GLOBAL TUBERCULOSIS REPORT 2016

World Health Organization

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Annexes

Abbreviations

aDSM	active TB drug-safety monitoring and management
AE	adverse event
AIDS	acquired immunodeficiency syndrome
ART	antiretroviral therapy
ATP	adenosine triphosphate
BCG	Bacille-Calmette-Guérin
BRICS	Brazil, the Russian Federation, India, China, South Africa
CC	critical concentration
CFR	case fatality ratio
CHOICE	CHOosing Interventions that are Cost-Effective (WHO)
CI	confidence interval
CRS	creditor reporting system
DST	drug susceptibility testing
EQA	external quality assessment
FIND	Foundation for Innovative New Diagnostics
GAF	Global Action Framework for TB Research
GDP	gross domestic product
GHE	government health expenditures
GIS	geographic information system
Global Fund	The Global Fund to Fight AIDS, TB and Malaria
GTB	Global TB Programme
HBC	high burden country
HIV	human immune-deficiency virus
IGRA	interferon gamma release assays
IHME	Institute of Health Metrics and Evaluation
LAMP	loop-mediated isothermal amplification
LPA	line probe assay
LTBI	latent TB infection
MDG	Millennium Development Goal
MDR	multidrug-resistant
MDR/RR-TB	RR-TB cases including MDR-TB cases
M:F	male to female (ratio)
MSF	Médecins Sans Frontières
NGO	nongovernmental organization
NHI	national health insurance
NTP	national TB programme
OBR	optimized background regimen
OECD	Organisation for Economic Co-operation and Development
OOP	out-of-pocket
PAF	population attributable fraction
PMDT	programmatic management of drug-resistant TB
POC	point-of-care
P:N	prevalence to notification (ratio)
PPM	public–private mix
RR	rifampicin-resistant
SAE	serious adverse event
SDG	Sustainable Development Goal
SHA	System of health accounts
SNP	single nucleotide polymorphism
SRL	Supranational Reference Laboratory
SSI	Statens Serum Institute
STD	sexually transmitted disease
TB	tuberculosis
TBTC	TB Trial Consortium
TBVI	Tuberculosis Vaccine Initiative
TDR	Special Programme for Research and Training in Tropical Diseases
TNF	tumour necrosis factor
TST	tuberculin skin test
UCS	Universal Coverage Scheme (Viet Nam)
UHC	universal health coverage
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
US	United States
USAID	US Agency for International Development
VR	vital registration
WHO	World Health Organization
WRD	WHO-recommended rapid diagnostic
XDR-TB	extensively drug-resistant TB

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Global actions and investments fall far short of those needed to end the global TB epidemic.

Executive Summary

Background

The Sustainable Development Goals (SDGs) for 2030 were adopted by the United Nations in 2015. One of the targets is to end the global TB epidemic. The WHO End TB Strategy, approved by the World Health Assembly in 2014, calls for a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate by 2030, compared with 2015.

This global TB report is the first to be produced in the era of the SDGs and the End TB Strategy. It provides an assessment of the TB epidemic and progress in TB diagnosis, treatment and prevention efforts, as well as an overview of TB-specific financing and research. It also discusses the broader agenda of universal health coverage, social protection and other SDGs that have an impact on health. Data were available for 202 countries and territories that account for over 99% of the world's population and TB cases.

Main findings and messages

Status of the TB epidemic and MDR-TB crisis

The TB epidemic is larger than previously estimated, reflecting new surveillance and survey data from India. However, the number of TB deaths and the TB incidence rate continue to fall globally and in India.

In 2015, there were an estimated 10.4 million new (incident) TB cases worldwide, of which 5.9 million (56%) were among men, 3.5 million (34%) among women and 1.0 million (10%) among children. People living with HIV accounted for 1.2 million (11%) of all new TB cases.

Six countries accounted for 60% of the new cases: India, Indonesia, China, Nigeria, Pakistan and South Africa.[1] Global progress depends on major advances in TB prevention and care in these countries. Worldwide, the rate of decline in TB incidence remained at only 1.5% from 2014 to 2015. This needs to accelerate to a 4–5% annual decline by 2020 to reach the first milestones of the End TB Strategy.

In 2015, there were an estimated 480 000 new cases of multidrug-resistant TB (MDR-TB) and an additional 100 000 people with rifampicin-resistant TB (RR-TB) who were also newly eligible for MDR-TB treatment.[2] India, China and the Russian Federation accounted for 45% of the combined total of 580 000 cases.

There were an estimated 1.4 million TB deaths in 2015, and an additional 0.4 million deaths resulting from TB disease among people living with HIV.[3] Although the number of TB deaths fell by 22% between 2000 and 2015, TB remained one of the top 10 causes of death worldwide in 2015.

TB care and prevention results

TB treatment averted 49 million deaths globally between 2000 and 2015, but important diagnostic and treatment gaps persist.

In 2015, 6.1 million new TB cases were notified to national authorities and reported to WHO. Notified TB cases increased from 2013–2015, mostly due to a 34% increase in notifications in India. However, globally there was a 4.3 million gap[4] between incident and notified cases, with India, Indonesia and Nigeria accounting for almost half of this gap.[5]

The crisis of MDR-TB detection and treatment continues. In 2015, of the estimated 580 000 people newly eligible for MDR-TB treatment, only 125 000 (20%) were enrolled. Five countries accounted for more than 60% of the gap: India, China, the Russian Federation, Indonesia and Nigeria.[5] Globally, the MDR-TB treatment success rate was 52% in 2013.[6]

In 2015, 55% of notified TB patients had a documented HIV test result. The proportion of HIV-positive TB patients on antiretroviral therapy (ART) was 78%.

Access to TB preventive treatment needs to be expanded. A total of 910 000 people living with HIV were started on such treatment in 2015, as well as 87 000 children under five (7% of those eligible).

TB financing, universal health coverage, social protection and social determinants

US$ 6.6 billion was available for TB care and prevention in low and middle-income countries in 2016, of which 84% was from domestic sources. Nonetheless, national TB programmes (NTPs) in low-income countries continue to rely on international donors for almost 90% of their financing. Investments in low and middle-income countries fall almost US$ 2 billion short of the US$ 8.3 billion needed in 2016. This annual gap will widen to US$ 6 billion in 2020 if current funding levels do not increase.

Improvements are also needed in overall health financing. Government expenditures on health in 2014 were less than the WHO benchmark of at least 6% of gross domestic product (GDP) in 150 countries. Out-of-pocket expenditures exceeded 45% of total health expenditures in 46 countries, including 11 of the 30 high TB burden countries.

TB research and development

Despite some progress in the pipeline for new diagnostics, drugs and regimens, and vaccines, TB research and development remains severely underfunded.

Additional highlights from the report

A new era of global TB monitoring

The End TB Strategy has three high-level indicators: the TB incidence rate, the absolute number of TB deaths and the percentage of TB patients and their households that experience catastrophic costs as a result of TB disease. Targets for these indicators have been set for 2030 and 2035, with accompanying milestones for 2020 and 2025.

The 2020 milestones of the End TB Strategy are a 35% reduction in the absolute number of TB deaths and a 20% reduction in the TB incidence rate, compared with levels in 2015; and that no TB-affected households face catastrophic costs.

WHO has defined three lists of high burden countries for the period 2016–2020, for TB, TB/HIV and MDR-TB. Each list includes 30 countries.

TB disease burden

Upward revisions to estimates of the burden of TB disease in India for the period 2000–2015 follow accumulating evidence that previous estimates were too low. This evidence includes household surveys, a state-wide TB prevalence survey, studies of anti-TB drug sales in the private sector, notification data and new analysis of mortality data. Since India accounts for more than one quarter of the world's TB cases and deaths, these revisions have had a major impact on global estimates. Estimates for India are considered interim, pending a national TB prevalence survey scheduled for 2017/2018.

The proportion of TB cases living with HIV was highest in the WHO African Region (31%), and exceeded 50% in parts of southern Africa.

In addition to accelerating the annual decline in TB incidence, reaching the 2020 milestone for a 35% reduction in TB deaths requires reducing the global proportion of people with TB who die from the disease (the case fatality ratio or CFR) from 17% in 2015 to 10% by 2020.

The CFR in 2015 varied from under 5% in a few countries to more than 20% in most countries in the WHO African Region. This shows considerable inequalities among countries in access to TB diagnosis and treatment that need to be addressed. If everyone with TB had a timely diagnosis and high-quality treatment, the CFR would be low in all countries.

National notification and vital registration systems (with standard coding of causes of death) of high coverage and quality are needed in all countries. In the interim, national TB prevalence surveys will continue to provide the best method for directly measuring the burden of TB disease and identifying actions required to reduce that burden in an important subset of countries. In recent years, there has been enormous progress in implementing such surveys, with 22 completed between 2009 and August 2016.

Diagnosis and treatment: TB, HIV-associated TB and drug-resistant TB

The global male:female (M:F) ratio for notifications was 1.7, varying from 1.0 in Pakistan to 3.1 in Viet Nam among the 30 high TB burden countries. Results from national TB prevalence surveys of adults show higher M:F ratios, indicating that notification data understate the share of the TB burden accounted for by men in some countries. Globally, children (aged <15 years) accounted for 6.3% of the new cases that were notified in 2015.

In 2015, 30% of the 3.4 million new bacteriologically confirmed and previously treated TB cases notified globally were reported to have had drug susceptibility testing for rifampicin, with coverage of 24% for new TB patients and 53% for previously treated TB patients.

The only WHO-recommended rapid diagnostic test for detection of TB and rifampicin resistance currently available is the Xpert MTB/RIF® assay. Of the 48 countries in at least one of the three new lists of high burden countries, 15 had adopted national algorithms positioning Xpert MTB/RIF as the initial diagnostic test for all people with signs and symptoms of pulmonary TB by the end of 2015. These countries accounted for 10% of the estimated global number of incident TB cases in 2015.

In 2015, the gap of 4.3 million between notifications of new cases and the estimated number of incident cases[4] reflects a mixture of underreporting of detected TB cases (especially in countries with large private sectors) and underdiagnosis (especially in countries where there are major geographic or financial barriers to accessing care). Ten countries accounted for 77% of the total estimated gap: India, Indonesia, Nigeria, Pakistan, South Africa, Bangladesh, the Democratic Republic of the Congo, China, the United Republic of Tanzania and Mozambique.[5]

In the African Region where the burden of HIV-associated TB is highest, 81% of notified TB patients had a documented HIV test result. The proportion of known HIV-positive TB patients on ART was above 90% in India, Kenya, Malawi, Mozambique, Namibia and Swaziland.

The latest treatment outcome data show a treatment success rate of 83% for TB (2014 cohort), 52% for MDR-TB (2013 cohort) and 28% for extensively drug-resistant TB (XDR-TB; 2013 cohort).

At least 23 countries in Africa and Asia have introduced shorter regimens for treatment of MDR-TB or RR-TB. These have achieved high treatment success rates (87–90%) under operational research conditions. A standardised regimen of 9–12 months is recommended by WHO for all patients (excluding pregnant women) with pulmonary MDR/RR-TB that is not resistant to second-line drugs.

As part of efforts to improve outcomes for MDR/XDR-TB, at least 70 countries had started using bedaquiline and 39 countries had introduced delamanid by the end of 2015.

TB prevention services

South Africa accounted for the largest share (45%) of people living with HIV who received TB preventive treatment for latent TB infection (LTBI) in 2015, followed by Malawi, Mozambique and Kenya. Ten countries reported data for the first time, including Kenya. Despite this progress, 21 of the 30 high TB/HIV burden countries did not report data.

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 control in health facilities. In 16 countries, the number of TB cases per 100 000 health-care workers was more than double the notification rate in the general adult population in 2015.

BCG vaccination should be provided as part of national childhood immunization programmes according to a country's TB epidemiology. In 2015, 163 countries reported providing BCG vaccination as a standard part of these programmes; 102 reported coverage of above 90%.

Universal health coverage, social protection and addressing social determinants: Implications for TB

In some high TB burden settings, emerging health financing schemes, including national health insurance, could lead to major reductions in out-of-pocket expenditures in low-income populations. Thailand and a range of countries in the Region of the Americas are good pathfinding examples.

Building on established approaches to private engagement in TB care could help to address the burgeoning private sector in health-care delivery, especially in Asia. This includes a combination of provider incentives and regulation, and application of innovative institutional intermediaries and communications technologies. Such levers can help to assure the quality of services provided.

Social protection can be advanced through better models of care and social benefits. Many low- and middle-income countries have financed social and economic support for TB patients, but these support packages need to be better documented and evaluated. For overall impact and sustainability, using national social protection platforms is a priority.

WHO-recommended baseline national surveys are underway to assess the nature and severity of TB patient costs, and to improve service delivery and social protection accordingly. One country survey was conducted in 2015, eight began in 2016 and ten are planned for 2017–2018.

The available evidence about links between ending TB and ending poverty needs to be used to advocate for poverty elimination and action on related risk factors, such as noncommunicable disease prevention, food security, and housing.

TB financing

The BRICS countries (Brazil, the Russian Federation, India, China and South Africa), which collectively account for about 50% of the world's TB cases, rely mostly or exclusively (the exception is India) on domestic funding.

In other countries with a high TB burden, international donor funding dominates, accounting for 75% of reported funding for NTPs in the group of 25 high TB burden countries outside BRICS, 87% of funding in low-income countries and 60% of funding in lower middle-income countries. The single largest source of international donor funding is the Global Fund to Fight AIDS, Tuberculosis and Malaria.

International donor funding for TB falls far short of donor contributions for HIV and malaria. The latest data from the Organisation for Economic Co-operation and Development (OECD) creditor reporting system show totals of US$ 5.4 billion for HIV/AIDS, US$ 1.7 billion for malaria and US$ 0.7 billion for TB in 2014.

The cost per patient treated is usually in the range of US$ 100–1000 for drug-susceptible TB and US$ 2000–20 000 for MDR-TB.

TB research and development

At least US$ 2 billion per year is needed for TB research and development. Funding during the decade 2005–2014 never exceeded US$ 0.7 billion per year.

In 2016, four diagnostic tests were reviewed and recommended by WHO: the loop-mediated isothermal amplification test for TB (known as TB-LAMP), two line probe assays (LPAs) for the detection of resistance to the first-line anti-TB drugs isoniazid and rifampicin, and an LPA for the detection of resistance to second-line anti-TB drugs. A next-generation cartridge called Xpert Ultra and a new diagnostic platform called GeneXpert Omni are in development; assessment of both by WHO is expected in 2017.

There are nine drugs in advanced phases of clinical trials for the treatment of drug-susceptible TB, drug-resistant TB or LTBI. These are bedaquiline, delamanid, linezolid, PBTZ169, pretomanid, Q203, rifampicin (high-dose), rifapentine and sutezolid.

There are 13 vaccine candidates in clinical trials, including candidates for prevention of TB infection and candidates for prevention of TB disease in people with LTBI.

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[1] Countries are listed in descending order of their number of cases.

[2] MDR-TB is defined as resistance to rifampicin and isoniazid. WHO recommends that all patients with rifampicin-resistant TB (RR-TB) are treated with a second-line MDR-TB regimen. Cases of MDR-TB and RR-TB are collectively referred to as MDR/RR-TB in this report.

[3] When an HIV-positive person dies from TB disease, the underlying cause is classified as HIV in the International Classification of Diseases system (ICD-10).

[4] i.e. 10.4 million minus 6.1 million.

[5] Countries are listed in descending order of the size of their gap.

[6] This is the latest year for which treatment outcome data are currently available.

:: Box 1.1
Basic facts about TB

TB is an infectious disease caused by the bacillus *Mycobacterium tuberculosis*. It typically affects the lungs (pulmonary TB) but can also affect other sites (extrapulmonary TB). The disease is spread when people who are sick with pulmonary TB expel bacteria into the air, for example by coughing. Overall, a relatively small proportion (5–15%) of the estimated 2–3 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 infected with HIV.

Diagnostic tests for TB disease include:

- sputum smear microscopy. This was developed more than 100 years ago. Sputum samples are examined under a microscope to see if bacteria are present. In the current case definitions recommended by WHO, one positive result is required for a diagnosis of smear-positive pulmonary TB;
- rapid molecular tests. The only rapid test for diagnosis of TB currently recommended by WHO is the Xpert® MTB/RIF assay (Cepheid, Sunnyvale USA). It was initially recommended (in 2010) for diagnosis of pulmonary TB in adults. Since 2013, it has also been recommended for children and specific forms of extrapulmonary TB. The test has much better accuracy than microscopy; and
- culture methods. These are the current reference standard but require more developed laboratory capacity and can take up to 12 weeks to provide results.

Globally, use of rapid molecular tests is increasing, and many countries are phasing out use of smear microscopy for diagnostic purposes (although microscopy and culture remain necessary for treatment monitoring). Despite advances in diagnostics, a considerable proportion of the TB cases reported to WHO are still clinically diagnosed rather than bacteriologically confirmed. In 2015, for example, 57% of the pulmonary cases reported to WHO were bacteriologically confirmed.

There are also tests for TB that is resistant to first and second-line anti-TB drugs. They include Xpert MTB/RIF, which simultaneously tests for TB and resistance to rifampicin (the most effective first-line anti-TB drug); rapid line probe assays (LPAs) that test for resistance to rifampicin and isoniazid (referred to as first-line LPAs); a rapid LPA that tests for resistance to fluoroquinolones and injectable anti-TB drugs (referred to as a second-line LPA); and sequencing technologies. First-line LPAs were first recommended by WHO in 2008; the second-line LPA was first recommended in May 2016. Culture-based methods currently remain the reference standard for drug susceptibility testing.

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

Effective drug treatments were first developed in the 1940s. The currently recommended treatment for new cases of drug-susceptible TB 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 new cases of drug-susceptible TB are regularly reported to WHO by its 194 Member States. Treatment for rifampicin-resistant TB (RR-TB) and multidrug-resistant TB (MDR-TB)[b] is longer, and requires more expensive and more toxic drugs. Until early 2016, the treatment regimens recommended by WHO typically lasted for 20 months, and cost about US$ 2000–5000 per person. As a result of new evidence from several countries, WHO issued updated guidance in May 2016. A standardised shorter MDR-TB regimen of 9–12 months is now recommended for all patients (excluding pregnant women) with pulmonary MDR/RR-TB that is not resistant to second-line drugs. The cost of a shortened drug regimen is about US$ 1000 per person.

New TB drugs have begun to emerge from the pipeline, and combination regimens that include new compounds are being tested in clinical trials. The Bacille-Calmette-Guérin (BCG) vaccine, which was developed almost 100 years ago and has been shown to prevent severe forms of TB in children, is widely used. However, there is currently no vaccine that is effective in preventing TB disease in adults, either before or after exposure to TB infection. There are 13 TB vaccines in Phase I, Phase II or Phase III trials.

[a] 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 (http://www.ncbi.nlm.nih.gov/pubmed/21483732, accessed 27 July 2016).

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

Chapter 1 :: Introduction

Tuberculosis (TB) has existed for millennia and remains a major global health problem. It causes ill-health in millions of people each year and in 2015 was one of the top 10 causes of death worldwide, ranking above HIV/AIDS as one of the leading causes of death from an infectious disease.[1] This is despite the fact that with a timely diagnosis and correct treatment, most people who develop TB disease can be cured. Basic facts about TB are summarized in **Box 1.1**.

The best estimate is that there were 1.4 million TB deaths in 2015, and an additional 0.4 million deaths resulting from TB disease among HIV-positive people.[2] In terms of cases, the best estimates for 2015 are that there were 10.4 million new TB cases (including 1.2 million among HIV-positive people), of which 5.9 million were among men, 3.5 million among women and 1.0 million among children. Overall, 90% of cases were adults and 10% children, and the male:female ratio was 1.6:1.

WHO has published a global TB report every year since 1997. The main aim of the report is to provide a comprehensive and up-to-date assessment of the TB epidemic, and of progress in prevention, diagnosis and treatment of the disease at global, regional and country levels. This is done in the context of recommended global TB strategies and targets endorsed by WHO's Member States and broader development goals set by the United Nations (UN).

As usual, the 2016 global TB report is based primarily on data gathered from countries and territories. WHO has implemented annual rounds of global TB data collection since 1996, with an online system[3] used since 2009. In 2016, this system was opened for reporting at the end of March. Following the May deadline for reporting and subsequent review and follow-up of submitted data between June and August, data were available for 202 countries and territories that account for more than 99% of the world's population and estimated TB cases; this included 183 of WHO's 194 Member States.

Other sources of data used in 2016 include the HIV department in WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS), which collect information about the provision of TB preventive treatment to people living with HIV and about antiretroviral therapy for HIV-positive TB patients; the creditor reporting system of the Organisation for Economic Co-operation and Development (OECD); the World Bank, for development indicators; and the WHO national health accounts database.

This is the first global TB report to be produced in the post-2015 era of the Sustainable Development Goals (SDGs) and the End TB Strategy, which have superseded the Millennium Development Goals (2000–2015) and the Stop TB Strategy (2006–2015), respectively. The SDGs were adopted by the UN in September 2015 and cover the period 2016–2030. The End TB Strategy spans a 20-year timeframe (2016–2035) and was unanimously endorsed by WHO's Member States at the 2014 World Health Assembly. The SDGs and the End TB Strategy share a common aim: to end the global TB epidemic. Targets set in the End TB Strategy include a 90% reduction in TB deaths and an 80% reduction in TB incidence by 2030, compared with 2015.

In this new context, the structure and content of the global TB report have been reshaped. Chapter 2 provides an overview of the SDGs, the End TB Strategy and new lists of high burden countries (for TB, TB/HIV and drug-resistant TB) that will be given particular attention in the period 2016–2020. The remaining six chapters of the report cover TB disease burden; diagnosis and treatment of TB, HIV-associated TB and drug-resistant TB; TB prevention services; universal health coverage, social protection and social determinants from the TB perspective; TB financing; and TB research and development.

The report also has four annexes. Annex 1 explains how to access the online WHO global TB database and provides further details about the 2016 round of global TB data collection. Annex 2 contains country profiles for the 30 high TB burden countries (profiles for other countries are available online[4]) and Annex 3 contains profiles for WHO's six regions. Annex 4 provides data tables that give details of key indicators for the most recent year for which data or estimates are available, for all countries.

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[1] In 2015, there were an estimated 1.1 million deaths due to HIV, including 0.4 million deaths from TB among HIV-positive people (see unaids.org).

[2] When an HIV-positive person dies from TB disease, the underlying cause is classified as HIV in the international classification of diseases system.

[3] https://extranet.who.int/tme

[4] www.who.int/tb/data

Chapter 2 :: A new era of global TB monitoring

From 2000 to 2015, global and national efforts to reduce the burden of tuberculosis (TB) disease were 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 MDG6 was to "halt and reverse" TB incidence. The Stop TB Partnership, established in 2001, adopted this target and set two additional targets: that TB prevalence and TB mortality rates should be halved by 2015 compared with their levels in 1990. The global TB strategy developed by WHO for the decade 2006–2015, the Stop TB Strategy, had the overall goal of reaching all three targets.

WHO published its assessment of whether the 2015 global TB targets for reductions in TB incidence, prevalence and mortality were achieved in October 2015.[1] The assessment indicated that the MDG target was achieved on a worldwide basis, in each of WHO's six regions and in 16 of the 22 countries that were classified by WHO as high TB burden countries during the period 2002–2015. Globally, the TB mortality rate fell by 47% between 1990 and 2015, with most of that improvement occurring after 2000. The target of a 50% reduction was met in four WHO regions – the Region of the Americas, the Eastern Mediterranean Region, the South-East Asia Region and the Western Pacific Region – and in 11 high TB burden countries. Globally, TB prevalence fell by 42% between 1990 and 2015. The target of a 50% reduction was achieved in three WHO regions – the Region of the Americas, the South-East Asia Region and the Western Pacific Region – and in nine high TB burden countries.

The MDGs (2000–2015) have now been superseded by the Sustainable Development Goals (SDGs), which have an end date of 2030. Similarly, WHO's Stop TB Strategy has been replaced by the End TB Strategy, which covers the period 2016–2035. With the *Global tuberculosis report 2016* being the first such report in the post-2015 era, this chapter provides an overview of both the SDGs (**Section 2.1**) and the End TB Strategy (**Section 2.2**), including the indicators that will be used to monitor progress. For the first 5 years of this new era (2016–2020), WHO has also defined updated lists of high burden countries (HBCs) for TB, TB/HIV and multidrug-resistant TB (MDR-TB). The updated lists are presented and explained in **Section 2.3**.

[1] World Health Organization. Global tuberculosis report 2015. Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf, accessed 27 July 2016).

2.1 The Sustainable Development Goals

The SDGs were adopted by all UN Member States in September 2015, at the UN General Assembly.[2] The 17 goals are shown in **Box 2.1**. Departures from the MDGs include a broader agenda (17 goals compared with the previous eight), one consolidated goal on health compared with three health-related MDGs, and a desire for universal relevance rather than a focus on issues mostly of concern to developing countries.

SDG3 is to "Ensure healthy lives and promote well-being for all at all ages", and it includes 13 targets (**Box 2.2**). 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, waterborne diseases and other communicable diseases". The language of "ending epidemics" is also now a prominent element of global health strategies developed by WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS) for the post-2015 era,[3] including the End TB Strategy (**Section 2.2**). Such language is much more ambitious than the MDG language of "halting and reversing" epidemics (or "stopping" them, as in the Stop TB Strategy). The TB indicator for Target 3.3 is TB incidence per 100 000 population.

SDG3 also includes a target (Target 3.8) related to universal health coverage (UHC). The WHO/World Bank definition of UHC is that all people receive the health services they need, while at the same time ensuring that the use of these services does not expose the user to financial hardship.[4] Indicators for Target 3.8 include coverage of tracer interventions for prevention and treatment (including TB treatment coverage),[5] and financial coverage provided by health insurance or a public health system.

Across the SDG indicator framework as a whole, the definitions of many indicators include much greater emphasis on within-country disaggregation compared with the MDGs. This includes disaggregation by age, sex, geog-

[2] United Nations. Sustainable Development Goals (https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals, accessed 27 July 2016).

[3] World Health Organization. Accelerating progress on HIV, tuberculosis, malaria, hepatitis and neglected tropical diseases: A new agenda for 2016–2030. Geneva: WHO; 2015 (http://www.who.int/about/structure/organigram/htm/progress-hiv-tb-malaria-ntd/en/, accessed 27 July 2016).

[4] World Health Organization/World Bank Group. Tracking universal health coverage: first global monitoring report. Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/174536/1/9789241564977_eng.pdf?ua=1, accessed 28 July 2016).

[5] There are many different prevention and treatment interventions. In this context, a few interventions are selected to act as tracers for progress towards UHC for all interventions.

:: 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

SDG3: 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 new-borns 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 wellbeing

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

raphy (e.g. urban versus rural), wealth (e.g. bottom 40%, or bottom versus top income quintiles) and employment status. Some indicators also give particular attention to specific subpopulations, such as pregnant women, people with disabilities, victims of work injuries and migrants.

Disaggregation is intended to inform analysis of within-country inequalities and associated assessments of equity, as a basis for identifying particular areas or subpopulations where progress is lagging and greater attention is needed. This is an important consideration for the TB community, given the influence of socio-economic status and access to health care on TB epidemiology. **Chapter 3** of this report includes examples of within-country analyses of TB data; it also illustrates across-country inequities in access to TB diagnosis and treatment using the case fatality ratio (CFR), one of the top 10 indicators for monitoring implementation of the End TB Strategy (see **Section 2.2**).

2.2 The End TB Strategy

In 2012, in anticipation of the end of the eras of the MDGs and Stop TB Strategy, WHO's Global TB Programme initiated the development of a post-2015 global TB strategy. Following 2 years of consultations, the proposed strategy was discussed at the 2014 World Health Assembly, where it was unanimously endorsed by all Member States.[1] That strategy is now known as the End TB Strategy.[2]

The End TB Strategy "at a glance" is shown in **Box 2.3**. It covers the period 2016–2035 and the overall goal is to "End the global TB epidemic", defined as around 10 new cases per 100 000 population per year. This is the level found in countries considered to have a low burden of TB in 2015 (**Chapter 3**).

The End TB Strategy has 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:

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1 World Health Assembly. Global strategy and targets for tuberculosis prevention, care and control after 2015 (WHA67.1, Agenda item 12.1). Geneva: World Health Assembly; 2014 (http://apps.who.int/gb/ebwha/pdf_files/WHA67/A67_R1-en.pdf, accessed 28 July 2016).

2 Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, et al. WHO's new End TB Strategy. Lancet. 2015;385(9979):1799–1801 (http://www.ncbi.nlm.nih.gov/pubmed/25814376, accessed 28 July 2016).

:: 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% (approximately 10 per 100 000 population)
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

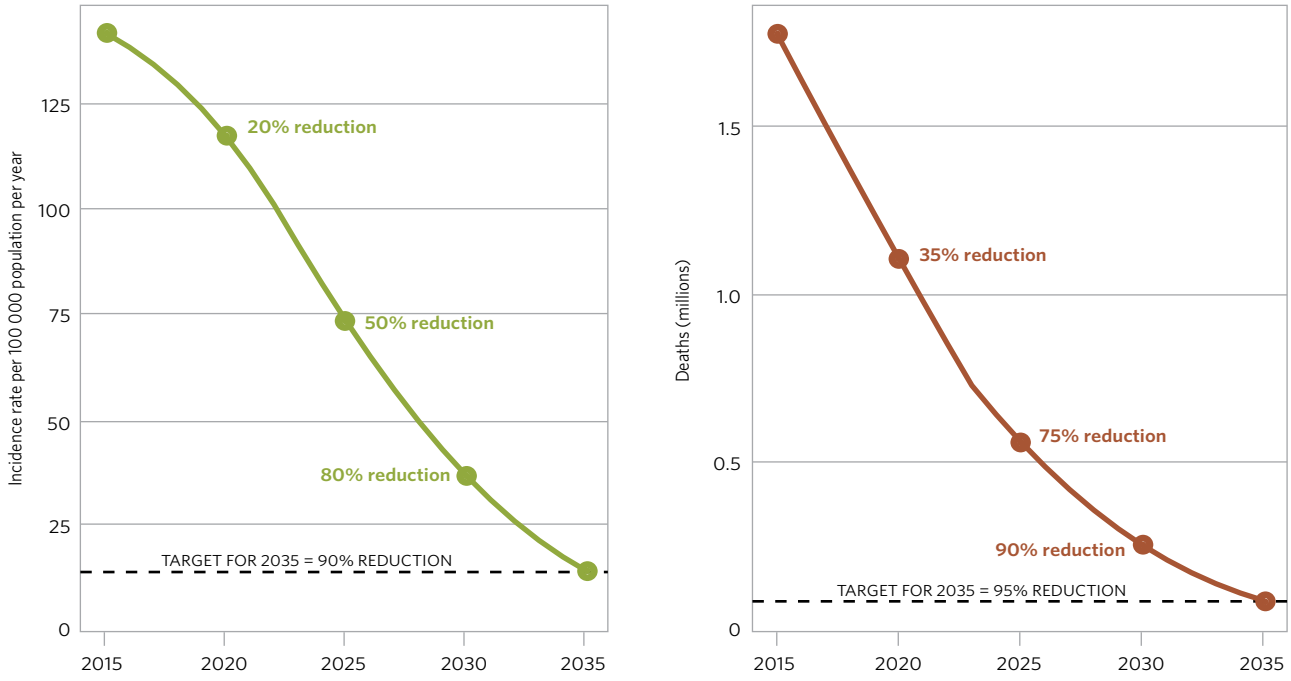
3. INTENSIFIED RESEARCH AND INNOVATION

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).

:: FIG. 2.1

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



- the number of TB deaths per year;
- the TB incidence rate per year; and
- the percentage of TB-affected households that experience catastrophic costs as a result of TB disease.

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 2030 targets are a 90% reduction in TB deaths and an 80% 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 Stop TB Partnership has developed a *Global Plan to End TB, 2016–2020*,[1] which focuses on the actions and funding needed to reach these 2020 milestones. More details about this plan are provided in **Chapter 7**.

For the third indicator (the percentage of TB-affected households that experience catastrophic costs as a result of TB disease), the milestone for 2020 is zero, to be sustained thereafter. This indicator is a good tracer for progress towards UHC. If UHC is in place, then people with TB should be able to access high-quality diagnosis and treatment with financial protection; that is, they should not face catastrophic costs.

UHC is also fundamental to achieving the targets for reductions in TB cases and deaths, for two reasons. First, reaching the milestones for reductions in cases and deaths set for 2020 and 2025 requires the annual decline in the global TB incidence rate to accelerate from 1.5% per year in 2015 to 4–5% per year by 2020, and then to 10% per year by 2025. A decline of 10% per year is equivalent to the best-ever performance at national level historically – for example, in countries in western Europe during the 1950s and 1960s. Declines of 10% per year have only been documented in the context of UHC (and of broader social and economic development). Second, the global proportion of people with TB who die from the disease (i.e. the CFR) needs to be reduced to 10% by 2020 and then to 6.5% by 2025. A CFR of 6.5% is similar to the current level in many high-income countries but is only possible if all those with TB disease can access high-quality treatment. Analysis of CFRs across and within countries is included in **Chapter 3**.

After 2025, an unprecedented acceleration in the rate at which TB incidence falls globally is required if the 2030 and 2035 targets are to be reached. Such an acceleration will depend on a technological breakthrough – for example, a post-exposure vaccine or a short, efficacious and safe treatment for latent TB infection (LTBI) – so that the risk of developing TB disease among the approximately 2–3 billion people who are already infected with *Mycobacterium tuberculosis* is substantially reduced. The trajectories of TB incidence and TB deaths that are required to reach End TB Strategy milestones and targets are shown in **Fig. 2.1**, and the latest status of the development pipelines for new diagnostics, drugs and vaccines is presented in **Chapter 8**.

This report includes estimates of trends in TB incidence and mortality for the period 2000–2015 (**Chapter 3**). In contrast to previous global TB reports, estimates of TB prevalence are not shown for all countries. This is because (unlike the era of the MDGs and Stop TB Strategy) TB prev-

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

:: TABLE 2.1

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.

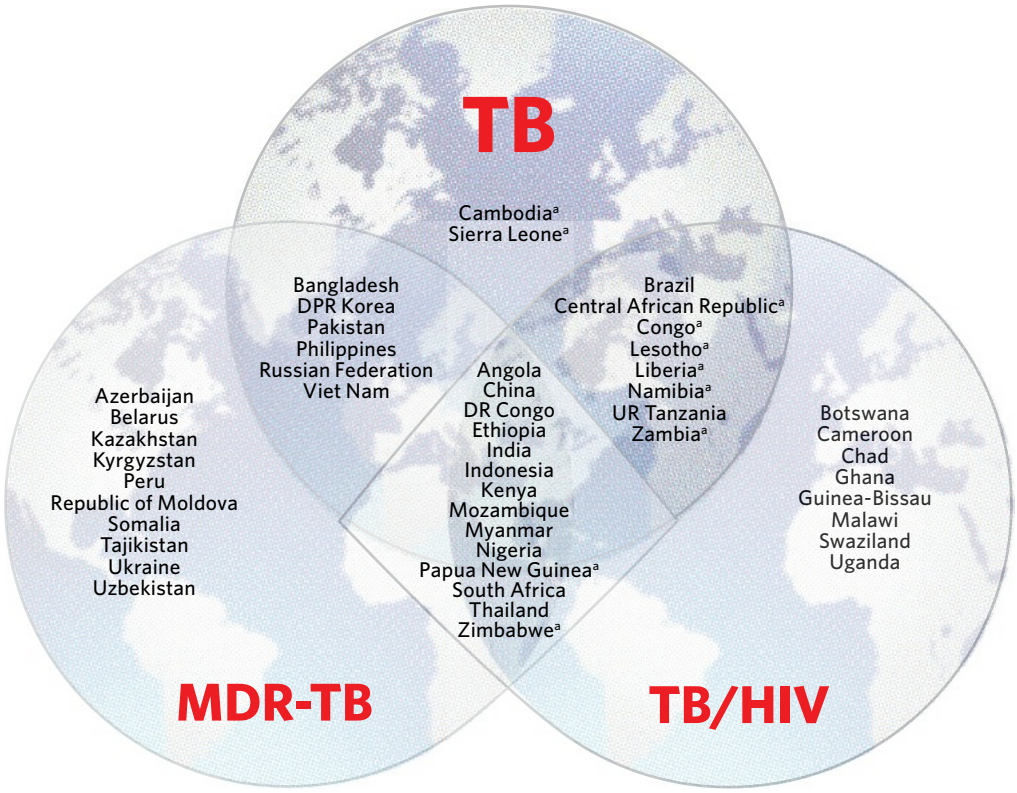
	INDICATOR	RECOMMENDED TARGET LEVEL	MAIN RATIONALE FOR INCLUSION IN TOP 10	MAIN METHOD OF MEASUREMENT, AND CHAPTER OF THIS REPORT WHERE INDICATOR IS FEATURED
1	TB treatment coverage *Number of new and relapse cases that were notified and treated, divided by the estimated number of incident TB cases in 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 a fundamental requirement for achieving the milestones and targets of the End TB Strategy. In combination, it is likely that these two indicators will be used as tracer indicators for monitoring progress towards UHC within the SDGs.	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 6**
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 a fundamental 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 living with HIV newly enrolled in HIV care and the number of children aged <5 years who are household contacts of cases started on LTBI treatment, divided by the number eligible for treatment, expressed as a percentage (separately for each of the two groups).*	≥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.	As above for LTBI.
7	Drug-susceptibility testing (DST) coverage for TB patients *Number of TB patients with DST results for at least rifampicin, divided by the total number of notified (new and retreatment) cases in the same year, expressed as a percentage. DST coverage includes results from molecular (e.g. Xpert MTB/RIF) as well as conventional phenotypic DST results.*	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**
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 patients for treatment with new drugs may differ among countries.*	As above for DST.
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 years, 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, Chapter 6**

CFR, case fatality ratio; DST, drug-susceptibility testing; HIV, human immunodeficiency virus; LTBI, latent TB infection; SDG, Sustainable Development Goal; TB, tuberculosis; UHC, universal health care; WHO, World Health Organization; WRD, WHO-recommended rapid diagnostic.

[a] Catastrophic costs are provisionally defined as total costs that exceed 20% of annual household income.

:: FIG. 2.2

Countries in the three TB high-burden country lists that will be used by WHO during the period 2016–2020, and their areas of overlap



DPR Korea, Democratic People's Republic of Korea; DR Congo, Democratic Republic of the Congo; HIV, human immunodeficiency virus; MDR, multidrug resistant; TB, tuberculosis; UR Tanzania, United Republic of Tanzania; WHO, World Health Organization

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

alence is no longer a high-level indicator for which a global target has been set. However, national TB prevalence surveys remain important for assessing TB disease burden and trends (through repeat surveys) in many countries, and can also inform estimates of TB incidence. For these reasons, results from recent national TB prevalence surveys are included in **Chapter 3**.

To achieve the targets and milestones, the End TB Strategy has four underlying principles and three pillars. The 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; and intensified research and innovation.

The 10 components of the three pillars are shown in **Box 2.3** and the 10 priority indicators (defined in March 2015 in association with the publication of a journal article about the End TB Strategy)[1] to monitor their implementation are shown in **Table 2.1**. The chapter of this report in which available data for each indicator can be found is also explained in the table.

Data for 5 of the 10 indicators cannot be captured routinely using the standard recording and reporting forms for paper-based systems that are included in the latest revision of WHO's framework for TB case definitions and reporting.[2] Collection of data on the costs faced by TB patients and their households and assessment of whether these are catastrophic (indicator 3 in **Table 2.1**) requires periodic surveys of a representative sample of TB patients; further details are provided in **Chapter 6**. For the other four indicators (numbered 4, 5, 6 and 8 in **Table 2.1**), data may already be captured routinely in countries with electronic case-based systems for recording and reporting of data, or these systems can be adapted to do so. Alternatively, periodic surveys of the medical records or patient cards of a random sample of TB patients can be done. Further guidance is provided in WHO operational guidance on the

[1] Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, et al. WHO's new End TB Strategy. Lancet. 2015;385(9979):1799–1801 (http://www.ncbi.nlm.nih.gov/pubmed/25814376, accessed 28 July 2016). The 10 indicators are defined and explained in an appendix.

[2] World Health Organization. Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014) (WHO/HTM/TB/2013.2). Geneva: WHO; 2013 (www.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf, accessed 15 August 2016).

TABLE 2.2

:: The three TB high-burden country lists that will be used by WHO during 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 Ghana Guinea-Bissau Liberia Namibia Papua New Guinea Swaziland	*The top 20 by estimated absolute number (in alphabetical order):* Bangladesh China DPR Korea DR Congo Ethiopia India Kazakhstan Kenya Indonesia 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
% global total	84%	3.1%	87%	4.8%	84%	5.4%
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

End TB Strategy.[1] In addition, the Global TB Programme has begun working with a pilot group of countries in the African Region on collection of data using this approach.

For the first time, this report includes chapters related to TB prevention (**Chapter 5**) and UHC and social protection (**Chapter 6**), reflecting the much greater prominence of these topics in the End TB Strategy compared with previous global TB strategies.

[1] World Health Organization. Implementing the end TB strategy: the essentials. Geneva: WHO, 2016 (http://www.who.int/tb/publications/2015/The_Essentials_to_End_TB/en/). See in particular part II, section 2.4.

2.3 Lists of high-burden countries to be used by WHO during the period 2016–2020

During the period 1998 to 2015, the concept of an HBC became familiar and widely used in the context of TB. In 2015, three lists – for TB, TB/HIV and MDR-TB – were in use. The TB HBC list (22 countries) had remained unchanged since 2002, and the HBC lists for TB/HIV (41 countries) and MDR-TB (27 countries) had not been updated since 2009 and 2008, respectively. With 2015 marking the end of the MDGs and their replacement with the SDGs, and the last year of the Stop TB Strategy and its replacement with the

End TB Strategy, it was an ideal time to revisit these three HBC lists.

Following a wide consultation process,[1] WHO has defined three new HBC lists for the period 2016–2020: one for TB, one for MDR-TB and one for TB/HIV (**Fig. 2.2**, **Table 2.2**).[2] Each list contains 30 countries (**Table 2.2**). These are defined as the top 20 in terms of absolute numbers of cases, plus the additional 10 countries that have the most severe burden in terms of incidence rates per capita, do not appear in the top 20 and meet a minimum threshold in terms of absolute numbers of incident cases (10 000 per year for TB, and 1000 per year for TB/HIV and MDR-TB). The lists were defined using the latest estimates of TB disease burden available in October 2015. Each list accounts for 87–92% of the global burden, with almost all 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 list. The 14 countries that are in all three lists (shown in the central diamond in **Fig. 2.2**) are: Angola, China, the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Kenya, Mozambique, Myanmar, Nigeria, Papua New Guinea, South Africa, Thailand and Zimbabwe.

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 TB/HIV and MDR-TB specifically, the countries in the TB/HIV and MDR-TB lists respectively are given particular attention. **Annex 2** contains a one-page profile for each of the 30 high TB burden countries, with a clear demarcation between the 20 countries included on the basis of absolute numbers of incident cases and the 10 additional countries included on the basis of the incidence rate per capita.

As in the 2015 global TB report, data for all countries are included in **Annex 4** and in WHO's online global TB database. Country profiles for all countries (with the same content as those presented in **Annex 2**) are also available online.

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[1] 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: WHO; 2015 (http://www.who.int/tb/publications/global_report/high_tb_burdencountrylists2016-2020.pdf?ua=1, accessed 28 July 2016).

[2] As explained in the last row of **Table 2.2**, the three lists have a lifetime of 5 years, and the countries included in each list and the criteria used to define each list will be reviewed in June 2020.

Chapter 3 :: TB disease burden

KEY FACTS AND MESSAGES

Global targets and milestones for reductions in the burden of TB disease in the period 2016–2035 have been set as part of the Sustainable Development Goals (SDGs) and WHO's End TB Strategy.

The first milestones of the End TB Strategy, set for 2020, are a 35% reduction in the absolute number of TB deaths and a 20% reduction in the TB incidence rate, compared with levels in 2015. To reach these milestones, the TB incidence rate needs to be falling by 4–5% per year globally by 2020 and the proportion of people with TB who die from the disease (the case fatality ratio or CFR)[a] needs to be reduced to 10% globally by 2020.

A substantial acceleration in the current rate of progress in reducing the burden of TB disease, based on all elements of the End TB Strategy, is required to bring these milestones within reach.

Globally, the absolute number of TB deaths (excluding TB deaths among HIV-positive people[b]) and the TB incidence rate have fallen since 2000. The number of TB deaths fell from 1.8 million in 2000 to 1.4 million in 2015. However, the global rate of decline in the TB incidence rate was only 1.5% from 2014 to 2015 and the CFR in 2015 was 17%. TB is one of the top 10 causes of death worldwide and caused more deaths than HIV in 2015.

Worldwide in 2015, there were an estimated 10.4 million incident TB cases. An estimated 62% of these cases were male, and 90% of cases were adults. Six countries accounted for 60% of the global total: India, Indonesia, China, Nigeria, Pakistan and South Africa. The rate of progress in these countries will have a major influence on whether or not the 2020 global milestones are achieved.

Estimates of the burden of TB disease in India have been revised substantially upwards for the period 2000–2015, compared with those published in previous reports. This follows accumulating evidence from surveys and routinely collected TB notification data that previous estimates of cases and deaths were too low. As the country with the highest burden of TB disease in the world, these revisions have had a major impact on the global estimates. The estimates for India are still considered as interim, pending a national TB prevalence survey scheduled for 2017/2018.

An estimated 11% of incident TB cases in 2015 were HIV-positive. The proportion was highest in countries in the WHO African Region, and exceeded 50% in parts of southern Africa. In addition to the 1.4 million TB deaths among HIV-negative people, there were 0.4 million deaths from TB among HIV-positive people[b] in 2015.

Variation in the CFR in 2015, from under 5% in a few countries to more than 20% in most countries in the WHO African Region, shows considerable inequalities among countries in access to TB diagnosis and treatment that need to be addressed. If everyone with TB had a timely diagnosis and access to high-quality treatment, the CFR would be low in all countries.

Following WHO guidance issued in May 2016, all cases of rifampicin-resistant TB (RR-TB), including those with multidrug-resistant TB (MDR-TB), should be treated with a second-line MDR-TB treatment regimen. Globally in 2015, there were an estimated 480 000 new cases of MDR-TB and an additional 100 000 people with rifampicin-resistant TB who were also newly eligible for MDR-TB treatment; India, China and the Russian Federation accounted for 45% of these cases.

Until national notification and vital registration systems (with standard coding of causes of death) of high coverage and quality are present in all countries, national TB prevalence surveys will continue to provide the best method for directly measuring the burden of TB disease and identifying actions required to reduce that burden in an important subset of countries. In recent years, there has been enormous progress in implementing such surveys, with 22 completed between 2009 and August 2016. In this report, estimates of TB incidence were derived from prevalence surveys for 20 countries with 62% of the world's TB cases.

[a] The CFR can be approximated as the number of TB deaths divided by the number of incident cases in the same year.

[b] When an HIV-positive person dies from TB disease, the underlying cause is classified as HIV in the International Classification of Diseases system (ICD-10).

The burden of tuberculosis (TB) disease can be measured in terms of:

- *incidence* – the number of new and relapse cases of TB arising in a given time period, usually 1 year;
- *prevalence* – the number of cases of TB at a given point in time; and
- *mortality* – the number of deaths caused by TB in a given time period, usually 1 year.

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 (**Chapter 2**).[1] SDG3 includes a target to end the global TB epidemic by 2030, with TB incidence (per 100 000 population) 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 TB incidence, compared with levels in 2015. Targets for 2035 and milestones for 2020 and 2025 have also been defined (**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 *(compared with 2015 baseline)*	35	75	90	95
Percentage reduction in the TB incidence rate *(compared with 2015 baseline)*	20	50	80	90 (~10/100 000 population)

This chapter is structured in six major sections. **Section 3.1** and **Section 3.2** present the latest WHO estimates of TB incidence and mortality between 2000 and 2015. These sections also highlight sources of data and actions needed to improve measurement of TB incidence and mortality. **Section 3.3** focuses on the burden of drug-resistant TB, including the latest status of progress in global surveillance of resistance to anti-TB drugs and estimates of the incidence of multidrug-resistant TB (MDR-TB) and rifampicin-resistant TB (RR-TB). **Section 3.4** discusses national TB prevalence surveys. Although TB prevalence is no longer an indicator for which a global target has been set,[2] in many countries, national TB prevalence surveys still provide the best method for estimating the burden of TB disease and for planning actions needed to reduce that burden. In addition, results from national TB prevalence surveys can inform estimates of TB incidence and mortality, and thus contribute to monitoring of progress towards SDG and End TB Strategy targets. Finally, **Section 3.5** and **Section 3.6** cover disaggregated estimates of disease burden (TB incidence and mortality by age and sex), and what can be learned from disaggregated analysis (by age, sex and location) of TB surveillance and survey data. This is in line with the increasing emphasis on the importance of within-country disaggregation of key indicators in the SDGs and the End TB Strategy (**Chapter 2**).

WHO updates its estimates of the burden of TB disease annually, using the latest available data and analytical methods.[3],[4] Since 2006, concerted efforts have been made to improve the available data and methods used, 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 2015 global TB report is provided in **Box 3.2**; further details for India are provided in **Box 3.3**.

3.1 TB incidence

3.1.1 Methods to estimate TB incidence

TB incidence has never been measured at national level because this would require long-term studies among large cohorts (hundreds of thousands) of people, which would involve high costs and challenging logistics. 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. In the large number of countries where these criteria are not yet met, better estimates of TB incidence can be obtained from an inventory study (i.e. a survey to quantify the level of underreporting of detected TB cases); also, if certain conditions are met, results from an inventory study can be combined with capture–recapture methods to estimate TB incidence.[5] To date, such studies have been undertaken in only a few countries, but interest and implementation is growing (**Box 3.4**).

The ultimate goal is to directly measure TB incidence 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) and universal access to health care. A TB surveillance checklist developed by the WHO Global Task Force on TB Impact Measurement (**Box 3.1**)

[1] World Health Organization. WHO End TB Strategy: global strategy and targets for tuberculosis prevention, care and control after 2015. Geneva: WHO; 2015 (http://www.who.int/tb/post2015_strategy/en/, accessed 8 August 2016).

[2] This is in contrast to the eras of the Millennium Development Goals and Stop TB Strategy, when a target of halving prevalence between 1990 and 2015 was set.

[3] The online technical appendix is available at www.who.int/tb/data.

[4] The updates can affect the entire time-series back to 2000. Therefore, estimates presented in this chapter for 2000–2014 supersede those of previous reports, and direct comparisons (e.g. between the 2014 estimates in this report and the 2014 estimates in the previous report) are not appropriate.

[5] Inventory studies can be used to measure the number of cases that are diagnosed but not reported. For a guide to inventory studies, see World Health Organization. Assessing tuberculosis under-reporting through inventory studies. Geneva: WHO; 2012 (http://www.who.int/tb/publications/inventory_studies/en/, accessed 15 August 2016).

:: Box 3.1
The WHO Global Task Force on TB Impact Measurement

Progress to date

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

- strengthening routine surveillance of TB cases (via national notification systems) and deaths (via national 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.

Notification data are consistently reported to WHO by about 200 countries and territories each year. In 2015, direct measurements of TB mortality from national or sample VR systems were available for 128 countries. Between 2009 and the end of 2015, a total of 19 national TB prevalence surveys were completed. When surveys in the Philippines and Viet Nam in 2007 are included, 16 of the 22 global focus countries had competed a survey according to screening and diagnostic methods recommended by WHO by the end of 2015.

Comprehensive reviews of methods used by WHO to produce estimates of TB incidence, prevalence and mortality were undertaken between June 2008 and October 2010, and in a meeting of the Task Force dedicated to this topic in April 2015.[a] WHO published its assessment of whether 2015 global TB targets for reductions in TB incidence, prevalence and mortality were achieved in its 2015 global TB report, using the methods agreed in April 2015.

Looking forward: mandate and strategic areas of work, 2016–2020

In the context of a new era of 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.[b]

The mandate was defined 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 national notification systems for direct measurement of TB cases, including drug-resistant TB and HIV-associated TB specifically.
2. Strengthening national VR systems for direct measurement of TB deaths.
3. Priority studies to periodically measure TB disease burden, including:
   - national TB prevalence surveys
   - drug-resistance surveys
   - mortality surveys
   - surveys of 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:
   - disaggregated analyses (e.g. by age, sex, location) to assess inequalities and equity
   - projections of disease burden
   - 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 does recognize that indirect estimates will continue to 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 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 next 5 years, 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.

Further details about the work of the Task Force are available online;[c] an up-to-date summary is provided in the latest brochure about its work.[d]

[a] World Health Organization Global Task Force on TB Impact Measurement. Methods to be used for WHO's definitive assessment of whether 2015 global TB targets are met: report of the 3rd meeting of the TB estimates subgroup. Geneva: WHO; 2015 (www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/global_consultation_meeting_report.pdf, accessed 24 August 2016). All background documents are available at www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/consultation_april_2015_tb_estimates_subgroup/en/

[b] For further details, please see Background Document 1 that was prepared for the April 2016 meeting of the Task Force, available at www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_background_1_mandate_strategic_areas_work.pdf?ua=1

[c] www.who.int/tb/advisory_bodies/impact_measurement_taskforce/

[d] www.who.int/tb/publications/factsheet_tb_impactmeasurement.pdf?ua=1

:: Box 3.2
Updates to estimates of TB disease burden in this report and anticipated updates

Updates in this report

1. Interim update for India

Estimates for India have been updated following an accumulating body of evidence that indicated that previously published estimates were too low. The updated estimates are interim in nature. A more definitive assessment will follow the completion of a national TB prevalence survey scheduled for 2017/2018. Further details are provided in **Box 3.3**.

2. New data from national TB prevalence surveys

Between October 2014 and August 2015, final results from surveys in Mongolia and Uganda became available. The post-survey estimate of TB prevalence in Uganda was consistent with pre-survey estimates, but was more precise and had values located towards the upper end of the previously published uncertainty interval. In Mongolia, TB prevalence was higher than anticipated. More details are provided in **Section 3.4**.

3. Newly reported data and updated estimates from other agencies

New VR data were reported to WHO between mid-2015 and mid-2016, and some countries made corrections to historical data. Updated estimates of the burden of disease caused by HIV were obtained from UNAIDS in July 2016. 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 South Africa, estimates of TB mortality (HIV-negative) were based on estimates from the Institute of Health Metrics and Evaluation (IHME), Washington University, USA; these estimates use data from the national VR system, adjusted for widespread miscoding of deaths caused by HIV and TB,[a,b] For India, estimates of TB mortality (HIV-negative) were also based on estimates from IHME, following the Institute's extensive analysis of available mortality data (see also **Box 3.3**).

4. Deaths due to TB sequelae

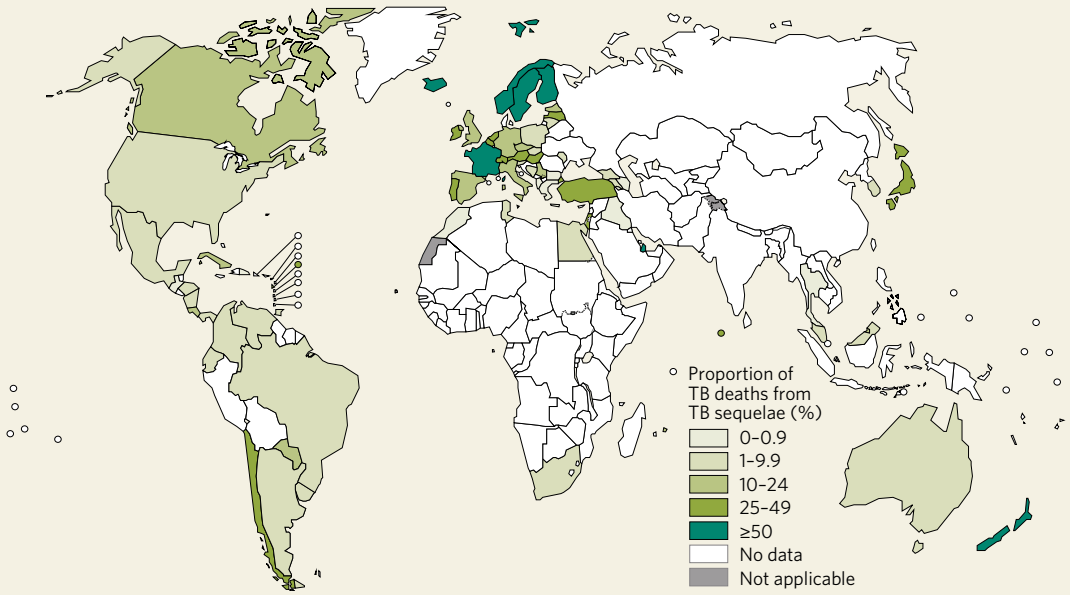
For the first time in 2016, deaths attributed to TB sequelae (ICD-10 codes B90.*) are included in HIV-negative TB mortality estimates for countries reporting VR data to WHO. The proportion of overall TB deaths that were classified as deaths from TB sequelae varies widely between countries (**Fig. B3.2.1**) as a result of variation in certification practices (i.e. what is written on death certificates) or coding (i.e. which code is selected).

5. In-depth epidemiological reviews at country level

A regional workshop on TB epidemiology and TB mortality was held in Lima, Peru in June 2016. Methods to estimate TB incidence were reviewed and altered in most countries, shifting to the high-income method based on a larger standard adjustment factor (using a factor of [1, 1.5] except in Brazil, where the standard factor already used for high-income countries was applied). A national TB epidemiology workshop was held in China in April 2016, to review options for estimating TB disease burden. Estimates of TB incidence in 2009–2015 are now based on notifications adjusted by a standard factor to account for underreporting and underdiagnosis, with the standard adjustment [1, 1.3] based on that already used for high-income countries (see also **Section 3.1**). Mortality estimates are derived from the sample VR system, as before.

:: FIG. B3.2.1

Deaths from TB sequelae as a proportion of the total number of reported TB deaths, countries reporting national VR data (using the most recent year of data reported to WHO)



6. *Indirect prevalence estimates are no longer presented*

National TB prevalence surveys will continue to provide the best method for measuring the burden of TB disease and related assessment of actions needed to reduce that burden in a large number of countries – specifically, those with a high burden of TB that do not yet have health, national notification and VR systems of the quality and coverage required to provide reliable and routine measurements of the number of TB cases and deaths. Results from these surveys will continue to be featured in global TB reports. However, indirect estimates of prevalence for other countries are no longer presented. Prevalence is not an indicator in the SDGs or a high-level indicator of the End TB Strategy, and no global target has been set (in contrast to the era of the MDGs and Stop TB Strategy, when a target of halving prevalence between 1990 and 2015 was set). Furthermore, indirect estimates of prevalence suffer from considerable uncertainty, because they are derived from estimates of incidence and assumptions about disease duration.

7. *Time series of TB burden estimates start with the year 2000*

Series of TB estimates published in this report start with the year 2000. In previous reports, estimates started in 1990, because this was the baseline for the 2015 global targets set in the context of the MDGs. TB data for the period 1990–2000 were of relatively poor quality in many countries, because standardized systems for recording and reporting cases were often introduced only after the mid-1990s, in association with the introduction of the DOTS strategy (WHO's recommended global TB strategy from the mid-1990s until the end of 2005). The quality and coverage of TB data since 2000 are comparatively much improved, and estimates are generally more robust.

8. *Estimates of the burden of drug-resistant TB*

Previous WHO global TB reports have focused on the burden of MDR-TB. In this report, estimates are of the burden of RR-TB (TB resistant to rifampicin, with or without resistance to other drugs) including MDR-TB, and are referred to as MDR/RR-TB. This update is because the latest WHO guidance on treatment of drug-resistant TB (an update issued in May 2016, see **Chapter 4**, **Box 4.3**) recommends that all people with RR-TB (not only those with MDR-TB) should be treated with an MDR-TB treatment regimen. Estimates of the burden of MDR/RR-TB are thus needed to assess progress in detection and treatment coverage for drug-resistant TB. Global and national estimates of the incidence of MDR/RR-TB are presented in this chapter; in addition, **Chapter 4** includes estimates of the number of cases of MDR/RR-TB among notified cases of pulmonary TB (i.e. the number of cases that could be detected if all notified TB cases were tested for drug resistance). Methods used to produce the estimates of the incidence of MDR/RR-TB featured in this report are those agreed following an expert review during the April 2016 meeting of the WHO Global Task Force on TB Impact Measurement.[c]

9. *Country-level estimates of TB incidence disaggregated by age and sex*

In line with the SDG and End TB Strategy requirements for higher levels of data granularity and corresponding estimates, country-level estimates of TB incidence disaggregated by age (children and adults) and sex are shown (see **Annex 2 and 3**). Estimates of TB incidence in children (aged <15 years) are based on methods previously used at a global level, in which estimates based on case notifications adjusted for underdetection and underreporting[d] are combined with estimates derived from dynamic modelling.[e]

Updates anticipated in the near future

Updates to estimates of disease burden are expected towards the end of 2016 or in early 2017 for Bangladesh, Kenya and the Philippines, following the completion of national TB prevalence surveys. Estimates of TB incidence in Indonesia, the Philippines, Thailand and Viet Nam may be updated following the implementation of inventory studies to measure underreporting of detected TB cases. Estimates of TB burden in India will be further updated once results from the national TB prevalence survey are available.

Updates to childhood TB mortality (primarily for the 0–14 year age group and, where possible, further disaggregated for those aged 0–4 and 5–14 years) are expected by early 2017, based on a systematic review and meta-analysis to inform CFRs for children[f] and a mathematical model estimating TB mortality in children as a function of TB incidence and CFRs.[g]

[a] Murray CJ, Ortblad KF, Guinovart C, Lim SS, Wolock TM, Roberts DA et al. Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014;384(9947):1005–1070 (http://www.ncbi.nlm.nih.gov/pubmed/25059949, accessed 24 August 2016).

[b] Groenewald P, Nannan N, Bourne D, Laubscher R, Bradshaw D. Identifying deaths from AIDS in South Africa. AIDS. 2005;19(2):193–201 (http://www.ncbi.nlm.nih.gov/pubmed/15668545, accessed 24 August 2016).

[c] For further details, please see Background Document 3b prepared for the April 2016 meeting of the Task Force, available at www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_background_3b_drtb_burden.pdf?ua=1 /

[d] Jenkins HE, Tolman AW, Yuen CM, Parr JB, Keshavjee S, Pérez-Vélez CM et al. Incidence of multidrug-resistant tuberculosis disease in children: systematic review and global estimates. The Lancet. 2014;383(9928):1572–1579 (http://www.ncbi.nlm.nih.gov/pubmed/24671080, accessed 24 August 2016).

[e] 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):e453-459 (http://www.ncbi.nlm.nih.gov/pubmed/25103518, accessed 24 August 2016).

[f] Jenkins H et al. Mortality among children diagnosed with tuberculosis: Systematic review and meta-analysis. Submitted for publication.

[g] Dodd P et al. The global burden of tuberculosis mortality in children. *Under development*.

:: Box 3.3

Updated and interim estimates of TB disease burden in India and plans for a national TB prevalence survey in 2017/2018

The estimates of TB disease burden in India published in the 2011–2015 global TB reports were based on the outcomes of a national consensus workshop held in Delhi in April 2011. This report includes estimates for India that have been revised substantially upwards compared with those published in 2011–2015, following accumulating evidence that the TB disease burden in India is higher than was estimated at that time.

The revised estimates of TB incidence (absolute numbers) are based on extrapolation of the results from a prevalence survey in one state (Gujarat). This survey used methods recommended by WHO and is the largest as well as the only state-wide prevalence survey implemented in India to date. It was assumed that the national prevalence of TB disease is the same as the prevalence in Gujarat, with incidence then estimated using a standard methodological approach recently reviewed by the WHO Global Task Force on TB Impact Measurement.[a] The trend in TB incidence is estimated as in global reports published 2011–2015; that is, using results from repeat tuberculin surveys (2000, 2010) and (to a lesser extent) trends in TB notifications in the districts where the Revised National TB Control Programme first implemented the DOTS strategy.

The revised estimates of TB mortality are derived from those published by IHME,[b] after adjustment for differences between WHO and IHME estimates of the total number of deaths each year.

These updated estimates of TB burden in India are considered *interim estimates*, pending results from a national TB prevalence survey that is scheduled to start in 2017 (see also Section 3.4).

The revised estimates, and how they compare with those published in the 2015 global TB report, can be summarized as follows:

- The updated estimate of incidence (new TB cases per year) is 2.8 million cases in 2015 (217 per 100 000 population), and 2.9 million (223 per 100 000 population) in 2014. These figures can be compared with notifications of 1.7 million new and relapse cases in 2015 (127 per 100 000 population) and 1.6 million new and relapse cases in 2014 (124 per 100 000 population). These figures suggest that 56% of incident cases were officially reported in 2014 and 59% in 2015. In the 2015 global TB report, the estimate for 2014 was that there were 2.2 million incident cases (167 per 100 000 population), with an estimated 74% of incident cases officially reported.
- The updated estimate of the number of TB deaths (excluding those in HIV-positive people, which are classified as deaths due to HIV/AIDS in ICD-10) is 478 000 in 2015 (36 per 100 000 population), and 483 000 (37 per 100 000 population) in 2014. In the 2015 global TB report, the estimate for 2014 was 220 000 (17 per 100 000 population).
- Estimated trends in TB incidence and mortality remain similar to those published in previous years, with incidence falling by 2% per year over 2000–2015 and mortality falling by 3.3% per year over the same period.

The six sources of evidence that the burden of TB is higher than estimated in April 2011 are summarized below.

1. *Household survey in 30 districts of numbers of people on TB treatment, 2011*

Starting in 2011, a TB project that aimed to increase civil society's support to the NTP in India and to engage communities and community-based care providers was implemented in 374 out of 650 districts.[c] The 374 districts were selected based on suspected low TB case detection or limited access of populations to health services. Funding for the project was from the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund).

In a sample of 30 of the 374 districts, the number of people on TB treatment based on self-reporting was assessed using a dataset compiled as part of a survey of knowledge, attitudes and practices conducted from January to March 2011. Of the self-reported cases, 54% had not been officially reported to national authorities. The number of undetected cases could not be assessed because of the study design. For comparison, the estimate published in the 2015 global TB report was that 59% of incident cases were officially reported in 2010 (with the gap of 41% including both unreported and undetected cases).

2. *Results from a state-wide prevalence survey in Gujarat state*

In 2011, a prevalence survey was conducted in Gujarat. This was the country's first state-wide survey (other surveys have been conducted in districts that were not nationally representative). Results were shared with WHO in 2015, and indicated a prevalence (adjusted for all ages and all forms of TB) of 390 cases per 100 000 population. This is much higher than the national estimate published by WHO in the 2015 global TB report of 250 prevalent cases per 100 000 population. Gujarat is among the wealthiest states in India, and given the link between overall levels of income and the burden of TB disease it seems unlikely that TB prevalence in Gujarat would be higher than the national average.

3. *A district level household and facility survey (DLHS-4)*

A survey in 2012–2013 estimated prevalence based on interview screening at 592 cases per 100 000. However, this method for estimating prevalence is not recommended in the WHO handbook on TB prevalence surveys.

4. A study of sales of anti-TB drugs, 2014

A study of sales of anti-TB drugs in 2014 was published in 2016.[d] The study indicated that there were 17.8 million patient-months of TB treatment in the private sector, twice as many as in the public sector. The authors noted that if 40–60% of private-sector TB diagnoses are correct, and if private-sector TB treatment lasts on average 2–6 months, then about 2.2 million (range 1.2 million to 5.3 million) TB cases were treated in the private sector in 2014.[e] This is 2–3 times higher than the level assumed when the April 2011 workshop on TB disease burden estimates (mentioned above) was held.

5. A large increase in national case notifications in 2013–2015

India implemented a policy of mandatory TB notification in 2012 and has also rolled out a national web-based reporting system since 2012. In 2014, the number of notified cases increased by 29% compared with 2013, and the number of notified cases in 2015 was 34% higher than the level of 2013. Most of the increase is related to improved coverage of notifications from the private sector in a small number of districts.

6. Analyses of TB mortality by IHME

IHME has used a large body of cause-of-death data from VR and verbal autopsy surveys, including data that are not yet accessible to WHO, to estimate TB mortality in India. The estimated number of TB deaths is much higher than previously published WHO estimates.

[a] Glaziou P, Sismanidis C, Pretorius C, Floyd K. Methods used by WHO to estimate the Global burden of TB disease. arXiv preprint arXiv:1603.00278. 2016;(http://arxiv.org/abs/1603.00278, accessed 24 August 2016).

[b] http://vizhub.healthdata.org/cod

[c] Satyanarayana S, Nair SA, Chadha SS, Shivashankar R, Sharma G, Yadav S et al. From where are tuberculosis patients accessing treatment in India? Results from a cross-sectional community based survey of 30 districts. PLoS One. 2011;6(9):e24160.

[d] Arinaminpathy N, Batra D, Khaparde S, Vualnam T, Maheshwari N, Sharma L et al. The number of privately treated tuberculosis cases in India: an estimation from drug sales data. Lancet Infect Dis. 2016;16:30259-30256 (http://www.download.thelancet.com/pdfs/journals/laninf/PIIS1473-3099(16)30259-6.pdf, accessed 25 August 2016).

[e] This is consistent with an earlier study of drug sales in 2008 and 2009. See Wells WA, Ge CF, Patel N, Oh T, Gardiner E, Kimerling ME. Size and usage patterns of private TB drug markets in the high burden countries. PLoS One. 2011;6(5):e18964. doi: 10.1371/journal.pone.0018964.

defines the standards that need to be met for notification data to provide a direct measure of TB incidence.[1] By August 2016, a total of 42 countries, including 19 of the 30 high TB burden countries (listed in **Table 3.2**) had completed the checklist, often in association with a TB epidemiological review or regional workshop focused on analysis of TB data (**Fig. 3.1**).

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

1. **Case notification data combined with expert opinion about case-detection gaps.** Expert opinion, elicited in regional workshops or country missions, is used to estimate levels of underreporting 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 74 countries that accounted for 22% of the estimated global number of incident cases in 2015.
2. **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 co-infection on the distribution of disease duration. This method is used for 20 countries, 19 of which have national survey data and one – India – that has a survey in one state. The 20 countries accounted for 62% of the estimated global number of incident cases in 2015.
3. **Notifications in high-income countries adjusted by a standard factor to account for underreporting and underdiagnosis.** This method is used for 118 countries: all high-income countries except the Netherlands and the United Kingdom, plus selected upper-middle income countries with low levels of underreporting, including Brazil and China. For three countries (France, Republic of Korea and Turkey) the adjustment was country specific, based on results from studies of underreporting. These 118 countries accounted for 15.5% of the estimated global number of incident cases in 2015.
4. **Results from inventory studies and capture–recapture analysis.** This method is used for five countries: Egypt, Iraq, the Netherlands, the United Kingdom and Yemen. These countries accounted for 0.5% of the estimated global number of incident cases in 2015.

Further details about these methods are provided in the **online technical appendix**[2] and in background documents prepared for the global review of methods used to produce TB burden estimates that was held in April 2015 (**Box 3.1**).[3]

[1] World Health Organization. Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: WHO; 2014 (http://www.who.int/tb/publications/standardsandbenchmarks/en/, accessed 24 August 2016).

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

[3] All background documents are available at www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/consultation_april_2015_tb_estimates_subgroup/en/

:: Box 3.4

Inventory studies to measure the underreporting of detected TB cases: progress to date

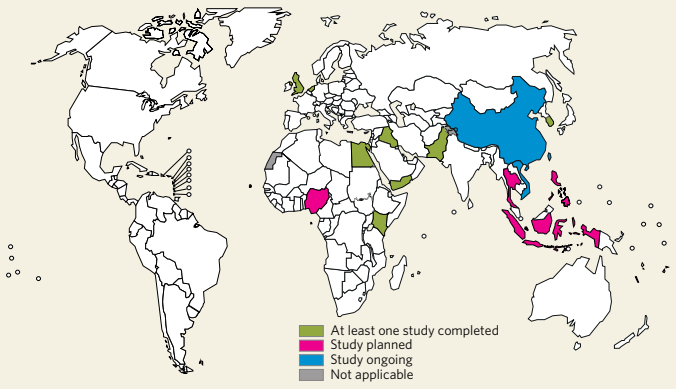
The accurate understanding and measurement of TB incidence, one of the high-level indicators consistently used by the global health community since 2000, is pivotal to monitoring progress against international targets set for TB in the End TB Strategy and the SDGs, and for assessing whether investments in TB care and prevention actually work. Although the level of and trends in TB incidence could be directly measured through population cohort studies, national cohort studies are too expensive and impractical to implement. In settings with state-of-the-art routine surveillance systems where most, if not all, new TB cases are diagnosed and registered, TB cases notified to the NTP provide a good proxy for TB incidence. More often than not, however, case-detection gaps plague national TB surveillance systems at different stages in the patient cascade, including gaps in diagnosis, treatment and reporting. TB inventory studies are a customized and more cost-effective alternative to population cohort studies that could inform the extent of such gaps. TB inventory studies have two broad study objectives, one involving the direct measurement of TB underreporting and the other, under certain conditions, the estimation of TB incidence through capture–recapture analysis.[a]

There has been growing interest in and implementation of national inventory studies to measure TB underreporting in the past 10 years (Fig. B3.4.1) – often in combination with capture–recapture analysis – in countries including the Netherlands,[b] the United Kingdom,[c] French Guiana,[d] Egypt,[e] Yemen,[f] Iraq,[g] Pakistan[h] and Kenya.[i] Hypothesis-generating investigations to assess the level of TB case-detection gaps were also completed in India (cross-sectional survey of households),[j] Indonesia[k] and Viet Nam (nested within a national prevalence survey among adults).[l] Based on these studies, the level of TB underreporting found was context-dependent, and ranged from about 15% in European countries, 20% in Africa and 30% in the WHO Eastern Mediterranean Region, to 50% in countries in Asia with a large private sector. These data have all informed national estimates of TB disease burden reported by WHO. Results from TB inventory studies provide the platform and evidence to make programmatic changes to better address the TB epidemic. The European Centre for Disease Prevention and Control acknowledges the value of inventory studies for providing evidence about the performance of surveillance systems in Europe, and UNITAID and the Global Fund are already supporting the implementation of national TB inventory studies in Asia, including some studies with a particular focus on children.

Strengthening national TB surveillance systems and the data they produce is the only credible way to ensure the robust and routine monitoring of progress towards global targets for TB. Inventory studies are an important tool, one of the few available today, for achieving that goal for TB surveillance. As countries begin working towards the new TB incidence targets set within the SDGs and the End TB Strategy, increased commitment from NTPs and funding agencies to conducting and funding TB inventory studies is required.

:: FIG. B3.4.1

Countries in which inventory studies of the underreporting of detected TB cases have been implemented since 2000 (status in August 2016)[a,b]



[a] Pakistan is currently undertaking a second inventory study focussing on children with TB.
[b] Nigeria is planning to undertake a subnational level study (in metropolitan Lagos).

[a] World Health Organization. Assessing tuberculosis under-reporting through inventory studies. Geneva: WHO; 2012 (http://www.who.int/tb/publications/inventory_studies/en/, accessed 15 August 2016).
[b] van Hest NAH, Smit F, Baars HWM, De Vries G, De Haas PEW, Westenend PJ et al. Completeness of notification of tuberculosis in The Netherlands: how reliable is record-linkage and capture-recapture analysis? Epidemiology and Infection. 2007;135(6):1021–1029.
[c] van Hest NAH, Story A, Grant AD, Antoine D, Crofts JP, Watson JM. Record-linkage and capture-recapture analysis to estimate the incidence and completeness of reporting of tuberculosis in England 1999-2002. Epidemiology and Infection. 2008;136(12):1606–1616..
[d] Guernier V, Guegan J-F, Deparis X. An evaluation of the actual incidence of tuberculosis in French Guiana using a capture-recapture model. Microbes and Infection. 2006;8(3):721–727.
[e] Bassili A, Grant AD, El-Mohgazy E, Galal A, Glaziou P, Seita A et al. Estimating tuberculosis case detection rate in resource-limited countries: a capture-recapture study in Egypt. The International Journal of Tuberculosis and Lung Disease. 2010;14(6):727–732.
[f] Bassili A, Al-Hammadi A, Al-Absi A, Glaziou P, Seita A, Abubakar I et al. Estimating the tuberculosis burden in resource-limited countries: a capture-recapture study in Yemen. The International Journal of Tuberculosis and Lung Disease. 2013;17(4):456–461.
[g] Huseynova S, Hashim DS, Tbena MR, Harris R, Bassili A, Abubakar I et al. Estimating tuberculosis burden and reporting in resource-limited countries: a capture-recapture study in Iraq. The International Journal of Tuberculosis and Lung Disease. 2013;17(4):462–467.
[h] Fatima R, Harris RJ, Enarson DA, Hinderaker SG, Qadeer E, Ali K et al. Estimating tuberculosis burden and case detection in Pakistan. The International Journal of Tuberculosis and Lung Disease. 2014;18(1):55–60.
[i] Tollefson D, Ngari F, Ndisha M, Gethi D, Kipruto H, Cain K, Bloss E. Underreporting of sputum smear-positive tuberculosis cases in Kenya. International Journal of Tuberculosis and Lung Disease. (Under peer review).
[j] Satyanarayana S, Nair SA, Chadha SS, Shivashankar R, Sharma G, Yadav S et al. From where are tuberculosis patients accessing treatment in India? Results from a cross-sectional community based survey of 30 districts. PLoS One. 2011;6(9):e24160 (http://www.ncbi.nlm.nih.gov/pubmed/21912669, accessed 24 August 2016).
[k] Ministry of Health. Report of Indonesia National TB prevalence survey 2013–2014. Ministry of Health, Republic of Indonesia, Jakarta, 2015.
[l] Hoa NB, Cobelens FGJ, Sy DN, Nhung NV, Borgdorff MW, Tiemersma EW. Diagnosis and treatment of tuberculosis in the private sector, Vietnam. Emerging Infectious Diseases. 2011;17(3):562–564.

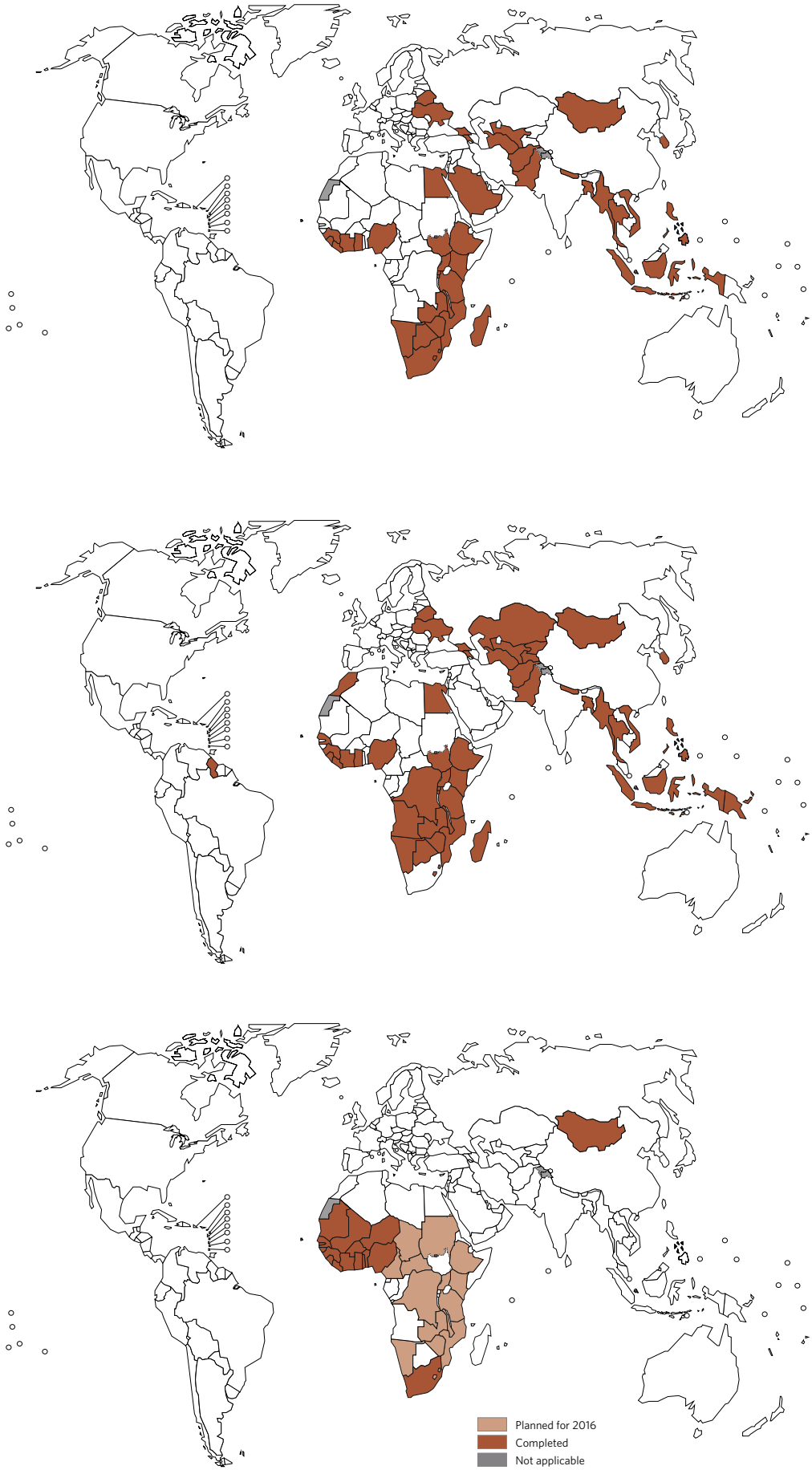
:: FIG. 3.1

Strengthening national TB surveillance (status in August 2016)

Countries in which a checklist of standards and benchmarks has been completed since January 2013

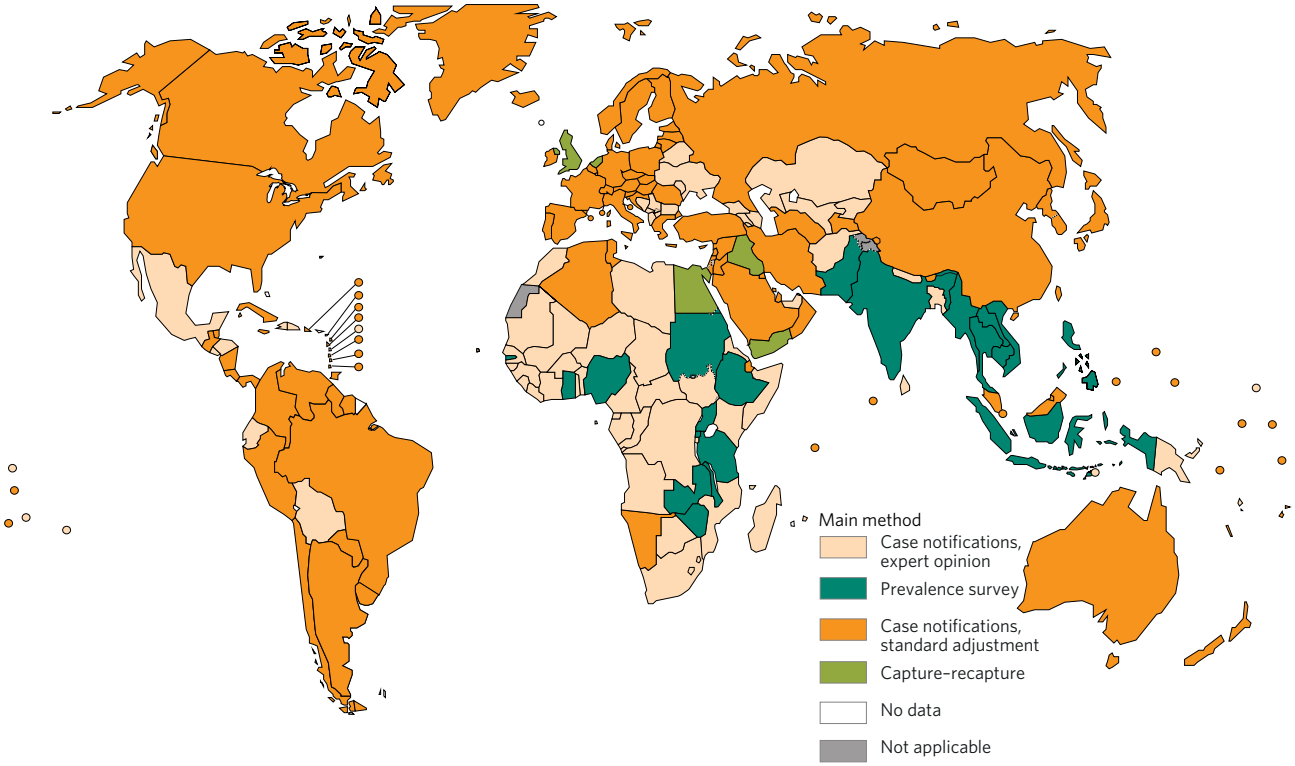
Countries in which an epidemiological review has been undertaken since July 2012

Countries covered by a regional or country-specific workshop focused on analysis and use of TB data since October 2015



:: FIG. 3.2

Main methods used to estimate TB incidence[a]



[a] In the first method, case notification data are combined with expert opinion about case detection gaps (under-reporting and under-diagnosis), and trends are estimated using either mortality data, repeat surveys of the annual risk of infection or exponential interpolation using estimates of case detection gaps for three years. For all high-income countries except the Netherlands and the United Kingdom, notifications are adjusted by a standard amount or measure of under-reporting from inventory studies, to account for case detection gaps. In India, results from a subnational prevalence survey for the state of Gujarat were used. For further details about all four methods, see text.

3.1.2 Estimates of TB incidence in 2015

Globally in 2015, there were an estimated 10.4 million incident cases of TB (range, 8.7 million to 12.2 million),[1] equivalent to 142 cases per 100 000 population (estimates of absolute numbers are shown in **Table 3.2** and estimates of rates per capita are shown in **Table 3.3**). As explained in **Box 3.2**, estimates of TB incidence have been revised upwards for the period 2000–2015, compared with those published in the 2015 global TB report. This follows accumulating evidence that the burden of TB disease in India is considerably higher than previously estimated (**Box 3.3**), and more minor upward revisions for the Democratic People's Republic of Korea and the Philippines. The updated estimates for India should be considered interim in nature, pending a more definitive assessment that will follow completion of a national TB prevalence survey, which is scheduled to start in 2017.

Most of the estimated number of cases in 2015 occurred in Asia (61%)[2] and the WHO African Region (26%); smaller proportions of cases occurred in the Eastern Mediterranean Region (7%), the European Region (3%) and the Region of the Americas (3%). The 30 high TB burden countries[3] accounted for 87% of all estimated incident cases worldwide. The six countries that stood out as having the largest number of incident cases in 2015 were (in descending order) India, Indonesia, China, Nigeria, Pakistan and South Africa (combined, 60% of the global total). Of these, China, India and Indonesia alone accounted for 45% of global cases in 2015.

The annual number of incident TB cases relative to population size (the incidence rate) varied widely among countries in 2015, from under 10 per 100 000 population in most high-income countries to 150–300 in most of the 30 high TB burden countries (**Fig. 3.3**), and above 500 in a few countries including Lesotho, Mozambique and South Africa (**Table 3.3**).

An estimated 11% (range, 9–14%) of the incident TB cases in 2015 were among people living with HIV (**Table 3.2**, **Table 3.3**). The proportion of TB cases coinfected with HIV was highest in countries in the WHO African Region, and exceeded 50% in parts of southern Africa (**Fig. 3.4**).

Estimates of the incidence of zoonotic TB are shown in **Box 3.5**.

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

[2] "Asia" refers to the WHO regions of South-East Asia and the Western Pacific.

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

:: TABLE 3.2

Estimated epidemiological burden of TB in 2015 for 30 high TB burden countries, WHO regions and globally.
Numbers in thousands.[a]

	POPULATION	HIV-NEGATIVE TB MORTALITY		HIV-POSITIVE TB MORTALITY[b]		TOTAL TB INCIDENCE		HIV-POSITIVE TB INCIDENCE	
		BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Angola	25 000	11	6.6–17	7.2	1.6–17	93	60–132	28	17–41
Bangladesh[c]	161 000	73	43–110	0.23	0.19–0.29	362	234–517	0.63	0.39–0.94
Brazil	208 000	5.5	5.2–5.9	2.2	1.2–3.6	84	72–97	13	11–15
Cambodia	15 600	8.6	6.1–12	0.44	0.19–0.79	59	38–85	1.4	0.92–2.1
Central African Republic	4 900	2.2	1.3–3.4	2.7	1.0–5.3	19	12–27	8.6	5.3–13
China	1 380 000	35	34–37	2.6	1.2–4.5	918	788–1 060	15	12–19
Congo	4 620	2.3	1.3–3.5	2.4	2.0–2.9	18	11–25	6.4	3.9–9.5
DPR Korea	25 200	15	10–22	0.04	0.02–0.06	141	109–178	0.45	0.32–0.60
DR Congo	77 300	51	30–77	16	13–20	250	162–357	39	23–57
Ethiopia	99 400	25	15–38	3.9	1.6–7.3	191	141–249	16	10–23
India[d]	1 310 000	480	380–590	37	21–57	2 840	1 470–4 650	113	58–186
Indonesia	258 000	100	67–150	26	20–34	1 020	658–1 450	78	48–116
Kenya	46 100	9	6.1–12	7.2	0.71–21	107	87–129	36	29–43
Lesotho	2 140	1.2	0.63–1.9	4.8	3.0–7.0	17	11–24	12	7.7–18
Liberia	4 500	3.2	1.9–4.8	0.84	0.70–1.0	14	9.0–20	1.8	1.1–2.6
Mozambique	28 000	21	12–32	34	21–50	154	100–220	79	50–115
Myanmar	53 900	27	16–40	4.8	3.5–6.5	197	144–258	17	11–25
Namibia	2 460	0.78	0.51–1.1	0.88	0.06–2.8	12	9.3–15	4.9	3.8–6.2
Nigeria	182 000	180	96–290	57	43–74	586	345–890	100	56–155
Pakistan	189 000	44	9.3–110	1.6	1.1–2.1	510	330–729	8.8	5.4–13
Papua New Guinea	7 620	3.1	1.8–4.6	0.67	0.40–1.0	33	27–40	4.9	3.0–7.3
Philippines	101 000	14	8.8–19	0.44	0.24–0.70	324	279–373	4.3	3.3–5.4
Russian Federation	143 000	15	15–16	1.5	<0.01–7.4	115	98–132	11	9.3–13
Sierra Leone	6 450	3.3	1.9–4.9	0.82	0.40–1.4	20	13–28	2.6	1.7–3.8
South Africa	54 500	25	21–29	73	27–140	454	294–649	258	165–370
Thailand	68 000	8.4	6.9–10	5.4	3.3–8.1	117	69–176	15	8.0–25
UR Tanzania	53 500	30	13–53	25	16–35	164	78–281	57	27–100
Viet Nam	93 400	16	11–22	1.1	0.20–2.7	128	103–155	5.5	3.5–7.9
Zambia	16 200	5	2.9–7.7	12	6.9–20	63	41–91	38	24–55
Zimbabwe	15 600	1.7	0.99–2.5	6.3	2.2–13	38	28–49	26	17–37
High TB burden countries	**4 630 000**	**1 200**	**1 100–1 400**	**340**	**280–410**	**9 050**	**7 410–10 800**	**1 000**	**859–1 160**
Africa	989 000	450	350–560	300	230–360	2 720	2 360–3 110	834	710–969
The Americas	991 000	19	17–20	5.9	4.2–7.9	268	250–287	32	29–35
Eastern Mediterranean	648 000	80	38–140	3	2.5–3.5	749	561–965	13	9.5–17
Europe	910 000	32	31–33	4.9	1.5–10	323	299–349	27	23–31
South-East Asia	1 930 000	710	600–830	74	56–95	4 740	3 230–6 540	227	159–307
Western Pacific	1 860 000	89	81–98	5.7	3.8–8.1	1 590	1 440–1 740	34	29–40
Global	**7 320 000**	**1 400**	**1 200–1 600**	**390**	**320–460**	**10 400**	**8 740–12 200**	**1 170**	**1 020–1 320**

[a] Numbers for mortality shown to two significant figures. Numbers for incidence 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 Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.
[d] Estimates of TB incidence and mortality for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

:: TABLE 3.3

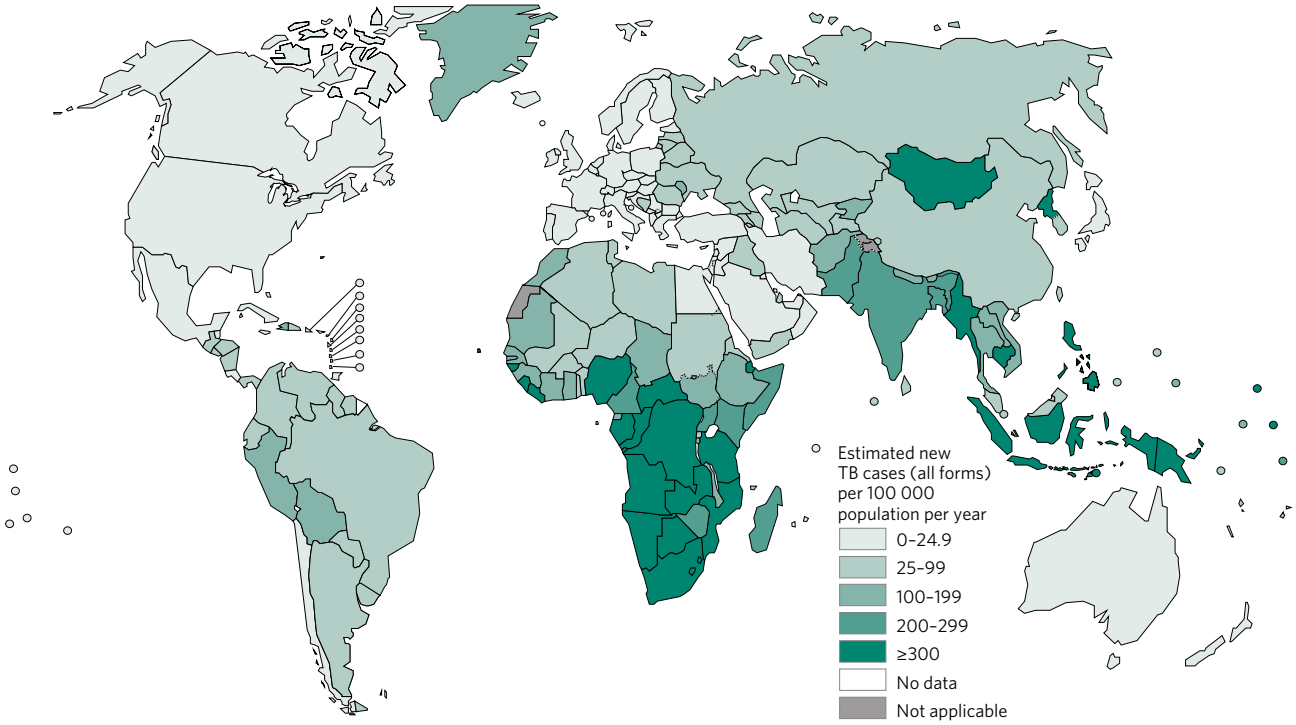
Estimated epidemiological burden of TB in 2015 for 30 high TB burden countries, WHO regions and globally. Best estimates are followed by the lower and upper bounds of the 95% uncertainty interval. Rates per 100 000 population except where indicated.[a]

	HIV-NEGATIVE TB MORTALITY		HIV-POSITIVE TB MORTALITY		TOTAL TB INCIDENCE		HIV PREVALENCE IN INCIDENT TB %	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Angola	45	27–67	29	6.5–67	370	240–529	30	24–36
Bangladesh[b]	45	27–68	0.14	0.12–0.18	225	146–321	0.18	0.14–0.21
Brazil	2.7	2.5–2.8	1.1	0.56–1.7	41	35–47	15	14–16
Cambodia	55	39–74	2.8	1.2–5.0	380	246–543	2.4	2.2–2.7
Central African Republic	45	26–70	55	20–107	391	253–558	45	36–54
China	2.6	2.5–2.7	0.19	0.09–0.33	67	57–77	1.7	1.4–2.0
Congo	49	29–75	53	44–63	379	246–542	36	29–44
DPR Korea	61	40–87	0.15	0.07–0.26	561	432–706	0.31	0.26–0.38
DR Congo	66	39–99	21	17–26	324	210–463	15	13–19
Ethiopia	26	15–38	4.0	1.6–7.4	192	142–250	8.3	7.6–9.1
India[c]	32	29–35	2.8	1.6–4.3	217	112–355	4.0	3.6–4.4
Indonesia	40	26–57	10	7.6–13	395	255–564	7.7	6.2–9.3
Kenya	20	13–27	16	1.5–45	233	189–281	33	32–35
Lesotho	55	29–89	223	139–328	788	510–1125	72	63–80
Liberia	70	41–107	19	16–22	308	199–440	13	11–15
Mozambique	74	43–115	120	73–178	551	356–787	52	45–58
Myanmar	49	30–74	9.0	6.4–12	365	267–479	8.9	7.9–9.8
Namibia	32	21–45	36	2.5–112	489	376–616	41	39–43
Nigeria	99	53–160	31	24–40	322	189–488	17	14–20
Pakistan	23	4.9–56	0.83	0.60–1.1	270	175–386	1.7	1.4–2.1
Papua New Guinea	41	24–61	8.8	5.2–13	432	352–521	15	12–18
Philippines	13	8.7–19	0.44	0.24–0.70	322	277–370	1.3	1.1–1.6
Russian Federation	11	10–11	1.0	0–5.2	80	69–92	9.9	8.8–11
Sierra Leone	51	30–76	13	6.2–21	307	198–438	13.3	12–15
South Africa	44	39–50	133	50–256	834	539–1190	57	52–61
Thailand	12	10–15	8.0	4.9–12	172	102–259	13	12–14
UR Tanzania	56	25–99	47	31–66	306	146–525	35	31–40
Viet Nam	17	12–23	1.1	0.21–2.8	137	110–166	4.3	4.0–4.6
Zambia	31	18–47	77	42–121	391	253–558	60	54–66
Zimbabwe	11	6.3–16	40	14–81	242	179–314	69	64–74
High TB burden countries	**25**	**22–28**	**7.3**	**5.9–8.8**	**195**	**160–234**	**11**	**8.6–14**
Africa	45	35–57	30	24–37	275	239–314	31	25–37
The Americas	1.9	1.8–2.0	0.59	0.42–0.79	27	25–29	12	10–13
Eastern Mediterranean	12	5.8–21	0.46	0.38–0.54	116	86–149	1.8	1.2–2.7
Europe	3.5	3.4–3.6	0.54	0.17–1.1	36	33–38	8.4	7.0–9.9
South-East Asia	37	31–43	3.9	2.9–4.9	246	167–339	4.9	2.8–7.6
Western Pacific	4.8	4.4–5.3	0.31	0.20–0.44	86	78–94	2.2	1.8–2.6
Global	**19**	**17–21**	**5.3**	**4.4–6.3**	**142**	**119–166**	**11**	**9.1–14**

[a] Deaths among HIV-positive TB cases are classified as HIV deaths according to ICD-10.
[b] Estimates of TB incidence and mortality for Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.
[c] Estimates of TB incidence and mortality for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

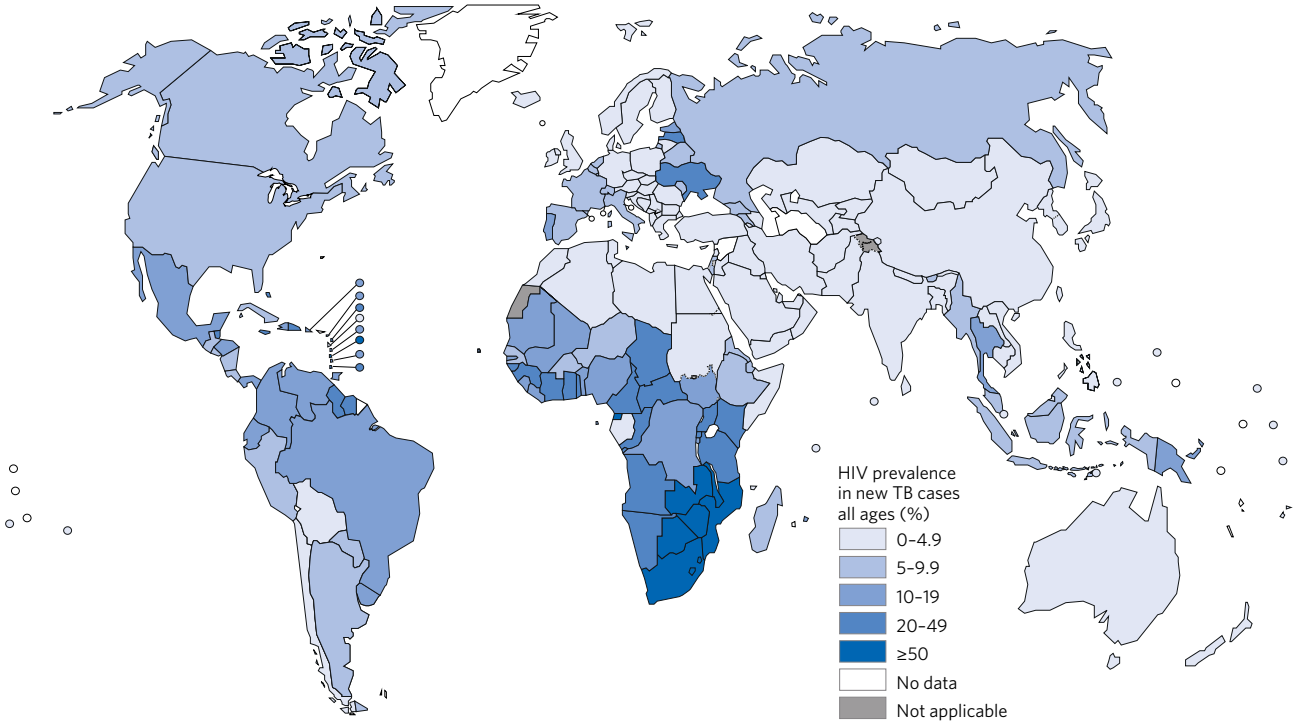
:: FIG. 3.3

Estimated TB incidence rates, 2015



:: FIG. 3.4

Estimated HIV prevalence in new and relapse TB cases, 2015



:: Box 3.5
Incidence and mortality due to zoonotic TB

Mycobacterium bovis is the causal agent of bovine TB in cattle and zoonotic TB in people. Bovine TB has a major impact on livestock productivity, and on the livelihoods of poor and marginalised communities. The most common route of transmission to people is through the consumption of unpasteurized dairy products.

