HIV-positive TB, 2017 cohort		MDR/RR-TB, 2016 cohort		XDR-TB, 2016 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Afghanistan	46 640	91	766	42	7	29	153	62		
Albania	499	87	0		4	75	1	100	0	
Algeria*	5 934	91	27	67						
American Samoa	5	80	0		0					
Andorra	1	100	0		0		0		0	
Angola	57 877	25					175	4	0	
Anguilla	0		0		0		0		0	
Antigua and Barbuda*	1	100	0		0		0		0	
Argentina	10 292	57	1 372	48	706	36	114	32	2	50
Armenia	710	79	42	67	50	54	118	49	10	30
Aruba										
Australia	1 434	82	0		26	54	21	81	0	
Austria	543	69	7	57			15	67	2	50
Azerbaijan*	1 777	84	2 496	74			798	60		
Bahamas	51	71	0		15	40	1	100	0	
Bahrain										
Bangladesh	242 640	94	1 561	86	89	67	918	78	8	62
Barbados	0		0		0		0		0	
Belarus	1 792	89	132	68	101	79	1 180	67	393	53
Belgium	905	79	54	78	38	82	12	83	0	
Belize	117	71	5	80	28	64	0		0	
Benin	3 561	87	98	80	549	77	11	82	0	
Bermuda	2	100	0		0		0		0	
Bhutan	864	93	16	100	5	100	55	91	0	
Bolivia (Plurinational State of)	7 576	83	82	72			50	60	1	0
Bonaire, Saint Eustatius and Saba										
Bosnia and Herzegovina	766	45	2				0			
Botswana	5 375	78	136	43	2 431	76	109	78	0	
Brazil	78 652	71	7 350	39	7 617	51	546	61	17	41
British Virgin Islands										
Brunei Darussalam	238	75	0		2	50	0		0	
Bulgaria	1 386	84	48	81	3	67	22	55	0	
Burkina Faso	5 768	80	202	73	534	74	41	63	0	
Burundi	7 862	93	314	90	887	87	80	96	0	
Cabo Verde	249	91	8	75	28	93	0		0	
Cambodia	34 238	94	229	79			101	64		
Cameroon	24 371	84	396	74	7 513	79	136	83	5	80
Canada	1 831	80			28	75				
Cayman Islands	4	100	0		0		0		0	
Central African Republic	9 302	78	147	73	2 137	74	41	59	0	
Chad	11 774	79	354	57	0		41	49	0	
Chile	2 588	78	242	54	278	63	14	71	0	
China	764 701	93	5 077	83	5 308	87	5 405	52		
China, Hong Kong SAR	4 237	65			31	42	36	75	2	100
China, Macao SAR	378	82	2	100	0		1	100	0	
Colombia	12 970	73	863	78	1 284	52	178	51	7	14
Comoros										
Congo	10 005	66	258	41	374	25	0		0	
Cook Islands*	0		0		0		0		0	
Costa Rica	379	92	5	80	31	87	3	33	0	
Côte d'Ivoire	20 760	83	330	71	4 283	74	318	75		
Croatia	372	66	6	17	0					
Cuba	708	82	62	18	106	66	6	33	0	
Curaçao										
Cyprus	51	67	1	100	0					
Czechia	489	69	4	100	8	62	5	40	0	
Democratic People's Republic of Korea	100 553	83					814	80		
Democratic Republic of the Congo	149 657	90	1 593	70	9 688	78	634	86	18	39

* Relapses included in the previously treated cohort.