In 2015, there were an estimated 149 000 cases of zoonotic TB (**Table B3.5.1**). This was calculated by applying the regional proportions of all TB cases that are estimated to be caused by *M. bovis* to estimates of TB incidence in 2015. A standard deviation of 50% relative to the best estimate of each regional proportion was assumed when propagating uncertainty. Given the absence of routine reporting in most countries where bovine TB is endemic, these proportions were drawn from scientific studies[a,b] that lack regional representativeness. As a result, estimates have a large uncertainty range. Mortality (excluding TB deaths in HIV-positive people) was similarly estimated based on the same proportions, but this time was applied to aggregated estimates of TB mortality by WHO region, and reduced by a factor of 20% to account for a higher proportion of extrapulmonary TB cases among those with *M. bovis*, and associated lower CFR.

There is a need to strengthen surveillance of zoonotic TB to better quantify the burden of disease. One of the major barriers for diagnosis is that the most commonly used laboratory procedures do not differentiate the *M. tuberculosis* complex into the species of *M. bovis* and *M. tuberculosis*. Zoonotic TB also presents a treatment challenge. It more often occurs in extrapulmonary sites and is inherently resistant to pyrazinamide, one of the drugs in the standard first-line anti-TB treatment regimen.

In the context of WHO's End TB Strategy, which calls for diagnosis and treatment of every TB case, zoonotic TB must be better addressed. This requires a holistic approach that links the human and animal health sectors to reduce the risk of TB transmission at the human–animal interface.

:: TABLE B3.5.1

Estimated incidence and mortality due to *M. bovis* TB. Best estimates (absolute numbers) are followed by the lower and upper bounds of the 95% uncertainty interval.

REGION	INCIDENCE	MORTALITY
Africa	76 300 (20 300–168 000)	10 000 (2570–22 500)
Americas	804 (218–1770)	46 (12–98)
Eastern Mediterranean	7490 (1883–16 900)	639 (113–1610)
Europe	1290 (350–2840)	103 (28–225)
South-East Asia	47 400 (11 300–109 000)	2280 (602–5050)
Western Pacific	15 900 (4290–34 900)	286 (77–630)
Global	**149 000 (71 600–255 000)**	**13 400 (5050–25 700)**

[a] World Health Organization. WHO estimates of the global burden of foodborne diseases. Geneva: WHO, Foodborne diseases burden epidemiology reference group 2007–2015; 2015 (http://www.who.int/foodsafety/publications/foodborne_disease/fergreport/en/, accessed 24 August 2016).

[b] Muller B, Durr S, Alonso S, Hattendorf J, Laisse CJ, Parsons SD et al. Zoonotic *Mycobacterium bovis*-induced tuberculosis in humans. Emerg Infect Dis. 2013;19(6):899–908 (http://www.ncbi.nlm.nih.gov/pubmed/23735540, accessed 24 August 2016).

3.1.3 Estimated trends in TB incidence, 2000–2015

Consistent with previous global TB reports, the number of incident cases is falling slowly, in both absolute terms and per capita (**Fig. 3.5**, **Fig. 3.6**). Globally, the average rate of decline in the TB incidence rate was 1.4% per year in 2000–2015, and 1.5% between 2014 and 2015. This needs to accelerate to 4–5% per year by 2020 to achieve the milestones for reductions in cases and deaths set in the End TB Strategy (**Chapter 2**).

Trends are shown for the six WHO regions in **Fig. 3.7** and for the 30 high TB burden countries in **Fig. 3.8**. The fastest declines are in the WHO European Region (3.3% per year from 2014 to 2015). The estimated decline in the incidence rate since 2010 has exceeded 4% per year in several high TB burden countries, including Zimbabwe (11%), Lesotho (7%), the United Republic of Tanzania (6.8%), Ethiopia (6.7%), Namibia (6.2%), Kenya (5.0%) and the Russian Federation (4.2%).

3.2 TB mortality

Deaths from TB among HIV-negative people are classified as TB deaths in the most recent version of the *International classification of diseases* (ICD-10).[1] When an HIV-positive person dies from TB, the underlying cause is classified as HIV. For consistency with these classifications, this section makes a clear distinction between TB deaths in HIV-negative people and TB deaths in HIV-positive people.

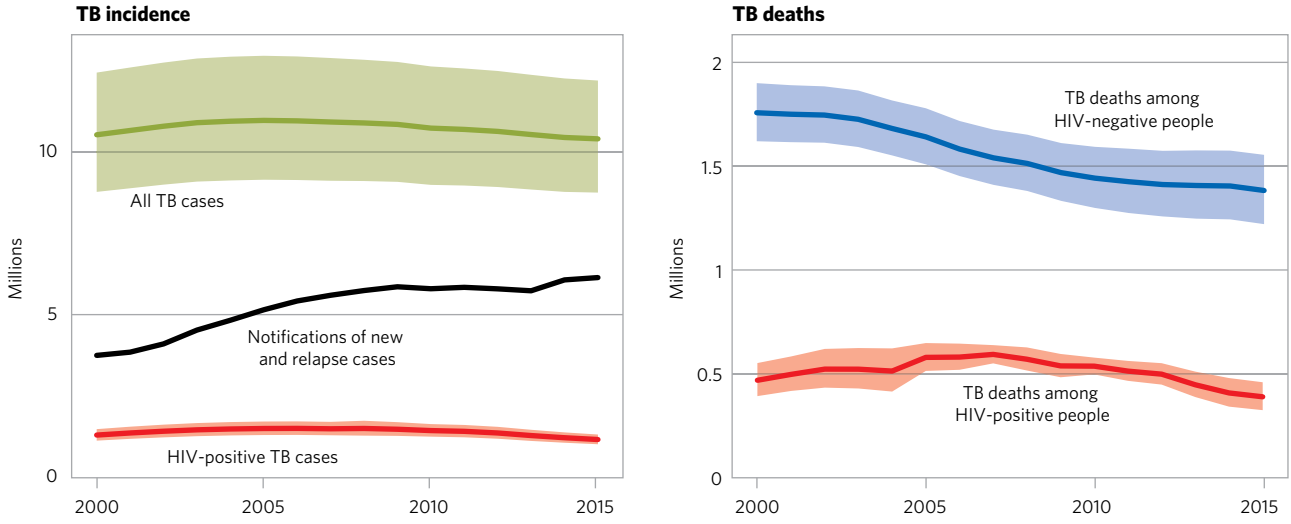
3.2.1 Methods to estimate TB mortality

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

[1] World Health Organization. International statistical classification of diseases and health related problems (The) ICD-10. Geneva: WHO; 2004.

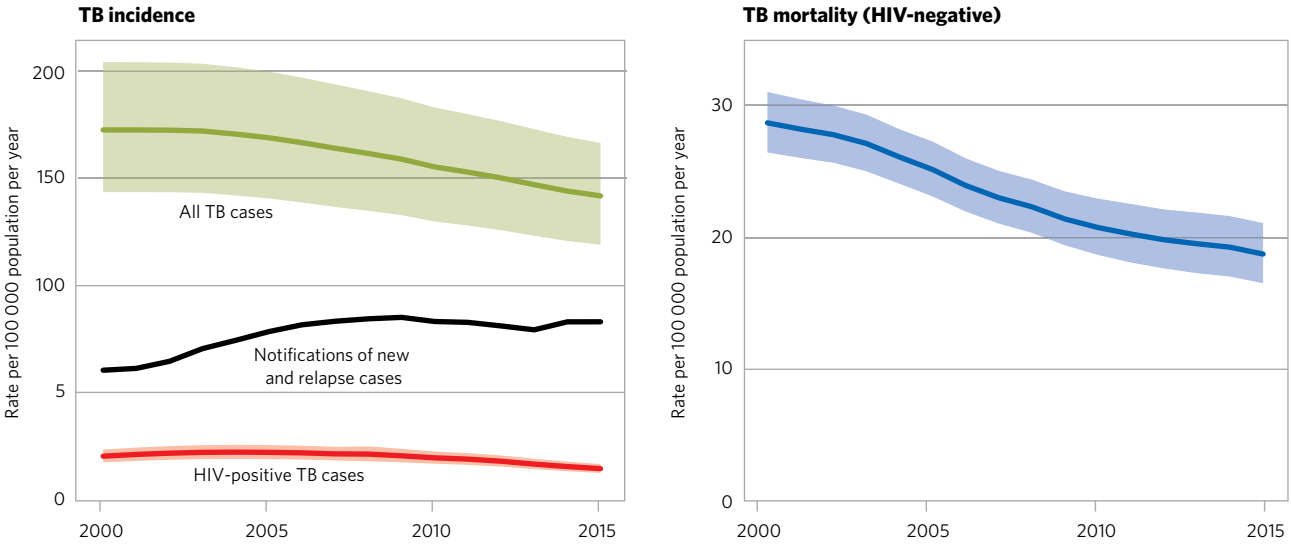
:: FIG. 3.5

Global trends in the estimated number of incident TB cases and the number of TB deaths (in millions), 2000–2015. Shaded areas represent uncertainty intervals.



:: FIG. 3.6

Global trends in estimated TB incidence and mortality rates, 2000–2015. The **black** line show notifications of new and relapse cases, for comparison with estimates of the total incidence rate. Shaded areas represent uncertainty intervals.



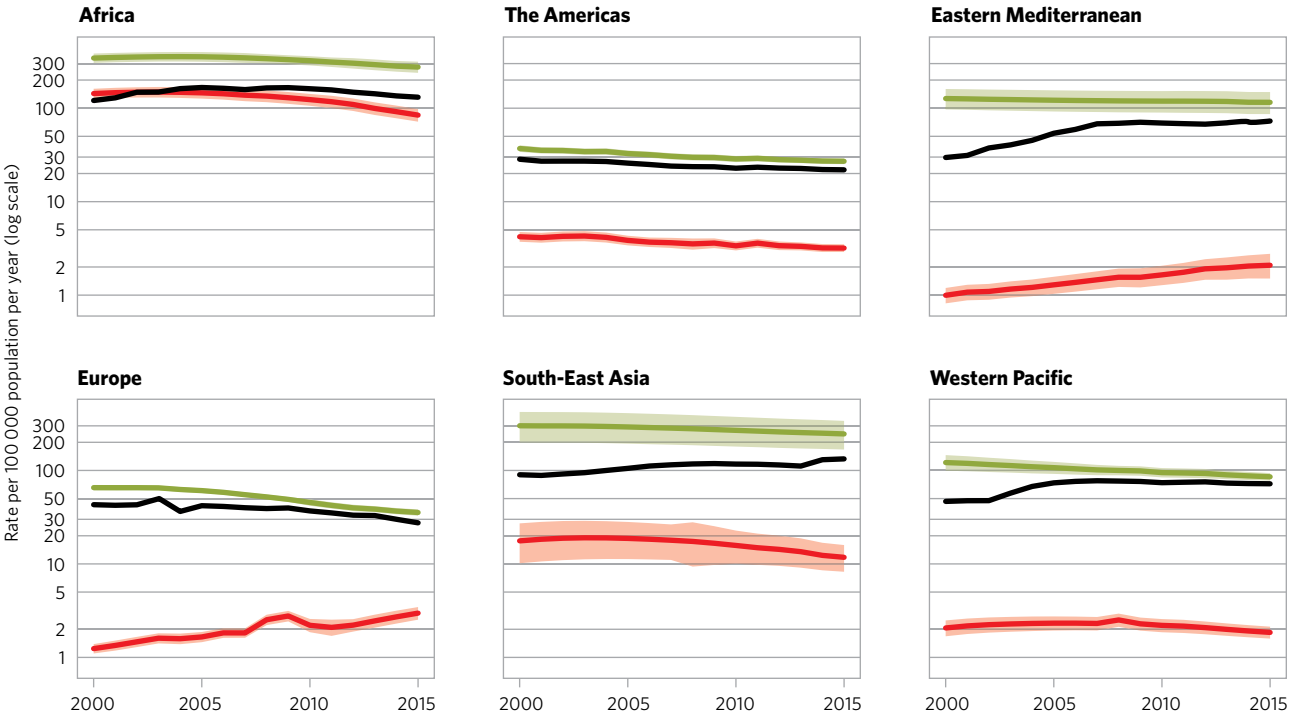
of the country (e.g. as in China) provide an interim solution. Mortality surveys can also be used to estimate deaths caused by TB. In 2015, most countries with a high burden of TB lacked national or sample VR systems, and few had conducted mortality surveys. In the absence of VR systems or mortality surveys, TB mortality can be estimated as the product of TB incidence and the case fatality ratio (CFR), or from ecological modelling based on 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 recorded. TB deaths among HIV-positive people were estimated as the product of TB incidence and the CFR, with the latter accounting for the protective effect of antiretroviral therapy (ART).

Until 2008, WHO estimates of TB mortality used VR data for only three countries. This was substantially improved to 89 countries in 2009, although most of the data were from countries in the European Region and the Region of the Americas, which accounted for less than 10% of the world's TB cases. For the current report, VR data were used for 128 countries (**Fig. 3.9**), which collectively accounted for 52% of the estimated number of TB deaths (among HIV-negative people) globally in 2015. The WHO African

:: FIG. 3.7

Regional trends in estimated TB incidence rates (log scale) by WHO region, 2000–2015. Total 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** lines show notifications of new and relapse cases for comparison with estimates of the total incidence rate.



Region is the part of the world in which there is the greatest need to introduce or strengthen a VR system in which causes of death are classified according to ICD-10.

Details about the methods used to produce estimates of TB mortality are provided in the **online technical appendix**[1] and in background documents prepared for the global review of methods used to produce TB burden estimates that was held in April 2015 (**Box 3.1**).

3.2.2 Estimates of TB mortality in 2015

Estimates of the number of deaths caused by TB are shown globally, for the six WHO regions and for the 30 high TB burden countries in **Table 3.2**. There were an estimated 1.4 million (range, 1.2 million to 1.6 million) deaths from TB among HIV-negative people in 2015 and an additional 0.39 million (range, 0.32 million to 0.46 million) deaths from TB among HIV-positive people. TB is one of the top 10 causes of death worldwide, and caused more deaths than HIV/AIDS in 2015 (**Fig. 3.10**, **Fig. 3.11**).[2]

About 84% of TB deaths among HIV-negative people occurred in the WHO African Region and South-East Asia Region in 2015; these regions accounted for 86% of the combined total of TB deaths in HIV-negative and HIV-positive people. India and Nigeria accounted for 48% of global TB deaths among HIV-negative people and for 43% of the combined total TB deaths in HIV-negative and HIV-positive people.

Estimates of TB mortality rates (per 100 000 population) are shown globally, for the six WHO regions and for the 30 high TB burden countries in **Table 3.3**. Globally, the number of TB deaths among HIV-negative people per 100 000 population was 19 in 2015, and 24 when TB deaths among HIV-positive people were included. There was considerable variation among countries (**Fig. 3.12**), ranging from less than one TB death per 100 000 population in many high-income countries to more than 40 deaths per 100 000 population in much of the WHO African Region and in five high TB burden countries in Asia (Bangladesh, Cambodia, the Democratic People's Republic of Korea, Myanmar and Papua New Guinea).

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

3.2.3 Estimated trends in TB mortality, 2000–2015

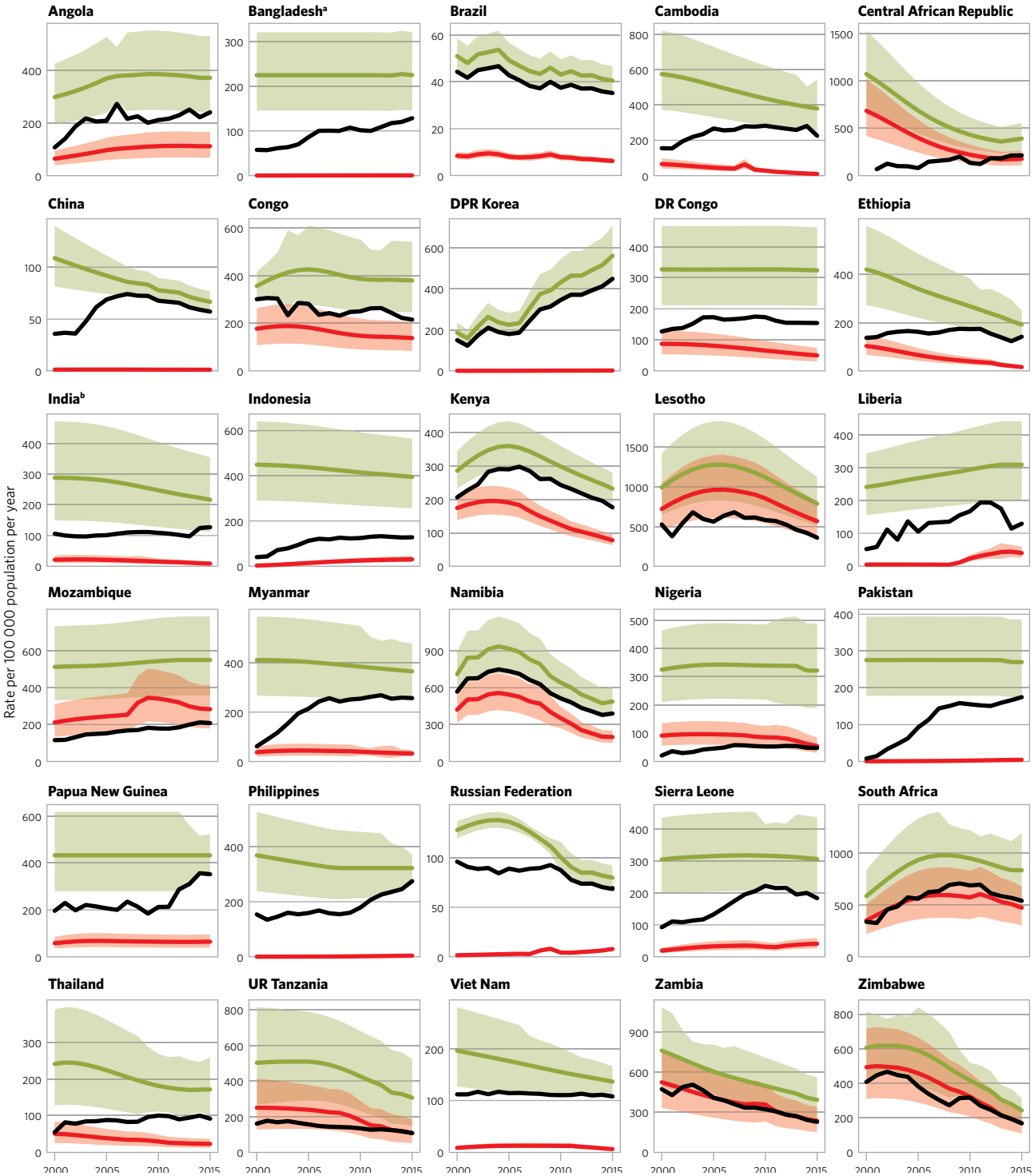
Globally, the absolute number of TB deaths among HIV-negative people has been falling since 2000, from 1.8 million in 2000 to 1.4 million in 2015 (**Fig. 3.5**). The TB

[1] The online technical appendix is available at www.who.int/tb/data.

[2] WHO Global Health Observatory data repository, available at http://apps.who.int/gho/data/node.main.GHECOD?lang=en (accessed 27 July 2016).

:: FIG. 3.8

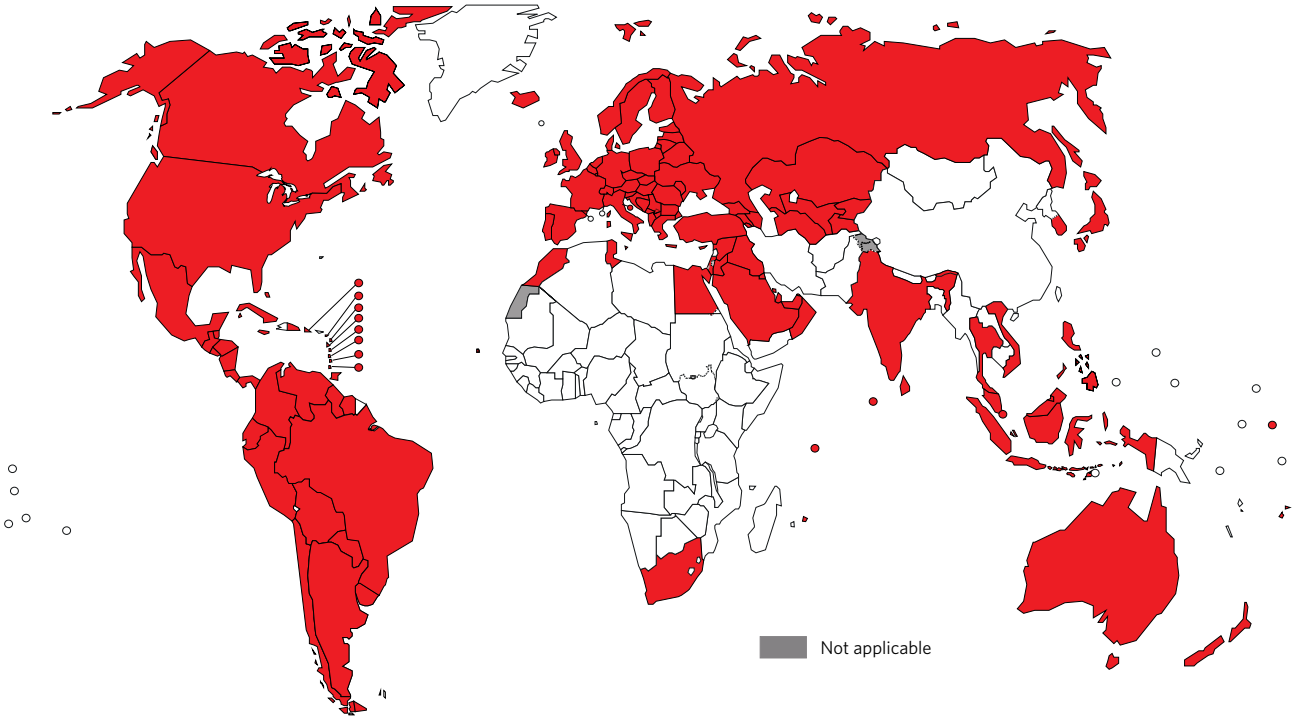
Trends in estimated TB incidence in the 30 high TB burden countries, 2000–2015. TB incidence rates are shown in **green** and incidence rates of HIV-positive TB are shown in **red**. Shaded areas represent uncertainty intervals. The **black** lines show notifications of new and relapse cases for comparison with estimates of the total incidence rate.



[a] Estimates of TB incidence for Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.
[b] Estimates of TB incidence for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

:: FIG. 3.9

Countries (in red) for which TB mortality in HIV-negative people is estimated using measurements from vital registration systems and/or a mortality survey



mortality rate (per 100 000 population) fell by 34% between 2000 and 2015 (**Fig. 3.6**), and by 2.7% between 2014 and 2015. Rates have also been falling in all six of the WHO regions (**Fig. 3.13**). Since 2010, the fastest average rates of decline in the mortality rate have been in the WHO Eastern Mediterranean and European regions (6.5% and 6.2% per year, respectively) and slowest in the WHO African Region (2.2% per year). Trends in mortality rates in the 30 high TB burden countries vary markedly (**Fig. 3.14**), ranging from substantial reductions since 2000 (e.g. China, Ethiopia, Myanmar, Pakistan the Philippines and the Russian Federation) to increases in Congo and the Democratic People's Republic of Korea.

3.2.4 The case fatality ratio and across-country equity

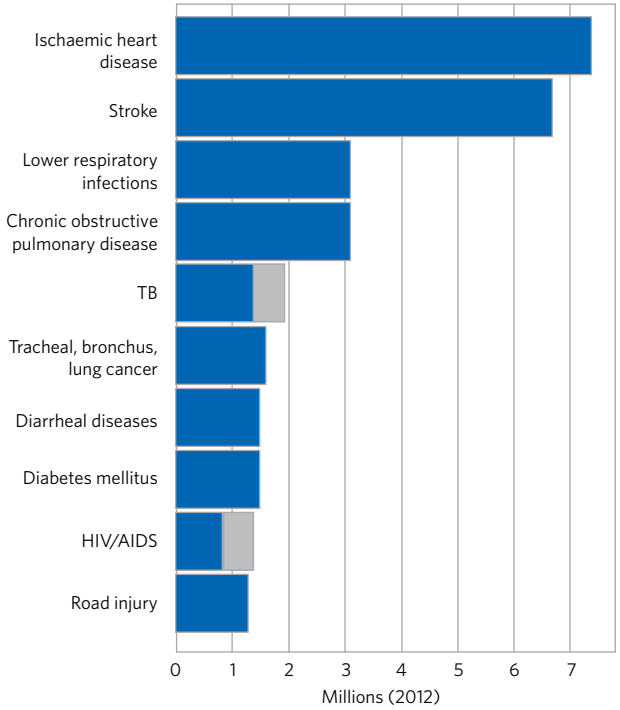
The CFR is the proportion of people with TB who die from the disease; it can be approximated as the number of TB deaths divided by TB incidence in the same year. The CFR allows assessment of variation in equity in terms of access to TB diagnosis and treatment among countries because, if everyone with TB had access to timely diagnosis and high-quality treatment, the CFR would be low in all countries. To achieve the milestones for reductions in TB deaths set for 2020 and 2025 in the End TB Strategy, the global CFR needs to fall to 10% by 2020 and to 6% by 2025 (**Chapter 2**).

In 2015, 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 17% and varied widely among countries (**Fig. 3.15**), 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.

[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 that 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. At the subnational level, CFRs can also be restricted to HIV-negative TB deaths, depending on the country and its HIV burden.

:: FIG. 3.10a

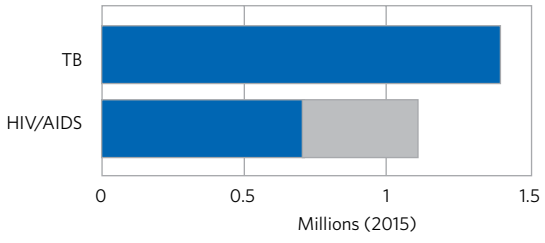
Top causes of death worldwide in 2012.[a,b,c,d] Deaths from TB among HIV-positive people are shown in grey.[d]



[a] Estimates of causes of death will be updated by WHO before the end of 2016.
[b] This is the latest year for which estimates for all causes are currently available. See WHO Global Health Observatory data repository, available at http://apps.who.int/gho/data/node.main.GHECOD (accessed 28 July 2016).
[c] For HIV/AIDS, the latest estimates of the number of deaths in 2012 that have been published by UNAIDS are available at www.unaids. org/en/resources/documents/2016/HIV_estimates_with_uncertainty_bounds_1990-2015. For TB, the estimates for 2012 are those published in this report.
[d] Deaths from TB among HIV-positive people are officially classified as deaths caused by HIV/AIDS in the International Classification of Diseases.

:: FIG. 3.10b

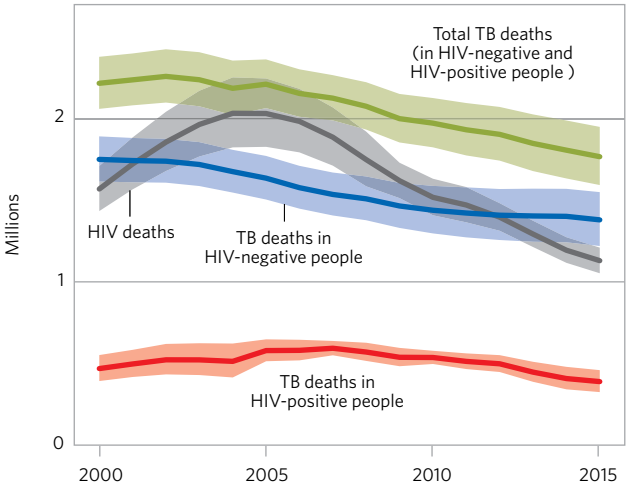
Estimated number of deaths from HIV/AIDS and TB in 2015. Deaths from TB among HIV-positive people are shown in grey.[a,b]



[a] For HIV/AIDS, the latest estimates of the number of deaths in 2015 that have been published by UNAIDS are available at www.unaids.org/en/resources/documents/2016/HIV_estimates_with_uncertainty_bounds_1990-2015. For TB, the estimates for 2015 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. 3.11

Global trends in the estimated number of deaths caused by TB and HIV (in millions), 2000–2015.[a,b] Shaded areas represent uncertainty intervals.



[a] For HIV/AIDS, the latest estimates of the number of deaths in 2015 that have been published by UNAIDS are available at www.unaids.org/en/resources/documents/2016/HIV_estimates_with_uncertainty_bounds_1990-2015. For TB, the estimates for 2015 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.

3.2.5 Estimated number of deaths averted by TB treatment, 2000–2015

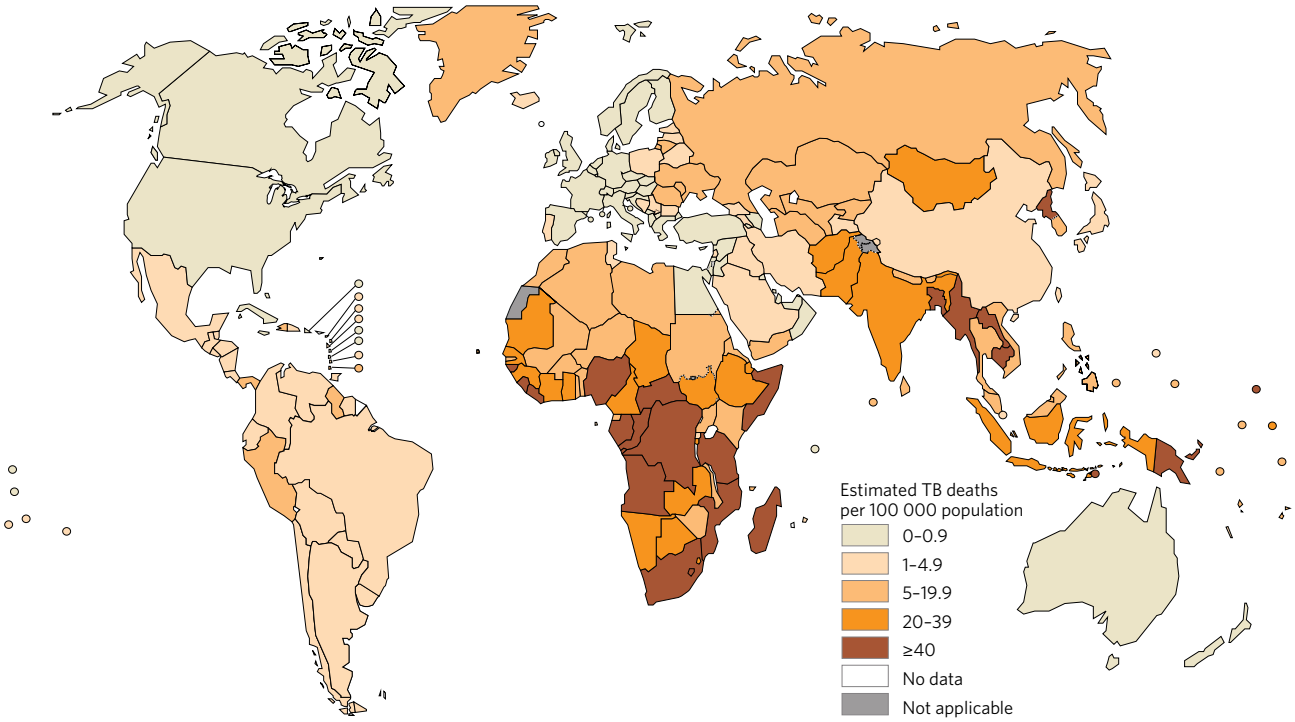
The actual numbers of TB deaths (presented above) can be compared with the number of TB deaths that would have occurred in the absence of TB treatment to give an estimate of the deaths averted by TB interventions. The number of deaths that would have occurred each year in the absence of TB treatment (and without ART provided alongside TB treatment for HIV-positive cases) can be conservatively estimated as the number of estimated incident cases (**Section 3.1**) multiplied by the relevant estimated CFR for untreated TB.[1] Estimates are conservative because they do not account for the impact of TB control or ART on the level of TB incidence, or for the indirect, downstream impact of these interventions on future levels of infections, cases and deaths.

Between 2000 and 2015, TB treatment alone averted an estimated 39 million deaths among HIV-negative people (**Table 3.4**). Among HIV-positive people, TB treatment supported by ART averted an additional 9.6 million deaths.

[1] Further details about methods used to estimate lives saved, including CFRs for different categories of TB case, are provided in the online technical appendix, available at www.who.int/tb/data.

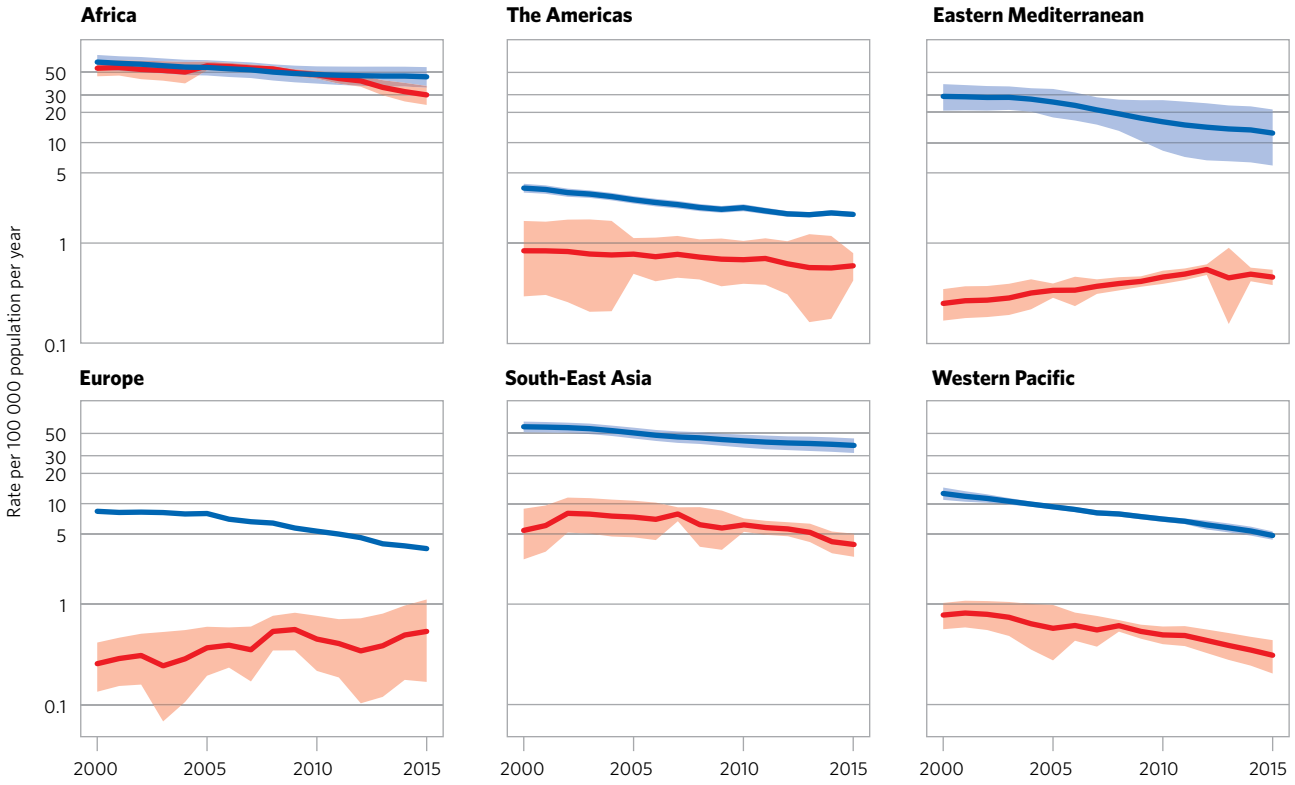
:: FIG. 3.12

Estimated TB mortality rates in HIV-negative people, 2015



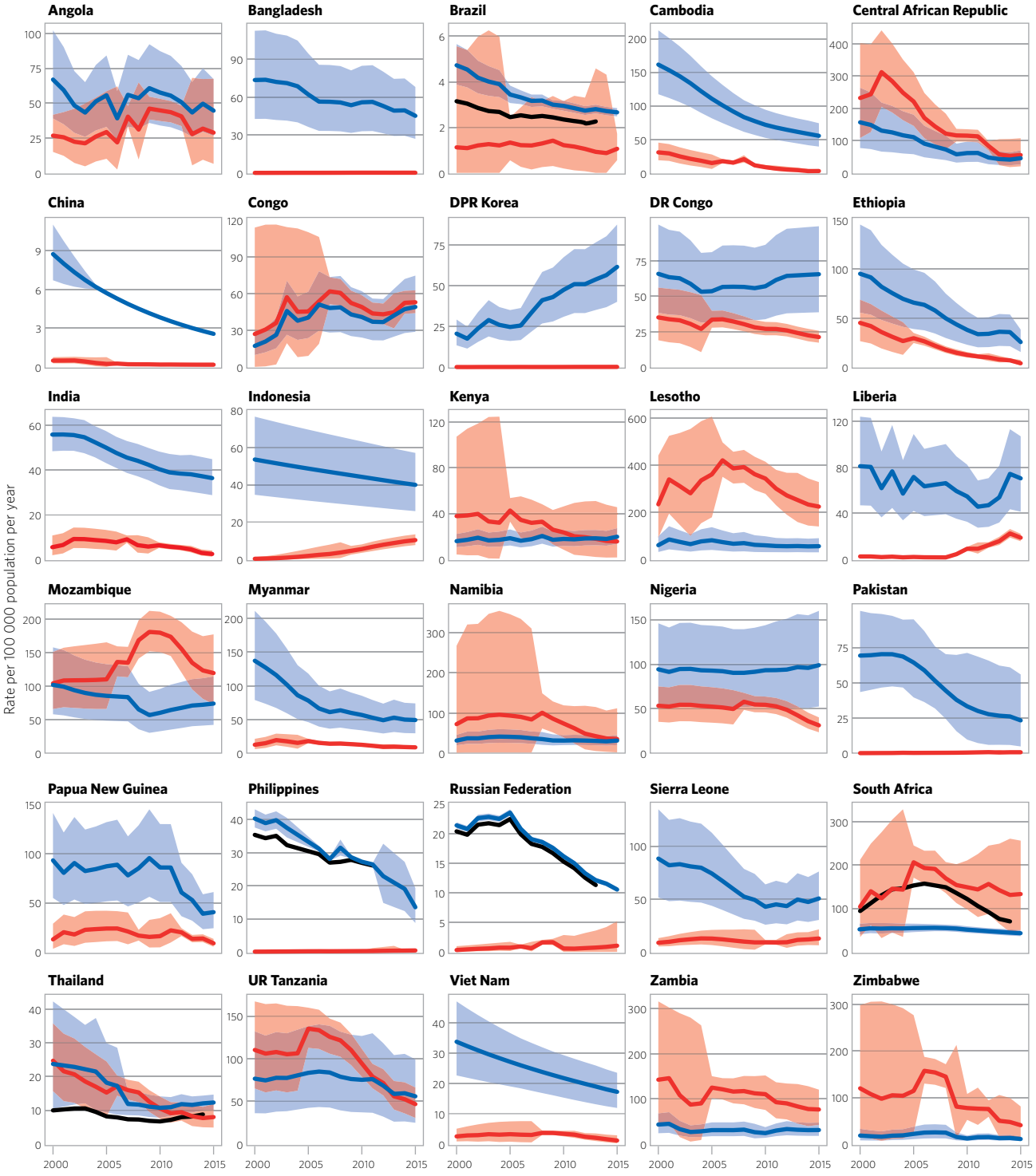
:: FIG. 3.13

Regional trends in estimated TB mortality rates (log scale), 2000–2015. TB mortality rates in HIV-negative people are shown in **blue** and mortality rates of HIV-positive TB are shown in **red**. Shaded areas represent uncertainty intervals.



:: FIG. 3.14

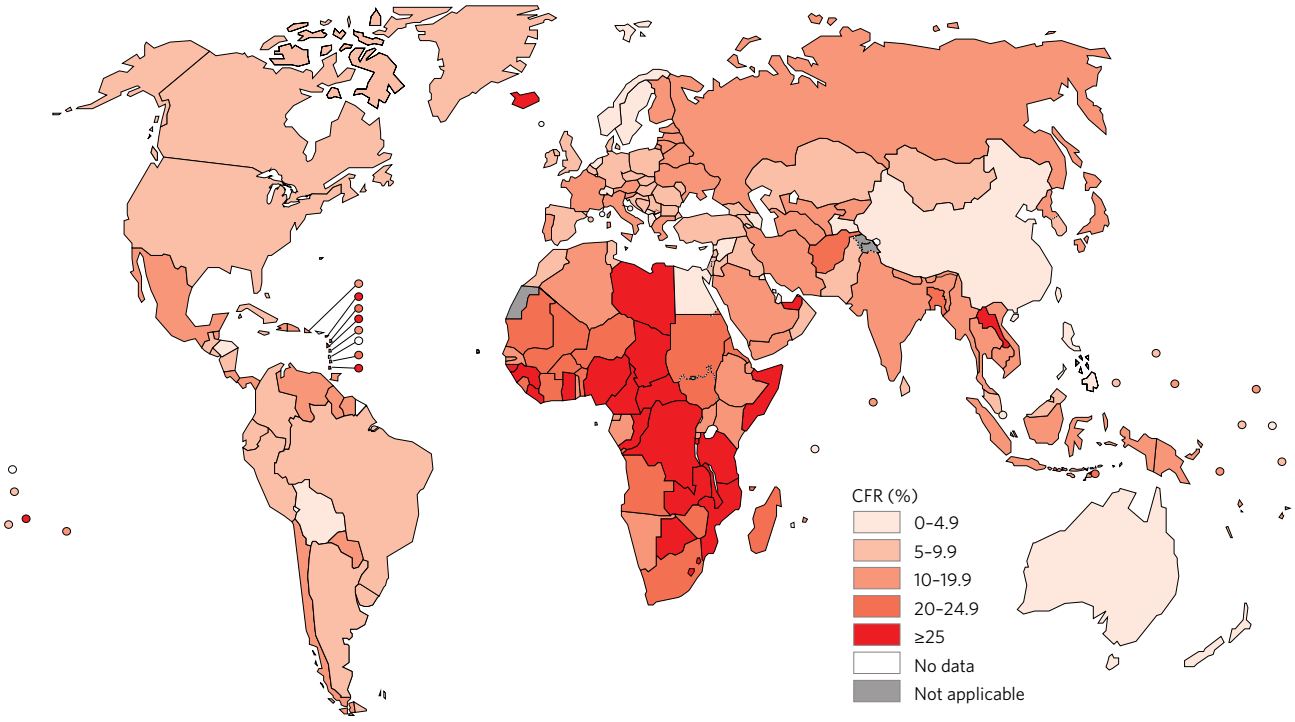
Trends in estimated TB mortality rates, 2000–2015, in the 30 high TB burden countries. TB mortality rates in HIV-negative people are shown in **blue** and mortality rates of HIV-positive TB are shown in **red**. The **black** lines show observations from vital registration systems. Shaded areas represent uncertainty intervals.[a,b]



[a] Estimates of TB mortality for Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.
[b] Estimates of TB mortality for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

:: FIG. 3.15

Estimates of the case fatality ratio (CFR), (including HIV-negative and HIV-positive people), 2015



:: TABLE 3.4

Cumulative number of deaths averted by TB and TB/HIV interventions 2000–2015 (in millions), globally and by WHO region

WHO REGION	HIV-NEGATIVE PEOPLE		HIV-POSITIVE PEOPLE		TOTAL	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	4.6	3.6–5.5	6.6	5.8–7.4	11	9.9–12
The Americas	1.4	1.2–1.5	0.32	0.29–0.35	1.7	1.5–1.8
Eastern Mediterranean	2.8	2.3–3.3	0.07	0.06–0.08	2.9	2.4–3.3
Europe	2.2	1.9–2.4	0.17	0.15–0.19	2.3	2.1–2.6
South-East Asia	19	15–22	1.9	1.4–2.4	21	17–24
Western Pacific	9.8	8.8–11	0.32	0.29–0.36	10	9.1–11
Global	**39**	**34–45**	**9.6**	**8.5–11**	**49**	**43–54**

3.3 Drug-resistant TB

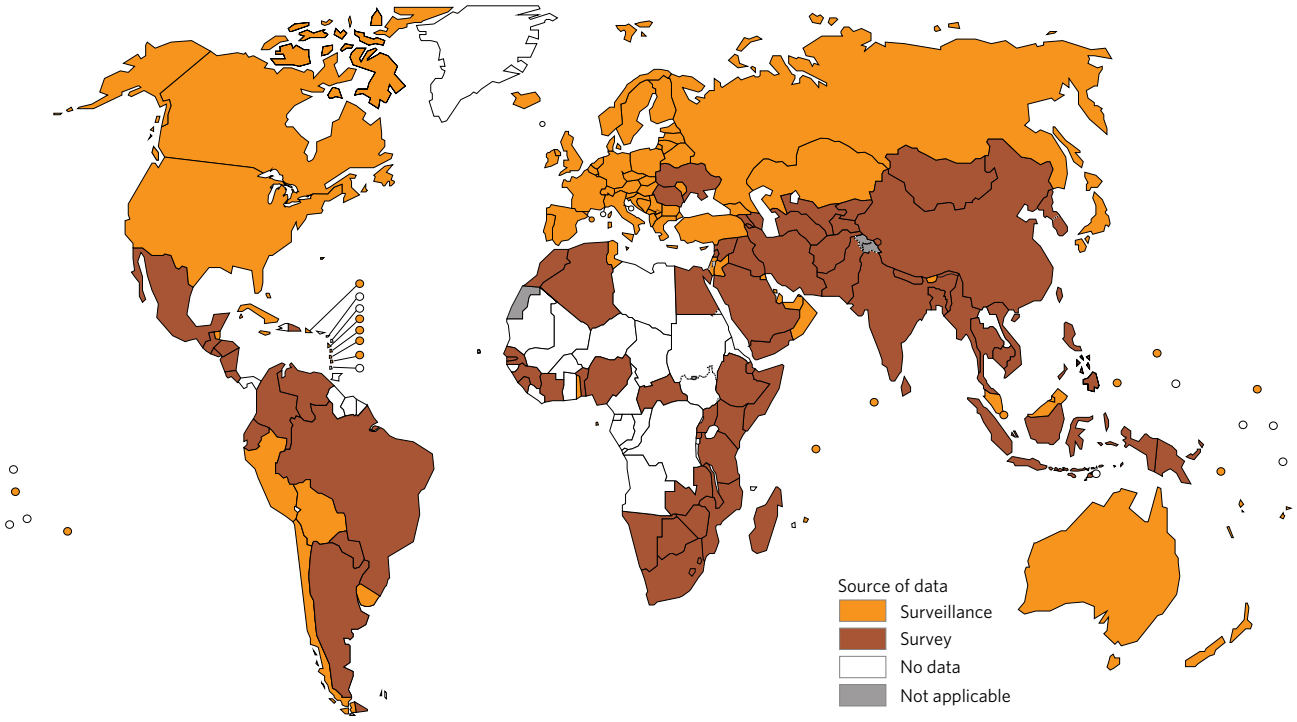
3.3.1 Global surveillance of anti-TB drug resistance

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 155 countries worldwide (80% of 194 WHO Member States), which collectively have more than 95% of the world's population and TB cases. This includes 83 countries that have continuous surveillance systems based on routine diagnostic drug-susceptibility testing (DST) of *Mycobacterium tuberculosis* isolates obtained from all TB patients, and 72 countries that rely on epidemiological surveys of bacterial isolates collected from representative samples of patients (**Fig. 3.16**). Surveys conducted 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 owing to lack of laboratory capacity or resources.

Progress towards achieving global coverage of drug resistance surveillance data is shown in **Fig. 3.17**. Among the 30 high TB burden countries and 30 high MDR-TB burden countries (which comprise a total of 40 countries, given

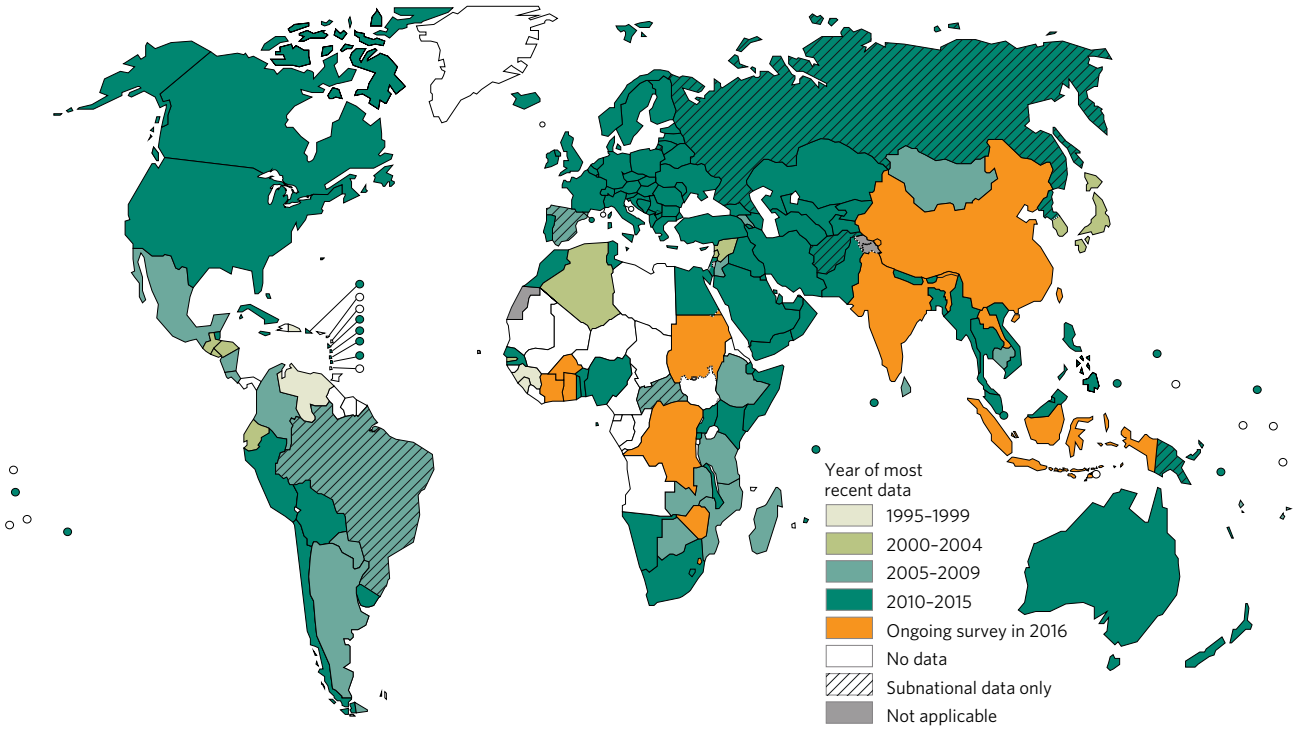
:: FIG. 3.16

Data sources available to estimate levels of TB drug resistance



:: FIG. 3.17

Global coverage of surveillance data on drug resistance, 1995–2016



overlap between the two groups[1]), 37 have data on levels of drug resistance. The three countries that that have never conducted a drug resistance survey are Angola, Congo and Liberia. Among the other 37 high TB burden countries, the data for Sierra Leone are from before the year 2000, and five countries (Brazil, Central African Republic, Democratic People's Republic of Korea, Papua New Guinea and the Russian Federation) rely on drug-resistance surveillance data gathered from subnational areas only.

In 2015, the first-ever drug resistance survey was completed in Djibouti, and repeat surveys were completed in Kenya, Lesotho, Namibia, Romania, Rwanda and South Africa. In 2016, drug resistance surveys were ongoing in 11 countries, with the first nationwide surveys in seven countries (Burkina Faso, the Democratic Republic of the Congo, Ghana, India, Indonesia, Lao People's Democratic Republic and Sudan) and repeat surveys in four countries (China, Côte d'Ivoire, Swaziland and Zimbabwe).

3.3.2 Estimates of the disease burden caused by MDR/RR-TB

In previous global TB reports, estimates of the burden of drug-resistant TB have focused on MDR-TB (defined as resistance to rifampicin and isoniazid, the two most effective anti-TB drugs). In May 2016, WHO issued guidance[2] that people with TB resistant to rifampicin, with or without resistance to other drugs, should be treated with an MDR-TB treatment regimen. This includes patients with MDR-TB as well as any other patient with TB resistant to rifampicin (referred to in this report as MDR/RR-TB). Following that guidance, estimates of the burden of MDR/RR-TB are required for assessing progress in detection of cases with drug-resistant TB and treatment coverage.

Globally in 2015, an estimated 3.9% (95% confidence interval [CI]: 2.7–5.1%) of new cases and 21% (95% CI: 15–28%) of previously treated cases had MDR/RR-TB (**Table 3.5**). The proportions of new and previously treated TB cases with MDR/RR-TB at the country level are shown in **Fig. 3.18** and **Fig. 3.19**.

There were an estimated 580 000 (range, 520 000–640 000) incident cases of MDR/RR-TB in 2015, with cases of MDR-TB accounting for 83% of the total (**Table 3.5**). The number of MDR-TB incident cases (480 000) is in line with the estimate published in 2015. The countries with the largest numbers of MDR/RR-TB cases (45% of the global total) are China, India and the Russian Federation (**Fig. 3.20**).

There were about 250 000 (range, 160 000–340 000) deaths from MDR/RR-TB in 2015. The best estimate is slightly higher than estimates of deaths from MDR-TB published in recent global TB reports, due to the inclusion of deaths from all cases with RR-TB (and not only those with MDR-TB).

Data compiled from surveys and continuous surveillance of drug resistance among TB patients also allow estimation of the number of MDR/RR-TB cases among notified TB patients with pulmonary TB. These are the MDR/RR-TB cases that could be detected if all notified patients were tested for drug resistance to rifampicin and isoniazid using WHO-recommended diagnostic tests. Globally in 2015, there were an estimated 340 000 (range, 320 000–350 000) MDR/RR-TB cases among notified TB patients. Country-specific estimates are presented and discussed in **Chapter 4**.

3.3.3 Trends in drug resistance

Of the 40 countries with a high TB or MDR-TB burden (or both), only 20 have repeated a survey at least once to evaluate trends in drug resistance. Among these countries, eight have at least 3 years of data: Belarus, Kazakhstan, Myanmar, Peru, Republic of Moldova, Tomsk Oblast in the Russian Federation, Thailand and Viet Nam. For these settings, trends in the number of new TB cases notified, the proportion of new TB cases with MDR, and per capita TB and MDR-TB rates are shown in **Fig. 3.21**. Based on these data, there is a slight trend for cases of MDR-TB to increase as a proportion of all TB cases in these countries, with the burden of MDR-TB either increasing faster or decreasing more slowly than the overall TB burden in each country.

3.3.4 Resistance to second-line anti-TB drugs and pyrazinamide

By the end of 2015, extensively drug-resistant TB (XDR-TB)[3] had been reported by 117 WHO Member States. Of these, 88 countries and five territories 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 9.5% (95% CI: 7.0–12.1%), similar to estimates for previous years (9.7% in 2014 and 9.0% in 2013).

Among the 40 countries with a high TB or MDR-TB burden, 21 have surveillance data on resistance to second-line anti-TB drugs, but only six have established a national continuous surveillance system for second-line drug resistance among patients with MDR-TB. The proportion of MDR-TB cases with resistance to any fluoroquinolone for which testing was done – including ofloxacin, levofloxacin and moxifloxacin – was 21.0% (95% CI: 8.8–33.3%). A total of 51% (30–70%) of patients with MDR-TB have resistance to a fluoroquinolone or a second-line injectable agent, or both. Levels of resistance to fluoroquinolones and pyrazinamide among all TB cases have been studied in a multicountry surveillance project; results are summarized in **Box 3.6**.

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

[2] World Health Organization. WHO treatment guidelines for drug-resistant tuberculosis (2016 update) (WHO/HTM/TB/2016.04). Geneva: WHO; 2016 (http://www.who.int/tb/areas-of-work/drug-resistant-tb/MDRTBguidelines2016.pdf,).

[3] XDR-TB is defined as MDR-TB plus resistance to at least one fluoroquinoline and a second-line injectable agent.

:: TABLE 3.5

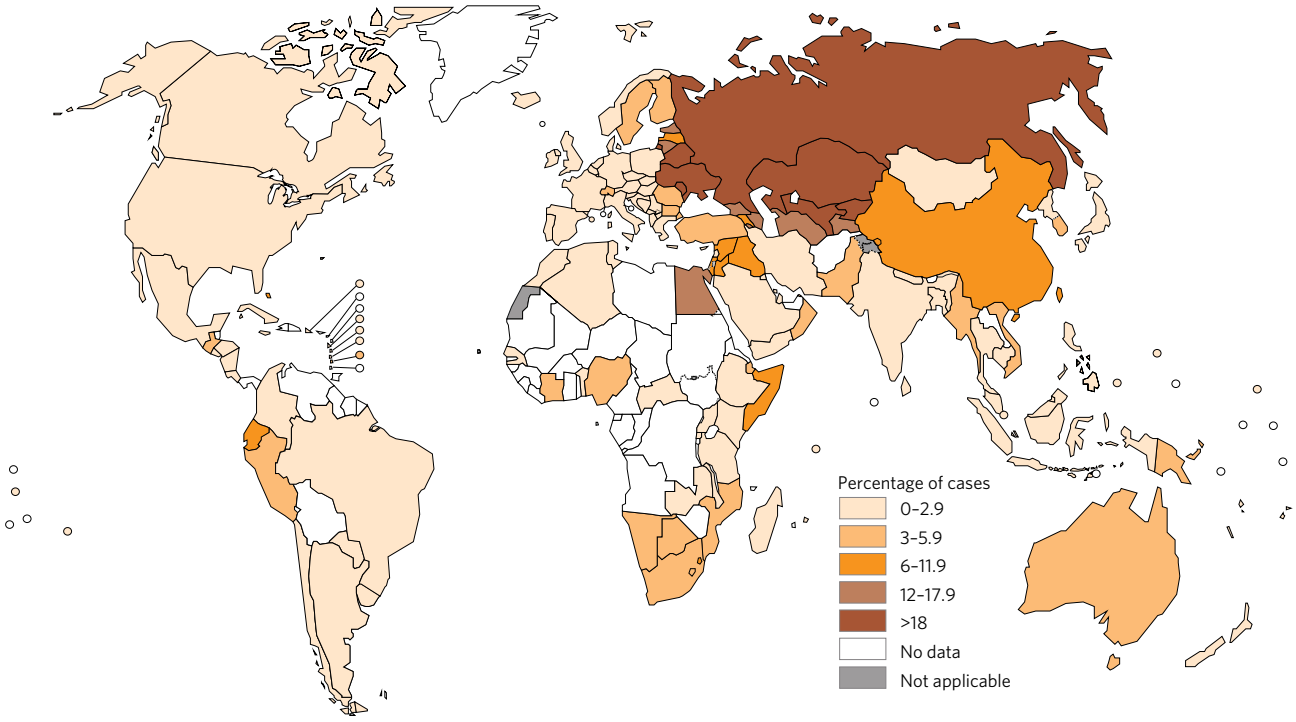
Estimated incidence of MDR/RR-TB in 2015 for 30 high MDR-TB burden countries, WHO regions and globally

	ESTIMATED % OF NEW CASES WITH MDR/RR-TB		ESTIMATED % OF PREVIOUSLY TREATED CASES WITH MDR/RR-TB		INCIDENCE OF MDR/RR-TB				
	BEST ESTIMATE[a]	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	NUMBER (IN 1000s)	UNCERTAINTY INTERVAL (IN 1000s)	RATE[b]	UNCERTAINTY INTERVAL	% OF MDR AMONG MDR/RR-TB
Angola	2.8	0.1–6.7	21	2.2–39	4.1	0.36–7.8	16	1.4–31	66
Azerbaijan	13	10–16	29	23–35	2.5	2.0–3.0	26	21–31	96
Bangladesh	1.6	0.59–2.6	29	24–34	9.7	5.4–14	6.0	3.4–8.7	93
Belarus	37	35–39	69	66–72	3.5	2.8–4.2	37	29–44	97
China	6.6	5.3–7.9	30	25–34	70	55–84	5.1	4.0–6.1	86
DPR Korea	2.2	0.51–3.9	16	8.4–24	6.0	3.4–8.6	24	14–34	90
DR Congo	3.2	1.4–5.0	14	6.9–21	10	4.6–15	13	6.0–19	67
Ethiopia	2.7	1.5–4.0	14	5.6–23	6.2	3.5–8.9	6.2	3.5–9.0	63
India	2.5	2.1–3.1	16	14–18	130	88–180	9.9	6.7–14	92
Indonesia	2.8	2.2–3.5	16	10–20	32	19–45	12	7.4–17	69
Kazakhstan	25	24–26	43	42–45	8.8	7.1–10	50	40–57	92
Kenya	1.3	0.68–1.9	9.4	8.7–10	2.0	1.3–2.8	4.3	2.8–6.1	50
Kyrgyzstan	32	28–36	56	53–59	5.0	4.1–5.9	84	69–99	92
Mozambique	3.7	2.4–5.0	20	1.9–37	7.3	4.1–10	26	15–36	86
Myanmar	5.1	3.2–7.0	27	15–39	14	8.9–18	26	17–33	93
Nigeria	4.3	3.2–5.4	25	19–31	29	15–43	16	8.2–24	66
Pakistan	4.2	3.2–5.3	16	15–17	26	16–36	14	8.5–19	77
Papua New Guinea	3.4	1.7–5.0	26	15–36	1.9	1.2–2.5	25	16–33	38
Peru	5.9	5.6–6.3	21	19–22	3.2	2.7–3.8	10	8.6–12	91
Philippines	2.6	1.8–3.3	29	21–38	17	14–20	17	14–20	76
Republic of Moldova	32	29–34	69	66–72	3.9	2.9–4.8	96	71–118	79
Russian Federation	22	14–25	53	40–59	60	49–71	42	34–49	90
Somalia	8.7	5.9–11	47	29–65	3.1	1.8–4.4	29	17–41	65
South Africa	3.5	2.8–4.2	7.1	5.3–8.9	20	13–27	37	24–50	60
Tajikistan	14	12–15	77	73–80	1.9	1.5–2.2	22	18–26	51
Thailand	2.2	1.5–2.9	24	18–30	4.5	2.9–6.2	6.6	4.3–9.1	87
Ukraine	25	21–28	58	53–64	22	17–27	49	38–60	95
Uzbekistan	24	18–30	63	54–71	10	7.6–12	33	25–40	97
Viet Nam	4.1	2.6–5.5	25	24–26	7.3	5.2–9.5	7.8	5.6–10	67
Zimbabwe	3.2	1.4–5.0	14	6.9–21	1.8	1.0–2.5	12	6.4–16	67
High MDR/RR-TB burden countries	**4.3**	**2.7–5.8**	**22**	**14–31**	**520**	**470–580**	**12**	**10–13**	**84**
Africa	3.0	1.2–4.9	15	7.5–22	110	88–120	11	8.9–13	67
The Americas	2.9	1.6–4.2	12	7.3–17	11	10–12	1.1	1.0–1.2	88
Eastern Mediterranean	4.1	3.0–5.1	17	12–23	39	30–50	6.0	4.6–7.7	74
Europe	16	11–20	48	42–53	120	110–140	14	12–15	91
South-East Asia	2.6	2.3–3.0	17	15–19	200	150–250	10	7.9–13	90
Western Pacific	5.1	3.0–7.2	26	23–30	100	88–120	5.5	4.8–6.4	82
Global	**3.9**	**2.7–5.1**	**21**	**15–28**	**580**	**520–640**	**7.9**	**7.2–8.7**	**83**

[a] Best estimates are for the latest available year.
[b] Rates are per 100 000 population.

:: FIG. 3.18

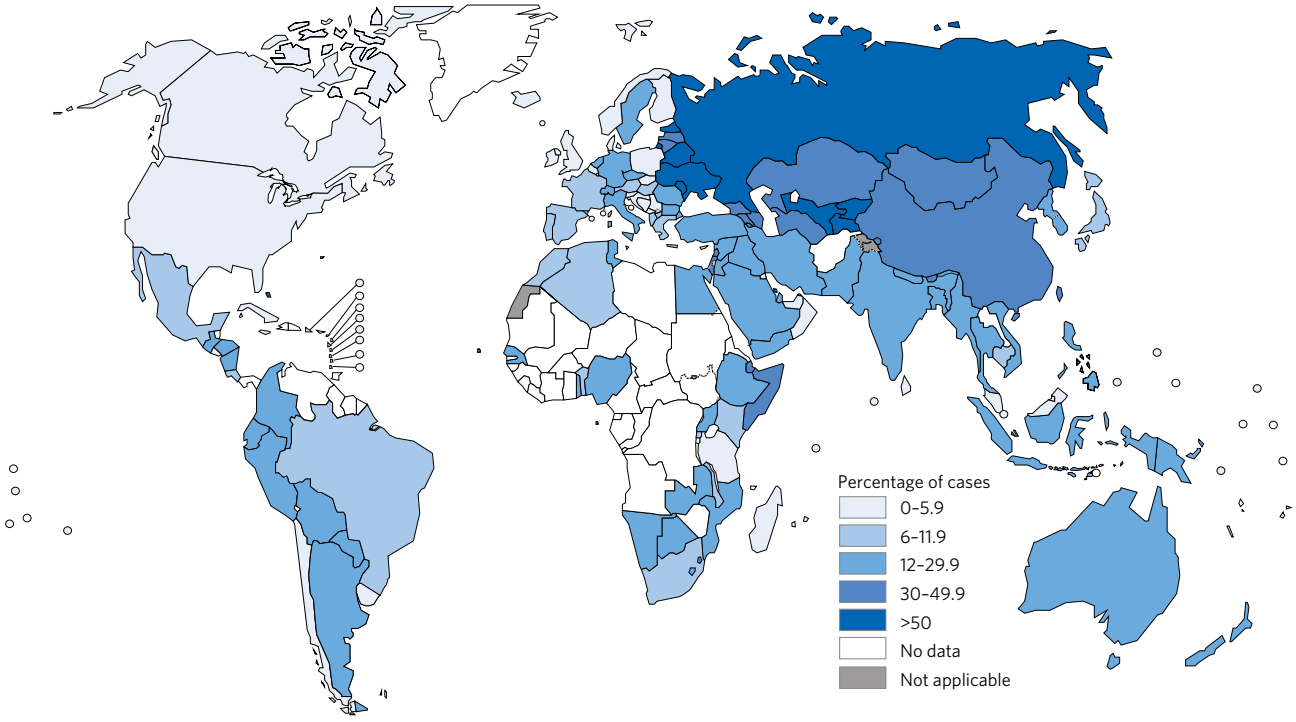
Percentage of new TB cases with MDR/RR-TB[a]



[a] Figures are based on the most recent year for which data have been reported, which varies among countries. Data reported before the year 2001 are not shown.

:: FIG. 3.19

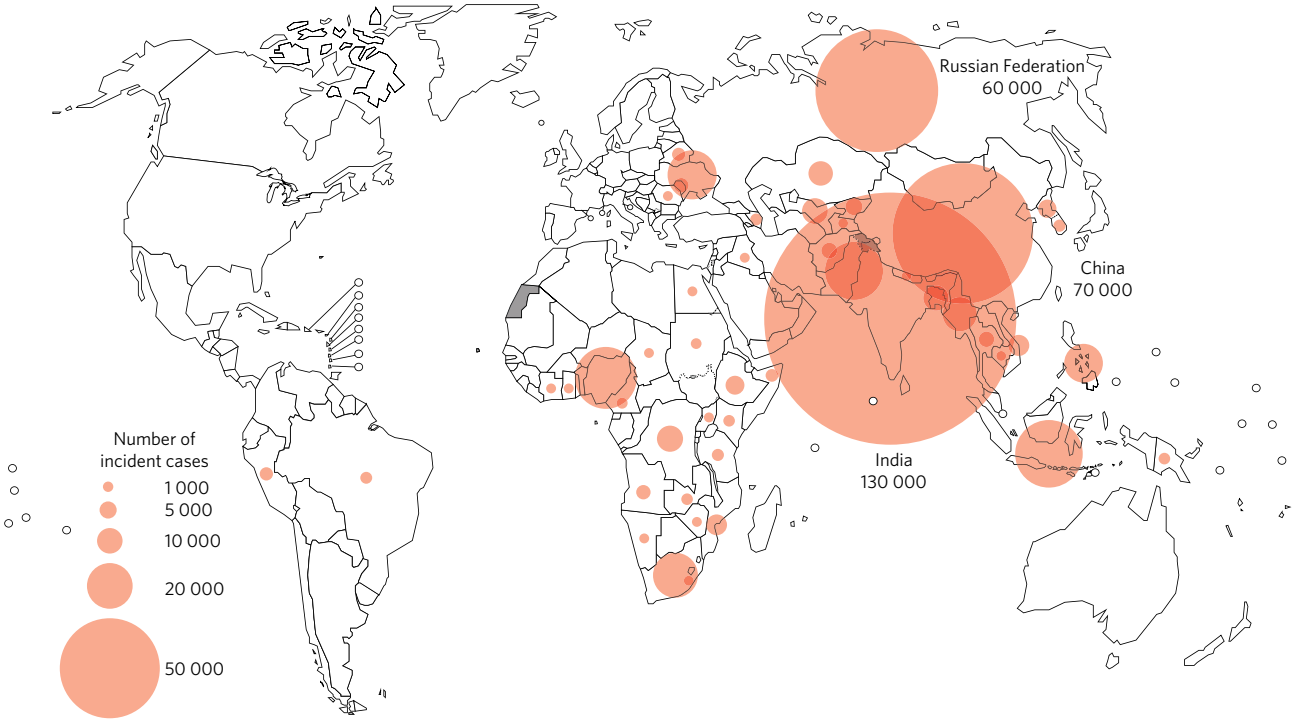
Percentage of previously treated TB cases with MDR/RR-TB[a]



[a] Figures are based on the most recent year for which data have been reported, which varies among countries. Data reported before the year 2001 are not shown. The high percentages of previously treated TB cases with MDR-TB in Bahamas, Bahrain, Belize, Bonaire – Saint Eustatius and Saba, French Polynesia and Sao Tomé and Principe refer to only a small number of notified cases (range: 1-8 notified previously treated TB cases).

:: FIG. 3.20

Estimated incidence of MDR/RR-TB in 2015, for countries with at least 1000 incident cases. Areas that are not applicable are in grey.



:: Box 3.6

Resistance to pyrazinamide and fluoroquinolones: a summary of results from the first surveys in five countries

The combination of pyrazinamide plus a fourth-generation fluoroquinolone (moxifloxacin or gatifloxacin) is considered essential in novel rifampicin-sparing regimens for the treatment of TB and in shorter regimens for the treatment of MDR-TB. Understanding the background prevalence at population level of resistance to these drugs is important to assess the feasibility of introducing new and shorter regimens in TB control programmes.

Although levels of resistance to rifampicin and isoniazid are monitored in most TB-endemic countries through drug-resistance surveys, testing for susceptibility to fluoroquinolones and pyrazinamide is not routinely performed as part of surveillance efforts. Therefore, population-representative surveillance data on levels of resistance to these drugs are limited. To start to address this knowledge gap, a multicountry project was coordinated by WHO in five countries – Azerbaijan, Bangladesh, Belarus, Pakistan and South Africa – enrolling more than 5000 patients. Results from this project were published in May 2016a and a summary is provided here.

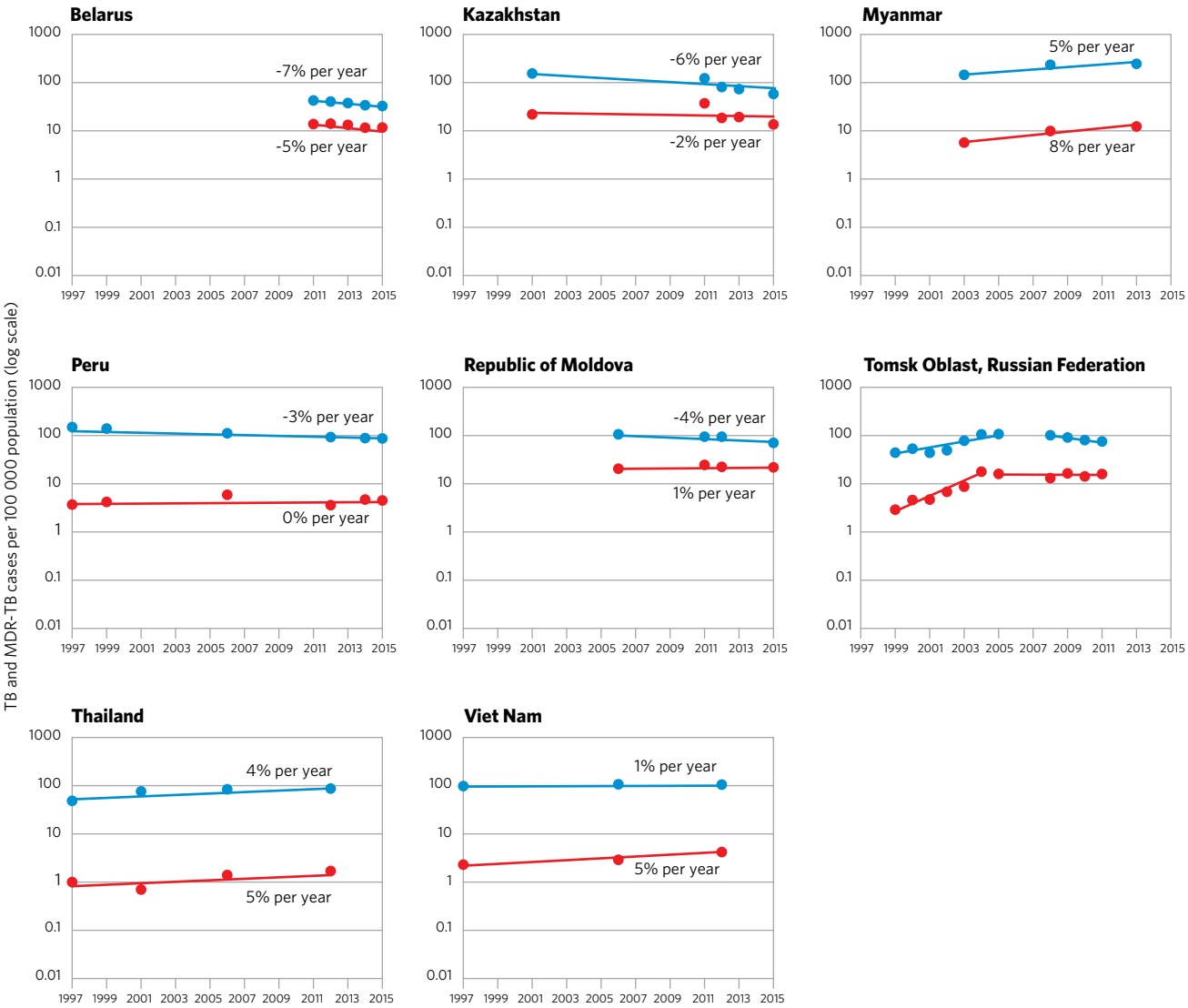
Levels of resistance varied substantially among settings (3.1–42.1%). In all settings, pyrazinamide resistance was significantly associated with rifampicin resistance (0.5–4.2% among rifampicin-susceptible cases and 36.7–81.3% among rifampicin-resistant cases). Resistance ranged from 1.0% to 16.6% for ofloxacin, from 0.5% to 12.4% for levofloxacin and from 0.9% to 14.6% for moxifloxacin when tested at 0.5 µg/ml. High levels of ofloxacin resistance were found in Pakistan. Resistance to moxifloxacin and gatifloxacin when tested at 2 µg/ml was low in all countries. Cross-resistance was high between ofloxacin and levofloxacin (87%) and between ofloxacin and moxifloxacin (72%) when tested at 0.5 µg/ml. Cross-resistance was very low between ofloxacin and moxifloxacin and gatifloxacin when tested at 2 µg/ml.

The presence of rifampicin resistance, which currently is easily identified because of the wide availability of new rapid molecular technology, should prompt attention to the possibility of the simultaneous presence of resistance to pyrazinamide and, in some settings, the earlier generation fluoroquinolones. Resistance to the latest generation fluoroquinolones at the clinical breakpoint is still uncommon, a finding that supports current WHO recommendations to use moxifloxacin or gatifloxacin in the treatment of MDR-TB.

[a] 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;16:30190–30196 (http://www.ncbi.nlm.nih.gov/pubmed/27397590, accessed 24 August 2016).

:: FIG. 3.21

Trends in levels of drug resistance in selected high MDR-TB burden countries with at least three years of data. The **blue** line shows the number of new notified TB cases per 100 000 population. The **red** line shows the number of MDR-TB cases among new TB patients per 100 000 population.



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 post-2015. This is in contrast to the era of the Millennium Development Goals (MDGs) and Stop TB Strategy, when one of the global targets for reductions in TB disease burden was to halve prevalence between 1990 and 2015. Furthermore, indirect estimates of prevalence suffer from considerable uncertainty, because they are derived from incidence and assumptions about disease duration. Hence, indirect estimates of TB prevalence are not presented in this chapter.[1]

These developments notwithstanding, in an important subset of countries with a large proportion of the world's TB burden, national TB prevalence surveys will continue to provide the best method for measuring the burden of TB disease (both in absolute terms and to assess trends when repeat surveys are done), and related assessment of actions needed to reduce that burden. This group of countries can be broadly defined as those with a relatively high burden of TB (about 150 incident cases per 100 000 population)[2] 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. In addition, results from national TB prevalence surveys can inform estimates of TB incidence and mortality, and thus contribute to monitoring

[1] WHO will continue to produce indirect estimates of TB prevalence. These can be provided upon request to tbdata@who.int.

[2] In low- and medium-burden countries, sample sizes and costs for surveys become prohibitively large.

:: FIG. 3.22

Global progress in implementing national surveys of the prevalence of TB disease, actual (2000–2016) and expected (2017)[a]

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

[a] In 2007, 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 for the period up to the end of 2015. In Africa, these countries included Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Sierra Leone, South Africa, Uganda, UR Tanzania and Zambia. In Asia, these countries included Bangladesh, Cambodia, China, Indonesia, Myanmar, Pakistan, Philippines, Thailand and Viet Nam.

[b] The national survey 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.

of progress towards SDG and End TB Strategy targets. For these reasons, the status of progress in implementation of national TB prevalence surveys, and summaries of key results, will continue to be featured in global TB reports.

There has already been substantial progress in the number of countries that have implemented a national TB prevalence survey. This was particularly the case during the period 2007–2015, when 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**). The Task Force has retained national TB prevalence surveys in selected countries[1] within its strategic areas of work 2016–2020.

Countries in which surveys have been implemented since 2000 or are planned in the near future are shown in **Fig. 3.22** and **Fig. 3.23**. Between 2009 and August 2016, an unprecedented number of national TB prevalence surveys were completed: 22 in total, of which 12 were in African countries and 10 in Asian countries. A major development in 2016 was a decision to implement a national TB prevalence survey in India (**Box 3.3**).

Results in terms of the number of cases detected in surveys and prevalence per 100 000 population are shown for surveys implemented since 2009 in **Table 3.6**. All of these surveys used the screening and diagnostic methods recommended in WHO's handbook on national TB prevalence surveys.[2] A comparison of estimates of TB prevalence before and after the implementation of a national survey is shown for the 19 countries that completed a survey (and finalized results) between 2009 and August 2016 in **Fig. 3.24**. Post-survey prevalence estimates were almost always more precise (i.e. had narrow uncertainty intervals). For 12 countries, estimates were within the pre-survey uncertainty interval, whereas for the other seven countries the survey found a burden that was either significantly above (six countries) or below (one country) the burden that had been estimated in the absence of survey data. Estimates of TB incidence that have been derived from a prevalence survey are shown in **Fig. 3.25**. This comparison shows that post-survey estimates of TB incidence sometimes have wider uncertainty intervals. This occurred when pre-survey estimates of incidence were based on case notification data and expert opinion (i.e. method 1 as explained in **Section 3.1** and as shown in **Fig. 3.1**); in several countries, uncertainty (based on the range of plausible incidence values elicited from experts) was understated. This demonstrates and reinforces the importance of direct measurements of TB disease burden as opposed to indirect estimates that rely on expert opinion, as emphasized by the WHO Global Task Force on TB Impact Measurement since its establishment in 2006 (**Box 3.1**).

A recent and more detailed presentation and discussion of results and lessons learnt from national TB prevalence surveys 2009–2015 is available on the Task Force website.[3] Examples of how survey data can provide important insights into the distribution of TB disease by age, sex and location, as well as differences in detection and reporting of cases by age and sex, are provided in **Section 3.6.1**.

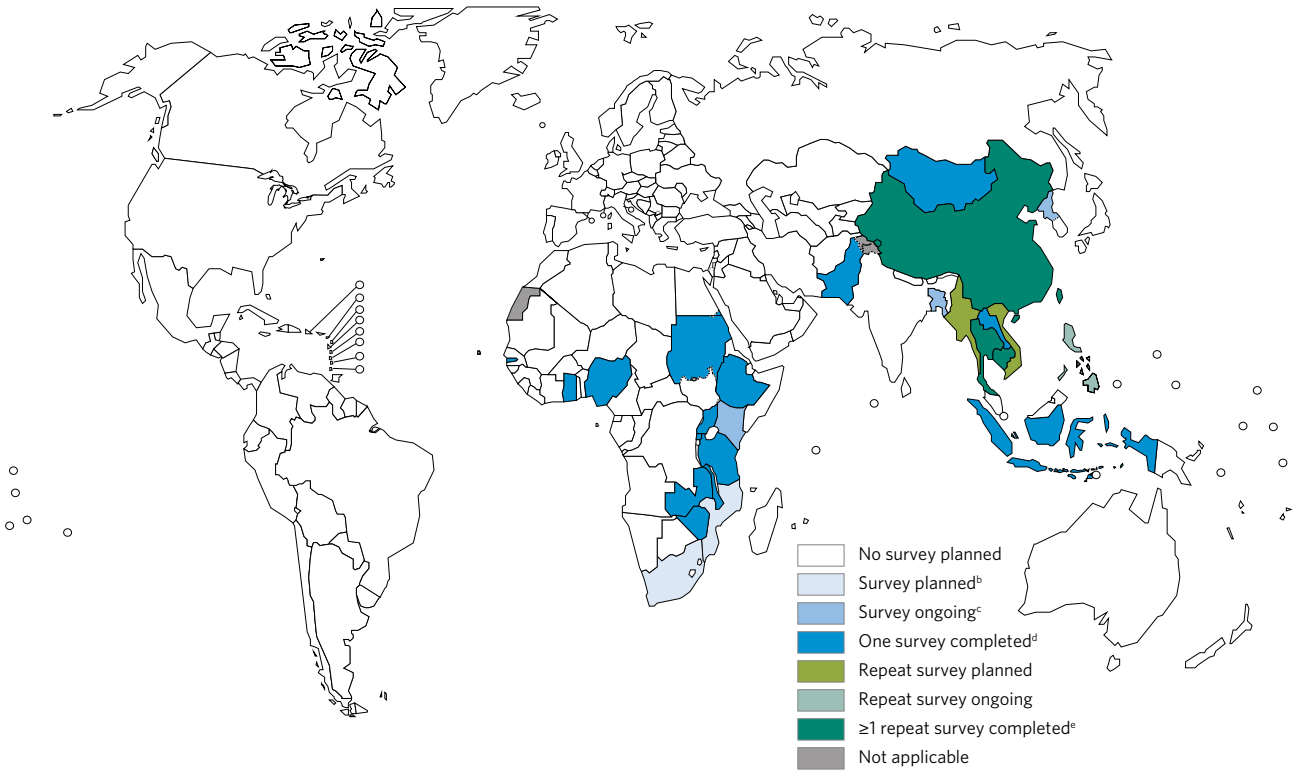
[1] In the Task Force's April 2016 meeting, epidemiological criteria for conducting a survey were defined for two groups of countries: a) those that implemented a survey in 2009–2015 and in which a repeat survey could be considered; and b) countries that have never conducted a survey. There were 24 countries in the first group and 33 in the second group. For any of these 57 countries, it was also 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 (see next footnote) should be met.

[2] World Health Organization. Tuberculosis prevalence surveys: a handbook (WHO/HTM/TB/2010.17). Geneva: WHO; 2011 (www.who.int/tb/advisory_bodies/impact_measurement_taskforce/resources_documents/thelimebook/, accessed 24 August 2016).

[3] http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_p06_prevalence_surveys_2009_2015.pdf?ua=1

:: FIG. 3.23

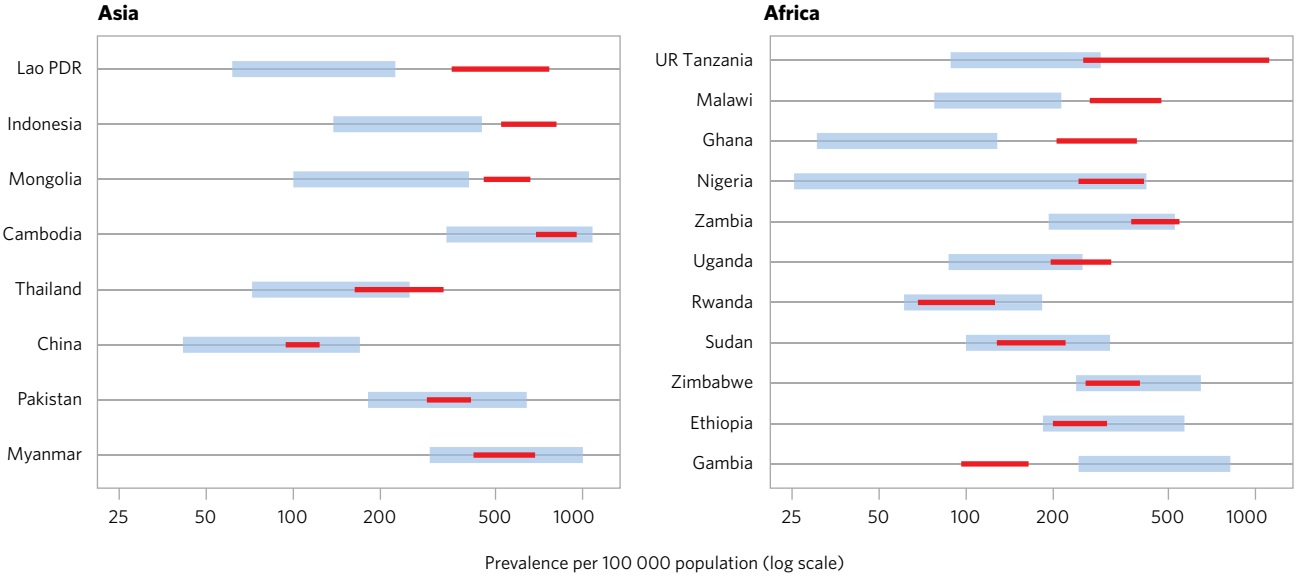
Countries in which national population-based surveys of the prevalence of TB disease have been implemented using currently recommended screening and diagnostic methods[a] since 2000 or are planned in the future (status in August 2016)



[a] Screening methods include field chest X-ray; culture is used to confirm diagnosis. For current surveys ongoing in Bangladesh, Kenya and the Philippines, culture and Xpert MTB/RIF are used 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 2016 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 culture examination was used to diagnose TB cases.

:: FIG. 3.24

Estimates of TB prevalence (all ages, all forms of TB) for 19 countries, before (in blue) and after (in red) survey results from national TB prevalence surveys became available. Panels are ordered according to the before-after difference.



:: TABLE 3.6

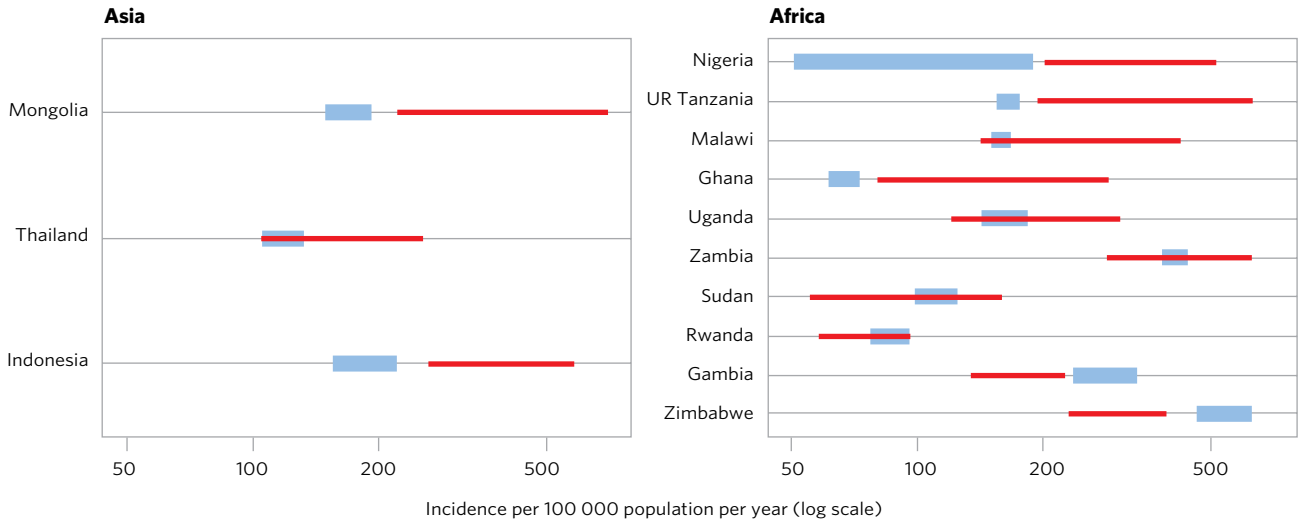
Number of TB cases found in national TB prevalence surveys implemented 2009-2015, and associated estimates of the prevalence of pulmonary TB in adults (aged ≥15 years)

COUNTRY	MAIN YEAR(S) OF SURVEY	NUMBER OF SMEAR-POSITIVE CASES	NUMBER OF BACTERIOLOGICALLY CONFIRMED CASES	PREVALENCE PER 100 000 POPULATION: SMEAR-POSITIVE CASES[a]		PREVALENCE PER 100 000: BACTERIOLOGICALLY CONFIRMED CASES[a]	
				BEST ESTIMATE	95% CONFIDENCE INTERVAL	BEST ESTIMATE	95% CONFIDENCE INTERVAL
Cambodia	2011	103	314	271	212–348	831	707–978
China	2010	188	347	66	53–79	119	103–135
Ethiopia	2010–2011	47	110	108	73–143	277	208–347
Gambia	2012	34	77	90	53–127	212	152–272
Ghana	2013	64	202	111	76–145	356	288–425
Indonesia	2013–2014	165	426	257	210–303	759	590–961
Lao PDR	2010–2011	107	237	278	199–356	595	457–733
Malawi	2013	62	132	220	142–297	452	312–593
Mongolia	2014–2015	88	248	204	143–265	560	455–665
Myanmar	2009–2010	123	311	242	186–315	613	502–748
Nigeria	2012	107	144	318	225–412	524	378–670
Pakistan	2010–2011	233	341	270	217–322	398	333–463
Rwanda	2012	27	40	74	48–99	119	79–160
Sudan	2013–2014	57	112	87	54–118	180	128–233
UR Tanzania[b]	2012	134	—	275	232–326	—	—
Thailand[c]	2012	58	142	104	55–195	242	176–332
Uganda	2014–2015	66	160	174	111–238	401	292–509
Zambia	2013–2014	135	265	319	232–406	638	502–774
Zimbabwe	2014	23	107	82	53–128	344	275–430

[a] Estimates based upon the use of robust standard errors with missing value imputation and inverse probability weighting for all countries except for Cambodia, Myanmar and UR Tanzania which used a cluster-level model of analysis without imputation.
[b] Laboratory challenges meant that it was only possible to directly estimate the prevalence of smear-positive (as oppose to bacteriologically confirmed) TB.
[c] Data excludes clusters from the capital city, Bangkok.

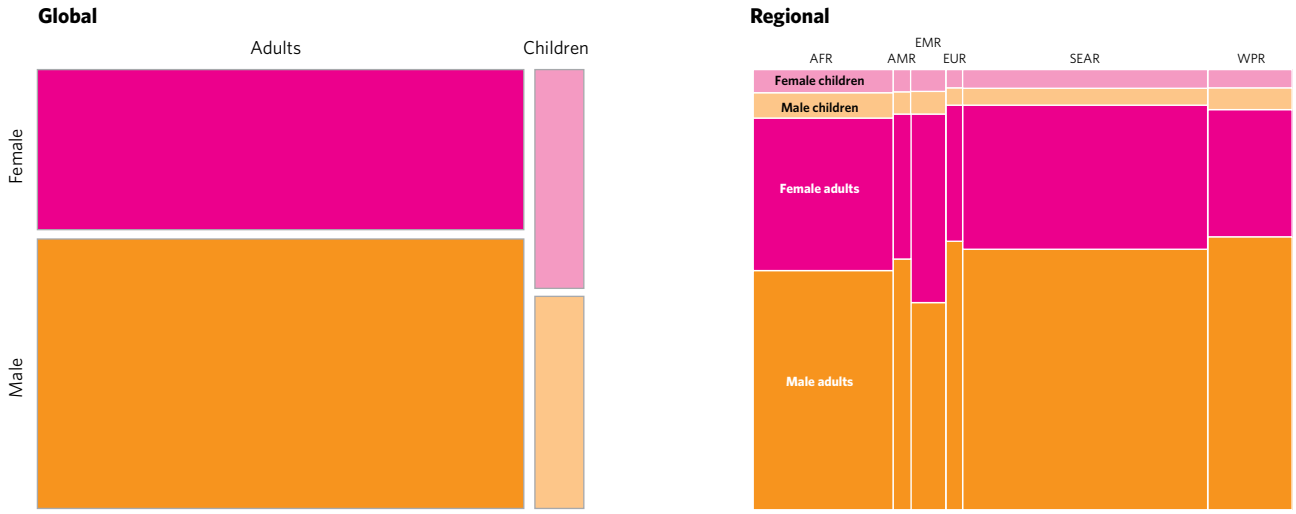
:: FIG. 3.25

Estimates of TB incidence (all ages, all forms of TB) for 13 countries that implemented a national TB prevalence survey in the period 2012–2015, before (in blue) and after (in red) survey results became available



:: FIG. 3.26

Global and regional estimates of TB incidence disaggregated by age and sex[a]



[a] The total area represents global TB incidence and all rectangles are proportional to their share of total TB incidence.

3.5 Estimates of TB incidence and mortality disaggregated by age and sex

This section presents estimates of TB incidence and TB mortality disaggregated by age and sex.

3.5.1 Methods to disaggregate estimates by age and sex

Estimates of TB incidence disaggregated by age and sex were produced by assuming that the male to female (M:F) ratio of notified cases (with adults and children considered separately) was the same as the ratio for incident cases. This assumption is reasonable for children (defined as people aged under 15 years),[1] but is recognized to be problematic for some countries, given evidence from recent prevalence surveys that case detection and reporting gaps are often larger for adult men compared with adult women (**Section 3.6.1**). Resulting estimates may thus understate the burden of TB in men compared with women.

For 113 countries, (all of which were middle- or high-income countries in 2015), estimates of TB deaths among HIV-negative adults were produced using age and sex-disaggregated mortality data from VR systems. For countries without VR data, estimates were produced using an imputation model that included risk factors known to be associated with TB mortality. TB deaths among HIV-positive people were disaggregated by age and sex using the assumption that the M:F and children:adult ratios are similar to the corresponding ratios of AIDS deaths estimated by the Joint United Nations Programme on HIV/AIDS (UNAIDS).

Details of the methods used are provided in the **online technical appendix**.[2]

3.5.2 TB incidence disaggregated by age and sex

Estimates of TB incidence are shown for males and females, both in total and by age group (adults and children), in **Fig. 3.26**. Globally in 2015, there were an estimated 6.4 million (range, 5.7 million to 7.2 million) incident cases of TB among males, of which 5.9 million (range, 5.3 million to 6.7 million) were adults and 0.47 million (range, 0.42 million to 0.53 million) were children. There were 4.0 million (range, 3.1 million to 4.9 million) incident cases of TB in females, of which 3.5 million (range, 2.7 million to 4.4 million) were adults and 0.48 million (range, 0.41 million to 0.56 million) were children. These numbers correspond to 62% of cases being males and 38% females, and 90% of cases being adults and 10% children. Further breakdowns by HIV status are not possible, because data on the HIV status of TB cases by age and sex are not available.

The M:F ratio of incident TB cases for all ages ranged from 1.1 in the WHO Eastern Mediterranean Region to 2.0 in the Western Pacific Region. Similar M:F ratios were estimated for adults, whereas for children the M:F ratio ranged from 0.9 in the WHO Eastern Mediterranean Region to 1.1 in the Western Pacific Region. Most of the estimated cases among males in 2015 were in Asia (63%) and the WHO African Region (25%),[3] whereas for females the percentages were 58% for Asia and 28% for the WHO African Region, respectively. For children, the top three regions were the WHO South-East Asia Region with 40% of incident TB cases in 2015, followed by the African Region with 31% and the Western Pacific Region with 14%.

[1] Adults are defined as those aged ≥15 years because this is consistent with the age categories for which notification data are reported, and with the cut-off used in current guidelines to define people eligible to participate in a TB prevalence survey.

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

[3] Asia refers to the WHO Regions of South-East Asia and the Western Pacific.

:: TABLE 3.7

HIV-negative and HIV-positive TB mortality by age (children and adults), globally and for WHO regions, 2015

HIV-NEGATIVE

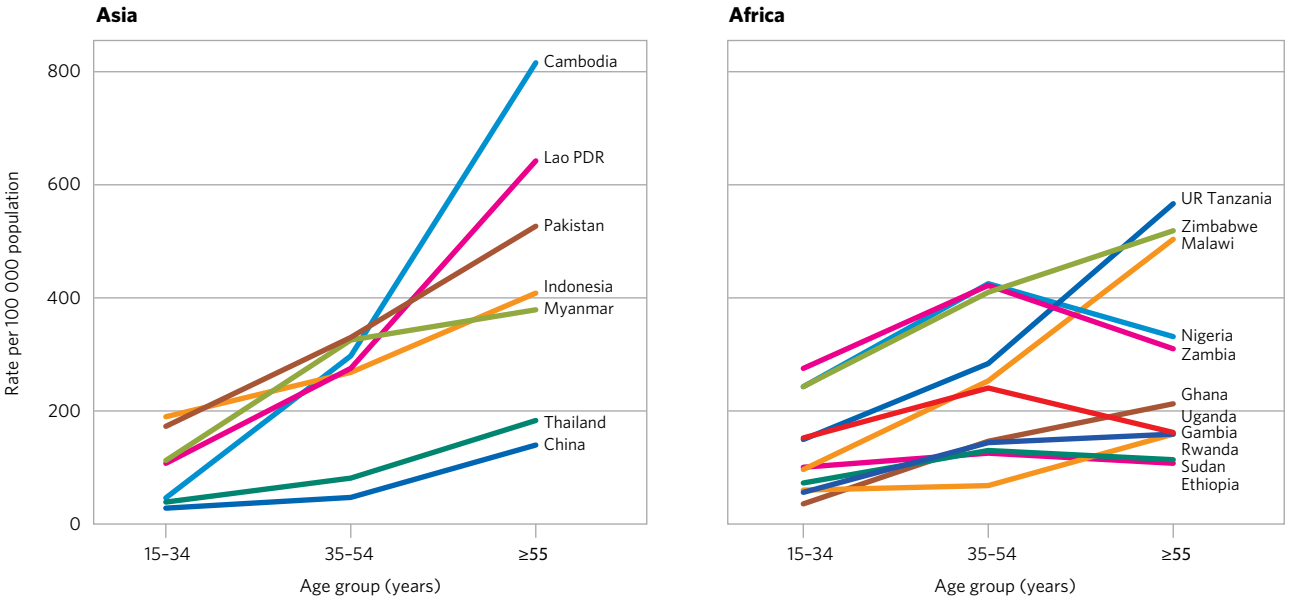
WHO REGION	TOTAL		0–14 YEARS		MALE ≥15 YEARS		FEMALE ≥15 YEARS	
	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL	BEST ESTIMATE	UNCERTAINTY INTERVAL
Africa	448 000	351 000–556 000	63 500	48 800–80 100	274 000	228 000–324 000	110 000	63 200–170 000
The Americas	18 500	17 500–19 600	2 170	1 640–2 780	11 700	10 600–12 800	4 670	3 820–5 610
Eastern Mediterranean	79 800	39100–135 000	10 500	5 220–17 600	49 400	31 300–71 600	19 900	3 660–49 700
Europe	32 100	31 400–32 800	521	481–562	18 700	16 900–20 500	12 900	11 800–13 900
South-East Asia	712 000	601 000–832 000	83 900	67 000–103 000	447 000	372 000–527 000	181 000	117 000–260 000
Western Pacific	89 500	81 300–98 000	8 300	7 200–9 490	57 600	51 500–64 100	23 600	18 600–29 100
Global	**1 380 000**	**1 220 000–1 550 000**	**169 000**	**145 000–194 000**	**858 000**	**767 000–954 000**	**353 000**	**266 000–451 000**

HIV-POSITIVE

WHO REGION	TOTAL		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
Africa	295 000	236 000–360 000	34 000	29 000–40 000	142 000	122 000–163 000	120 000	94 300–148 000
The Americas	5 890	4 270–7 770	200	140–270	3 870	3 210–4 590	1 820	1 110–2 690
Eastern Mediterranean	2 970	2 490–3 500	310	260–370	1 760	1 490–2 070	847	586–1 160
Europe	4 870	1 770–9 510	47	28–70	3 490	2 140–5 160	1 330	192–3 550
South-East Asia	74 300	56 500–94 500	6 100	4 100–8 500	49 500	40 300–59 700	18 600	9 930–30 100
Western Pacific	5 750	3 840–8 030	270	190–360	4250	3 330–5 270	1 230	426–2 440
Global	**389 000**	**327 000–457 000**	**41 000**	**35 000–47 000**	**204 000**	**182 000–228 000**	**143 000**	**116 000–174 000**

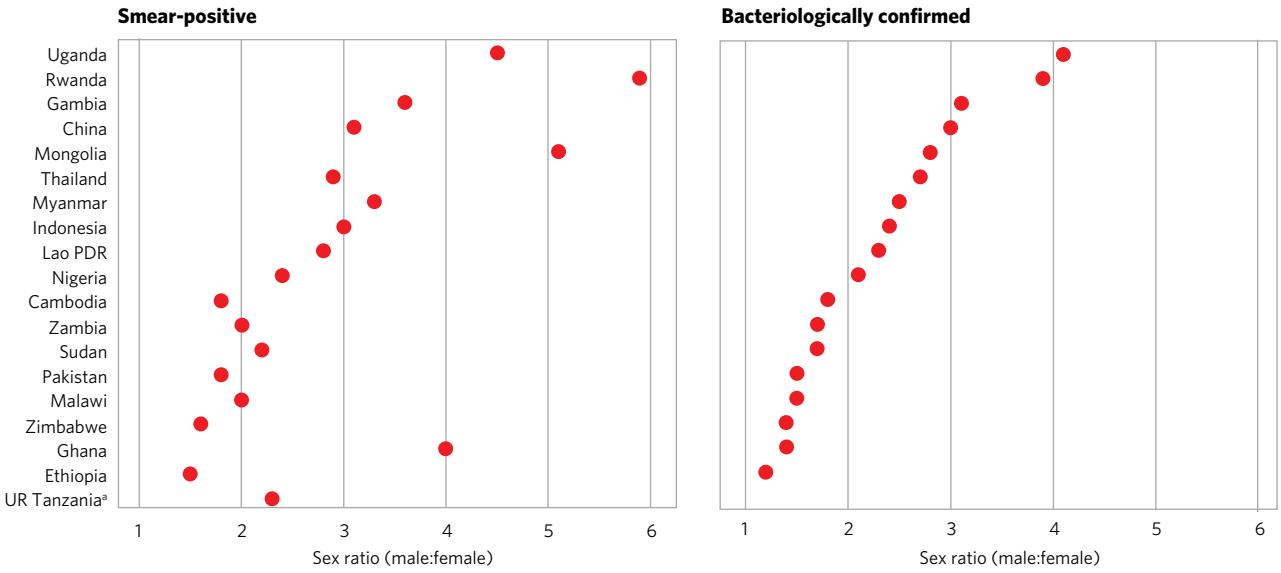
:: FIG. 3.27

The age distribution of adult TB cases detected in prevalence surveys implemented 2009–2015



:: FIG. 3.28

The male:female ratio of adult TB cases detected in prevalence surveys implemented 2009–2015



[a] Laboratory challenges during the survey in UR Tanzania meant that it was only possible to directly estimate the prevalence of smear-positive (as oppose to bacteriologically confirmed) TB.

3.5.3 TB mortality disaggregated by age and sex

Estimates of TB mortality disaggregated by age and sex are shown 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 (see also **Section 3.2**).

TB mortality among HIV-negative people

Globally in 2015, there were an estimated 0.86 million (range, 0.77 million to 0.95 million) deaths from TB among HIV-negative men. There were an additional 0.35 million (range, 0.27 million to 0.45 million) deaths from TB among HIV-negative women, and 0.17 million (range, 0.15 to 0.19 million) among children. These numbers correspond to 62% of deaths being in men, 25% in women, and 13% in children. Higher numbers of TB deaths among men are consistent with the estimate that 62% of incident cases were among men in 2015, and with evidence from prevalence surveys that show that TB disease affects men more than women (**Fig. 3.28**) and that case detection and reporting gaps are higher among men (**Fig. 3.29**). The WHO South-East Asia and African regions accounted for more than 80% of TB deaths among HIV-negative people.

TB mortality among HIV-positive people

There were an estimated 0.20 million (range, 0.18 million to 0.23 million) TB deaths among HIV-positive men, 0.14 million (range, 0.12 million to 0.17 million) among HIV-positive women and 0.04 million (range, 0.03 million to 0.05 million) among HIV-positive children in 2015 (**Table 3.7**). The WHO African Region accounted for 75% of these deaths, where the M:F ratio was close to one. The M:F ratio in other regions varied from about 2 to 4.

3.6 Disaggregated analysis of TB surveillance and survey data

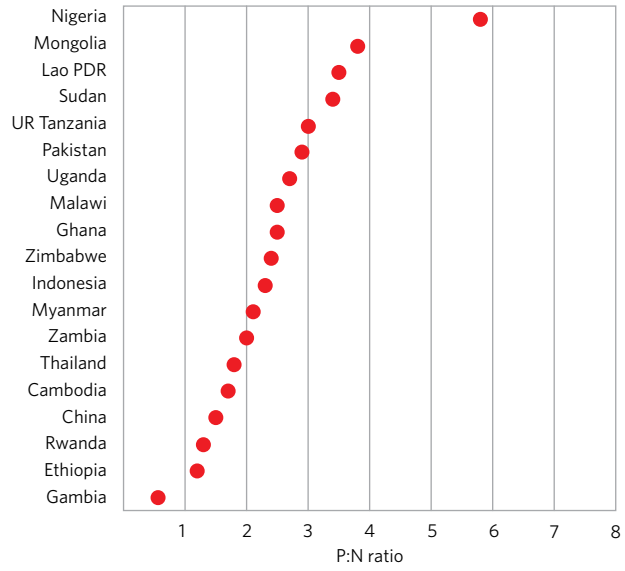
Disaggregated analysis of national TB surveillance and survey data is important to understand how the TB epidemic varies geographically and which population groups are most affected. The results can be used to inform national and local response efforts, including strategic allocation of resources. The importance of such within-country analyses and disaggregation of key indicators is emphasized within the End TB Strategy and the SDGs (**Chapter 2**). This section showcases examples of such analyses.

3.6.1 TB prevalence survey data disaggregated by age, sex and location

Results from national TB prevalence surveys (**Section 3.4**) provide representative data about the distribution of TB disease by age (in adults) and sex. The prevalence of disease per 100 000 population for three age groups found in surveys implemented in 2009–2015 is shown in **Fig. 3.27**. In Asia and some African countries (e.g. Ghana, Malawi, Rwanda, the United Republic of Tanzania and Zimbabwe), prevalence increases with age. In several African countries (e.g. Ethiopia, Gambia, Nigeria, Sudan, Uganda and Zambia), however, prevalence per 100 000 population peaks among those aged 35–54 years. The M:F ratio of cases for the same set of surveys is shown in **Fig. 3.28**. These show a systematically higher burden of TB disease among men, with ratios ranging from 1.5 (in Ethiopia) to 6.0 (in Rwanda)

:: FIG. 3.29a

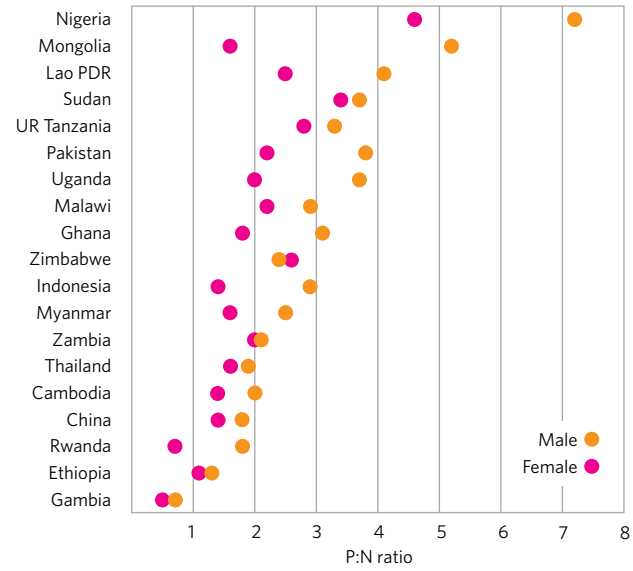
The prevalence:notification (P:N) ratio of adult TB cases in prevalence surveys implemented 2009–2015[a]



[a] The P:N ratio is for smear-positive TB, except for Uganda and Zimbabwe where it is based on bacteriologically confirmed TB. Notification data are from the main year of the survey (shown in Fig. 3.22).

:: FIGURE 3.29b

The prevalence to notification (P:N) ratio by sex for adult TB cases in prevalence surveys implemented 2009–2015[a]



[a] The P:N ratio is for smear-positive TB, except for Uganda and Zimbabwe where it is based on bacteriologically confirmed TB. Notification data are from the main year of the survey (shown in Fig. 3.22).

for smear-positive TB, and from 1.2 (in Ethiopia) to 4.5 (in Viet Nam) for bacteriologically confirmed TB.

The ratio of prevalence to notification (P:N) can be used to assess detection and reporting gaps (Fig. 3.29a), and variation in these gaps by age and sex (Fig. 3.29b). The P:N ratios from surveys implemented in 2009–2015 indicate that women are probably accessing available diagnostic and treatment services more effectively than men. The higher disease burden in men, combined with larger detection and reporting gaps, also suggests that strategies to improve access to and use of health services among men are required.

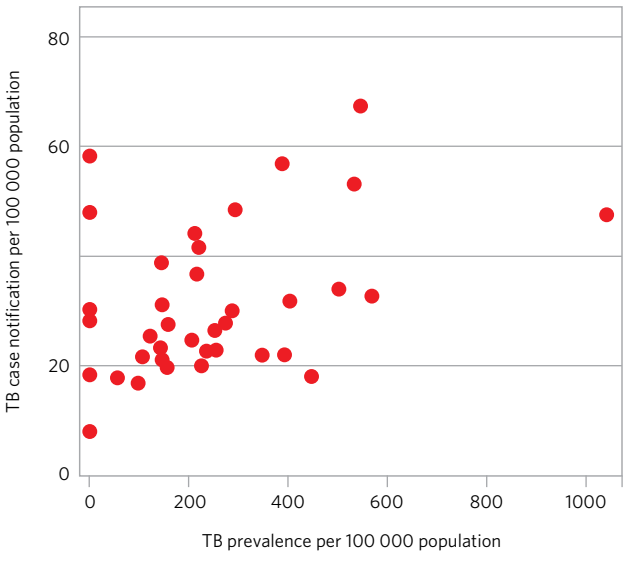
Due to sample-size requirements, feasibility and budget restrictions, most of the national TB prevalence surveys carried out since 2000 produced a single national estimate of high statistical precision. However, there can still be value in subnational estimates, especially for hypothesis building, and to identify potential priority areas for further evidence generation and subsequent action. In Nigeria, the national TB programme (NTP) identified states that had high levels of TB prevalence but large gaps in surveillance systems in terms of the actual number of cases being detected, treated and notified (Fig. 3.30).

3.6.2 The case fatality ratio disaggregated by age, sex and location – an example from Brazil

As explained in Section 3.2.4, the CFR is the proportion of people with TB who die from the disease, and it is an important indicator for monitoring progress towards SDG and End TB Strategy milestones set for 2020 and 2025.

:: FIG. 3.30

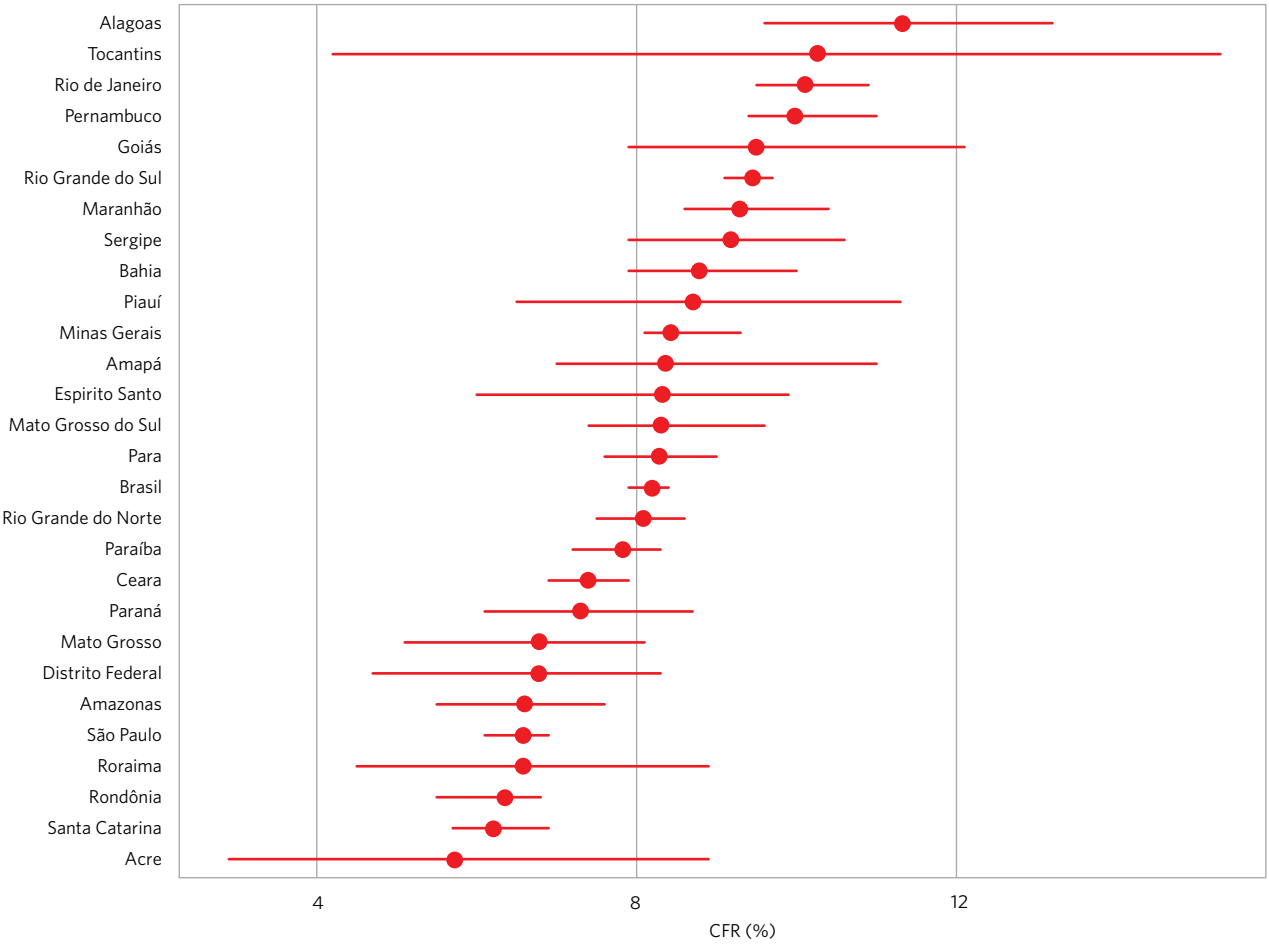
Scatter-plot of state-level adult, pulmonary TB prevalence and case notification rates in Nigeria (2012)



Source: NTP database and first national TB prevalence survey, Nigeria.

:: FIG. 3.31a

The average value and range (minimum–maximum) in the CFR by state in Brazil, 2011–2014



Reaching the milestones for reductions in the number of TB deaths requires the CFR at global level to fall to 10% by 2020 and to 6.5% by 2025. The CFR is one of the top priority indicators for monitoring implementation of the End TB Strategy (**Chapter 2**).

In countries with national notification and VR systems of sufficient quality and coverage, the number of TB deaths measured using national VR data divided by the number of notified new and relapse cases in the same time period provides a good approximation of the CFR. Since notification and VR data are available for subnational areas and are disaggregated by age and sex, the CFR can then be estimated for subnational areas and subpopulations (in addition to the global and national estimates discussed in **Section 3.2.4**). This is useful because it can help to identify within-country inequalities and inequities in access to TB diagnosis and treatment. If everyone had similar and good access to diagnosis and treatment, for example, the CFR should be low for all areas and subpopulations.

Brazil is an example of a high TB burden country that has both a VR system (called SIM) of national coverage[1] and a notifiable disease surveillance system (called SINAN) that is thought to capture most incident cases of TB (the best estimate is 87%, as shown in the country profile for Brazil in **Annex 2**). It thus provides a good example of how CFRs can be assessed at subnational level and for subpopulations.

The distribution of the CFR in Brazil by state in the years 2011–2014 is shown in **Fig. 3.31a–b**. There was a two-fold difference in the average CFR between the state with the highest average CFR (Alagoas, 11.3%) and the state with the lowest average CFR (Acre, 5.7%). The distribution of the CFR by sex in 2014 is shown in **Fig. 3.31c**. The CFR was higher among males than females, although there was considerable overlap between the two distributions.[2] The relationship between the CFR and age in 2014 is shown in **Fig. 3.31d**. This shows a positive relationship between age and the CFR, with marked differences between those aged 15–59 years and those aged over 60 years.

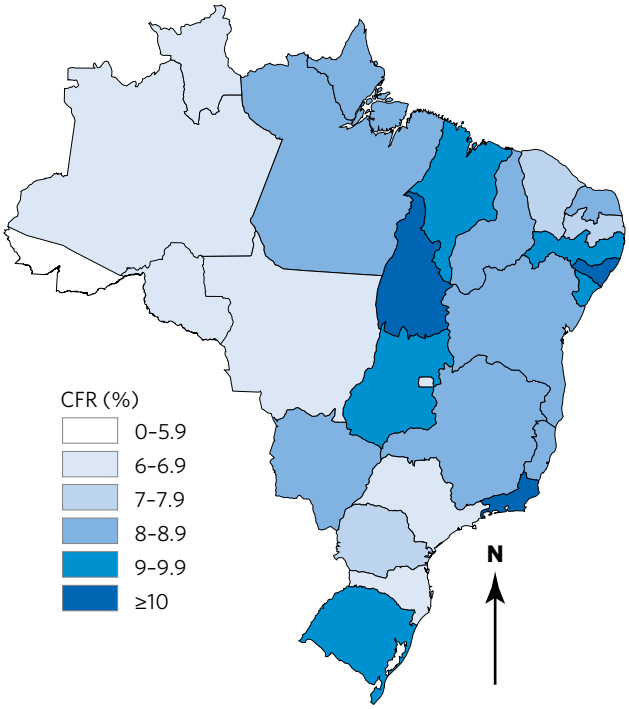
The variation in the CFR estimated in Brazil probably reflects a combination of differences in case detection, the quality of care and the coverage of reporting. These can be further explored through record-linkage studies using the

[1] http://www.who.int/healthinfo/statistics/mortcoverage/en/

[2] The violin plots shown in **Fig. 3.31c-d** are similar to box plots, but they also show the probability density of the data at different values.

:: FIG. 3.31b

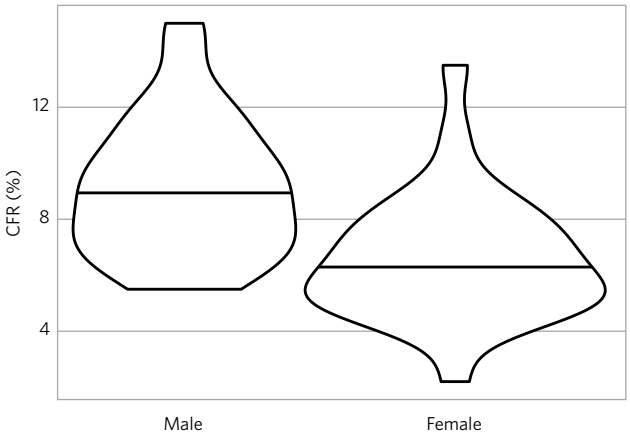
The average CFR by state in Brazil, 2011–2014



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

:: FIG. 3.31c

The distribution of state CFRs by sex in Brazil, 2014.[a] Horizontal segments denote the average.



[a] These violin plots are used to visualise the distribution of the data and its probability density. It is a combination of a box plot and a density plot that is rotated and placed on each side, to show the distributional shape of the data.

:: FIG. 3.31d

The distribution of state CFRs by age in Brazil, 2014.[a] Horizontal segments denote the average.

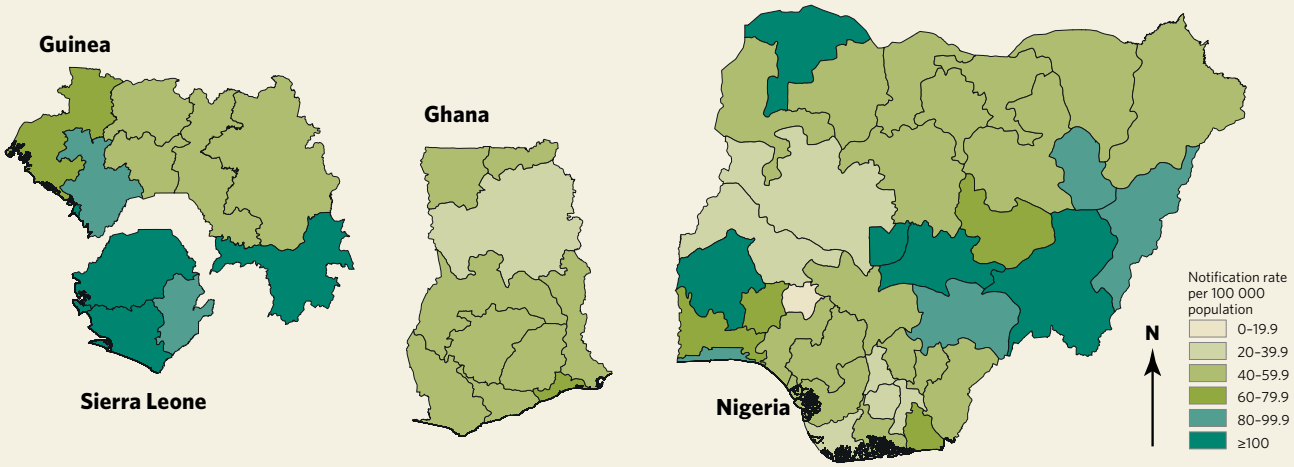
[a] These violin plots are used to visualise the distribution of the data and its probability density. It is a combination of a box plot and a density plot that is rotated and placed on each side, to show the distributional shape of the data.

:: Box 3.7

Promoting the analysis and use of disaggregated data for policy, planning and programmatic action

:: FIG. B 3.7.1

Subnational TB notifications (new and relapse, 2015) from Ghana, Guinea, Nigeria and Sierra Leone



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Strong TB surveillance systems allow the TB epidemic to be tracked at national level, and for subnational areas and specific population groups, using routinely collected data. The results can be used to inform national and local response efforts, including strategic allocation of resources.

As part of efforts to improve the availability and facilitate the analysis of disaggregated TB surveillance data by age, sex and location, a pilot workshop was held in May 2016 with the NTPs of 16 countries in west Africa.[a,b] In TB epidemiological reviews (**Fig. 3.1b**), a common finding was that historical subnational data were stored in multiple separate spreadsheets that made it difficult to use the available data. In response to this finding, preparations for the workshop included the development of a standard platform[c] for safeguarding and analysing subnational notification and treatment outcome data. This platform was developed using the DHIS2 software,[d] which is open source and is already used for collecting, managing, visualizing and exploring health and other data in many countries. The standard platform was designed to be suitable for compilation of TB data from recording and reporting systems that use either the 2006 or the 2013 versions of the WHO reporting framework,[e,f] and can be used to conduct the analyses recommended in the WHO handbook for understanding and using TB data.[g]

For the pilot workshop in west Africa, data entry focused on the first administrative level (e.g. province). However, the platform can also capture data at lower levels, such as districts or individual health facilities. Subnational population estimates, if available disaggregated by age and sex, can also be entered. This requires coordination with national census agencies, unless already available (as may be the case in countries using DHIS as their health management information system). Geographic information system (GIS) shape-files can also be imported into the platform, allowing for generation of maps for available surveillance indicators.

Examples of the analyses that can be generated are shown in **Fig. B3.7.1**.

The establishment of this DHIS2 platform could also provide the basis for prospective collection of aggregate-level data for countries still using a paper-based TB surveillance system or for countries that are in the process of transitioning to a national case-based TB surveillance solution.

The next multi-country workshop is scheduled for central and east African countries towards the end of 2016, and is expected to be followed by further workshops in other parts of the world.

[a] For further details, please see Background Document 2b prepared for the April 2016 meeting of the Task Force, available at www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_background_3b_drtb_burden.pdf?ua=1

[b] The 16 countries were Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea Conakry, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo. They are part of the West Africa Research Network for TB that has been established by the Special Programme for Research and Training in Tropical Diseases (TDR).

[c] https://tbhistoric.org

[d] https://www.dhis2.org/

[e] http://apps.who.int/iris/bitstream/10665/69608/1/WHO_HTM_TB_2006.373_eng.pdf

[f] World Health Organization. Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014) (WHO/HTM/TB/2013.2). Geneva: WHO; 2013 (www.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf, accessed 15 August 2015).

[g] World Health Organization. Understanding and using tuberculosis data. Geneva: WHO Global Task Force on TB Impact Measurement; 2014 (http://www.who.int/tb/publications/understanding_and_using_tb_data/en/, accessed 24 August 2016).

SIM and SINAN case-based databases, followed by actions as appropriate to address gaps in detection, treatment or reporting.

3.6.3 TB case notification and treatment outcome data disaggregated by age, sex and location

Data on TB case notifications and the treatment outcomes of notified cases are routinely collected in most countries, and for the past decade about 200 countries and territories have reported national data to WHO in annual rounds of global TB data collection (**Chapter 1** and **Chapter 4**). This has been facilitated by a standard recording and reporting framework that was first developed by WHO in the mid-1990s, with subsequent updates in 2006 and most recently in 2013.[1] Most (98%) countries that reported 2015 notification data to WHO were able to disaggregate notifications of new and relapse (incident) cases by age and sex; these data are shown in **Chapter 4** (see in particular **Fig. 4.2**) as well as in **Annex 2** and **Annex 4**.

Notification and treatment outcome data for subnational areas are not routinely requested by WHO in annual rounds of global TB data collection. However, these data are usually available at country level and are a key source of information, including for TB epidemiological reviews and assessment of the performance of TB surveillance (**Fig. 3.1**). Moreover, as part of the WHO Global Task Force on TB Impact Measurement's fifth strategic areas of work for 2016–2020 (**Box 3.1**), increased attention is being given to the analysis and use of subnational data. This has started with an initiative to provide a platform that allows safeguarding of subnational TB case notification and treatment outcome data for as many years as possible, while at the same time facilitating analysis and use of data to inform policy, planning, budgeting and resource mobilization. The platform has been built using the open source DHIS2 software,[2] and its use was piloted as part of the preparations for and implementation of a regional workshop for 16 countries in West Africa in May 2016. Its use will be expanded to other countries later in 2016 and in 2017. Further details, including examples of the analyses that can be produced, are provided in **Box 3.7**.

[1] World Health Organization. Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014) (WHO/HTM/TB/2013.2). Geneva: WHO; 2013 (www.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf, accessed 15 August 2015). The document available online includes a few updates made in 2014.

[2] https://www.dhis2.org/

Chapter 4 :: Diagnosis and treatment: TB, HIV-associated TB and drug-resistant TB

KEY FACTS AND MESSAGES

In 2015, 6.4 million people with TB were notified to national TB programmes (NTPs) and reported to WHO. Of these, just over 6.1 million had an incident episode (new or relapse) of TB. The number of new and relapse TB cases notified and the notification rate per 100 000 population increased globally in 2013–2015, mostly explained by a 34% increase in notifications in India.

In 2015, 30% of the 3.4 million new bacteriologically confirmed and previously treated TB cases notified globally were reported to have had DST for rifampicin, with coverage of 24% for new TB patients and 53% for previously treated TB patients. Globally, 132 120 cases of multidrug-resistant TB or rifampicin-resistant TB (MDR/RR-TB) were detected and notified in 2015, and 124 990 were enrolled on treatment.

Despite increases in notifications of TB and MDR/RR-TB, big detection and treatment gaps remain. In 2015, the gap between notifications of new and relapse cases and the best estimate of the number of incident cases was 4.3 million, reflecting a mixture of underreporting of detected TB cases (especially in countries with large private sectors) and underdiagnosis (especially in countries where there are major geographic or financial barriers to accessing care). The gap between the number of MDR/RR-TB cases started on treatment and the number of notified cases estimated to have MDR/RR-TB was 205 000 (455 000 if compared with the estimated incidence of MDR/RR-TB).

From a global perspective, closing detection and treatment gaps requires progress in a particular subset of countries. Ten countries account for 77% of the total estimated gap between incidence and notifications, with India, Indonesia and Nigeria alone accounting for almost half of the total. Five countries account for over 60% of the gap between enrolments on MDR-TB treatment in 2015 and the estimated number of incident MDR/RR-TB cases in 2015: China, India, Indonesia, Nigeria and the Russian Federation.

The global male:female (M:F) sex ratio for notifications was 1.7, varying from 1.0 in Pakistan to 3.1 in Viet Nam among the high TB burden countries. Results from national TB prevalence surveys of adults show higher M:F ratios, indicating that notification data understate the share of the TB burden accounted for by men in some countries. Globally, children (aged <15 years) accounted for 6.3% of the new and relapse cases that were notified in 2015.

Globally in 2015, 55% of notified TB patients had a documented HIV test result, an 18-fold increase in testing coverage since 2004. In the African Region where the burden of HIV-associated TB is highest, 81% of TB patients had a documented HIV test result. The proportion of known HIV-positive TB patients on antiretroviral therapy (ART) was 78% globally, and above 90% in India, Kenya, Malawi, Mozambique, Namibia and Swaziland.

The only WHO-recommended rapid diagnostic test for detection of TB and rifampicin resistance currently available is the Xpert MTB/RIF® assay. The number of cartridges procured by countries eligible for concessional prices was 6.2 million in 2015, up from 550 000 in 2011. Of the 48 countries in at least one of the new lists of high burden countries, 15 had adopted national algorithms positioning Xpert MTB/RIF as the initial diagnostic test for all people suspected of having pulmonary TB by the end of 2015. These countries accounted for 10% of the estimated global number of incident TB cases in 2015.

The latest treatment outcome data show treatment success rates of 83% for TB (2014 cohort), 52% for MDR/RR-TB (2013 cohort) and 28% for XDR-TB (2013 cohort).

At least 23 countries in Africa and Asia have introduced shorter regimens for treatment of MDR/RR-TB, which have achieved high treatment success rates (87–90%) under operational research conditions. A standardised shorter MDR-TB regimen of 9–12 months is now recommended in WHO guidance issued in May 2016 for all patients (excluding pregnant women) with pulmonary MDR/RR-TB that is not resistant to second-line drugs. As part of efforts to improve outcomes for MDR/XDR-TB, at least 70 countries had started using bedaquiline and 39 countries had used delamanid by the end of 2015.

Prompt and accurate diagnosis of tuberculosis (TB), HIV-associated TB and drug-resistant TB, followed by provision of treatment in line with international standards, prevents deaths and limits ill-health among people who develop the disease. 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 (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 those with TB are promptly diagnosed and effectively treated. Patient-centred care and prevention, backed by bold policies and supportive systems (including universal health coverage, UHC), are pillars one and two of the End TB Strategy (**Box 4.1**).

This chapter provides the latest data reported to WHO on the diagnosis and treatment of TB, HIV-associated TB and drug-resistant TB. **Section 4.1** presents and discusses data for 2015 on notifications of TB cases and associated coverage of diagnostic testing, as well as trends since 2000. It includes data on the contribution of community engagement and public–public and public–private mix (PPM) initiatives to case-finding efforts in 2015. **Section 4.2** focuses on treatment coverage (and 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 (presented in more detail in **Chapter 3**). **Section 4.3** provides the most recent data on treatment outcomes, for new and relapse TB patients, TB patients coinfected with HIV, and patients with multidrug-resistant TB (MDR-TB)[1] or rifampicin-resistant TB (RR-TB).[2] It also contains information about the use of shorter MDR-TB regimens for treatment of MDR/RR-TB (i.e. RR-TB cases including those with MDR-TB) and the use of new anti-TB drugs for treatment of extensively drug-resistant TB (XDR-TB).[3]

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

4.1 Case notifications and testing coverage

4.1.1 TB case notifications and bacteriological confirmation

In 2015, 6.4 million people with TB were notified to national TB programmes (NTPs) and reported to WHO (**Table 4.1**).

[1] MDR-TB is defined as resistance to at least isoniazid and rifampicin, the two most powerful first-line anti-TB medicines.

[2] WHO recommends an MDR-TB treatment regimen for patients with RR-TB. This includes patients with MDR-TB as well as any other patient with TB resistant to rifampicin (MDR/RR-TB).

[3] XDR-TB is defined as MDR-TB plus resistance to at least one fluoroquinolone and a second-line injectable agent, the two most important classes of medicines in the MDR-TB regimen.

[4] For an explanation of how the three lists of HBCs (for TB, HIV-associated TB and MDR-TB) featured in this chapter were defined, see **Chapter 2**.

:: Box 4.1
Pillars one and two of the End TB Strategy

The first pillar 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 (DST), 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 the first pillar is the topic of **Chapter 5**.

The second pillar of the End TB Strategy is "bold policies and supportive systems". It 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 the second pillar are primarily discussed in **Chapter 6**.

For an overview of all aspects of the End TB Strategy, see **Chapter 2** (**Box 2.3**).

Of these, just over 6.1 million had a new (incident) episode of TB (shown as the total of new and relapse cases), and an additional 227 873 had been previously diagnosed with TB but their treatment was changed to a retreatment regimen (and they were re-registered as a retreatment case). The number of new and relapse TB cases notified and the notification rate per 100 000 population increased between 2000 and 2009, then fell slowly until 2013, before increasing in 2013–2015 (**Fig. 4.1**). The increase since 2013 is mostly explained by increased notifications in India (+34% between 2013 and 2015), following the introduction of a national policy of mandatory notification, and the rollout 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. Further details about trends in notifications and comparisons with underlying estimates of TB incidence are provided in **Section 4.2.1**.

:: TABLE 4.1

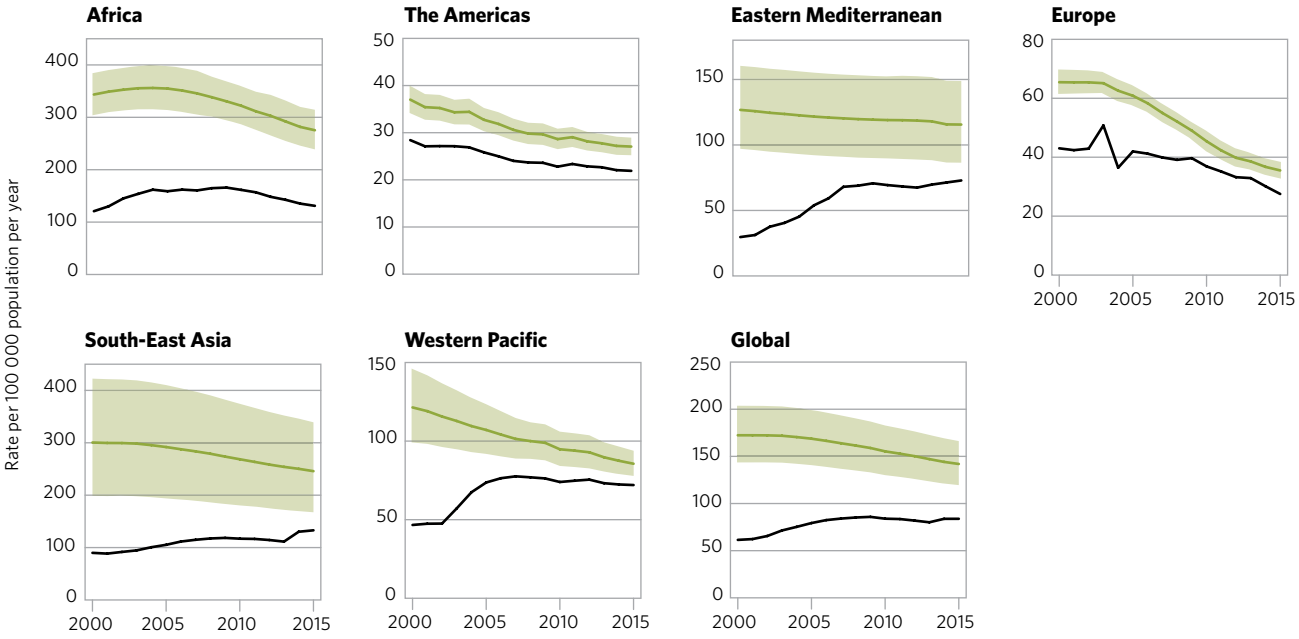
Notifications of TB, TB/HIV and MDR/RR-TB cases, globally and for WHO regions, 2015

	TOTAL NOTIFIED	NEW AND RELAPSE[a]	PULMONARY NEW AND RELAPSE		EXTRAPULMONARY NEW AND RELAPSE (%)	HIV-POSITIVE NEW AND RELAPSE	MDR/RR-TB	XDR-TB
			NUMBER	OF WHICH BACTERIOLOGICALLY CONFIRMED (%)				
Africa	1 333 504	1 296 122	1 084 280	64%	16%	380 032	26 929	1 100
The Americas	230 519	217 081	184 081	77%	15%	21 885	4 489	122
Eastern Mediterranean	484 733	472 587	362 935	56%	23%	1 456	4 081	117
Europe	297 448	250 459	215 751	61%	14%	16 137	42 646	2 691
South-East Asia	2 656 560	2 563 325	2 137 433	63%	17%	64 238	35 953	3 099
Western Pacific	1 361 430	1 336 747	1 233 132	38%	8%	16 816	18 022	450
Global	**6 364 194**	**6 136 321**	**5 217 612**	**57%**	**15%**	**500 564**	**132 120**	**7 579**

[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 lost to follow up* or as *other previously treated* (whose outcome after the most recent course of treatment is unknown or undocumented).

:: FIG. 4.1

Case notification rates (new and relapse cases, all forms) (black) compared with estimated TB incidence rates (green), 2000–2015, globally and for WHO regions. Shaded areas represent uncertainty bands.

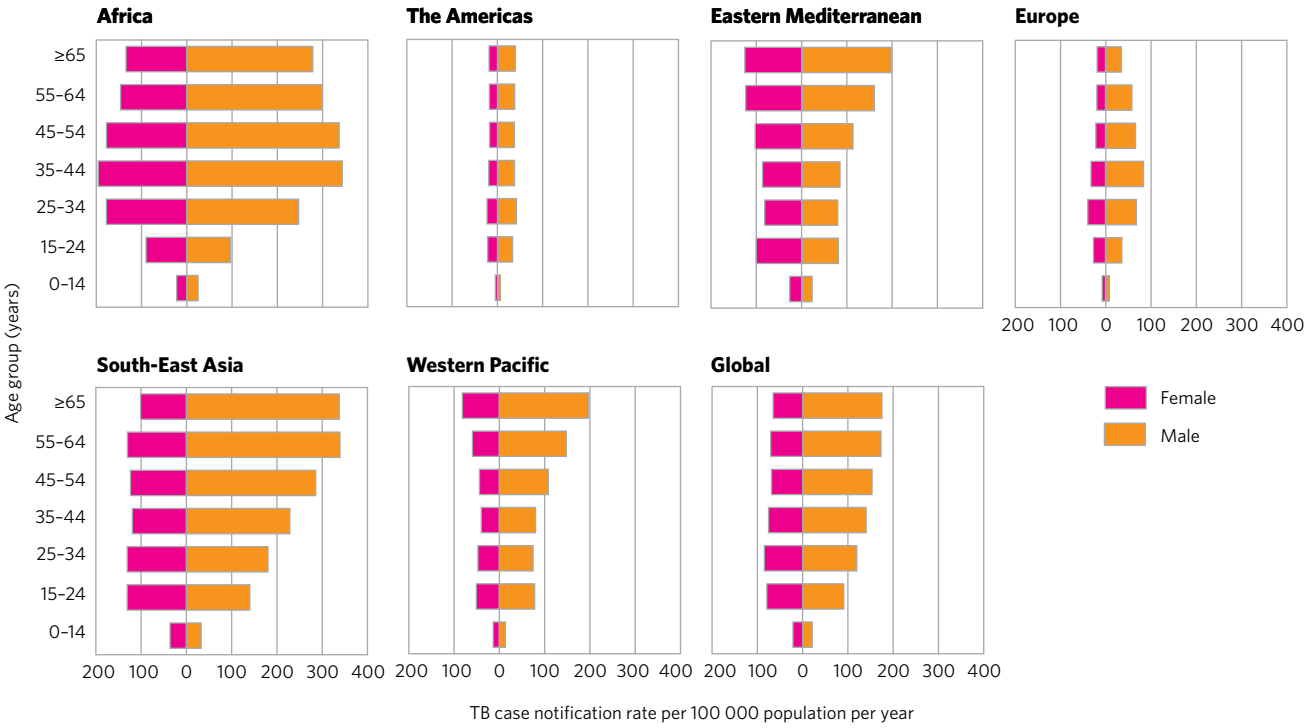


The distribution of notified cases in 2015 by age and sex is shown globally and for WHO regions in **Fig. 4.2**. The global male:female (M:F) sex ratio for notifications was 1.7. Among the 30 high TB burden countries, the ratio ranged from 1.0 in Pakistan to 3.1 in Viet Nam. Results from national TB prevalence surveys of adults show higher M:F ratios (for example, a M:F ratio of 4.5 in Viet Nam), indicating that notification data understate the share of the TB burden accounted for by men in some countries (see **Section 3.6.1** in **Chapter 3** for further details). Children (aged <15 years) accounted for 6.3% of the new and relapse cases that were notified globally. In the WHO Eastern Mediterranean, South-East Asia and Western Pacific regions, 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. Elsewhere, and most noticeably in the WHO African Region, notification rates were highest among younger adults. In several eastern European countries as well as four high TB burden countries – China, Papua New Guinea, Thailand and Viet Nam – less than 2% of notified cases were children (**Fig. 4.3**). 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 reliable health care services, or differential reporting practices.

Extrapulmonary TB represented 15% of the 6.1 million incident cases that were notified, ranging from 8% in the WHO Western Pacific Region to 23% in the Eastern Medi-

:: FIG. 4.2

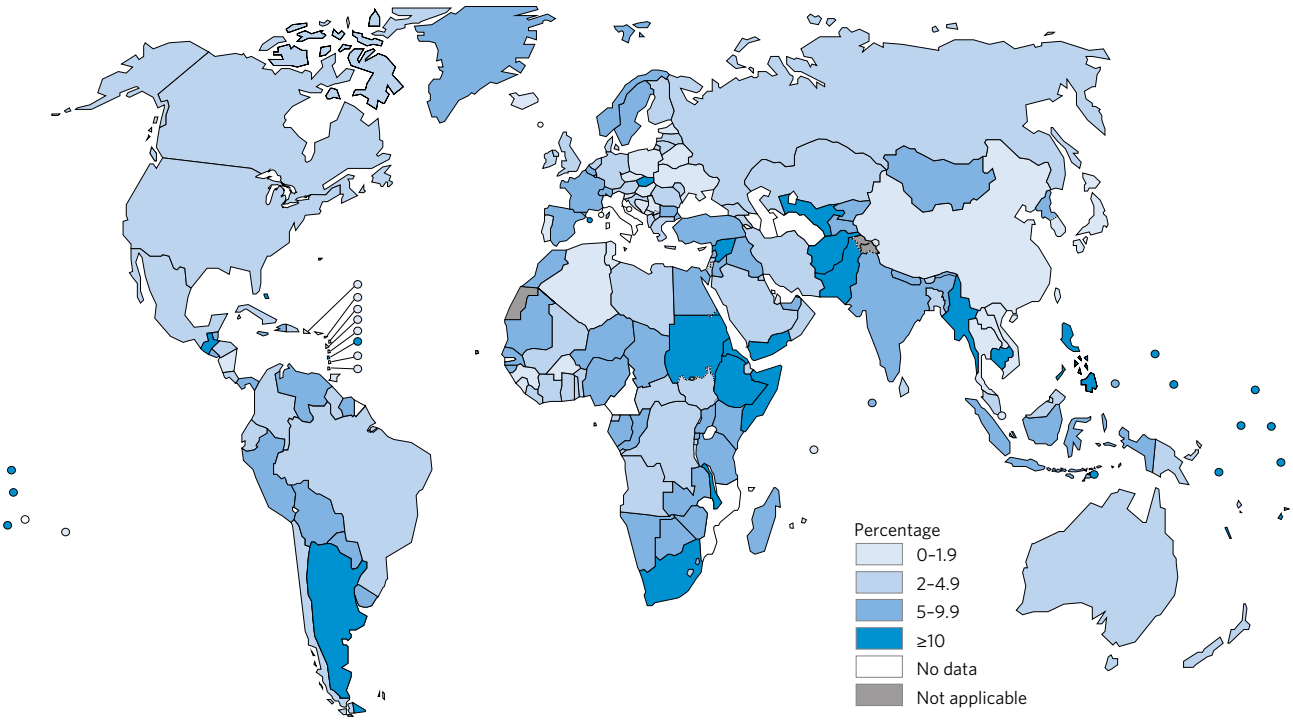
New and relapse TB case notification rates by age and sex[a] in 2015, globally and for WHO regions



[a] Countries not reporting cases in these categories are excluded. Cases included make up 85% of reported cases.

:: FIG. 4.3

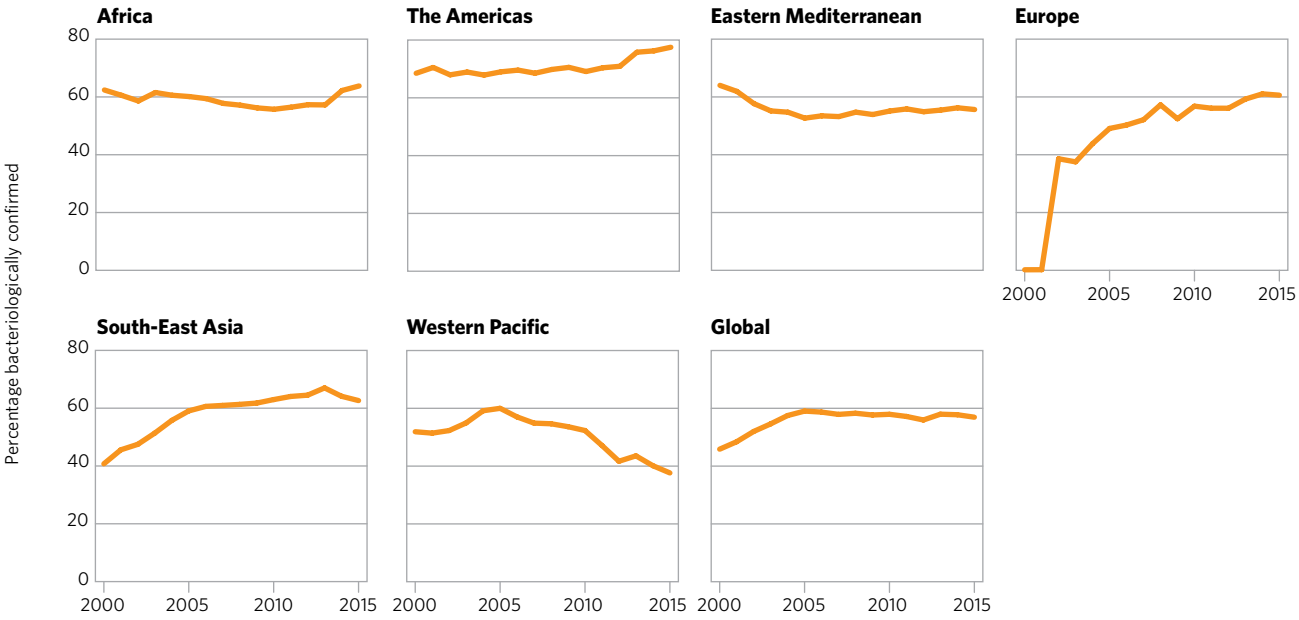
Percentage of new and relapse TB cases that were children (aged <15), 2015[a]



[a] 2014 data were used for 17 countries.

:: FIG. 4.4

Percentage of new and relapse[a] pulmonary TB cases with bacteriological confirmation, 2000–2015, globally and for WHO regions



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

terranean Region. Of the 5.2 million new and relapse pulmonary TB patients notified globally in 2015, 3.0 million (57%) were bacteriologically confirmed[1] (**Table 4.1**). The remaining patients were diagnosed clinically; that is, based on symptoms, chest X-ray abnormalities or suggestive histology. Although the percentage of cases with bacteriological confirmation worldwide has remained stable over the past 6 years, there have been improvements in the WHO African Region (56% to 64%), European Region (52% to 60%) and Region of the Americas (71% to 78%) (**Fig. 4.4**). In contrast, there was a fall (from 54% to 38%) in the WHO Western Pacific Region, influenced by a decline in bacteriological confirmation of notified cases in China in recent years.

There is considerable variation among countries in the percentage of new and relapse pulmonary TB patients that are bacteriologically confirmed (**Fig. 4.5**). Reasons for a low proportion of cases being bacteriologically confirmed should be assessed at country level, as should reductions over time. The microbiological detection of TB allows patients to be correctly diagnosed and started on the most effective treatment regimen as early as possible. Most clinical features of TB and abnormalities on X-ray or histology results generally associated with TB have low specificity, which may lead to false diagnoses of TB, and hence to people being enrolled on TB treatment unnecessarily.

PPM initiatives and schemes are integral components of national TB strategies, and have particular relevance to HBCs in Asia and Africa. The contribution of PPM to total notifications is shown in **Table 4.2** for countries that have been collecting and reporting data for several years. In these countries, public–public mix interventions contributed 5–56% of total notifications in 2015, and public-private mix interventions contributed 6–48% of total case notifications.

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

In 2015, 3.4 million notified TB patients had a documented HIV test result, equivalent to 55% of notified TB cases. This represented an 18-fold increase in testing coverage since 2004, when WHO first requested countries to report data (**Fig. 4.6**). In 2015, the percentage of TB patients with known HIV status was highest in the WHO African Region (81%) and the Americas (82%). The level of testing in the 30 high TB/HIV burden countries averaged 64%, but varied considerably from 11% in Indonesia to above 75% in 18 countries (**Fig. 4.7**).

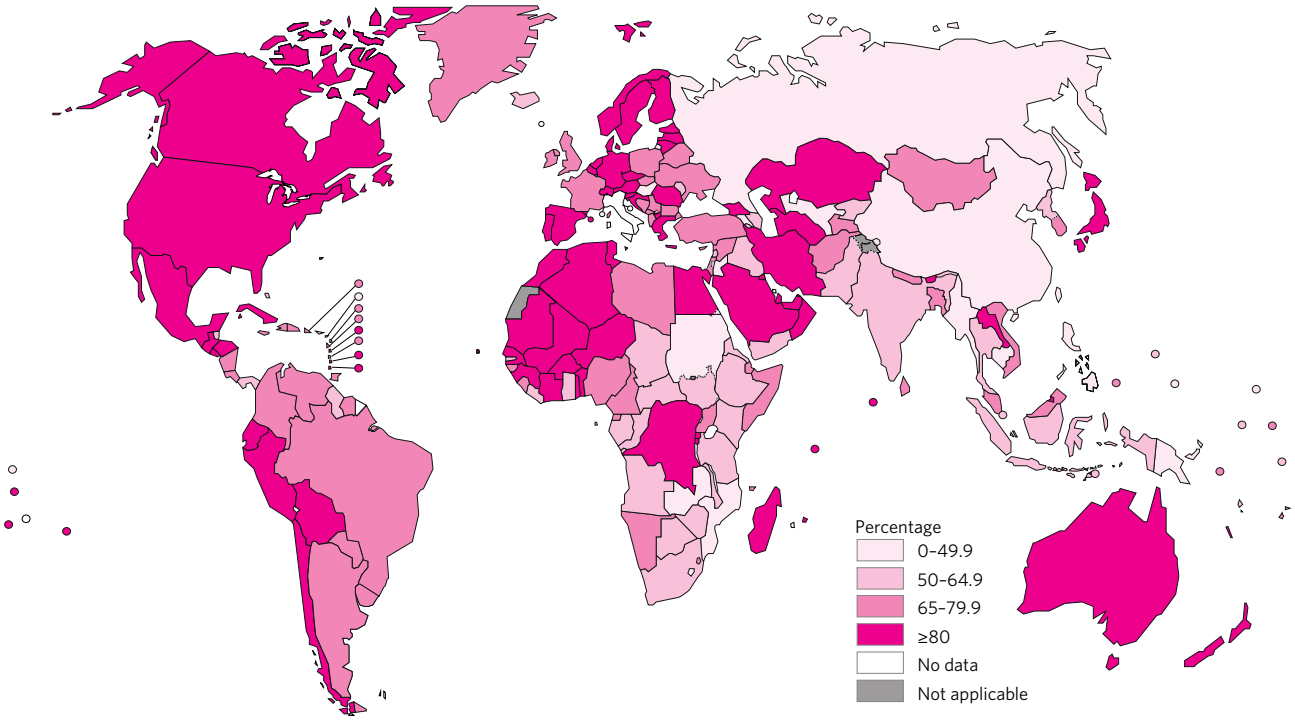
Globally, 15% of TB patients with an HIV test result were HIV-positive. Among WHO regions, the highest figure was in the African Region (36%). Overall, the percentage of TB patients testing HIV-positive has been falling globally since 2008 (**Fig. 4.8**). A total of 500 564 HIV-positive TB patients were reported by NTPs in 2015 (**Table 4.1**).

Systematic screening for TB among people living with HIV is recommended by WHO as an essential component of the HIV care package. In 2015, 86 countries reported

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

:: FIG. 4.5

Percentage of new and relapse pulmonary TB cases with bacteriological confirmation, 2015[a]



[a] 2014 data were used for 15 countries.

:: TABLE 4.2

Contribution of public-public mix[a] and public-private mix[b] to notifications of TB cases in selected countries, 2015

Contribution of public-public mix[a] to notifications of TB cases in selected countries, 2015

COUNTRY	NUMBER OF TB CASES NOTIFIED BY NON-NTP PUBLIC SECTOR CARE PROVIDERS IN 2015	CONTRIBUTION OF NON-NTP PUBLIC SECTOR CARE PROVIDERS TO TOTAL CASE NOTIFICATIONS IN 2015 (%)
China	447 148	56
Egypt	1 375	17
India	284 636	16
Indonesia	61 183	18
Iran	7 196	69
Iraq	2 438	30
Nigeria	6 996	7.7
Philippines	79 197	28
Sri Lanka	4 575	48
Swaziland	312	6.8
Thailand	3 444	5.2
Viet Nam	6 913	6.7

Contribution of public-private mix[b] to notifications of TB cases in selected countries, 2015

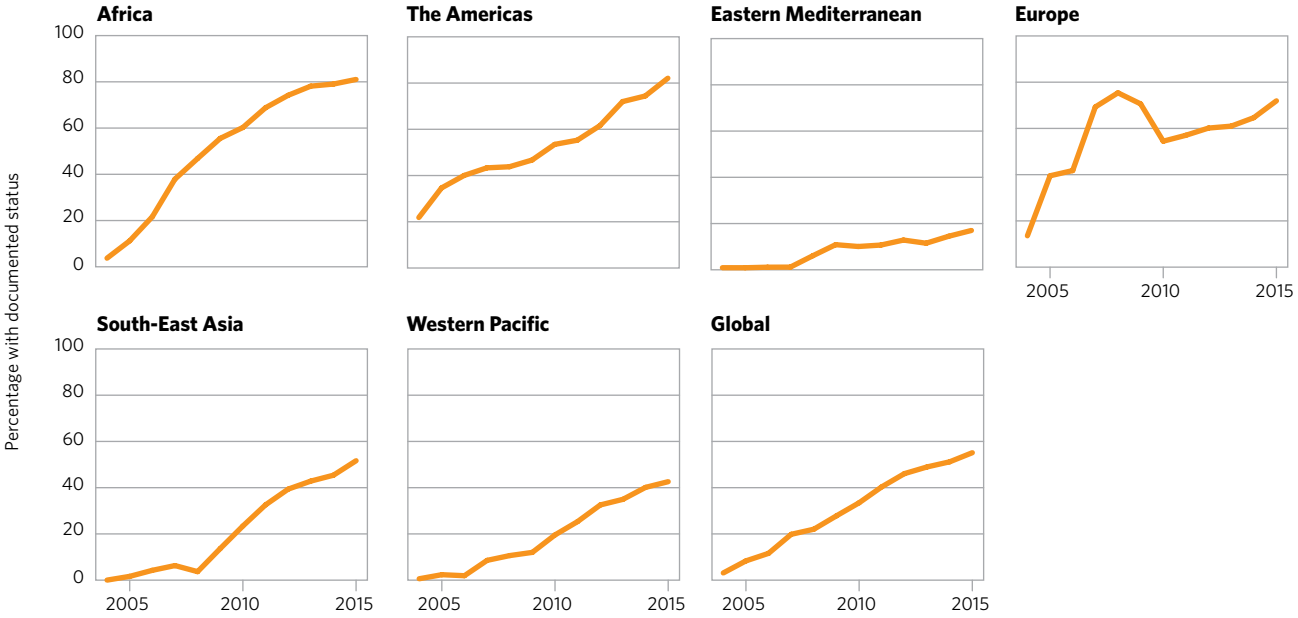
COUNTRY	NUMBER OF TB CASES NOTIFIED BY PRIVATE SECTOR CARE PROVIDERS IN 2015	CONTRIBUTION OF PRIVATE SECTOR CARE PROVIDERS TO TOTAL NOTIFICATIONS IN 2015 (%)
Bangladesh	60 879	29
Ethiopia	15 195	11
India	184 802	11
Indonesia	30 550	9.2
Iran	3 019	29
Kenya	15 531	19
Malawi	3 049	18
Myanmar	23 513	17
Nigeria	13 088	14
Pakistan	72 144	22
Philippines	18 442	6.4
UR Tanzania	7 773	13

[a] Includes all contributions from non-NTP providers of care in the public sector, including public hospitals, public medical colleges, prisons/detention centres, military facilities, railways and public health insurance organizations.

[b] Private sector providers include private individual and institutional providers, corporate/business sector providers, mission hospitals, nongovernmental organizations and faith-based organizations.

:: FIG. 4.6

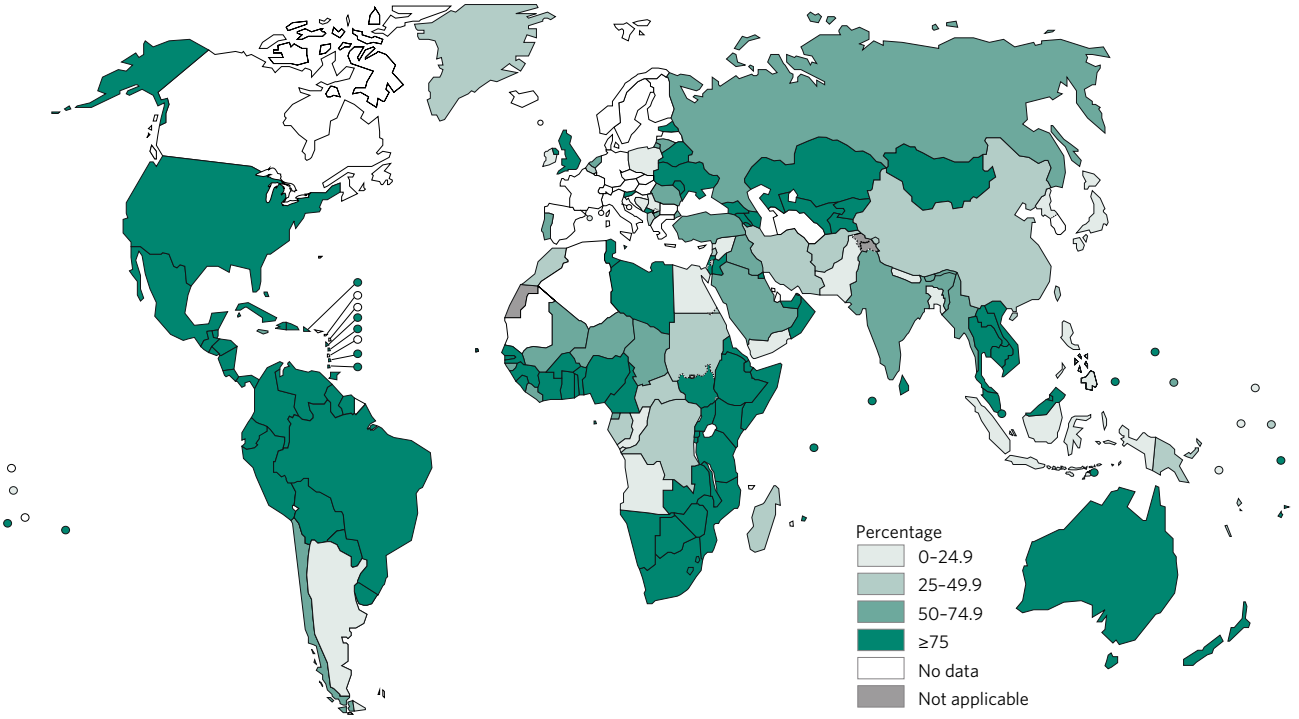
Percentage of new and relapse[a] TB cases with documented HIV status, 2004–2015, globally and for WHO regions



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

:: FIG. 4.7

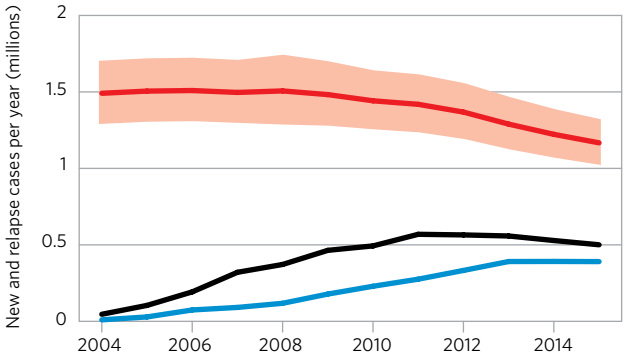
Percentage of new and relapse TB cases with documented HIV status, 2015[a]



[a] Data for the Russian Federation are for new TB patients in the civilian sector only.

:: FIG. 4.8

Global numbers 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), 2004–2015.
Shaded areas represent uncertainty bands.



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

:: TABLE 4.3.

Number of people newly enrolled in HIV care in 2015 who were also notified as a TB case in 2015, 12 high TB/HIV burden countries that reported data

	NUMBER OF PEOPLE NEWLY ENROLLED IN HIV CARE IN 2015 (A)	NUMBER NOTIFIED AS A TB CASE IN 2015 (B)	NOTIFIED TB CASES AS A PERCENTAGE OF THOSE NEWLY ENROLLED IN HIV CARE (B÷A)
Central African Republic	33 891	1 963	5.8%
China	101 966	2 802	2.7%
DR Congo	130 829	4 329	3.3%
Ghana	24 203	2 662	11%
India	178 470	21 065	12%
Indonesia	29 914	6 974	23%
Kenya	171 453	26 261	15%
Liberia	3 706	548	15%
Malawi	165 131	16 716	10%
Mozambique	292 083	16 197	5.5%
Myanmar	33 415	4 329	13%
South Africa	1 091 549	127 791	12%
Total	**2 256 610**	**231 637**	**10%**

data about the number of TB cases notified from among those newly enrolled in HIV care (up from 59 countries in 2013 and 76 in 2014). In total, 231 637 (10%) of the almost 2.3 million people who were newly enrolled in HIV care in 2015 were notified as TB cases during the same year; data for the 12 high TB/HIV burden countries that reported data are shown in **Table 4.3**. Improvements in the coverage and quality of data for this indicator are necessary to track the impact of HIV care, especially antiretroviral therapy (ART), on the burden of TB in people living with HIV.

4.1.3 Rapid testing for TB

Use of rapid tests facilitates early detection of TB. One of the 10 priority indicators for monitoring implementation of the End TB Strategy (shown in **Chapter 2**, **Table 2.1**) is the percentage of new and relapse TB cases tested with a WHO-recommended rapid diagnostic (WRD) at the time of diagnosis. This and other indicators related to laboratory strengthening activities are part of the *Framework of indicators and targets for laboratory strengthening under the End TB Strategy* developed in 2016 (**Box 4.2**).

In this first year of reporting, 113 of 191 reporting countries and territories indicated that their routine surveillance system captures data on the percentage of new and relapse TB cases tested with a WRD at the time of diagnosis. However, further validation of the data as well as refinements to reporting systems are needed to improve data accuracy.

The only WRD currently available for detection of TB and rifampicin resistance is the Xpert MTB/RIF® assay (developed by Cepheid, USA). The original WHO recommendations in 2010 prioritized its use as the initial diagnostic test in individuals suspected of having MDR-TB or HIV-associated TB, and most HBCs have adopted the original WHO recommendations into national policy (**Table 4.4**).

A policy update in 2013 expanded the recommended uses of the assay, to include its use for the diagnosis of TB in children, on selected specimens for the diagnosis of extrapulmonary TB, and for all people suspected of having pulmonary TB as a replacement for microscopy (conditional recommendations). A growing number of countries have already adopted national algorithms positioning Xpert MTB/RIF as the initial diagnostic test for all people suspected of having pulmonary TB. Among the 48 countries in one or more of three new lists of HBCs, 15 had adopted such algorithms by the end of 2015 (**Table 4.4**). In 2015, these 15 countries accounted for 11% of global notifications of pulmonary TB cases and 10% of the estimated global number of incident TB cases.

Between 2010 and 2015, a cumulative total of 4672 GeneXpert instruments comprising 21 549 modules were procured in the public sector in 122 of the 145 countries eligible for concessional pricing. In 2015, 6.2 million test cartridges were procured by eligible countries, up from 550 000 in 2011. Of these, 45% (2.8 million) went to South Africa, but this percentage has fallen from a high of 63% in 2013, reflecting increasing adoption of the technology in other parts of the world. South Africa accounted for 20% of the total cumulative number of modules procured by the end of 2015.

Despite the significant scale-up in procurement of cartridges globally, installed instruments are still underused in many countries. Outside South Africa, the number of procured cartridges in 2015 compared to the total number of instrument modules reflects an average ratio of only 1.0 test per module per working day.

:: Box 4.2

Strengthening the capacity and quality of diagnostic testing

A well-equipped and staffed, quality-assured laboratory network with an efficient specimen referral system is an essential requirement for any NTP in the post-2015 era. Strengthening TB laboratories involves not only deploying modern diagnostics, but also ensuring widespread patient access with fast turnaround time and high-quality diagnosis.

A WHO *Framework of indicators and targets for laboratory strengthening under the End TB Strategy* was launched in 2016. It is intended to serve as a guide for all countries, with monitoring at global level on progress towards reaching targets. The indicators measure the capacity of programmes to detect patients accurately and rapidly using WRDs, provide universal DST, and ensure quality of testing at each level of the laboratory network.

Country capacity for diagnostic testing was previously monitored according to indicators and global targets describing numbers of microscopy centres per 100 000 population and culture/DST laboratories per 5 million population. These targets are no longer recommended, given the displacement of these technologies by new WRD technology in diagnostic algorithms and the need for country-specific targets considering epidemiology and patient access (urban or rural populations, specimen referral systems, etc.). Recommended methods for setting country-specific targets for numbers of tests and facilities[a] for each of the main diagnostic technologies – microscopy, WRDs (including Xpert MTB/RIF), culture and DST – have been developed, and are contained in an annex to the framework.

Ensuring quality of testing is critical for all diagnostic methods. A comprehensive external quality assessment (EQA) programme for smear microscopy should be implemented that includes slide rechecking or panel testing (or both), and regular supervision visits. Of the 150 countries and territories that reported data on the number of smear microscopy centres undergoing EQA in 2015, only 62 (41%) indicated the existence of a scheme that covered all centres in the country, with a further 21 (14%) covering at least 90% of centres. EQA programmes for Xpert MTB/RIF should include monitoring of key performance indicators (at least monthly, ideally using a remote monitoring system that receives data via a connectivity solution), panel testing and regular supervision visits; 54 of 114 reporting countries and territories (47%) indicated having a comprehensive scheme in 2015. Quality-assured DST is also important to ensure accurate detection of drug resistance to inform treatment decisions and to avoid false diagnoses. Of the 123 countries and territories globally reporting DST capacity, 73 (59%) indicated that all of their DST laboratories had demonstrated proficiency by panel testing in 2015. Establishing a comprehensive quality management system in laboratories allows for the necessary activities to be carried out at the right time and by the appropriately trained people; for the necessary equipment and consumables to be in stock; and for all manuals, guidelines, forms and standard operating procedures to be in place, so that processes are carried out correctly. In 2015, 78 of 153 responding countries and territories (51%) indicated that a formal quality management system towards achieving accreditation was being implemented in all laboratories conducting culture, line probe assays (LPAs) or DST.

As a key partner in strengthening the capacity and quality of TB diagnostic testing globally, the WHO TB Supranational Reference Laboratory (SRL) Network comprises 36 laboratories that provide a benchmark for proficiency testing, and can also provide long-term technical assistance to partner countries under the framework of collaborative agreements (**Fig. B4.2.1**). In 2016, the Centre for Tuberculosis at the National Institute for Communicable Diseases in Johannesburg, South Africa became the newest member of the network and the third SRL in the WHO African Region.

:: FIG. B4.2.1

The WHO TB Supranational Reference Laboratory Network

[a] The numbers of facilities by country in 2015 that were performing microscopy, Xpert MTB/RIF, culture, LPA, first and second line DST can be downloaded from http://www.who.int/tb/data/.

:: TABLE 4.4

National guidance in place on use of Xpert MTB/RIF in high burden countries, 2015[a]

YES ■ NO ☐	HIGH TB BURDEN	HIGH TB/HIV BURDEN	HIGH MDR-TB BURDEN	NATIONAL POLICY STIPULATING XPERT MTB/RIF AS THE INITIAL DIAGNOSTIC TEST FOR:				
				ALL PEOPLE PRESUMED TO HAVE TB	PEOPLE AT RISK OF HIV-ASSOCIATED TB	PEOPLE AT RISK OF DRUG-RESISTANT TB	CHILDREN PRESUMED TO HAVE TB	EXTRA-PULMONARY TB USING SELECTED SPECIMENS
Angola	■	■	■	■	■	■	■	■
Azerbaijan	☐	☐	■	■	■	■	■	■
Bangladesh	■	☐	■	☐	■	■	☐	■
Belarus	☐	☐	■	■	■	■	■	■
Botswana	☐	■	☐	■	■	■	■	■
Brazil	■	■	☐	■	■	■	■	■
Cambodia	■	☐	☐	☐	■	■	☐	■
Cameroon	☐	■	☐	☐	☐	■	☐	☐
Central African Republic	■	■	☐	☐	☐	■	☐	☐
Chad	☐	■	☐	☐	☐	■	☐	☐
China	■	■	■	☐	☐	■	☐	☐
Congo	■	■	☐	☐	■	■	■	☐
DPR Korea	■	☐	■	☐	☐	■	■	☐
DR Congo	■	■	■	☐	☐	■	☐	☐
Ethiopia	■	■	■	☐	■	■	■	■
Ghana	☐	■	☐	☐	■	■	■	☐
Guinea-Bissau	☐	■	☐	☐	■	■	■	■
India	■	■	■	☐	■	■	■	■
Indonesia	■	■	■	☐	■	■	■	■
Kazakhstan	☐	☐	■	■	■	■	■	■
Kenya	■	■	■	☐	■	■	■	■
Kyrgyzstan	☐	☐	■	■	■	■	■	■
Lesotho	■	■	☐	■	■	■	■	■
Liberia	■	■	☐	☐	■	☐	■	☐
Malawi	☐	■	☐	☐	■	■	☐	☐
Mozambique	■	■	■	☐	■	■	■	■
Myanmar	■	■	■	☐	■	■	☐	■
Namibia	■	■	☐	☐	☐	■	■	■
Nigeria	■	■	■	☐	■	■	■	■
Pakistan	■	☐	■	☐	■	■	■	■
Papua New Guinea	■	■	■	☐	■	■	■	☐
Peru	☐	☐	■	☐	☐	☐	☐	☐
Philippines	■	☐	■	☐	■	■	■	■
Republic of Moldova	☐	☐	■	■	■	■	■	■
Russian Federation	■	☐	■	■	■	■	■	■
Sierra Leone	■	☐	☐	☐	☐	☐	☐	☐
Somalia	☐	☐	■	☐	☐	■	☐	☐
South Africa	■	■	■	■	■	■	■	■
Swaziland	☐	■	☐	■	■	■	■	■
Tajikistan	☐	☐	■	■	■	■	■	■
Thailand	■	■	■	☐	■	■	■	■
Uganda	☐	■	☐	☐	■	■	■	☐
Ukraine	☐	☐	■	☐	■	■	■	☐
UR Tanzania	■	■	☐	■	■	■	■	■
Uzbekistan	☐	☐	■	■	■	■	■	■
Viet Nam	■	☐	■	☐	■	■	■	■
Zambia	■	■	☐	☐	■	■	■	☐
Zimbabwe	■	■	■	☐	■	■	■	■
High TB burden countries				**20%**	**80%**	**93%**	**77%**	**70%**
High TB/HIV burden countries				**23%**	**80%**	**97%**	**77%**	**60%**
High MDR-TB burden countries				**33%**	**83%**	**97%**	**80%**	**77%**

[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 2.3 and Table 2.2).

:: Box 4.3

The *WHO treatment guidelines for drug-resistant tuberculosis 2016 update*

In May 2016, WHO revised its policy recommendations for the treatment of drug-resistant TB.[a] The main changes in the 2016 recommendations were as follows:

- A shorter MDR-TB treatment regimen is now recommended for patients (other than pregnant women) with pulmonary RR or MDR-TB that is not resistant to second-line drugs.[b]
- All RR-TB cases are to be treated with a MDR-TB regimen, regardless of isoniazid susceptibility.
- The design of longer MDR-TB regimens uses a different regrouping of component medicines, based on current evidence on their effectiveness and safety. Clofazimine and linezolid are now recommended as core second-line medicines in the MDR-TB regimen, whereas p-aminosalicylic acid is an add-on agent. Macrolides are no longer indicated for MDR-TB regimens.
- Specific recommendations are made on the treatment of children with MDR/RR-TB based on a first-ever meta-analysis of individual-level paediatric patient data for treatment outcomes.
- Evidence-informed recommendations on the role of partial resection surgery are now included.

No new evidence on the role of bedaquiline and delamanid was available at the time of the 2016 update and therefore no changes were made to the interim policy on the use of these new medicines. Both of these medicines have now been assigned to a specific subgroup of add-on agents.

The Global TB Programme in WHO is actively engaged with NTPs, technical and funding partners, the Global Drug-resistant TB Initiative (www.stoptb.org/wg/mdrtb/), the Global Laboratory Initiative (www.stoptb.org/wg/gli/) and Regional Green Light Committees to support countries to revise their national guidance, strengthen laboratory capacity, implement aDSM (see **Box 4.2** and **Box 4.6**), and address barriers to the importation and use of new medicines and novel regimens.[c]

[a] World Health Organization. WHO treatment guidelines for drug-resistant tuberculosis (2016 update) (WHO/HTM/TB/2016.04). Geneva: WHO; 2016 (http://www.who.int/tb/areas-of-work/drug-resistant-tb/treatment/resources/en/, accessed 15 August 2016).

[b] Frequently asked questions about the implementation of the new WHO recommendation on the use of the shorter MDR-TB regimen under programmatic conditions (http://www.who.int/tb/areas-of-work/drug-resistant-tb/treatment/FAQshorter_MDR_regimen.pdf).

[c] Médecins Sans Frontières/Stop TB Partnership. Out of step 2015: TB policies in 24 countries: a survey of diagnostic and treatment practices. Geneva: MSF/Stop TB Partnership; 2015 (http://www.msfaccess.org/sites/default/files/MSF_assets/TB/Docs/TB_report_Out_of_Step_ENG_2015.pdf, accessed 15 August 2016).

4.1.4 Drug susceptibility testing and detection of drug-resistant TB

Drug-resistant TB threatens global TB control and remains a major public health concern in many countries. All RR-TB cases including those with MDR-TB are eligible for treatment with second-line medicines (**Box 4.3**).[1] Cases of MDR-TB account for 83% of the worldwide total of MDR/RR-TB cases, with the proportion varying by region and country (e.g. from 67% to 91% among the WHO regions). Further details are provided in **Chapter 3** (see in particular **Table 3.5**).

Universal access to DST, as called for in the End TB Strategy, can be defined as DST for at least rifampicin for all TB cases, plus DST for at least fluoroquinolones and second-line injectable agents among all TB cases with rifampicin resistance. DST methods include both phenotypic (conventional) and genotypic (molecular) testing methods. The most widespread technology currently available to test for drug resistance is Xpert MTB/RIF (see also **Section 4.1.3**), which can detect RR-TB.

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

Progress in DST coverage since 2009, when WHO intensified efforts to track progress in the programmatic response to drug-resistant TB,[2] is shown in **Fig. 4.9**. In 2015, 30% of the 3.4 million new bacteriologically confirmed and previously treated TB cases notified globally were reported to have had DST for rifampicin, with coverage of 24% for new TB patients and 53% for previously treated TB patients. These figures represent a small increase in DST coverage for rifampicin since 2014 (22% of new and previously treated TB cases) and major progress since 2009 (4.9%). The WHO European Region is the only part of the world where DST coverage has remained comparatively stable at a high level (about 60–70%; 69% in 2015). DST coverage varied substantially between countries, even within the same region, and among the 30 high MDR-TB burden countries (**Fig. 4.10**).

Globally, 132 120 cases of MDR/RR-TB were detected and notified in 2015 (**Table 4.1**). This was only a slight increase from 2014 (**Fig. 4.11**), although the aggregate global figure conceals country variation (**Fig. 4.12**). Between 2014 and 2015, the number of reported MDR/RR-TB cases increased by more than 20% in four of the 30 high MDR-TB burden countries (China, Nigeria, Philippines and Ukraine), but also fell by more than 20% in seven of those countries.[3] The decline or stagnation in detection despite high

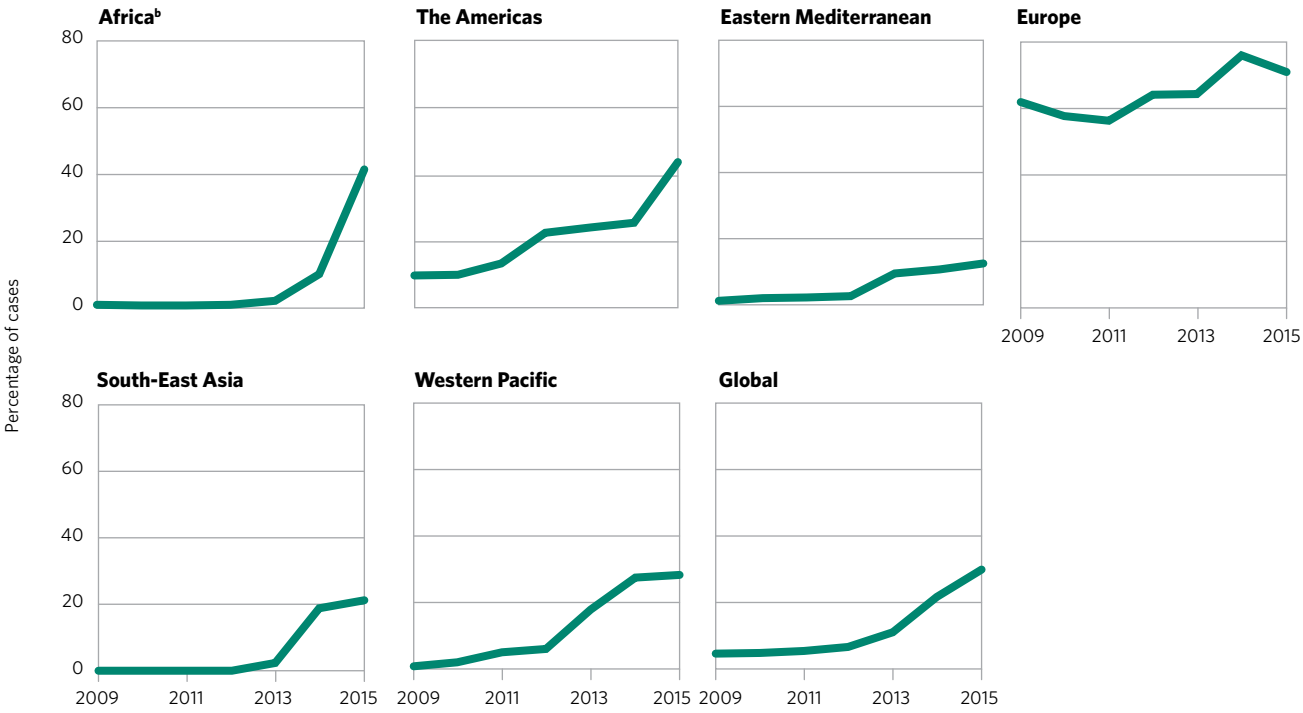
[1] World Health Organization. WHO treatment guidelines for drug-resistant tuberculosis (2016 update) (WHO/HTM/TB/2016.04). Geneva: WHO; 2016 (http://www.who.int/tb/areas-of-work/drug-resistant-tb/treatment/resources/en/, accessed 15 August 2016).

[2] This was done in association with a ministerial conference for high MDR-TB burden countries held in Beijing, China in April 2009.

[3] Country and regional time trends for the main TB indicators for drug-resistant TB can be accessed at https://extranet.who.int/sree/Reports?op=vs&path=/WHO_HQ_Reports/G2/PROD/EXT/DRTB_charts

:: FIG. 4.9

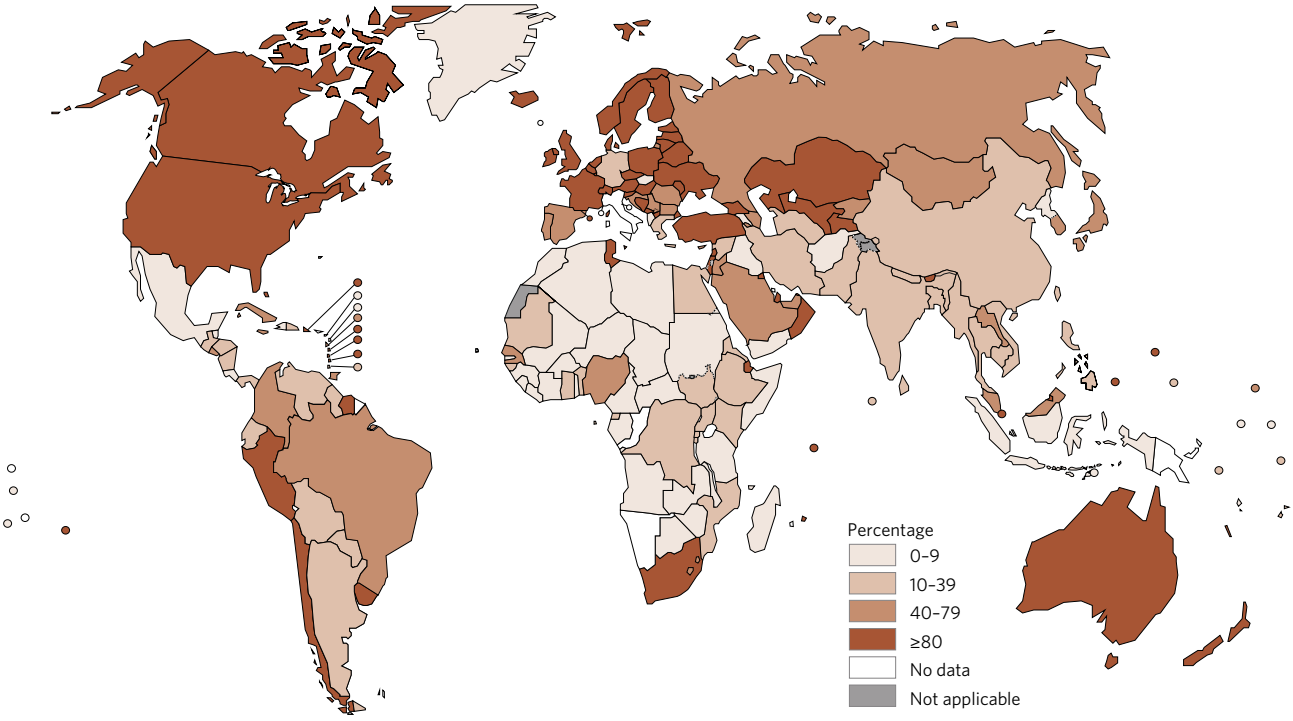
Percentage of bacteriologically confirmed TB cases tested for RR-TB, globally and for WHO regions, 2009–2015[a]



[a] Among new laboratory confirmed and retreatment cases; test results in cases with previous history unknown not included.
[b] The abrupt increase in coverage in the African region in 2015 is largely due to improved differentiation by treatment history of reports from South Africa.