TABLE A4.5

Treatment outcomes by TB case type, 2017 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2016

	New and relapse, 2017 cohort		Previously treated, excluding relapse, 2017 cohort		HIV-positive TB, 2017 cohort		MDR/RR-TB, 2016 cohort		XDR-TB, 2016 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Denmark	251	39	22	45	3	33				
Djibouti	1 059	85	1	0			71	69	6	67
Dominica	1	100	0		0		0		0	
Dominican Republic	3 791	74	242	40	841	60	107	52	1	100
Ecuador	5 721	74					155	55	0	
Egypt	8 053	86	142	45	53	91	86	66	0	
El Salvador	3 666	90	17	53	169	76	5	100	0	
Equatorial Guinea	1 367	75	42	67	410	69	36	86		
Eritrea	2 036	92	36	97	89	89	24	79	0	
Estonia	138	80	0		10	80	19	79	6	50
Eswatini	3 042	86	88	77	2 150	85	295	72	37	65
Ethiopia*	113 690	96					703	72		
Fiji	352	81	7	86	9	89	1	100	0	
Finland	237	36	3	67			5	80	0	
France	4 715	24	290	24						
French Polynesia	53	81	1	0	1	100	2	100	0	
Gabon	4 914	25	83	19	0		14	57	0	
Gambia	2 489	81					2	100	0	
Georgia	2 351	84	225	64	33	70	339	65	55	56
Germany	5 233	71	124	53			114	37	7	43
Ghana	14 121	85	429	82	2 759	77	77	62	0	
Greece										
Greenland	57	77	3	67						
Grenada	3	67	0		1	100	0		0	
Guam	83	89	0		1	100	2	100	0	
Guatemala	3 217	87	51	53	126	70	54	52		
Guinea	13 749	88	220	57	2 903	85	137	70		
Guinea-Bissau	2 226	64	22	91	507	72	36	56	0	
Guyana	508	71	54	48	125	68	10	60	0	
Haiti	15 189	78	448	52	2 286	61	131	82	1	0
Honduras	2 793	87	15	47	183	63	20	70	0	
Hungary	639	67	33	52	1	100	13	38	7	43
Iceland	13	92	1	100	0					
India	1 568 392	81	146 982	56	31 213	71	33 197	48	2 464	30
Indonesia	425 819	85	4 934	73	7 966	69	1 905	48	61	21
Iran (Islamic Republic of)	8 986	86	211	79	297	69	49	55	0	
Iraq	7 644	92	63	75	0		83	81	0	
Ireland	282	35	17	18	11	55	7	71	0	
Israel	225	87	0		12	83	9	67	2	100
Italy										
Jamaica	124	27	3	67	20	10	0		0	
Japan	16 702	68			31	65	56	52		
Jordan	526	56	11	91	0		3	33	0	
Kazakhstan	8 589	91	250	82			6 260	80	435	48
Kenya	83 088	83	1 583	72	23 060	78	308	68	0	
Kiribati	385	89	9	78	0		0		0	
Kuwait	986	89	0		5	40	11	73	0	
Kyrgyzstan	5 752	82	590	62	181	59	1 232	53	68	15
Lao People's Democratic Republic	5 730	89	222	84	325	69	33	82	0	
Latvia										
Lebanon	621	84	11	91	4	75	10	70	0	
Lesotho	7 305	76	121	73	4 949	75	222	77	0	
Liberia	6 907	77	16	69	833	63	74	73		
Libya	1 363	59			48	33				
Lithuania	1 086	83	37	57	26	85	197	56	58	0
Luxembourg	31	0	0		0					
Madagascar*	29 654	84	2 331	76	0		15	60	0	
Malawi	16 321	86	352	80	7 763	84	58	59		

* Relapses included in the previously treated cohort.

TABLE A4.5

Treatment outcomes by TB case type, 2017 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2016