:: FIG. 4.10

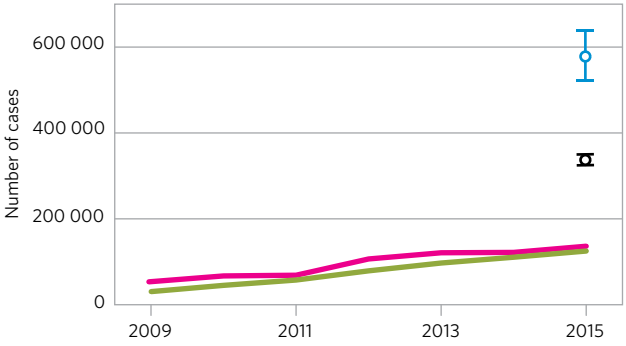
Percentage of bacteriologically confirmed TB cases tested for RR-TB, 2015[a]



[a] Among new laboratory confirmed and retreatment cases; test results in cases with previous history unknown not included. Values for 2014 were used in countries without 2015 data by the reporting deadline.

:: FIG 4.11

Global number of MDR/RR-TB cases detected (pink) and number enrolled on MDR-TB treatment (green) 2009–2015, compared with estimates for 2015 of the number of incident cases of MDR/RR-TB (uncertainty interval shown in blue) and the number of MDR/RR-TB cases among notified pulmonary cases (uncertainty interval shown in black)



and increasing DST coverage could be due to more accurate reporting of laboratory test results (e.g. de-duplication of repeated counts of laboratory results for multiple specimens for the same individual patient) and other improvements to reporting of data. Wider use of electronic case-based systems to manage MDR-TB patient data could help to further improve the completeness and accuracy of reporting. By 2015, 23 of the 30 high MDR-TB burden countries reported that national case-based electronic registers were in place (16 of which covered all TB patients). These systems vary from surveillance databases to more elaborate clinical case-management registers with links to laboratory information systems.

The 132 120 MDR/RR-TB cases notified globally in 2015 (**Table 4.1**) amount to about 40% of the estimated total of 340 000 MDR/RR-TB cases that could have been detected had DST been provided to all pulmonary TB patients notified in 2015, and about 23% of the 580 000 estimated incident cases of MDR/RR-TB in 2015 (**Fig. 4.11**). The proportion of MDR/RR-TB cases estimated to exist among notified pulmonary TB cases that were detected and reported varied from 21% to 64% in the six WHO regions. Among the 30 high MDR-TB burden countries, the proportion ranged from under 10% in the Democratic People's Republic of Korea and Somalia to above 75% in Kazakhstan, Peru, South Africa and Ukraine (**Fig. 4.12**).

Evidence of progress in DST coverage notwithstanding, diagnostic DST must be further expanded to close detection gaps. Nine countries with more than 5000 notified TB cases in 2015 reported no capacity to perform phenotypic DST (Afghanistan, Burkina Faso, Chad, Congo, Papua New Guinea, Sierra Leone, Somalia, South Sudan and Yemen). Hence, there is a need for continued strengthening of laboratory capacity and wider uptake of new rapid diagnostics (**Box 4.2**, **Box 4.4**), as well as increased deployment of digital health technologies (especially "connected diagnostics"[1]), to improve the completeness of reporting from laboratory and treatment centres.

:: Box 4.4

Updated WHO policy guidance on TB diagnostics

WHO convened Guideline Development Groups in 2016 to review the evidence on the performance and utility of four TB diagnostic technologies. The following recommendations have been issued:

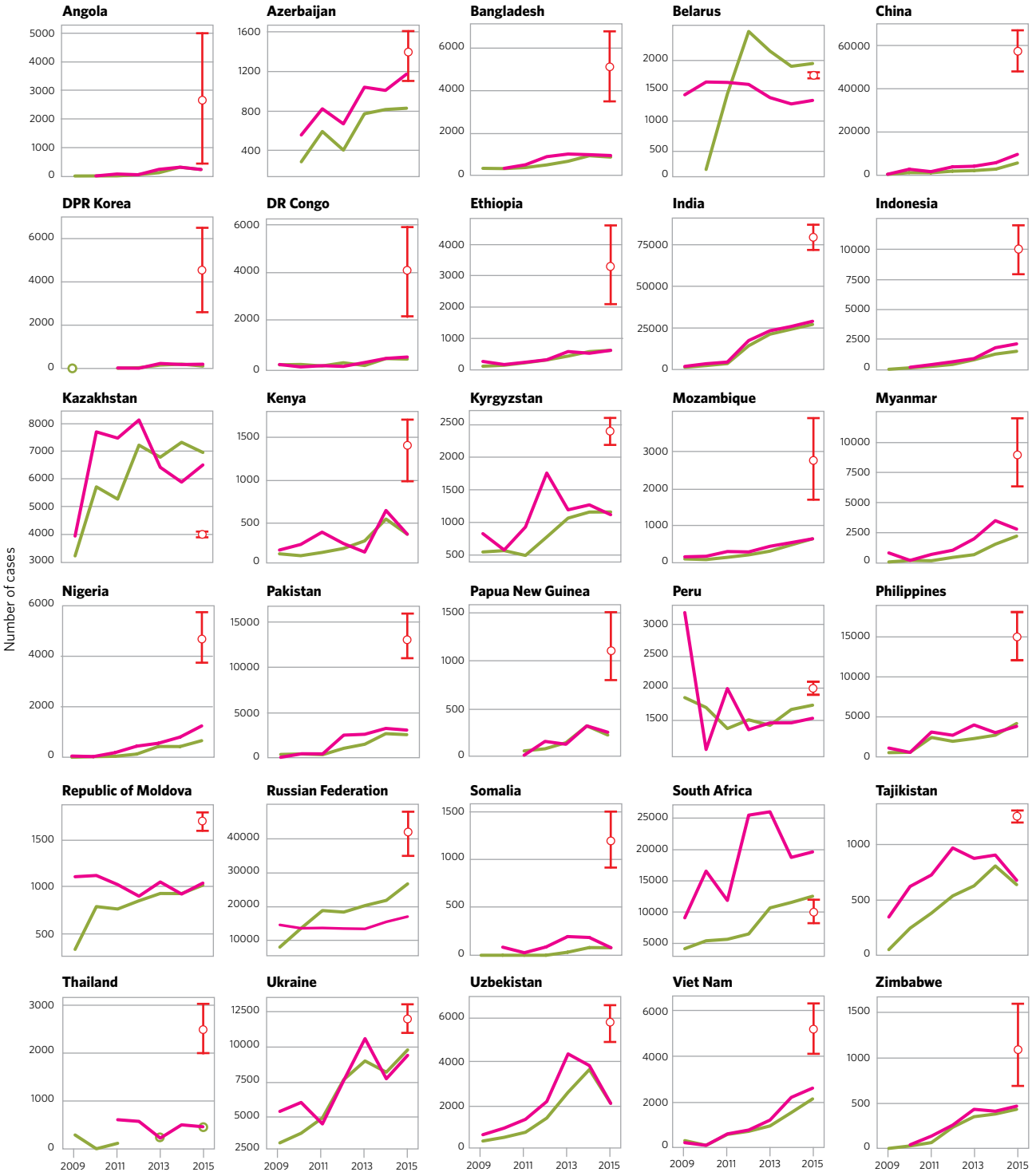
- For patients with confirmed rifampicin-resistant TB or MDR-TB, the Genotype® MTBDRsl (Hain LifeScience, Germany) second-line LPA may be used as the initial test, instead of phenotypic culture-based DST, to detect resistance to fluoroquinolones and the second-line injectable drugs (conditional recommendation). This test allows quick triage of confirmed MDR/RR-TB patients into either the shorter MDR-TB regimen or the conventional longer regimen.
- Two new first-line LPAs – the MTBDRplus Version 2 (Hain LifeScience, Germany) and the Nipro NTM+MDRTB detection kit 2 (Nipro Corp., Japan) – demonstrated equivalence to the MTBDRplus Version 1 assay. These new LPAs are now also recommended for the detection of TB and for resistance to rifampicin and isoniazid.
- A molecular assay based on loop-mediated isothermal amplification (TB-LAMP), Loopamp™ MTBC Detection Kit (Eiken Chemical Company Ltd, Japan) may be used as a replacement for microscopy for the diagnosis of pulmonary TB in adults with signs and symptoms of TB (conditional recommendation). TB-LAMP may also be used as a follow-on test to microscopy in adults with signs and symptoms of pulmonary TB, especially when further testing of sputum smear-negative specimens is necessary.

Information about technologies in the pipeline is provided in **Chapter 8**. A comprehensive list of existing WHO policy documents on TB diagnostics is available at: http://www.who.int/tb/areas-of-work/laboratory/policy_statements

[1] World Health Organization. Digital health for the End TB Strategy: an agenda for action (WHO/HTM/TB/2015.21). Geneva: WHO; 2015 (http://www.who.int/tb/areas-of-work/digital-health/Digital_health_EndTBstrategy.pdf, accessed 8 August 2016).

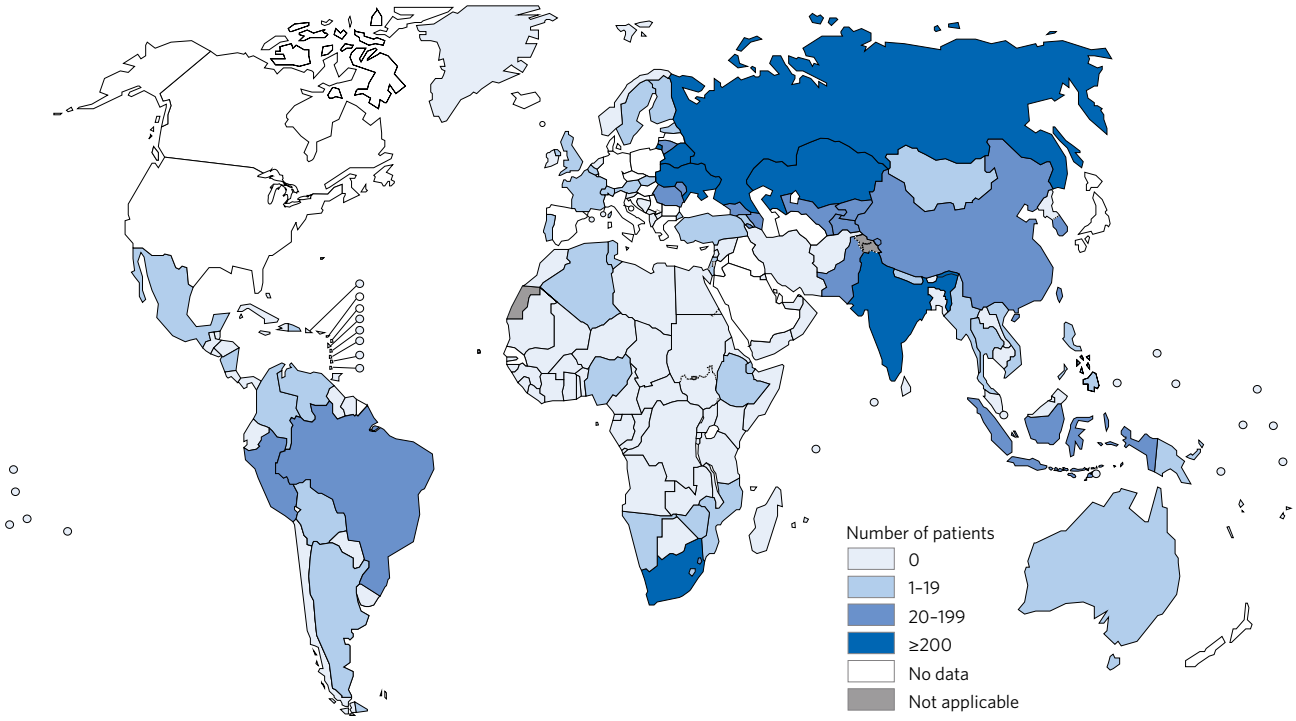
:: FIG. 4.12

Number of MDR/RR-TB cases detected (pink) and enrolled on MDR-TB treatment (green) 2009–2015 compared with estimated number of MDR/RR-TB cases among notified pulmonary TB cases in 2015 (uncertainty interval shown in red), 30 high MDR-TB burden countries



:: FIG. 4.13

Number of patients with laboratory-confirmed XDR-TB started on treatment in 2015



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

Among MDR/RR-TB patients notified in 2015, 36% were reported to have had DST for both fluoroquinolones and second-line injectable agents. Coverage was lowest in the WHO Western Pacific and South-East Asia regions. In 2015, 7579 XDR-TB cases were reported to have been detected by 74 countries.

Treatment of XDR-TB patients was reported by 58 countries and territories (**Fig. 4.13**). Globally, 7234 patients with XDR-TB were enrolled on treatment (more than twice the level in 2014). Most of the cases in 2015 were notified by India (2130), Ukraine (1206), the Russian Federation (1205) and South Africa (719).

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 healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all" (**Chapter 2**, **Box 2.2**). Indicators for Target 3.8 of SDG3 include prevention and treatment coverage of tracer interventions,[1] one of which is TB treatment.

TB treatment coverage is also one of the 10 priority indicators for monitoring progress in implementation of the End TB Strategy (**Chapter 2**, **Table 2.1**). This is because, as highlighted in the introduction to this chapter, universal coverage of appropriate diagnosis and treatment is a fundamental requirement for achieving the milestones and targets of the End TB Strategy. 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 (**Table 2.1**). In this section, the number of notified new and relapse cases in 2015 is used as a proxy for the number of cases detected and treated. As discussed further below, however, there are also 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.

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

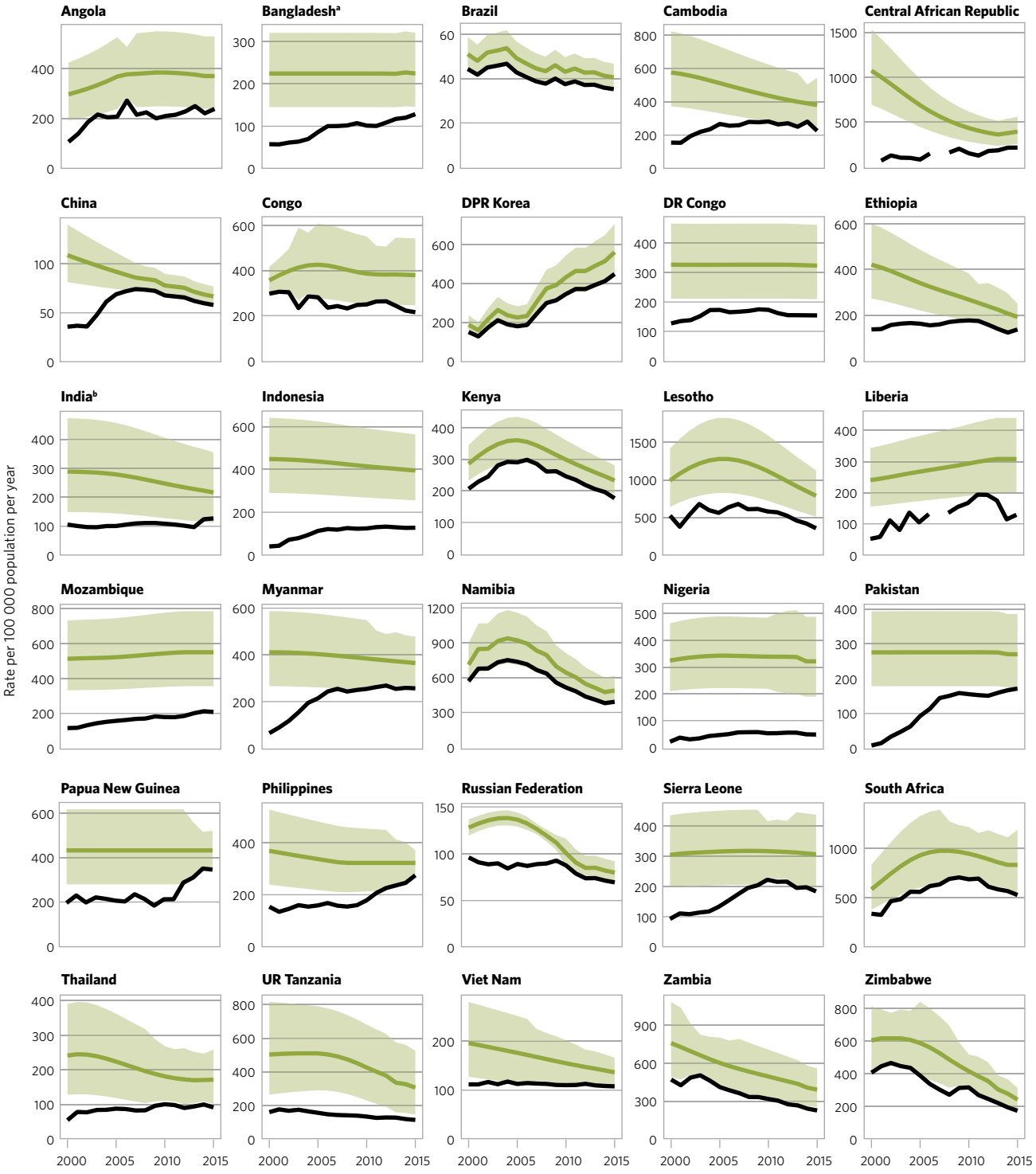
Trends in notifications of new and relapse cases and estimated incidence are shown for the 30 high TB burden countries in **Fig. 4.14**. Estimates of TB treatment coverage in 2015 (calculated as notifications of new and relapse cases divided by estimated TB incidence) are shown globally, for WHO regions and the 30 high TB burden countries in **Fig. 4.15**. Globally, TB treatment coverage was 59% (range, 50–70%)[2] in 2015, up from 54% (range, 46–65%) in 2010 and 36% (range, 30–43%) in 2000. Three WHO

[1] There are many different prevention and treatment interventions. In this context, a few interventions are selected to act as tracers for progress towards UHC for all interventions.

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

:: FIG. 4.14

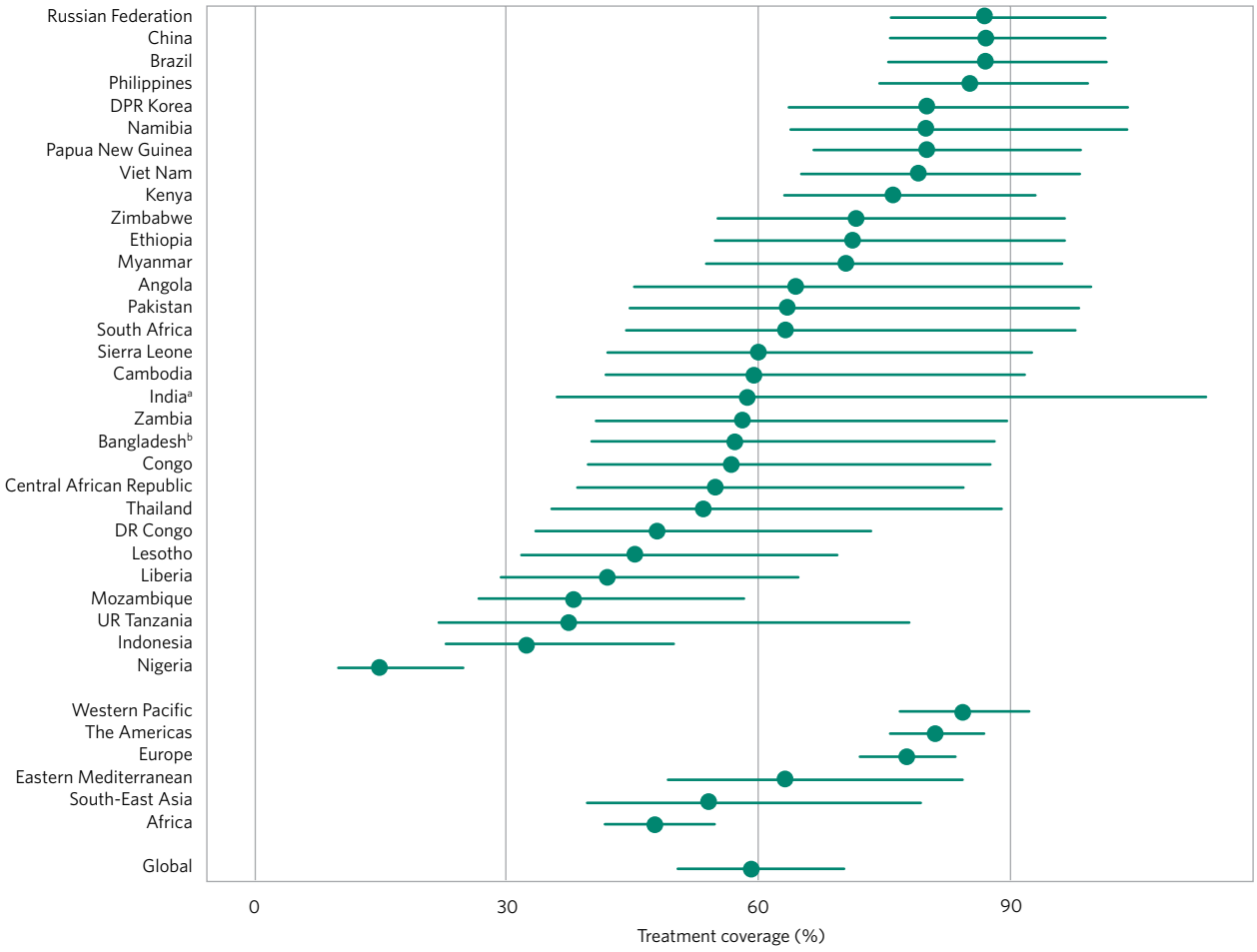
Case notification rates (new and relapse cases, all forms) (black) compared with estimated TB incidence rates (green), 2000–2015, 30 high TB burden countries. Shaded areas represent uncertainty bands.



[a] Estimates of TB incidence for Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.
[b] Estimates of TB incidence for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

:: FIG. 4.15

Estimated TB treatment coverage (new and relapse patients as a percentage of estimated TB incidence) in 2015, 30 high TB burden countries, WHO regions and globally



[a] Estimates of TB incidence for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.
[b] Estimates of TB incidence for Bangladesh will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.

regions achieved higher levels of above 75%: the Region of the Americas, and the European and Western Pacific regions. Among the 30 high TB burden countries, the highest levels of treatment coverage in 2015 (>80%) were in Brazil, China, the Philippines and the Russian Federation. The lowest levels, with best estimates of 50% or less, were in the Democratic Republic of the Congo, Indonesia, Mozambique, Nigeria and the United Republic of Tanzania.

Globally in 2015, there was a gap of about 4.3 million cases between the 6.1 million new and relapse cases that were notified, and the estimated 10.4 million incident TB cases in the same year (**Fig. 4.1**). Although notifications have increased in recent years, especially in India (**Section 4.1.1**), the size of this gap is larger than indicated in previous global TB reports following an upward revision to estimated TB incidence in India for 2015 and previous years (for further details, see **Chapter 3** and in particular **Box 3.3**). However, using the entire updated time-series of estimates of TB incidence as shown in **Fig. 4.1**, the global gap has been narrowing, especially in the WHO Eastern Mediterranean and Western Pacific regions, and to a lesser extent in the WHO South-East Asia Region.[1] Ten countries account for 77% of the total estimated gap between incidence and notifications (**Fig. 4.16a**), and India, Indonesia and Nigeria alone account for almost half of the total.

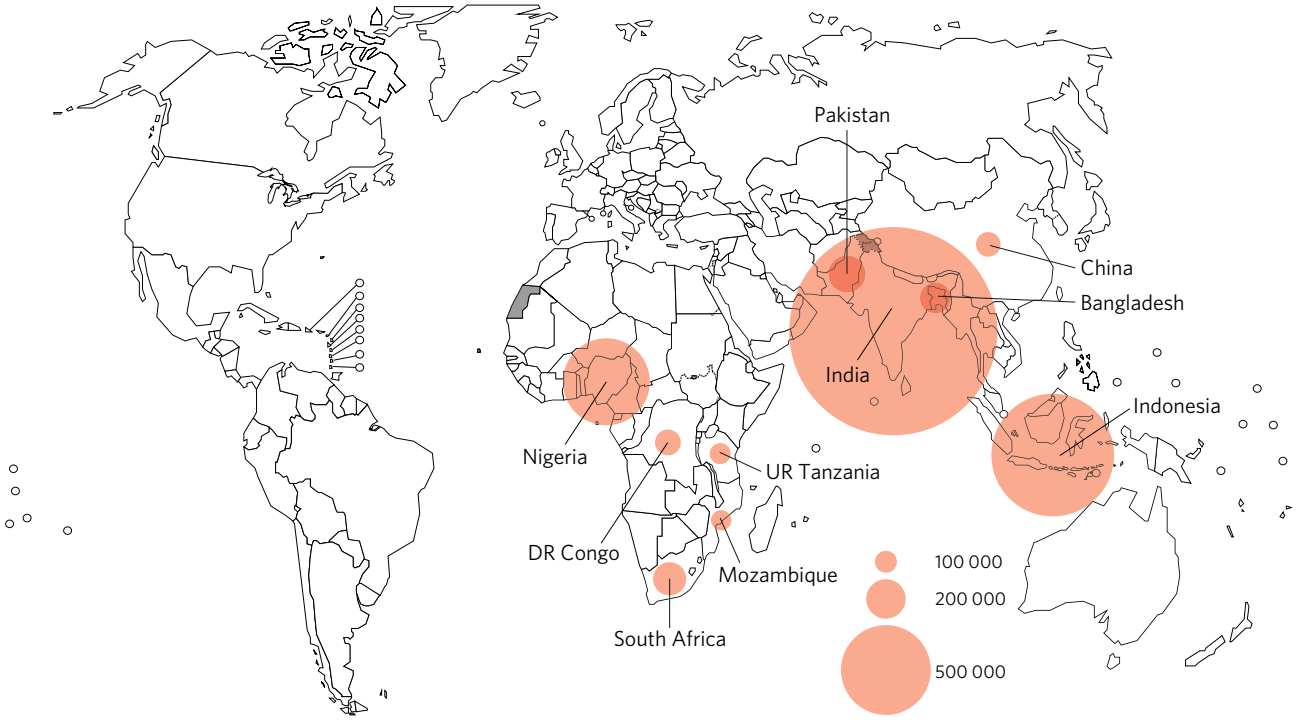
There are three main reasons for a gap between notifications and estimated incidence:

- **Underreporting of detected TB cases.** In many countries, especially those without policies on mandatory notification and other measures to ensure reporting of detected cases by all care providers and large private health sectors, levels of underreporting may be high.
- **Underdiagnosis of people with TB.** This can occur for reasons such as poor geographical and financial access to health care; failure to recognize TB signs and symptoms, and to test for TB when people do present to health facilities; and diagnostic tests that are not good enough to ensure accurate identification of all cases.

[1] Time trends in countries and regions are shown in **Annex 2** and **Annex 3**, respectively.

:: FIG. 4.16a

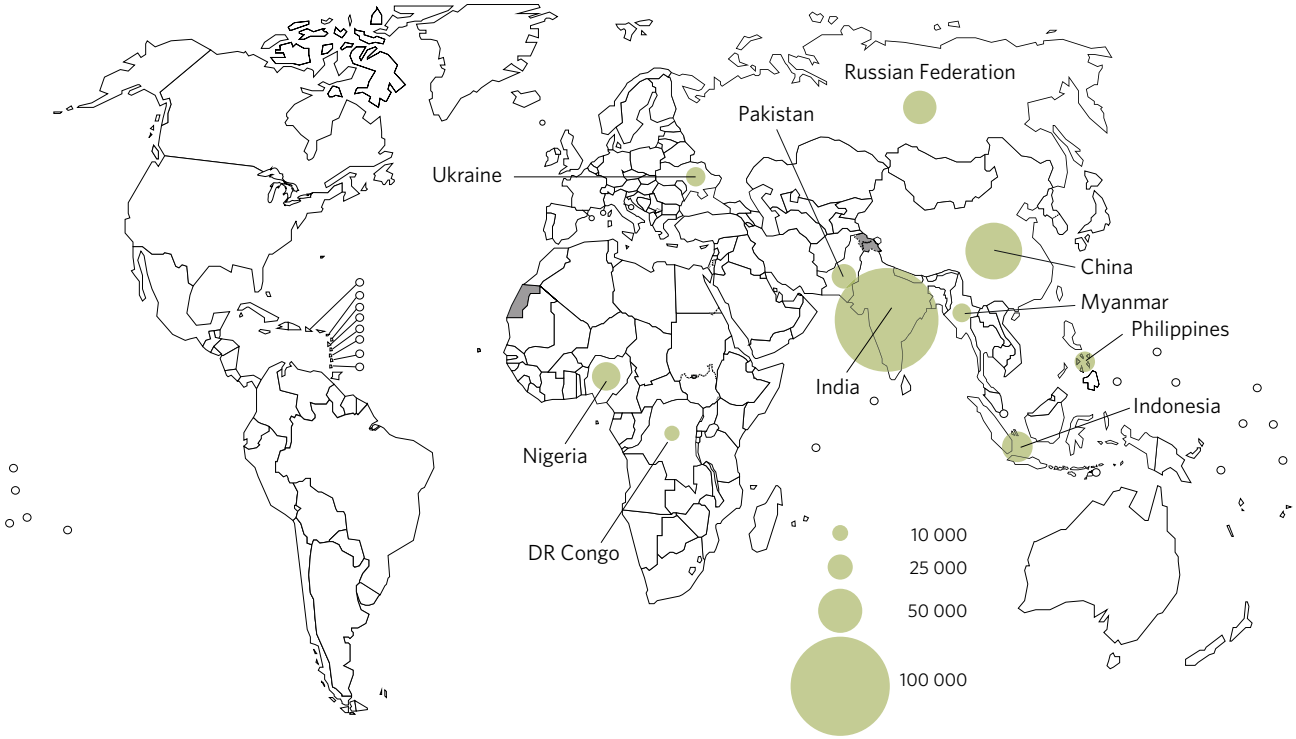
The ten countries with the largest gaps between notifications of new and relapse (incident) TB cases and the best estimates of TB incidence, 2015[a]



[a] The ten countries, ranked in order of the size of the gap between notified cases and the best estimate of TB incidence in 2015, are India, Indonesia, Nigeria, Pakistan, South Africa, Bangladesh, DR Congo, China, UR Tanzania and Mozambique. Estimates of TB incidence for India are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

:: FIG. 4.16b

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, 2015[a]



a The ten countries, ranked in order of the size of the gap between number of patients started on MDR-TB treatment and the best estimate of MDR/RR-TB incidence in 2015, are India, China, Russian Federation, Indonesia, Nigeria, Pakistan, Philippines, Ukraine, Myanmar and DR Congo.

- **Overestimation of the level of TB incidence.** In this report, estimates of TB incidence for 74 countries with 22% of the world's estimated cases are based on expert opinion about levels of underreporting and underdiagnosis, as opposed to direct measurements from surveillance or survey data (**Chapter 3**). Also, the uncertainty intervals around the best estimates of TB incidence can be wide, and gaps may be lower or higher than the best estimates quoted in this section.

In some of the countries with the largest estimated gaps between notifications and TB incidence there is already evidence about the reasons for such gaps, and actions to address them are being taken or are planned. In India, various data sources point to large underreporting of detected TB cases (see also **Chapter 3**, **Box 3.3**). These include two studies of sales of anti-TB drugs in the private sector; the recent upsurge in notifications that followed a national policy of mandatory notification, as well as efforts to increase engagement with all care providers and to facilitate reporting via a national web-based reporting system; and comparison of household survey data on self-reported TB treatment with notification data in the same survey areas. In Indonesia, the 2013–2014 national TB prevalence survey showed high levels of underreporting of detected TB cases, leading to recommendations such as a mandatory policy on notification and intensified engagement with public and private hospitals where many people with TB were being treated.[1] In Nigeria, the 2012 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 high levels of underdiagnosis and a need to strengthen access to diagnostic and treatment services.[2]

In countries where underreporting is thought to exist, inventory studies in which electronic lists of notified cases are compared with electronic lists of TB cases detected by all care providers, ideally employing unique identifiers, can be used to quantify levels of underreporting.[3] Such studies have already been used to inform estimates of TB incidence in several countries (**Chapter 3**), and are planned or under way in China, Indonesia (as a follow-on from the levels of underreporting indicated by the 2013–2014 national TB prevalence survey), Nigeria (metropolitan Lagos), the Philippines and Viet Nam. When these studies are 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.

Examples of mechanisms to ensure reporting of all detected cases include linking reimbursement from health insurance schemes to notification of cases (as in the Republic of Korea), linking the supply of first-line drugs to notification of cases (as in Brazil), facilitating reporting via online web-based systems with limited data entry requirements (as in India), and wider implementation of PPM schemes and initiatives (**Table 4.2**). Even in the countries shown in **Table 4.2**, PPM implementation is often not nationwide, and its contribution to notifications may come from a small proportion of providers that willingly collaborate with NTPs, or from parts of the country only. In India, for example, the big increase in notifications that occurred in 2013–2015 was from a small subset of districts. Chapter 6 provides further discussion of PPM, including the role of a whole-of-government approach, and innovative approaches to engaging private practitioners that are being tested in Bangladesh, India, Indonesia, Pakistan and Myanmar.

Recent national TB prevalence surveys[4] have also shown that, in both Africa and Asia, detection and reporting gaps are systematically higher for men than for women (for further details, see **Section 3.6.2** in **Chapter 3**). This suggests that specific efforts are needed to improve access to TB diagnosis and treatment for men.

Systematic screening for active TB among specific populations can also help to ensure early diagnosis and reduce levels of underdiagnosis. WHO recommends such screening for contacts of bacteriologically confirmed cases, people living with HIV and people exposed to silica dust (see also **Chapter 5**).[5,6] Other individuals at risk should be considered for systematic screening based on an assessment of TB epidemiology in each setting. To date, there have been few assessments of the implementation and outcomes of systematic screening in countries that are currently introducing or scaling up systematic screening. However, this is expected to become a more prominent part of national programme monitoring and evaluation efforts in future. Engaging communities could also add value to efforts to improve case detection and patient support (**Box 4.5**).

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1 For further details, see Box 2.4 in World Health Organization. Global tuberculosis report 2015 (WHO/HTM/TB/2015.22). Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf, accessed 27 July 2016).

2 For further details, see Box 2.2 in World Health Organization. Global tuberculosis report 2014 (WHO/HTM/TB/2014.08). Geneva: WHO; 2014 (http:// http://apps.who.int/iris/bitstream/10665/137094/1/9789241564809_eng.pdf, accessed 15 August 2016).

3 For a guide to inventory studies, see World Health Organization. Assessing tuberculosis under-reporting through inventory studies. Geneva: WHO; 2012 (http://www.who.int/tb/publications/inventory_studies/en/, accessed 15 August 2016).

4 www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_p06_prevalence_surveys_2009_2015.pdf

5 World Health Organization. Systematic screening for active tuberculosis: principles and recommendations (WHO/HTM/TB.2013.04). Geneva: WHO; 2013 (http://www.who.int/tb/tbscreening/en/, accessed 15 August 2016). The data requested in the global monitoring done by WHO focus on screening among people living with HIV and close contacts.

6 For this reason, the data requested in WHO's annual round of global TB data collection focus on screening among people living with HIV and close contacts. These data are presented in **Chapter 5**.

:: Box 4.5
Community contributions to TB notifications and treatment support

Engagement of communities, nongovernmental and civil society organizations is at the heart of the End TB Strategy. Community-based TB activities cover a wide range of activities that contribute to the detection, referral and treatment of people with drug-susceptible, drug-resistant and HIV-associated TB. They are conducted outside the premises of formal health facilities (e.g. hospitals, health centres and clinics) in community-based structures (e.g. schools, places of worship, congregate settings and markets) and homesteads. Community health workers and community volunteers carry out community-based TB activities. They can be part of the public health services or nongovernmental or other civil society organizations. ENGAGE-TB is an approach to integrating community-based TB activities into the work of these organizations.[a]

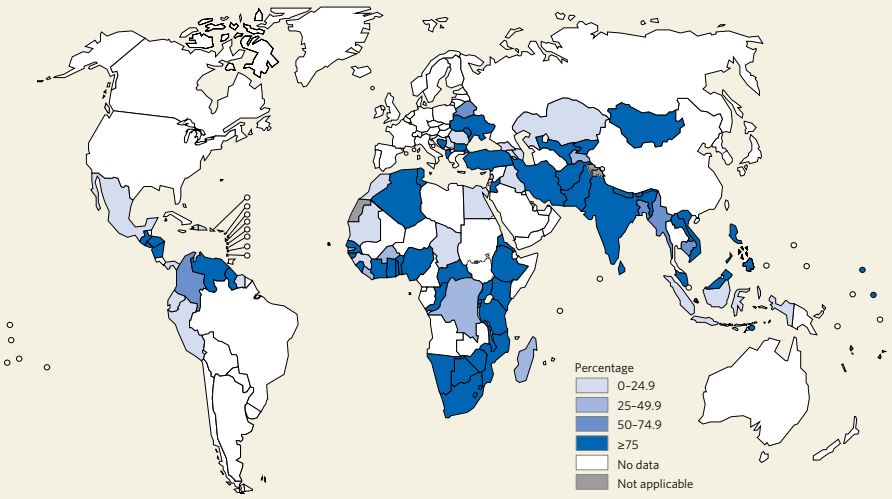
Of the 114 countries that were asked to respond to questions about the contributions of communities to TB notifications and treatment support in WHO's 2016 round of global TB data collection, 49 reported data for at least one indicator.

Of the 49 countries, 60% (29/49) reported nationwide coverage of community engagement in case notification or community-based treatment support (**Fig. B4.5.1**). 40 out of 49 countries (82%) reported data on the contribution of community referrals to TB notifications; 41 out 49 (86%) reported on the proportion of TB patients receiving community-based treatment support; and 34 out of 49 (69%) reported information about the treatment success rate among TB patients who received treatment support in the community.

There are many countries in which community-based TB activities are a routine component of TB services, but where it is not yet possible to quantify this contribution. Of the 65 (out of 114) countries that were asked to report but did not submit any data on notifications, more than half (33/65) nonetheless stated that community-based activities are implemented. In these 33 countries, the mean coverage of community-based activities is 79% of basic management units while a total of 19 countries reported countrywide implementation of community-based activities. Efforts to support countries to incorporate community engagement indicators into their routine monitoring and evaluation systems continue.

:: FIG. B4.5.1

Percentage of basic management units in which there is community engagement or provision of treatment adherence support, 2015



[a] World Health Organization. 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: WHO; 2012 (http://www.who.int/tb/publications/2012/engage_tb_policy/en/, accessed 15 August 2016).

4.2.2 Treatment coverage of antiretroviral therapy for HIV-positive TB cases

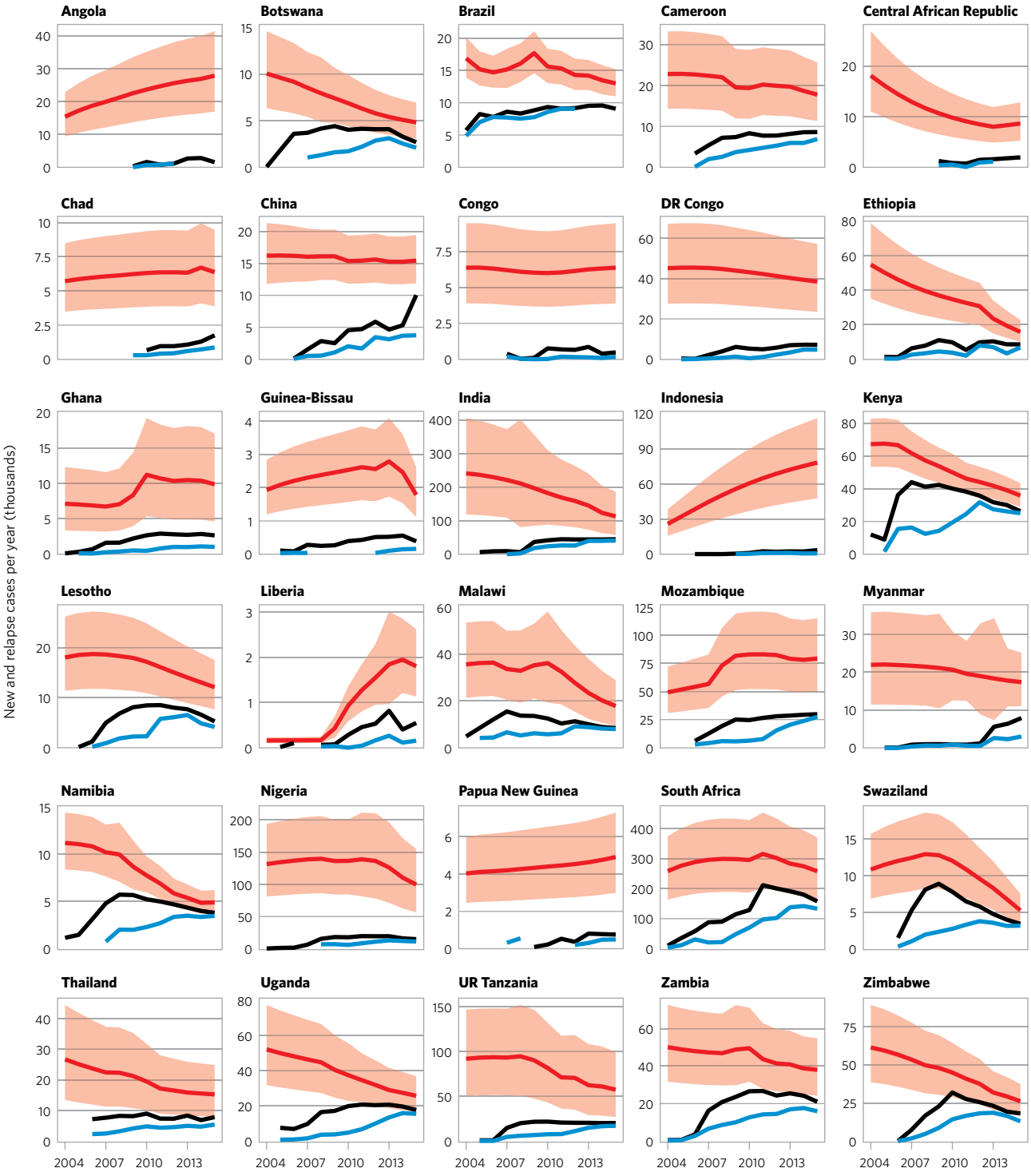
WHO recommends ART for all HIV-positive TB patients within the first 8 weeks of starting TB treatment.[1] The number of notified HIV-positive TB patients on ART has grown in recent years (**Fig. 4.8**, **Fig. 4.17**) and reached 390 630 in 2015, equivalent to 78% of the 500 564 notified TB patients known to be HIV-positive (**Table 4.1**). This was an increase from 36% in 2005, when data on provision of ART to HIV-positive TB patients were first collected at global level.[2] In the 30 high TB/HIV burden countries, 80% of the TB patients known to be HIV-positive were on ART and in six of these countries (India, Kenya, Malawi, Mozambique, Namibia and Swaziland) the figure was more than 90%.

[1] World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection. Recommendations for a public health approach. 2nd edition. Geneva: WHO; 2016. (http://www.who.int/hiv/pub/arv/annexes_new.pdf, accessed 26 August 2016)

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

:: FIG. 4.17

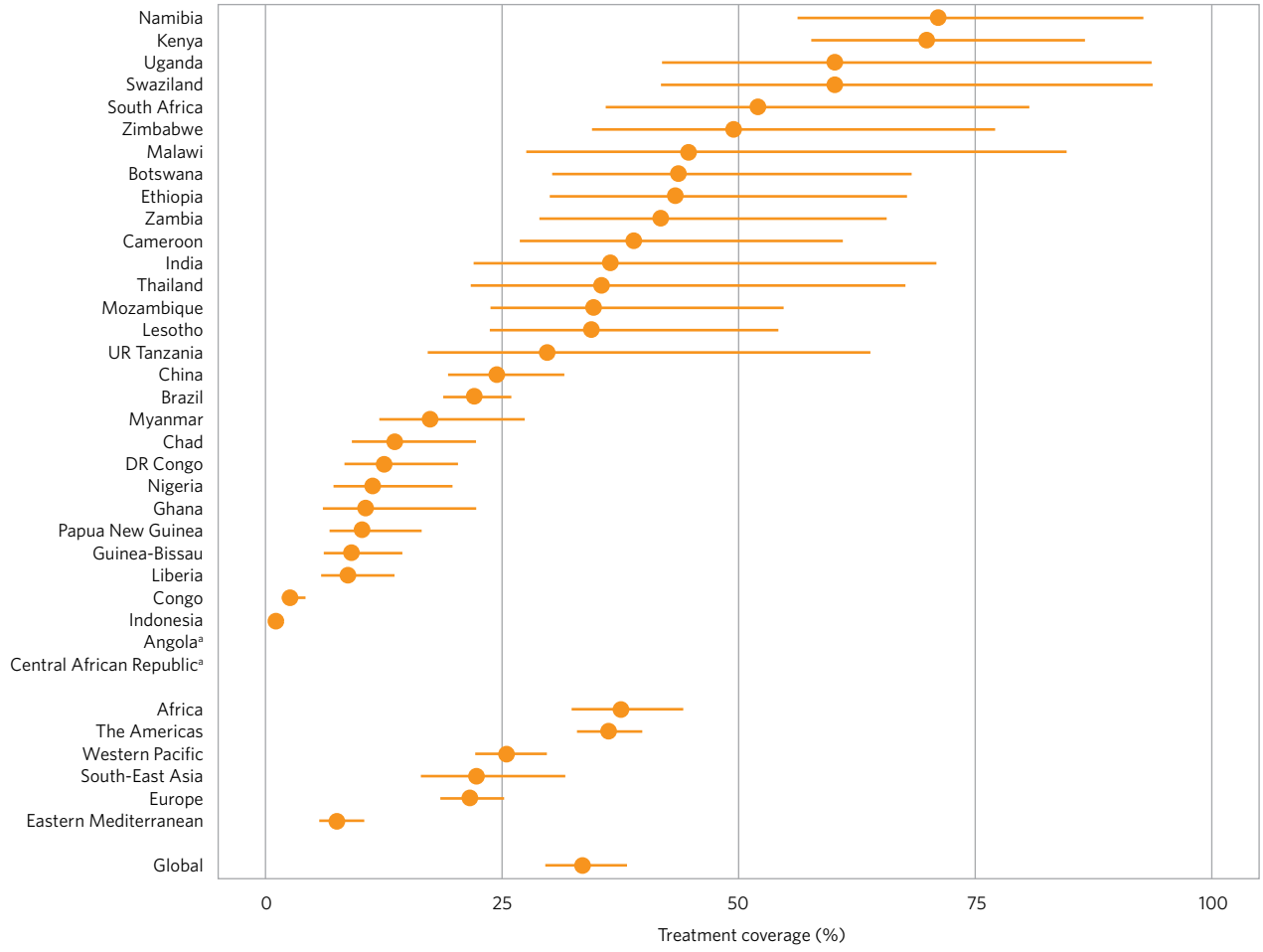
Number of new and relapse cases[a] known to be HIV-positive (black) and number started on ART (blue) compared with estimated number of incident HIV-positive TB cases (red), 2004–2015, 30 high TB/HIV burden countries



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

:: FIG. 4.18

Estimated ART treatment coverage for HIV-positive TB cases (HIV-positive TB patients on ART as a percentage of the estimated incidence of HIV-positive TB) in 2015, 30 high TB/HIV burden countries, WHO regions and globally



[a] No data

In contrast, there were nine high TB/HIV burden countries (Brazil, Chad, China, Congo, Ghana, Guinea-Bissau, Indonesia, Liberia, and Myanmar) in which less than 50% of HIV-positive TB patients were started on ART in 2015.

ART treatment coverage 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. 4.18**). This comparison reveals larger gaps. Globally in 2015, the number of HIV-positive TB patients on ART was 33% of the estimated global number of incident HIV-positive TB cases. There was considerable variation among the high TB/HIV burden countries and only four achieved ART coverage of more than 50% (Kenya, Namibia, Swaziland and Uganda). Improvements are needed in the detection of TB among HIV-positive people, the coverage of HIV testing among TB patients, and the enrolment of HIV-positive TB patients on ART.

4.2.3 Treatment coverage for MDR/RR-TB

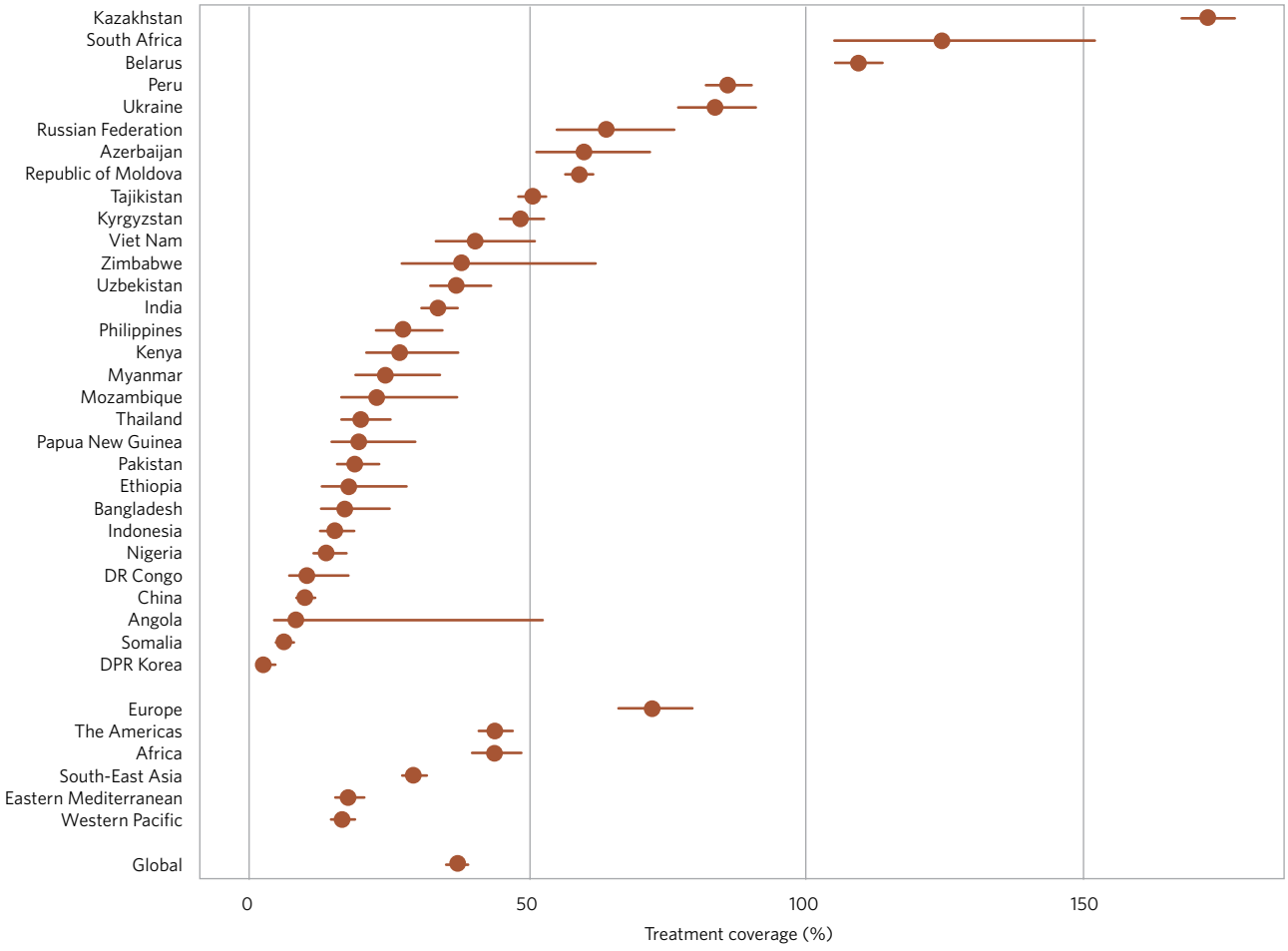
Trends in the number of patients enrolled on MDR-TB treatment globally and in the 30 high MDR-TB countries since 2009 are shown in **Fig. 4.11** and **Fig. 4.12**. The number of people enrolled on treatment globally was 124 990 in 2015, an increase of 13% from 110 587 in 2014. There was a 14% increase in enrolments between 2014 and 2015 in the 30 high MDR-TB burden countries, with increments amounting to more than 1000 patients in China, India, the Philippines, the Russian Federation and Ukraine.

Globally, the 124 990 patients starting second-line MDR-TB treatment in 2015 represented about 37% of the 340 000 MDR/RR-TB cases estimated to have existed among pulmonary TB patients notified in 2015 (**Fig. 4.19**), and 20% of the incidence estimate (**Fig. 4.11**). Five countries accounted for over 60% of the gap between enrolments on MDR-TB treatment in 2015 and the estimated number of incident MDR/RR-TB cases in 2015: China, India, Indonesia, Nigeria and the Russian Federation (**Fig. 4.16b**).

The number of cases starting MDR-TB treatment in 2015 was equivalent to 95% of the 132 120 MDR/RR-TB patients notified in that year (**Table 4.1**). The ratio exceeded 90% in 19 high MDR-TB burden countries, and the WHO European and South-East Asian regions, and was lowest in the

:: FIG. 4.19

Estimated MDR/RR-TB treatment coverage for MDR/RR-TB (patients started on treatment for MDR-TB as a percentage of the estimated number of MDR/RR-TB cases among notified pulmonary TB cases) in 2015, 30 high MDR–TB burden countries, WHO regions and globally



African Region (**Fig. 4.19**). In 2015, enrolments outstripped notifications of MDR/RR-TB in eight high MDR-TB burden countries (**Fig. 4.12**). This may be caused by 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, or enrolment of "waiting lists" of people with MDR/RR-TB who were detected before 2015.

The ratio of enrolled to diagnosed cases was below 60% in two high MDR-TB burden countries in 2015: China (59%) and Nigeria (53%). These low ratios show that progress in detection is far outstripping capacity to provide treatment; they may also reflect weaknesses in data collection systems. Treatment coverage will not improve globally unless there is an intensification of efforts in the countries with the largest burden, particularly China and the Russian Federation, but also India where the rate of increase in enrolments has slowed.

In many countries, one of the reasons for inadequate access to treatment of drug-resistant TB is that the network for the programmatic management of drug-resistant TB (PMDT) is too centralized. Hospital-based models of care continue to dominate in many countries, and hold back wider use of decentralized ambulatory care, a change of direction that could expand population access to PMDT (see also **Chapter 6**). In addition, gaps for palliative and end-of-life care are evident. In 2015, only 34 countries (including 16 of the 30 high MDR-TB burden countries) reported that such services were provided within the scope of their NTPs.

4.3 Treatment outcomes

This section highlights the latest results of treatment for people who started TB treatment on a first-line regimen in 2014, and people that started a second-line regimen for MDR/RR-TB in 2013.

4.3.1 Treatment outcomes for new and relapse TB patients

The definitions of TB treatment outcomes for new and relapse cases of TB that are recommended by WHO are provided in an updated recording and reporting framework

issued in March 2013 and updated in 2014.[1] Most new and relapse cases do not have MDR/RR-TB; however, in some parts of the world, especially countries of the former Soviet Union, more than 20% of new and relapse cases do so (**Chapter 3**). Universal access to DST is required to ensure that all people with TB receive appropriate treatment, as discussed in **Section 4.1**.

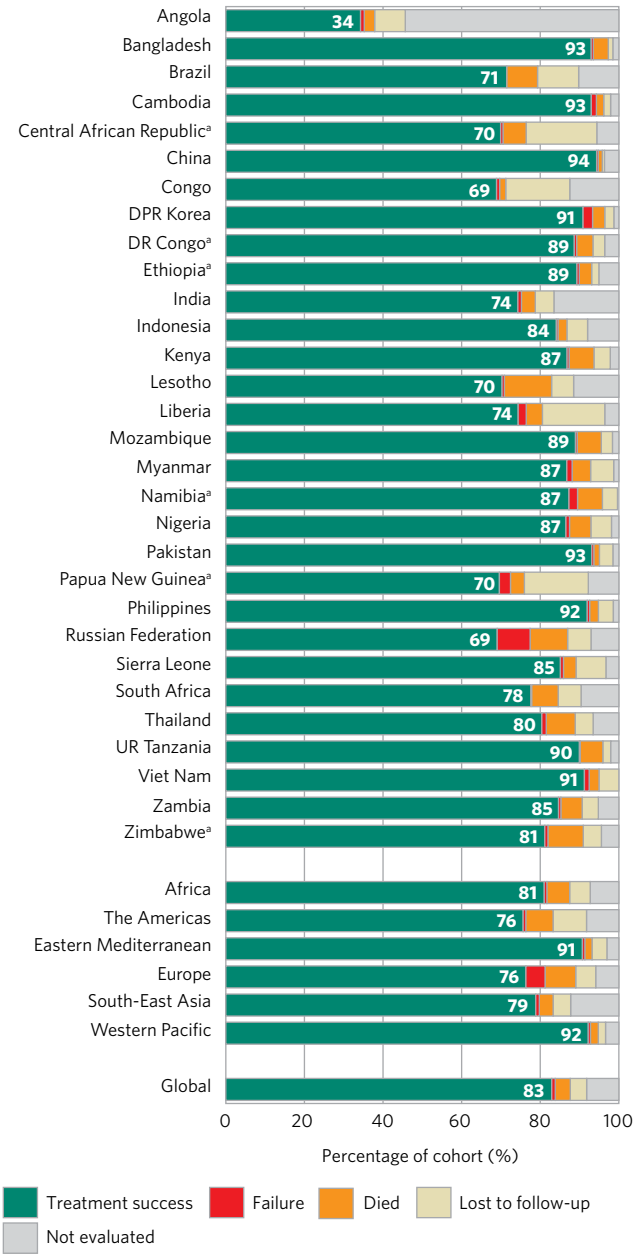
Data on treatment outcomes in 2014 for new and relapse cases of TB are shown for the world, the six WHO regions and the 30 high TB burden countries in **Fig. 4.20**, and trends globally and in the six WHO regions since 2000 are shown in **Fig. 4.21**. Globally, the treatment success rate for the 5.9 million new and relapse cases that were treated in the 2014 cohort was 83%. This was a reduction from 87% for the 2013 cohort, which can be explained by data for India. From 2013 to 2014, there was a big increase in notifications of TB cases in India (see also **Section 4.1.1**) from the private sector. However, while the total number of TB patients reported as successfully treated also increased in India, there was an increase in the percentage of TB patients for whom the treatment outcome was categorized as "not evaluated" (17%). As a consequence, the overall treatment success rate fell from 86% to 74%, and the impact is large enough to be evident in the aggregated data for 2014 for the world and the WHO South-East Asia Region (**Fig 4.21**). The NTP in India has been taking actions to improve reporting of treatment outcomes from private sector providers, including by facilitating reporting of outcomes via the national web-based reporting system known as Nikshay, and the aim is to achieve complete reporting of outcomes from the private sector by 2017. Of note, when the 2014 data for India are restricted to the same providers/facilities, the treatment success rate remains comparable to 2013, at 87%. When India is excluded from global calculations, the treatment success rate is 86%.

Among the six WHO regions, the highest treatment success rates in 2014 were in the Western Pacific Region (92%) and the Eastern Mediterranean Region (91%), and the lowest (at 76%) were in the Region of the Americas (due to high levels of loss to follow up and missing data) and the European Region (due to high rates of treatment failure and death, influenced by the high frequency of MDR/RR-TB). Only eight of the 30 high TB burden countries had reached or exceeded a 90% treatment success rate, although the validity of treatment outcome data was not always ascertained. In several high TB burden countries, the completeness of outcome reporting was low. In the Central African Republic, Congo, Liberia and Papua New Guinea, loss to follow-up exceeded 15%, whereas in Angola, Congo, India and Lesotho more than 10% of cases were unevaluated. In Brazil (71% success), 21% of cases were either lost to follow-up or their treatment outcome was missing.

Despite the decrease in the overall treatment success

:: FIG. 4.20

Treatment outcomes for new and relapse TB cases in 2014, 30 high TB burden countries, WHO regions and globally

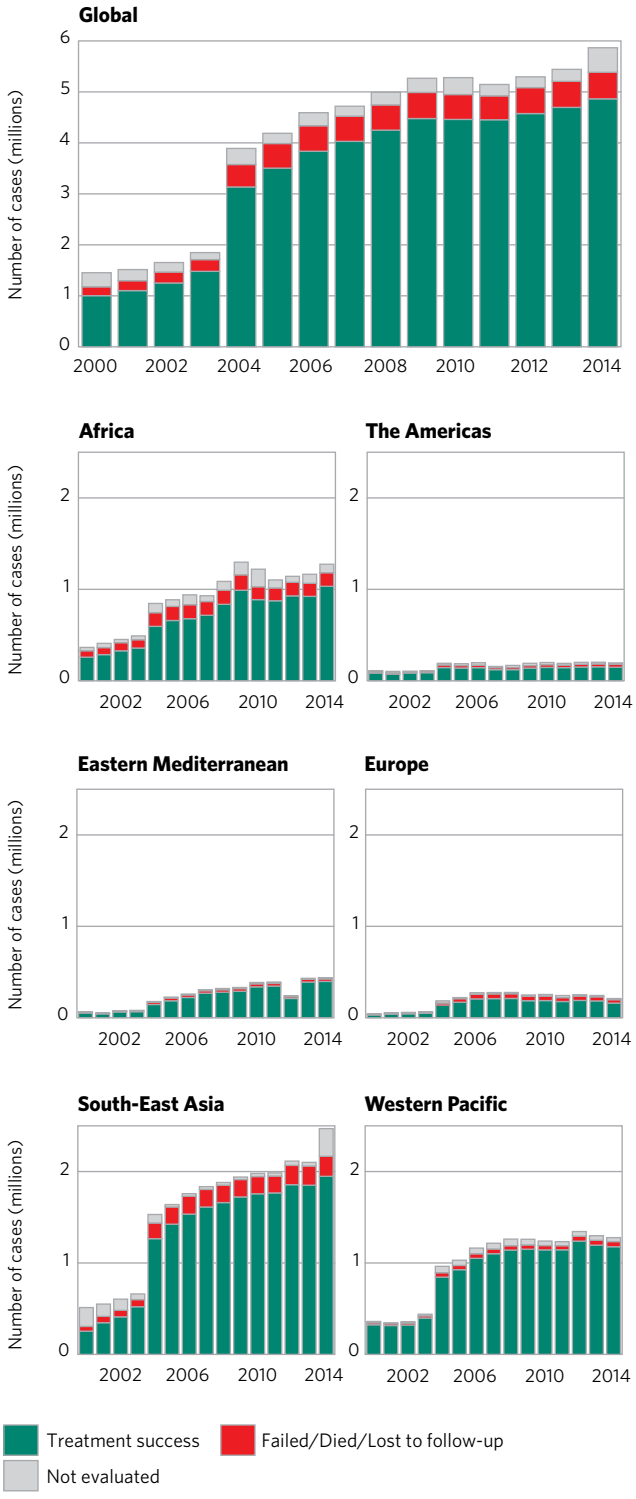


[a] Treatment outcomes are for new cases only.

[1] World Health Organization. Definitions and reporting framework for tuberculosis – 2013 revision (updated December 2014) (WHO/HTM/TB/2013.2). Geneva: WHO; 2013 (www.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf, accessed 15 August 2015).

:: FIG. 4.21

Treatment outcomes for new and relapse TB cases[a] (absolute numbers), 2000–2014, globally and for WHO regions



[a] Cohorts before 2012 included new cases only.

rate, the absolute number of TB patients reported to have been successfully treated has continued to increase over time, both globally and in all WHO regions (**Fig. 4.21**).

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

In the 2016 round of global TB data collection, 106 countries (which collectively accounted for 80% of the HIV-positive TB patients reported by NTPs in 2014) reported treatment outcomes for the 2014 patient cohort disaggregated by HIV status. This included 19 of the 30 high TB/HIV burden countries. Treatment outcomes for these countries, as well as the six WHO regions and globally, are shown in **Fig. 4.22**. Overall, the treatment success rate in 2014 was worse for HIV-positive TB patients (75%) than for HIV-negative TB patients (83%). There were particularly large differences in the Region of the Americas, the Eastern Mediterranean and the Western Pacific regions, where the treatment success rates for HIV-positive TB patients were 56%, 53% and 72% respectively, compared with 77%, 82% and 93% respectively among HIV-negative patients.

Globally, the proportion of TB patients who died during treatment was about four times higher among HIV-positive TB patients (11% versus 3%). In WHO regions the relative difference was lowest in the African Region (10% versus 5%) and highest in the Western Pacific Region (15% versus 2%).

Reasons for the comparatively poor outcomes of 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 HIV-positive people, WHO recommends routine HIV testing among presumptive and diagnosed TB cases and TB screening among people living with HIV, early ART and provision of TB preventive treatment. WHO recently published a revised algorithm for clinical management of HIV-positive people who are seriously ill and suspected of having TB.[1]

4.3.3 Treatment outcomes for TB patients with MDR/RR-TB and XDR-TB

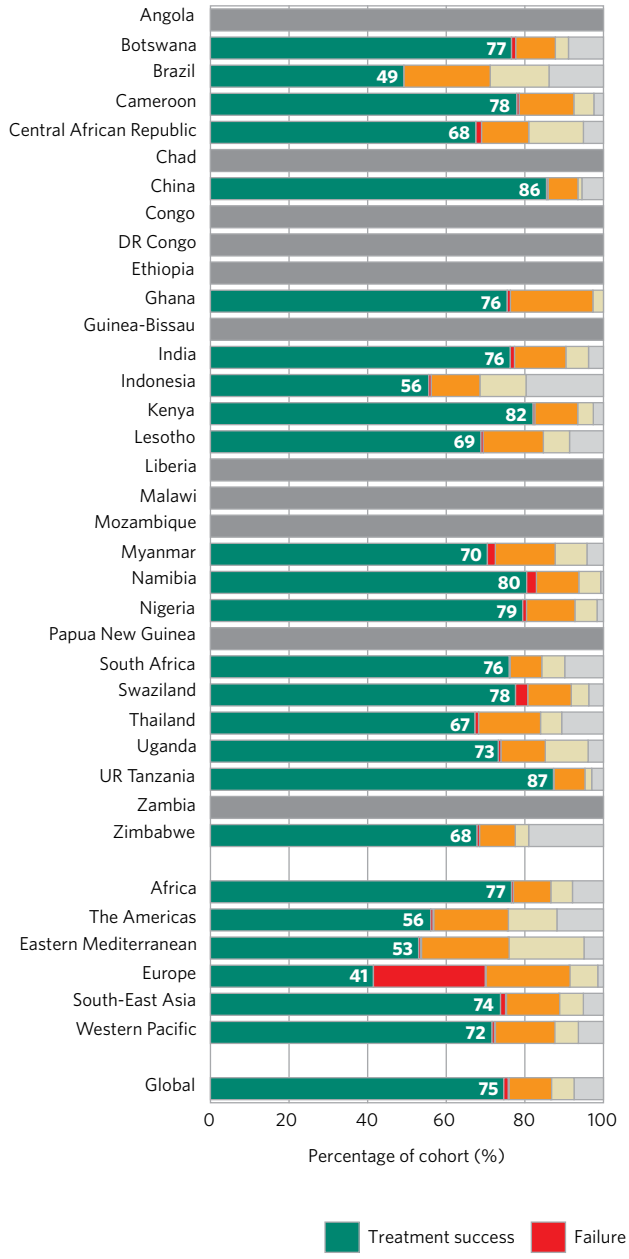
A total of 127 countries and territories reported treatment outcomes for people started on MDR-TB treatment in 2013. The number of cases reported in annual cohorts has steadily increased over time, reaching 86 936 cases globally in the 2013 cohort, a 17% increase over the previous year (**Fig. 4.23**).

Overall, the proportion of MDR/RR-TB patients in the 2013 cohort who successfully completed treatment (i.e. cured or treatment completed) was 52%: 17% died, 15% were lost to follow-up, 9% were determined to be treatment failure and 7% had no outcome information. The treatment success rate was highest in the WHO Eastern

[1] World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection. Recommendations for a public health approach. 2nd edition. Geneva: WHO; 2016. (http://www.who.int/hiv/pub/arv/annexes-5Sep2016.pdf, accessed 26 August 2016). See Annex 14.

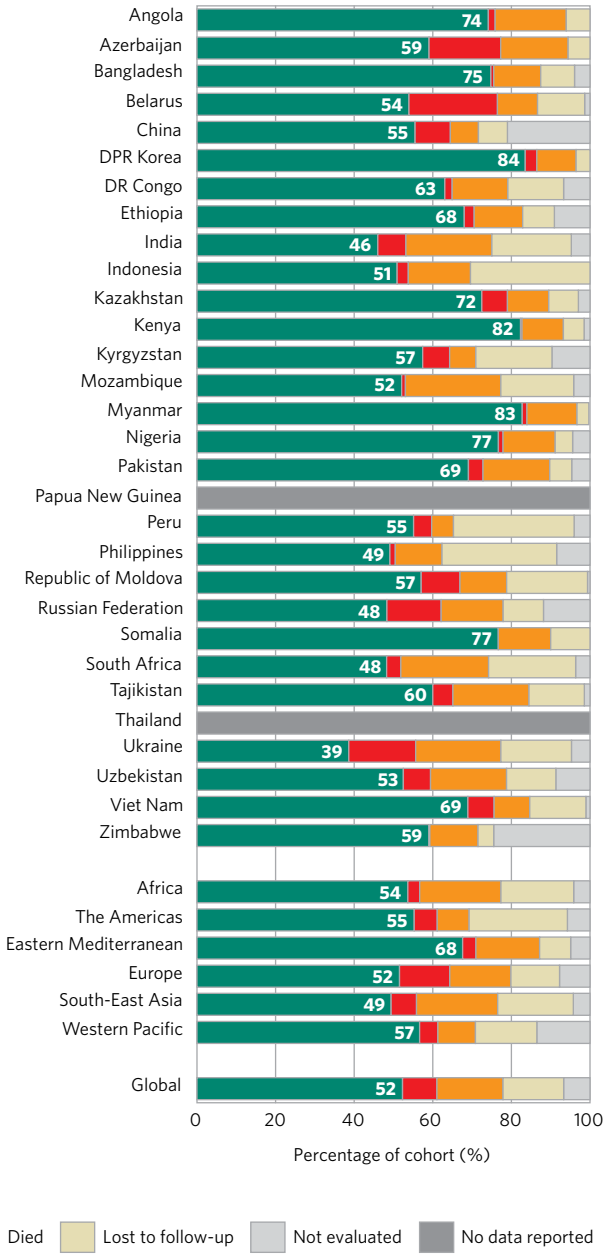
:: FIG. 4.22

Treatment outcomes for new and relapse TB/HIV cases in 2014, 30 high TB/HIV burden countries, WHO regions and globally



:: FIG. 4.23

Treatment outcomes for rifampicin-resistant TB cases started on treatment in 2013, 30 high MDR-TB burden countries, WHO regions and globally



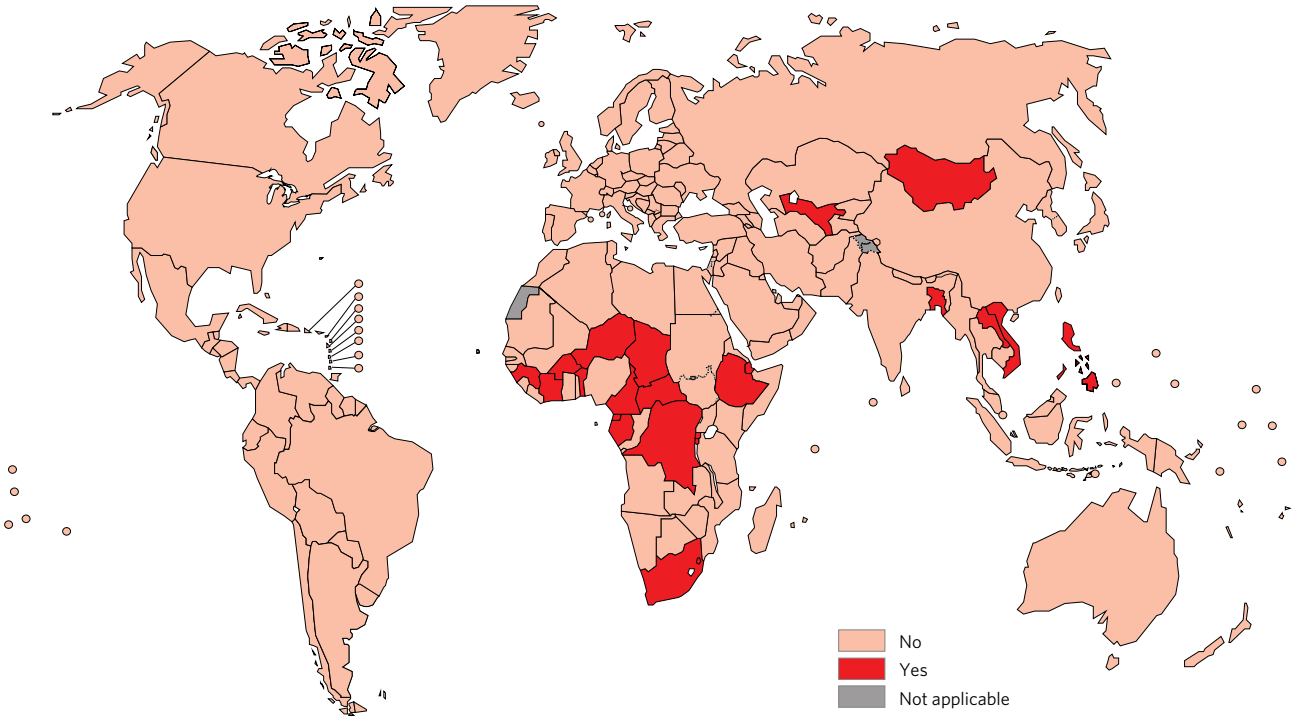
Mediterranean Region (68%), and lowest in the South-East Asia Region (49%). In the 2013 cohort, treatment failure was highest in the WHO European Region (13%), and the death rate was highest in the African and South-East Asia regions (21%). Loss to follow-up was highest in the WHO Region of the Americas (25%).

Despite the low levels of treatment success, over 150 000 people who started MDR-TB treatment globally between 2007 and 2013 were reported to have completed their treatment successfully. Among the 30 high MDR-TB burden countries, the Democratic Republic of Korea, Kenya, Myanmar, Nigeria, and Somalia reported >75% treatment success among the MDR/RR-TB cohorts enrolled in 2013. Conversely, treatment success was <50% in countries with the largest cohorts: India, the Philippines, the Russian Federation, South Africa and Ukraine. This was primarily due to high death rates in India, South Africa and Ukraine; high treatment failure rates in the Russian Federation and Ukraine; and high rates of loss to follow up or missing data in India, the Philippines and South Africa. Data on treatment outcomes for MDR/RR-TB patients were not reported by Papua New Guinea and Thailand.

Among 4086 XDR-TB patients started on treatment in 2013 in 47 countries and for whom outcomes were reported, 28% completed treatment successfully, 27% died, treatment failed for 21%, and 23% were lost to follow-up or

:: FIG. 4.24

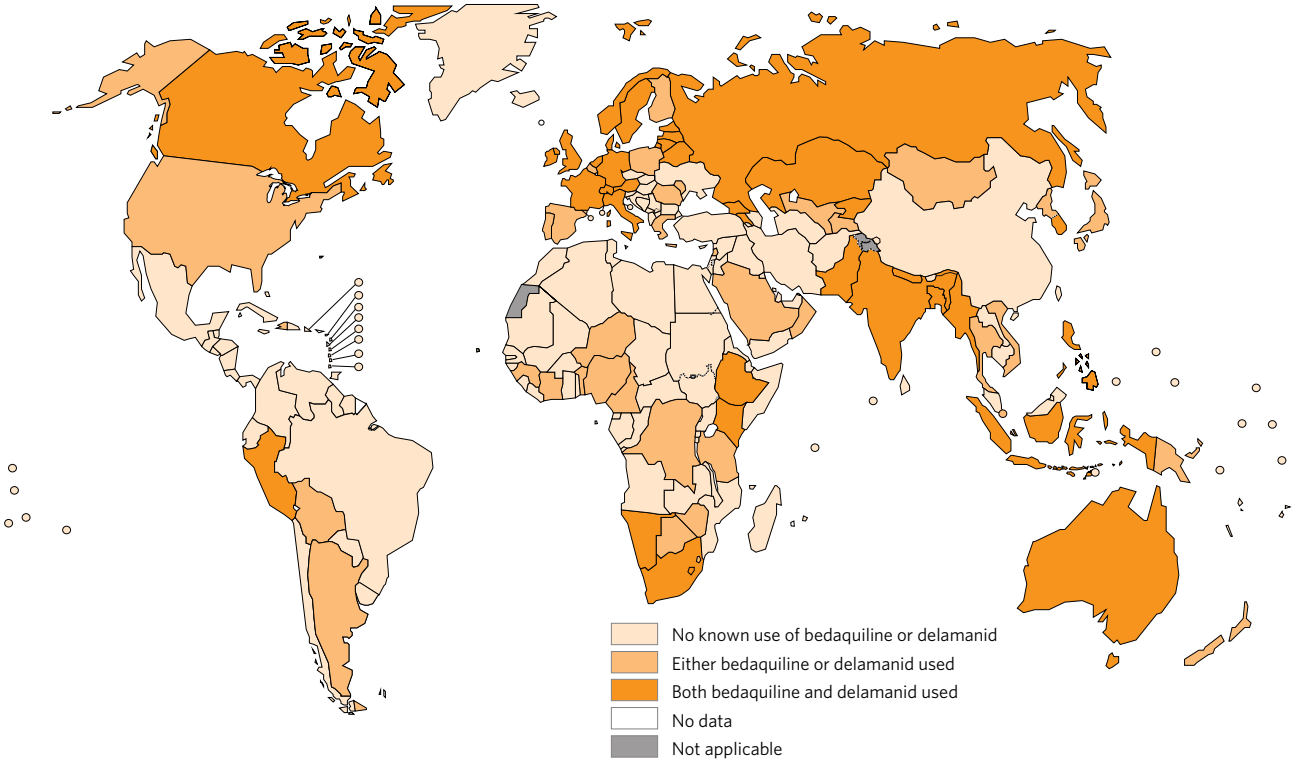
Countries that had used shorter MDR-TB treatment regimens by the end of 2015[a]



[a] STREAM Trial sites = Ethiopia, Mongolia, South Africa and Viet Nam.

:: FIG. 4.25

Countries that had used bedaquiline and/or delamanid for the treatment of M/XDR-TB as part of expanded access, compassionate use or under normal programmatic conditions by the end of 2015



Data shown reflects country reports supplemented with additional information from pharmaceutical manufacturers.

:: Box 4.6
Active TB drug-safety monitoring and management

aDSM is the active and systematic, clinical and laboratory assessment of patients on treatment with new anti-TB drugs, novel MDR-TB regimens, or XDR-TB regimens, to detect, manage and report suspected or confirmed drug toxicities.[a] The overall objectives of aDSM are to reduce risks from drug-related harms in patients on second-line treatment for drug-resistant TB and to generate standardized data to inform future policy updates on the use of such medicines.

aDSM includes three essential activities to achieve these objectives:

- Patients targeted for aDSM should undergo active and systematic clinical and laboratory assessment during treatment to detect drug toxicity and adverse events (AEs). Proposed schedules have been developed for use in patients on shorter regimens or on new medications.
- All AEs detected should be managed in a timely manner, to deliver the best possible patient care. Management of AEs is beyond the scope of this document, and further details are provided in other implementation documents.[b]
- Standardized data should be systematically collected and reported for any detected serious adverse event (SAE). These data will eventually be used to characterize the types of SAEs, assess the safety of the treatment, and inform future policy on the use of these medicines.

In 2015, 51 of the 140 countries that enrolled patients on MDR-TB treatment (including 15 of the 30 high MDR-TB burden countries) reported AEs in least one patient.

[a] World Health Organization. Active tuberculosis drug-safety monitoring and management (aDSM): framework for implementation (WHO/HTM/TB/2015.28). Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/204465/1/WHO_HTM_TB_2015.28_eng.pdf, accessed 15 August 2016).

[b] World Health Organization. Companion handbook to the WHO guidelines for the programmatic management of drug-resistant tuberculosis (WHO/HTM/TB/2014.11). Geneva: WHO; 2014 (http://apps.who.int/iris/bitstream/10665/130918/1/9789241548809_eng.pdf, accessed 15 August 2016).

their treatment outcome was not evaluated. The Russian Federation accounted for nearly 50% of the XDR-TB patients for whom outcomes were reported in 2013. Among six countries with XDR-TB cohorts of more than 100 individuals, mortality was highest (>40%) in India and South Africa.

Treatment success rates in patients with drug-resistant TB remain unacceptably low. The wider use of shorter MDR-TB treatment regimens of 9–12 months (**Box 4.3**) and of new TB drugs (bedaquiline and delamanid) for patients with M/XDR-TB could help to improve this situation.

At least 23 countries in Africa and Asia have introduced shorter regimens as part of trials or observational studies under operational research conditions (**Fig. 4.24**). These regimens achieved high treatment success rates (87–90%) in selected MDR/RR-TB patients included in a pooled meta-analysis undertaken to inform the latest WHO policy update for the treatment of drug-resistant TB (**Box 4.3**).

As part of efforts to improve access to treatment and treatment outcomes for MDR/XDR-TB, at least 70 countries had imported or started using bedaquiline and 39 countries had used delamanid by the end of 2015 (**Fig. 4.25**). Most (75%) 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, active TB drug-safety monitoring and management (aDSM), 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 to detect, manage and report suspected or confirmed drug toxicities,[1] is required (**Box 4.6**).

Further details on research and development of new drugs and novel regimens are given in **Chapter 8**.

[1] World Health Organization. Active TB drug-safety monitoring and management (aDSM). WHO. Available from: http://www.who.int/tb/areas-of-work/drug-resistant-tb/treatment/pharmacovigilance/en/

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 disease and death caused by TB, and to achieve the End TB Strategy targets set for 2030 and 2035.

Current health interventions for TB prevention are: treatment of latent TB infection (LTBI), with particular attention to children aged under 5 years who are household contacts of bacteriologically confirmed pulmonary TB cases, and people living with HIV; prevention of transmission of *Mycobacterium tuberculosis* through infection control; and vaccination of children with the Bacille-Calmette-Guérin (BCG) vaccine.

Globally in 2015, there were an estimated 1.2 million children aged under 5 years who were household contacts of bacteriologically confirmed pulmonary TB cases and who were eligible for TB preventive treatment according to current policy recommendations. In comparison, only 87 236 children in this age group (7.1%) were reported to have been started on TB preventive treatment in 2015, based on data from 88 countries.

A total of 910 124 people who were newly enrolled in HIV care were started on TB preventive treatment in 2015, based on data from 58 countries. This was a large increase from negligible levels in 2005, when WHO first requested data. South Africa accounted for the largest share (45%) of the total in 2015, as in previous years, followed by Malawi, Mozambique and Kenya. Ten countries reported data for the first time, including Kenya.

Despite progress in providing TB preventive treatment to people living with HIV, much more remains to be done. Of the 30 high TB/HIV burden countries, 21 did not report any provision of preventive treatment in 2015. In the nine high TB/HIV burden countries that did report data, coverage among people newly enrolled in HIV care ranged from 2% in Indonesia to 79% in Malawi.

There is a need to improve initiation, completion and reporting of TB preventive treatment for other at-risk populations, including clinical risk groups such as patients with silicosis, patients starting anti-tumour necrosis factor (TNF) therapy and patients preparing for organ transplantation.

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 control in health facilities. In 2015, 9977 health-care workers were reported with TB from 67 countries; China accounted for 30% of these cases and South Africa for 21%. In 16 countries, 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 should be provided as part of national childhood immunization programmes according to a country's TB epidemiology. In 2015, 163 countries reported providing BCG vaccination as a standard part of these programmes, of which 102 reported coverage of above 90%.

Monitoring and evaluation of TB prevention services is challenging given the lack of systems for recording and reporting data, and the involvement of multiple service providers. In 2016, WHO developed standard indicators to monitor and evaluate the provision of TB preventive treatment. Countries are encouraged to adopt these indicators and an electronic surveillance system that facilitates collection and analysis of the relevant data.

Development and expanded use of shorter regimens for TB preventive treatment, which require a smaller number of doses and are associated with fewer adverse events, will facilitate implementation at a larger scale. Innovative diagnostic tests with improved performance and predictive value are needed to target individuals who will benefit most from TB preventive treatment.

Prevention of new infections of Mycobacterium tuberculosis and their progression to TB disease is critical to reduce the burden of disease and death caused by TB, and to achieve the End TB Strategy targets set for 2030 and 2035. The targets of an 80% reduction in TB incidence by 2030 and a 90% reduction by 2035, compared with 2015, require an historically unprecedented acceleration in the rate at which TB incidence falls after 2025 (**Chapter 2**). This can only happen if the probability of progression from latent TB infection (LTBI) to active TB disease among the 2–3 billion people already infected worldwide is reduced below the current lifetime risk of 5–15%.[1] In some low-burden countries, reactivation accounts for about 80% of new cases of disease.[2,3] Interventions that could result in a much greater reduction include more effective treatments for LTBI and a new vaccine capable of preventing reactivation of LTBI in adults.

There are three major categories of health interventions currently available for TB prevention:

- treatment of LTBI – through isoniazid daily for 6 or 9 months, or isoniazid plus rifampicin daily for 3–4 months, or rifampicin daily for 3–4 months or isoniazid plus rifapentine once a week for 3 months – with particular attention to children aged under 5 years who are household contacts of TB cases with bacteriologically confirmed pulmonary disease, and people living with HIV (**Section 5.1**);
- prevention of transmission of *Mycobacterium tuberculosis* through infection control (**Section 5.2**); and
- vaccination of children with the Bacille-Calmette-Guérin (BCG) vaccine (**Section 5.3**).

The three main sections of this chapter present and discuss the status of progress in provision of these services. Particular attention is given to countries in the lists of 30 high TB burden and 30 high TB/HIV burden countries (**Chapter 2**).

5.1 Treatment of latent TB infection

LTBI is defined as a state of persistent immune response to *Mycobacterium tuberculosis* without clinically-manifested evidence of active TB disease. There are two particular risk groups for whom specific efforts to diagnose and treat LTBI are recommended by WHO: children aged under 5 years who are household contacts of pulmonary TB cases, and people living with HIV.[4] Coverage of contact investigation and treatment of LTBI among child contacts and people living with HIV are in the top-10 list of indicators for monitoring implementation of the End TB Strategy, with a target of over 90% coverage by 2025 at the latest (**Chapter 2**, **Table 2.1**).

Data on provision of TB preventive treatment for people living with HIV have been collected for more than 10 years. However, until 2016 there was no standardized global guidance on how to monitor the coverage of preventive treatment among child contacts or other high-risk groups. Such guidance has now been developed by a WHO Global LTBI Task Force,[5] and the recommended indicators are shown in **Table 5.1**. The rest of this section discusses findings from data gathered from countries and territories in WHO's 2016 round of global TB data collection about TB preventive treatment for the three risk groups.

5.1.1 Child contacts under 5 years of age who are household contacts of TB cases

In 2015, of the 189 countries that reported at least one notified bacteriologically confirmed pulmonary TB case, 88 (47%) reported data about the number of contacts aged under 5 years who were started on TB preventive treatment (**Fig. 5.1**). A total of 87 236 child household contacts were initiated on TB preventive treatment (**Table 5.2**), with the largest numbers reported by the WHO African Region (28% of the global total) and Eastern Mediterranean Region (20% of the global total). At country level, Afghanistan reported the largest number (10 164) followed by Bangladesh (9833). Only nine of the 30 high TB burden countries reported data. A few countries in the WHO European Region noted that it was not possible to report data for children specifically because preventive treatment is provided to adults as well as children; this may also apply to some low TB burden countries that did not report data. Thus, the data reported to WHO understate the actual number of children who were started on TB preventive treatment.

Comparisons of the number of children started on treatment for LTBI in 2015 with national estimates of the number of children aged under 5 years who were contacts of bacteriologically confirmed pulmonary TB cases and eligible for TB preventive treatment are also shown in **Table 5.2**. Globally, the 87 236 children started on TB preventive treatment in 2015 represented 7.1% (range, 6.9–7.4%) of the 1.2 million (range, 1.18 million to 1.26 million) children estimated to be eligible for it. Higher levels of coverage were achieved in the WHO Region of the Americas (best estimate 67%; range, 63–71%) followed by the European Region (best estimate 42%; range, 40–44%). In the high TB or TB/HIV burden countries that reported data, coverage ranged from 2.6% in Cameroon to 41% in Malawi.

5.1.2 People living with HIV

There has been a considerable increase in the provision of preventive TB treatment in recent years, especially in

[1] Vynnycky E, Fine PE. Lifetime risks, incubation period, and serial interval of tuberculosis. Am J Epidemiol. 2000;152(3):247–263.

[2] Heldal E, Docker H, Caugant DA, Tverdal A. Pulmonary tuberculosis in Norwegian patients. The role of reactivation, re-infection and primary infection assessed by previous mass screening data and restriction fragment length polymorphism analysis. Int J Tuberc Lung Dis. 2000;4(4):300–307.

[3] Shea KM, Kammerer JS, Winston CA, Navin TR, Horsburgh CR. Estimated rate of reactivation of latent tuberculosis infection in the United States, overall and by population subgroup. Am J Epidemiol. 2014;179(2):216–225.

[4] World Health Organization. Guidelines on the management of latent tuberculosis infection. Geneva: WHO; 2015 (http://www.who.int/tb/publications/ltbi_document_page/en/, accessed 30 August 2016).

[5] http://www.who.int/tb/challenges/task_force/en/

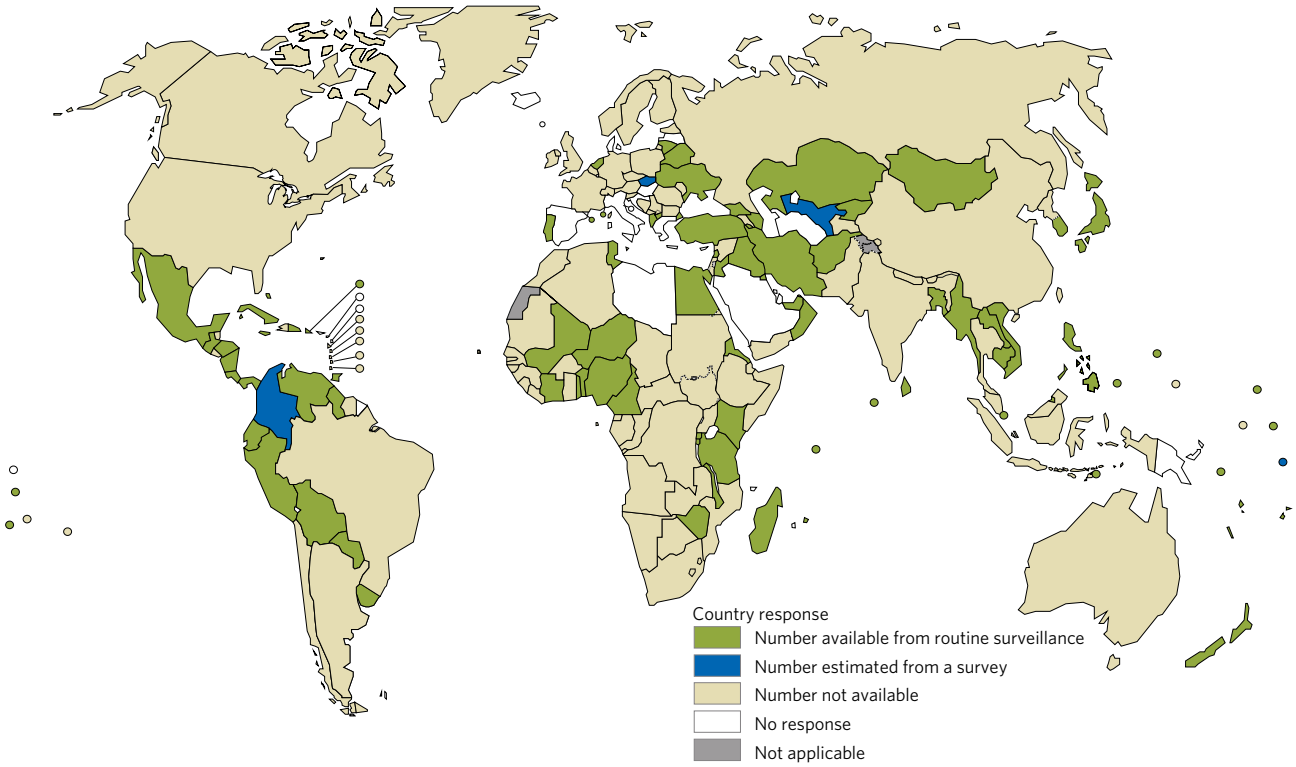
:: TABLE 5.1.

Summary of monitoring and evaluation indicators for LTBI programmatic management recommended by WHO

COUNTRY GROUP	AT RISK POPULATIONS WITH STRONG RECOMMENDATIONS	CORE GLOBAL AND NATIONAL INDICATORS	CORE NATIONAL INDICATORS	OPTIONAL INDICATORS
LOW TB BURDEN High-income and upper middle-income countries with an estimated TB incidence rate of less than 100 per 100 000 population	1) People living with HIV. 2) Adults and children who are household contacts of pulmonary TB cases. 3) Clinical indications: patients with silicosis; patients initiating anti-tumour necrosis factor (TNF) treatment; patients on dialysis; patients preparing for organ or haematologic transplantation.	1) Proportion of children less than 5 years old who are household TB contacts (according to national guidelines) who have completed TB investigations 2) Proportion of children under 5 years old who are household TB contacts (according to national guidelines) who are eligible for starting on TB preventive therapy that have started treatment 3) Proportion of eligible people living with HIV newly enrolled in HIV care, started on TB preventive therapy	1) Proportion of eligible individuals from at risk populations (according to national guidelines) tested for latent TB infection. 2) Proportion of individuals from at risk populations (according to national guidelines) with a positive latent TB test who are eligible for starting TB preventive therapy that have started treatment. 3) Proportion of individuals from at risk populations (according to national guidelines) with a positive latent TB test who have started on TB preventive therapy that have completed the course.	1) TB incidence rate among risk populations (as defined by national guidelines).
HIGH TB BURDEN Resource-limited and other high and middle-income countries with an estimated TB incidence rate equal to or more than 100 per 100 000 population	1) People living with HIV. 2) Children under 5 years of age who are household contacts of pulmonary TB cases.		1) Proportion of eligible people living with HIV who completed a course of TB preventive therapy. 2) Proportion of children less than 5 years old who are household TB contacts (according to national guidelines) who have completed a course of TB preventive therapy.	

:: FIG. 5.1

Availability of data on the number of children aged <5 years who were household contacts of bacteriologically confirmed pulmonary TB cases and were started on TB preventive treatment, 2015



:: TABLE 5.2

TB preventive treatment in 2015 for people living with HIV and children under 5 years of age who were household contacts of a bacteriologically confirmed pulmonary TB case, 16 high TB or TB/HIV burden countries that reported data, WHO regions and globally[a]

	NUMBER OF PEOPLE LIVING WITH HIV NEWLY ENROLLED IN CARE (A)[b]	PEOPLE NEWLY ENROLLED IN HIV CARE WHO WERE STARTED ON TB PREVENTIVE TREATMENT IN 2015		ESTIMATED NUMBER OF CHILDREN UNDER 5 YEARS OF AGE WHO WERE HOUSEHOLD CONTACTS OF A NOTIFIED BACTERIOLOGICALLY CONFIRMED PULMONARY TB CASE, AND ELIGIBLE FOR TB PREVENTIVE TREATMENT, IN 2015 (C)[c]	CHILDREN UNDER 5 YEARS OF AGE WHO WERE STARTED ON TB PREVENTIVE TREATMENT IN 2015	
		NUMBER (B)[b]	COVERAGE, % (B÷A)		NUMBER (D)	COVERAGE, % (D÷C)[c]
Bangladesh	—	—	—	45 000 (41 000–49 000)	9 833	22 (20–24)
Cambodia	3475	868	25	5100 (4600–5500)	731	14 (13–16)
Cameroon	—	—	—	11 000 (10 000–13 000)	298	2.6 (2.4–2.8)
Ethiopia	37 600	17 585	47	31 000 (28 000–34 000)	—	—
Indonesia	29 893	591	2.0	67 000 (61 000–73 000)	—	—
Kenya	258 763	85 392	33	23 000 (21 000–25 000)	1 256	5.5 (5.0–6.0)
Malawi	165 131	130 525	79	4800 (4400–5200)	1 947	41 (37–45)
Mozambique	292 083	130 420	45	17 000 (16 000–19 000)	—	—
Myanmar	33 415	3361	10	16 000 (14 000–17 000)	553	3.6 (3.3–3.9)
Nigeria	202 434	40 855	20	39 000 (35000–42000)	6 254	16 (15–18)
Philippines	2970	1278	43	45 000 (41 000–49 000)	6 337	14 (13–16)
Sierra Leone	14 041	1025	7.3	6300 (5700–6800)	—	—
South Africa	1 091 549	409 496	38	49 000 (45 000–53 000)	—	—
UR Tanzania	—	—	—	19 000 (17 000–21 000)	1 314	6.9 (6.3–7.6)
Viet Nam	—	—	—	16 000 (14 000–17 000)	1 774	11 (10–12)
Zimbabwe	125 740	38 489	31	7600 (6900–8300)	2 333	31 (28–34)
Africa	2 215 755	856 529	39	440 000 (430 000–450 000)	24 728	5.6 (5.5–5.7)
Americas	66 598	27 905	42	24 000 (23 000–25 000)	16 024	67 (63–71)
Eastern Mediterranean	4967	1992	40	150 000 (140 000–160 000)	17 203	12 (11–12)
Europe	28 130	10 037	36	16 000 (16 000–17 000)	6920	42 (40–44)
South-East Asia	65 756	5 859	8.9	510 000 (470 000–540 000)	11 498	2.3 (2.1–2.4)
Western Pacific	15 555	7 802	50	84 000 (78 000–90 000)	10 863	13 (12–14)
GLOBAL	**2 396 761**	**910 124**	**38**	**1 220 000 (1180 000–1260 000)**	**87 236**	**7.1 (6.9–7.4)**

— indicates data not available.

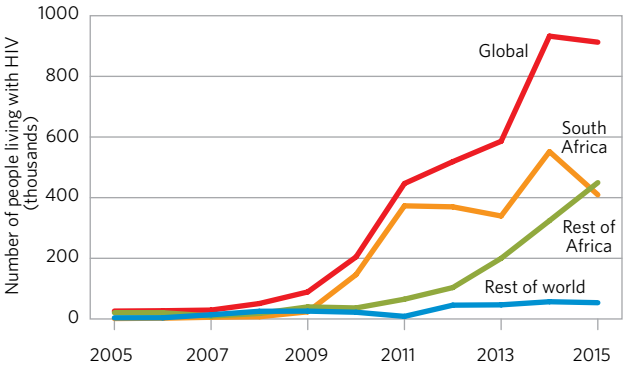
[a] There were 22 other countries in the list of high TB or TB/HIV burden countries that did not report data for either risk group. These were Angola, Botswana, Brazil, Central African Republic, Chad, China, Congo, Democratic People's Republic of Korea, Democratic Republic of the Congo, Ghana, Guinea-Bissau, India, Lesotho, Liberia, Namibia, Pakistan, Papua New Guinea, Russian Federation, Swaziland, Thailand, Uganda and Zambia.

[b] In some countries due to data quality issues, the figures may not exclusively include number of people living with HIV who are newly enrolled in to HIV care.

[c] Best estimates are followed by the uncertainty interval, and are shown to two significant figures.

:: FIG. 5.2

Provision of TB preventive treatment to people living with HIV, 2005–2015[a]



[a] Up to 2014, countries were requested to report data on the provision of isoniazid preventive therapy (IPT). In 2015, countries were requested to report data on the number of people treated for LTBI according to the new TB/HIV monitoring and evaluation guide published in 2015.

:: Box 5.1
Enablers for establishing effective monitoring and evaluation of treatment for LTBI

In April 2016, WHO in collaboration with the Republic of Korea's Centers for Disease Control and Prevention, and International Tuberculosis Research Center organized a global consultation on the programmatic management of LTBI. This was the first such consultation in the era of the End TB Strategy, and brought together participants from both high and low TB burden countries to discuss and identify challenges, opportunities and best practices in the programmatic management of LTBI.

Barriers to monitoring and evaluation of the provision of treatment for LTBI that were identified included the non-notifiable status of LTBI in many countries, the existence of multiple paper-based registers for recording of treatment, fragmentation due to the involvement of multiple service providers and lack of regulation of the private sector.

Examples of approaches that can facilitate effective monitoring and evaluation system were shared. These included:

- incorporating treatment of LTBI in the routine surveillance system for TB by making LTBI a notifiable condition (Japan);
- improving data management, including by using an electronic web-based register (the Netherlands) and linking data from multiple electronic databases (Norway); and
- establishing better relationships with the private sector (Republic of Korea), especially to improve the reporting of preventive treatment for people in clinical risk groups.

the WHO African Region (Fig. 5.2). In 2015, a total of 57 countries (representing 61% of the estimated global burden of HIV-associated TB) reported providing preventive TB treatment to people newly enrolled in HIV care, up from 49 countries in 2014. The total number of people started on preventive treatment globally was 910 124, similar to the level of 2014 and up from the very low levels in 2005 when WHO first requested data. Most of this progress has occurred since 2010, following definition of a four-symptom algorithm for screening for TB among people living with HIV and associated WHO guidance.[1,2]

As in previous years, South Africa accounted for the largest proportion (45%) of the global total in 2015 (Fig. 5.2), followed by Malawi, Mozambique and Kenya (Table 5.2). Ten countries reported data for the first time, including Kenya, and several other countries in the WHO African Region reported higher numbers in 2015 compared with 2014 (e.g. Ethiopia, Mozambique, Nigeria and Zimbabwe).

Despite this progress, much more remains to be done. Of the 30 high TB/HIV burden countries, 21 did not report any provision of preventive treatment in 2015, and in the nine that did report data, coverage among people newly enrolled in HIV care ranged from 2% in Indonesia to 79% in Malawi (Table 5.2).

5.1.3 Other at-risk populations

Data on provision of preventive treatment to other at-risk populations were reported by seven countries: France, Japan, the Netherlands, Norway, Portugal, Republic of Korea and Slovakia (Table 5.3). Only four countries could report denominators, and then only for a subset of risk groups. All seven countries reported providing preventive treatment to adult contacts, and coverage was more than 50% in the four countries that reported denominators. Data for clinical risk groups such as patients starting anti-tumour necrosis factor (TNF) therapy and those preparing for transplantation were reported by Norway, Portugal and Slovakia. The lack of routinely reported data, particularly for clinical risk groups, makes it difficult to monitor coverage levels. Better monitoring mechanisms need to be established; examples of how to do this are provided in Box 5.1.

5.2 TB infection control

TB infection control is one of the key components of the second pillar of the End TB Strategy (Chapter 2) and is also one of the collaborative TB/HIV activities that falls under pillar one. The risk of TB transmission is high in health-care and other congregate settings. This puts health-care workers at greater risk of TB infection and disease, and nosocomial outbreaks of multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) among people living with HIV have been documented in the literature.[3,4]

TB infection control should be part of national infection

[1] Getahun H, Kittikraisak W, Heilig CM, Corbett EL, Ayles H, Cain KP et al. Development of a standardized screening rule for tuberculosis in people living with HIV in resource-constrained settings: individual participant data meta-analysis of observational studies. PLoS Med. 2011;8(1):e1000391 (http://www.ncbi.nlm.nih.gov/pubmed/21267059, accessed 30 August 2016).

[2] World Health Organization. Guidelines for intensified tuberculosis case-finding and isoniazid preventive therapy for people living with HIV in resource-constrained settings. Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/44472/1/9789241500708_eng.pdf, accessed 31 August 2016).

[3] 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.

[4] 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):1095–1102.

:: TABLE 5.3

Provision of TB preventive therapy to other at-risk populations in 2015,for selected low TB burden countries for which data could be reported[a]

	NUMBER OF INDIVIDUALS AMONG AT RISK POPULATIONS ELIGIBLE AND STARTED ON TB PREVENTIVE TREATMENT									
	AT-RISK POPULATIONS FOR WHICH THERE IS A STRONG RECOMMENDATION TO PROVIDE PREVENTIVE TREATMENT					AT-RISK POPULATIONS FOR WHICH THERE IS A CONDITIONAL RECOMMENDATION TO PROVIDE PREVENTIVE TREATMENT				
	ADULT CONTACTS OF TB CASES	PATIENTS INITIATING ANTI-TNF TREATMENT	PATIENTS RECEIVING DIALYSIS	PATIENTS PREPARING FOR ORGAN OR HAEMATOLOGICAL TRANSPLANTATION	PATIENTS WITH SILICOSIS	IMMIGRANTS FROM HIGH TB BURDEN COUNTRIES	HEALTH WORKERS	PRISONERS	HOMELESS PEOPLE	ILLICIT DRUG USERS
France	1 224	—	—	—	—	—	—	—	—	—
Japan	4 063	—	—	—	—	400	1785	—	20	—
Netherlands	595	—	—	—	—	10	17	—	—	—
Norway	30	35	3	0	0	327	—	—	—	—
Portugal	1 798	—	25	—	10	202	381	70	1	105
Republic of Korea	539	—	—	—	—	—	368	76	—	—
Slovakia	1 400	252	354	—	31	3	—	—	—	—

— indicates data not available.

[a] Data for France and Norway are for 2014.

prevention and control policy, and TB and HIV programmes at national and subnational level should provide managerial direction to implement TB infection control measures. In health-care facilities and congregate settings, a comprehensive set of infection control measures – comprising administrative, environmental and personal protection measures – should be implemented.[1] Periodic assessment of TB infection control in health-care facilities is essential to ensure that appropriate measures are in place.[2]

In the latest revision of WHO guidance on monitoring and evaluation of collaborative TB/HIV activities,[3] the risk of TB among health-care workers relative to the general adult population is an indicator recommended to measure the impact of TB infection control activities in health-care facilities. If effective TB infection 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 2015, 9977 TB cases among health-care workers were reported from 67 countries; China accounted for 30% of these cases and South Africa for 21%. The notification rate among health-care workers could be calculated for 46 of the 67 countries; it ranged from zero in Belize, Gambia, Haiti, Jordan and Marshall Islands to 1565 cases per 100 000 population in South Africa. 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 estimated size of the adult populations from the United Nations (UN) population division (2015 revision). The ratios of the TB notification rate among health-care workers to the rate in the general adult population are shown in **Fig. 5.3**. The ratio was above 2 in 16 countries, including South Africa. In the other four high TB/HIV burden countries for which the ratio could be calculated, the ratio was between 1 and 2 in three countries (Botswana, the Russian Federation and Zimbabwe) and below 1 in one country (China).

5.3 TB vaccination

There is a clear need for a vaccine that is more effective than BCG, especially to reduce the risk of infection with *Mycobacterium tuberculosis* and the risk of progression from infection to active TB disease in adults. Although there are 13 candidates in the TB vaccine pipeline, a new TB vaccine is not expected in the near future (**Chapter 8**).

BCG vaccination has been shown to prevent disseminated disease; this category includes TB meningitis and miliary TB, which are associated with high mortality in infants and young children. Currently, 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 BCG may be limited to neonates and infants in recognized high-risk groups, or to skin-test negative older children.

A summary of national policies on BCG vaccination[4] is

[1] World Health Organization. WHO policy on TB infection control in health-care facilities. Geneva: WHO; 2009 (http://apps.who.int/iris/bitstream/10665/44148/1/9789241598323_eng.pdf, accessed 31 August 2016).

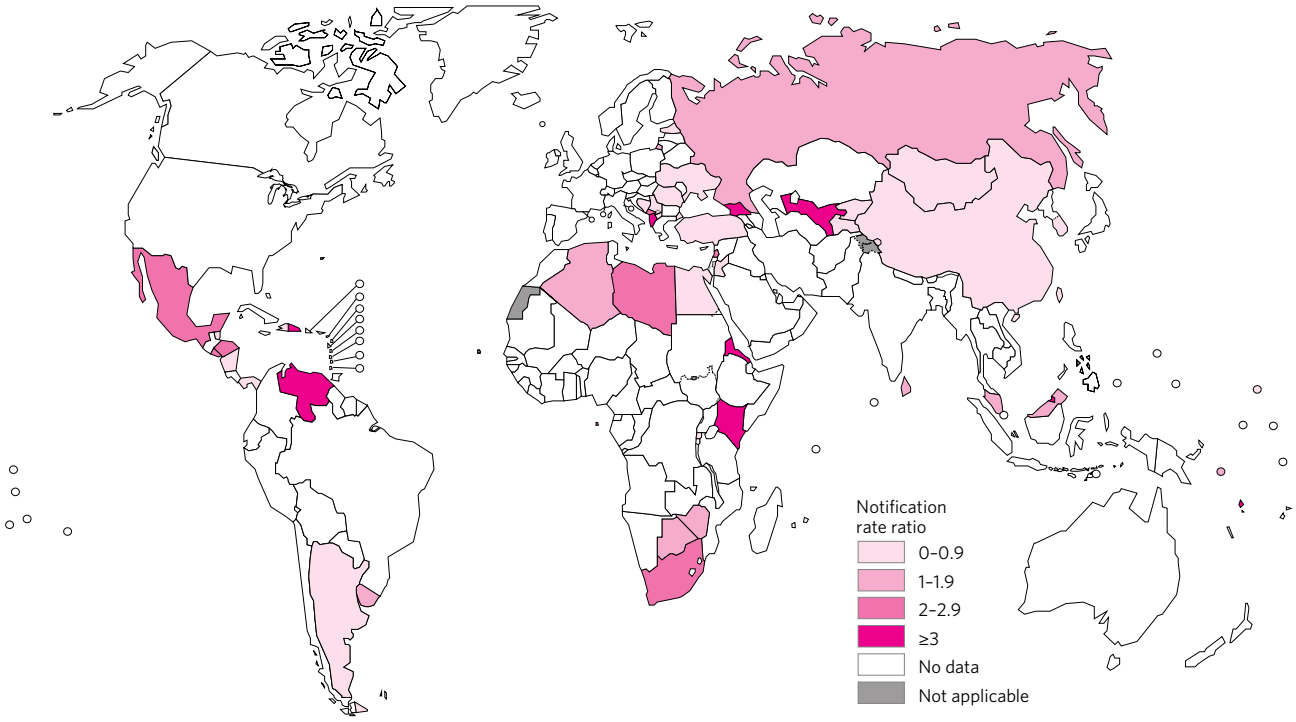
[2] World Health Organization. Checklist for Periodic Evaluation of TB Infection Controlin Health-Care Facilities. Geneva. WHO; 2015 (http://www.who.int/tb/areas-of-work/preventive-care/checklist_for_periodic_evaluation_of_tb_infection_control_in_health_facilities.pdf, accessed 16 September 2016).

[3] World Health Organization. A guide to monitoring and evaluation for collaborative TB/HIV activities: 2015 revision. Geneva: WHO; 2015 (http://www.who.int/tb/publications/monitoring-evaluation-collaborative-tb-hiv/en/, accessed 31 August 2016).

[4] Zwerling A, Behr MA, Verma A, Brewer TF, Menzies D, Pai M. The BCG World Atlas: a database of global BCG vaccination policies and practices. PLoS Medicine. 2011;8(3):e1001012.

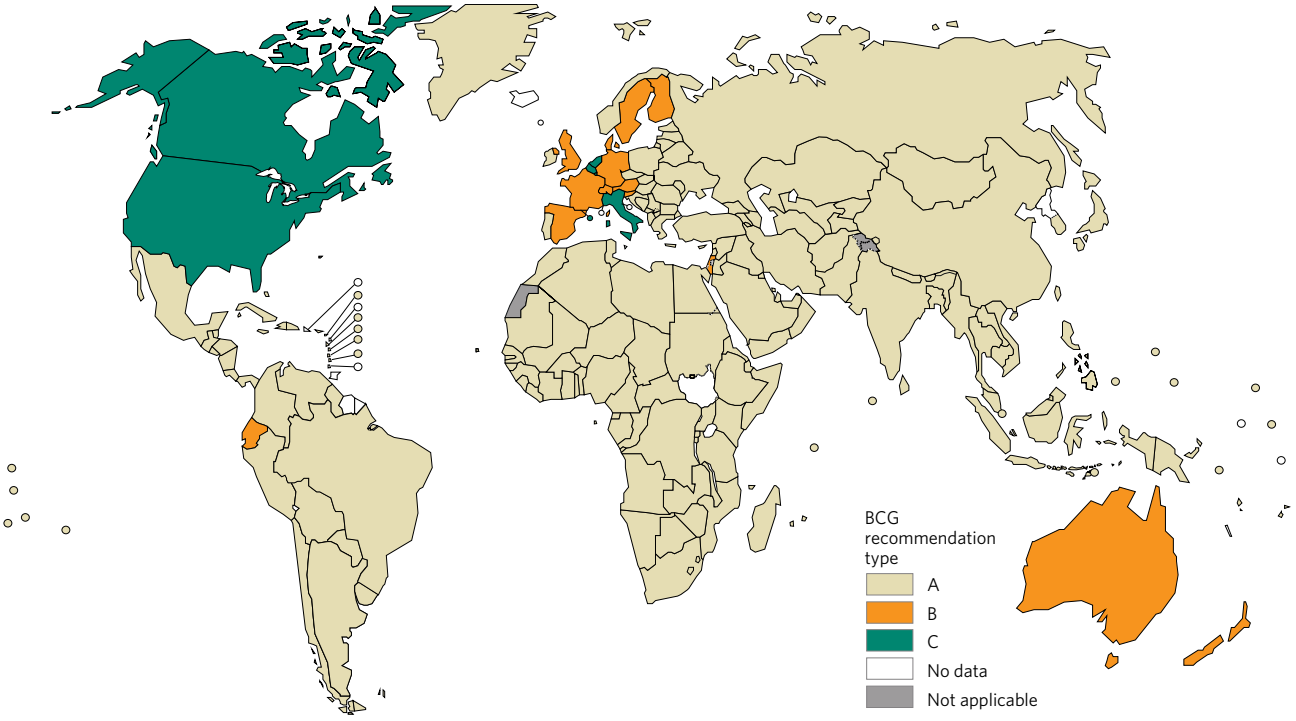
:: FIG. 5.3

Notification rate ratio of TB among healthcare workers compared with the general adult population, 2015



:: FIG. 5.4

BCG vaccination policy by country

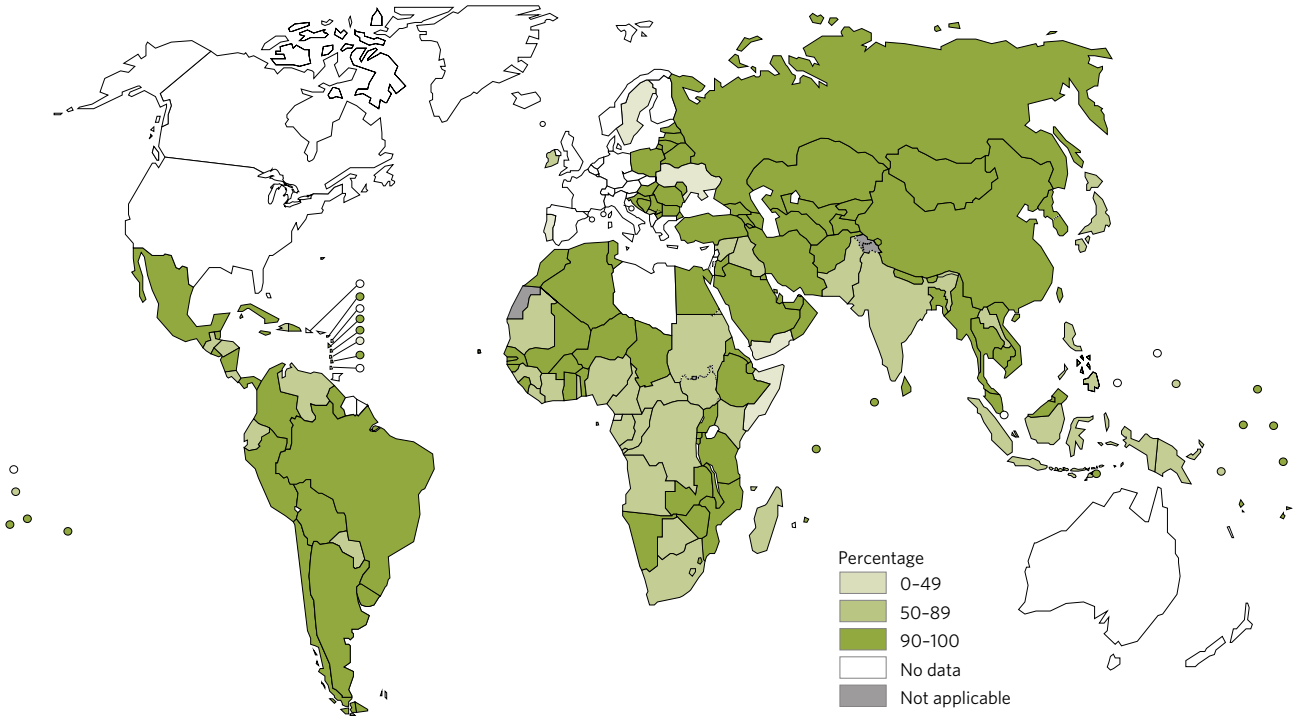


A. The country currently has a universal BCG vaccination programme.
B. The country used to recommend BCG vaccination for everyone, but currently does not.
C. The country never had universal BCG vaccination programmes.

Source: Zwerling A, Behr MA, Verma A, Brewer TF, Menzies D, Pai M. The BCG World Atlas: A database of Global BCG Vaccination Policies and Practices. PLoS Med. 2011 Mar;8(3):e1001012. http://dx.doi.org/10.1371/journal.pmed.1001012. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium.

:: FIG. 5.5

Coverage of BCG vaccination, 2015[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.

shown in **Fig. 5.4**. Among 180 countries for which data were collected, 157 recommended universal BCG vaccination; the remaining countries had policies of selective vaccination for at-risk individuals in high-risk groups.

The latest data on BCG coverage[1] (for 2015) are shown in **Fig. 5.5**. In the 163 countries that reported data, 102 reported coverage of above 90%. Among the 30 high TB burden countries, coverage ranged from 56% in the Central African Republic to 99% in Bangladesh, Brazil, Cambodia, China, Thailand and the United Republic of Tanzania. A further 16 of these countries reported coverage of at least 90%. Coverage was below 80% in seven of the high TB burden countries: Angola, Central African Republic, Kenya, Lesotho, Liberia, Nigeria and Papua New Guinea.

[1] http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tscoveragebcg.html

Chapter 6 :: Universal health coverage, social protection and addressing social determinants: Implications for TB

KEY FACTS AND MESSAGES

Progress towards universal health coverage (UHC) is essential for all of the health-related Sustainable Development Goals (SDGs), including ending the tuberculosis (TB) epidemic. UHC is also closely aligned with the goal of ending poverty.

Two regularly monitored UHC financing indicators reveal the health financing conditions that must change in many of the highest TB burden countries to enable UHC and meet the ambitious milestones on route to end TB. These are total government spending on health as a proportion of gross domestic product (GDP) and out-of-pocket (OOP) expenditures as a share of total health expenditures. In 2014, government expenditures on health were less than the WHO benchmark of at least 6% in 150 of 191 countries (79%) for which data were available. OOP expenditures represented over 45% of overall health expenditures in 46 countries in 2014, including 11 of the 30 highest TB burden countries.

There are opportunities for improving TB service coverage as part of wider efforts, and examples are highlighted in this chapter, including:

- In some high TB burden settings, emerging UHC health financing schemes, including national health insurance, could lead to major reductions in OOP expenditures in low-income populations. Models need to explicitly include support for TB care and public health functions, and to address administrative and financing constraints that may otherwise hinder the impact of these schemes. More analysis is needed to inform their design and implementation but Thailand as well as countries in the Region of the Americas are good pathfinders.
- In Asia, building on established approaches to private provider engagement in TB care could help to address the burgeoning private sector in health-care delivery. This includes a combination of provider incentives and regulation, and application of innovative institutional intermediaries and communications technologies. Such levers can help to assure the quality of services provided.
- In the context of humanitarian emergencies and post-emergency system rebuilding, such as in the Eastern Mediterranean and sub-Saharan Africa, drug-supply coordination and cross-programme use of common laboratory technology are enabling access to TB and MDR-TB care and prevention.
- In Europe, modification of health system incentives is helping to improve patient-centred care, including by reducing costly hospitalization of patients with drug-susceptible TB and long stays for patients with MDR-TB, while expanding investments in outpatient care.

Social protection can be advanced through better models of care and social benefits. Many low- and middle-income countries have used international and community-level funds to finance social and economic support for TB and MDR-TB patients, but these support packages need to be better documented and evaluated. For overall impact and sustainability, using national social protection platforms is a priority.

The End TB Strategy includes a 2020 target to eliminate catastrophic costs for TB-affected households. WHO-recommended baseline national surveys are underway to assess the nature and severity of TB patient costs, and to improve service delivery and social protection accordingly. One country survey was conducted in 2015, eight began in 2016 and another ten are currently being planned for 2017–2018.

Ending TB and ending poverty are intertwined goals. Ministries of health, affected communities and partners can do more to use available evidence of the links in order to advocate for poverty elimination and action on related risk factors (e.g. noncommunicable disease prevention, food security, and housing).

This chapter aims to provide a tuberculosis (TB) perspective on what progress on universal health coverage (UHC) can mean for TB and for movement on other elements of the Sustainable Development Goal (SDG) agenda; for example, ending poverty, advancing social protection and reducing inequality.[1]

It covers six topics:

- the definition and dimensions of UHC (**Section 6.1**);
- monitoring progress towards UHC (**Section 6.2**);
- opportunities for UHC and specifically for those affected by TB that are provided by innovations in financing and systems (**Section 6.3**);
- harnessing the benefits of social protection platforms (**Section 6.4**);
- assessing total costs borne by TB patients and the related occurrence of catastrophic total costs due to TB (**Section 6.5**); and
- linking with poverty elimination efforts and action on other social determinants of TB (**Section 6.6**).

This chapter is in large part descriptive. It addresses some of the challenges faced as countries embark on new UHC-related policies and schemes; it also discusses the health financing, social protection and social development opportunities that TB programmes and affected communities can build on in their efforts to end TB. Country experiences and epidemiological, policy and operational research inform the discussion.

6.1 Definition of universal health coverage

To achieve all of the health-related SDGs, WHO promotes the need for accelerated progress towards SDG Target 3.8 i.e. UHC by 2030 (see also **Box 2.2** in **Chapter 2**). According to WHO and the World Bank, "UHC means all people receiving the health services they need, including health initiatives designed to promote better health, prevent illness, and to provide treatment, rehabilitation, and palliative care of sufficient quality to be effective, while at the same time ensuring that the use of these services does not expose the user to financial hardship".[2]

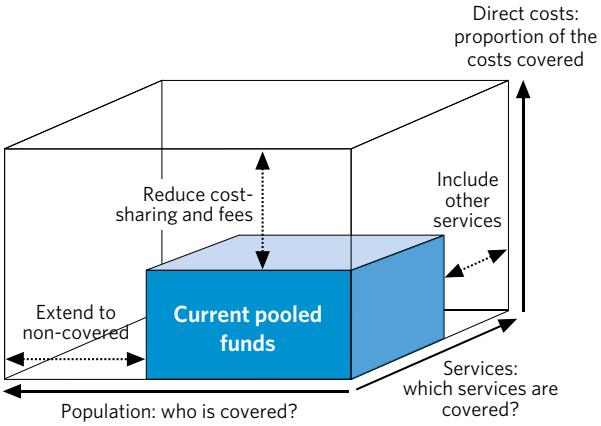
UHC is a hugely ambitious aim and so far no country has fully achieved it; nevertheless, many countries have shown that dramatic gains are possible in low-, middle- and high-income settings. Furthermore, global health security depends on a commitment to UHC. As noted recently by Dr Margaret Chan, Director-General of WHO, "Well-functioning health systems that cover entire populations are now regarded as the first line of defence against the threat from emerging and re-emerging diseases".[3]

Ending the global TB epidemic and resolving the multidrug-resistant TB (MDR-TB) crisis depend on major movement towards UHC before 2025. There is no rationale for discussing universal coverage for interventions against one health challenge in isolation from the movement for UHC in general.

The dimensions of UHC efforts are reflected in the "UHC cube", which is shown in **Fig. 6.1**, and examples are given of how each dimension is relevant for serving those affected by TB.

- The first dimension is expanding pooled funding to enable coverage of more of the population (including, for example, specific groups who are especially vulnerable to poverty, ill-health or rights barriers). In TB, this can mean ensuring that the poorest communities and marginalized groups (e.g. migrants, ethnic minorities) are covered by available social or national health insurance schemes and have better physical or legal access to services.
- The second dimension is expanding the services in any essential package covered by pooled funding. For TB, this may mean covering the costs of initial consultations, X-rays, second-line drugs, treating adverse events, and management of comorbidities and TB sequelae. All these services are essential for effective TB care.
- The third dimension is increasing the share of individual direct costs of care covered by pooled funds. Surveys of TB patient costs suggest that in many settings the financial burden is significant (on average equivalent to 50% of annual income), about half of which is incurred when using non-TB specific services in the public and/

:: FIG. 6.1
Three dimensions to consider when moving towards universal health coverage



Source: WHO. The world health report: health systems financing: the path to universal coverage. Geneva: World Health Organization, 2010.

[1] United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. New York: UN; 2015 (https://sustainabledevelopment.un.org/post2015/transformingourworld/publication, accessed 5 September 2016).

[2] World Health Organization/World Bank. Tracking universal health coverage: first global monitoring report. Geneva: WHO; 2015 (http://www.who.int/healthinfo/universal_health_coverage/report/2015/en/, accessed 5 September 2016).

[3] Chan M. Keynote address at a high-level side event on universal health coverage in Africa at TICAD (Tokyo International Conference for African Development). (http://www.who.int/dg/speeches/2016/universal-health-africa/en/, accessed 5 September 2016).

or private sector, before TB diagnosis is made and TB treatment starts.[1]

UHC efforts across all three dimensions could improve overall primary care service access and rapidly reduce the cost burden faced by patients.

6.2 Monitoring progress on universal health coverage

WHO and the World Bank have jointly proposed core indicators for monitoring progress towards UHC, addressing service access, health financing and financial protection.[2]

For measuring access, *effective TB treatment coverage* is among the proposed eight core service-access indicators that can be regularly monitored as "tracers" for overall UHC. *Effective TB treatment coverage* is defined as notifications, divided by incidence, multiplied by the treatment success rate.[3]

For *health financing*, UHC calls for the absolute level of funding for health care to be sufficient to ensure that it is possible to provide essential health services to the whole population. In addition, the costs of using those services, once available, must not be prohibitive (i.e. using them should not result in financial hardship). The three health financing indicators proposed for annual monitoring of progress towards UHC are:

- **Total government spending on health as a proportion of gross domestic product (GDP)** – the suggested benchmark is at least 6%.[4,5]
- **Government health spending per capita in low-income countries** – the suggested benchmark in the Millennium Development Goal (MDG) era was US$ 86 (in 2012 prices).[2,4] A new benchmark for SDG-related health interventions for low and upper middle income countries will soon be recommended by WHO.
- **Out-of-pocket (OOP) expenditures as a proportion of total health expenditures** – the suggested benchmark is at most 15%.[6] The level of OOP payments provides a proxy measure of the degree to which people lack financial protection.[7]

Country reporting against these three indicators is available in the WHO Global Health Expenditure Database.[8]

Two other indicators for assessing *financial protection* are proposed for periodic monitoring through population-based surveys:

- The proportion of households experiencing **catastrophic health expenditures**. This occurs when household OOP expenditures crowd out consumption of other necessary goods and services. Catastrophic health expenditures are defined as health-care expenditures that exceed a given fraction of the household's expenditure. The fraction used by WHO and the World Bank is currently 25%.
- The proportion of people experiencing **impoverishing expenditures**, defined as the extent to which OOP expenditures push people into poverty, given a predefined "poverty line". Accepted poverty lines vary. The international poverty line used by the World Bank uses the consumption indicator of US$ 1.50 or US$ 2.00 per day per capita at purchasing power parity. WHO uses a relative poverty line, based on a subsistence level of food expenditure.

Fig. 6.2, Fig. 6.3 and Fig. 6.4 provide an indication of where the 30 high TB burden countries stand in relation to three of the core health financing indicators described above.

Fig. 6.2 shows the latest data (for 2014) on government health expenditures (GHE).[9] GHE were less than 6% of GDP in most countries (150/191, 79%). In only 41 countries did GHE exceed 6% of GDP. Of these countries, only six are low or lower-middle income – Djibouti, Lesotho, Kiribati, Micronesia, Marshall Islands and Swaziland – and only one (Lesotho) is among the highest TB burden countries.

In 2014, government spending on health per capita was far below the suggested benchmark of US$ 86 per capita in all low-income countries (data not shown). Most countries spent less than US$ 20 per capita. The country that was closest to this benchmark was Senegal, which spent US$ 26 per capita.

In 2014, OOP expenditures were less than 15% of total health spending in 46 of the 190 countries for which data were available, including five of the 30 high TB burden countries: Mozambique, Namibia, Papua New Guinea, Thailand and South Africa (Fig. 6.3). There were 46 countries where OOP expenditures accounted for at least 45% of total health expenditures, including 11 high TB burden countries: Bangladesh, Cambodia, Central African Republic, India, Indonesia, Myanmar, Nigeria, Pakistan, Philippines, Russian Federation, Sierra Leone.

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1 Tanimura T, Jaramillo E, Weil D, Raviglione M, Lonnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. Eur Respir J. 2014;43(6):1763-1775 (https://www.ncbi.nlm.nih.gov/pubmed/24525439, accessed 5 September 2016).

2 World Health Organization/World Bank Group. Monitoring progress towards universal health coverage at country and global levels: framework, measures and targets (WHO/HIS/HIA/14). Geneva: WHO; 2014 (http://apps.who.int/iris/bitstream/10665/112824/1/WHO_HIS_HIA_14.1_eng.pdf, accessed 5 September 2016).

3 See reporting in: World Health Organization/World Bank Group. Tracking universal health coverage: First global monitoring report. Geneva: WHO, 2015.

4 World Health Organization. Health systems financing: the path to universal coverage: world health report 2010. Geneva: WHO; 2010 (http://www.who.int/whr/2010/en/, accessed 5 September 2016).

5 This figure is determined by a combination of revenue generation and prioritization of health within government expenditures.

6 Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. Health Affairs. 2007;26(4):972–983.

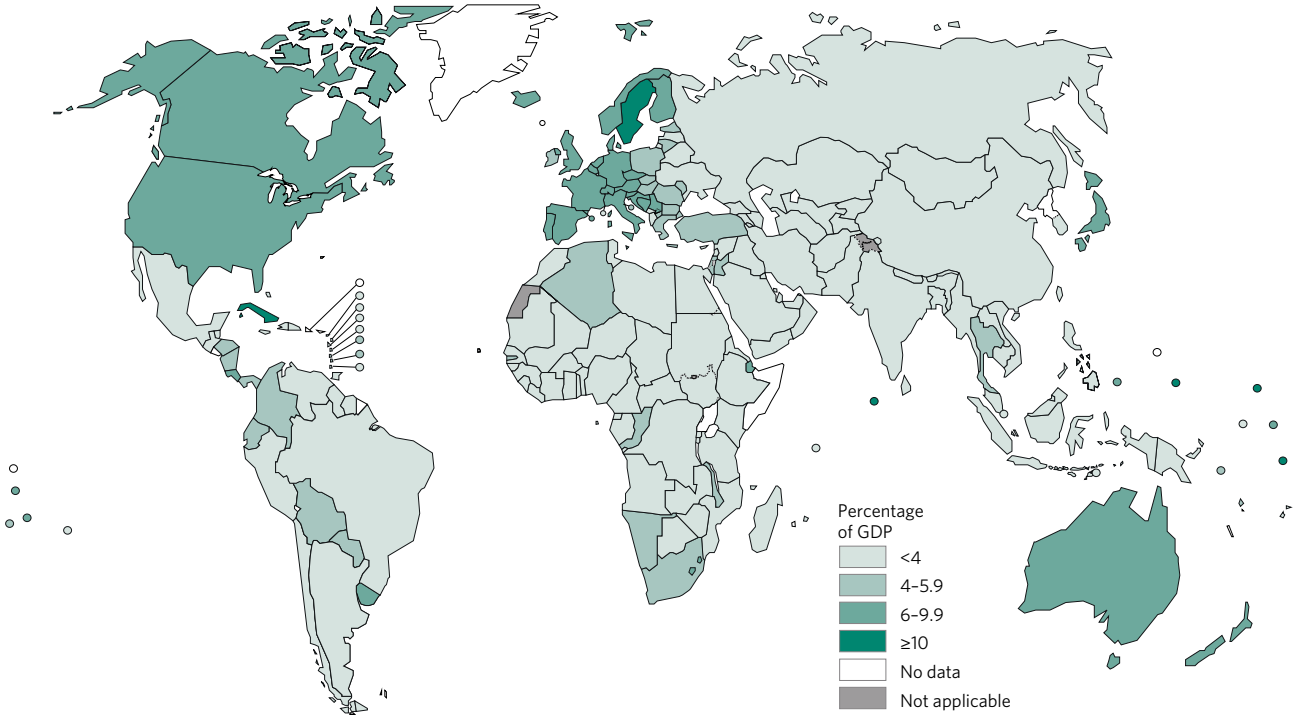
7 Note: OOP expenditures are defined as direct payments made to health-care providers by individuals at the time of health service use; therefore, they exclude prepayment.

8 http://apps.who.int/nha/database/Select/Indicators/en

9 WHO National health accounts database, accessed July 2016 via http://apps.who.int/nha/database

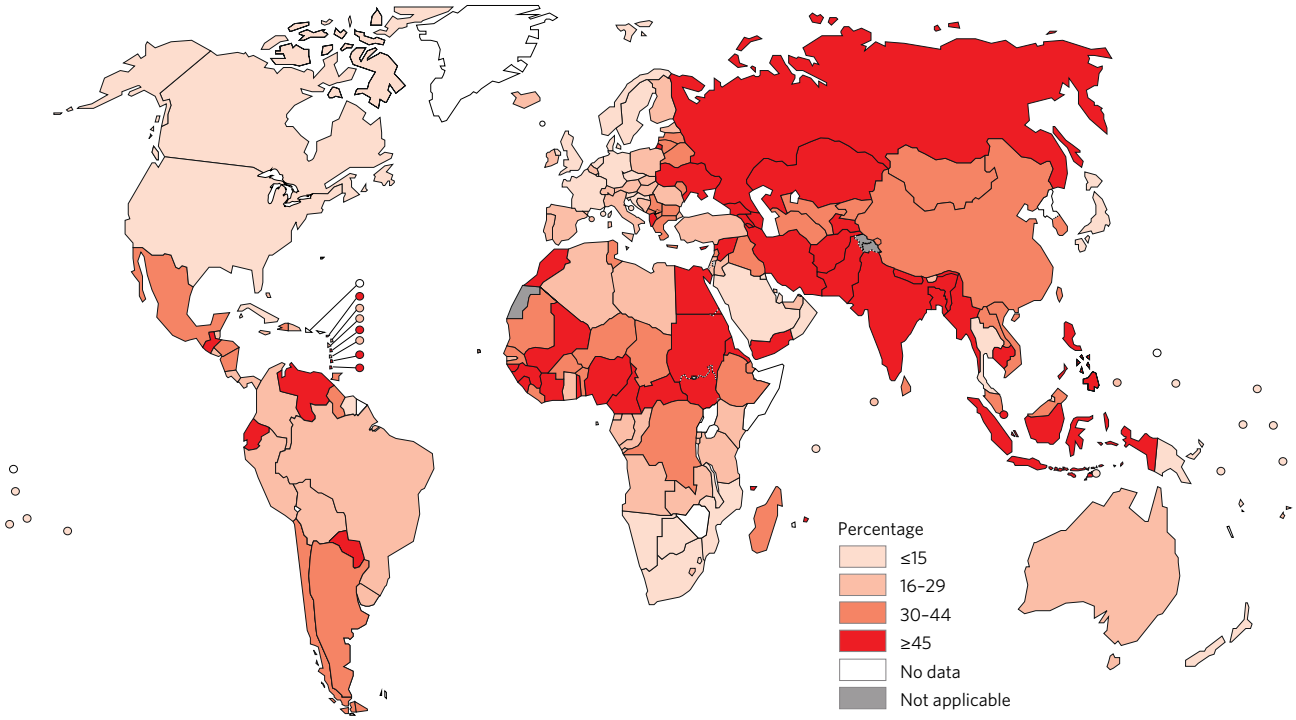
:: FIG. 6.2

Government spending on health, as a percentage of gross domestic product (GDP), 2014



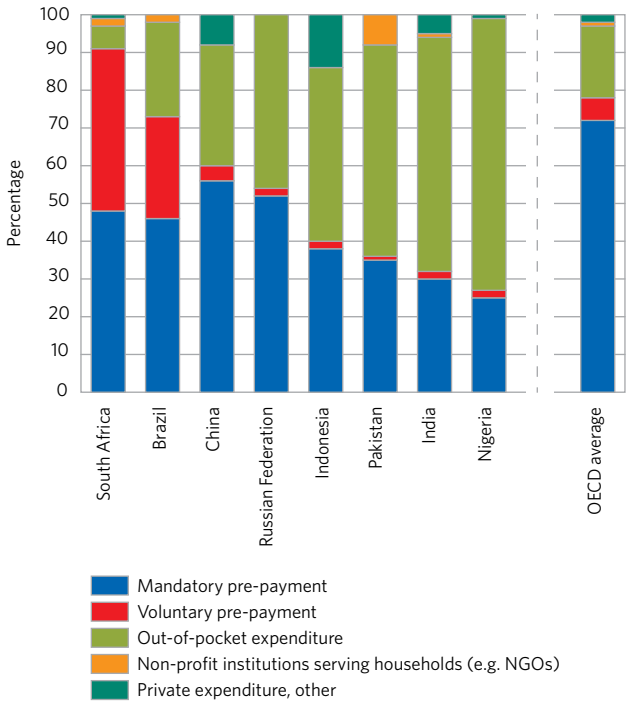
:: FIG. 6.3

Out-of-pocket expenditures as a percentage of total health expenditures, 2014



:: FIG. 6.4

Total health expenditures by source of financing in BRICS and other selected high TB burden countries, 2014[a]



[a] Countries are ordered according to the sum of mandatory and voluntary pre-payment.

Source: Data extracted from World Health Organisation's Global Health Expenditure Database (http://apps.who.int/nha/database/Key_indicators)

Fig. 6.4 provides the breakdown of total health expenditures by source of funding, including OOP expenditures, for BRICS (Brazil, Russian Federation, India, China, South Africa) and other high TB burden countries, relative to the average breakdown for countries that are members of the Organisation for Economic Co-operation and Development (OECD).[1] It suggests that most of the high TB burden countries have far to go in enabling substantial coverage of alternatives to OOP expenditures.

6.3 Innovations in domestic health financing and in health systems towards UHC

To dramatically reduce OOP expenditures and to more robustly fund health systems in general, mandatory pre-payment financing mechanisms (e.g. taxation, social or national health insurance schemes) need to form the core of domestic health financing.[2] An estimate of the additional financing needed in low- and middle-income countries to move towards levels of health coverage in higher income countries is US$ 30 billion between now and 2035, with US$ 21 billion of this sum to be derived from increased domestic resources and US$ 9 million proposed to come from international sources.[3] **Box 6.1** provides a sense of how some pathfinding low- and middle-income countries in Asia are moving to develop more robust financing systems, and especially to address coverage for poor people. The national health insurance experience of Thailand, as well as experiences in a range of Latin American countries,[4] provide good pathfinder examples of how to reach large shares of the population, including the poor, with health services free of catastrophic burden.

Beyond population-wide financing schemes, UHC means reaching those affected by TB, irrespective of where they seek care, including in the private sector. This requires a range of innovative demand- and supply-side approaches, as part of overall government stewardship of the health system as a whole. **Box 6.2** provides an overview of some of the innovations being applied in Asia to harness the significant scope of the private sector while also enabling better quality of care overall. Countries in several regions have developed and applied mandatory case notification systems to engage with public and private institutions, and with providers not previously collaborating actively with national TB efforts. China's well-established web-based communicable diseases notification system that incorporates TB has given a boost to TB case notifications from public hospitals. Similarly, NIKSHAY, India's recent web-based, case-based TB notification system has led to a remarkable increase in case notifications from the private sector. In many countries of the Americas, high levels of case notification are possible through relatively strong public and social security sectors in health care.[5]

To achieve UHC also requires enabling access for highly vulnerable populations. Target 1.5 of the SDGs is "by 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters".[6] In parts of the WHO Eastern Mediterranean Region, humanitarian emergencies brought on by civil unrest and war have led to large populations being internally displaced, and to a refugee crisis. Among the first steps towards regaining basic health service coverage, including TB care, has been securing adequate drug supplies and applying established good practices in screening, testing and care in emergencies. WHO and partners, including the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund), the International

[1] Note: mandatory pre-payment refers to pre-payments required for individuals either by the government, the employer and/or the individual themselves.

[2] World Health Organisation. The World Health Report 2010. Health systems financing: the path to universal coverage. Geneva: World Health Organisation; 2010

[3] Jamison DT, Summers LH, Alleyne G, Arrow KJ, Berkley S, Binagwaho A et al. Global health 2035: a world converging within a generation. Lancet. 2013;382(9908):1898-1955 (https://www.ncbi.nlm.nih.gov/pubmed/24309475, accessed 5 September 2016)

[4] Atun R, Monteiro de Andrade LO, Aleida G. et al. Health-system reform and universal health coverage in Latin America. Lancet 2015. 385(994): 1230-1247.

[5] Uplekar M, Atre S, Wells W, Weil D, et al. Mandatory TB case notification in high TB-incidence countries: policy and practice. Eur Respir J. 2016.

[6] United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. New York: UN; 2015 (https://sustainabledevelopment.un.org/post2015/transformingourworld/publication, accessed 5 September 2016).

:: Box 6.1

Implications for TB of evolving health financing schemes in selected Asian high TB burden countries

Innovative health financing schemes towards UHC, be they national health insurance (NHI) or other models, can potentially have profound and positive benefits for extending access to high quality health care to all those in need, including those affected by TB. This box provides some examples of the schemes and the main issues in assuring financing and coverage for TB and other services in selected high TB burden countries in Asia.

Indonesia is making strides towards UHC under its NHI programme or Jaminan Kesehatan Nasional (JKN), which was launched in 2014. The system is financed by premiums paid by employers, the employee and, for those with a low income, the national government. Beneficiaries can access a package of health services through public and selected private health-care providers, who are paid by capitation for primary health-care services and by reimbursement based on disease classification for hospital care. TB services covered include diagnosis and treatment services for drug-susceptible TB. In addition to the insurance scheme, there is also substantial budget-line support, including first-line TB drugs financed by the central government, and second-line drugs financed primarily by the Global Fund. High demand and costs, particularly in higher- level facilities, are challenging sustainability. Therefore, the government is in the process of reviewing the benefits package, including through cost–effectiveness analysis. The NTP is working with JKN, via Indonesia's Centre for Health Financing and Health Security, to create TB service provision guidelines and monitoring tools for JKN. The government has announced its intention to shift financing of TB care and prevention to the NHI scheme, which is likely to lead to changes in access to TB medications and services. The mechanisms for financing public health functions are also in flux. A significant proportion of TB patients in Indonesia are treated in the private sector, and JKN may enable further leverage in promoting notification and quality care. By increasing investment in primary care, JKN may help to defray pre-TB diagnostic costs for patients.[a]

The Philippines is committed to achieving UHC via investment in PhilHealth, the country's NHI programme. The scheme is financed by government revenue and per capita premium payments, for which the government subsidizes the contribution for those identified by local governments as indigent. Local government units have a supplementary mechanism, whereby the units aggregate additional funds to finance local service delivery operations. TB services (hospitalization, first-line drugs, and consultations) are provided free of charge by PhilHealth to patients served by accredited providers. The programme is particularly important in encouraging private practitioners and institutions to provide standardized TB care. A series of operational challenges persist with PhilHealth. For example:

- not all patients are educated about the PhilHealth benefits or the locations of PhilHealth-accredited facilities;
- not all providers are in the PhilHealth system due to the complex accreditation system;
- reimbursement processes can impede interest of providers to pursue the accreditation process; and
- currently, MDR-TB is not included in the benefits package but an expansion of the programme is being formulated.

Under the updated National Strategic Plan for the NTP, measures are proposed to resolve several of these bottlenecks.[b]

Viet Nam is expanding its social health insurance (SHI) system with the aim of achieving universal coverage by 2020. The scheme is financed by a combination of national revenue and employer–employee contributions. The government tax revenue subsidizes the premium for the poor and for ethnic minorities, with partial subsidies for the near-poor and students. Since May 2016, under the SHI, latent TB infection, TB diagnosis and treatment services are covered by the government, although users contribute a co-payment that ranges from 0% to 20%. The NTP has plans to establish a foundation that can cover co-payment of TB patients and the premium for TB patients who do not yet have a health insurance card. One area of concern is drug supply, which will shift under SHI financing. Currently, first-line TB drugs have been financed and distributed by the central government, and second-line TB drugs by the Global Fund. The NTP is now working with counterparts within the Ministry of Health and the SHI agency to ensure that financing is secure from central SHI resources, to maintain a full supply of quality-assured drugs to TB patients.[c]

Thailand has a robust and progressive NHI scheme in place. There are three schemes for Thai nationals: the Universal Coverage Scheme (UCS), the Social Security Scheme and the Civil Servants Medical Benefit Scheme. These schemes cover 99% of the Thai population. In 2013, the Ministry of Public Health initiated a scheme for migrants not covered under the social security scheme and, by the end of 2015, nearly 1.45 million migrants could purchase subsidized health insurance. The UCS currently covers about 75% of the Thai population. It is entirely tax-revenue financed, and is administered by the National Health Security Office (NHSO), an independent government agency that purchases and reimburses services. The Ministry of Public Health provides the quality standards, public health functions and consolidation of case reporting. Financing for TB services is channelled through the TB Fund within the NHSO. UCS provides free first-line and second-line TB and MDR-TB treatment, molecular diagnostics for certain groups and resistance monitoring. Overall, coverage for TB services appears to be high, with additional UHC efforts under way to cover previously uncovered populations, such as migrants – an important risk group for TB. The NHSO and NTP are in the process of addressing gaps and discrepancies in TB information flow by harmonizing systems. Improved information will enable further review of the quality of TB care provided.[d]

Continued

Box 6.1 continued

China has NHI schemes that are estimated to reach 95% of the population. The Basic Medical Insurance scheme is co-financed by government revenue and per capita premium payments. Under recent health-care reforms, China is moving towards a mixed source funding mechanism, whereby funds from multiple levels of government, individual beneficiaries and social assistance programmes will be pooled to improve financial sustainability. At the same time, reforms have altered the delivery model for TB care. Patients will no longer access care from TB dispensaries, and state-owned hospitals will be the primary TB service providers. Basic TB care in these hospitals is technically free, but a complicated reimbursement mechanism combined with benefit package limitations may result in high costs for drug-sensitive TB services.[e]

Enabling or expanding financing for MDR-TB treatment is among the ongoing challenges under all of the evolving schemes above.[f]

[a] Sources: Harimurti, Pandu; Pambudi, Eko; Pigazzini, Anna; Tandon, Ajay. 2013. The nuts and bolts of Jamkesmas – Indonesia's government-financed health coverage program for the poor and near-poor. Universal Health Coverage (UNICO) studies series; no 8. Washington D.C.: The Worldbank. http://documents.worldbank.org/curated/en/430821468044119982/The-nuts-and-bolts-of-Jamkesmas-Indonesias-government-financed-health-coverage-program-for-the-poor-and-near-poor. Mukti, A. G., D. Mustikawati, D. Collins, F. Hafi, B. Setyaningsih, and H. Utami. Policy Options and Levers for Financing TB Services in Indonesia. USAID TB CARE I, 2013.

[b] Sources: Chakraborty, Sarbani. 2013. Philippines government sponsored health coverage program for poor households. Universal Health Coverage (UNICO) studies series; no. 22. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/812011468092964098/Philippines-government-sponsored-health-coverage-program-for-poor-households. Holohan, M., F. Luelmo, R. Morfe, T. Ryan, and M. Voniatis. USAID/Philippines: External Evaluation of the Tuberculosis Portfolio (2006-2011). Report No. 12-01-041. USAID, 2012.Smith-Arthur A, Kak N, Matji R (2013) Synthesis report: inclusion of TB in national insurance programs. http://tbcare2.org/sites/tbcare2.org/files/Synthesis%20Report%20on%20Country%20%20Assessments%20on%20TB%20Insurance%20Study%20TB%20CARE%20II%20Final.pdf

[c] Sources: Kashi Barbara Carasso, Grace Chee, Altea Cico, Duong Hoang Quyen, Phan Cam Tu, Alexei Sitruk. August 2014. Options for Integrating Procurement and Supply Chain Systems for ARVs, Methadone, and anti-Tuberculosis Drugs in Vietnam. Bethesda, MD: Health Finance & Governance Project, Abt Associates Inc.

[d] Sources: Guinto RLLR Curran UZ, Suphanchaimat, R, Pocock, NS. (2015). Universal health coverage in "One ASEAN": are migrants included? Global Health Action, 8, 10.3402/gha.v8.25749. http://doi.org/10.3402/gha.v8.25749. Hanvoravongchai, Piya. 2013. Thailand – Health financing reform in Thailand : toward universal coverage under fiscal constraints. UNICO study series ; no. 20. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/476621468132279566/Thailand-Health-financing-reform-in-Thailand-toward-universal-coverage-under-fiscal-constraints.

[e] Sources: Yu H. "Universal Health Insurance Coverage for 1.3 Billion People: What Accounts for China's Success?" Health Policy 119.9 (2015): 1145-152. Korolev, Alexander, China's Healthcare: Developing a Universal Coverage Plan (January 27, 2013). Far Eastern Affairs. No. 1, 2012, pp. 45-76. Ministry of Health (2011) National Tuberculosis Control Programme (2011–2015). and Wei X, Yin J, Zou G et al. "Patient Care Pathways under the Model of Integrating Tuberculosis Service with General Hospitals in China." Trop Med Int Health Tropical Medicine & International Health 18.11 (2013): 1392-399. Pan Y, Chen S, Chen M, et al. Disparity in reimbursement for tuberculosis care among different health insurance schemes: evidence from three counties in Central China. Infectious Diseases of Poverty Infect Dis Poverty 5.1 (2016): 1-9.

[f] See also: TB CARE II (2015) Exploring the promise of improving access and delivery of TB services through insurance-based financing reforms: Meeting report. http://tbcare2.org/sites/default/files/Bangkok%20Meeting%20Report%20415.pdf

Organization of Migration, the United Nations High Commission for Refugees and other organizations are supporting TB efforts in countries facing these emergencies, and collaborating with countries receiving migrants and refugees. New technical assistance, evidence generation, guidance and coordination mechanisms are emerging.[1,2,3]

Recently, the Ebola epidemic took an enormous toll in three countries in West Africa – Guinea, Liberia and Sierra Leone – all of which were still recovering from conflicts. The economic, social and health repercussions were severe. The TB response was affected, along with many public health priorities. Now, all three countries are using the opportunities that have come with broader investment in post-Ebola health systems and a focus on public health functions. **Box 6.3** provides some examples related to extending TB diagnostic capacity.

In middle-income countries, UHC progress and better disease control often depend on reforming well-established health system institutions, management and financing mechanisms. **Box 6.4** offers an example of the ramifications of health financing approaches, specifically in Central and Eastern Europe, for patient care and cost burdens overall. It also highlights efforts underway through research, policy dialogue and collaboration to overcome the bottlenecks.

6.4 Harnessing the benefits available with social protection platforms

As has been well documented, and advocated for in the SDGs and the End TB Strategy, social protection can contribute to ending poverty and ending disease epidemics, including those of TB and HIV. Action for UHC is in itself a major lever for social protection. Ecological analysis suggests that there is an inverse association between government investment in social protection and national TB incidence in countries worldwide.[4]

There are varying institutional definitions of social protection, but the broad concepts are clear. Social protection represents a system of policies and programmes that seek to reduce poverty and support

[1] The Global Fund to Fight AIDS, TB and Malaria. The challenging operating environments policy, GF/B35/03. The Global Fund; 2016.

[2] World Health Organization. Tuberculosis control in complex emergencies. WHO Regional Office for the Eastern Mediterranean; 2015 (http://applications.emro.who.int/dsaf/EMROPUB_2015_EN_1913.pdf, accessed 5 September 2016).

[3] World Health Organization. Interregional workshop for tuberculosis control and care among refugees and migrant populations (2016). 10–11 May 2016. Catania, Italy. 2016(http://www.euro.who.int/en/health-topics/communicable-diseases/tuberculosis/publications/2016/interregional-workshop-for-tuberculosis-control-and-care-among-refugees-and-migrant-populations-2016, accessed 5 September 2016.

[4] Siroka A, Ponce NA, Lonnroth K. Association between spending on social protection and tuberculosis burden: a global analysis. Lancet Infect Dis. 2016;16(4):473–479.

:: Box 6.2
Innovations in engaging private care providers in Asia

For a large proportion of people with TB in Asia, the pathway to care begins with a visit to a neighbourhood private practitioner. In scaling up engagement of all care providers through public–private mix (PPM) approaches, working with numerous formal and informal, weakly organized and poorly regulated private practitioners is both demanding and resource intensive for NTPs (see **Table 4.2** in **Chapter 4**). Intermediary organizations in high TB-incidence countries in Asia have worked with NTPs to address collaboration with private practitioners by developing and implementing innovative models of engagement. The results are impressive; some have been published and some presented in a recent meeting of the global PPM Working Group. In the social franchising model in Myanmar, which was designed, implemented and scaled up with the assistance of an international NGO, franchisee practitioners use integrated service delivery to contribute 15% of all TB cases notified in the country while also achieving high treatment success rates that are comparable to those reported by public sector health centres (see **Box 4.2**). Social franchising for TB care provision has been as successful in other settings as it is for reproductive health and other public health programmes.[a]

Breaking away from the traditional methods, the social business models developed and implemented by another international NGO in Bangladesh and Pakistan incorporate active screening for TB in private clinics, private hospitals and laboratories, while also providing access to new rapid diagnostic tests at subsidized or no cost for TB patients in private clinics. TB screening in private clinics in the megacity of Karachi doubled the case notifications from the city in a year; also, over 2000 additional TB cases were detected by the project site in Dhaka in a year. In further advancing the model, simultaneous screening for lung health and diabetes in private clinics was later added as a part of the package.[c] Use of digital tools has helped significantly in facilitating project operations and in ensuring adherence to recommended routines by both providers and patients in private clinics.[c]

"Private provider interface agency" models are being implemented by an international NGO in close collaboration with the NTP and the local TB programmes in three cities in India (Mehsana, Mumbai and Patna). These models have produced impressive results with a remarkably large yield of TB cases: nearly 2000 additional TB cases every month in Mumbai alone. The package of innovations that suits the ecosystems of private health care in the respective cities includes introduction of vouchers for free diagnosis and free drugs for patients in private clinics through linkages with private laboratories and pharmacies in the neighbourhoods, and tiered referrals to access these services. The projects ensure that all the essential tasks required to ensure quality TB care provision are accomplished through smart use of digital tools and technologies such as a call centre, mobile phones, electronic notifications and short text messages.[d] Another pioneering and innovative initiative in India has successfully fostered a partnership between private laboratories and manufacturers to support adoption of a low-price, high-volume model that improves access to new diagnostics and strengthens linkages between public and private sectors.[e]

[a] Beyeler N, York De La Cruz A, Montagu D. The impact of clinical social franchising on health services in low- and middle-income countries: a systematic review. PLoS One. 2013;8(4):e60669.

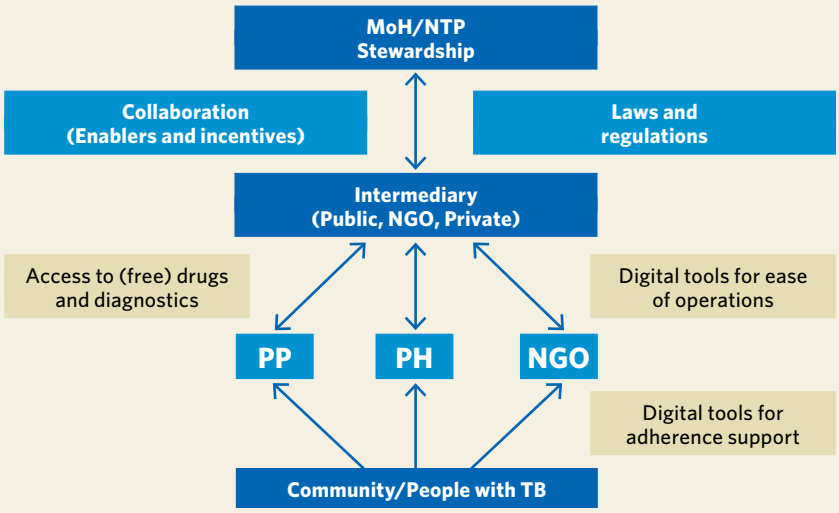
[b] Khan AJ, Khowaja S, Khan FS, Qazi F, Lotia I, Habib A, et al. Engaging the private sector to increase tuberculosis case detection: an impact evaluation study. Lancet Infect Dis. 2012;12(8):608–616.

[c] Khan A. Social enterprise models for lung health and diabetes screening and management in three Asian megacities. 2014;(http://www.stoptb.org/wg/gli/assets/documents/M6/Khan%20-%20Establishment%20of%20social%20business%20model.pdf, accessed 12 July 2016).

[d] Working with frontline private providers: innovations in scaling up collaboration and regulation . Report of eleventh global meeting on Public-Private mix for TB care and prevention 2016 (http://www.who.int/tb/areas-of-work/engaging-care-providers/11thGlobalPPMreport.pdf, accessed 12 July 2016).

[e] Clinton Health Access Initiative. Case study: catalyzing the market for accurate tuberculosis testing in India's extensive private sector through IPAQT. Boston: CHAI; 2016 (http://www.clintonhealthaccess.org/content/uploads/2016/06/Case-Study-India-IPAQT-June-2016.pdf, accessed 5 September 2016).

:: FIG. B6.2.1
Innovations in TB public-private mix (PPM) models



MoH: ministry of health; NTP: national tuberculosis programme; NGO: nongovernmental organization; PH: public hospital or private hospital; PP: private provider (formal, informal, pharmacy, laboratory)

:: Box 6.3

After Ebola: enhancing the capacity for TB and MDR-TB diagnosis

In 2015, some 29 809 TB cases were reported in the three post-Ebola West African countries: Guinea, Liberia and Sierra Leone. WHO estimates that Liberia and Sierra Leone are among the 10 countries with the highest TB rates per capita worldwide. Reported cases for the three countries represent only 42–60% of the estimated incident TB cases,[a] and population-based surveys are needed to improve estimates. With financing from the United States Agency for International Development (USAID) and from the Global Fund, WHO is supporting the strengthening of TB capacity accompanying other efforts to strengthen health systems.

During the Ebola outbreak, Guinea, Liberia and Sierra Leone all received support from partner agencies to introduce GeneXpert instruments for Ebola screening. As these countries transition from the outbreak response to routine disease surveillance, an opportunity has arisen for the integration of these instruments into the general laboratory network, including for testing for TB, rifampicin-resistant TB and HIV viral load. A review of the current placement of the machines will inform the best deployment to serve the multiple needs of the populations covered. The assessment is taking into consideration epidemiology, availability of other companion diagnostic tools, laboratory personnel and power supply. In all three countries, WHO is supporting the data managers of the TB programmes to map TB cases notified by prefecture or district, and to calculate needs for the rapid molecular diagnostic tool based on recommended diagnostic algorithms. The Foundation for Innovative New Diagnostics (FIND), a non-profit public–private partnership that helps to enable evidence generation and roll-out of new diagnostic tools, is providing training using the Global Laboratory Initiative-endorsed Xpert MTB/RIF training package.

Other health systems platforms that emerged in response to the Ebola outbreak can also improve timely TB diagnosis. For example, in 2015, the Ministry of Health and Social Welfare of Liberia invited Riders for Health (RfH), an NGO, to manage their fleet of 250 new vehicles and 200 new motorcycles donated during the Ebola outbreak. RfH offers transportation of medical samples to the nearest laboratory for testing. Planning is underway, with NTP and Global Fund financing, to enable transfer of sputum samples from anywhere in the country to Xpert MTB/RIF sites and the central TB laboratory.

[a] 42% estimated case detection coverage in Liberia, 55% in Guinea and 60% in Sierra Leone.

economic growth. Social protection can build resilience to risks and shocks, advance equity in assets and access to services, and improve economic and social opportunities.[1] The International Labour Organization coordinates efforts to promote social protection "floors"; that is, "nationally defined sets of basic social security guarantees that should ensure, at a minimum that, over the life cycle, all in need have access to essential health care and to basic income security which together secure effective access to goods and services defined as necessary at the national level".[2] The SDGs include a social protection target (Target 1.3), which is to "implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable".[3]

In TB care, patient economic support today may include (for at least some patients) cash transfers, food packages or nutritional support, toiletries or transport vouchers. Also, in fewer cases, it may include access to social benefits, sickness insurance or disability grants, and explicit protections of rights to work, housing and health-care access.

Both economic and nutritional support can be important for TB patients. Economic support is often critical as TB disease is strongly related to poverty, and seeking and staying in TB care can be impoverishing. Nutritional care is needed to improve nutritional recovery for those TB patients who are undernourished before and/or during TB treatment.[4]

Few TB patient support packages are well documented and evaluated. Improved design, management and evaluation may help, but stand-alone TB-specific approaches may be hard to sustain. For greater coverage and impact, making more use of developed or nascent national social protection platforms is a priority.[5] Review of documentation on cash transfer programmes by the WHO Global TB Programme suggests that at least 13 of the highest TB burden countries have experience with large-scale cash transfer schemes beyond TB,[6] although many such schemes still have financial and administrative constraints. **Table 6.1** illustrates the TB-specific and broader approaches available in some high TB burden countries.

With documentation from partners, WHO included pointers on effective social protection in *Implementing the*

1 World Bank. Managing risk, promoting growth: Developing systems for social protection in Africa. The World Bank's Africa Social Protection Strategy, 2012-2012. Washington: World Bank, June 2012.

2 International Labour Organization. World social protection report 2014/15: building economic recovery, inclusive development and social justice. Geneva: ILO; 2014 (http://www.ilo.org/global/research/global-reports/world-social-security-report/2014/WCMS_245201/lang--en/index.htm, accessed 6 September 2016).

3 United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. New York: UN; 2015. (https://sustainabledevelopment.un.org/post2015/transformingourworld/publication, accessed 5 September 2016).

4 World Health Organization. Nutritional care and support for people with tuberculosis. Geneva: WHO, 2013.

5 World Health Organization. Implementing the end TB strategy: the essentials. Geneva: WHO, 2015.

6 Brazil, China, Ethiopia, India, Indonesia, Kenya, Mozambique, Namibia, Nigeria, Pakistan, South Africa, Tanzania and Thailand.

:: Box 6.4

Reforming systems to expand people-centred outpatient care in high MDR-TB burden countries in Europe

MDR-TB poses a particular challenge in WHO's European Region, which has nine of the world's 30 high MDR-TB burden countries. For both patient-centered care and cost-effectiveness, TB care is best delivered in the community. Nevertheless, many of these high MDR-TB-burden countries still provide substantial inpatient care for patients with drug-susceptible and drug-resistant TB (see Fig. B6.4.1 and Fig. B6.4.2). Some historical systems of institutional staffing, payment and reimbursement created perverse incentives in many settings to hospitalize patients unnecessarily, or for much longer periods than required. These incentives often persist. Also, for lack of resources (and insufficient capacity), outpatient and primary care services have been ill-prepared to provide adequate TB and MDR-TB treatment and care. Major challenges to enable greater outpatient care include developing appropriate, country-specific TB care delivery models; creating sustainable financing mechanisms for TB care; ensuring adequate human resources; and providing social protection for TB patients. With technical support, many of these countries are increasing their efforts to reduce hospitalization rates by improving patient-centred outpatient services, decreasing the number of TB beds and the unnecessarily long duration of hospital stays, reallocating TB budgets accordingly, and reassigning staff in hospitals to overall pulmonary and primary health care.

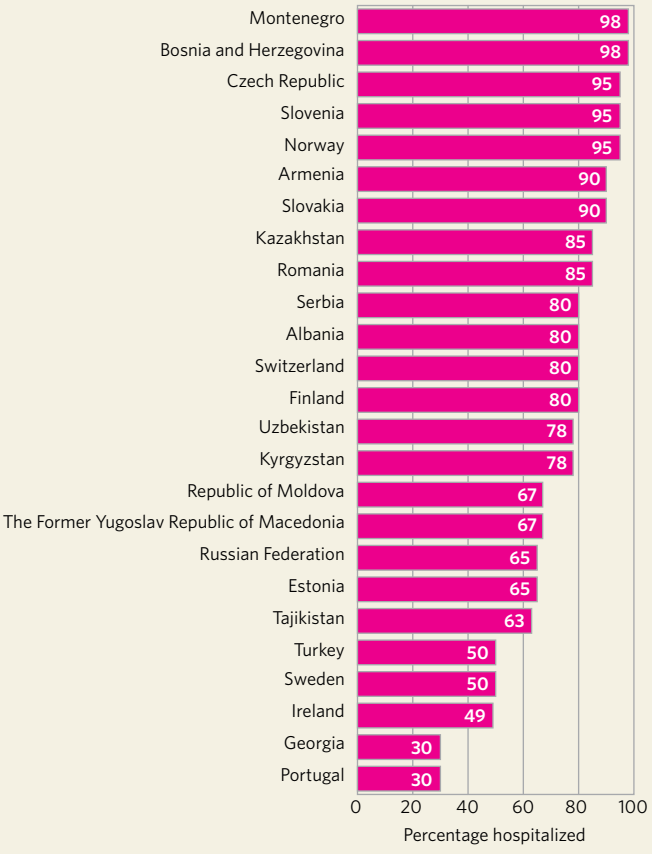
In a concerted effort to support countries to face their MDR-TB challenge and the necessary reform of systems, the Center for Health Policies and Studies (PAS) and the WHO Regional Office for Europe (EURO) conceived the Tuberculosis Regional Eastern European and Central Asian Project (TB-REP),[a] which is funded by the Global Fund. The aim of TB-REP is to use a systems-based approach to improve TB treatment outcomes and accelerate progress in ending the epidemic by removing health system barriers and scaling up health system reforms. The project complements country TB-specific and broader health reform efforts supported by

[a] http://www.pas.md/en/TBRep

Continued

:: FIG. B6.4.1

Hospitalization of drug-susceptible cases in the WHO European region, 2015[a]



[a] Countries for which data are available.

:: FIG. B6.4.2

Hospitalization of M/XDR-TB cases in the WHO European region, 2015[a]

[a] Countries for which data are available.

Box 6.4 continued

USAID, the World Bank and the German government-owned development bank, KfW, among others. It enables intercountry activities involving 11 eastern European and central Asian countries[b] for the coming four years. Among the aims are minimizing TB patient hospitalization rates and average lengths of hospital stay by shifting resources towards more people-centred care, including outpatient services, and supporting other cost-effective solutions to local challenges.

The countries involved in TB-REP will be supported by PAS, as principal recipient for the project, WHO/EURO and other partners, including the TB Europe Coalition, the European Respiratory Society, the London School of Economics and Political Science, the London School of Hygiene and Tropical Medicine, and the Stop TB Partnership. Work will include analytic reviews, documentation and adaptation of good practices, operational research, development of human resources for health, capacity-building, advocacy and civil society engagement.

[b] The 11 countries addressed in TB-REP are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

End TB Strategy: the essentials.[1] These pointers include assessing needs; building collaboration with social protection counterparts; determining clear terms of eligibility; making informed decision on interventions and level of support; enabling sustainable funding; and improving management, monitoring, evaluation and research. There is some consensus that MDR-TB patients and low-income or undernourished patients with drug-susceptible TB should probably have higher priority than other TB patients for social protection resources. WHO guidance on the role of nutritional care and support for TB patients suggests there is a need to more effectively differentiate nutritional need and economic needs in deciding on support.[2] Updated WHO TB treatment guidelines now in development include a review of the evidence to determine which patient support interventions have a documented impact on treatment outcomes. Their impact on the cost burden faced by patients will not be covered in this guidance.

In conclusion, social support for TB patients must become more efficient and sustainable. National TB programmes (NTPs), working with health and social sector partners and nongovernmental organizations (NGOs), can enable patient support to move from a project-based approach to a programmatic one, integrated with larger platforms. Good practices depend on context, but opportunities exist in many high TB burden countries to extend the reach, depth and impact of social protection for those in need and for TB prevention overall.

[1] World Health Organization. Implementing the End TB Strategy: the essentials. Geneva: WHO, 2015 (http://www.who.int/tb/publications/2015/end_tb_essential.pdf?ua=1, accessed 6 September 2016).

[2] World Health Organization. Guideline: nutritional care and support for patients with tuberculosis. Geneva: WHO; 2014 (http://apps.who.int/iris/bitstream/10665/94836/1/9789241506410_eng.pdf, accessed 5 September 2016).

6.5 Assessing the total costs borne by TB patients and determining the occurrence of catastrophic total costs due to TB

To inform policy and practices for improved social protection of TB patients and affected households, and to reach the 2020 target of eliminating catastrophic costs for TB TB-affected households,[3] WHO is supporting countries to design, implement and analyse TB patient cost surveys.

In 2015, the WHO Global TB Programme worked with a task force of experts to develop a field-testing version of a standardized methodology for this work, and produced a questionnaire and protocol for country adaptation.

The nationally representative patient surveys have both primary and secondary objectives. The primary objectives are:

- To document costs and identify the main cost drivers to inform policy.
- To monitor progress towards the End TB Strategy target that no (zero per cent) of TB-affected households face catastrophic total costs due to TB.

The secondary objectives are:

- To enable subgroup analyses (e.g. for drug-susceptible TB and MDR-TB separately, and analyses by socioeconomic status, sex, and location such as urban or rural).
- To determine the association between costs and treatment outcome (using routine cohort data).

A key indicator that can be derived from a survey is the proportion of patients with catastrophic total costs due to TB. This is defined for operational purposes as the number of TB patients (and their households) who experience catastrophic total costs divided by the number of all TB patients treated in the NTP network.

Catastrophic total costs is defined as total costs (indirect and direct combined) incurred during illness and treatment that exceed a given threshold (e.g. 20%) of the household's annual income. The numerator is the total direct and indirect costs incurred from the onset of symptoms to the end of TB treatment for the household, and the denominator is annual household income.

This TB-specific indicator of catastrophic total costs is distinct from the indicator that WHO uses to measure financial protection. WHO uses the share of the population incurring "catastrophic expenditures", which, as noted above, refers to OOP expenditures for health care (for all

[3] Lonnroth K, Glaziou P, Weil D, Floyd K, Uplekar M, Raviglione M. Beyond UHC: monitoring health and social protection coverage in the context of tuberculosis care and prevention. PLoS Med. 2014;11(9):e1001693 (https://www.ncbi.nlm.nih.gov/pubmed/25243782, accessed 5 September 2016).

:: TABLE 6.1

TB patient social support in selected high TB or MDR-TB burden countries, and potential linkages with broader social protection platforms

COUNTRY	INTERVENTIONS	CHALLENGES	MEASURES TAKEN TO IMPROVE EFFECTIVENESS	SOCIAL PROTECTION PLATFORMS
Belarus	In-kind food, transport and cash support to MDR-TB patients	Large MDR-TB patient population, many of whom have other social service needs (e.g. related to alcohol and drug use)	• Increased domestic budget for social support enables donor support transition • Linkage with NHI • Direct bank cash transfers and in-kind support • Transportation support for prisoner release liaison	Large scale: • NHI, sick leave and disability coverage, social services
Brazil	Food parcels and some discrete cash and transport support; targeted efforts for vulnerable groups	Resource constraints inhibit expansion; slow process to link formally with cash-transfer system	• NTP has prioritized the challenge • Documented link of improved TB treatment outcomes with cash transfers • Further research is under way • Institutional and parliamentary discussions on linking TB patients with cash-transfer programme	Large scale: • *Bolsa Familia* – cash transfer programme for women and children • Linkages with health services and education
India	Range of interventions from food and vouchers, small facility payments to patients, social welfare payment access, prepayment cards, etc.	Limited patient coverage, wide variability across states and localities on TB specific support packages, and weaknesses in administration; NGOs play a role but not formally linked	• Stated concern of government • Operational research studies documenting inputs and results • Sharing of state-specific experiences in TB patient cash transfers, nutrition and social service linkages • NGO engagement to help patients access benefits • Efforts to link online TB register to the national unique identifier system used for other major social programmes	Large scale: • Food support, including: — *Antyodaya Anna Yojana* — *Food Security Act* • Financial support: state-level and national-level initiatives • Disability and livelihood schemes
Kenya	Food packages, targeting undernourished MDR-TB patients; food support and some cash transfers; transport	Financing limits extension and level of patient support	• NTP priority • Assessment of nutritional status of patient cohorts, nutritional needs and district TB performance review • Linkage to national nutrition programme and external donors for more coverage of MDR-TB patients • Active link with national insurance subsidy programme	• *Vision 2030* – national development agenda • National social development policy and health sector services fund • National insurance subsidy programme • National nutrition programme
Myanmar	Food packages and/or cash transfers for TB/MDR-TB patients from major project financing; additional NGO and community contributions	Different sources funding different levels of food support, even within single health facilities; financing limits coverage	• Supportive donor community • NTP-led effort for standardization of food package levels and cash transfers for MDR-TB patients • Social protection included in new National TB Strategic Plan	• National social protection strategy and programme under development • UHC-oriented health policies including essential package of free services and service extension
Philippines	Food and transport support, especially for MDR-TB patients, and piloting of conditional cash transfer	Financing limits coverage and administrative bottlenecks, with variability in practice	• Patient support advocated for in new legislation • Donor support for related operational research • Active system for inclusion of patients with PhiHealth, and outreach to conditional cash-transfer programme	Large scale: • Bridging Program for the Filipino Family conditional cash transfer (*4Ps*) • *Listahanan* – register of families living in poverty • *PhilHealth* – NHI programme
South Africa	Food packages, or vouchers, and transport support for MDR-TB patients, other NGO and local area provided benefits; some disability grant and other grant recipients	Widely variable support elements for TB or MDR-TB patients in different states and facilities; variable application of disability grant access for hospitalized and needy ambulatory patients	• New collaboration across health, social development and benefits administration agency • Research and patient costing efforts • Enhancement of information on disability grants and other grants; strong opportunities for engagement with community organizations, and to expand TB linkages to range of social development • Additional domestic TB financing mobilized	Large scale: • *Child Support* grant • *Care Dependency* grant • *Disability* grant • *Social Relief of Distress* grant • *Workmen's Compensation Fund* • NHI in process
Various low-income countries – nutrition focus	Food packages, vouchers or cash provided by the WFP, often with financing from The Global Fund and sometimes linked as part of HIV-targeted food assistance	Variability in defining beneficiaries and in documentation; financial constraints and sustainability issues	Potential for: • improved use of WHO nutrition and TB care guidance; • improved assessment to determine beneficiaries; and • increased monitoring and evaluation, and engagement with national food or nutrition partners	National nutrition programmes vary in coverage – small scale in many low-income settings, except where supported by WFP, relief agencies, NGOs

The Global Fund, The Global Fund to Fight AIDS, Tuberculosis and Malaria; HIV, human immunodeficiency virus; MDR, multidrug resistant; NGO, nongovernmental organization; NHI, national health insurance; NTP, national TB programme; TB, tuberculosis; UHC, universal health coverage; WHO, World Health Organization; WFP, World Food Programme.
Sources: Operational documents of NTPs, Ministries of Health and social welfare and development ministries, The Global Fund, World Food Programme.

conditions) exceeding a given fraction of a household's total consumption. The "catastrophic expenditures" indicator focuses on the financial burden that households face from the payments that they make for health services for any of their members, and general household surveys are used to generate the data on all health-care spending and to compare OOP expenditures to overall household consumption. The "catastrophic total costs due to TB" indicator, on the other hand, is based on data from interviews with TB patients in health facilities. It captures the total economic burden, including payments for care (e.g. diagnostic and treatment services, and medicines), payments associated with care seeking (e.g. travel costs) and the "opportunity costs" associated with care seeking (e.g. lost income).

For these reasons, the TB-specific measures of "catastrophic total costs due to TB" are not comparable with the population-based "catastrophic expenditures" measure of financial protection referred to in **Section 6.2**. However, the TB-specific estimates of these costs are relevant to UHC because they offer the potential to provide useful information on the magnitude and nature of demand-side barriers to access care (take-up and completion), and can make an important contribution to the diagnosis of barriers to progress towards UHC.

Fig. 6.5 provides an overview of the status of planning and conduct of TB patient cost surveys following WHO recommendations. **Box 6.5** presents a summary of findings from a survey conducted in Myanmar.

6.6 Ending poverty and addressing other social determinants of TB

As shown in **Fig. 6.6**, there is a strong inverse association between GDP per capita and TB incidence.

The first goal of the SDGs is ending poverty in all its forms everywhere and it includes two targets for 2030.[1] The first (Target 1.1) is to eradicate extreme poverty for all people everywhere, currently measured as people living on less than US$ 1.25 a day. The second (Target 1.2) is to reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions, according to national definitions.

Societies that have experienced broad socioeconomic development have seen a substantial reduction in TB incidence and mortality rates. Poverty alleviation has historically contributed the most to the reduction in TB rates in countries that now have a low TB burden. However, economic growth alone is not a guarantee for a rapid decline in TB cases and deaths. Unequal wealth distribution, with large parts of the population are left behind, leaves fertile ground for a sustained TB burden.

Not all economic development is of benefit to the fight against TB. Industrialization with rapid urbanization increases population density and is often coupled with rapid growth of urban deprivation and overcrowded slums. Dramatic lifestyle changes in emerging economies – for example, increasing smoking and alcohol use, and changes in diet and exercise – can have a negative impact on TB rates via an increase in noncommunicable diseases that act as risk factors for TB. In most societies, the poorest are also the worst affected by these risk factors and diseases. Underfunded or poorly organized health systems are often not equipped to ensure equitable access to high-quality TB diagnosis and treatment. The poorest and most vulnerable groups face severe barriers to accessing diagnosis and treatment, and to staying in care. They also have a particularly high risk of suffering severe financial and social consequences as a result of TB, and may have the least access to any social protection mechanisms. Although poverty is a cause of TB, the disease is also a cause of poverty; this vicious circle plays out on individual, household and community level.

There is strong evidence of major direct social, medical and behavioural risk factors for TB, many of which are also closely linked to underlying poverty. **Table 6.2** provides a summary review of the population attributable fraction (PAF) for some TB risk factors with large population-level impact. The PAF is an estimate of the relative reduction in TB incidence that would result from the elimination of a given risk factor. PAF estimates can be used to more effectively advocate for the reduction of these risk factors, through public health interventions and efforts to address their underlying social determinants.

The table includes only a few of the known TB risk factors, focusing mainly on risk factors for progression from TB infection to active disease. The table does not include some important risk factors such as contact with people with infectious TB, crowding, poor ventilation and silicosis. Moreover, the calculation of the PAF does not consider the secondary effects of TB transmission from people that fall ill with TB. In addition, due to a lack of detailed global data on the distribution of the various risk factors in the population, the estimations assume the same prevalence of the risk factors in all (adult) population segments. More sophisticated estimations can be made when risk factor distribution data are available, and when the dynamic effects of indirect prevention of onward transmission are modelled. Such models are conceptually more appropriate, but they also introduce more uncertainty into the estimated impact of changes in risk factor exposure. **Box 6.6** provides an introduction to some ongoing modelling efforts to assess the effect of measures to reduce risk factors on future TB burden in selected countries.

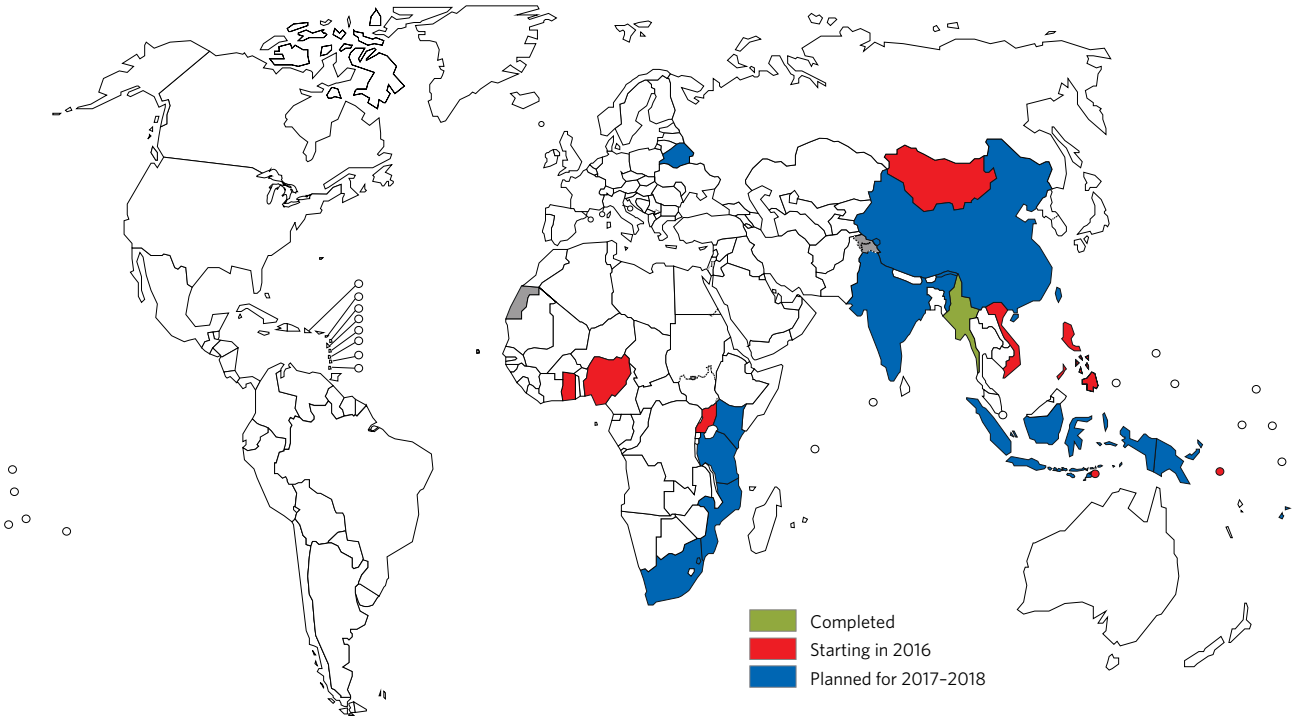
In response to social determinants of TB, there are a number of societal-level actions that can help to drive effective TB prevention beyond the poverty alleviation, UHC financing and social protection discussed above, for which governments are ultimately responsible. Societal-level actions include:

- integrated public health programmes that help to reduce diabetes, smoking and harmful alcohol use;

[1] United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. New York: UN; 2015 (https://sustainabledevelopment.un.org/post2015/transformingourworld/publication, accessed 5 September 2016).

:: FIG. 6.5

Surveys of costs faced by TB patients and their households: progress and plans as of August 2016



Source: Global TB Programme survey monitoring up to August 2016.

:: Box 6.5

Myanmar TB patient cost survey

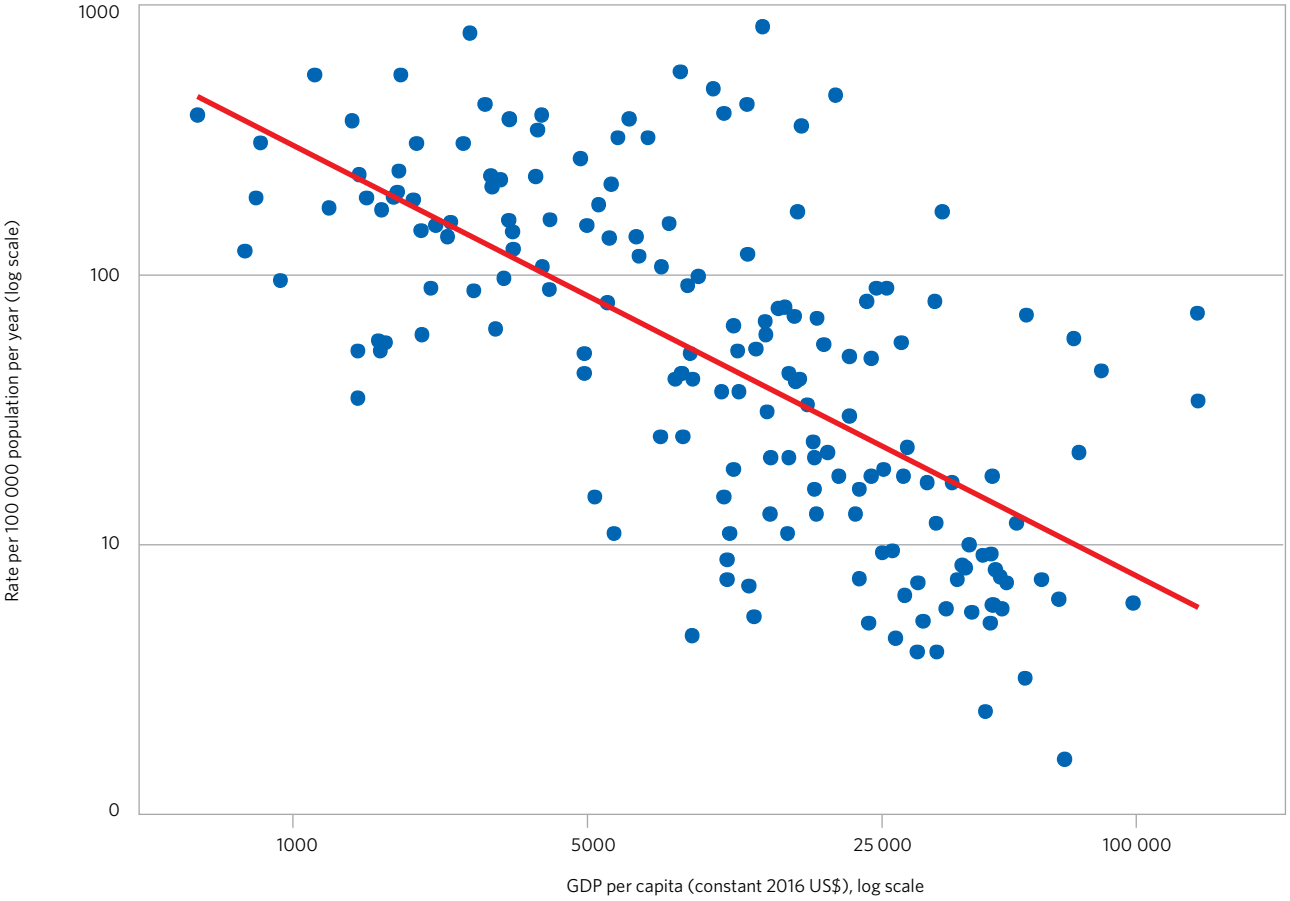
In Myanmar, from December 2015 to February 2016, the Ministry of Health worked with a national research partner to conduct a nationally representative patient cost survey involving 996 eligible TB patients in health facilities. Myanmar is a low-income country with among the highest TB burdens in the WHO South-East Asia Region. The survey was the first to apply the new WHO-recommended protocol for TB patient cost surveys and to adapt its instrument. The cross-sectional survey included questions on the patient's current treatment and retrospective questions on the costs incurred by patients for this illness episode before they were diagnosed as having TB. Current costs were extrapolated for the full treatment duration to estimate total costs (both direct and indirect) for the whole TB episode, as a percentage of household income. If total costs exceeded 20% of annual household income, the TB-affected household was deemed to have faced catastrophic total costs.

The survey results suggested that, in Myanmar, an estimated 65% of TB-affected households face catastrophic costs. On average, total TB-related costs were US$ 1178 per household and the largest proportion of this total was accounted for by foregone income (49%) followed by nutritional supplement costs (25%), and post-diagnosis medical costs (14%). Being on MDR-TB treatment and in a lower household wealth quintile were both significant predictors of facing catastrophic costs.

The high proportion of TB-affected households experiencing catastrophic costs bolsters the need for effective, patient-centred health care free of charge, and the need for social protection. The large proportion of total spending attributable to lost wages and food or nutritional supplements suggests that efforts to reduce income loss (reduced time spent seeking care through decentralization and more patient-friendly service organization, as well as employment protection), income support and/or food support may need to be considered to reduce the burdensome costs faced by patients and their families. The NTP is convening a consultation to review the results, and to further discuss the probable dynamics behind the highest areas of spending and the income losses associated with TB and its treatment. The participants will consider the probable policy and practice implications, and further operational research that might be needed. The results should inform ongoing work on Myanmar's first national social protection strategy, and its ongoing efforts to strengthen health services.

:: FIG. 6.6

Association between GDP per capita and TB incidence, for 170 countries with available data



Source: GDP per capita data were obtained from the World Bank database (http://data.worldbank.org/).

:: TABLE 6.2

Population attributable fractions for risk factors for TB

	RELATIVE RISK FOR ACTIVE TB DISEASE[a]	PREVALENCE (%)[b] (ADULTS IN 30 HIGH TB BURDEN COUNTRIES)	POPULATION ATTRIBUTABLE FRACTION (ADULTS IN 30 HIGH TB BURDEN COUNTRIES)
HIV	21	0.9	15
Undernutrition	3.2	12	21
Diabetes	3.1	8.5	15
Alcohol misuse	2.9	4.0	7.0
Smoking	1.9	19	15
Indoor air pollution	1.4	53	17

[a] Source: Lönnroth K, Castro K, Chakaya JM, Chauhan LS, Floyd K, Glaziou P, Raviglione *M. Tuberculosis* control and elimination 2010–2050: cure, care and social change. Lancet. 2010 May 22;375(9728):1814-29. doi: 10.1016/S0140-6736(10)60483-7.

[b] Estimate of prevalence is based on a weighted average (by population size) for the 30 high TB burden countries.

- food security initiatives for high-risk populations and regions;
- environmental protection, especially in certain industries (e.g. mining);
- building codes (e.g. for homes, workplaces, health facilities, prisons, schools and institutions for elderly) that are conducive to infection control;
- good urban planning (e.g. with slum upgrading); and
- effective and safe energy and cooking devices that minimize pollution.

In moving forward to end TB and on the SDGs in general, there needs to be close collaboration across and beyond government on multiple development priorities. Hence, this global TB report includes results for some key SDG indicators for the 30 highest TB burden countries (**Table 6.3**). As the colour coding in the table shows, most of the highest TB burden countries have indicators suggesting lower than average status relative to benchmarks. Therefore, there is a substantial challenge ahead to ramp up investment and commitment to the new development agenda.

:: TABLE 6.3

Status of selected SDG indicators in August 2016, 30 high TB burden countries[a]

COUNTRY	**SDG 1 INDICATOR** PROPORTION LIVING ON LESS THAN US$ 1.25 (PPP) PER DAY	**SDG 2 INDICATOR** PROPORTION OF POPULATION UNDERNOURISHED	**SDG 10 INDICATOR** GINI COEFFICIENT (%)[b]	**SDG 11 INDICATOR** PROPORTION OF URBAN POPULATIONS LIVING IN SLUMS
Angola	43	14	43	56
Bangladesh	43	16	32	55
Brazil	3.8	5.0	53	22
Cambodia	10	14	31	55
Central African Republic	63	48	56	93
China	6.3	9.3	42	25
Congo	33	31	40	47
DPR Korea	—	42	—	—
DR Congo	88	—	42	75
Ethiopia	37	32	33	74
India	24	15	34	24
Indonesia	16	7.6	36	22
Kenya	43	21	—	56
Lesotho	56	11	54	51
Liberia	84	32	37	66
Mozambique	61	25	46	80
Myanmar	—	14	—	41
Namibia	24	42	61	33
Nigeria	62	7.0	43	50
Pakistan	13	22	30	46
Papua New Guinea	36	—	44	—
Philippines	19	14	45	38
Russian Federation	0	—	27	—
Sierra Leone	57	22	34	76
South Africa	9.4	5.0	63	23
Thailand	0.3	7.4	38	25
UR Tanzania	44	32	38	51
Viet Nam	2.4	11	39	27
Zambia	74	48	56	54
Zimbabwe	—	33	—	25
High-burden country average	**35**	**22**	**42**	**48**
Global average	**18**	**11**	**36**	**33**

— Indicates values that were not available. PPP, purchasing power parity.