	New and relapse, 2017 cohort		Previously treated, excluding relapse, 2017 cohort		HIV-positive TB, 2017 cohort		MDR/RR-TB, 2016 cohort		XDR-TB, 2016 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Malaysia	24 810	81	704	52	1 302	58	71	49	0	
Maldives	136	68	0		0		1	0	0	
Mali	6 388	78	217	72	441	74	27	70	2	0
Malta										
Marshall Islands	199	83	0		0		0		0	
Mauritania	2 427	77	18	33	0		8	50	0	
Mauritius	118	88	1	100	21	67	3	67	0	
Mexico	22 757	77	763	51	2 512	58	77	68	1	100
Micronesia (Federated States of)	139	88	0		0		0		0	
Monaco										
Mongolia	4 002	91	181	78	7	86	241	62	4	50
Montenegro	75	87	2	0	0		0		1	100
Montserrat	0		0		0					
Morocco	30 772	88	629	63	206	88	236	55	4	50
Mozambique	82 674	90	1 139	79	34 056	85	854	50	25	32
Myanmar	126 746	87	1 638	78	10 294	73	2 512	79	8	62
Namibia	8 559	86	292	64	2 983	82	348	71	10	50
Nauru	9	78	0		0		0		0	
Nepal	31 219	91	425	81	121	83	348	68	18	61
Netherlands	762	87	10	90	23	83	15	73	0	
New Caledonia	31	35					0		0	
New Zealand	302	82	6	83	1	0	4	25	0	
Nicaragua	2 255	86	72	65	103	66			1	100
Niger	10 409	82	195	71	363	71	42	88	0	
Nigeria	101 734	86	2 781	82	13 851	76	1 251	77		
Niue*	0		0		0		0		0	
North Macedonia	219	88	3	100	0		2	50	0	
Northern Mariana Islands	41	98	0		0		0		0	
Norway	228	91	24	79	6	83	11	91	0	
Oman	268	51	0		3	33	4	75	2	0
Pakistan	358 730	93	9 673	79			2 804	64	77	35
Palau	20	80	0		0		0		0	
Panama	1 874	73	94	35	340	55	40	35		
Papua New Guinea*	26 954	68	983	56	835	66	236	75	8	62
Paraguay	2 566	71	184	54	184	35	13	54	0	
Peru	26 099	86	899	57	1 462	66	1 271	59	88	69
Philippines	315 923	91	9 486	82	1 258	83	5 071	58	10	20
Poland							44	23	8	12
Portugal	1 751	38	39	31	125	26	15	33	0	
Puerto Rico	39	69	1	100	10	90	0		0	
Qatar	594	64	0		1	0	10	40	0	
Republic of Korea	31 699	83	2 919	68			852	66	36	58
Republic of Moldova	2 715	81	176	50	204	58	979	53	65	26
Romania	12 007	86	527	47	205	70	479	52	68	34
Russian Federation	67 593	69	9 339	50	9 655	43	22 593	54	2 909	38
Rwanda	4 853	87	178	77	1 186	76	79	91	0	
Saint Kitts and Nevis	1	0	0		0		0		0	
Saint Lucia	11	91	0		0		0		0	
Saint Vincent and the Grenadines	3	67								
Samoa	30	57	0		0					
San Marino	0		0		0		0		0	
Sao Tome and Principe	143	75	5	0	21	62	3	100	0	
Saudi Arabia	2 925	90	60	87	83	94	34	91	0	
Senegal	13 235	87	302	64	749	56	54	93	0	
Serbia	1 440	86	18	56	8	75	10	70	1	0
Seychelles	16	56	0		0		0		0	
Sierra Leone	15 935	90	207	63	1 936	82				
Singapore	2 300	79	4	100	31	81	19	26	0	

* Relapses included in the previously treated cohort.

TABLE A4.5

Treatment outcomes by TB case type, 2017 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2016