[a] Data come from the United Nations Statistics Division SDG indicator database. Individual data points are coloured pink if they are worse than the global average and green if better than the global average.

[b] The Gini coefficient is a measure of statistical dispersion intended to represent the income distribution of a country's population and is the most commonly used measure of inequality. Generally, the coefficient ranges from 0% to 100%; a value of 0% expresses complete equality between everyone in the population, and a value of 100% expresses maximum inequality in the population i.e. one person has all the income.

:: Box 6.6

Modelling the effect of risk factor reduction on future trend of TB incidence

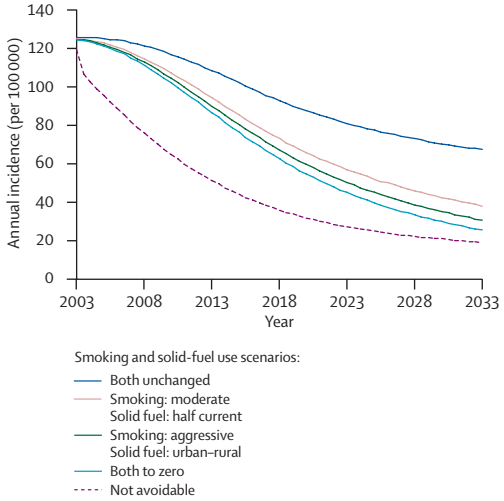
To quantify the population-level impact of a risk factor on the burden of TB, previous studies have reported the population attributable fraction (PAF) for one specific risk factor. The PAF incorporates information on the prevalence of risk factor exposure and the strength of association (often measured as relative risks) between the risk factor and TB disease. Relatively straightforward to calculate, PAF can be interpreted as "the proportion of TB burden that would be prevented if the risk factor exposure were removed, with other things the same". Despite its popularity, the PAF approach has two limitations. First, it assumes that the probability of disease is independent among individuals, which is clearly not the case for TB. In other words, the approach does not account for the impact of a risk factor on disease transmission and therefore often underestimates the overall population-level impact. Second, the PAF approach is "timeless" and cannot be used to project the impact of risk factor reduction on the future trend of TB epidemiology.

A few studies have applied dynamic modelling of TB transmission to investigate the impact of risk factors on TB. Dynamic models incorporate the natural history of TB (susceptible or latent infection, active disease or recovered) and the effect (relative risk) of risk factors on the natural history of TB (e.g. increasing the rate of reactivation or increasing the case fatality rate upon having disease). This type of model accounts for the transmissible nature of TB disease and can be used for the purpose of future projections, although caution is needed when interpreting the results from such complex models. To illustrate, two examples of such dynamic modelling are provided below.

- In a dynamic modelling study conducted in China, Lin et al.[a] projected the potential impact of reducing tobacco smoking and indoor air pollution from solid fuels on the trend of TB incidence. The study found that aggressive interventions on smoking and indoor air pollution could accelerate the decline of TB incidence (**Fig. B6.6.1**).
- Pan et al.[b] investigated the impact of diabetes prevention on TB morbidity and mortality in 13 high burden countries without a generalized HIV epidemic (Afghanistan, Bangladesh, Brazil, Cambodia, China, India, Indonesia, Myanmar, Pakistan, Philippines, Russian Federation, Thailand and Viet Nam). These countries cover over 60% of all incident TB cases globally. The study indicated that, in the worst case scenario in which diabetes prevalence increases greatly over the next two decades, the TB incidence would increase (reversing the current slow rate of decline in TB incidence). On the other hand, simply stopping the rise in the prevalence of diabetes would accelerate the decline of TB, preventing 6.0 million TB cases and 1.1 million TB deaths in the 13 countries over 20 years. Aggressive interventions that reduce diabetes incidence would have an even larger impact on TB, avoiding 7.8 million cases and 1.5 million deaths. See **Fig. B.6.6.2, A/B/C/D**.

:: FIG. B6.6.1

Projected incidence of TB in Guizhou Province, China under different scenarios for reduction in smoking prevalence and exposure to solid-fuel use

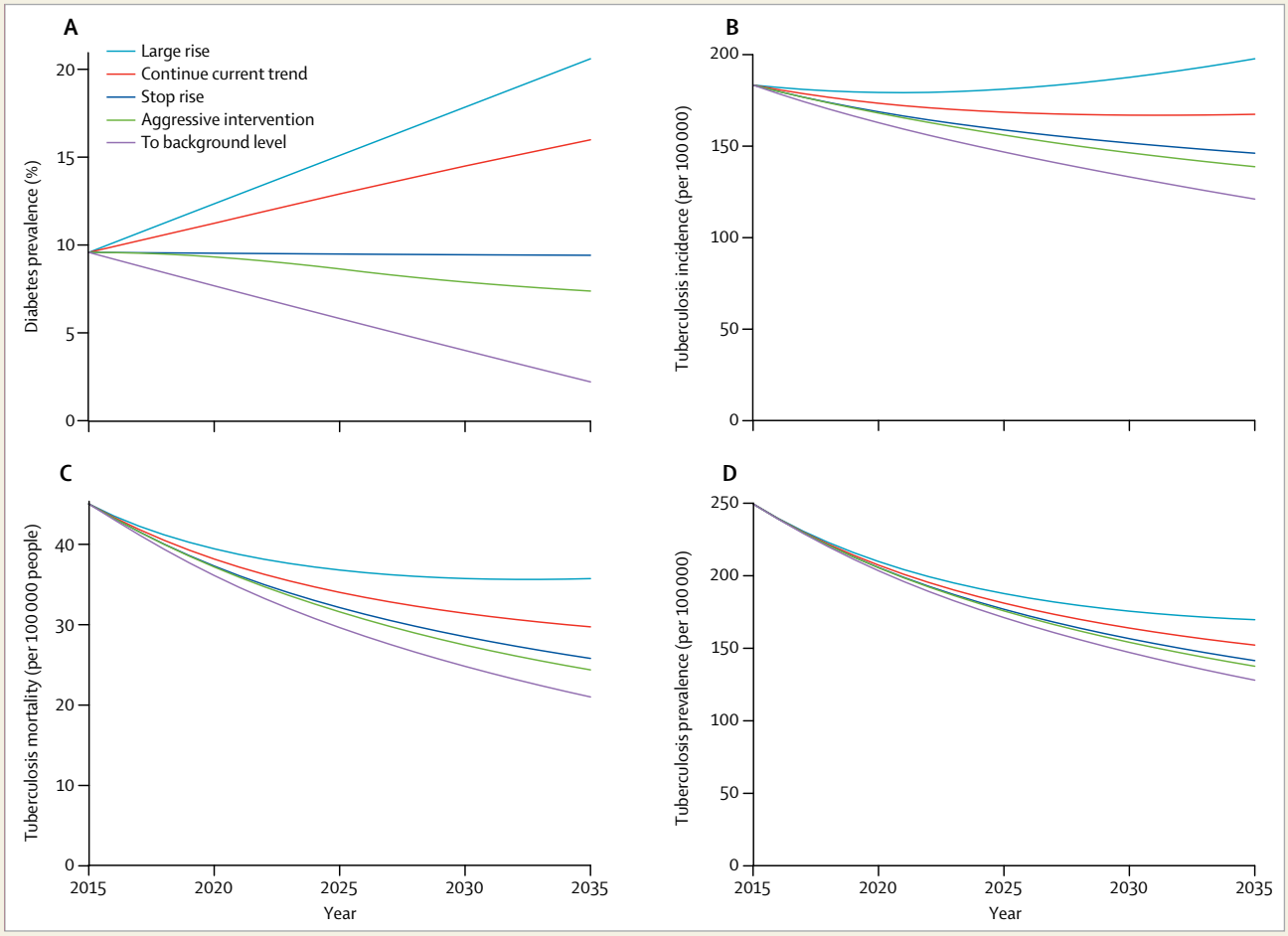


[a] Lin HH, Murray M, Cohen T, Colijn C, Ezzati M. Effects of smoking and solid-fuel use on COPD, lung cancer, and tuberculosis in China: a time-based, multiple risk factor, modelling study. Lancet. 2008;372(9648):1473–1483

[b] Pan S-C, Ku C-C, Kao D, Ezzati M, Fang C-T, Lin H-H. Effect of diabetes on tuberculosis control in 13 countries with high tuberculosis: a modelling study. Lancet Diabetes Endocrinol. 2015;3(5):323–330.

:: FIG. B6.6.2

Projected TB incidence/mortality/prevalence (B/C/D) under different scenarios of diabetes control (A) in 13 high TB burden countries, 2015–2035



Source: Pan S-C, Ku C-C, Kao D, Ezzati M, Fang C-T, Lin H-H. Effect of diabetes on tuberculosis control in 13 countries with high tuberculosis: a modelling study. Lancet Diabetes Endocrinol. 2015;3(5):323–330.

Chapter 7 :: TB financing

KEY FACTS AND MESSAGES

The Stop TB Partnership's *Global Plan to End TB, 2016–2020*[a] estimates that in low- and middle-income countries US$ 52 billion is required over 5 years to implement interventions that are currently available. The amount required will increase from US$ 8.3 billion in 2016 to US$ 12.3 billion in 2020. Most of this funding is for drug-susceptible tuberculosis (TB) (e.g. US$ 6.4 billion in 2016), but the amount for multidrug-resistant TB (MDR-TB) doubles from US$ 1.7 billion in 2016 to US$ 3.6 billion by 2020; the remainder is for TB/HIV interventions. Over the period 2016–2020, a further US$ 6 billion is needed for high-income countries, and an additional US$ 9 billion is needed for TB research and development.

Based on data reported to WHO by 126 countries with 97% of the world's notified TB cases, US$ 6.6 billion was available for TB prevention, diagnosis and treatment in low- and middle-income countries in 2016. This is an increase from previous years, but is still about US$ 2 billion less than the estimated requirement for this group of countries in the Global Plan. Increased domestic and international donor commitments are needed to close the funding gaps.

Of the US$ 6.6 billion available in 2016, 84% was from domestic sources. However, this aggregate figure is strongly influenced by the BRICS countries (Brazil, the Russian Federation, India, China and South Africa), which collectively account for about 50% of the world's TB cases, and rely mostly or exclusively (the exception is India) on domestic funding. In other countries with a high TB burden, international donor funding dominates, accounting for 75% of reported funding in the group of 25 high TB burden countries outside BRICS, 87% of funding in low-income countries and 60% of funding in lower middle-income countries. The single largest source of international donor funding is the Global Fund to Fight AIDS, Tuberculosis and Malaria.

International donor funding for TB falls far short of donor contributions for HIV and malaria. The latest data from the Organisation for Economic Co-operation and Development (OECD) creditor reporting system show totals of US$ 5.4 billion for HIV/AIDS, US$ 1.7 billion for malaria and US$ 0.7 billion for TB in 2014. To provide some context for these amounts, the latest estimates (for 2013) of the burden of disease in terms of disability-adjusted life years (DALYs) lost due to illness and death are 69 million for HIV/AIDS, 50 million for malaria and 65 million for TB.

The cost per patient treated is usually in the range of US$ 100–1000 for drug-susceptible TB and US$ 2000–20 000 for MDR-TB.

Health financing data from national health accounts provide insights into the current status of progress towards universal health coverage, as discussed in **Chapter 6**.

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

Progress in tuberculosis (TB) prevention, diagnosis and treatment requires adequate funding sustained over many years. WHO began annual monitoring of funding for TB in 2002, with findings published in global TB reports and peer-reviewed publications.[1]

This chapter has four main sections. It starts with a summary of the most up-to-date estimates of financial resources required for a full response to the TB epidemic 2016–2020 (**Section 7.1**). It then presents and discusses trends in funding for TB prevention, diagnosis and treatment by category of expenditure and source of funding for the period 2006–2016, globally and for major country groupings (**Section 7.2**). The third part of the chapter analyses funding gaps reported by national TB programmes (NTPs) to WHO, with breakdowns by category of expenditure and country group (**Section 7.3**). The final section provides the latest estimates (for 2015) of the unit costs of treatment for drug-susceptible TB and multidrug-resistant TB (MDR-TB) (**Section 7.4**).

As highlighted in the financing chapter of the *Global tuberculosis report 2015*,[2] analysis of health financing data

[1] The most recent publication is: 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):e105–115 (http://www.ncbi.nlm.nih.gov/pubmed/25104145, accessed 28 July 2016).

[2] World Health Organization. Global tuberculosis report 2015. Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf, accessed 27 July 2016).

can provide 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 who face catastrophic costs as a result of TB disease. The milestone of zero set for this indicator for 2020 requires progress in terms of both 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 covered in Chapter 6.

Further country-specific data on TB financing can be found in finance profiles that are available online.[1]

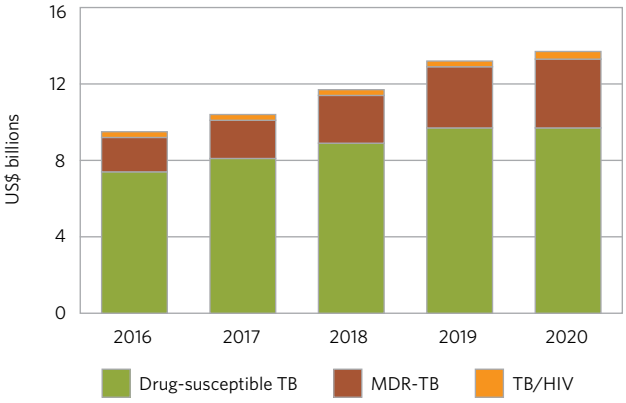
7.1 Estimates of funding required for a full response to the global TB epidemic, 2016–2020

The latest estimates of the funding required for a full response to the global TB epidemic, to achieve the End TB Strategy milestones for 2020, have been set out in the Stop TB Partnership's *Global Plan to End TB, 2016–2020*.[2] Worldwide, the amount for implementation of TB prevention, diagnostic and treatment interventions rises from almost US$ 9.5 billion in 2016 to US$ 14 billion in 2020 (Fig 7.1). Most of this total (75%) is for diagnosis and treatment of drug-susceptible TB, which grows from US$ 7.4 billion in 2016 (US$ 6.4 billion in low- and middle-income countries) to US$ 9.7 billion in 2020. However, the amount for drug-resistant TB doubles from US$ 1.8 billion in 2016 to US$ 3.6 billion in 2020.[3] Relatively small amounts are needed for TB/HIV interventions, mainly because the figure does not include the funding needed for antiretroviral therapy for HIV-positive TB patients.[4] An additional US$ 9 billion is needed for TB research and development over the 5-year period (data not shown; this topic is discussed further in Chapter 8).

Of the total of US$ 58 billion over 5 years (excluding research and development), US$ 52 billion was estimated to be required in low- and middle-income countries (growing from US$ 8.3 billion in 2016 to US$ 12.3 billion in 2020). Within this group of countries, estimates of the funding that could be mobilized from domestic and international donor sources were restricted to countries eligible to apply to the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund).[5] For eligible countries, the funding required over 5 years amounts to US$ 29 billion; it was estimated that about US$ 16 billion of this amount could be mobilized from domestic sources and that the remainder (an average of US$ 2.6 billion per year) would need to come from international donors.

:: FIG. 7.1

Estimates of funding required globally for drug-susceptible TB, MDR-TB and TB/HIV in the Global Plan to End TB 2016—2020 (constant 2015 US$ billions)



Source: Data from Stop TB Partnership Global Plan to End TB 2016-2020

The *Global Plan to End TB* did not attempt to assess the broader investments required to increase the overall coverage and quality of health-care services, and to remove financial barriers to accessing care. Such investments are needed for many essential preventive, treatment and care interventions, not only for TB. Progress on these fronts is critical, as explained in Chapter 2, reflected in Pillar 2 of the End TB Strategy and discussed in Chapter 6. The costings in the Global Plan can thus be seen as the financial resources required for Pillars 1 and 3 of the End TB Strategy.

7.2 TB funding, overall and by category of expenditure and source of funding, 2006–2016

Data reported by NTPs to WHO since 2006 were used to analyse funding trends over the period 2006–2016 in 126 countries (Table 7.1). These countries accounted for 97% of the global number of TB cases reported in 2015, and included 126 low- and middle-income countries. The methods used to collect, review and analyse financial data are summarized in Box 7.1.

In these 126 countries, funding for TB prevention, diagnosis and treatment reached US$ 6.6 billion in 2016, up from US$ 6 billion in 2015 and almost double the US$ 3.5 billion that was available in 2006 (all figures are in constant values for 2016, see Fig. 7.2). Of the total of US$ 6.6 bil-

[1] www.who.int/tb/data

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

[3] The burden of drug-resistant TB (in terms of cases per year) is not projected to increase between 2016 and 2020. Increased funding is required to close detection and treatment gaps (see also Chapter 4).

[4] Funding needs for ART for HIV-positive TB patients are part of HIV resource needs estimates, and are not included in the Global Plan to End TB, to avoid double counting. For details on resource needs estimates for HIV/AIDS, see Stover J, Bollinger L, Izazola JA, Loures L, DeLay P, Ghys PD et al. What is required to end the AIDS epidemic as a public health threat by 2030? The cost and impact of the fast-track approach. PLoS One. 2016;11(5):e0154893 (http://www.ncbi.nlm.nih.gov/pubmed/27159260, accessed 28 July 2016).

[5] Countries not eligible to apply to the Global Fund include Brazil, China, the Russian Federation and about half of the other 52 countries classified as upper middle income.

:: TABLE 7.1

126 countries included in analyses of TB financing, by income group and WHO region, 2016[a,b]

	LOW-INCOME (30/31 COUNTRIES REPRESENTING 13% OF NOTIFIED CASES GLOBALLY IN 2015)	LOWER-MIDDLE-INCOME (48/52 COUNTRIES REPRESENTING 58% OF NOTIFIED CASES GLOBALLY IN 2015)	UPPER-MIDDLE-INCOME (48/55 COUNTRIES REPRESENTING 26% OF NOTIFIED CASES GLOBALLY IN 2015)	BRICS (48% OF NOTIFIED CASES GLOBALLY IN 2015)	25 HIGH-BURDEN COUNTRIES EXCLUDING BRICS (37% OF NOTIFIED CASES GLOBALLY IN 2015)
African	Benin, Burkina Faso, Burundi, Central African Republic, Chad, DR Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, South Sudan, Togo, Uganda, UR Tanzania, Zimbabwe	Cabo Verde, Cameroon, Congo, Côte d'Ivoire, Ghana, Kenya, Lesotho, Mauritania, Nigeria, Sao Tomé and Principe, Swaziland, Zambia	Angola, Botswana, Gabon, **Mauritius**, Namibia, South Africa	South Africa	Angola, Central African Republic, Congo, DR Congo, Ethiopia, Kenya, Lesotho, Liberia, Mozambique, Namibia, Nigeria, Sierra Leone, UR Tanzania, Zambia, Zimbabwe
Americas	Haiti	Bolivia, El Salvador, Guatemala, Honduras, Nicaragua	Belize, Brazil, Colombia, **Cuba**, Dominican Republic, Ecuador, **Grenada**, Guyana, Jamaica, Mexico, Panama, Paraguay, Peru, **Saint Lucia**, **Saint Vincent and the Grenadines**, Suriname, **Venezuela (Bolivian Republic of)**	Brazil	
Eastern Mediterranean	Afghanistan, Somalia	Djibouti, Morocco, Pakistan, Sudan, Syria, Tunisia, Yemen	Iran (Islamic Republic of), Iraq, Jordan, Lebanon		Pakistan
European		Armenia, Kyrgyzstan, Republic of Moldova, Tajikistan, Ukraine, Uzbekistan	**Azerbaijan**, **Belarus**, Bosnia and Herzegovina, Bulgaria, Georgia, Kazakhstan, Montenegro, Romania, Russian Federation, Serbia, The Former Yugoslav Republic of Macedonia, Turkey	Russian Federation	
South-East Asia	Democratic People's Republic of Korea, Nepal	Bangladesh, Bhutan, India, Indonesia, Myanmar, Sri Lanka, Timor-Leste	Maldives, Thailand	India	Bangladesh, Indonesia, Myanmar, Thailand
Western Pacific		Cambodia, Kiribati, Lao People's Democratic Republic, Mongolia, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tonga, Vanuatu, Viet Nam	American Samoa, China, Fiji, Malaysia, Marshall Islands, Palau, Tuvalu	China	Cambodia, Democratic People's Republic of Korea, Papua New Guinea, Philippines, Viet Nam
Excluded	Comoros	Egypt, Kosovo, Micronesia (Federal States of), West Bank and Gaza Strip	Albania, Algeria, Costa Rica, Dominica, Equatorial Guinea, Libya, Turkmenistan		

[a] Analyses focus on low and middle-income countries.
[b] Additional countries included in trend analyses of TB financing compared with those included in previous global reports are shown in bold.

lion, most (US$ 4.4 billion, 67%) is for the diagnosis and treatment of drug-susceptible TB. However, that amount still falls considerably short of the US$ 6.4 billion estimated to be needed for low- and middle-income countries in the Global Plan (**Section 7.1**).

Funding for MDR-TB was US$ 1.7 billion in 2016, and this amount has been comparatively stable since 2014, following a marked increase in 2010–2014 (**Fig. 7.2**). Trends in funding for MDR-TB have been driven by the BRICS (Brazil, Russian Federation, India, China and South Africa) group of countries (**Fig. 7.3**), with just over one third of reported funding for MDR-TB accounted for by the Russian Federation in 2016 (**Table 7.2**, **Fig. 7.2**). Given the large gaps in detection that remain for MDR-TB, and the gaps between the numbers of cases detected and started on treatment (**Chapter 4**), much more funding is required for MDR-TB globally and in most of the high MDR-TB burden countries. Based on the estimates in the Global Plan (**Section 7.1**), funding for MDR-TB needs to double between 2016 and 2020.

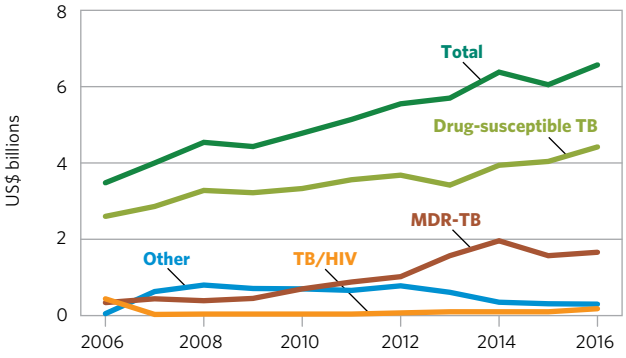
A detailed breakdown of the funding estimated to be required for drug-susceptible TB, MDR-TB and collaborative TB/HIV activities in 2016, based on NTPs' assessments of their needs, is shown for the 30 high TB burden countries (TB HBCs) in **Table 7.2**.[1]

Overall, domestic funding for the TB-specific budgets of NTPs accounts for the largest single share of funding, followed by funding for inpatient and outpatient care (**Fig. 7.4**). Since most (91%) of the funding estimated to be used for inpatient and outpatient care is accounted for by middle-income countries, it can be assumed that virtually all of this funding is from domestic sources (international donor funding for inpatient and outpatient care is only likely to occur in low-income countries, via general budget support to the health sector). Based on this assumption, about 84% of the estimated funding of US$ 6.6 billion in 2016 is from domestic sources.

[1] **Chapter 2** explains how the updated list of TB HBCs to be used by WHO in 2016–2020 was defined.

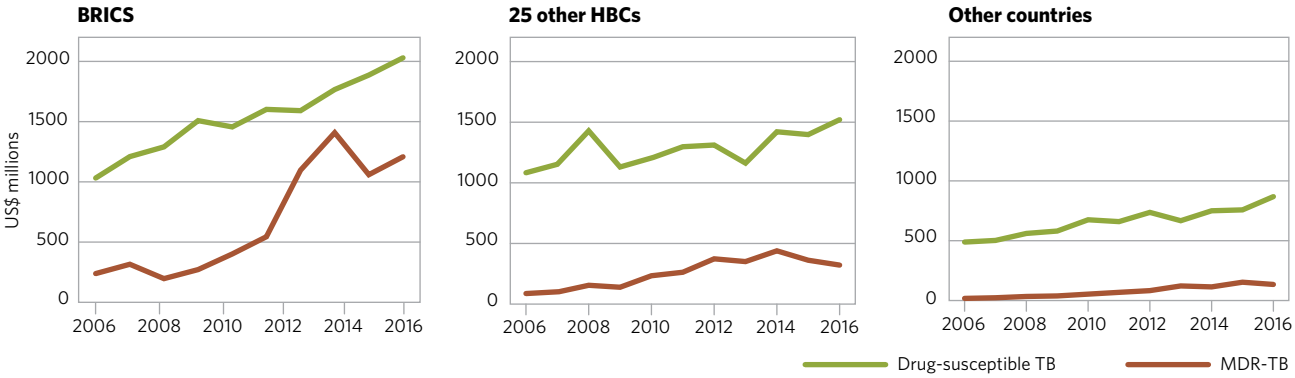
:: FIG. 7.2

Funding for TB prevention, diagnosis and treatment by intervention area, 2006—2016 (constant 2016 US$ billions)



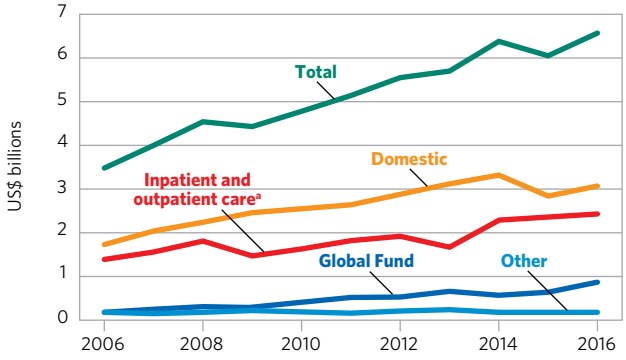
:: FIG. 7.3

Funding for drug-susceptible TB and MDR-TB, 2006–2016, by country group (constant 2016 US$ millions)



:: FIG. 7.4

Funding for TB prevention, diagnosis and treatment by funding source, 2006–2016 (constant 2016 US$ billions)



[a] 91% of funding for inpatient and outpatient care is accounted for by middle and high-income countries; such countries do not typically receive international donor funding for inpatient and outpatient care services. Data is an estimate based on country-reported utilization.

:: Box 7.1

Methods use to compile, validate and analyse financial data reported to WHO

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 have been described in detail elsewhere;[a,b] this box provides a summary.

Each year, WHO requests 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 2016 round of global TB data collection, the fiscal years were 2016 and 2015. Consistency in categories of expenditure used to report budget and expenditure data has been maintained as far as possible to enable monitoring of trends. For low- and middle-income countries, the categories of expenditure for drug-susceptible TB used in the 2016 round of global TB data collection were 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 (e.g. 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); and operational research, including surveys. For MDR-TB, two expenditure categories were used: second-line drugs, and programme costs specifically related to MDR-TB. Starting in 2015, a separate category for patient support was included, linked to the emphasis on financial and social protection in the End TB Strategy. There is also a separate category for collaborative TB/HIV activities. A breakdown of the total amount of available funding is requested in four categories: domestic funding excluding loans; external loans, also considered domestic funding; the Global Fund; and grant financing from sources other than the Global Fund.

As in previous years, all high-income countries were requested to report funding requirements and expenditures in total, without any breakdown by category of expenditure or source of funding.

All countries (irrespective of income level) were asked to report on the use of inpatient and outpatient care required for treatment of people with drug-susceptible 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 data (preferable), or on the expected use based on the typical approach used to deliver treatment (which may be defined in national policy documents). They are 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).

Core methods used to review and validate data have remained consistent since 2002. They include:

- **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** – such sources include estimates of unit costs from independent economic evaluations[c] and funding proposals (known as concept notes) submitted to the Global Fund[d] (**Table B7.1.1**); comprehensive budgets for national strategic plans are now an essential requirement for funding applications to the Global Fund.

Since 2014, an extra question about the average cost of drugs per patient treated has been asked, to allow reviewers to better assess the validity of budgets reported for first- and second-line drugs, and to identify whether reported budgets include funding for buffer stocks.

In 2016, additional efforts to improve the quality of financial data reported to WHO included presentations and discussions with NTP staff during workshops on the development of national strategic plans or TB modelling.

In review and validation of data, particular attention has always been given to HBCs. A summary of data validation methods used for the 30 TB HBCs is shown in **Table B7.1.1**.

Usually, TB funding reported by NTPs does not include the financial costs associated with the inpatient and outpatient care required during treatment. Since many detailed costing studies in a wide range of countries show that these costs 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 used for both inpatient and outpatient care.

WHO estimates the funding used for inpatient and outpatient care of TB patients by multiplying the number of outpatient visits and days of inpatient care per patient (reported by NTPs each year) by the cost per bed day and per clinic visit available from the WHO CHOosing Interventions that are Cost-Effective (WHO-CHOICE) database,[e] and then by the reported number of TB patients notified or projected to be notified. This is done separately for drug-susceptible TB and MDR-TB. Where possible, estimates are compared with hospital and clinic expenditure data for drug-susceptible and MDR-TB that are being tracked through the *System of health accounts* (SHA).[f] In 2016, SHA data were available for 27 countries (including the six HBCs shown in **Table B7.1.1**),[g] and were used in preference to estimates based on reported use

and unit costs estimates from WHO-CHOICE. In a few cases, there were large discrepancies (e.g. Cambodia, the Philippines and the United Republic of Tanzania). Further discussions with country focal points for national health account data are needed in order to better understand the reasons for these discrepancies.

Expanded implementation of SHA and associated validation against existing disease-specific tracking systems may also facilitate more comprehensive reporting of domestic funding for TB, especially 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 likely to be 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 (including TB-specific budgets) is a particular challenge in large countries with decentralized systems. Examples for TB include Indonesia, Nigeria and South Africa.

:: TABLE B7.1.1

Methods used to review and validate financing data reported by NTPs, 30 high TB burden countries

COUNTRY	UNIT COST DATA AVAILABLE FROM INDEPENDENT ECONOMIC EVALUATION	TRIANGULATION OF WHO TB DATA WITH OTHER SOURCES	
		NATIONAL HEALTH ACCOUNT DATA, FOR COMPARISON OF INPATIENT AND OUTPATIENT CARE EXPENDITURES FOR DRUG-SUSCEPTIBLE AND MDR-TB	COSTED NATIONAL STRATEGIC PLAN SUBMITTED AS PART OF A FUNDING APPLICATION TO THE GLOBAL FUND
Angola	no	no	no
Bangladesh	yes	no	yes
Brazil	yes	no	no
Cambodia	yes	yes, 2012	yes
Central African Republic	no	no	no
China	yes	no	no
Congo	no	no	no
DPR Korea	no	no	no
DR Congo	no	yes, 2014	yes
Ethiopia	yes	no	yes
India	yes	no	yes
Indonesia	yes	no	yes
Kenya	yes	no	no
Lesotho	no	no	no
Liberia	no	no	no
Mozambique	no	no	yes
Myanmar	no	no	yes
Namibia	no	yes, 2012	no
Nigeria	yes	no	no
Pakistan	yes	no	yes
Papua New Guinea	no	no	no
Philippines	yes	yes, 2012	yes
Russian Federation	yes	no	no
Sierra Leone	yes	yes, 2013	no
South Africa	yes	no	no
UR Tanzania	yes	yes, 2012	yes
Thailand	yes	no	yes
Viet Nam	yes	no	yes
Zambia	yes	no	yes
Zimbabwe	yes	no	yes

[a] Floyd K, Pantoja A, Dye C. Financing tuberculosis control: the role of a global financial monitoring system. Bull World Health Organ. 2007;85(5):334-340 (http://www.ncbi.nlm.nih.gov/pubmed/17639216, accessed 29 July 2016).

[b] 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):e105–115 (http://www.ncbi.nlm.nih.gov/pubmed/25104145, accessed 28 July 2016).

[c] Laurence YV, Griffiths UK, Vassall A. Costs to health services and the patient of treating tuberculosis: a systematic literature review. Pharmacoeconomics. 2015;33(9):939-955 (http://www.ncbi.nlm.nih.gov/pubmed/25939501, accessed 29 July 2016).

[d] Global Fund Data and the Open Data Protocol http://web-api.theglobalfund.org/odata/, accessed May 2016 and country financial gap analysis materials approved for funding in the first rounds of New Funding Model.

[e] Cost effectiveness and strategic planning (WHO-CHOICE): health service delivery costs. Geneva: World Health Organization; 2008 (http://www.who.int/choice/cost-effectiveness/inputs/health_service/en/, accessed 29 July 2016).

[f] OECD/Eurostat/WHO. A system of health accounts. OECD Publishing; 2011 (http://www.who.int/health-accounts/methodology/sha2011.pdf, accessed 29 July 2016).

[g] Health accounts. Geneva: World Health Organization (http://www.who.int/health-accounts/en/, accessed 29 July 2016).

:: TABLE 7.2

Reported NTP budget by intervention area and estimated cost of inpatient and outpatient care for drug-susceptible (DS-TB) and MDR-TB, 30 high TB burden countries, 2016 (current US$ millions)

	NATIONAL STRATEGIC PLAN BUDGET				RESOURCES REQUIRED FOR INPATIENT AND OUTPATIENT CARE[a]		RESOURCES REQUIRED FOR TB CARE[a]
	TOTAL	DS-TB	MDR-TB	TB/HIV	DS-TB	MDR-TB	
Angola	22	19	2.0	0.41	12	3.0	36
Bangladesh	52	49	2.3	0.11	1.5	0.2	54
Brazil	60	48	11	2.0	37	1.8	99
Cambodia	29	26	1.9	0.61	24	0.4	53
Central African Republic	1.8	1.4	0.06	0.35	0.63	0.04	2.5
China	372	348	24	0	—	—	372
Congo	3.8	2.1	1.6	0.07	0.10	0	3.9
DPR Korea	30	27	3.3	0.05	41	0.82	72
DR Congo	60	51	5.7	3.6	17	0	77
Ethiopia	81	54	17	9.3	9.9	0.29	91
India	280	209	65	5.6	456	76	811
Indonesia	123	101	15	6.2	29	6.2	158
Kenya	59	45	0.86	12.6	4.3	0.7	64
Lesotho	6.4	5.3	1.0	0.12	0.30	0.11	6.8
Liberia	1.3	0.89	0.26	0.15	32	0	34
Mozambique	24	16	2.9	4.9	3.4	0.13	27
Myanmar	69	51	16	1.9	5.8	0.44	75
Namibia	38	30	1.3	6.7	5.0	9.1	53
Nigeria	257	171	74	13	8.8	2.6	268
Pakistan	62	43	19	0.12	6.6	0.19	69
Papua New Guinea	11	7.8	3.0	0.48	3.3	0.47	15
Philippines	104	68	36	0.40	82	7.0	194
Russian Federation[b]	1 385	766	583	37	—	—	1 385
Sierra Leone	10	7.6	0.87	1.5	17	0	27
South Africa	425	276	68	81	92	387	905
Thailand	31	27	3.8	0.13	7.0	0.23	38
UR Tanzania	40	35	2.8	2.1	40	4.9	84
Viet Nam	71	55	14	3.0	28	3.9	103
Zambia	11	9.0	0.58	1.1	2.0	0.61	13
Zimbabwe	28	23	1.1	3.9	0.50	0.05	28
30 high TB burden countries	**3747**	**2573**	**977**	**198**	**966**	**506**	**5219**

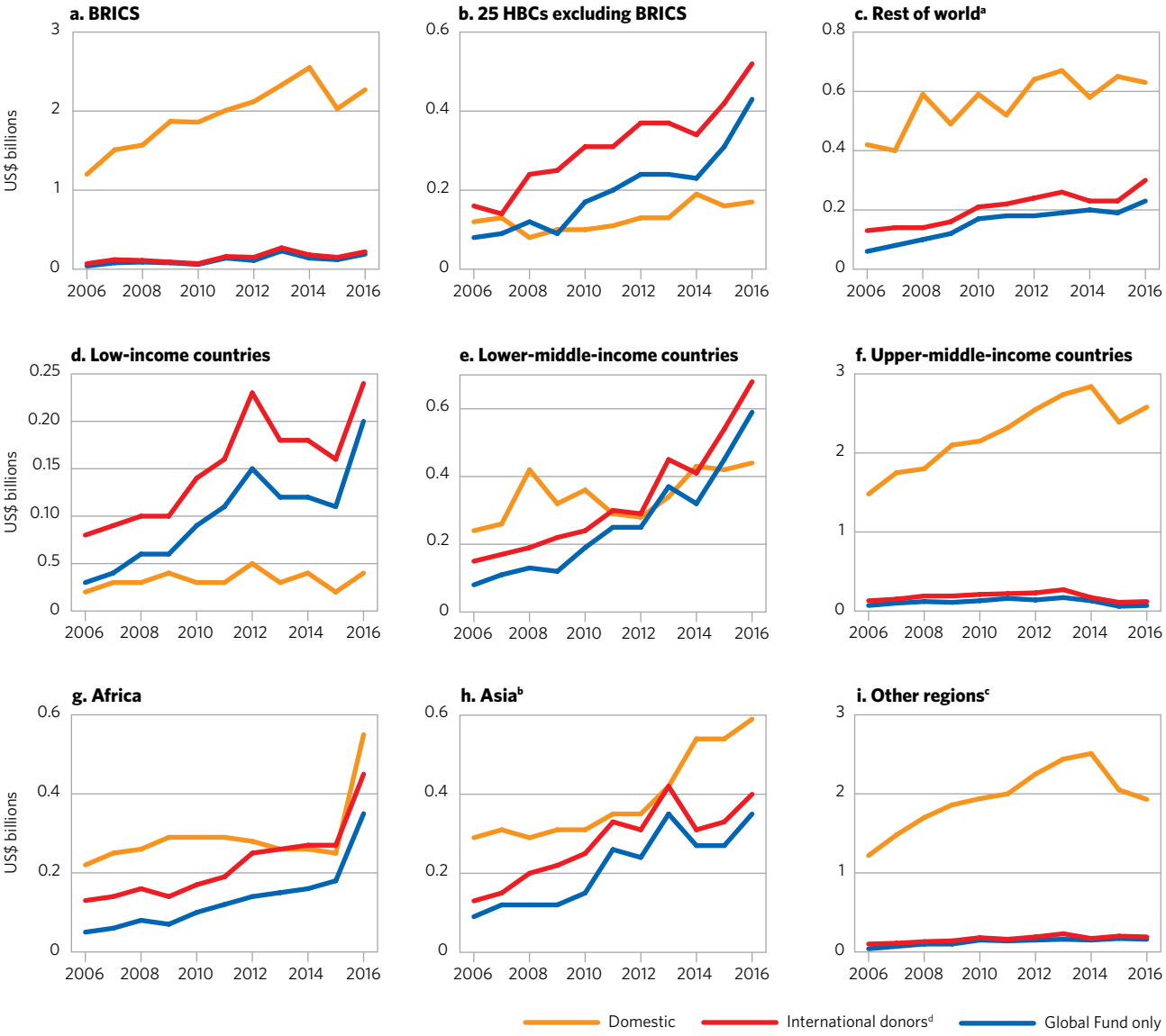
Blank cells indicate data not reported.
— indicates values that cannot be calculated.

[a] No amount is shown for China and the Russian Federation because the NTP budgets reported by those countries include all budgets for inpatient and outpatient care.

[b] In the Russian Federation, the staff and infrastructure reported for TB care and control were allocated to DS-TB (54%) and MDR-TB (46%) by WHO based on the proportion of beddays used by DS-TB and MDR-TB patients.

:: FIG. 7.5

Funding for NTP budgets from domestic sources and international donors, 2006–2016, 9 country groups (constant 2016 US$ billions)



[a] Rest of the world includes 96 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.
[d] This includes the Global Fund.

International donor funding for the TB-specific budgets of NTPs has generally increased year-on-year since 2006, and reached US$ 1.0 billion in 2016. The exception was 2013–2014, when amounts of donor funding reported by NTPs dropped by US$ 150 million (US$ 0.9 billion to US$ 0.75 billion). This change was not as marked as the fall indicated by the creditor reporting system (CRS) of the Organisation for Economic Co-operation and Development (OECD) (see **Box 7.2**). Some possible reasons for this situation are that the OECD data include transfers to entities other than NTPs, and that the lists of countries included do not fully overlap.

Global aggregates for countries reporting financing data to WHO conceal substantial variation among countries in the share of funding from domestic and international sources (**Fig. 7.5**, **Table 7.3**). Domestic funding dominates (representing 91–96% of the funding available to NTPs in 2016) in three country groups (that are not mutually exclusive): BRICS, upper middle-income countries, and regions outside Africa and Asia. In other country groups, international donors (especially the Global Fund) are the most important source of funding and are responsible for most of the growth in TB funding in the past decade, especially in the 25 TB HBCs outside BRICS (listed in **Table 7.1**)[1] and the

[1] See **Chapter 2** for further explanation of the HBC lists being used by WHO in 2016–2020.

:: Box 7.2

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. Funding data (both commitments and disbursements) are provided by 31 multilateral donor organizations, the 26 countries that are members of the OECD's Development Assistance Committee and a further two non-committee members (Kuwait and the United Arab Emirates).

Disbursement data include both direct transfers to countries and the provision of goods and services, such as in-kind transfers or technical assistance. Data on gross disbursements[a] for TB (code 12263: Tuberculosis control) received by non-OECD countries over the period 2004–2014 were analysed. Funding for TB that flows from one OECD member to an institution or government within the OECD, such as grants from the United States (US) National Institutes for Health to the United Kingdom, is not captured in the CRS. Also, government contributions to multilateral organizations are not attributed to the government of origin but only to the multilateral organization.[b]

Fig. B7.2.1 shows trends in international donor funding between 2004 and 2014, for four major categories. The total from all sources in 2014 was US$ 0.7 billion, up from US$ 0.1 billion in 2004. In 2014, 57% of international TB donor funding was from the Global Fund (US $ 0.4 billion) and the next largest contributor was the US government (32%; US $ 247 million). Given that about one third of the contributions to the Global Fund are from the US government, about half of international donor funding globally originated from the US government in 2014.[c] The remaining funding came from other countries (9%) and multilateral organizations (2%), among which the largest donors were the governments of the United Kingdom (5%) and Japan (2%).

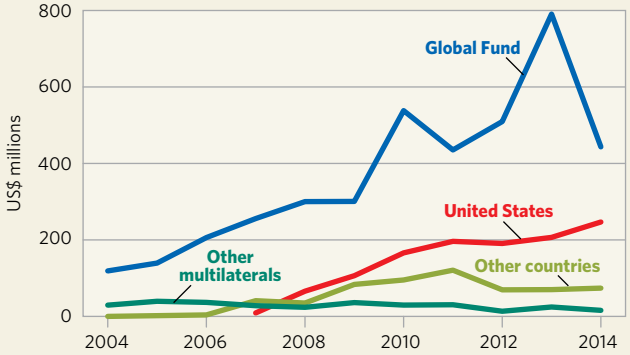
Throughout the period 2004–2014, the Global Fund was consistently the largest provider of international donor funding, but there was a striking drop of 44% from a peak of US$ 0.8 billion in 2013 to US$ 0.44 billion in 2014. This may reflect the transition to a new funding model that started in 2013, and some associated delays in approving and disbursing funds. Disbursements from the US government steadily increased over the period 2004–2014, reaching a peak of US$ 247 million in 2014.

Asia and Africa received the vast majority of international donor funding (Fig. B7.2.2), and the decline in funding from the Global Fund was evident in 2013–2014 in four geographical subregions. These reductions were partly mitigated by increased funding from the US government in Asia, Africa and Europe (but not the Americas).

A comparison of international donor funding for HIV/AIDS (coded as sexually transmitted disease [STD] control within the OECD reporting system), malaria and TB is shown in Fig. B7.2.3. In 2014, non-OECD countries received US$ 5.4 billion for HIV/AIDS, US$ 1.7 billion for malaria and US$ 0.7 billion for TB. To provide some context for these amounts, the latest estimates (for 2013) of the burden of disease in terms of disability adjusted life years (DALYs) lost due to illness and death are 69 million for HIV/AIDS, 50 million for malaria and 65 million for TB.[d] The decline in international donor funding observed for TB between 2013 and 2014 was also evident for HIV/AIDS, but not for malaria. The first- and second-ranking donors for TB and malaria are the Global Fund and the US government, whereas the order is reversed for HIV/AIDS (62% directly from the US government and 29% from the Global Fund).

::FIG. B7.2.1

International donor funding for TB prevention, diagnosis and treatment by region, 2004–2014



[a] As opposed to commitments, which may not materialize.

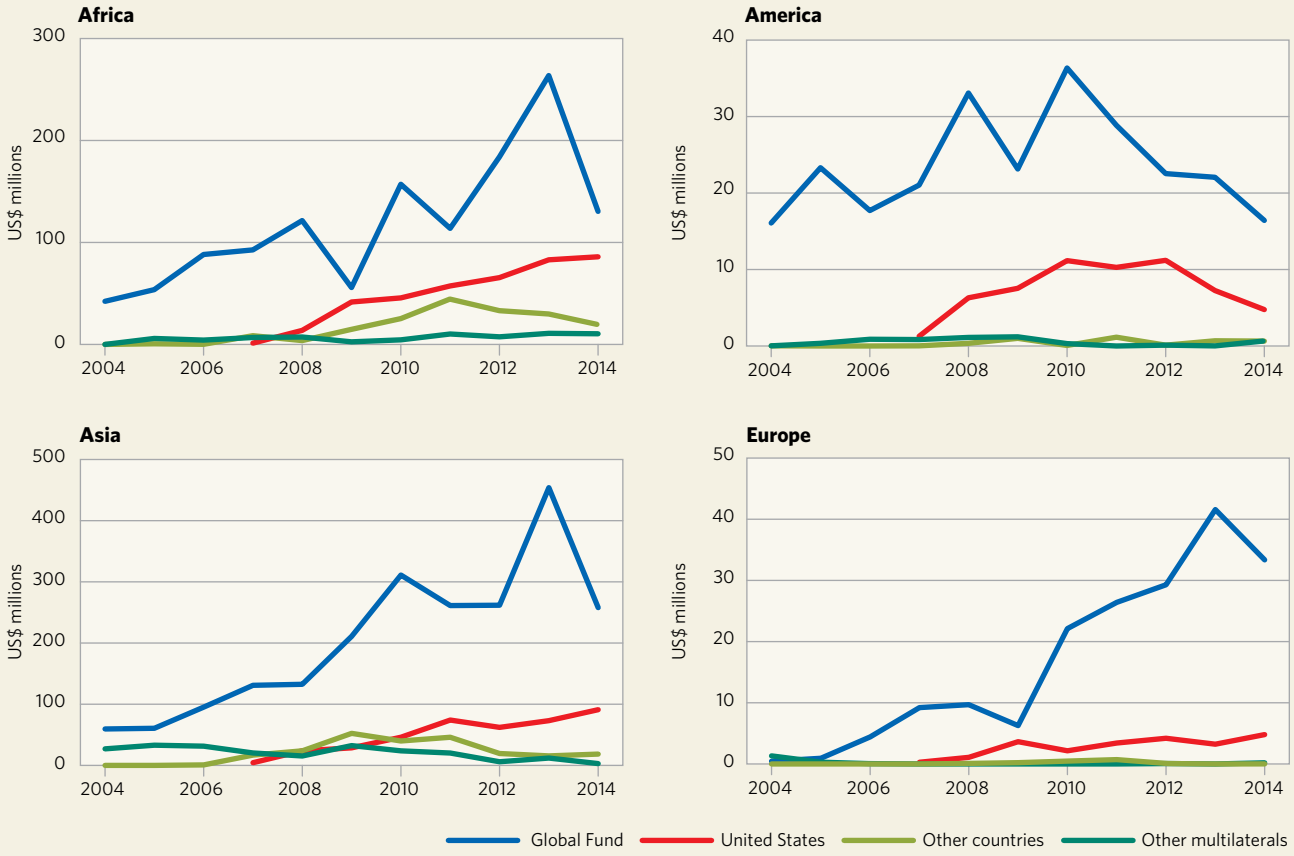
[b] An important example is funding from the Global Fund to non-OECD countries, which is attributed to the Global Fund and not to the governments or other entities that contribute to the Global Fund.

[c] It should be noted that contributions from the United States government captured in the OECD database are lower than official allocations. In 2014, the official allocation for TB was US$ 243 million and an additional US$ 154 million was allocated for TB/HIV via the President's Emergency Plan for AIDS Relief (PEPFAR).

[d] ghdx.healthdata.org/global-burden-disease-study-2013-gbd-2013-data-downloads

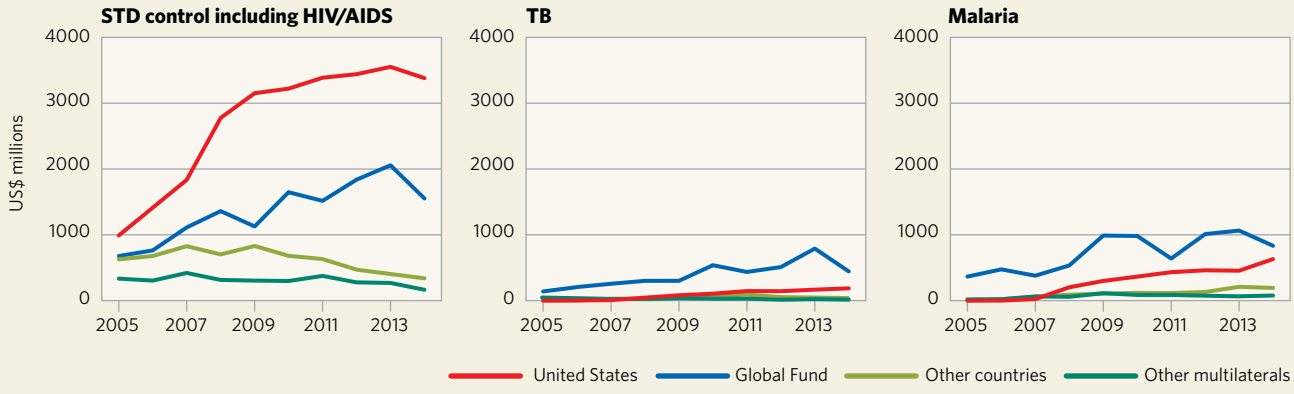
:: FIG. B7.2.2

International donor funding for TB prevention, diagnosis and treatment by region, 2004–2014



:: FIG. B7.2.3

International donor funding for TB, HIV and malaria by source, 2005–2014 (constant 2014 US$ millions)



:: TABLE 7.3

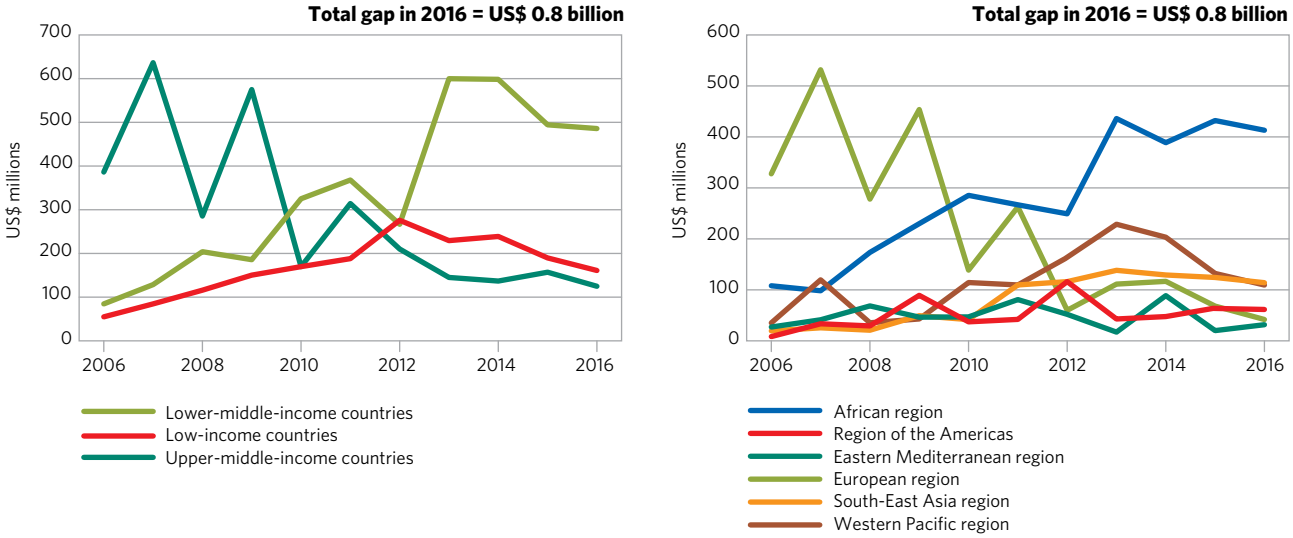
Reported NTP budget, available funding for NTP budget from domestic and international donor sources, funding gap and share of NTP budget provided by domestic and international donor funding, 30 high TB burden countries, 2016 (current US$ millions)[a]

	TOTAL NATIONAL STRATEGIC PLAN BUDGET	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
Angola	22	8.4	0	100	0	13
Bangladesh	52	6.0	45	12	88	0.58
Brazil	60	46	0.55	99	1.2	13
Cambodia	29	2.3	11	18	82	16
Central African Republic	1.8	0.27	1.0	21	79	0.56
China	372	361	6.4	98	1.7	4.4
Congo	3.8	0.47	2.6	15	85	0.8
DPR Korea	30	5.7	8.1	41	59	16
DR Congo	60	1.7	36	5	95	23
Ethiopia	81	9.3	41	18	82	31
India	280	105	175	38	62	0
Indonesia[b]	123		39			
Kenya	59	12	47	20	80	0
Lesotho	6.4	0.74	1.2	38	62	4.5
Liberia	1.3	0	1.3	0	100	0
Mozambique	24	1.0	17	6	94	5.7
Myanmar	69	14	36	29	71	19
Namibia	38	20	10	66	34	8.9
Nigeria	257	30	86	26	74	141
Pakistan	62	0.41	40	1.0	99	22
Papua New Guinea	11		11		100	0
Philippines	104	22	43	33	67	40
Russian Federation	1 385	1 385	0	100	0	0
Sierra Leone	10	0	10	0	100	0
South Africa	425	369	35	91	8.6	22
Thailand	31	11	2.9	79	21	17
UR Tanzania	40	1.9	16	11	89	22
Viet Nam	71	6.7	16	30	70	49
Zambia	11	1.0	5.5	15	85	4.3
Zimbabwe	28		15		100	13
30 high TB burden countries	**3747**	**2421**	**758**	**76**	**24**	**484**

Blank cells indicate data not reported.
— indicates values that cannot be calculated.
[a] Funding gap reflects the anticipated gap for the year at the time a country reported data in the 2016 round of global TB data collection.
[b] For Indonesia, available funding from domestic sources data are not shown because the Government of Indonesia is currently reviewing contributions from domestic sources.

:: FIG. 7.6

Reported funding gaps for TB prevention, diagnosis and treatment, by income group and WHO region, 2006–2016 (constant 2016 US$ millions)



group of low-income and lower middle-income countries (Fig. 7.5). International donors account for 75% of the total funding in 2016 in the group of 25 TB HBCs outside BRICS, 87% of funding in low-income countries and 60% of funding in lower middle-income countries. At the individual country level, international donors remain absolutely critical to funding for NTPs in most of the 30 TB HBCs (Table 7.3).

As noted above, funding reported by NTPs does not capture all international donor funding for TB. Donor funding is also provided to entities other than NTPs, including international and national governmental and nongovernmental organizations. A more comprehensive analysis of international donor funding for TB, including comparisons with HIV and malaria, is provided in Box 7.2, based on donor reports to the OECD.[1] Amounts for TB are much lower than donor contributions for HIV and malaria.

7.3 Funding gaps reported by national TB programmes, 2006–2016

Despite growth in funding from domestic and international donor sources, many NTPs continue to be unable to mobilize all the funding required for full implementation of their national strategic plans (Fig. 7.6). Funding gaps (i.e. the difference between assessments by NTPs of funding needs for TB prevention, diagnosis and treatment, and the actual amount of funds mobilized) have persisted, and in 2016 they amounted to a total of US$ 0.8 billion. This is less than half of the gap of US$ 1.7 billion that exists between the US$ 8.3 billion estimated to be needed in low- and middle-income countries in 2016 according to the Global Plan (Section 7.1) and the US$ 6.6 billion available in 2016 (Section 7.2). 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 (Section 7.1).

Lower middle-income countries account for the largest reported funding gaps (almost US$ 0.5 billion in 2016). Geographically, almost half of the total reported funding gap is accounted for by countries in the WHO African Region, with the largest gaps reported by Ethiopia and Nigeria (Table 7.3). Funding gaps were relatively small in upper middle-income countries in 2016 (Fig. 7.6), and have fallen in recent years. This trend is mostly explained by large reductions in the funding gaps reported by China, Kazakhstan and the Russian Federation, which reported funding gaps in 2006–2011 but negligible or zero gaps thereafter. Funding gaps reported by low-income countries have fallen since 2012, reflecting a transition of some countries out of the low-income country group and into the group of middle-income countries.

Of the US$ 0.8 billion funding gap reported by NTPs in 2016, US$ 0.63 billion is for drug-susceptible TB and US$ 0.14 billion is for MDR-TB. Relative to total funding needs, the funding gap is larger for drug-susceptible TB than for MDR-TB. Domestic funding accounts for a larger share of the funding for MDR-TB than for drug-susceptible TB: this is not surprising given that most of the high MDR-TB burden countries are middle- or high-income countries.

7.4 Unit costs of treatment for drug-susceptible and multidrug-resistant TB, 2015

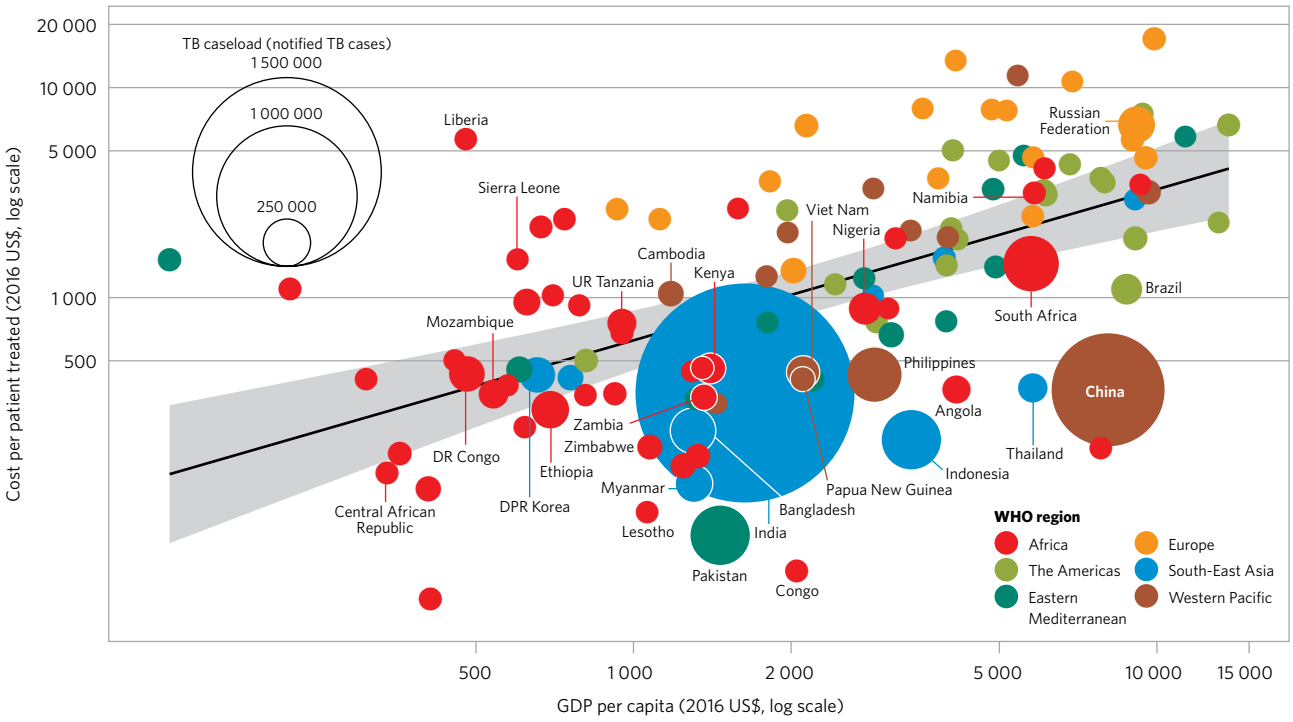
The cost per patient treated in 2015 for drug-susceptible and MDR-TB was estimated for 117 countries and 82 countries, respectively.[2] All 30 countries in the lists of TB and

[1] Out-of-pocket expenditures are also not included in NTP reports. These are discussed in more detail in Chapter 6.

[2] Analysis for drug-susceptible TB was limited to countries that notified at least 100 TB cases in 2015. For MDR-TB, estimates were restricted to countries that reported at least 10 patients on second-line treatment for MDR-TB.

:: FIG. 7.7

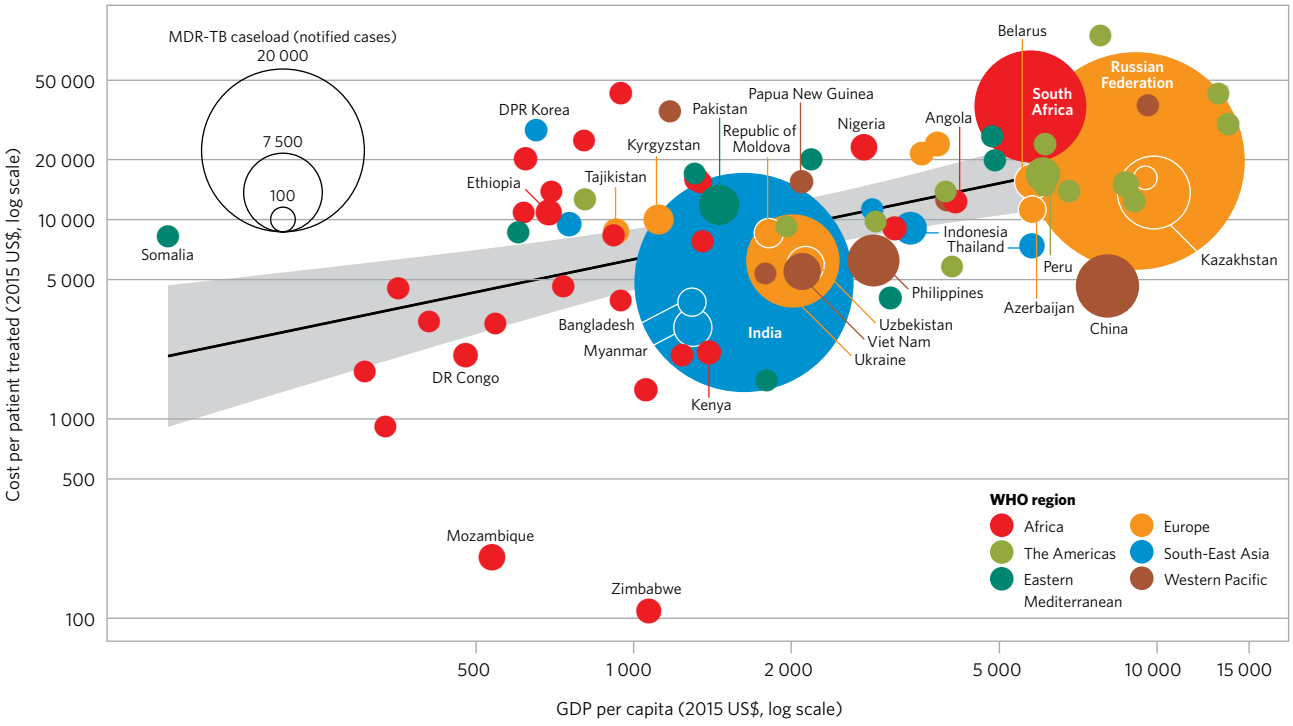
Estimated cost per patient treated for drug-susceptible TB in 117 countries, 2015[a]



[a] Limited to countries with at least 100 notified patients in 2015.

:: FIG. 7.8

Estimated cost per patient treated for MDR-TB in 82 countries, 2015[a]



[a] Limited to countries with at least 20 patients on second-line treatment in 2015.

:: Box 7.3
Methods used to estimate the cost per patient treated for drug-susceptible and MDR-TB

Two main data sources were used to estimate the cost per patient treated for drug-susceptible TB and MDR-TB. The first was the validated expenditure data reported by NTPs that are stored in the WHO global TB database. The second was country-specific estimates of the unit costs of bed days and outpatient visits available from the WHO-CHOICE model[a] and associated database (managed by the WHO Health Governance and Financing Department). In the few instances where no expenditure data could be reported, information about the total funding available was used as a proxy for expenditures. Also, for a few countries, WHO-CHOICE estimates were replaced with estimates of unit costs obtained directly from recent studies or discussions with experts.

Costs were calculated separately for drug-susceptible TB and MDR-TB. In each case, the numerator was the total estimated cost of treatment, which has two main parts: the national expenditures reported by the NTP, and the costs associated with the use of health services for TB patients.

As explained in **Box 7.1**, national NTP expenditures are reported annually to WHO using the online WHO global TB data collection system, and are then reviewed and validated. Categories of expenditure considered as costs for MDR-TB were second-line drugs and all other inputs or activities implemented for the programmatic management of MDR-TB. All other categories (with the exception of collaborative TB/HIV activities) were assumed to be for drug-susceptible TB.

For almost all countries, the total costs associated with use of inpatient and outpatient care were calculated using information about the typical number of days of inpatient care and outpatient visits required on a per-patient basis during treatment (reported separately for drug-susceptible TB and MDR-TB by NTPs) combined with WHO-CHOICE unit cost estimates, multiplied by the number of patients treated in a given year (based on notification data – see **Chapter 4**). Multiplying quantities of visits and bed days by their price estimates yields the total estimated cost of inpatient and outpatient services. For 27 countries (including six HBCs, see **Box 7.1**), TB inpatient and outpatient expenditures available from national health accounts[b] were used instead of the estimated cost from this ingredients-based approach.

Unit costs were then calculated as the sum of 2015 NTP expenditures and total costs for use of inpatient and outpatient care, divided by the reported number of patients treated. Again, this calculation was carried out separately for drug-susceptible TB and MDR-TB.

[a] Cost effectiveness and strategic planning (WHO-CHOICE): health service delivery costs. Geneva: World Health Organization; 2008 (http://www.who.int/choice/cost-effectiveness/inputs/health_service/en/, accessed 29 July 2016).

[b] Health accounts. Geneva: World Health Organization (http://www.who.int/health-accounts/en/, accessed 29 July 2016).

MDR-TB HBCs were included in this analysis. Unit cost estimates are shown in **Fig. 7.7** and **Fig. 7.8**, and analytical methods are summarized in **Box 7.3**.

7.4.1 Drug-susceptible TB

The cost per patient treated for drug-susceptible TB was generally in the range US$ 100–US$ 1000 (**Fig. 7.7**). In general, about 80% of this cost was accounted for by reported NTP expenditures, with the remainder being inpatient and outpatient care. There is a positive relationship between the cost per patient treated and gross domestic product (GDP) per capita, as well as the size of the patient caseload (indicating economies of scale, e.g. in China and India). In most (28/30) of the TB HBCs included in the analysis, the cost per patient treated for drug-susceptible TB was less than GDP per capita; the exceptions were Liberia and Sierra Leone.

The cost per patient treated was typically higher in countries in the WHO European Region and the WHO Region of the Americas. In countries of the former Soviet Union, the higher cost is partly explained by relatively lengthy hospitalizations, with admissions lasting up to an average of 75 days and accounting for about 40–60% of the total cost per patient. However, there are some striking examples of reductions in reliance on hospitalization. For example, the Russian Federation reported hospitalization of about 65% of TB patients with drug-susceptible TB in 2016, compared with 93% in 2014, and in Georgia the figures were 30% and 83%, respectively.

7.4.2 Multidrug-resistant TB

For MDR-TB, the cost per patient treated ranges from about US$ 2000–20 000 in most countries (**Fig. 7.8**). As with drug-susceptible TB, the cost per patient treated is related to GDP per capita. Following new WHO recommendations that shortened regimens of 9–12 months can be used for patients (other than pregnant women) with rifampicin-resistant or MDR pulmonary TB who do not have resistance to second-line drugs,[1] at a cost of about US$ 1000 per person for the drug regimen, there is scope for the unit cost of second-line treatment for MDR-TB to fall in the coming years.

[1] For further details about the new recommendations, see **Chapter 4**.

Chapter 8 :: TB research and development

KEY FACTS AND MESSAGES

"Intensified research and innovation" is the third pillar of the End TB Strategy.

WHO has developed a Global Action Framework for TB Research, to foster high-quality research to end the TB epidemic at both country and global levels.

In 2016, four diagnostic tests were reviewed and recommended by WHO: the loop-mediated isothermal amplification test for TB (known as TB-LAMP), two line probe assays (LPAs) for the detection of resistance to the first-line anti-TB drugs isoniazid and rifampicin, and an LPA for the detection of resistance to second-line anti-TB drugs.

A next-generation cartridge called Xpert Ultra, which may replace the Xpert MTB/RIF cartridge and could potentially replace conventional culture as the primary diagnostic tool for TB, will be assessed in 2017. The Xpert Ultra cartridge is designed to be used in existing GeneXpert instruments. A new diagnostic platform called the GeneXpert Omni is also in development. This is intended for point-of-care testing for TB and rifampicin-resistant TB using Xpert Ultra cartridges. Assessment of this new platform as an alternative to the GeneXpert instrument is expected in 2017.

Development of new drugs and regimens for the treatment of TB continues, with both advances and setbacks in 2015–2016. A new compound (Q203) entered a Phase I trial, but the development of AZD5847 by Astra-Zeneca was officially ended (due to lack of demonstrated anti-TB activity) and the development of TBA-354 was discontinued (due to signs of toxicity in the Phase I trial).

There are nine anti-TB drugs in advanced phases of clinical development for the treatment of drug-susceptible, multidrug-resistant TB or latent TB infection (LTBI), of which six are new and three are already approved or repurposed. The six new compounds are bedaquiline, delamanid, PBTZ169, pretomanid, Q203 and sutezolid. The three approved or repurposed drugs undergoing further testing are rifampicin, rifapentine and linezolid.

There are 13 vaccine candidates in clinical trials: eight in Phase II or Phase III trials, and five in Phase I trials. They include candidates for prevention of TB infection and candidates for prevention of TB disease in people with LTBI.

"Intensified research and innovation" is one of the three pillars of the WHO End TB Strategy.[1] Its two main components are "discovery, development and rapid uptake of new tools, interventions and strategies" and "research to optimize implementation and impact, and promote innovations" (**Chapter 2**). The strategy sets targets for reductions in TB incidence and TB mortality by 2030 and 2035. Reaching these targets will require a major technological breakthrough by 2025, so that the rate at which TB incidence falls can be dramatically accelerated compared with historic levels between 2025 and 2035 (**Chapter 2**). A substantial increase in investment in TB research and development will be needed to achieve such a breakthrough. The Stop TB Partnership's *Global Plan to End TB, 2016–2020*[2] estimates that about US$ 2 billion per year is needed during the period 2016–2020, compared with funding levels during the decade 2005–2014 that never exceeded US$ 0.7 billion per year.[3]

This chapter provides an overview of progress in the development of new TB diagnostics, drugs and vaccines as of August 2016, based on recent publications and communications with and contributions from the secretariats of the relevant working groups of the Stop TB Partnership, and various stakeholders.

The Global Action Framework for TB Research (GAF),[4] which has been developed by WHO to foster high-quality TB research across the spectrum, is profiled in **Box 8.1**.

[1] World Health Organization. WHO End TB Strategy: global strategy and targets for tuberculosis prevention, care and control after 2015. Geneva: WHO; 2015 (http://www.who.int/tb/post2015_strategy/en/, accessed 8 August 2016).

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

[3] 2015 Report on Tuberculosis Research Funding Trends, 2005–2014: A Decade of Data. New York: Treatment Action Group; 2015 (http://www.treatmentactiongroup.org/tbrd2015).

[4] World Health Organization. A Global Action Framework for TB research in support of the third pillar of WHO's End TB Strategy. Geneva: WHO; 2015 (http://www.who.int/tb/publications/global-framework-research/en/, accessed 8 August 2016).

:: Box 8.1
WHO's Global Action Framework for TB Research

WHO has developed Global Action Framework (GAF) to foster high-quality TB research across the spectrum (from basic science to implementation research), with the overall goal of ending the global TB epidemic. The GAF has two major dimensions: promoting research at country level and promoting research at global level, as summarized below.

Promoting research at country level

At country level, WHO encourages the establishment of a national TB research network of stakeholders (individuals and organizations) that will drive research and innovation based on a shared desire to address the national TB epidemic. It is expected that the network will provide a systematic approach to addressing issues in TB prevention, diagnosis and treatment research. The approach should start with a situational analysis of the TB epidemic, and of the performance of the national TB control programme and wider health system, and mapping of research capacity. This should be followed by the development of a national TB research agenda to address identified gaps, the outcomes of which should inform TB care policy and practice. To support the development of such plans for research, WHO's Global TB Programme has developed a toolkit to assist high and medium TB burden countries with each of these steps. Early adopters of this approach include Brazil, Ethiopia, the Russian Federation, South Africa and Viet Nam.

Promoting research at global level

WHO is promoting TB research by sharing innovations, organizing a variety of knowledge-sharing platforms, and facilitating the development of regional and global networks for research and capacity-building. This approach involves partnering with countries, organizations and institutions. WHO is also encouraging international collaboration between technologically advanced countries and those with limited resources, and is providing technical support to regional and global networks of TB researchers.

8.1 New diagnostics for TB

8.1.1 An overview of the diagnostics pipeline

The diagnostic technology landscape, which consists mostly of molecular tests, continues to look promising. An overview of the diagnostic pipeline for rapid molecular tests in August 2016 is shown in **Fig. 8.1**. The list of technologies is not necessarily complete, but does reflect technologies that have been documented in a recent report published by the Treatment Action Group.[1] Technologies under development include tests to detect TB, drug resistance or TB and drug resistance combined.

At least three new commercial technologies – Epistem Genedrive, Epistem, United Kingdom; EasyNAT, Ustar Biotechnologies, China; and Molbio TrueNAT, Molbio, India – are intended for use at the microscopy level. However, available performance data for these tests are limited and highly variable, and to date no multicentre evaluation or demonstration studies in different epidemiological settings have been conducted. Such studies are essential to generate the data required by WHO to assess and produce recommendations on their use, but funding and capacity to undertake the studies are limited. Several manufacturers have also indicated that they are developing centralized testing platforms suitable for high laboratory throughput. However, these platforms are not yet ready for field evaluation studies, and to be useful a large investment in sample transportation systems would be required.

Cepheid is developing a new platform called GeneXpert Omni, which is intended for point-of-care (POC) testing for TB and rifampicin-resistant TB using Xpert MTB/RIF cartridges or the next-generation Xpert Ultra cartridges. The device is expected to be smaller, lighter and less expensive than other currently available platforms for POC nucleic acid detection. The platform is expected to come with a built-in 4-hour battery and an auxiliary battery that provides an additional 12 hours of run time. Delays in the development of the GeneXpert Omni mean that the instruments are not likely to be available before the second half of 2017. The new platform will be assessed for equivalence to the current GeneXpert platform before its launch. The GeneXpert Omni is expected to be an alternative to and complement the existing multi-module instruments.

Major gaps that remain in the diagnostic pipeline include tests for the diagnosis of TB in children, rapid drug susceptibility tests for drugs that may be part of new treatment regimens, tests that accurately predict progression from latent TB infection (LTBI) to active TB disease, and alternatives to TB microscopy and culture for treatment monitoring. In addition, experience with GeneXpert has made it clear that any new technology will need to be rolled out with an entire set of interventions, including comprehensive training, quality assurance, implementation plans, data connectivity, and service and maintenance support.

[1] Frick M, Lessem E, McKenna L. Pipeline report: Tuberculosis (TB) edition. London/New York: HIV i-Base/Treatment Action Group; 2016 (http://www.pipelinereport.org/sites/default/files/2016%20Pipeline%20TB%20Edition_0.pdf, accessed 8 August 2016).

:: FIG. 8.1

An overview of progress in the development of molecular TB diagnostics, August 2016[a]

TECHNOLOGIES IN DEVELOPMENT FOR USE IN REFERENCE LEVEL LABORATORIES

- m2000 RealTime MTB System, Abbott, USA
- TruArray® MDR-TB, Akonni, USA
- INFINITI® System MDR-TB BioFilm Chip® Microarray, AutoGenomics, USA
- BD ProbeTec® ET Direct TB assay, BD, USA
- TB drug resistance array, Capital Bio, China
- AMTD test, Hologic Genprobe, USA
- Cobas TaqMan MTB test, Roche, Switzerland
- Anyplex™, Seegene, Korea
- Magicplex™ MTB, Seegene, Korea
- TRC Rapid®M.TB, Tosoh Bioscience, Japan
- MeltPro®, Zeesan Biotech, China

TECHNOLOGIES IN DEVELOPMENT FOR USE IN INTERMEDIATE LEVEL LABORATORIES

- FluoroType MTB/FluoroType MTB RNA, Hain Lifesciences, Germany
- iCubate System, iCubate, USA
- AdvanSure, LG Life sciences, Korea
- vereMTB, Veredus Laboratories, Singapore
- SPEED-OLIGO®, Vircell, Spain
- MolecuTech REBA, YD Diagnostics, Korea
- LATE-PCR, Brandeis University, USA
- GeneXpert XDR cartridge, Cepheid, USA
- Xpert Ultra, Cepheid, USA
- Enigma ML, Enigma Diagnostics, UK

TECHNOLOGIES IN DEVELOPMENT FOR USE IN PERIPHERAL LEVEL LABORATORIES

- Genedrive MTB/RIF ID, Epistem, UK
- HYDRA, Insilixa Inc, USA
- Truelab/Truenat MTB, Molbio/bigtec Diagnostics, India
- EasyNAT TB Diagnostic kit, Ustar Biotechnologies, China
- GenePOC test, GenePOC, Canada
- Xpert Omni, Cepheid, USA

[a] This is not an exhaustive list of technologies in development. Those listed are the ones documented in publications by UNITAID and TAG.

UNITAID. 2014. Tuberculosis Diagnostic Technology and Market Landscape, 3rd edition. Geneva: World Health Organization. http://www.unitaid.eu/images/marketdynamics/publications/UNITAID_TB_Diagnostics_Landscape_3rd-edition.pdf

Frick M., Lessem E., McKenna L., "2016 pipeline report. Tuberculosis (TB) Edition. Diagnostics, treatment, prevention and vaccines in development", HIV i-Base/Treatment Action Group. London/New York 2016. http://www.pipelinereport.org/sites/g/files/g575521/f/201507/2015%20Pipeline%20Report%20Full.pdf

8.1.2 TB diagnostic tests reviewed by WHO in 2016

WHO reviewed three diagnostic technologies in 2016: the loop-mediated isothermal amplification test for TB (referred to as TB-LAMP); line probe assays (LPAs) to test for resistance to first-line anti-TB drugs; and LPAs to test for resistance to second-line anti-TB drugs. These technologies are discussed below.

Loop-mediated isothermal amplification test for TB

TB-LAMP – developed by Eiken, Japan – is a manual test that takes less than 1 hour. Results can be read with the naked eye under ultraviolet light, and the TB-LAMP instrument can be used at the peripheral health centre level, which is where sputum smear microscopy is often performed. The level of training of staff required to perform the test is also similar to that needed for microscopy. TB-LAMP performs better than sputum smear microscopy, detecting at least 40% more patients with pulmonary TB; this is an increase comparable to other rapid tests that have been recommended by WHO in recent years. The test does not detect drug resistance and is therefore only suitable for testing of patients at low risk of multidrug-resistant TB (MDR-TB).

Following review of the latest evidence, WHO recommends that TB-LAMP can be used as a replacement for microscopy for the diagnosis of pulmonary TB in adults with signs and symptoms of TB. It can also be considered as a follow-on test to microscopy in adults with signs and symptoms of pulmonary TB, especially when further testing of sputum smear-negative specimens is necessary.

Line probe assays to test for resistance to first-line anti-TB drugs

Two LPAs for the detection of resistance to the first-line drugs isoniazid and rifampicin have been developed, one by the Nipro Corporation, Japan and the other by Hain Lifesciences, Germany. These LPAs can provide results on drug resistance within days, compared with up to 4 weeks for phenotypic culture-based testing.

Following review of the latest evidence, WHO recommends that both these LPAs can be considered for use as an initial test to detect resistance to rifampicin and isoniazid in smear-positive specimens. They can also be used to test cultured isolates of *Mycobacterium tuberculosis*. Direct testing of sputum smear-negative specimens is not recommended. Further details are available online.[1]

Line probe assay to test for resistance to second-line anti-TB drugs

An LPA for the detection of resistance to second-line anti-TB drugs (fluoroquinolones and injectables) has been developed by Hain Lifesciences, Germany. Following review of the latest evidence, WHO recommends that this LPA can be considered as an initial test for resistance to second-line anti-TB drugs, given its ability to provide rapid results, especially when used for the direct testing of sputum specimens from patients with confirmed multidrug-resistant TB (MDR-TB) or rifampicin-resistant TB. The speed of testing

[1] The use of molecular line probe assays for the detection of resistance to isoniazid and rifampicin. Policy Guidance. Geneva: World Health Organization; 2016 (WHO/HTM/TB 2016.12). Available at http://www.who.int/tb/areas-of-work/laboratory/policy_statements/en/

is critical to allow for the time-sensitive step of triaging patients between the standardized short regimen for MDR-TB (which is recommended for use only in patients who do not have second-line drug resistance). If the LPA result is negative, WHO recommends that phenotypic culture-based testing may be necessary, especially in settings with a high pretest probability for resistance to fluoroquinolones or second-line injectable drugs, or both. Further details are available online.[1]

8.1.3 Technologies scheduled for evaluation in 2017

Xpert Ultra

A new version of the Xpert MTB/RIF assay, called Xpert Ultra, is in development by Cepheid. The current assay has been modified with the aim of improving its sensitivity for the detection of TB and its specificity in the detection of resistance to rifampicin; it can be used in the Omni platform (described above).

In early 2017, WHO will initiate a two-step evaluation process of Xpert Ultra based on data from evaluations by the Foundation for Innovative New Diagnostics (FIND). The first step is a rapid noninferiority (i.e. equivalence) study that will compare the new Xpert Ultra assay with the current Xpert MTB/RIF assay. If noninferiority is demonstrated, the Xpert Ultra assay will be recommended as a replacement for the current Xpert MTB/RIF assay. Later in 2017, the second evaluation step will involve multicountry studies.

Updated critical concentrations for culture-based drug susceptibility testing

Phenotypic methods to detect resistance to anti-TB drugs are based on assessment of the ability of the *M. tuberculosis* complex (MTBC) to grow in culture media containing critical concentrations (CC) of specific anti-TB agents (which indicates resistance) or, conversely, its inability to grow in that media (which indicates susceptibility). Susceptibility is used as a proxy for successful treatment outcome, and resistance as a proxy for treatment failure.

New drugs for the treatment of MDR-TB have been recommended by WHO (**Section 8.2**), and other drugs are being repurposed (notably linezolid and clofazamine) in the shortened MDR-TB regimens. Methods for testing for susceptibility to these drugs are therefore needed. Other anti-TB agents – for example, the fluoroquinolones, second-line injectable agents, thioamides, cycloserine and pyrazinamide – are becoming increasingly important in the treatment of drug-resistant TB; hence, there is a need for the CCs of these anti-TB agents to be re-evaluated as well.

WHO has initiated a systematic approach to aggregating and analysing data (published and unpublished) to assess the association of CC or minimal inhibitory concentration with epidemiological cut-offs and patient outcomes. Through this approach, WHO expects to be able to revise current CCs and validate new CCs, especially for the new and repurposed drugs.

Role of molecular sequencing as a reference standard for drug susceptibility testing

Drug resistance in MTBC is, possibly exclusively, due to mutations affecting the bacterial genome. Rapid molecular diagnostic tests have been developed for the simultaneous detection and identification of MTBC, and for the most common mutations causing resistance to specific drugs. However, for some anti-TB drugs, the association between the observed phenotypic resistance, mechanisms of resistance and the genetic basis of the phenotype are still poorly understood. Many new tools for sequencing and analysing the genome of MTBC have become widely accessible for the molecular detection of the mutations associated with drug resistance, but uncertainties remain about the correlation between specific single nucleotide polymorphisms (SNPs) and their expressed phenotypic resistance (as measured by both solid and liquid culture methods).

In 2017, WHO will evaluate the accuracy of genotypic drug susceptibility testing (DST) compared with the current phenotypic gold standards. WHO will also assess whether genotypic DST can replace phenotypic DST, at least for certain key drugs such as pyrazinamide and rifampicin.

8.1.4 Tests that predict progression from latent to active TB

Identifying and effectively treating people with LTBI who have no signs and symptoms of TB disease will be key to achieving the 2030 and 2035 targets of the End TB Strategy (**Chapter 2**). On average, 5–15% of those infected will develop active TB during their lifetime, typically within the first 2–5 years after the initial infection.

Current tests for LTBI are the interferon gamma release assays (IGRAs) and the tuberculin skin test (TST). These tests are immunity based, and have limited ability to predict disease or to identify which individuals with TB infection are likely to progress to active TB disease. They also have limited sensitivity in people with HIV infection, and cannot differentiate between recent and remote infection, or whether a person has been reinfected if re-exposed.

Current IGRA assays primarily detect a CD4 T-cell response. However, a new generation assay, the QuantiFERON-TB Plus (QFT-Plus, Qiagen, Hilden, Germany), has been developed to stimulate gamma interferon production by both CD4 and CD8 T-cells. First results indicate that the CD8 T-cell response may be able to identify people at greater risk of progression to active TB.[2]

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[1] World Health Organization. The use of molecular line probe assays for the detection of resistance to second-line anti-tuberculosis drugs (WHO/HTM/TB/2016.07). Geneva: WHO; 2016 (http://www.who.int/tb/areas-of-work/laboratory/policy_statements/en/, accessed 8 August 2016).

[2] Barcellini L, Borroni E, Brown J, Brunetti E, Campisi D, Castellotti PF et al. First evaluation of QuantiFERON-TB Gold Plus performance in contact screening. Eur Respir J. 2016:ERJ-00510-02016.

8.1.5 Diagnostic connectivity

The roll out of rapid diagnostic tools for TB patients allows for faster and more accurate testing. However, these benefits can be jeopardized if bottlenecks occur in the handling of samples and results. Streamlining the flow of data between testing, storage and sending of results is a critical sequence of steps that must accompany the roll out of new tests. For diagnostic systems to make a measurable impact on patient care, they should be able to communicate through a standardized digital interface, using technologies that are feasible regardless of the income level of the country or setting.[1] Diagnostics connectivity solutions are now being monitored by WHO as a core indicator for laboratory strengthening under the End TB Strategy.

8.2 New drugs and drug regimens

Development of new drugs and regimens for the treatment of TB continues, with both advances and setbacks in 2015–2016. A new compound (Q203) entered a Phase I trial, but the development of AZD5847 by Astra-Zeneca was officially ended (due to lack of demonstrated anti-TB activity) and the development of TBA-354 was discontinued (due to signs of toxicity in the Phase I trial).[2]

The status of the pipeline for new anti-TB drugs in August 2016 is shown in **Fig. 8.2**. There are currently nine new or repurposed drugs in Phase I, II or III trials for the treatment of drug-susceptible TB, MDR-TB or LTBI. Of these, six are new compounds (bedaquiline, delamanid, PBTZ169, pretomanid, Q203 and sutezolid.) and three are drugs that have already been approved or have been repurposed and are undergoing further testing (linezolid, rifampicin and rifapentine). These drugs are discussed below.

8.2.1 New compounds in development

Bedaquiline

After approval by the US Food and Drug Administration in December 2012 and WHO's interim policy guidance on its use in June 2013,[3] bedaquiline has been introduced in several countries for the treatment of severe forms of MDR-TB (**Chapter 4**).[4,5] The safety and efficacy of bedaquiline as part of short MDR-TB regimens of 6 and 9 months duration, compared with the current standard of care recommended by WHO, is now being investigated in the second stage of the Phase III STREAM trial that started recruitment in March 2016. The first results are expected towards the end of 2020.

Delamanid

A conditional marketing authorization for delamanid was granted by the European Medicines Agency in April 2014. This was for the treatment of pulmonary MDR-TB in adult patients "when an effective treatment regimen cannot otherwise be composed for reasons of resistance or tolerability". Interim guidance on the use of delamanid was issued by WHO in October 2014.[6]

The follow-up stage of a Phase III trial of the safety and efficacy of delamanid as an addition to an optimized background regimen (OBR) for the treatment of MDR-TB in adults was recently completed. It is anticipated that results will be published in 2018.

The use of delamanid in addition to OBR for treatment of MDR-TB in children is being investigated in Phase I and II trials. Partial results were presented in 2015.[7]

PBTZ169

A new series of piperazine-containing benzothiazinones (PBTZ) have shown highly potent activity against drug-susceptible and drug-resistant TB.[8] PBTZ169 is compatible with all TB drugs and appears to have synergies with bedaquiline and clofazimine. A Phase I trial of PBTZ169 was completed in the Russian Federation in July 2016, and a second Phase I trial will be undertaken in Switzerland in 2017. A Phase IIa trial is expected to start towards the end of 2016 in the Russian Federation.

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1 World Health Organization. Digital health for the End TB Strategy: an agenda for action (WHO/HTM/TB/2015.21). Geneva: WHO; 2015 (http://www.who.int/tb/areas-of-work/digital-health/Digital_health_EndTBstrategy.pdf, accessed 8 August 2016).

2 TBA-354, belonging to the nitroimidazole class, was the first candidate to enter Phase 1 TB trials over the past 6 years. However, in a Phase 1 dose-escalating trial the drug was found to be associated with mild signs of neurotoxicity (repetitive uncontrolled eye movements and overactive reflexes, from which all affected study participants recovered). The TB Alliance announced the discontinuation of its development in March 2016. http://www.tballiance.org/news/phase-1-clinical-trial-tb-drug-candidate-tba-354-discontinued

3 World Health Organization. The use of bedaquiline in the treatment of multidrug-resistant tuberculosis: interim policy guidance (WHO/HTM/TB/2013.6). Geneva: WHO; 2013 (http://apps.who.int/iris/bitstream/10665/84879/1/9789241505482_eng.pdf, accessed 8 August 2016).

4 Guglielmetti L, Le Du D, Jachym M, Henry B, Martin D, Caumes E et al. Compassionate use of bedaquiline for the treatment of multidrug-resistant and extensively drug-resistant tuberculosis: interim analysis of a French cohort. Clin Infect Dis. 2015;60(2):188–194 (http://www.ncbi.nlm.nih.gov/pubmed/25320286, accessed 8 August 2016).

5 Ndjeka N, Conradie F, Schnippel K, Hughes J, Bantubani N, Ferreira H et al. Treatment of drug-resistant tuberculosis with bedaquiline in a high HIV prevalence setting: an interim cohort analysis. Int J Tuberc Lung Dis. 2015;19(8):979–985 (http://www.ncbi.nlm.nih.gov/pubmed/26162365, accessed 8 August 2016).

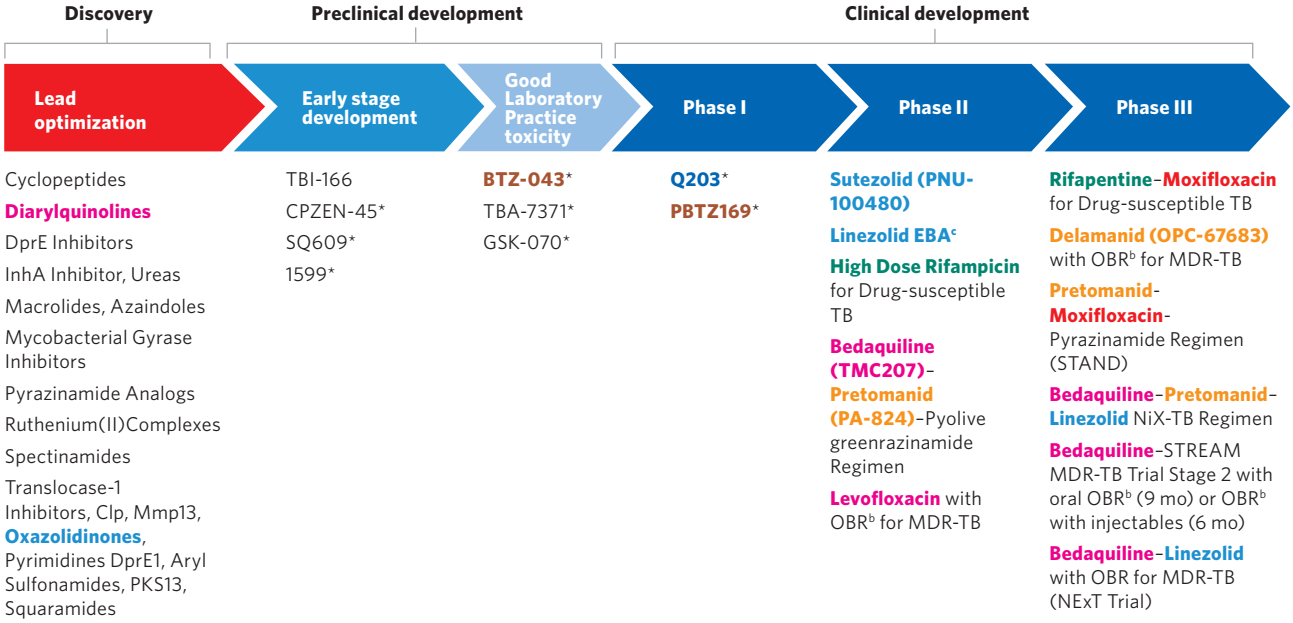
6 World Health Organization. The use of delamanid in the treatment of multidrug-resistant tuberculosis: interim policy guidance (WHO/HTM/TB/2014.23). Geneva: WHO; 2014. (http://apps.who.int/iris/bitstream/10665/137334/1/WHO_HTM_TB_2014.23_eng.pdf, accessed 8 August 2016).

7 Hafkin J, Frias M, Hesseling A, Garcia-Prats AJ, et al. Pharmacokinetics and safety of delamanid in pediatric MDR-TB patients: ages 6–17 years. Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC). San Diego, California. 2015; and Hafkin J, Frias M, De Leon A, et al. Long-term safety, tolerability and pharmacokinetics of delamanid in pediatric MDR-TB patients, ages 12–17 years. 46th Union World Conference on Lung Health. Cape Town, South Africa. 2015.

8 Makarov V, Lechartier B, Zhang M et al. Towards a new combination therapy for tuberculosis with next generation benzothiazinones. EMBO Mol Med. 2014 Mar;6(3):372–83.

:: FIG. 8.2

The global development pipeline for new anti-TB drugs, August 2016[a]



Chemical classes: **fluoroquinolone**, **rifamycin**, **oxazolidinone**, **nitroimidazole**, **diarylquinoline**, **benzothiazinone**, **imidazopyridine amide**.
* New chemical class

[a] Details for projects listed can be found at http://www.newtbdrugs.org/pipeline.php and ongoing projects without a lead compound series identified can be viewed at http://www.newtbdrugs.org/pipeline-discovery.php
[b] OBR = Optimized Background Regimen
[c] EBA = Early Bactericidal Activity
Source: Working Group on New TB Drugs, 2016 – www.newtbdrugs.org

Pretomanid

Pretomanid is a nitroimidazole developed by the Global Alliance for TB drug development (TB Alliance). It is currently being tested as part of three potential combination regimens for the treatment of both drug-susceptible and drug-resistant TB (further details in **Section 8.2.2**).

Q203

Q203 is a new compound of the imidazopyridine class developed by Qurient. It blocks the growth of TB bacilli by targeting the respiratory cytochrome bc1 complex, inhibiting the synthesis and homeostasis of adenosine triphosphate (ATP).[1] Different levels of a single dose are being tested in a Phase I trial.

Sutelozid

Sutezolid (PNU-100480) is an oxazolidinone and an analogue of linezolid. Results from a study of early bactericidal activity presented in 2012 showed that this compound led to a significant reduction in counts of colony-forming units compared with the baseline level following 14 days of treatment. In August 2016, however, there was no further information available to WHO about its subsequent development.

8.2.2 Approved or repurposed drugs

Rifapentine

Investigation of the potential effectiveness of rifapentine in the treatment of drug-susceptible TB has continued, based on the encouraging results from TB Trial Consortium (TBTC) Studies 29 and 29X. TBTC Study 31/A5349 is investigating the possibility of shortening treatment of drug-susceptible pulmonary TB to 4 months by using rifapentine, with or without moxifloxacin. Recruitment started in January 2016.

Rifampicin

A recent 2-month study testing the safety of high doses of rifampicin together with standard treatment for drug-susceptible TB showed no significant increase in adverse events at doses of 10 mg/kg, 15 mg/kg and 20 mg/kg.[2]

8.2.3 New regimens for the treatment of drug-susceptible or drug-resistant TB

Besides individual compounds, new combinations of drugs are being tested in several Phase II or Phase III trials.

The TB Alliance is investigating the efficacy, safety and tolerability of pretomanid in combination with moxifloxacin and pyrazinamide (PaMZ). Following the encour-

[1] Pethe K, Bifani P, Jang J, Kang S, Park S, Ahn S et al. Discovery of Q203, a potent clinical candidate for the treatment of tuberculosis. Nat. Med. 2013;19(9):1157–1160.

[2] Jindani A, Borgulya G, de Patino IW, Gonzales T, de Fernandes RA, Shrestha B et al. A randomised Phase II trial to evaluate the toxicity of high-dose rifampicin to treat pulmonary tuberculosis. Int. J. Tuberc. Lung Dis. 2016;20(6):832–838.

aging results of the 2-month NC-002 Phase IIb trial,[1] the STAND trial was launched in February 2015. This is a Phase III trial of the safety and efficacy of Pa(100 mg)MZ for 4 months, Pa(200 mg)MZ for 4 months and Pa(200 mg) MZ for 6 months in patients with drug-susceptible TB; and of Pa(200 mg)MZ for 6 months in patients with drug-resistant TB. In late 2015, enrolment was temporarily suspended due to three deaths related to high liver toxicity. Subsequently, the TB Alliance has been working with regulatory authorities and the trial's data safety and monitoring committee to determine whether to restart enrolment, and if so, when to do so.

A Phase IIb trial (NC-005) to test all-oral combination regimens started in October 2014. The regimens being tested are bedaquiline (at two different doses), pretomanid and pyrazinamide for patients with drug-susceptible TB, and the same drugs in combination with moxifloxacin for patients with MDR-TB. Enrolment was completed towards the end of 2015, and results are expected in late 2016.

The NiX-TB trial is being implemented by the TB Alliance in South Africa. It is investigating the safety and efficacy of a 6-month combination of bedaquiline, pretomanid and linezolid in patients with extensively drug-resistant TB (XDR-TB). The primary end-point is the incidence of bacteriologic failure (relapse or clinical failure) 6 months after completion of treatment, with long-term follow-up for 24 months after the end of treatment. Alongside this trial, the efficacy of escalating doses of linezolid in patients with drug-susceptible TB over a period of 2 weeks is also being investigated. Results will inform adjustments to the dosing of linezolid in the NiX-TB trial as well as other regimens that include linezolid.

The endTB and TB-PRACTECAL trials are scheduled to start around the end of 2016. The former is a Phase III trial funded by UNITAID, and implemented by Partners in Health and Médecins Sans Frontières (MSF). It will compare several regimens for treatment of MDR-TB or XDR-TB with the current WHO standard of care. The regimens being tested contain bedaquiline or delamanid (or both), moxifloxacin or levofloxacin, and pyrazinamide plus linezolid or clofazimine (or both), in various combinations. The TB-PRACTECAL trial is a Phase II/III adaptive 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. The trial is funded by MSF and will be conducted in Belarus, Uzbekistan, and potentially in countries in southern Africa.

The NeXT study is an open label trial of a 6–9 month injection-free regimen containing bedaquiline, ethionamide or high-dose isoniazid, linezolid, levofloxacin, and pyrazinamide, compared with the WHO-recommended 12-month shorter regimen for MDR-TB treatment. Recruitment started in South Africa in 2016.

8.2.4 Treatment of latent TB infection

Several studies evaluating shorter regimens for LTBI are being implemented, particularly for prevention of LTBI in people living with HIV. ACTG A5279 is evaluating the safety and effectiveness of ultra-short-course rifapentine or isoniazid (or both) for the prevention of active TB in HIV-positive people with LTBI. Rifapentine (at a dosage based on weight) in combination with 300 mg of isoniazid for 1 month is being compared with 300 mg of isoniazid for 9 months. Results are expected in the last quarter of 2017.

The "Weekly High dose Isoniazid and rifapentine (P) Periodic Prophylaxis for TB" trial, known as WHIP3 TB, is due to start by the end of 2016. It will evaluate a 3-month regimen of high dose rifapentine plus isoniazid for people living with HIV, administered either as a single round or given annually. It will be implemented in South Africa, Mozambique and Ethiopia, in two parts. Part A will compare a single round of weekly high dose rifapentine plus isoniazid for three months (3HP) to six months of daily isoniazid (6H); Part B will compare periodic 3HP (p3HP) to a single round of 3HP.

Two trials to investigate drugs or regimens for the prevention of TB in contacts of MDR-TB patients are being implemented or are planned. The V-QUIN MDR study is assessing 6 months of daily levofloxacin for household contacts of patients with MDR-TB. It is being conducted in Viet Nam and recruitment started in March 2016. The TB-CHAMP study is a multicentre trial to evaluate the efficacy of levofloxacin in children aged 0–5 years who are household contacts of MDR-TB cases. It is due to start in South Africa in October 2016.

8.3 New vaccines to prevent TB

Both the slow decline in TB incidence globally and the persistent threat of MDR-TB highlight the critical need for new TB vaccines that are more effective than the Bacille-Calmette-Guérin (BCG) vaccine in preventing TB. The status of the pipeline for new vaccines in August 2016 is shown in **Fig. 8.3**. The pipeline includes recombinant BCGs, whole-cell derived vaccines, recombinant viral-vectored platforms, protein and adjuvant combinations, and mycobacterial extracts. These vaccines aim either to prevent infection (pre-exposure) or to prevent primary progression to disease or reactivation of LTBI (post-exposure). Further details are provided below.

8.3.1 Phase II and Phase III clinical trials

There are currently eight vaccines in Phase II or Phase III trials.

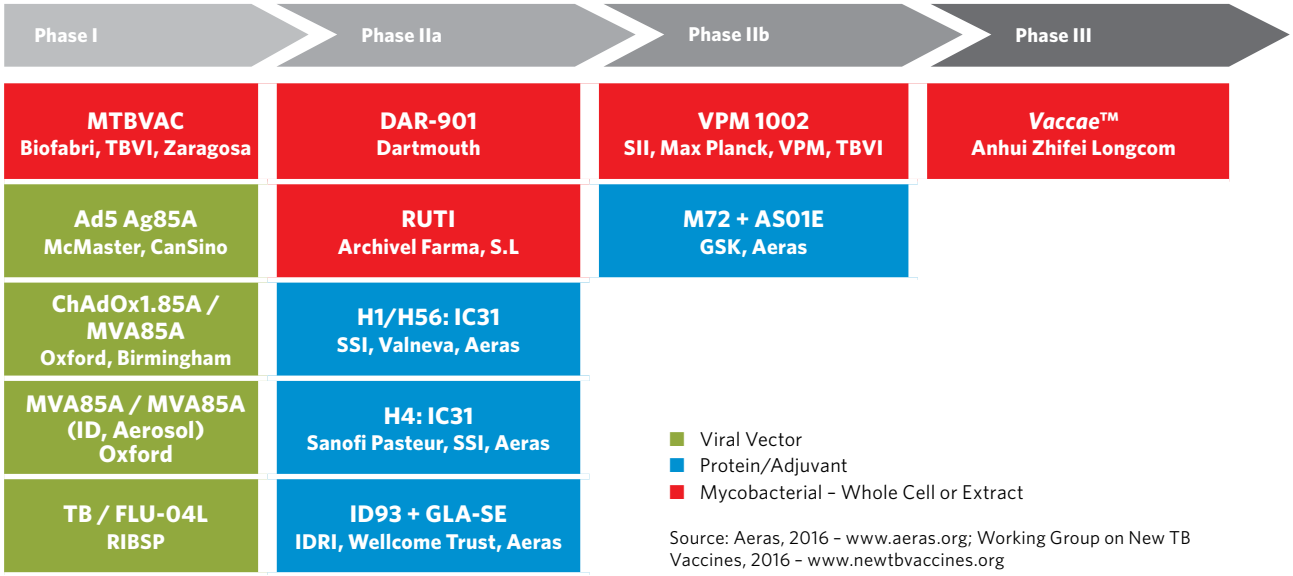
M72/AS01E

M72/AS01E is made by GlaxoSmithKline (GSK) and is a recombinant fusion protein of the *M. tuberculosis* antigens

[1] Dawson R, Diacon AH, Everitt D, van Niekerk C, Donald PR, Burger DA et al. Efficiency and safety of the combination of moxifloxacin, pretomanid (PA-824), and pyrazinamide during the first 8 weeks of antituberculosis treatment: a Phase 2b, open-label, partly randomised trial in patients with drug-susceptible or drug-resistant pulmonary tuberculosis. Lancet. 2015;385(9979):1738–1747.

:: FIG. 8.3

The development pipeline for new TB vaccines, August 2015



Source: Aeras, 2016 – www.aeras.org; Working Group on New TB Vaccines, 2016 – www.newtbvaccines.org

32 A and 39 A with the AS01E adjuvant. A large randomized placebo-controlled Phase IIb trial, conducted by GSK and Aeras, is enrolling pulmonary TB-negative, IGRA-positive, HIV-negative adults in Kenya, South Africa and Zambia. The primary end-point is the protective efficacy of two doses of M72/AS01E against pulmonary TB disease. Secondary end-points include safety and immunogenicity.

H4:IC31 and H56:IC31

The H4:IC31 and H56:IC31vaccines are protein subunits with adjuvants, initially developed by the Statens Serum Institute (SSI) in Copenhagen, Denmark.

H4:IC31 is being developed as a booster vaccine to BCG with Sanofi Pasteur. The vaccine candidate contains a fusion protein of Ag85B and TB10.4, formulated with the IC31 adjuvant. It is being tested in South Africa in a Phase II pre-proof of concept TB prevention study among IGRA-negative, HIV-negative adolescents at high risk of acquiring *M. tuberculosis* infection; an intensive immunogenicity study is also being done in the same population. H4:IC31 is also being evaluated in a Phase I/II trial in infants.

H56:IC31 is an adjuvanted subunit vaccine that combines three *M. tuberculosis* antigens (Ag85B, ESAT-6 and Rv2660c) with Valneva's IC31 adjuvant, developed by SSI and Aeras. A Phase I study to evaluate its safety and immunogenicity in HIV-negative adults with and without LTBI and with no history or evidence of TB disease has been completed. Two Phase I trials have been completed to determine the safety and immunogenicity profile of H56:IC31 in HIV-negative, BCG-vaccinated adults with and without LTBI, and in patients who have recently been treated for pulmonary TB disease. These Phase I trials demonstrated an acceptable safety profile and found the vaccine to be immunogenic at all doses studied. A Phase II trial including H4:IC31, H56:IC31 and BCG in 84 adolescents is now under way.

VPM 1002

VPM 1002 is a live recombinant vaccine that was originally developed at the Max Planck Institute of Infection Biology, Germany, with further development by Vakzine Projekt Management, the Tuberculosis Vaccine Initiative and the Serum Institute of India. 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. A Phase III trial for prevention of TB disease in adults is planned in India.

RUTI®

RUTI® is a non-live and polyantigenic vaccine based on fragmented and detoxified *M. tuberculosis* bacteria. It is being developed by Archivel Farma as an immunotherapeutic vaccine, in conjunction with a short intensive antibiotic therapy. A Phase II trial in South Africa was completed recently, and other clinical trials are in the planning stages.

DAR-901 booster

The DAR-901 booster vaccine is a whole-cell, heat-inactivated, non-tuberculous mycobacterial vaccine, developed by Dartmouth and Aeras. It was shown to be effective in a Phase III trial in the United Republic of Tanzania among people who were HIV-positive. A Phase I booster trial in the United States of America among BCG-primed adults with and without HIV infection found that it was safe and well tolerated. With funding from GHIT-Japan, a 2-year Phase II trial among adolescents was initiated in April 2016 in the United Republic of Tanzania.

ID93 + GLA-SE

The ID93 + GLA-SE vaccine comprises three *M. tuberculosis* immune-dominant antigens (Rv2608, Rv3619 and Rv3620), one *M. tuberculosis* latency-associated antigen (Rv1813), and the adjuvant GLA-SE. It was developed by the Infectious Disease Research Institute in collaboration with Aeras. A Phase I trial in BCG-vaccinated, QuantiFERON-TB-Gold negative and positive healthy adults has been completed in South Africa. ID93 antigen (2 mg or 10 mg) in combination with GLA-SE adjuvant (2 mg or 5 mg), given as three doses, was found to have an acceptable safety profile in BCG-vaccinated health adults (both QuantiFERON negative and QuantiFERON positive). Overall, significantly higher CD4+ responses were seen in all three intervention arms when compared with a placebo. A Phase IIa trial in South Africa, with the support of the Wellcome Trust, is evaluating safety and immunogenicity in HIV-naive TB patients that have recently completed treatment for pulmonary TB disease.

Vaccae™

The Vaccae™ vaccine is a specified lysate developed by the pharmaceutical company Anhui Zhifei Longcom Biologic Pharmacy Co., Ltd. It 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. In collaboration with the Guangxi Center for Disease Control and Prevention in China, a Phase III trial is being implemented to assess its efficacy and safety in preventing TB disease in people with LTBI. It is the largest TB vaccine trial undertaken in the past decade, including 10 000 people aged 15–65 years with a TST >15 mm. The trial was scheduled to be completed by mid-2016.

8.3.2 Phase I trials

There are five vaccines in Phase I trials.

MTBVAC

MTBVA is a live *M. tuberculosis* strain attenuated via deletions of the *pho*P and *fad*D26 genes. It was developed by the University of Zaragoza, Institut Pasteur and Biofabri, with the support of the TB Vaccine Initiative (TBVI). The primary target population is neonates (BCG replacement vaccine), with a secondary target being adolescents and adults (booster vaccine). In September 2015, MTBVAC moved into a Phase Ib trial in infants.

Ad5 Ag85A

Ad5 Ag85A is an adenovirus serotype 5 vector expressing Ag85A, which has been developed by McMaster University with support from CanSino. It has been evaluated for safety and immunogenicity in 24 healthy human volunteers (both BCG-naive and previously BCG-immunized) in Canada. Overall, it was found to be safe, well tolerated and immunogenic in both trial groups, stimulating polyfunctional T-cell responses. More potent immunogenicity was observed in the previously BCG-vaccinated volunteers. A safety and immunogenicity study of the aerosol administration of this vaccine was recently completed.

TB/FLU-04L

TB/FLU-04 L is a recombinant influenza vectored vaccine candidate that has been developed by the Research Institute for Biological Safety Problems and the Research Institute on Influenza in the Russian Federation. The influenza virus strain A/Puerto Rico/8/34 (H1N1) was used as a parent strain for construction of an attenuated replication-deficient vector expressing *M. tuberculosis* antigens Ag85A and ESAT-6. It was designed as a mucosal "boost" vaccine for infants, adolescents and adults. A Phase I trial in BCG-vaccinated QuantiFERON-TB-Gold negative healthy adult volunteers using intranasal administration was recently completed, and a Phase IIa trial is planned.

ChAdOx1.85A

ChAdOx1.85 A is a simian adenovirus expressing antigen 85 A, which was developed at the University of Oxford to boost BCG induced protection. It is being evaluated in a Phase I trial in BCG-vaccinated adults, both alone and as part of a prime-boost strategy with MVA85A.

MVA85A (Aerosol)

MVA85A (Aerosol) is an aerosolized vaccine MVA85A candidate that was developed at the University of Oxford. Its safety and immunogenicity has been tested in 24 BCG-vaccinated adults in the United Kingdom in a Phase I trial. The trial demonstrated that aerosol vaccination with MVA85A appears to be a safe and feasible compared with intradermal MVA85A, and produces a stronger CD4+ T-cell response than intradermal MVA85A. Further studies assessing the aerosol route are under way in people with LTBI.

Annex

1

Access to the WHO global TB database

A.1 Database contents

The 2016 global TB report is based on data collected annually from countries and territories, including 194 Member States. These data are stored in the global TB database.

In 2016, 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; TB infection control; engagement of all public and private care providers in TB control; 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$ 12 476 in 2015, 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).

Countries reported data using a dedicated website (**https://extranet.who.int/tme**), which was opened for reporting in early April 2016. Countries in the European Union submitted notification and treatment outcomes data 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 isoniazid preventive therapy (IPT) to people living with HIV and antiretroviral therapy (ART) for HIV-positive TB patients were collected by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the HIV department in WHO. 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 15 August 2016. The number of countries and territories that had reported data by 15 August 2016 is shown in **Table A1.1**.

:: TABLE A1.1

Reporting of data in the 2016 round of global TB data collection

WHO REGION OR SET OF COUNTRIES	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	41	35	33
Eastern Mediterranean Region	22	20	21	19
European Region	54	48	53	47
South-East Asia Region	11	11	11	11
Western Pacific Region	36	36	27	27
Global	216	202	194	183

[a] Countries that did not report by the deadline were mostly low-incidence countries in Western Europe.

A.2 Accessing TB data using the WHO Global TB Programme website

You can find most of the data held in the global TB database by going to **www.who.int/tb/data**. This web page gives you 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.

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.

[1] http://data.worldbank.org/about/country-classifications

A data dictionary that defines each of the variables available in the CSV files is also available and can be downloaded.

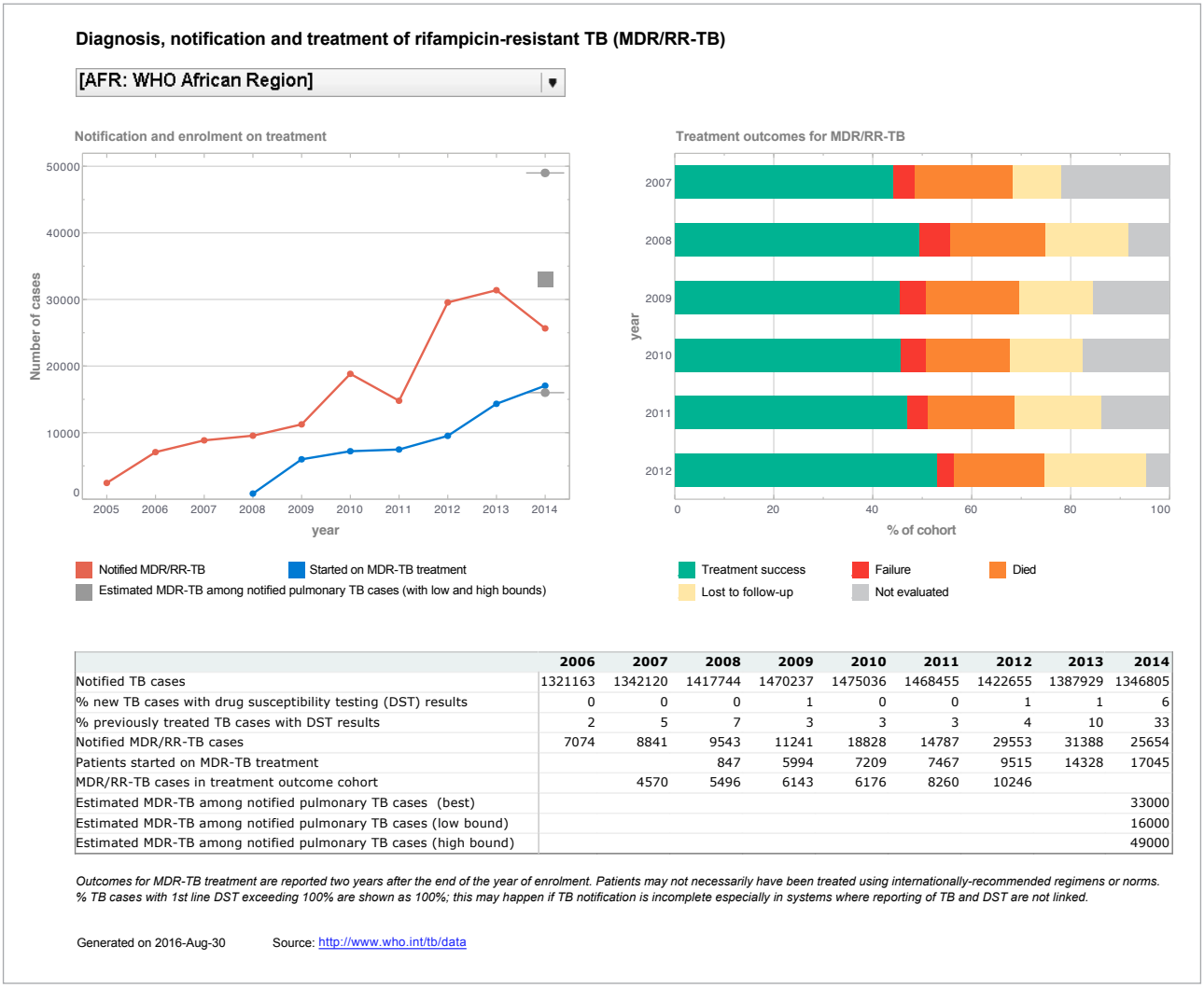
The CSV files are generated on-demand directly from the global TB database, and therefore may include updates received after publication of the global TB report.

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 (**Figure A1.1**).

:: FIG. A1.1

Interactive page to view MDR-TB indicators by region or country and year



	2006	2007	2008	2009	2010	2011	2012	2013	2014
Notified TB cases	1321163	1342120	1417744	1470237	1475036	1468455	1422655	1387929	1346805
% new TB cases with drug susceptibility testing (DST) results	0	0	0	1	0	0	1	1	6
% previously treated TB cases with DST results	2	5	7	3	3	3	4	10	33
Notified MDR/RR-TB cases	7074	8841	9543	11241	18828	14787	29553	31388	25654
Patients started on MDR-TB treatment			847	5994	7209	7467	9515	14328	17045
MDR/RR-TB cases in treatment outcome cohort		4570	5496	6143	6176	8260	10246		
Estimated MDR-TB among notified pulmonary TB cases (best)									33000
Estimated MDR-TB among notified pulmonary TB cases (low bound)									16000
Estimated MDR-TB among notified pulmonary TB cases (high bound)									49000

Outcomes for MDR-TB treatment are reported two years after the end of the year of enrolment. Patients may not necessarily have been treated using internationally-recommended regimens or norms.
% TB cases with 1st line DST exceeding 100% are shown as 100%; this may happen if TB notification is incomplete especially in systems where reporting of TB and DST are not linked.

Generated on 2016-Aug-30 Source: http://www.who.int/tb/data

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.

Key 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 (**Figure A1.2**).

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**

:: FIG. A1.2

A data table in the GHO Data Repository

Global Health Observatory Data Repository

By category > Tuberculosis

Co-epidemics of TB and HIV
Data by country

Also available:

– Data by WHO region
– Data by World Bank income groups

Data | Downloads

filter table | reset table | Mobile view

Download table data as: CSV table | XML (simple) | JSON (simple)

Country	Year	Total number of notified TB cases[i]	TB patients with known HIV status (%)[i]	Tested TB patients HIV-positive (%)[i]	HIV-positive TB patients on CPT (co-trimoxazole preventive therapy) (%)[i]	HIV-positive TB patients on ART (antiretroviral therapy) (%)[i]
Afghanistan	2013	31622	26	0.11		
	2012	29578	25	<0.1	250	250
	2011	28167	23	<0.1	80	80
	2010	28238	18	<0.1	100	100
	2009	26358	4.5	0.43	100	100
	2008	28301	0			
	2007	28769	0			
	2006	25475				
	2005	21844				
	2004	18404				
	2003	13949				

Annex

2

Country profiles

FOR
30 HIGH-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 2015 :: **25 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	11 (6.6–17)	45 (27–67)
Mortality (HIV+TB only)	7.2 (1.6–17)	29 (6.5–67)
Incidence (includes HIV+TB)	93 (60–132)	370 (240–529)
Incidence (HIV+TB only)	28 (17–41)	111 (68–165)
Incidence (MDR/RR-TB)[b]	4.1 (0.36–7.8)	16 (1.4–31)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	5.7 (3.1–8.4)	34 (16–51)	40 (19–60)
Males	4.4 (2.6–6.2)	49 (34–64)	53 (36–70)
Total	10 (6.6–14)	83 (63–102)	93 (60–132)

TB case notifications, 2015

Total cases notified	61 060
Total new and relapse	59 705
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	23%
— % pulmonary	93%
— % bacteriologically confirmed among pulmonary	51%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	64% (45–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.21 (0.1–0.37)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	1 558	12%
— on antiretroviral therapy		

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			2 700 (430–5 000)
Estimated % of TB cases with MDR/RR-TB	2.8% (0.1–6.7)	21% (2.2–39)	
% notified tested for rifampicin resistance			227
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 227, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 227, XDR-TB: 0

Treatment success rate and cohort size

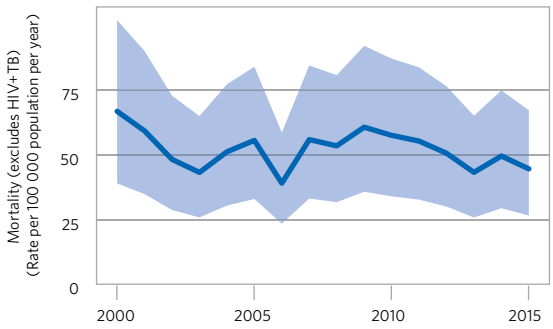
	Success	Cohort
New and relapse cases registered in 2014	34%	53 552
Previously treated cases, excluding relapse, registered in 2014	66%	1 654
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	74%	116
XDR-TB cases started on second-line treatment in 2013		

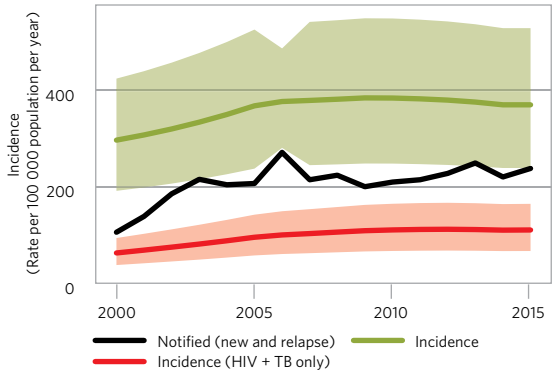
TB preventive treatment, 2015

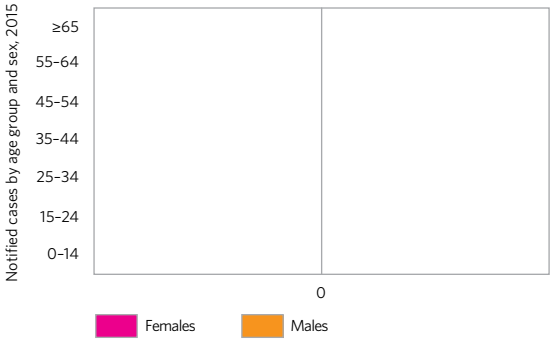
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

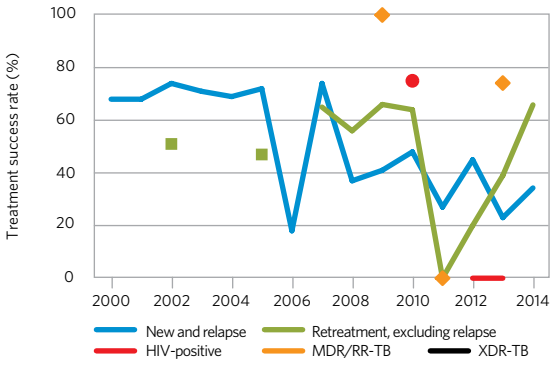
TB financing, 2016

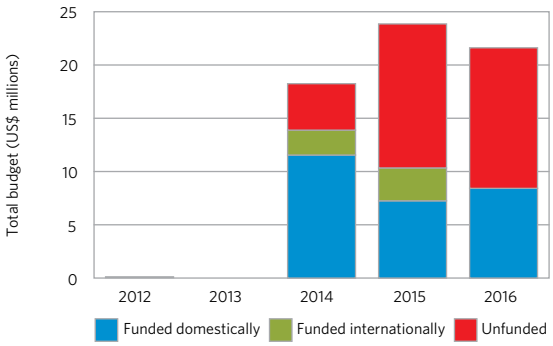
National TB budget (US$ millions)	22
Funding source	39% domestic, 0% international, 61% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Bangladesh

population 2015 :: **161 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	73 (43–110)	45 (27–68)
Mortality (HIV+TB only)	0.23 (0.19–0.29)	0.14 (0.12–0.18)
Incidence (includes HIV+TB)	362 (234–517)	225 (146–321)
Incidence (HIV+TB only)	0.63 (0.39–0.94)	0.39 (0.24–0.59)
Incidence (MDR/RR-TB)[b]	9.7 (5.4–14)	6 (3.4–8.7)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	20 (9.9–31)	131 (62–200)	151 (72–231)
Males	17 (9.8–24)	194 (134–254)	211 (143–278)
Total	37 (23–51)	325 (247–403)	362 (234–517)

TB case notifications, 2015

Total cases notified	209 438
Total new and relapse	206 915
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	<1%
— % pulmonary	79%
— % bacteriologically confirmed among pulmonary	72%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	57% (40–88)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.21 (0.11–0.37)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive[c]	92	16%
— on antiretroviral therapy	82	89%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[d]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			5 100 (3 500–6 800)
Estimated % of TB cases with MDR/RR-TB	1.6% (0.59–2.6)	29% (24–34)	
% notified tested for rifampicin resistance	5%	63%	36 836
MDR/RR-TB cases tested for resistance to second-line drugs			250
Laboratory-confirmed cases			MDR/RR-TB: 954, XDR-TB: 0
Patients started on treatment[e]			MDR/RR-TB: 880, XDR-TB: 0

Treatment success rate and cohort size

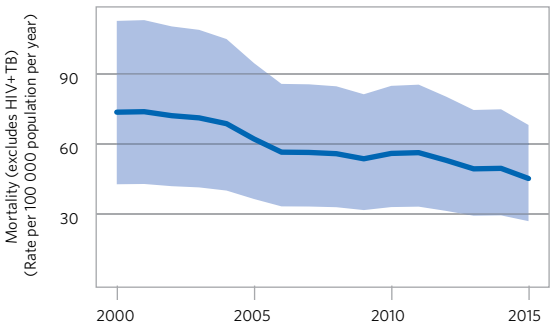
	Success	Cohort
New and relapse cases registered in 2014	93%	191 141
Previously treated cases, excluding relapse, registered in 2014	88%	5 497
HIV-positive TB cases, all types, registered in 2014	62%	45
MDR/RR-TB cases started on second-line treatment in 2013	75%	686
XDR-TB cases started on second-line treatment in 2013	0%	3

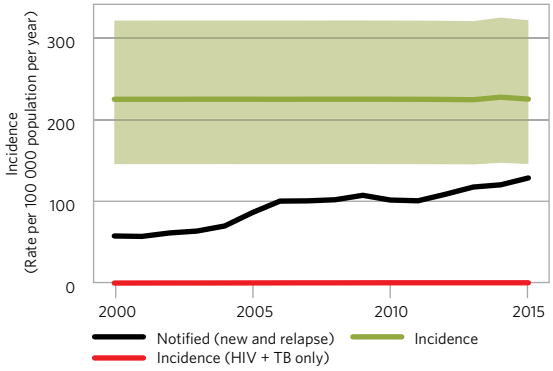
TB preventive treatment, 2015

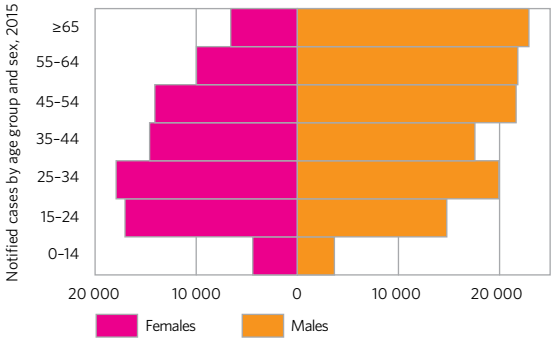
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	22% (20–24)

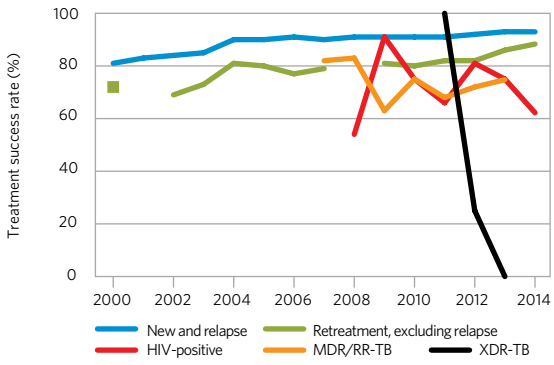
TB financing, 2016

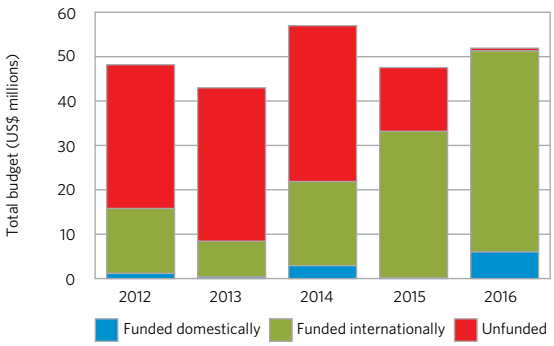
National TB budget (US$ millions)	52
Funding source	12% domestic, 87% international, 1% unfunded











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. Estimates of TB incidence and mortality will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.

[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.

[c] 17 HIV-positive cases were identified from 506 diagnosed TB patients considered at high risk for HIV co-infection and 75 were known to be HIV-positive before being diagnosed with TB.

[d] Includes cases with unknown previous TB treatment history.

[e] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Brazil

population 2015 :: **208 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	5.5 (5.2–5.9)	2.7 (2.5–2.8)
Mortality (HIV+TB only)	2.2 (1.2–3.6)	1.1 (0.56–1.7)
Incidence (includes HIV+TB)	84 (72–97)	41 (35–47)
Incidence (HIV+TB only)	13 (11–15)	6.3 (5.3–7.3)
Incidence (MDR/RR-TB)[b]	2.3 (1.9–2.8)	1.1 (0.91–1.3)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0-14 years	> 14 years	Total
Females	3.8 (2.2–5.4)	24 (14–33)	28 (17–38)
Males	4.3 (3–5.6)	52 (41–64)	57 (44–69)
Total	8.1 (6.2–10)	76 (69–83)	84 (72–97)

TB case notifications, 2015

Total cases notified	81 137
Total new and relapse	73 221
— % tested with rapid diagnostics at time of diagnosis	23%
— % with known HIV status	82%
— % pulmonary	87%
— % bacteriologically confirmed among pulmonary	73%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	87% (75–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.09 (0.07–0.11)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	9 069	15%
— on antiretroviral therapy	2 852	31%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			1 900 (1 600–2 300)
Estimated % of TB cases with MDR/RR-TB	1.5% (1.1–1.9)	8% (5.9–10)	
% notified tested for rifampicin resistance	26%	35%	22 608
MDR/RR-TB cases tested for resistance to second-line drugs			237
Laboratory-confirmed cases			MDR/RR-TB: 1 197, XDR-TB: 14
Patients started on treatment[d]			MDR/RR-TB: 619, XDR-TB: 29

Treatment success rate and cohort size

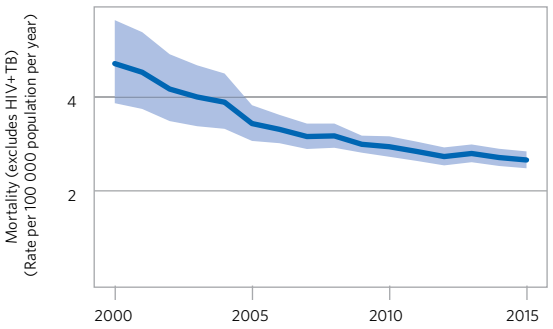
	Success	Cohort
New and relapse cases registered in 2014	71%	74 117
Previously treated cases, excluding relapse, registered in 2014	39%	7 532
HIV-positive TB cases, all types, registered in 2014	49%	6 891
MDR/RR-TB cases started on second-line treatment in 2013	52%	759
XDR-TB cases started on second-line treatment in 2013	12%	17

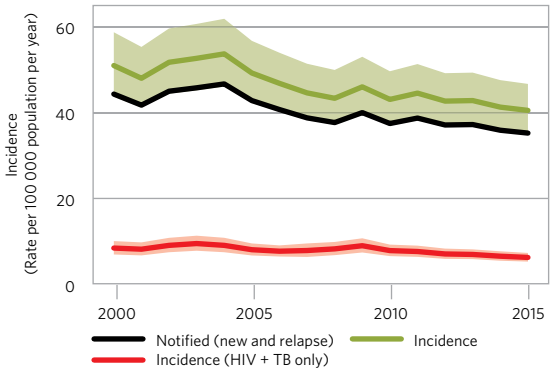
TB preventive treatment, 2015

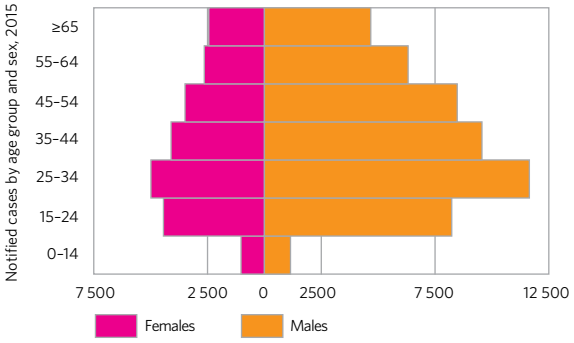
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

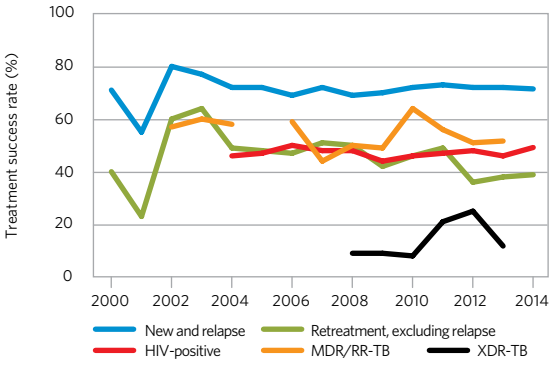
TB financing, 2016

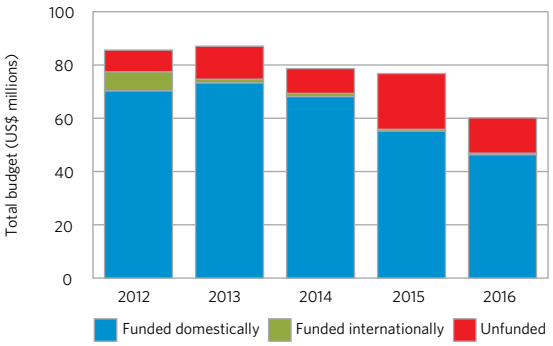
National TB budget (US$ millions)	60
Funding source	77% domestic, <1% international, 22% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

China

population 2015 :: **1 376 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	35 (34–37)	2.6 (2.5–2.7)
Mortality (HIV+TB only)	2.6 (1.2–4.5)	0.19 (0.09–0.33)
Incidence (includes HIV+TB)	918 (788–1 060)	67 (57–77)
Incidence (HIV+TB only)	15 (12–19)	1.1 (0.86–1.4)
Incidence (MDR/RR-TB)[b]	70 (55–84)	5.1 (4–6.1)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	37 (23–52)	258 (157–359)	296 (181–411)
Males	38 (26–49)	585 (459–711)	622 (485–760)
Total	75 (58–92)	843 (767–919)	918 (788–1 060)

TB case notifications, 2015

Total cases notified	804 163
Total new and relapse	798 439
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	47%
— % pulmonary	96%
— % bacteriologically confirmed among pulmonary	31%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	87% (75–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.04 (0.04–0.05)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	10 034	3%
— on antiretroviral therapy	3 750	37%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			57 000 (48 000–67 000)
Estimated % of TB cases with MDR/RR-TB	6.6% (5.3–7.9)	30% (25–34)	
% notified tested for rifampicin resistance	8%	0%	93 593
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 9 662, XDR-TB: 357
Patients started on treatment[d]			MDR/RR-TB: 5 691, XDR-TB: 122

Treatment success rate and cohort size

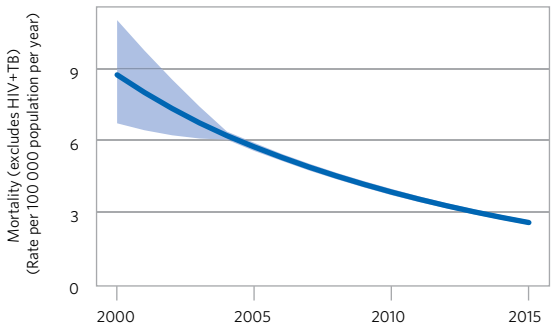
	Success	Cohort
New and relapse cases registered in 2014	94%	817 318
Previously treated cases, excluding relapse, registered in 2014	88%	6 679
HIV-positive TB cases, all types, registered in 2014	86%	2 169
MDR/RR-TB cases started on second-line treatment in 2013	55%	2 184
XDR-TB cases started on second-line treatment in 2013	22%	159

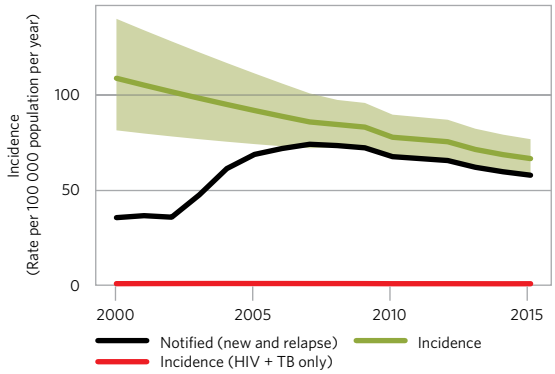
TB preventive treatment, 2015

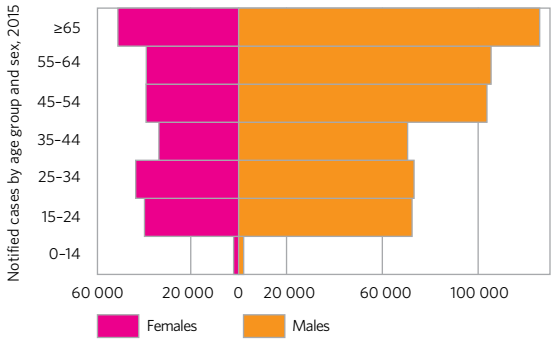
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

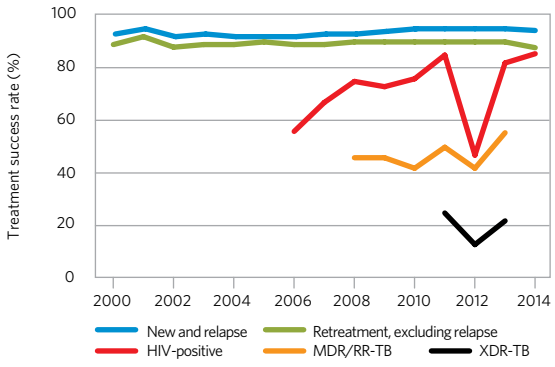
TB financing, 2016

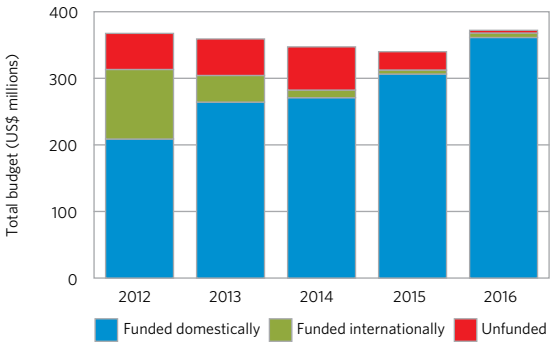
National TB budget (US$ millions)	372
Funding source	97% domestic, 2% international, 1% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Democratic People's Republic of Korea

population 2015 :: **25 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	15 (10–22)	61 (40–87)
Mortality (HIV+TB only)	0.037 (0.016–0.065)	0.15 (0.07–0.26)
Incidence (includes HIV+TB)	141 (109–178)	561 (432–706)
Incidence (HIV+TB only)	0.45 (0.32–0.6)	1.8 (1.3–2.4)
Incidence (MDR/RR-TB)[b]	6 (3.4–8.6)	24 (14–34)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	4.9 (2–7.8)	49 (30–69)	54 (32–76)
Males	6 (3.7–8.3)	81 (61–101)	87 (65–109)
Total	11 (7.4–14)	130 (111–149)	141 (109–178)

TB case notifications, 2015

Total cases notified	120 722
Total new and relapse	112 840
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	0%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	50%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	80% (64–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.11 (0.07–0.17)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	0	
— on antiretroviral therapy	0	

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			4 600 (2 600–6 500)
Estimated % of TB cases with MDR/RR-TB	2.2% (0.51–3.9)	16% (8.4–24)	
% notified tested for rifampicin resistance	0%	2%	336
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 209, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 125, XDR-TB: 0

Treatment success rate and cohort size

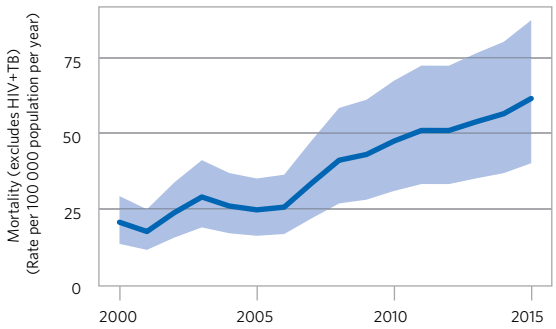
	Success	Cohort
New and relapse cases registered in 2014	91%	103 045
Previously treated cases, excluding relapse, registered in 2014	82%	7 245
HIV-positive TB cases, all types, registered in 2014		0
MDR/RR-TB cases started on second-line treatment in 2013	84%	170
XDR-TB cases started on second-line treatment in 2013		0

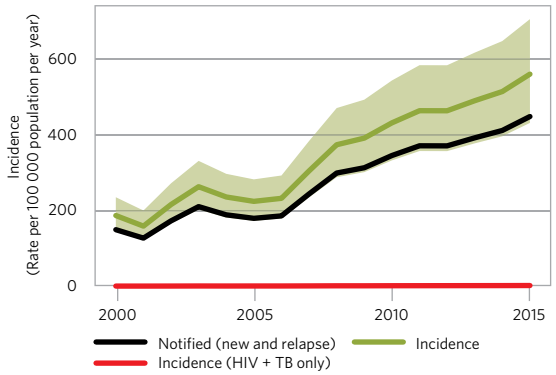
TB preventive treatment, 2015

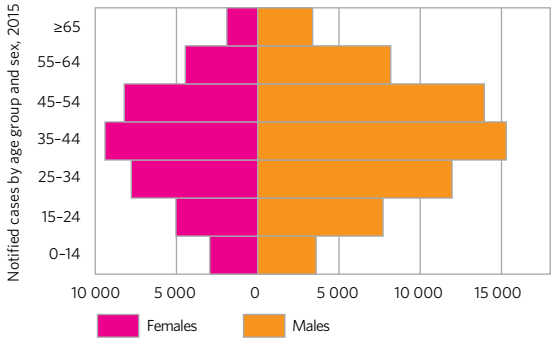
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

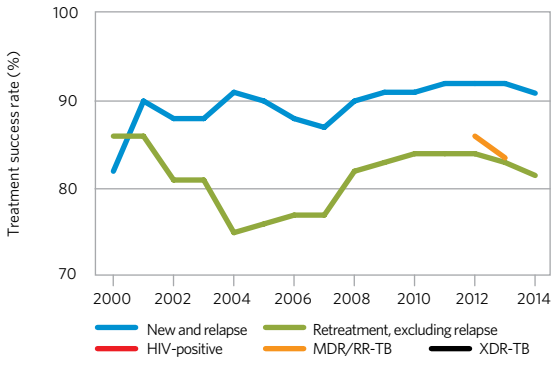
TB financing, 2016

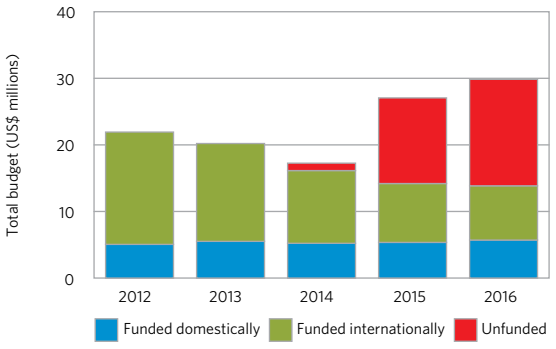
National TB budget (US$ millions)	30
Funding source	19% domestic, 27% international, 54% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Democratic Republic of the Congo

population 2015 :: **77 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	51 (30–77)	66 (39–99)
Mortality (HIV+TB only)	16 (13–20)	21 (17–26)
Incidence (includes HIV+TB)	250 (162–357)	324 (210–463)
Incidence (HIV+TB only)	39 (23–57)	50 (30–74)
Incidence (MDR/RR-TB)[b]	10 (4.6–15)	13 (6–19)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	18 (8.8–27)	91 (43–139)	109 (52–165)
Males	15 (9–21)	126 (86–167)	142 (95–188)
Total	33 (21–45)	217 (162–272)	250 (162–357)

TB case notifications, 2015

Total cases notified	120 508
Total new and relapse	119 213
— % tested with rapid diagnostics at time of diagnosis	10%
— % with known HIV status	50%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	83%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	48% (33–74)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.28 (0.16–0.46)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	7 154	12%
— on antiretroviral therapy	4 776	67%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			4 000 (2 300–5 700)
Estimated % of TB cases with MDR/RR-TB	3.2% (1.4–5)	14% (6.9–21)	
% notified tested for rifampicin resistance	2%	76%	9 028
MDR/RR-TB cases tested for resistance to second-line drugs			6
Laboratory-confirmed cases			MDR/RR-TB: 499, XDR-TB: 4
Patients started on treatment[d]			MDR/RR-TB: 413, XDR-TB: 0

Treatment success rate and cohort size

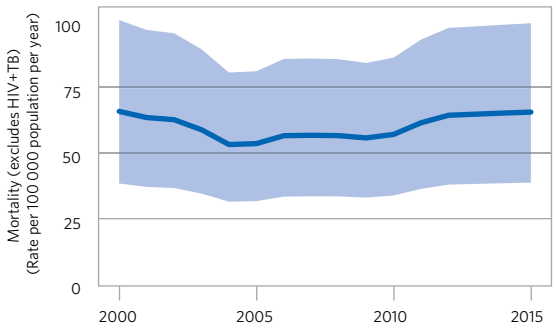
	Success	Cohort
New cases registered in 2014	89%	112 969
Previously treated cases registered in 2014	65%	1 099
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	63%	268
XDR-TB cases started on second-line treatment in 2013		0

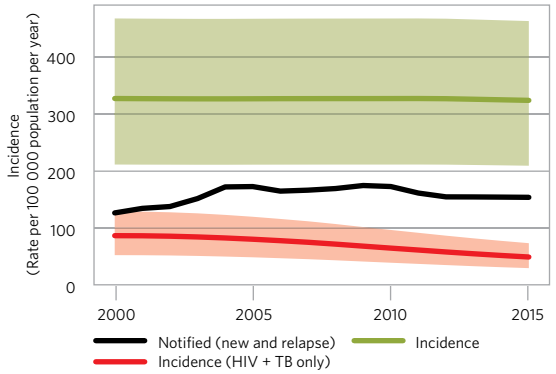
TB preventive treatment, 2015

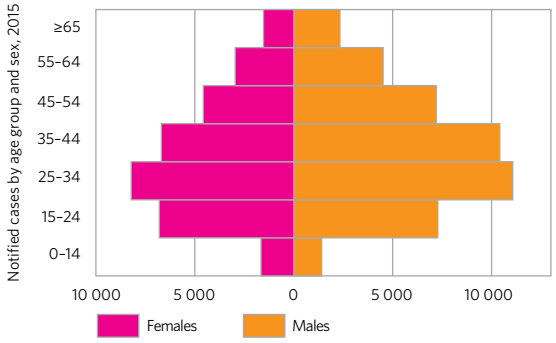
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment

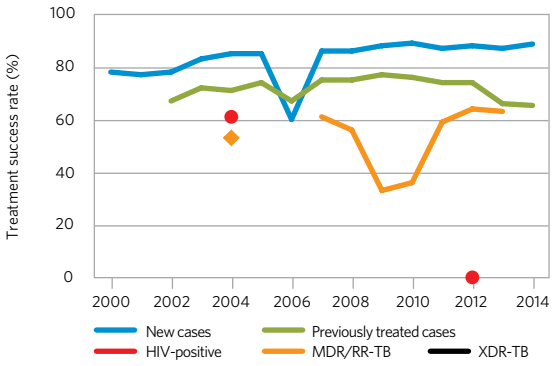
TB financing, 2016

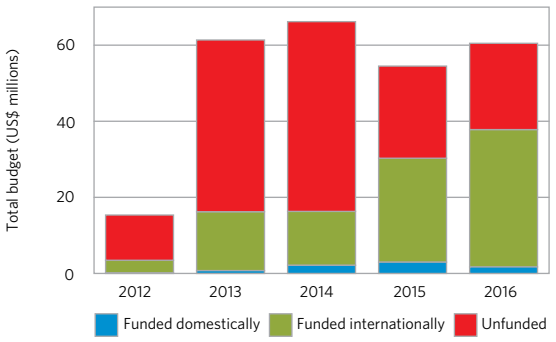
National TB budget (US$ millions)	60
Funding source	3% domestic, 60% international, 37% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. 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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Ethiopia

population 2015 :: **99 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	25 (15–38)	26 (15–38)
Mortality (HIV+TB only)	3.9 (1.6–7.3)	4 (1.6–7.4)
Incidence (includes HIV+TB)	191 (141–249)	192 (142–250)
Incidence (HIV+TB only)	16 (10–23)	16 (10–23)
Incidence (MDR/RR-TB)[b]	6.2 (3.5–8.9)	6.2 (3.5–9)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	7.3 (2.2–12)	77 (50–105)	85 (52–117)
Males	11 (6.9–15)	95 (70–120)	106 (77–136)
Total	18 (12–24)	173 (143–203)	191 (141–249)

TB case notifications, 2015

Total cases notified	137 960
Total new and relapse	135 951
— % tested with rapid diagnostics at time of diagnosis	6%
— % with known HIV status	77%
— % pulmonary	70%
— % bacteriologically confirmed among pulmonary	54%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	71% (55–96)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.16 (0.09–0.25)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	8 625	8%
— on antiretroviral therapy	6 848	79%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			3 300 (2 100–4 600)
Estimated % of TB cases with MDR/RR-TB	2.7% (1.5–4)	14% (5.6–23)	
% notified tested for rifampicin resistance	9%	75%	24 073
MDR/RR-TB cases tested for resistance to second-line drugs			113
Laboratory-confirmed cases		MDR/RR-TB: 597, XDR-TB: 2	
Patients started on treatment[d]		MDR/RR-TB: 597, XDR-TB: 2	

Treatment success rate and cohort size

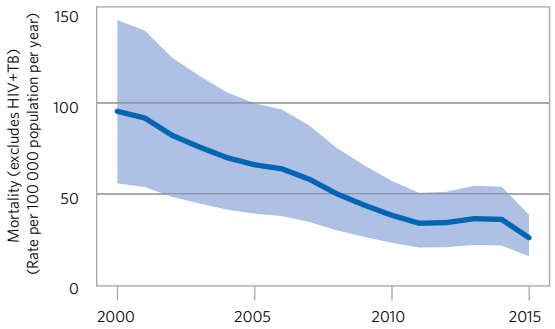
	Success	Cohort
New cases registered in 2014	89%	121 563
Previously treated cases registered in 2014		
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	68%	397
XDR-TB cases started on second-line treatment in 2013		

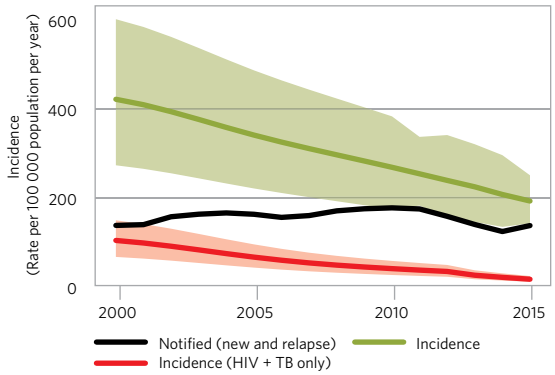
TB preventive treatment, 2015

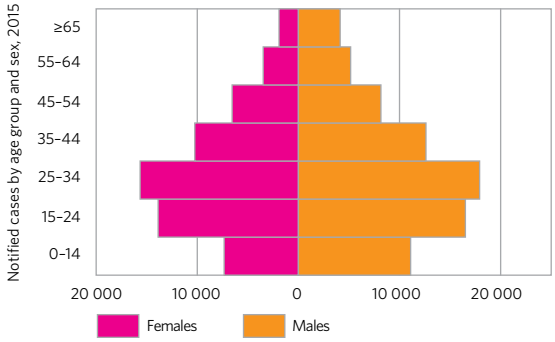
% of HIV-positive people (newly enrolled in care) on preventive treatment	47%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

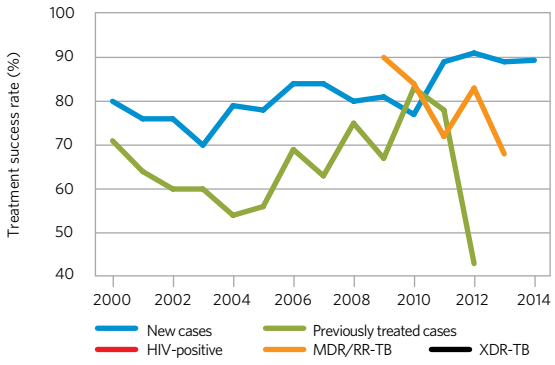
TB financing, 2016

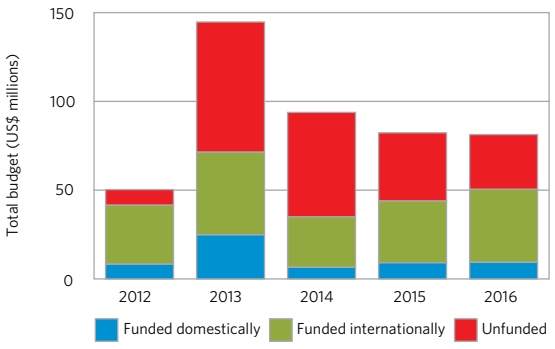
National TB budget (US$ millions)	81
Funding source	11% domestic, 51% international, 38% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

India

population 2015 :: **1 311 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	480 (380–590)	36 (29–45)
Mortality (HIV+TB only)	37 (21–57)	2.8 (1.6–4.3)
Incidence (includes HIV+TB)	2 840 (1 470–4 650)	217 (112–355)
Incidence (HIV+TB only)	113 (58–186)	8.6 (4.4–14)
Incidence (MDR/RR-TB)[b]	130 (88–180)	9.9 (6.7–14)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	136 (78–193)	860 (112–1 610)	995 (191–1 800)
Males	119 (78–161)	1 730 (1 070–2 380)	1 850 (1 150–2 540)
Total	255 (181–328)	2 590 (1 750–3 420)	2 840 (1 470–4 650)

TB case notifications, 2015

Total cases notified	1 740 435
Total new and relapse	1 667 136
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	67%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	64%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	59% (36–110)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.20 (0.11–0.36)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	44 652	4%
— on antiretroviral therapy	40 925	92%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			79 000 (72 000–87 000)
Estimated % of TB cases with MDR/RR-TB	2.5% (2.1–3.1)	16% (14–18)	
% notified tested for rifampicin resistance	6%	60%	275 321
MDR/RR-TB cases tested for resistance to second-line drugs			8 976
Laboratory-confirmed cases		MDR/RR-TB: 28 876, XDR-TB: 3 048	
Patients started on treatment[d]		MDR/RR-TB: 26 966, XDR-TB: 2 130	

Treatment success rate and cohort size

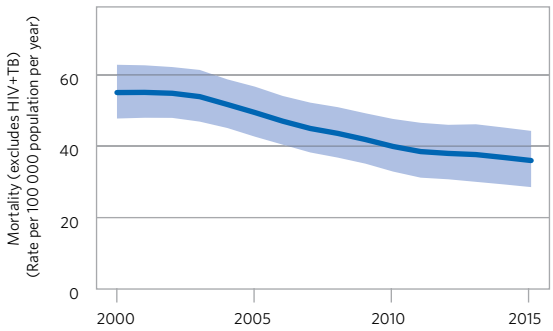
	Success	Cohort
New and relapse cases registered in 2014	74%	1 609 547
Previously treated cases, excluding relapse, registered in 2014	65%	74 368
HIV-positive TB cases, all types, registered in 2014	76%	44 257
MDR/RR-TB cases started on second-line treatment in 2013	46%	15 906
XDR-TB cases started on second-line treatment in 2013	37%	248

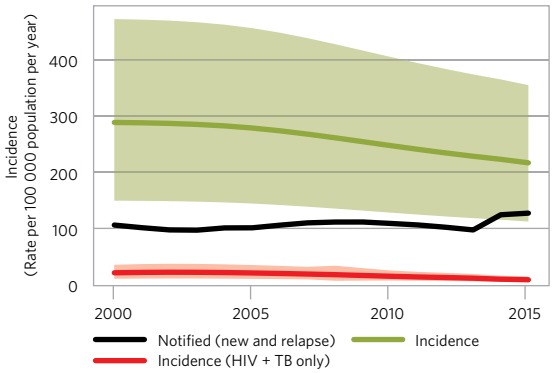
TB preventive treatment, 2015

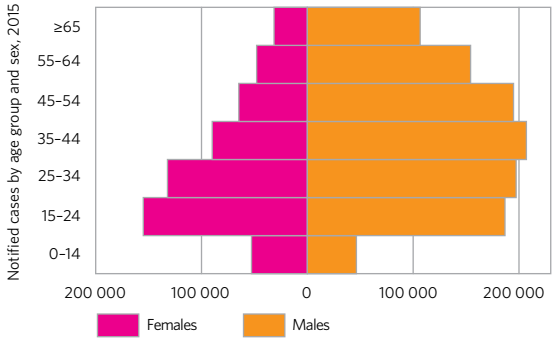
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

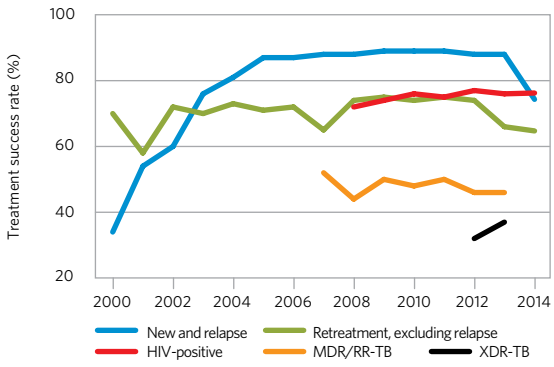
TB financing, 2016

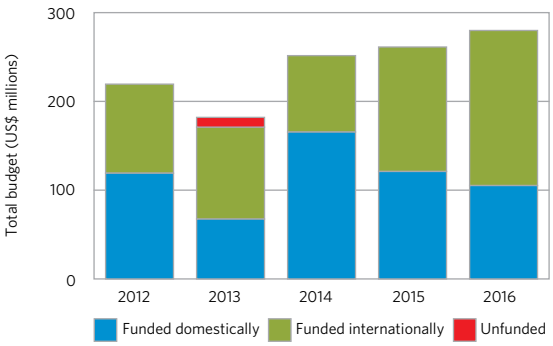
National TB budget (US$ millions)	280
Funding source	38% domestic, 62% international, 0% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[a] Ranges represent uncertainty intervals. Estimates of TB incidence and mortality are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.

[c] Includes cases with unknown previous TB treatment history.

[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Indonesia

population 2015 :: **258 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	100 (67–150)	40 (26–57)
Mortality (HIV+TB only)	26 (20–34)	10 (7.6–13)
Incidence (includes HIV+TB)	1 020 (658–1 450)	395 (255–564)
Incidence (HIV+TB only)	78 (48–116)	30 (18–45)
Incidence (MDR/RR-TB)[b]	32 (19–45)	12 (7.4–17)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	36 (16–57)	384 (194–573)	420 (210–630)
Males	39 (23–54)	559 (391–726)	597 (415–780)
Total	75 (49–100)	942 (730–1 150)	1 020 (658–1 450)

TB case notifications, 2015

Total cases notified	330 729
Total new and relapse	328 895
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	11%
— % pulmonary	93%
— % bacteriologically confirmed among pulmonary	64%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	32% (23–50)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.13 (0.08–0.21)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	3 523	10%
— on antiretroviral therapy	757	21%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			10 000 (8 000–12 000)
Estimated % of TB cases with MDR/RR-TB	2.8% (2.2–3.5)	16% (10–20)	
% notified tested for rifampicin resistance	<1%	80%	9 764
MDR/RR-TB cases tested for resistance to second-line drugs			895
Laboratory-confirmed cases			MDR/RR-TB: 2 135, XDR-TB: 28
Patients started on treatment[d]			MDR/RR-TB: 1 519, XDR-TB: 22

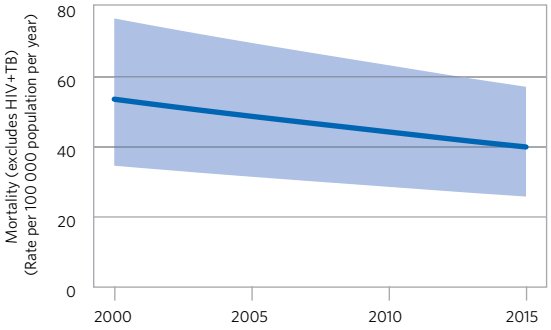
Treatment success rate and cohort size

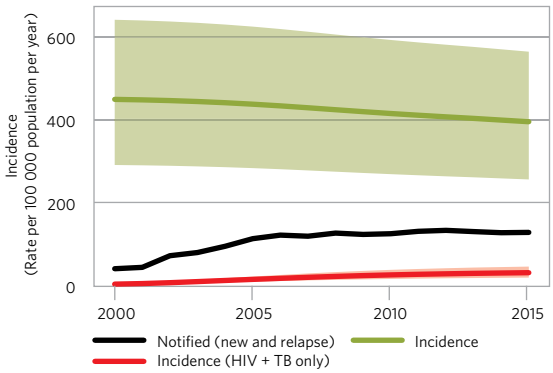
	Success	Cohort
New and relapse cases registered in 2014	84%	322 806
Previously treated cases, excluding relapse, registered in 2014	63%	1 733
HIV-positive TB cases, all types, registered in 2014	56%	2 548
MDR/RR-TB cases started on second-line treatment in 2013	51%	809
XDR-TB cases started on second-line treatment in 2013	40%	10

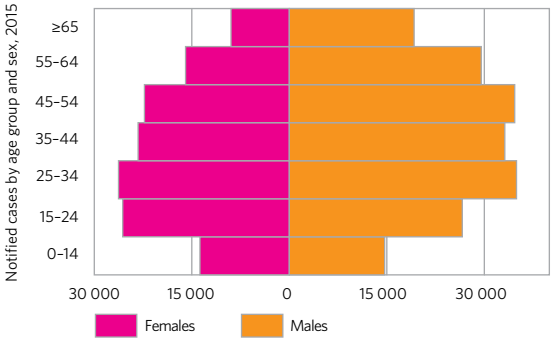
TB preventive treatment, 2015

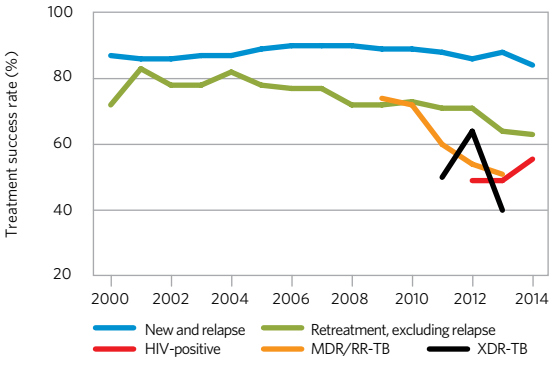
% of HIV-positive people (newly enrolled in care) on preventive treatment	2%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

TB financing, 2016[e]









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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.
[e] Finance data are not shown because the government of Indonesia is currently reviewing contributions from domestic sources.

Kenya

population 2015 :: **46 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	9 (6.1–12)	20 (13–27)
Mortality (HIV+TB only)	7.2 (0.71–21)	16 (1.5–45)
Incidence (includes HIV+TB)	107 (87–129)	233 (189–281)
Incidence (HIV+TB only)	36 (29–43)	78 (63–94)
Incidence (MDR/RR-TB)[b]	2 (1.3–2.8)	4.3 (2.8–6.1)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	6.1 (3.4–8.9)	35 (22–48)	41 (26–57)
Males	6.8 (4.6–9)	59 (45–73)	66 (50–82)
Total	13 (9.6–16)	94 (82–106)	107 (87–129)

TB case notifications, 2015

Total cases notified	81 518
Total new and relapse	81 292
— % tested with rapid diagnostics at time of diagnosis	10%
— % with known HIV status	97%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	59%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	76% (63–93)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.15 (0.07–0.28)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	26 288	33%
— on antiretroviral therapy	25 030	95%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			1 400 (980–1 700)
Estimated % of TB cases with MDR/RR-TB	1.3% (0.68–1.9)	9.4% (8.7–10)	
% notified tested for rifampicin resistance	8%	29%	8 321
MDR/RR-TB cases tested for resistance to second-line drugs			22
Laboratory-confirmed cases			MDR/RR-TB: 368, XDR-TB: 1
Patients started on treatment[d]			MDR/RR-TB: 368, XDR-TB: 0

Treatment success rate and cohort size

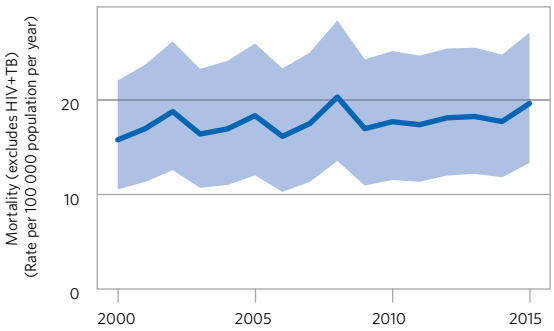
	Success	Cohort
New and relapse cases registered in 2014	87%	89 294
Previously treated cases, excluding relapse, registered in 2014	78%	227
HIV-positive TB cases, all types, registered in 2014	82%	30 107
MDR/RR-TB cases started on second-line treatment in 2013	82%	266
XDR-TB cases started on second-line treatment in 2013	0%	1

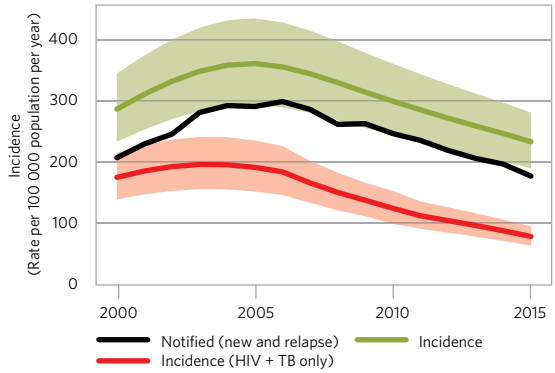
TB preventive treatment, 2015

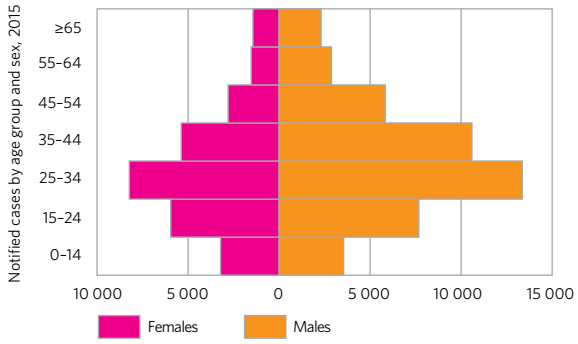
% of HIV-positive people (newly enrolled in care) on preventive treatment	33%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	5.5% (5–6)

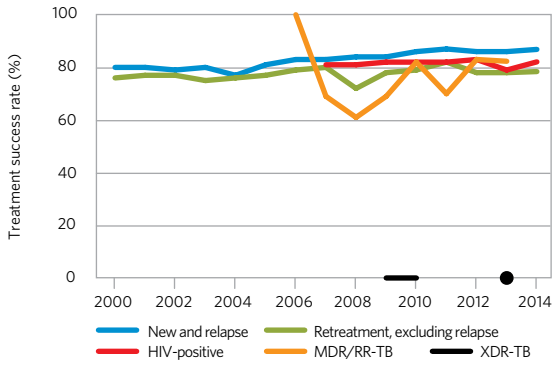
TB financing, 2016

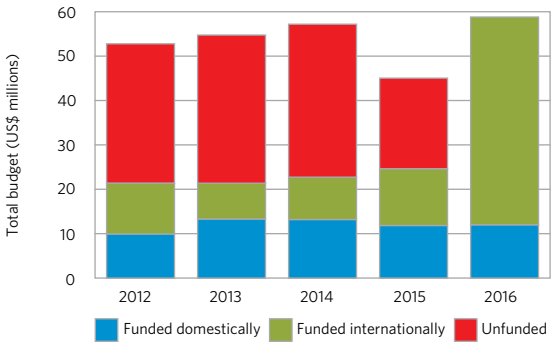
National TB budget (US$ millions)	59
Funding source	20% domestic, 80% international, 0% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
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[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Mozambique

population 2015 :: **28 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	21 (12–32)	74 (43–115)
Mortality (HIV+TB only)	34 (21–50)	120 (73–178)
Incidence (includes HIV+TB)	154 (100–220)	551 (356–787)
Incidence (HIV+TB only)	79 (50–115)	284 (179–412)
Incidence (MDR/RR-TB)[b]	7.3 (4.1–10)	26 (15–36)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	7.4 (3–12)	56 (27–86)	64 (30–98)
Males	7.4 (4.2–11)	83 (57–108)	90 (62–119)
Total	15 (9.2–20)	139 (106–172)	154 (100–220)

TB case notifications, 2015

Total cases notified	61 559
Total new and relapse	58 344
— % tested with rapid diagnostics at time of diagnosis	7%
— % with known HIV status	99%
— % pulmonary	89%
— % bacteriologically confirmed among pulmonary	50%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	38% (27–59)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.37 (0.21–0.6)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	29 827	51%
— on antiretroviral therapy	27 417	92%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number
Estimated MDR/RR-TB cases among notified pulmonary TB cases			2 800 (1 700–3 900)
Estimated % of TB cases with MDR/RR-TB	3.7% (2.4–5)	20% (1.9–37)	
% notified tested for rifampicin resistance	17%	31%	10 937
MDR/RR-TB cases tested for resistance to second-line drugs			195
Laboratory-confirmed cases			MDR/RR-TB: 646, XDR-TB: 29
Patients started on treatment[d]			MDR/RR-TB: 646, XDR-TB: 16

Treatment success rate and cohort size

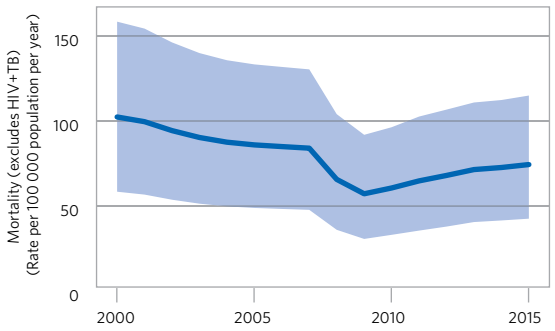
	Success	Cohort
New and relapse cases registered in 2014	89%	55 703
Previously treated cases, excluding relapse, registered in 2014	94%	2 567
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	52%	313
XDR-TB cases started on second-line treatment in 2013		

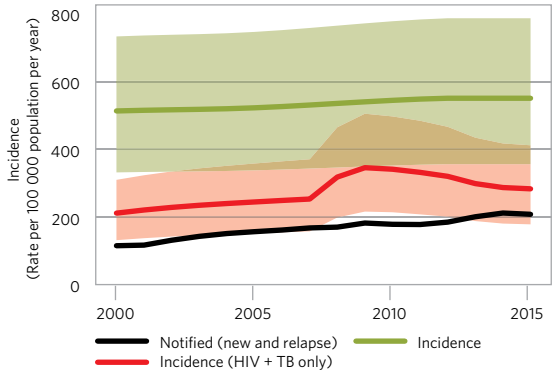
TB preventive treatment, 2015

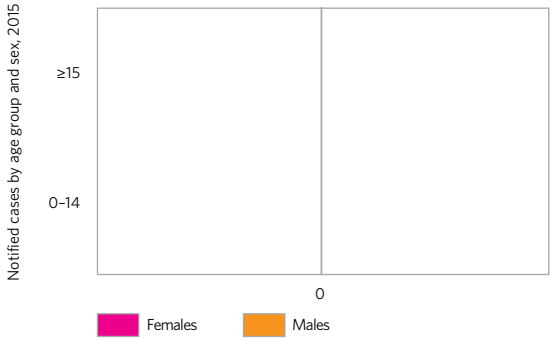
% of HIV-positive people (newly enrolled in care) on preventive treatment	45%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

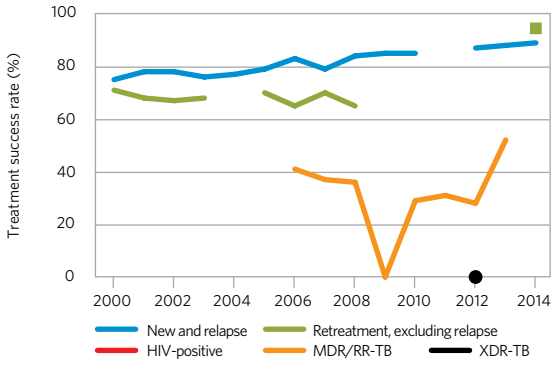
TB financing, 2016

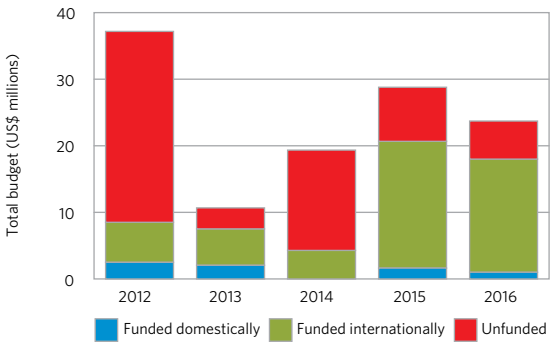
National TB budget (US$ millions)	24
Funding source	4% domestic, 72% international, 24% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Myanmar

population 2015 :: **54 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	27 (16–40)	49 (30–74)
Mortality (HIV+TB only)	4.8 (3.5–6.5)	9 (6.4–12)
Incidence (includes HIV+TB)	197 (144–258)	365 (267–479)
Incidence (HIV+TB only)	17 (11–25)	32 (21–47)
Incidence (MDR/RR-TB)[b]	14 (8.9–18)	26 (17–33)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	6 (2.4–9.6)	66 (35–97)	72 (38–106)
Males	7.7 (4.8–11)	117 (87–147)	125 (92–158)
Total	14 (9.4–18)	183 (152–214)	197 (144–258)

TB case notifications, 2015

Total cases notified	140 700
Total new and relapse	138 447
— % tested with rapid diagnostics at time of diagnosis	22%
— % with known HIV status	65%
— % pulmonary	88%
— % bacteriologically confirmed among pulmonary	39%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	70% (54–96)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.16 (0.1–0.26)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	7 918	9%
— on antiretroviral therapy	3 034	38%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			9 000 (6 400–12 000)
Estimated % of TB cases with MDR/RR-TB	5.1% (3.2–7)	27% (15–39)	
% notified tested for rifampicin resistance	7%	46%	14 599
MDR/RR-TB cases tested for resistance to second-line drugs			43
Laboratory-confirmed cases			MDR/RR-TB: 2 793, XDR-TB: 11
Patients started on treatment[d]			MDR/RR-TB: 2 207, XDR-TB: 7

Treatment success rate and cohort size

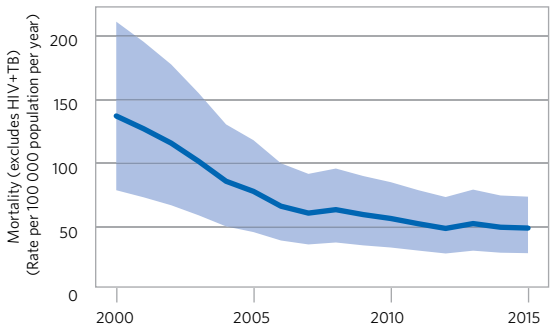
	Success	Cohort
New and relapse cases registered in 2014	87%	135 984
Previously treated cases, excluding relapse, registered in 2014	73%	3 677
HIV-positive TB cases, all types, registered in 2014	70%	10 782
MDR/RR-TB cases started on second-line treatment in 2013	83%	667
XDR-TB cases started on second-line treatment in 2013		

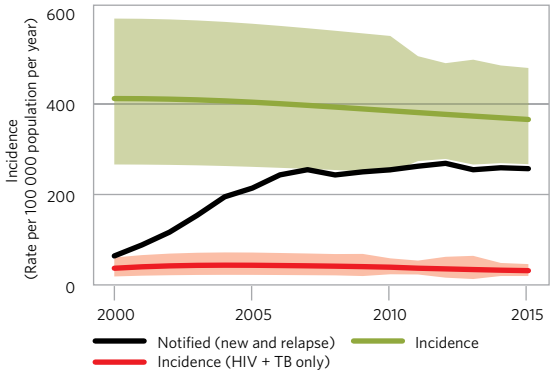
TB preventive treatment, 2015

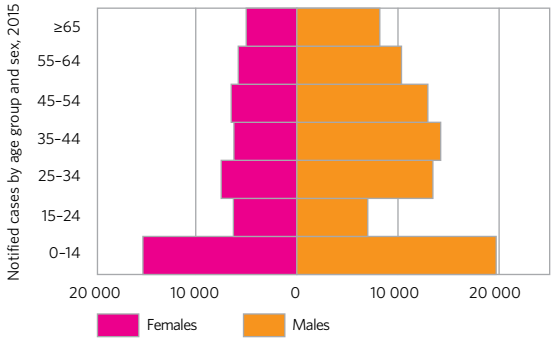
% of HIV-positive people (newly enrolled in care) on preventive treatment	10%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	3.6% (3.3–3.9)

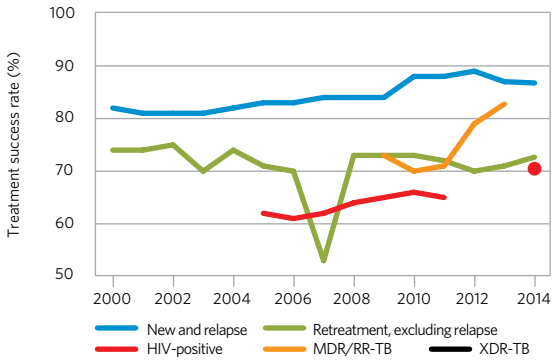
TB financing, 2016

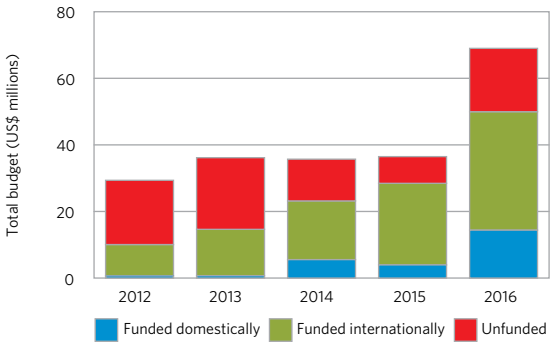
National TB budget (US$ millions)	69
Funding source	21% domestic, 52% international, 28% unfunded











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[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Nigeria

population 2015 :: **182 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	180 (96–290)	99 (53–160)
Mortality (HIV+TB only)	57 (43–74)	31 (24–40)
Incidence (includes HIV+TB)	586 (345–890)	322 (189–488)
Incidence (HIV+TB only)	100 (56–155)	55 (31–85)
Incidence (MDR/RR-TB)[b]	29 (15–43)	16 (8.2–24)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	33 (14–52)	198 (67–328)	231 (82–380)
Males	34 (20–47)	322 (210–434)	355 (229–481)
Total	67 (43–91)	519 (371–668)	586 (345–890)

TB case notifications, 2015

Total cases notified	90 584
Total new and relapse	87 211
— % tested with rapid diagnostics at time of diagnosis	58%
— % with known HIV status	100%
— % pulmonary	94%
— % bacteriologically confirmed among pulmonary	68%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	15% (9.8–25)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.43 (0.22–0.77)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	14 846	17%
— on antiretroviral therapy	11 141	75%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			4 700 (3 700–5 700)
Estimated % of TB cases with MDR/RR-TB	4.3% (3.2–5.4)	25% (19–31)	
% notified tested for rifampicin resistance	40%	64%	50 274
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 1 241, XDR-TB: 1
Patients started on treatment[d]			MDR/RR-TB: 656, XDR-TB: 1

Treatment success rate and cohort size

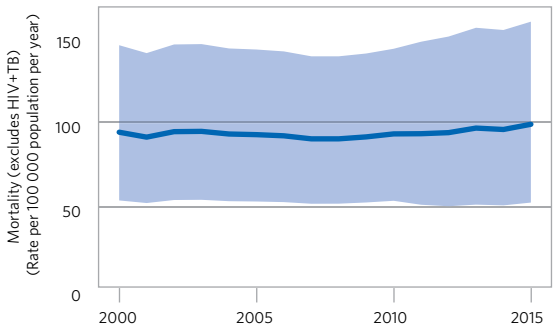
	Success	Cohort
New and relapse cases registered in 2014	87%	86 464
Previously treated cases, excluding relapse, registered in 2014	83%	4 890
HIV-positive TB cases, all types, registered in 2014	79%	17 014
MDR/RR-TB cases started on second-line treatment in 2013	77%	339
XDR-TB cases started on second-line treatment in 2013	0%	2

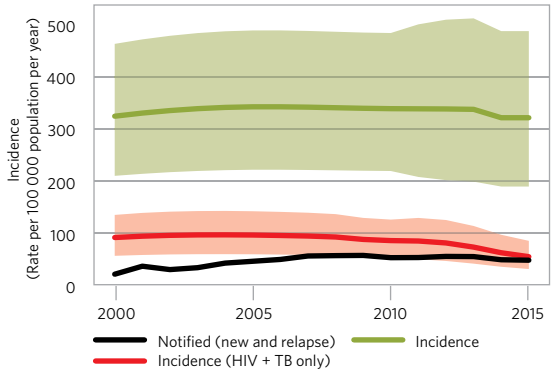
TB preventive treatment, 2015

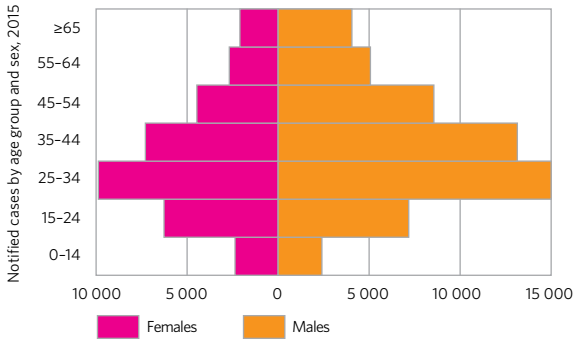
% of HIV-positive people (newly enrolled in care) on preventive treatment	20%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	16% (15–18)

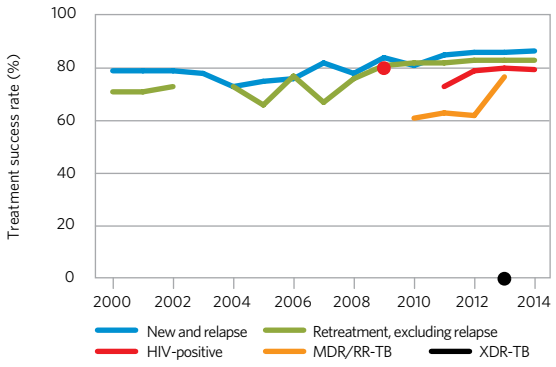
TB financing, 2016

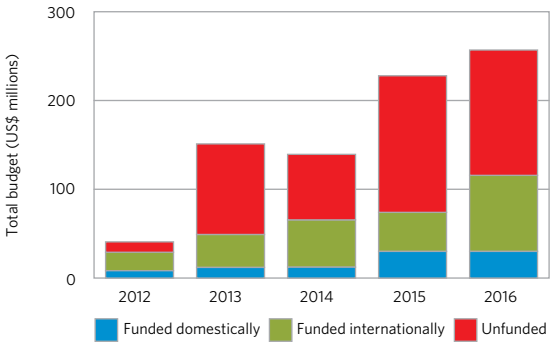
National TB budget (US$ millions)	257
Funding source	12% domestic, 33% international, 55% unfunded











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[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Pakistan

population 2015 :: **189 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	44 (9.3–110)	23 (4.9–56)
Mortality (HIV+TB only)	1.6 (1.1–2.1)	0.83 (0.6–1.1)
Incidence (includes HIV+TB)	510 (330–729)	270 (175–386)
Incidence (HIV+TB only)	8.8 (5.4–13)	4.6 (2.8–6.9)
Incidence (MDR/RR-TB)[b]	26 (16–36)	14 (8.5–19)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	25 (12–37)	231 (141–320)	255 (153–357)
Males	21 (13–29)	234 (163–305)	255 (175–335)
Total	46 (30–61)	465 (357–573)	510 (330–729)

TB case notifications, 2015

Total cases notified	331 809
Total new and relapse	323 856
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	4%
— % pulmonary	81%
— % bacteriologically confirmed among pulmonary	51%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	63% (44–98)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.09 (0.02–0.23)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	59	<1%
— on antiretroviral therapy	59	100%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			14 000 (11 000–16 000)
Estimated % of TB cases with MDR/RR-TB	4.2% (3.2–5.3)	16% (15–17)	
% notified tested for rifampicin resistance	1%	84%	23 078
MDR/RR-TB cases tested for resistance to second-line drugs			2 292
Laboratory-confirmed cases			MDR/RR-TB: 3 059, XDR-TB: 99
Patients started on treatment[d]			MDR/RR-TB: 2 553, XDR-TB: 68

Treatment success rate and cohort size

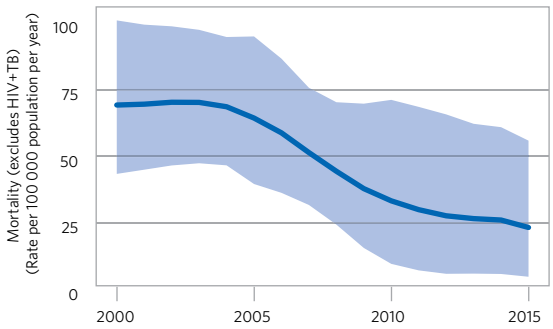
	Success	Cohort
New and relapse cases registered in 2014	93%	308 327
Previously treated cases, excluding relapse, registered in 2014	82%	8 005
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	69%	1 484
XDR-TB cases started on second-line treatment in 2013	30%	64

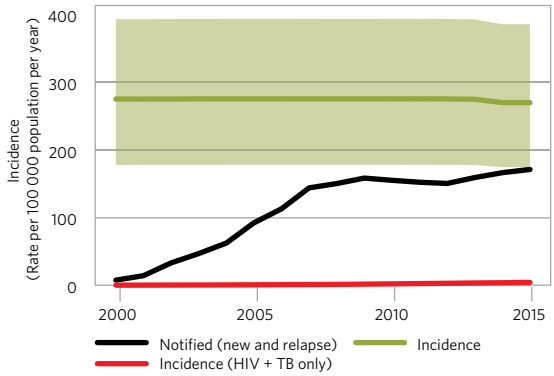
TB preventive treatment, 2015

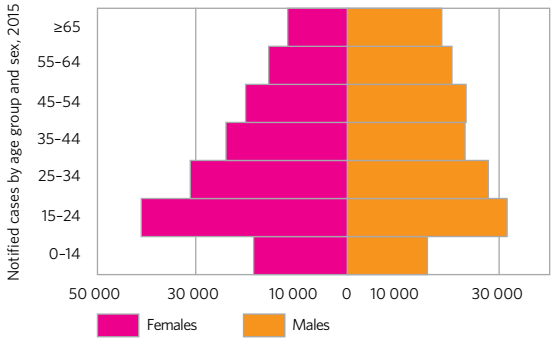
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

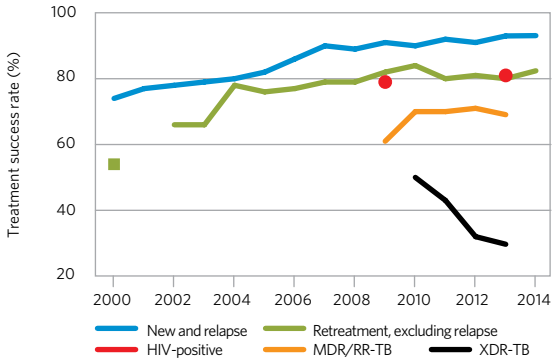
TB financing, 2016

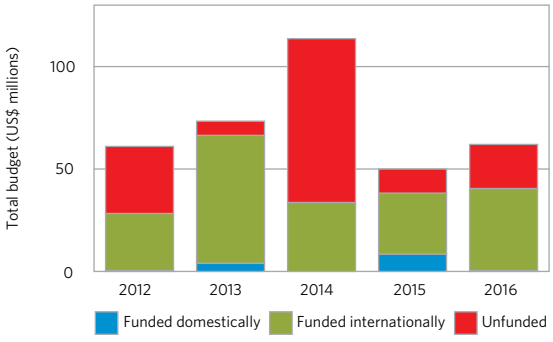
National TB budget (US$ millions)	62
Funding source	<1% domestic, 65% international, 35% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Philippines

population 2015 :: **101 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	14 (8.8–19)	13 (8.7–19)
Mortality (HIV+TB only)	0.44 (0.24–0.7)	0.44 (0.24–0.7)
Incidence (includes HIV+TB)	324 (279–373)	322 (277–370)
Incidence (HIV+TB only)	4.3 (3.3–5.4)	4.3 (3.3–5.4)
Incidence (MDR/RR-TB)[b]	17 (14–20)	17 (14–20)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	14 (6.4–22)	100 (64–135)	114 (71–156)
Males	17 (11–23)	194 (152–236)	211 (163–259)
Total	31 (22–40)	294 (266–322)	324 (279–373)

TB case notifications, 2015

Total cases notified	286 544
Total new and relapse	276 672
— % tested with rapid diagnostics at time of diagnosis	20%
— % with known HIV status	13%
— % pulmonary	97%
— % bacteriologically confirmed among pulmonary	36%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	85% (74–99)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.04 (0.03–0.06)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	255	<1%
— on antiretroviral therapy	178	70%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			15 000 (12 000–18 000)
Estimated % of TB cases with MDR/RR-TB	2.6% (1.8–3.3)	29% (21–38)	
% notified tested for rifampicin resistance	1%	45%	17 351
MDR/RR-TB cases tested for resistance to second-line drugs			414
Laboratory-confirmed cases			MDR/RR-TB: 3 788, XDR-TB: 2
Patients started on treatment[d]			MDR/RR-TB: 4 142, XDR-TB: 12

Treatment success rate and cohort size

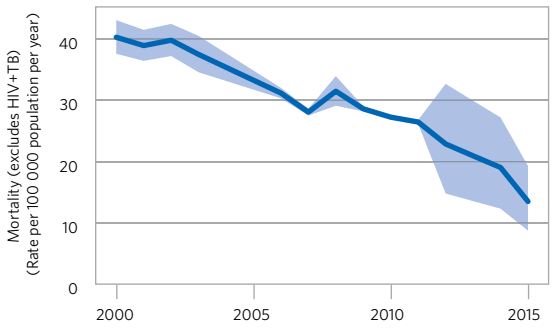
	Success	Cohort
New and relapse cases registered in 2014	92%	219 737
Previously treated cases, excluding relapse, registered in 2014	83%	6 062
HIV-positive TB cases, all types, registered in 2014	52%	174
MDR/RR-TB cases started on second-line treatment in 2013	49%	1 968
XDR-TB cases started on second-line treatment in 2013	50%	6

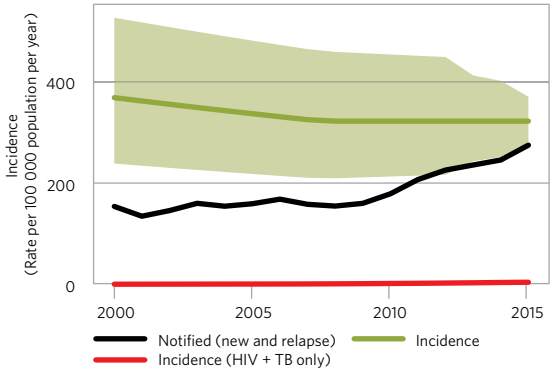
TB preventive treatment, 2015

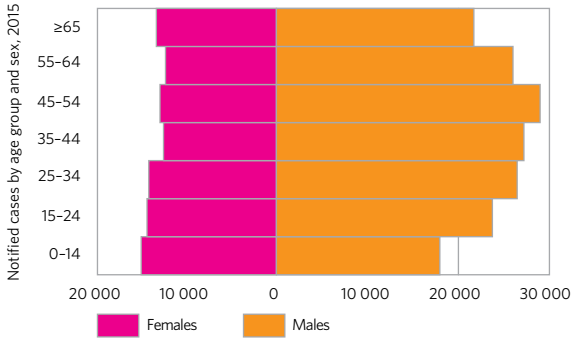
% of HIV-positive people (newly enrolled in care) on preventive treatment	43%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	14% (13–16)

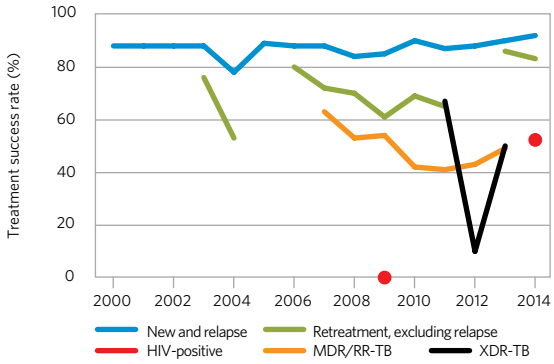
TB financing, 2016

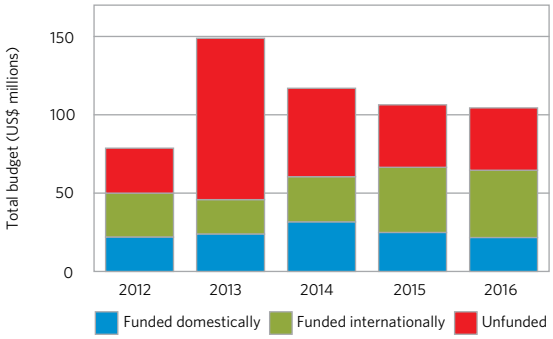
National TB budget (US$ millions)	104
Funding source	21% domestic, 41% international, 38% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Russian Federation

population 2015[a] :: **143 million**

Estimates of TB burden,[b] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	15 (15–16)	11 (10–11)
Mortality (HIV+TB only)	1.5 (<0.01–7.4)	1 (0–5.2)
Incidence (includes HIV+TB)	115 (98–132)	80 (69–92)
Incidence (HIV+TB only)	11 (9.3–13)	7.9 (6.5–9.4)
Incidence (MDR/RR-TB)[c]	60 (49–71)	42 (34–49)

Estimated TB incidence by age and sex (thousands),[b] 2015

	0–14 years	> 14 years	Total
Females	4.6 (2.8–6.4)	31 (19–44)	36 (21–50)
Males	4.4 (3–5.8)	74 (58–90)	79 (61–96)
Total	9 (6.8–11)	106 (96–115)	115 (98–132)

TB case notifications, 2015

Total cases notified	130 904
Total new and relapse	99 590
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status[d]	
— % pulmonary	93%
— % bacteriologically confirmed among pulmonary	49%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	87% (75–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.15 (0.11–0.19)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	6 407	
— on antiretroviral therapy		

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[e]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			42 000 (35 000–48 000)
Estimated % of TB cases with MDR/RR-TB	22% (14–25)	53% (40–59)	
% notified tested for rifampicin resistance	38%	31%	46 641
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 17 132, XDR-TB:
Patients started on treatment[f]			MDR/RR-TB: 26 756, XDR-TB: 1 205

Treatment success rate and cohort size

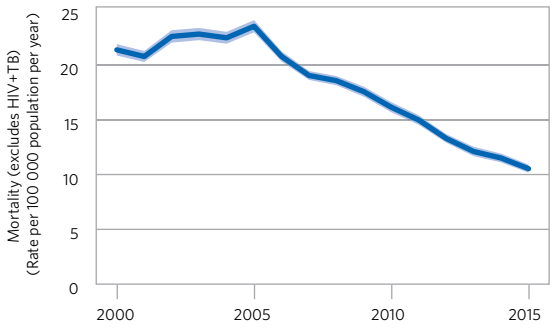
	Success	Cohort
New and relapse cases registered in 2014	69%	77 136
Previously treated cases, excluding relapse, registered in 2014	42%	5 790
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	48%	18 213
XDR-TB cases started on second-line treatment in 2013	26%	1 965

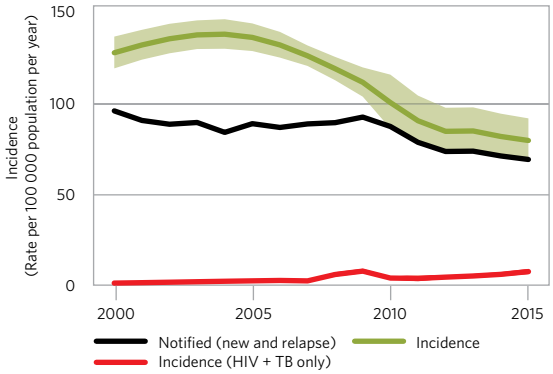
TB preventive treatment, 2015

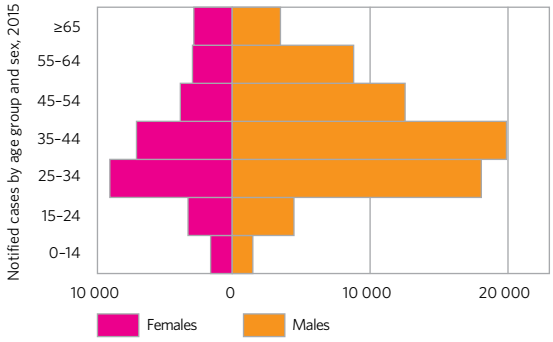
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

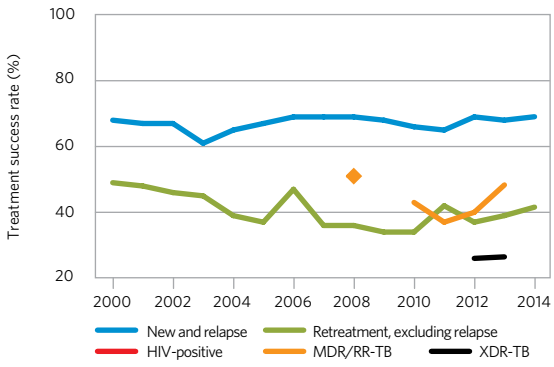
TB financing,[g] 2016

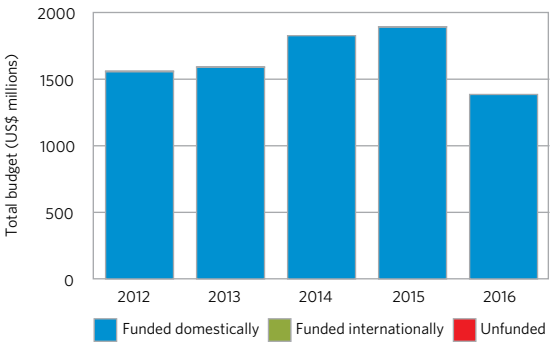
National TB budget (US$ millions)	1 385
Funding source	100% domestic, 0% international, 0% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. Estimates are rounded and totals are computed prior to rounding.