	New and relapse, 2017 cohort		Previously treated, excluding relapse, 2017 cohort		HIV-positive TB, 2017 cohort		MDR/RR-TB, 2016 cohort		XDR-TB, 2016 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Sint Maarten (Dutch part)	5	100	0		0		0		0	
Slovakia	222	92	20	70	0		3	0	0	
Slovenia	111	77	0		0					
Solomon Islands	373	92	5	100	0		0		0	
Somalia	16 627	86	142	76	158	66	244	79	0	
South Africa	240 332	77	6 508	59	134 672	75	11 159	54	601	58
South Sudan							0		0	
Spain	4 527	61	1 125	73	217	52	16	44	0	
Sri Lanka	8 328	85	183	70	29	69	17	65	0	
Sudan	20 188	80	914	73			133	84	1	
Suriname	129	73	8	50	23	48	0		0	
Sweden	477	87	30	80			21	100	4	50
Switzerland	518	78	24	58			17	47	0	
Syrian Arab Republic	2 845	86	96	78	0		8	50	0	
Tajikistan	5 259	91	226	83	157	73	681	65	43	47
Thailand	80 160	84	1 848	55	7 130	73	952	61	8	75
Timor-Leste	3 470	88	109	92	25	28	6	83	0	
Togo	2 551	82	82	67	453	75	10	90	0	
Tokelau										
Tonga	11	82	0		0		0		0	
Trinidad and Tobago	200	66	17	53	24	33	0		0	
Tunisia	3 087	89	47	100	11	100	13	62	0	
Turkey	11 638	86	180	58	64	61	211	62	9	56
Turkmenistan	1 968	85	264	77	0		557	54		
Turks and Caicos Islands	4	75	0		0		0		0	
Tuvalu*	22	68	1	100	0		0		0	
Uganda	45 099	72	1 825	67	18 101	69	364	64	4	0
Ukraine	21 165	76	3 309	59	4 454	67	7 277	49	1 353	37
United Arab Emirates	66	74	4	75	5	80	1	0	0	
United Kingdom of Great Britain and Northern Ireland	5 176	81	301	76	136	73	59	66	7	43
United Republic of Tanzania	68 278	90	1 250	84	21 349	80	158	80	0	
United States of America	8 536	77	401	76	403	68	111	69	1	100
Uruguay	921	73			136	51	3	67	0	
Uzbekistan	15 167	89	1 724	74	0		1 986	57	184	49
Vanuatu	91	96	1	100	0		0		0	
Venezuela (Bolivarian Republic of)	10 647	82	305	74	528	88	57	72	0	
Viet Nam	102 193	92	2 983	87	3 002	79	2 450	68	28	68
Wallis and Futuna Islands*										
West Bank and Gaza Strip*	49	100	0		0		0		0	
Yemen	9 693	89					33	85		
Zambia	36 010	90	1 193	83	20 362	86	136	71	0	
Zimbabwe	25 848	83	553	83	16 602	82	488	57	5	0
WHO regions										
African Region	1 278 013	82	25 932	71	340 993	78	18 571	60	707	56
Region of the Americas	226 231	76	13 555	48	19 569	56	2 966	59	120	62
Eastern Mediterranean Region	521 722	91	12 770	75	881	74	3 986	65	90	37
European Region	191 908	76	21 728	59	15 735	51	45 322	57	5 695	39
South-East Asia Region	2 588 327	83	157 696	57	56 872	71	40 725	52	2 567	31
Western Pacific Region	1 337 685	91	22 820	79	12 170	79	14 602	59	88	58
Global	6 143 886	85	254 501	61	446 220	75	126 172	56	9 267	39

* Relapses included in the previously treated cohort.

TABLE A4.6

Collaborative TB/HIV activities in 30 high TB/HIV burden countries, for WHO regions and globally, 2018

	Estimated HIV-positive incident TB cases	Notified TB patients with known HIV status[a]		HIV-positve TB patients		HIV-positive TB patients on antiretroviral therapy (ART)		Of people newly enrolled in HIV care	
	Number (thousands)	Number	%	as % of notified TB patients with known HIV status[b]	as % of estimated HIV-positive incident TB cases	as % of notified HIV-positive TB patients[b]	as % of estimated HIV-positive incident TB cases	% provided with TB preventive treatment[b]	% notified as a TB case[b]
Angola	11 (6.8–15)	44 998	68	9.6	41 (29–64)	49	20 (14–31)	42	8.9
Botswana	3.3 (2.6–4.2)	3 008	82	54	49 (39–63)	99	48 (38–62)		
Brazil	11 (9.3–13)	65 023	79	11	69 (59–80)	51	35 (30–41)		
Cameroon	13 (8.7–19)	22 566	95	29	48 (34–74)	96	46 (32–71)		
Central African Republic	6.6 (4.2–9.4)	8 739	79	26	35 (24–54)	85	29 (21–45)		
Chad	3.7 (2.4–5.3)	9 390	71	17	43 (30–66)				
China	18 (9.8–28)	480 415	60	1.7	45 (28–81)	87	39 (25–71)		2.1
Congo	5.7 (2.9–9.4)	2 007	19	28	9.8 (5.9–19)	49	4.8 (2.9–9.5)		26
Democratic Republic of the Congo	31 (9.4–65)	102 935	60	9.5	32 (15–>100)	87	28 (13–90)	39	8.5
Eswatini	2.5 (1.9–3.1)	3 126	99	66	84 (66–>100)	98	82 (64–>100)		
Ethiopia	7.6 (5.3–10)	104 682	92	4.6	63 (47–90)	91	58 (43–82)	49	4
Ghana	8.6 (4.1–15)	12 908	93	19	29 (17–61)	46	14 (7.9–28)		3.1
Guinea-Bissau	2.4 (1.5–3.4)	1 868	90	35	28 (19–43)	57	16 (11–24)		
India	92 (63–126)	1 438 912	72	3.4	54 (39–78)	90	48 (35–70)	17	17
Indonesia	21 (8.9–38)	208 898	37	4.9	48 (27–>100)	40	19 (11–46)	10	21
Kenya	40 (25–60)	92 447	98	27	62 (42–>100)	97	60 (40–98)		
Lesotho	8.4 (5.4–12)	6 813	97	65	53 (37–82)	92	49 (34–75)	33	
Liberia	2.6 (1.7–3.7)	6 000	77	17	40 (28–63)	66	27 (19–42)	21	6.9
Malawi	16 (9.9–23)	15 463	99	48	47 (32–76)	99	47 (32–75)		0.64
Mozambique	58 (38–83)	91 503	98	36	56 (39–87)	96	54 (38–84)		
Myanmar	15 (10–22)	123 181	89	8.5	68 (48–>100)	71	48 (34–73)	15	10
Namibia	4.5 (3.2–5.9)	7 980	99	35	62 (47–87)	97	60 (45–84)		
Nigeria	53 (34–75)	103 739	100	12	24 (17–37)	87	21 (15–32)	62	7.1
Papua New Guinea	2.7 (2.2–3.3)	15 396	52	7.3	41 (34–51)	81	33 (28–41)	21	15
South Africa	177 (127–235)	205 660	90	59	68 (51–95)	87	59 (45–83)	65	
Thailand	11 (8.2–14)	67 099	79	10	63 (49–83)	80	50 (39–66)		22
Uganda	34 (20–52)	54 785	98	40	64 (42–>100)	97	62 (41–>100)		
United Republic of Tanzania	40 (19–69)	73 586	99	28	52 (30–>100)	98	51 (30–>100)		
Zambia	36 (23–51)	34 074	95	59	57 (40–87)	91	52 (36–80)		
Zimbabwe	19 (14–24)	24 310	94	62	80 (62–>100)	91	73 (56–98)		
WHO regions									
African Region	615 (539–697)	1 175 391	87	29	55 (49–63)	90	49 (44–57)	60	4.6
Region of the Americas	29 (27–31)	193 383	82	10	69 (63–75)	63	41 (38–45)	9.3	6.1
Eastern Mediterranean Region	6.9 (5.3–8.8)	162 537	30	1.1	25 (20–33)	78	19 (15–25)	13	4
European Region	30 (23–37)	183 320	91	13	81 (65–>100)	73	58 (47–75)	69	17
South-East Asia Region	140 (107–178)	1 875 364	61	4.1	55 (43–72)	80	44 (34–57)	15	17
Western Pacific Region	41 (30–53)	747 407	54	2.1	39 (30–54)	84	32 (25–45)	39	4.2
Global	862 (776–952)	4 337 402	64	11	55 (50–62)	86	48 (43–53)	49	8

[a] For new and relapse cases only, although some countries report on all cases.
[b] Aggregates exclude countries with missing numerators or denominators.

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