[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] The reported number of TB patients with known HIV status is for new TB patients in the civilian sector only. It was not possible to calculate the percentage of all TB patients with known HIV status.

[e] Includes cases with unknown previous TB treatment history.

[f] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

[g] The decline in financing between 2015 and 2016 in terms of US dollars reflects a change in the US Dollar–Rouble exchange rate. However, the domestic price regulation system ensures that the level and quality of TB care is maintained.

Data for all years can be downloaded from www.who.int/tb/data

South Africa

population 2015 :: **54 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	25 (21–29)	46 (39–53)
Mortality (HIV+TB only)	73 (27–140)	133 (50–256)
Incidence (includes HIV+TB)	454 (294–649)	834 (539–1 190)
Incidence (HIV+TB only)	258 (165–370)	473 (303–680)
Incidence (MDR/RR-TB)[b]	20 (13–27)	37 (24–50)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	16 (6.9–25)	175 (91–260)	191 (98–285)
Males	17 (9.8–23)	246 (173–320)	263 (182–343)
Total	33 (21–44)	422 (327–516)	454 (294–649)

TB case notifications, 2015

Total cases notified	294 603
Total new and relapse	287 224
— % tested with rapid diagnostics at time of diagnosis	64%
— % with known HIV status	97%
— % pulmonary	90%
— % bacteriologically confirmed among pulmonary	60%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	63% (44–98)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.22 (0.1–0.42)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	157 505	57%
— on antiretroviral therapy	133 116	85%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			10 000 (8 200–12 000)
Estimated % of TB cases with MDR/RR-TB	3.5% (2.8–4.2)	7.1% (5.3–8.9)	
% notified tested for rifampicin resistance	65%	71%	196 783
MDR/RR-TB cases tested for resistance to second-line drugs			7 402
Laboratory-confirmed cases			MDR/RR-TB: 19 613, XDR-TB: 1 024
Patients started on treatment[d]			MDR/RR-TB: 12 527, XDR-TB: 730

Treatment success rate and cohort size

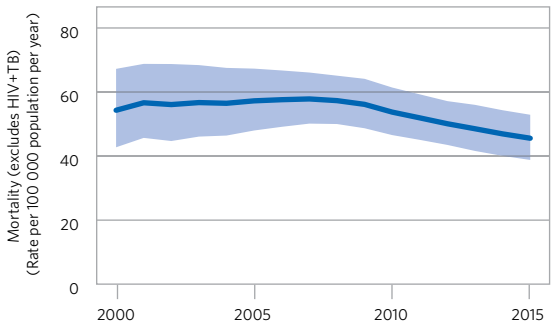
	Success	Cohort
New and relapse cases registered in 2014	78%	319 752
Previously treated cases, excluding relapse, registered in 2014	63%	4 652
HIV-positive TB cases, all types, registered in 2014	76%	183 697
MDR/RR-TB cases started on second-line treatment in 2013	48%	10 614
XDR-TB cases started on second-line treatment in 2013	24%	611

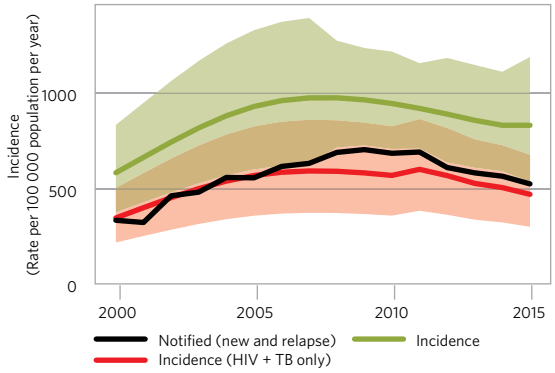
TB preventive treatment, 2015

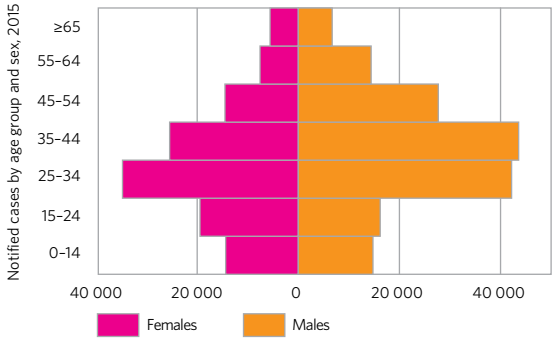
% of HIV-positive people (newly enrolled in care) on preventive treatment	38%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

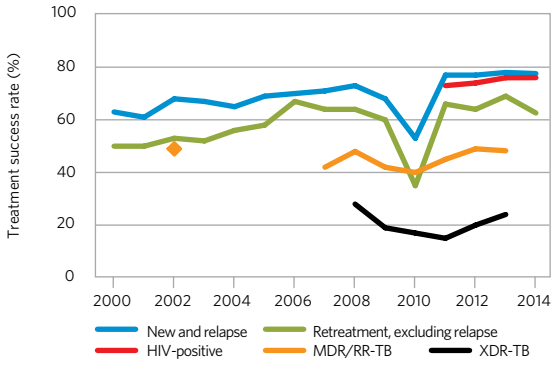
TB financing, 2016

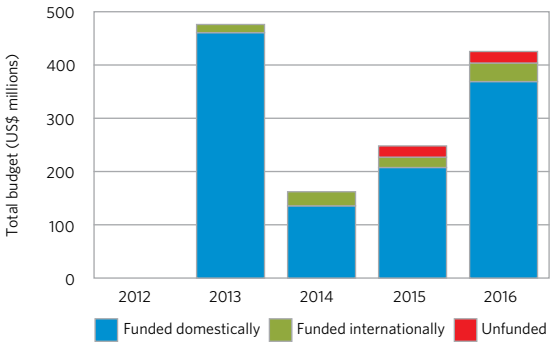
National TB budget (US$ millions)	425
Funding source	87% domestic, 8% international, 5% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Thailand

population 2015 :: **68 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	8.4 (6.9–10)	12 (10–15)
Mortality (HIV+TB only)	5.4 (3.3–8.1)	8 (4.9–12)
Incidence (includes HIV+TB)	117 (69–176)	172 (102–259)
Incidence (HIV+TB only)	15 (8–25)	22 (12–37)
Incidence (MDR/RR-TB)[b]	4.5 (2.9–6.2)	6.6 (4.3–9.1)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	3.9 (2.1–5.6)	32 (5.2–58)	36 (7.3–64)
Males	2.7 (1.6–3.9)	78 (53–103)	81 (55–107)
Total	6.6 (4.1–9)	110 (82–138)	117 (69–176)

TB case notifications, 2015

Total cases notified	66 179
Total new and relapse	62 135
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	98%
— % pulmonary	84%
— % bacteriologically confirmed among pulmonary	64%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	53% (35–89)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.12 (0.07–0.21)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	7 819	13%
— on antiretroviral therapy	5 389	69%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			2 500 (2 000–3 000)
Estimated % of TB cases with MDR/RR-TB	2.2% (1.5–2.9)	24% (18–30)	
% notified tested for rifampicin resistance	10%	30%	7 970
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 466, XDR-TB: 5
Patients started on treatment[d]			MDR/RR-TB: 506, XDR-TB: 5

Treatment success rate and cohort size

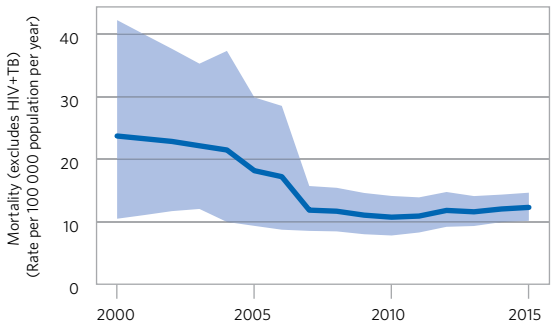
	Success	Cohort
New and relapse cases registered in 2014	80%	58 774
Previously treated cases, excluding relapse, registered in 2014	63%	1 433
HIV-positive TB cases, all types, registered in 2014	67%	6 451
MDR/RR-TB cases started on second-line treatment in 2013		
XDR-TB cases started on second-line treatment in 2013		

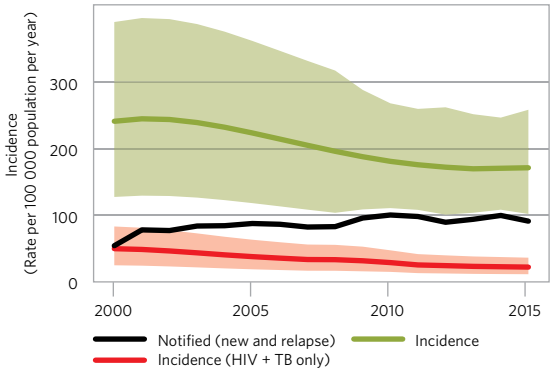
TB preventive treatment, 2015

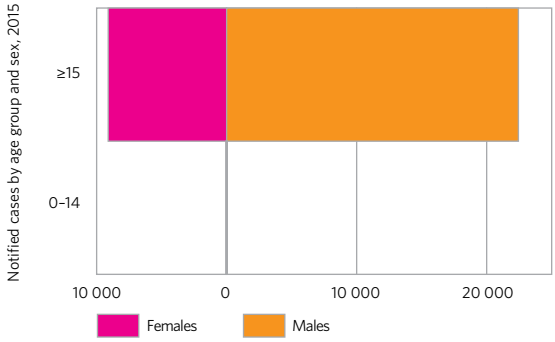
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment

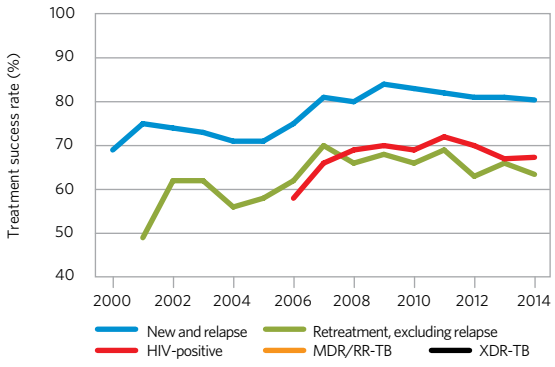
TB financing, 2016

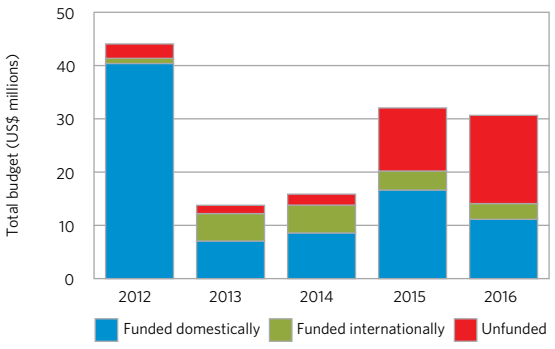
National TB budget (US$ millions)	31
Funding source	36% domestic, 10% international, 54% unfunded











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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

United Republic of Tanzania

population 2015 :: **53 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	30 (13–53)	56 (25–99)
Mortality (HIV+TB only)	25 (16–35)	47 (31–66)
Incidence (includes HIV+TB)	164 (78–281)	306 (146–525)
Incidence (HIV+TB only)	57 (27–100)	107 (50–186)
Incidence (MDR/RR-TB)[b]	2.6 (0.56–4.7)	4.9 (1–8.8)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	8.4 (2.9–14)	56 (9.2–102)	64 (12–116)
Males	9.5 (5.4–14)	90 (52–129)	100 (57–142)
Total	18 (11–25)	146 (91–201)	164 (78–281)

TB case notifications, 2015

Total cases notified	62 180
Total new and relapse	60 895
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	93%
— % pulmonary	79%
— % bacteriologically confirmed among pulmonary	53%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	37% (22–78)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.37 (0.17–0.76)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	20 117	36%
— on antiretroviral therapy	17 063	85%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			730 (320–1100)
Estimated % of TB cases with MDR/RR-TB	1.3% (0.47–2.1)	4.7% (0.37–9)	
% notified tested for rifampicin resistance	<1%	3%	692
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 178, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 123, XDR-TB: 0

Treatment success rate and cohort size

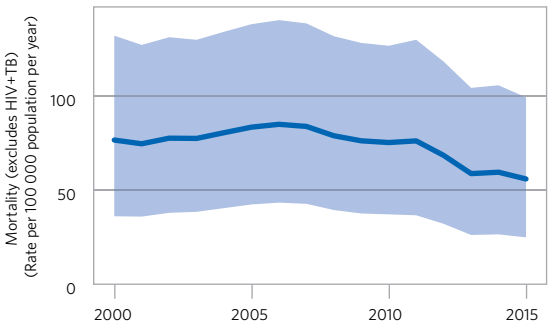
	Success	Cohort
New and relapse cases registered in 2014	90%	61 573
Previously treated cases, excluding relapse, registered in 2014	81%	1 578
HIV-positive TB cases, all types, registered in 2014	87%	20 658
MDR/RR-TB cases started on second-line treatment in 2013	68%	92
XDR-TB cases started on second-line treatment in 2013		0

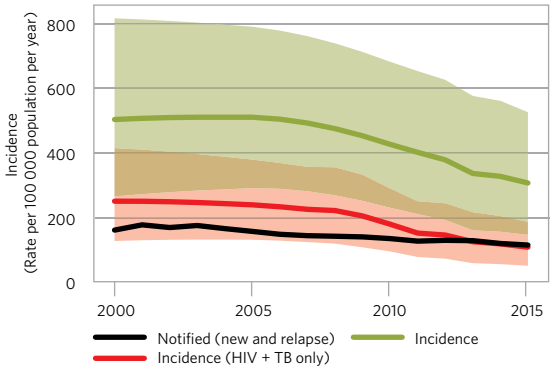
TB preventive treatment, 2015

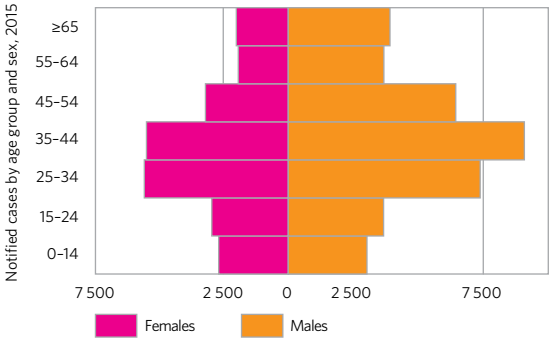
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	6.9% (6.3–7.6)

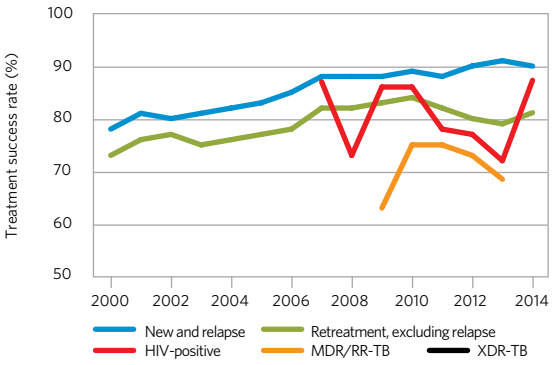
TB financing, 2016

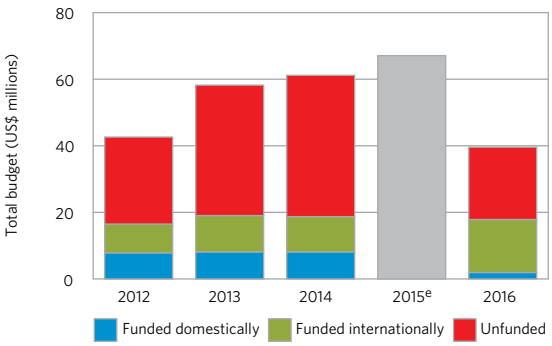
National TB budget (US$ millions)	40
Funding source	5% domestic, 40% international, 55% unfunded











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. The main direct measurement of TB disease burden is the 2012 national TB prevalence survey. Laboratory challenges during the survey meant that the prevalence of bacteriologically confirmed pulmonary TB could only be estimated with considerable uncertainty. This explains why estimates of TB incidence and mortality, which are informed by the prevalence survey, also have wide uncertainty intervals. A review of estimates of TB disease burden and how to improve their precision will be undertaken in early 2017.

[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.

[c] Includes cases with unknown previous TB treatment history.

[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

[e] Funding sources for 2015 were not reported.

Viet Nam

population 2015 :: **93 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	16 (11–22)	17 (12–23)
Mortality (HIV+TB only)	1.1 (0.2–2.7)	1.1 (0.21–2.8)
Incidence (includes HIV+TB)	128 (103–155)	137 (110–166)
Incidence (HIV+TB only)	5.5 (3.5–7.9)	5.9 (3.8–8.4)
Incidence (MDR/RR-TB)[b]	7.3 (5.2–9.5)	7.8 (5.6–10)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	5.5 (2.6–8.3)	28 (10–46)	34 (13–54)
Males	5.8 (3.6–8)	88 (67–109)	94 (71–117)
Total	11 (7.7–15)	116 (101–131)	128 (103–155)

TB case notifications, 2015

Total cases notified	102 676
Total new and relapse	100 780
— % tested with rapid diagnostics at time of diagnosis	11%
— % with known HIV status	79%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	69%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	79% (65–98)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.14 (0.09–0.19)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	3 428	4%
— on antiretroviral therapy	3 065	89%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			5 200 (4 100–6 300)
Estimated % of TB cases with MDR/RR-TB	4.1% (2.6–5.5)	25% (24–26)	
% notified tested for rifampicin resistance	8%	100%	15 841
MDR/RR-TB cases tested for resistance to second-line drugs			150
Laboratory-confirmed cases			MDR/RR-TB: 2 602, XDR-TB: 28
Patients started on treatment[d]			MDR/RR-TB: 2 131, XDR-TB: 3

Treatment success rate and cohort size

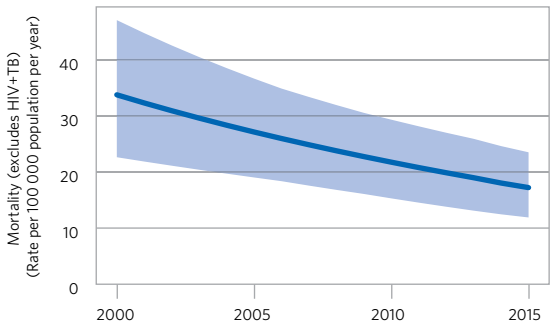
	Success	Cohort
New and relapse cases registered in 2014	91%	100 349
Previously treated cases, excluding relapse, registered in 2014	76%	1 738
HIV-positive TB cases, all types, registered in 2014	75%	1 519
MDR/RR-TB cases started on second-line treatment in 2013	69%	959
XDR-TB cases started on second-line treatment in 2013		

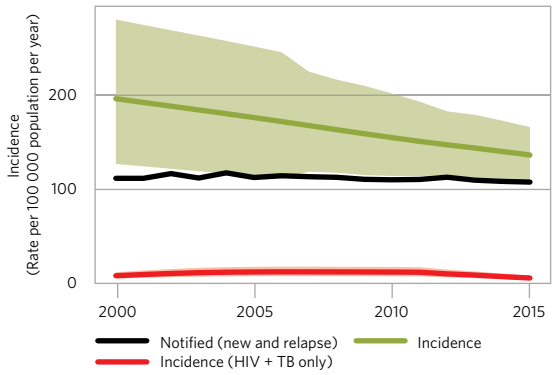
TB preventive treatment, 2015

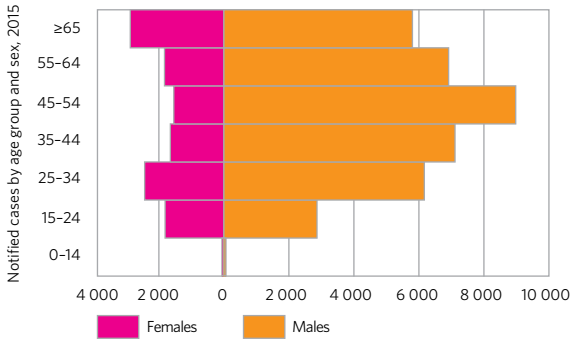
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	11% (10–12)

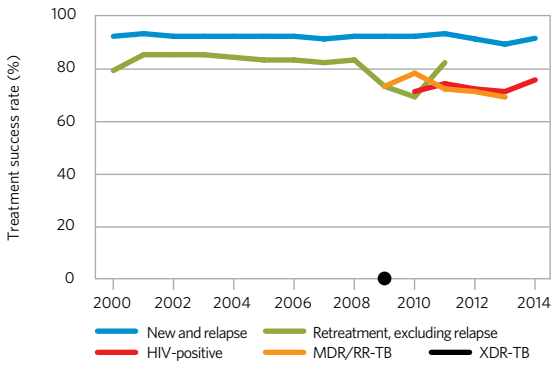
TB financing, 2016

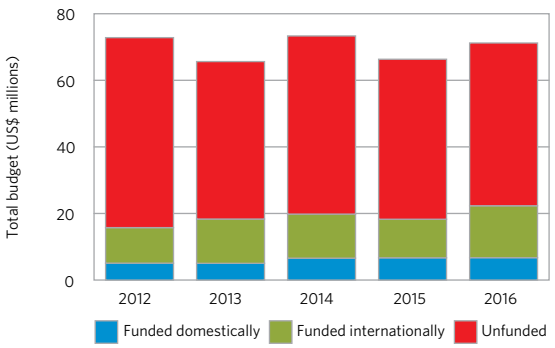
National TB budget (US$ millions)	71
Funding source	9% domestic, 22% international, 69% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. 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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Cambodia

population 2015 :: **16 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	8.6 (6.1–12)	55 (39–74)
Mortality (HIV+TB only)	0.44 (0.19–0.79)	2.8 (1.2–5)
Incidence (includes HIV+TB)	59 (38–85)	380 (246–543)
Incidence (HIV+TB only)	1.4 (0.92–2.1)	9.2 (5.9–13)
Incidence (MDR/RR-TB)[b]	1.3 (0.59–2.1)	8.3 (3.8–13)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	2.6 (0.9–4.4)	26 (15–36)	28 (16–41)
Males	3.5 (2.1–4.9)	27 (19–36)	31 (21–41)
Total	6.1 (4–8.2)	53 (40–66)	59 (38–85)

TB case notifications, 2015

Total cases notified	35 638
Total new and relapse	35 169
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	84%
— % pulmonary	63%
— % bacteriologically confirmed among pulmonary	48%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	59% (42–92)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.16 (0.09–0.26)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	740	3%
— on antiretroviral therapy	680	92%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			570 (290–840)
Estimated % of TB cases with MDR/RR-TB	1.8% (0.77–2.8)	11% (1.4–20)	
% notified tested for rifampicin resistance	<1%	80%	1 797
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 77, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 75, XDR-TB: 0

Treatment success rate and cohort size

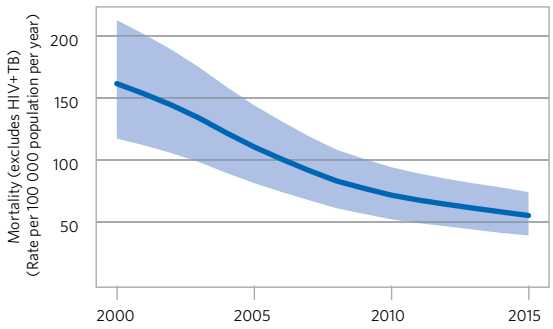
	Success	Cohort
New and relapse cases registered in 2014	93%	43 139
Previously treated cases, excluding relapse, registered in 2014		
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	75%	121
XDR-TB cases started on second-line treatment in 2013		

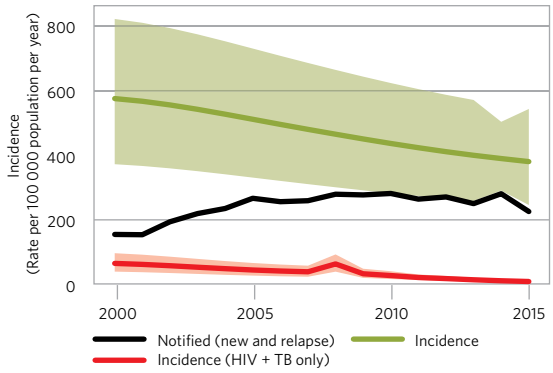
TB preventive treatment, 2015

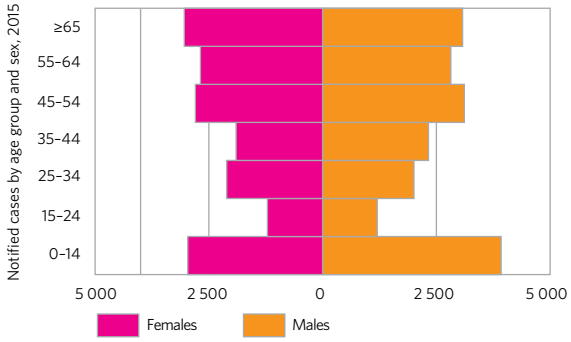
% of HIV-positive people (newly enrolled in care) on preventive treatment	25%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	14% (13–16)

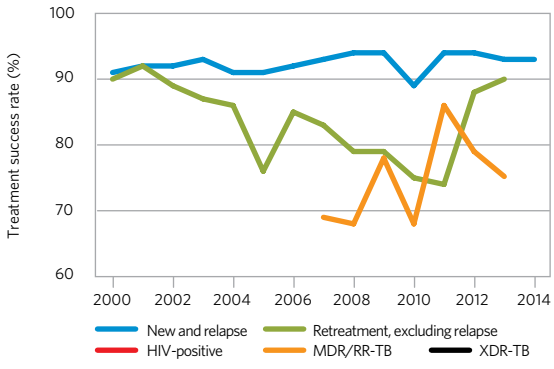
TB financing, 2016

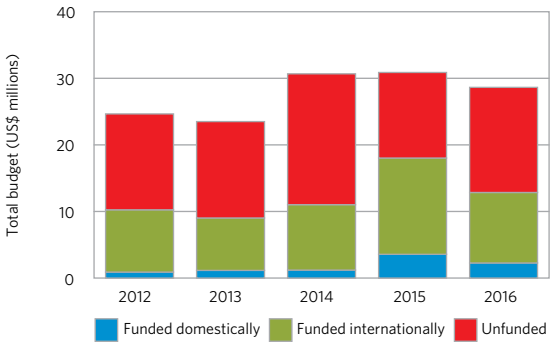
National TB budget (US$ millions)	29
Funding source	8% domestic, 37% international, 55% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Central African Republic

population 2015 :: **4.9 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	2.2 (1.3–3.4)	45 (26–70)
Mortality (HIV+TB only)	2.7 (1–5.3)	55 (20–107)
Incidence (includes HIV+TB)	19 (12–27)	391 (253–558)
Incidence (HIV+TB only)	8.6 (5.3–13)	176 (107–262)
Incidence (MDR/RR-TB)[b]	0.21 (0–0.45)	4.3 (0–9.2)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	1.3 (0.63–1.9)	7.2 (3.6–11)	8.4 (4.2–13)
Males	1 (0.59–1.4)	9.7 (6.6–13)	11 (7.2–14)
Total	2.3 (1.4–3.1)	17 (13–21)	19 (12–27)

TB case notifications, 2015

Total cases notified	10 799
Total new and relapse	10 459
— % tested with rapid diagnostics at time of diagnosis	1%
— % with known HIV status	48%
— % pulmonary	82%
— % bacteriologically confirmed among pulmonary	61%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	55% (38–84)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.27 (0.13–0.48)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	1 963	39%
— on antiretroviral therapy		

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			140 (23–250)
Estimated % of TB cases with MDR/RR-TB	0.4% (0–1.6)	14% (6.9–21)	
% notified tested for rifampicin resistance	<1%	14%	105
MDR/RR-TB cases tested for resistance to second-line drugs			38
Laboratory-confirmed cases			MDR/RR-TB: 62, XDR-TB: 2
Patients started on treatment[d]			MDR/RR-TB: 38, XDR-TB: 0

Treatment success rate and cohort size

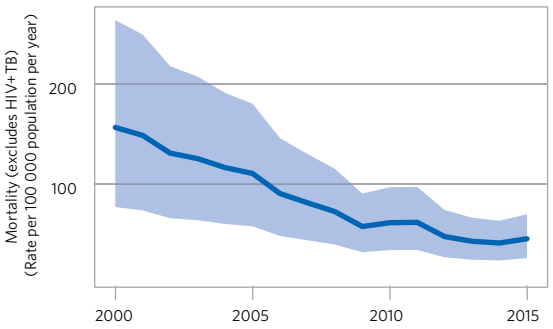
	Success	Cohort
New cases registered in 2014	70%	9 209
Previously treated cases registered in 2014	64%	476
HIV-positive TB cases, all types, registered in 2014	68%	2 056
MDR/RR-TB cases started on second-line treatment in 2013	81%	16
XDR-TB cases started on second-line treatment in 2013		0

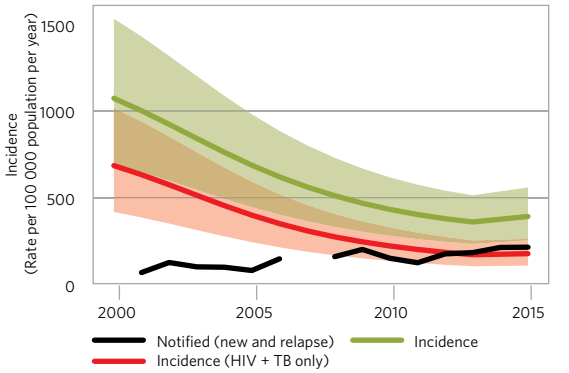
TB preventive treatment, 2015

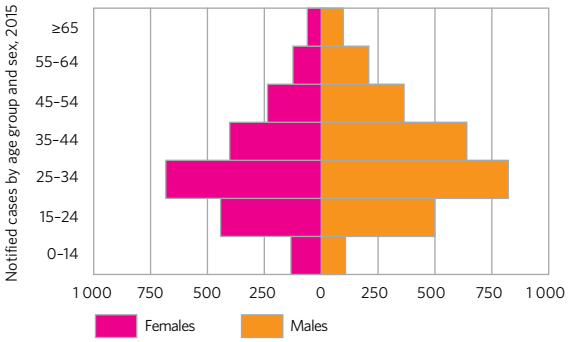
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

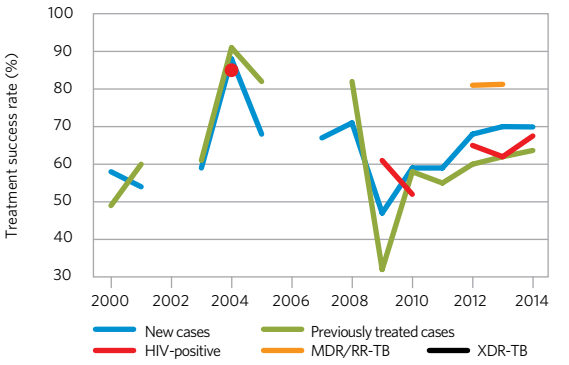
TB financing, 2016

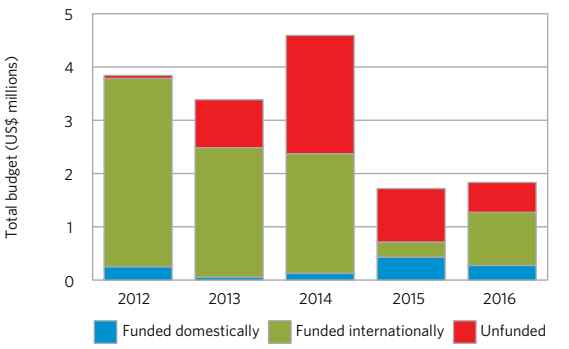
National TB budget (US$ millions)	1.8
Funding source	15% domestic, 55% international, 31% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Congo

population 2015 :: **4.6 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	2.3 (1.3–3.5)	49 (29–75)
Mortality (HIV+TB only)	2.4 (2–2.9)	53 (44–63)
Incidence (includes HIV+TB)	18 (11–25)	379 (246–542)
Incidence (HIV+TB only)	6.4 (3.9–9.5)	138 (84–205)
Incidence (MDR/RR-TB)[b]	0.67 (0.29–1)	15 (6.3–22)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	1 (0.5–1.5)	6.9 (3.6–10)	7.9 (4.1–12)
Males	0.92 (0.55–1.3)	8.7 (6–11)	9.6 (6.5–13)
Total	1.9 (1.3–2.6)	16 (12–19)	18 (11–25)

TB case notifications, 2015

Total cases notified	10 119
Total new and relapse	9 937
— % tested with rapid diagnostics at time of diagnosis	3%
— % with known HIV status	13%
— % pulmonary	75%
— % bacteriologically confirmed among pulmonary	51%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	57% (40–88)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.28 (0.17–0.44)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	479	38%
— on antiretroviral therapy	164	34%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			300 (160–430)
Estimated % of TB cases with MDR/RR-TB	3.2% (1.4–5)	14% (6.9–21)	
% notified tested for rifampicin resistance			9 469
MDR/RR-TB cases tested for resistance to second-line drugs			5
Laboratory-confirmed cases			MDR/RR-TB: 41, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 13, XDR-TB: 0

Treatment success rate and cohort size

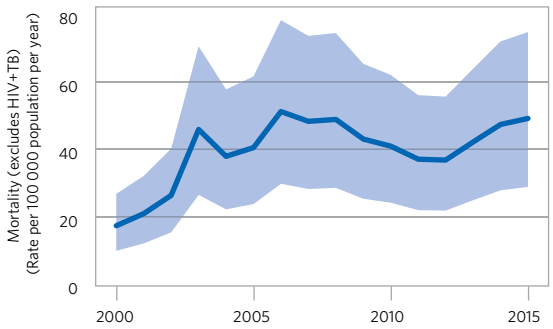
	Success	Cohort
New and relapse cases registered in 2014	69%	4 108
Previously treated cases, excluding relapse, registered in 2014	94%	182
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013		
XDR-TB cases started on second-line treatment in 2013		

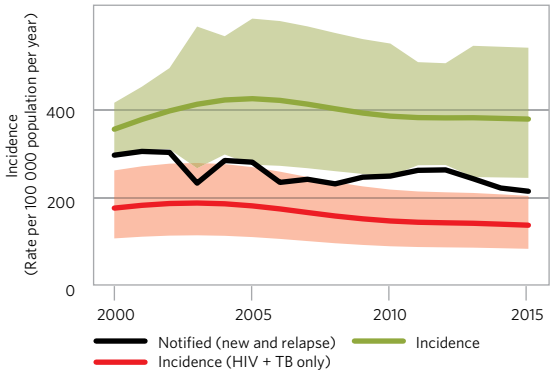
TB preventive treatment, 2015

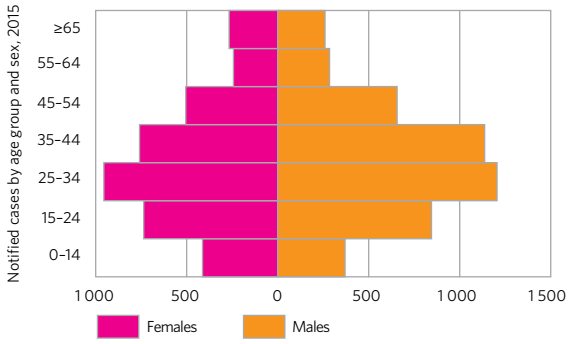
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment

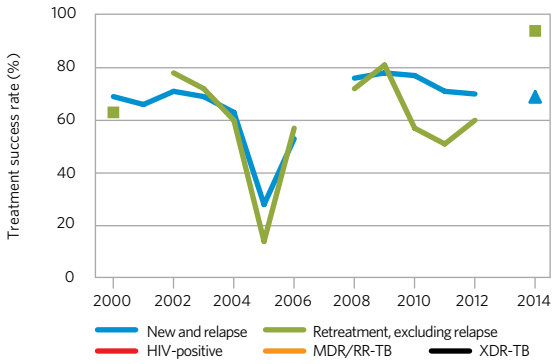
TB financing, 2016

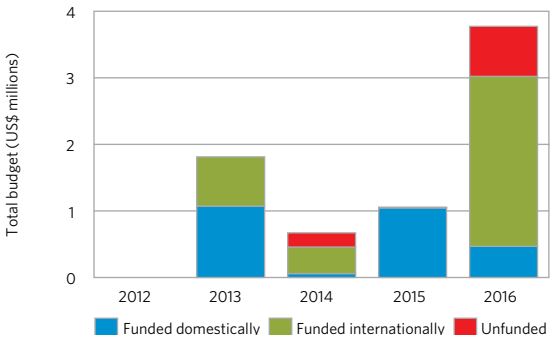
National TB budget (US$ millions)	3.8
Funding source	12% domestic, 68% international, 20% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Lesotho

population 2015 :: **2.1 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	1.2 (0.63–1.9)	55 (29–89)
Mortality (HIV+TB only)	4.8 (3–7)	223 (139–328)
Incidence (includes HIV+TB)	17 (11–24)	788 (510–1 125)
Incidence (HIV+TB only)	12 (7.7–18)	566 (359–820)
Incidence (MDR/RR-TB)[b]	1.1 (0.76–1.5)	52 (36–70)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	0.54 (0.18–0.9)	5.9 (2.7–9.1)	6.5 (2.9–10)
Males	0.63 (0.36–0.9)	9.7 (6.8–13)	10 (7.2–14)
Total	1.2 (0.72–1.6)	16 (12–19)	17 (11–24)

TB case notifications, 2015

Total cases notified	7 892
Total new and relapse	7 594
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	96%
— % pulmonary	86%
— % bacteriologically confirmed among pulmonary	49%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	45% (32–70)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.37 (0.21–0.61)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	5 258	72%
— on antiretroviral therapy	4 152	79%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			430 (350–510)
Estimated % of TB cases with MDR/RR-TB	4.8% (3.7–5.9)	14% (9.3–18)	
% notified tested for rifampicin resistance	21%	57%	2 536
MDR/RR-TB cases tested for resistance to second-line drugs			8
Laboratory-confirmed cases			MDR/RR-TB: 332, XDR-TB:
Patients started on treatment[d]			MDR/RR-TB: 217, XDR-TB: 5

Treatment success rate and cohort size

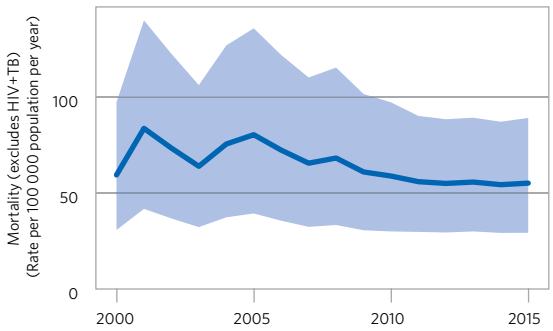
	Success	Cohort
New and relapse cases registered in 2014	70%	9 000
Previously treated cases, excluding relapse, registered in 2014	59%	936
HIV-positive TB cases, all types, registered in 2014	69%	5 466
MDR/RR-TB cases started on second-line treatment in 2013	63%	163
XDR-TB cases started on second-line treatment in 2013	33%	3

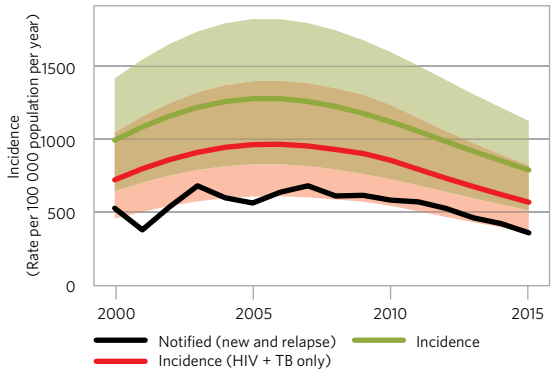
TB preventive treatment, 2015

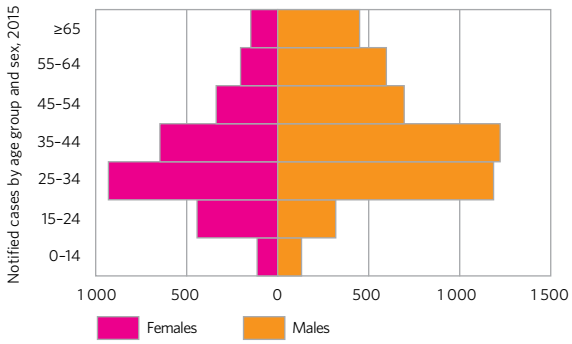
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

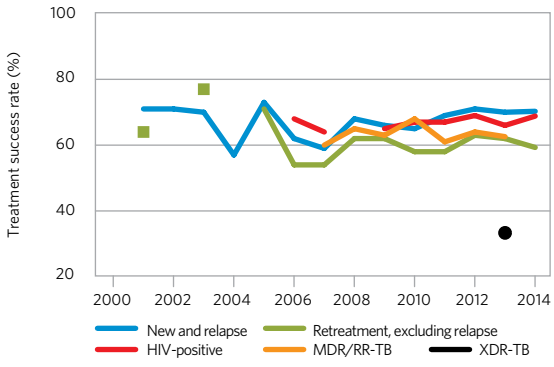
TB financing, 2016

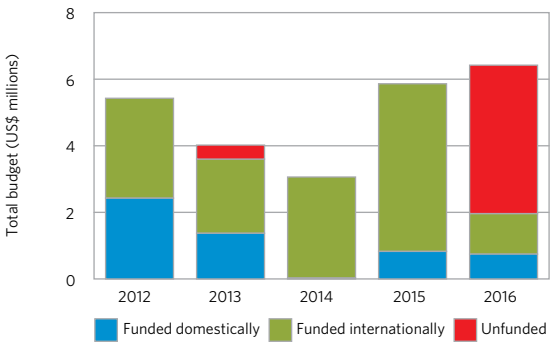
National TB budget (US$ millions)	6.4
Funding source	12% domestic, 19% international, 69% unfunded











Data are as reported to WHO. Estimates of TB and MDR/RR-TB burden are produced by WHO in consultation with countries. 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] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Liberia

population 2015 :: **4.5 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	3.2 (1.9–4.8)	70 (41–107)
Mortality (HIV+TB only)	0.84 (0.7–1)	19 (16–22)
Incidence (includes HIV+TB)	14 (9–20)	308 (199–440)
Incidence (HIV+TB only)	1.8 (1.1–2.6)	40 (25–58)
Incidence (MDR/RR-TB)[b]	0.43 (0–0.99)	9.5 (0–22)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	1.1 (0.54–1.6)	3.8 (0.96–6.7)	4.9 (1.5–8.3)
Males	0.91 (0.54–1.3)	8.1 (5.5–11)	9 (6–12)
Total	2 (1.3–2.7)	12 (8.8–15)	14 (9–20)

TB case notifications, 2015

Total cases notified	5 849
Total new and relapse	5 814
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	73%
— % pulmonary	78%
— % bacteriologically confirmed among pulmonary	61%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	42% (29–65)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.3 (0.17–0.5)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	548	13%
— on antiretroviral therapy	154	28%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			140 (0–320)
Estimated % of TB cases with MDR/RR-TB	2.8% (0.1–6.7)	21% (2.2–39)	
% notified tested for rifampicin resistance	<1%	0%	15
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 0, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 15, XDR-TB: 0

Treatment success rate and cohort size

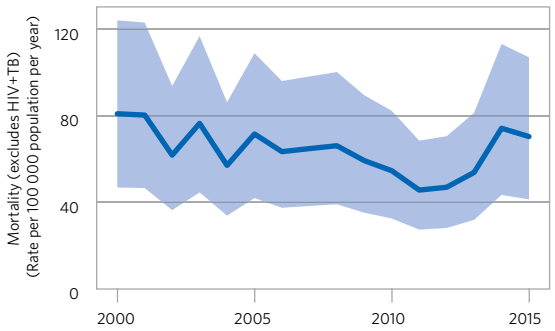
	Success	Cohort
New and relapse cases registered in 2014	74%	4 998
Previously treated cases, excluding relapse, registered in 2014	49%	37
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013		
XDR-TB cases started on second-line treatment in 2013		

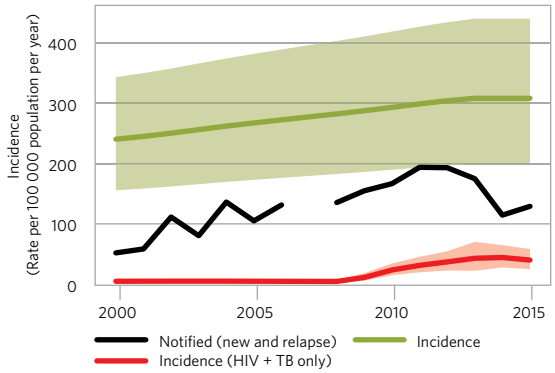
TB preventive treatment, 2015

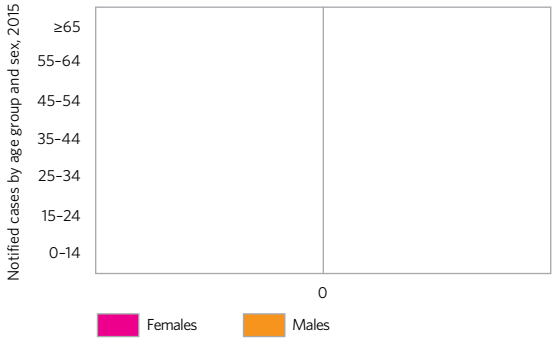
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment

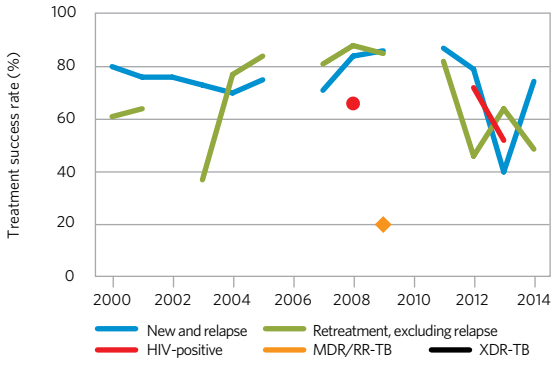
TB financing, 2016

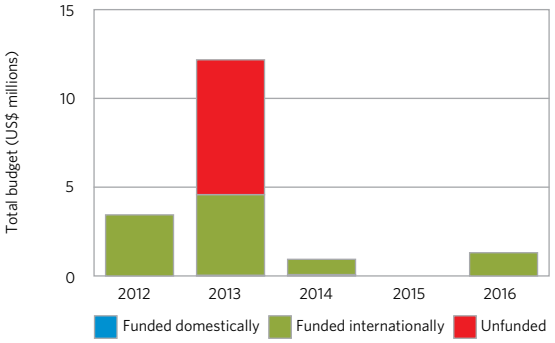
National TB budget (US$ millions)	1.3
Funding source	0% domestic, 100% international, 0% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Namibia

population 2015 :: **2.5 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	0.78 (0.51–1.1)	32 (21–45)
Mortality (HIV+TB only)	0.88 (0.062–2.8)	36 (2.5–112)
Incidence (includes HIV+TB)	12 (9.3–15)	489 (376–616)
Incidence (HIV+TB only)	4.9 (3.8–6.2)	199 (153–252)
Incidence (MDR/RR-TB)[b]	1.1 (0.84–1.3)	45 (34–53)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	0.57 (0.27–0.87)	4.4 (2.8–6)	5 (3–6.9)
Males	0.63 (0.39–0.86)	6.4 (4.8–8)	7.1 (5.2–8.9)
Total	1.2 (0.82–1.6)	11 (9.2–12)	12 (9.3–15)

TB case notifications, 2015

Total cases notified	9 944
Total new and relapse	9 614
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	98%
— % pulmonary	83%
— % bacteriologically confirmed among pulmonary	76%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	80% (64–100)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.14 (0.05–0.3)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	3 796	40%
— on antiretroviral therapy	3 480	92%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			540 (470–610)
Estimated % of TB cases with MDR/RR-TB	5% (4.1–5.9)	12% (9.3–14)	
% notified tested for rifampicin resistance			320
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: 320, XDR-TB: 3
Patients started on treatment[d]			MDR/RR-TB: 308, XDR-TB: 2

Treatment success rate and cohort size

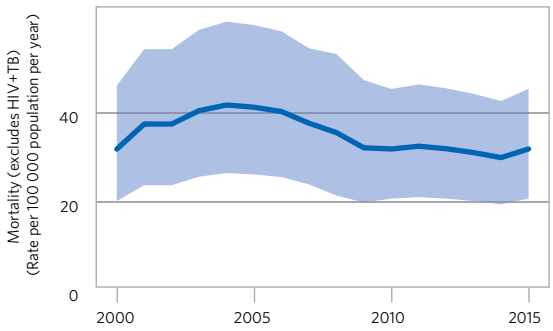
	Success	Cohort
New cases registered in 2014	87%	7 981
Previously treated cases registered in 2014	78%	2 068
HIV-positive TB cases, all types, registered in 2014	80%	3 112
MDR/RR-TB cases started on second-line treatment in 2013	64%	184
XDR-TB cases started on second-line treatment in 2013	0%	6

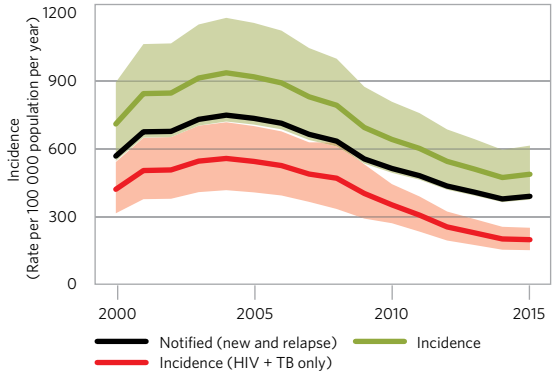
TB preventive treatment, 2015

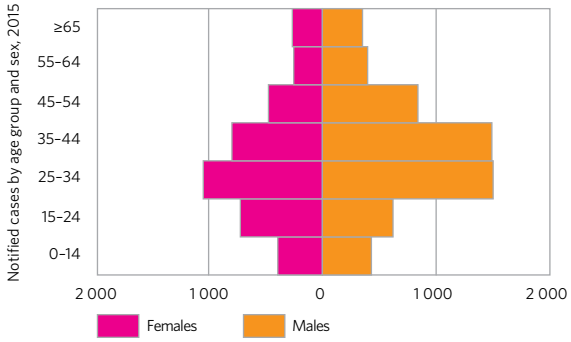
% of HIV-positive people (newly enrolled in care) on preventive treatment	
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

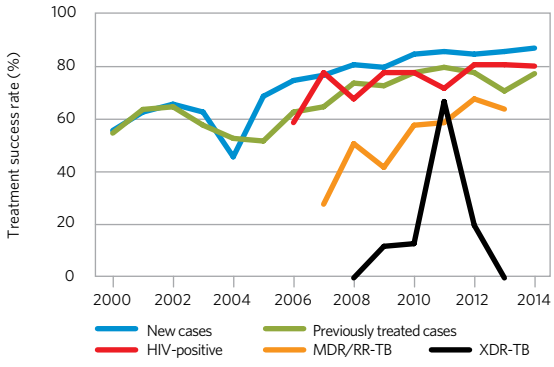
TB financing, 2016

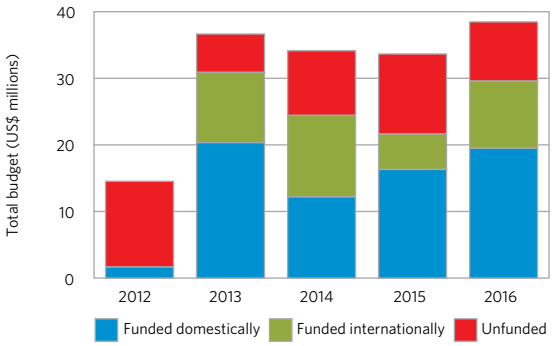
National TB budget (US$ millions)	38
Funding source	51% domestic, 26% international, 23% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Papua New Guinea

population 2015 :: **7.6 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	3.1 (1.8–4.6)	40 (24–61)
Mortality (HIV+TB only)	0.67 (0.4–1)	8.8 (5.2–13)
Incidence (includes HIV+TB)	33 (27–40)	432 (352–521)
Incidence (HIV+TB only)	4.9 (3–7.3)	64 (39–96)
Incidence (MDR/RR-TB)[b]	1.9 (1.2–2.5)	25 (16–33)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	2 (1.1–2.9)	14 (11–18)	16 (12–21)
Males	1.6 (0.99–2.2)	15 (12–19)	17 (13–21)
Total	3.6 (2.4–4.8)	29 (26–33)	33 (27–40)

TB case notifications, 2015

Total cases notified	28 696
Total new and relapse	26 347
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	36%
— % pulmonary	54%
— % bacteriologically confirmed among pulmonary	31%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	80% (66–98)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.11 (0.07–0.17)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	758	8%
— on antiretroviral therapy	494	65%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			1 100 (800–1 500)
Estimated % of TB cases with MDR/RR-TB	3.4% (1.7–5)	26% (15–36)	
% notified tested for rifampicin resistance			1 895
MDR/RR-TB cases tested for resistance to second-line drugs			147
Laboratory-confirmed cases			MDR/RR-TB: 254, XDR-TB: 11
Patients started on treatment[d]			MDR/RR-TB: 225, XDR-TB: 11

Treatment success rate and cohort size

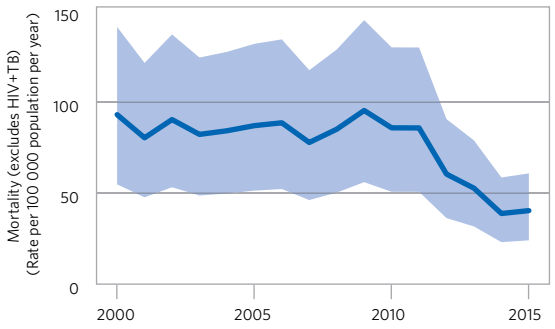
	Success	Cohort
New cases registered in 2014	70%	4 077
Previously treated cases registered in 2014	63%	728
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013		
XDR-TB cases started on second-line treatment in 2013		

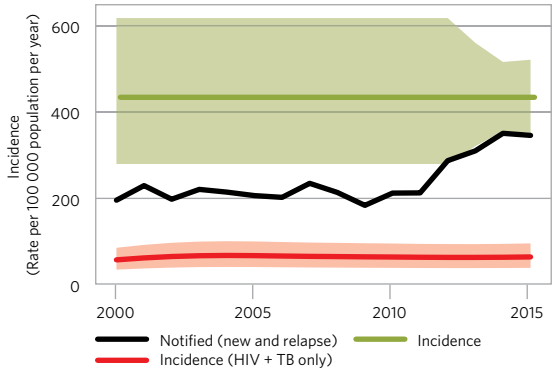
TB preventive treatment, 2015

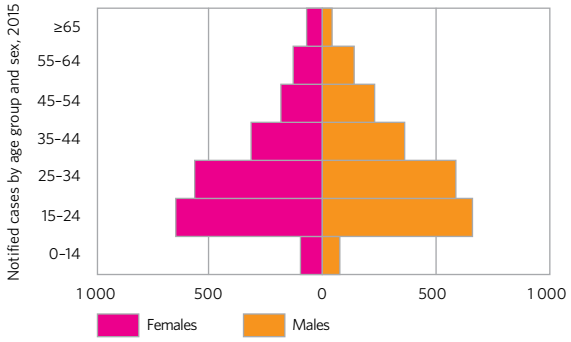
% of HIV-positive people (newly enrolled in care) on preventive treatment
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment

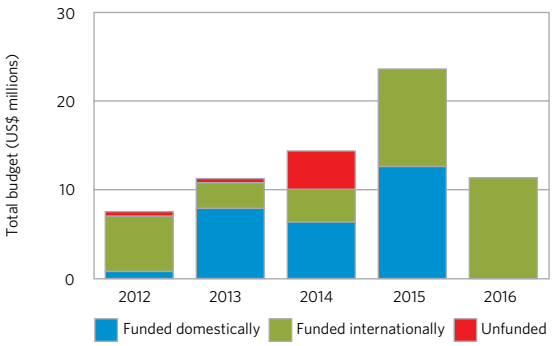
TB financing, 2016

National TB budget (US$ millions)	11
Funding source	domestic, 100% international, 0% unfunded









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[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Sierra Leone

population 2015 :: **6.5 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	3.3 (1.9–4.9)	51 (30–76)
Mortality (HIV+TB only)	0.82 (0.4–1.4)	13 (6.2–21)
Incidence (includes HIV+TB)	20 (13–28)	307 (198–438)
Incidence (HIV+TB only)	2.6 (1.7–3.8)	41 (26–59)
Incidence (MDR/RR-TB)[b]	0.7 (0–1.5)	11 (0–23)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	1.2 (0.46–1.9)	6.3 (2.4–10)	7.5 (2.9–12)
Males	1.3 (0.8–1.9)	11 (7.5–14)	12 (8.3–16)
Total	2.5 (1.6–3.3)	17 (13–22)	20 (13–28)

TB case notifications, 2015

Total cases notified	12 103
Total new and relapse	11 861
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	97%
— % pulmonary	95%
— % bacteriologically confirmed among pulmonary	69%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	60% (42–93)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.21 (0.12–0.36)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	1 573	14%
— on antiretroviral therapy	1 118	71%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			420 (0–860)
Estimated % of TB cases with MDR/RR-TB	2.8% (0.1–6.7)	21% (2.2–39)	
% notified tested for rifampicin resistance			
MDR/RR-TB cases tested for resistance to second-line drugs			
Laboratory-confirmed cases			MDR/RR-TB: , XDR-TB:
Patients started on treatment[d]			MDR/RR-TB: 0, XDR-TB: 0

Treatment success rate and cohort size

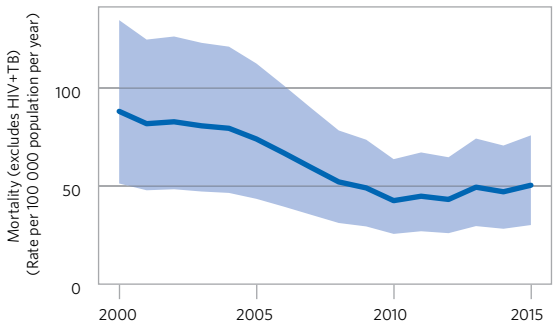
	Success	Cohort
New and relapse cases registered in 2014	85%	12 191
Previously treated cases, excluding relapse, registered in 2014	62%	227
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013		
XDR-TB cases started on second-line treatment in 2013		

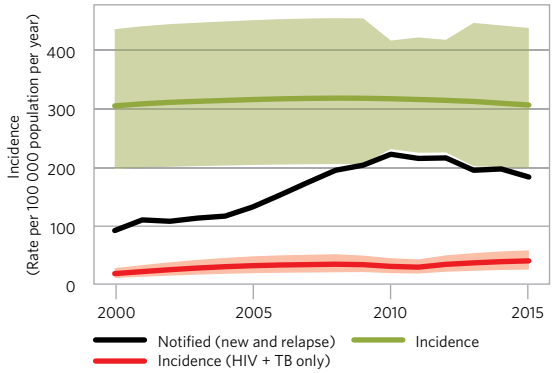
TB preventive treatment, 2015

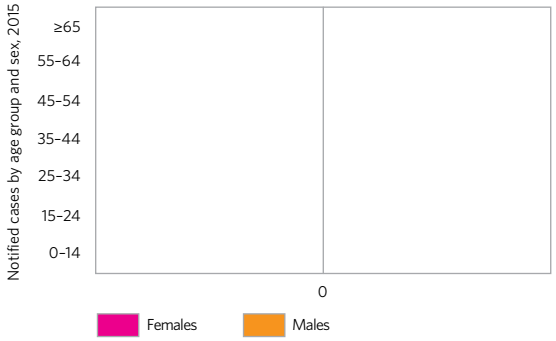
% of HIV-positive people (newly enrolled in care) on preventive treatment	7%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

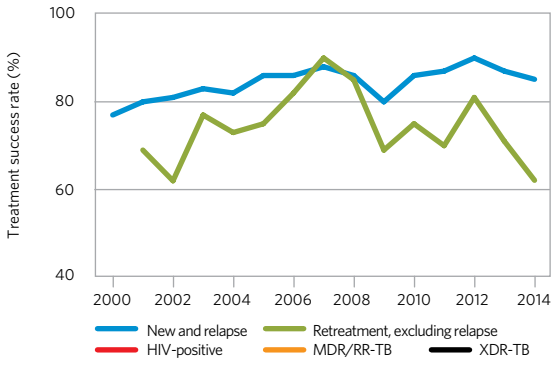
TB financing, 2016

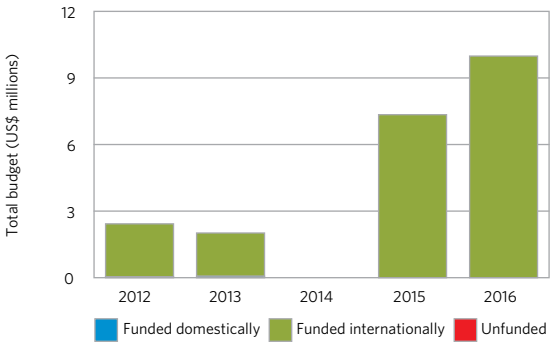
National TB budget (US$ millions)	10
Funding source	0% domestic, 100% international, 0% unfunded











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[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Zambia

population 2015 :: **16 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	5 (2.9–7.7)	31 (18–47)
Mortality (HIV+TB only)	12 (6.9–20)	77 (42–121)
Incidence (includes HIV+TB)	63 (41–91)	391 (253–558)
Incidence (HIV+TB only)	38 (24–55)	235 (149–339)
Incidence (MDR/RR-TB)[b]	2.3 (1.4–3.2)	14 (8.6–20)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	2.8 (1.1–4.5)	21 (8.8–33)	24 (9.9–38)
Males	3.2 (1.9–4.5)	36 (25–47)	39 (27–52)
Total	6 (3.9–8.2)	57 (44–71)	63 (41–91)

TB case notifications, 2015

Total cases notified	41 588
Total new and relapse	36 741
— % tested with rapid diagnostics at time of diagnosis	100%
— % with known HIV status	95%
— % pulmonary	79%
— % bacteriologically confirmed among pulmonary	49%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	58% (41–90)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.29 (0.16–0.48)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	20 967	60%
— on antiretroviral therapy	15 897	76%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			1 500 (990–2 100)
Estimated % of TB cases with MDR/RR-TB	1.1% (0.13–2.1)	18% (11–26)	
% notified tested for rifampicin resistance	<1%	9%	695
MDR/RR-TB cases tested for resistance to second-line drugs			0
Laboratory-confirmed cases			MDR/RR-TB: 196, XDR-TB: 0
Patients started on treatment[d]			MDR/RR-TB: 99, XDR-TB: 0

Treatment success rate and cohort size

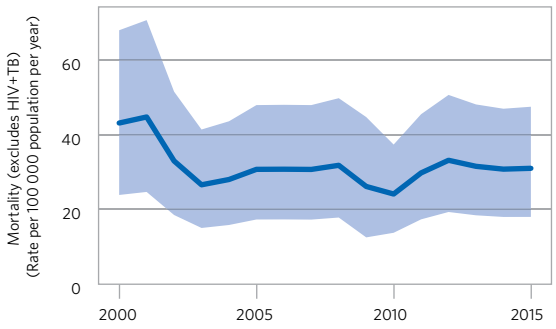
	Success	Cohort
New and relapse cases registered in 2014	85%	37 930
Previously treated cases, excluding relapse, registered in 2014	80%	4 786
HIV-positive TB cases, all types, registered in 2014		
MDR/RR-TB cases started on second-line treatment in 2013	33%	58
XDR-TB cases started on second-line treatment in 2013		0

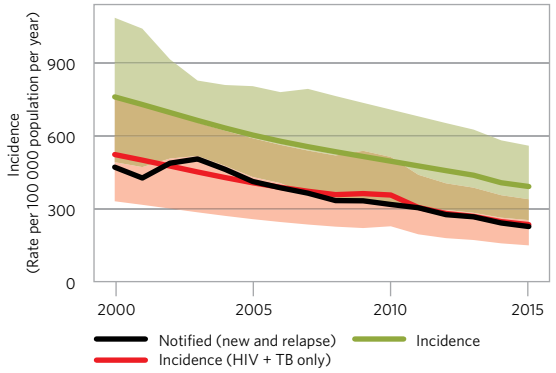
TB preventive treatment, 2015

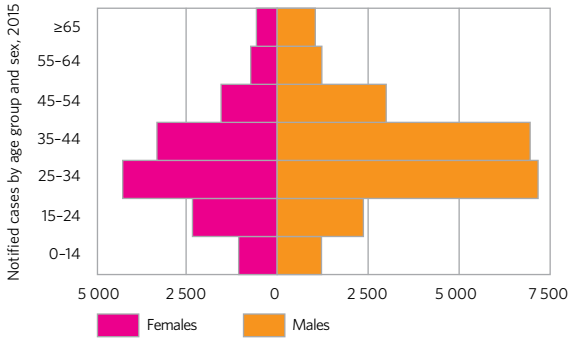
% of HIV-positive people (newly enrolled in care) on preventive treatment	66%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	

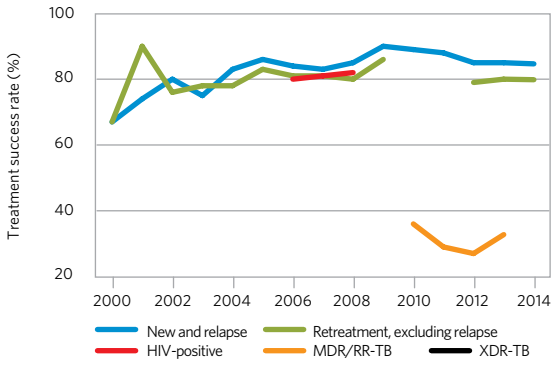
TB financing, 2016

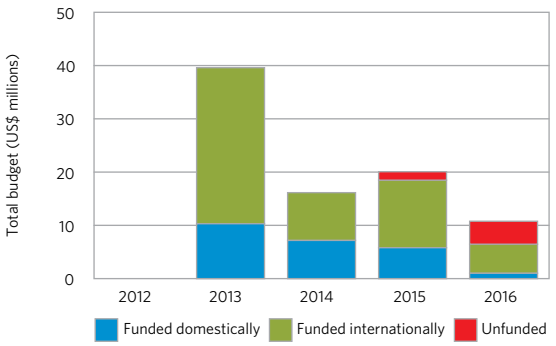
National TB budget (US$ millions)	11
Funding source	9% domestic, 51% international, 40% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Data for all years can be downloaded from www.who.int/tb/data

Zimbabwe

population 2015 :: **16 million**

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	1.7 (0.99–2.5)	11 (6.3–16)
Mortality (HIV+TB only)	6.3 (2.2–13)	40 (14–81)
Incidence (includes HIV+TB)	38 (28–49)	242 (179–314)
Incidence (HIV+TB only)	26 (17–37)	167 (107–240)
Incidence (MDR/RR-TB)[b]	1.8 (1–2.5)	12 (6.4–16)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	2.4 (1.1–3.6)	14 (8.3–19)	16 (9.4–23)
Males	2.6 (1.7–3.6)	19 (14–24)	22 (15–28)
Total	5 (3.5–6.5)	33 (27–39)	38 (28–49)

TB case notifications, 2015

Total cases notified	28 225
Total new and relapse	26 990
— % tested with rapid diagnostics at time of diagnosis	
— % with known HIV status	96%
— % pulmonary	87%
— % bacteriologically confirmed among pulmonary	54%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	72% (55–97)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.22 (0.09–0.4)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)
Patients with known HIV-status who are HIV-positive	18 072	70%
— on antiretroviral therapy	12 924	72%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			1 100 (690–1 600)
Estimated % of TB cases with MDR/RR-TB	3.2% (1.4–5)	14% (6.9–21)	
% notified tested for rifampicin resistance			9 241
MDR/RR-TB cases tested for resistance to second-line drugs			95
Laboratory-confirmed cases			MDR/RR-TB: 468, XDR-TB: 4
Patients started on treatment[d]			MDR/RR-TB: 433, XDR-TB: 5

Treatment success rate and cohort size

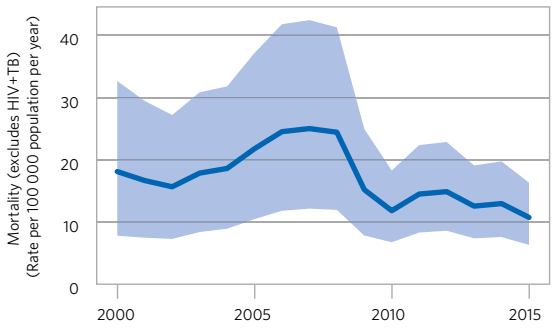
	Success	Cohort
New cases registered in 2014	81%	29 653
Previously treated cases registered in 2014	51%	2 363
HIV-positive TB cases, all types, registered in 2014	68%	19 290
MDR/RR-TB cases started on second-line treatment in 2013	59%	351
XDR-TB cases started on second-line treatment in 2013		

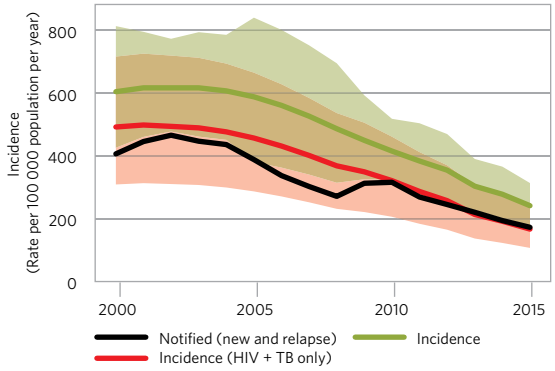
TB preventive treatment, 2015

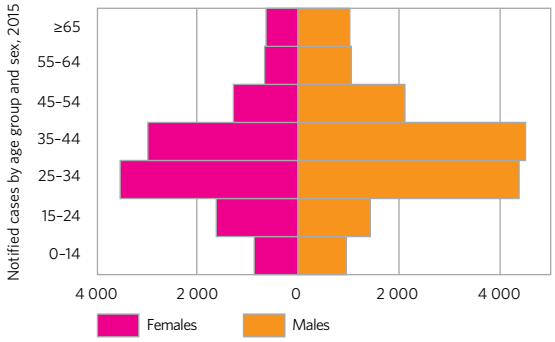
% of HIV-positive people (newly enrolled in care) on preventive treatment	31%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	31% (28–34)

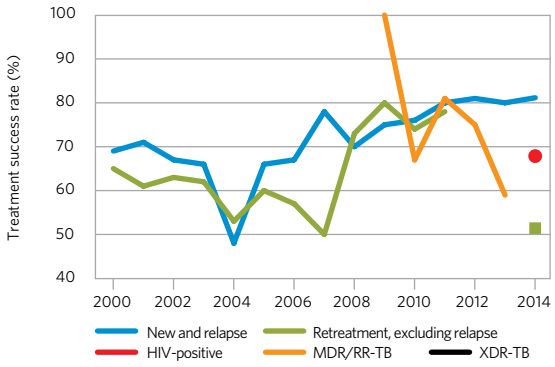
TB financing 2016

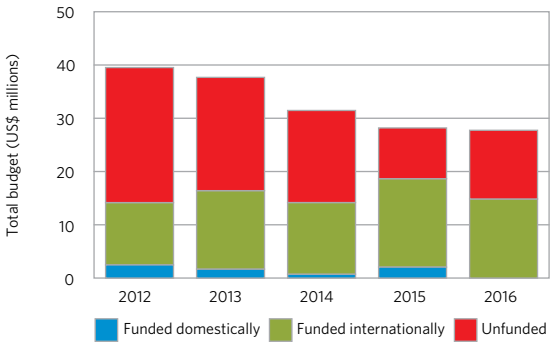
National TB budget (US$ millions)	28
Funding source	domestic, 54% international, 46% unfunded











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[a] Ranges represent uncertainty intervals.
[b] MDR is TB resistant to rifampicin and isoniazid; RR is TB resistant to rifampicin.
[c] Includes cases with unknown previous TB treatment history.
[d] Includes patients diagnosed before 2015 and patients who were not laboratory-confirmed.

Annex

3

Regional profiles

FOR
6 WHO REGIONS

WHO African Region

population 2015 :: **989 million**

WHO MEMBER STATES 47

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	450 (350–560)	45 (35–57)
Mortality (HIV+TB only)	300 (230–360)	30 (24–37)
Incidence (includes HIV+TB)	2 720 (2 360–3 110)	275 (239–314)
Incidence (HIV+TB only)	834 (710–969)	84 (72–98)
Incidence (MDR/RR-TB)[b]	110 (88–120)	11 (8.9–13)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	142 (118–169)	960 (790–1 150)	1 100 (908–1 310)
Males	145 (127–164)	1 480 (1 330–1 630)	1 620 (1 450–1 800)
Total	287 (256–320)	2 440 (2 240–2 640)	2 720 (2 360–3 110)

TB case notifications, 2015

Total cases notified	1 333 504
Total new and relapse	1 296 122
— % with known HIV status	81%
— % pulmonary	84%
— % bacteriologically confirmed among pulmonary	64%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	48% (42–55)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.27 (0.22–0.34)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	380 032	36%
— on antiretroviral therapy	376 511	83%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			42 000 (38 000–47 000)
Estimated % of TB cases with MDR/RR-TB	3% (1.2–4.9)	15% (7.5–22)	
% notified tested for rifampicin resistance	21%	51%	352 478
MDR/RR-TB cases tested for resistance to second-line drugs			8 795
Laboratory-confirmed cases			MDR/RR-TB: 26 929, XDR-TB: 1 100
Patients started on treatment[d]			MDR/RR-TB: 18 483, XDR-TB: 795

Treatment success rate and cohort size

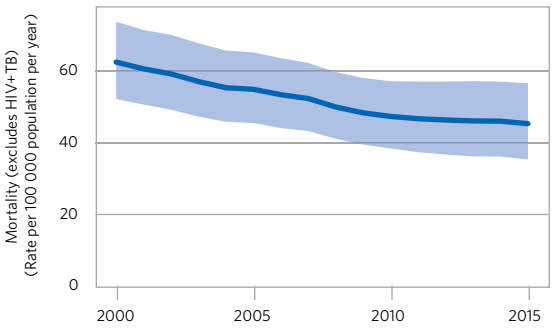
	Success	Cohort
New and relapse[e] cases registered in 2014	81%	1 274 882
Previously treated cases, excluding relapse, registered in 2014	72%	40 347
HIV-positive TB cases, all types, registered in 2014	77%	328 245
MDR/RR-TB cases started on second-line treatment in 2013	54%	14 553
XDR-TB cases started on second-line treatment in 2013	24%	630

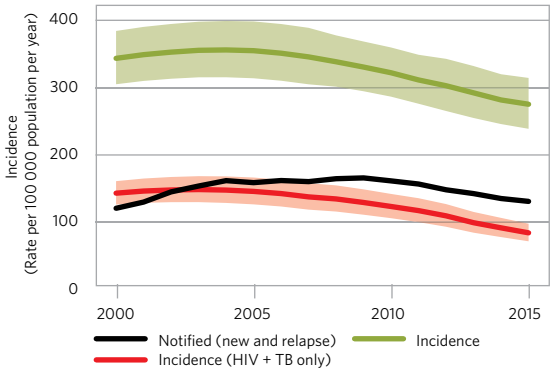
TB preventive treatment, 2015

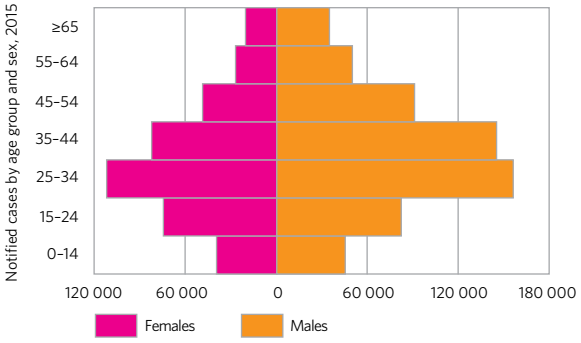
% of HIV-positive people (newly enrolled in care) on preventive treatment	39%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	5.6% (5.5–5.7)

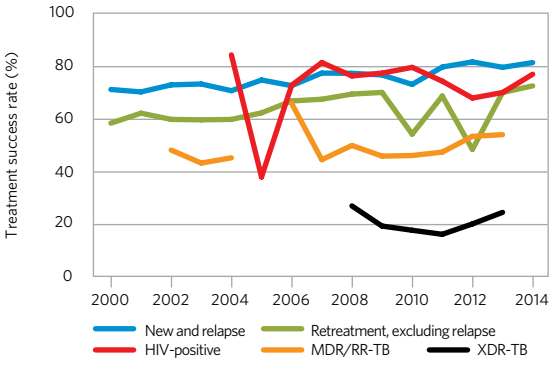
TB financing (low- and middle-income countries),[g,h] 2016

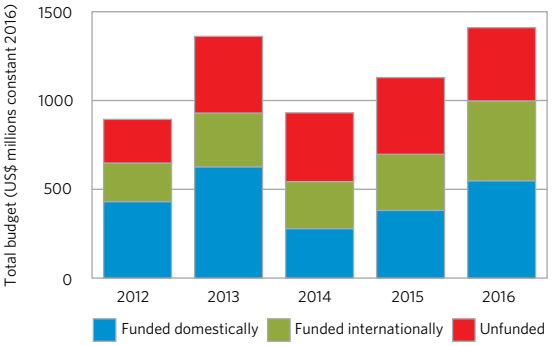
National TB budget (US$ millions)	1 410
Funding source	39% domestic, 32% international, 29% unfunded











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[e] Some countries reported on new cases only.
[f] Calculations exclude countries with missing numerators or denominators.
[g] Data are not collected from all Member States.
[h] Financing indicators exclude funding for general healthcare services provided outside NTPs.

WHO/PAHO Region of the Americas

population 2015 :: **991 million**

WHO MEMBER STATES 35
OTHER COUNTRIES AND TERRITORIES 11

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	19 (17–20)	1.9 (1.8–2)
Mortality (HIV+TB only)	6 (4–8)	0.59 (0.42–0.79)
Incidence (includes HIV+TB)	268 (250–287)	27 (25–29)
Incidence (HIV+TB only)	32 (29–35)	3.2 (2.9–3.5)
Incidence (MDR/RR-TB)[b]	11 (10–12)	1.1 (1–1.2)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	13 (11–15)	88 (76–100)	101 (87–115)
Males	13 (11–15)	155 (141–169)	168 (152–183)
Total	26 (23–28)	243 (232–253)	268 (250–287)

TB case notifications, 2015

Total cases notified	230 519
Total new and relapse	217 081
— % with known HIV status	82%
— % pulmonary	85%
— % bacteriologically confirmed among pulmonary	77%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	81% (76–87)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.09 (0.08–0.1)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	21 885	12%
— on antiretroviral therapy	20 601	55%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			7 700 (7 200–8 200)
Estimated % of TB cases with MDR/RR-TB	2.9% (1.6–4.2)	12% (7.3–17)	
% notified tested for rifampicin resistance	29%	45%	78 462
MDR/RR-TB cases tested for resistance to second-line drugs			1 764
Laboratory-confirmed cases			MDR/RR-TB: 4 489, XDR-TB: 122
Patients started on treatment[d]			MDR/RR-TB: 3 374, XDR-TB: 103

Treatment success rate and cohort size

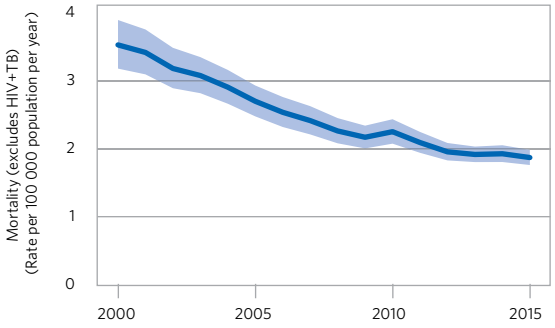
	Success	Cohort
New and relapse[e] cases registered in 2014	76%	195 507
Previously treated cases, excluding relapse, registered in 2014	48%	14 487
HIV-positive TB cases, all types, registered in 2014	56%	16 754
MDR/RR-TB cases started on second-line treatment in 2013	55%	2 920
XDR-TB cases started on second-line treatment in 2013	52%	90

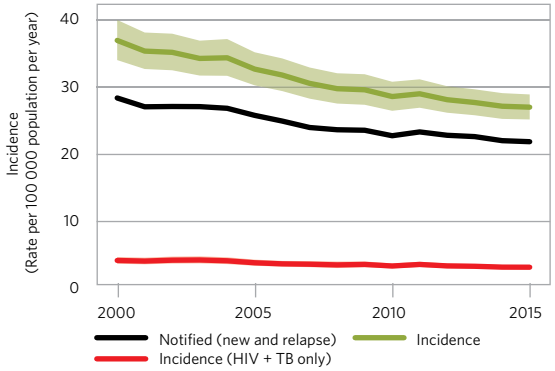
TB preventive treatment, 2015

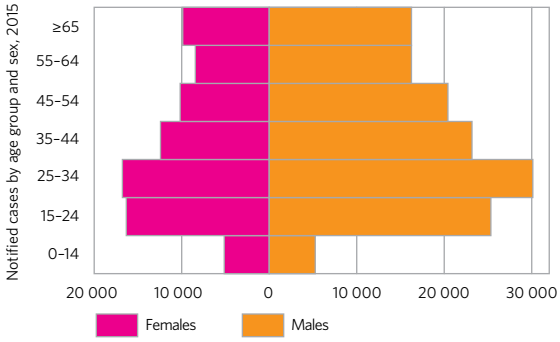
% of HIV-positive people (newly enrolled in care) on preventive treatment	42%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	67% (63–71)

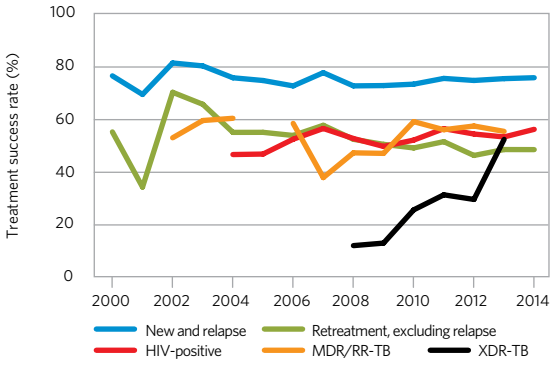
TB financing (low- and middle-income countries),[g,h] 2016

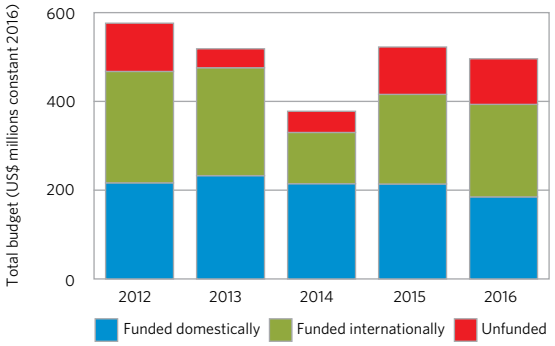
National TB budget (US$ millions)	496
Funding source	37% domestic, 42% international, 21% unfunded











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Data for all years can be downloaded from www.who.int/tb/data

WHO Eastern Mediterranean Region

population 2015 :: **648 million**

WHO MEMBER STATES 21
OTHER COUNTRIES AND TERRITORIES 1

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	80 (38–140)	12 (5.8–21)
Mortality (HIV+TB only)	3 (3–4)	0.46 (0.38–0.54)
Incidence (includes HIV+TB)	749 (561–965)	116 (86–149)
Incidence (HIV+TB only)	13 (9.5–17)	2 (1.5–2.7)
Incidence (MDR/RR-TB)[b]	39 (30–50)	6 (4.6–7.7)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	39 (27–52)	321 (237–418)	360 (264–470)
Males	36 (28–45)	354 (285–430)	390 (313–475)
Total	75 (59–92)	675 (570–788)	749 (561–965)

TB case notifications, 2015

Total cases notified	484 733
Total new and relapse	472 587
— % with known HIV status	17%
— % pulmonary	77%
— % bacteriologically confirmed among pulmonary	56%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	63% (49–84)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.11 (0.05–0.2)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	1 456	1.9%
— on antiretroviral therapy	1 366	72%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			19 000 (16 000–22 000)
Estimated % of TB cases with MDR/RR-TB	4.1% (3–5.1)	17% (12–23)	
% notified tested for rifampicin resistance	2.0%	65%	35 059
MDR/RR-TB cases tested for resistance to second-line drugs			2 461
Laboratory-confirmed cases			MDR/RR-TB: 4 081, XDR-TB: 117
Patients started on treatment[d]			MDR/RR-TB: 3 367, XDR-TB: 71

Treatment success rate and cohort size

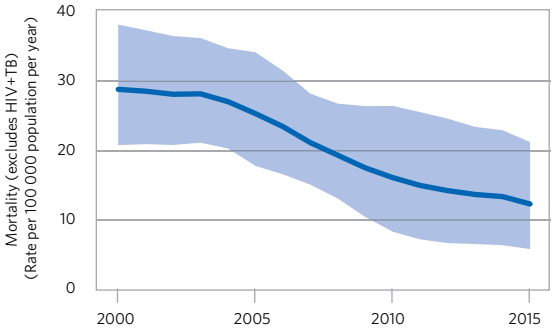
	Success	Cohort
New and relapse[e] cases registered in 2014	91%	438 187
Previously treated cases, excluding relapse, registered in 2014	79%	10 995
HIV-positive TB cases, all types, registered in 2014	53%	404
MDR/RR-TB cases started on second-line treatment in 2013	68%	1 950
XDR-TB cases started on second-line treatment in 2013	30%	67

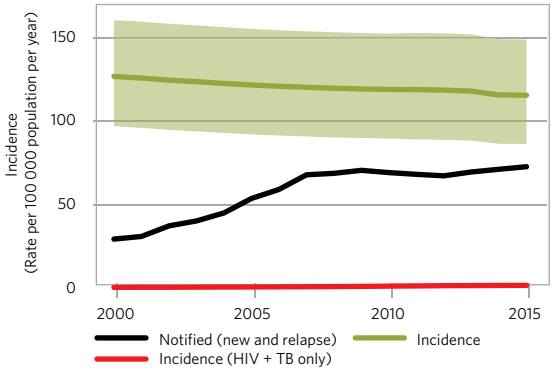
TB preventive treatment, 2015

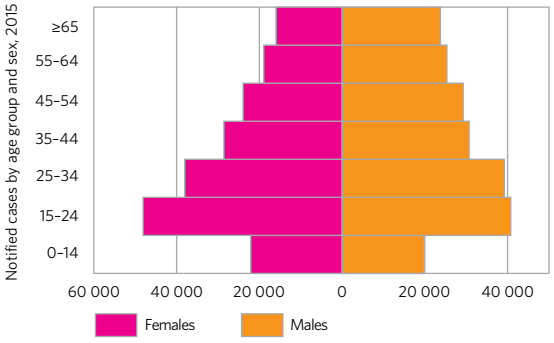
% of HIV-positive people (newly enrolled in care) on preventive treatment	40%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	12% (11–12)

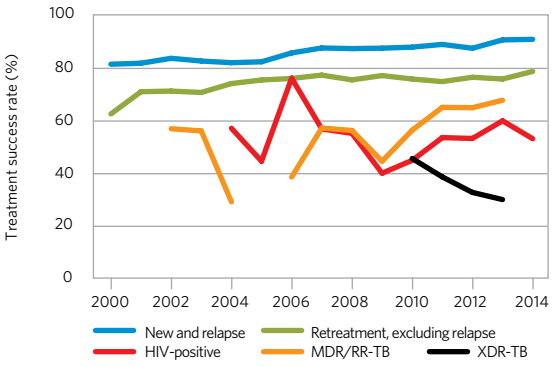
TB financing (low- and middle-income countries),[g,h] 2016

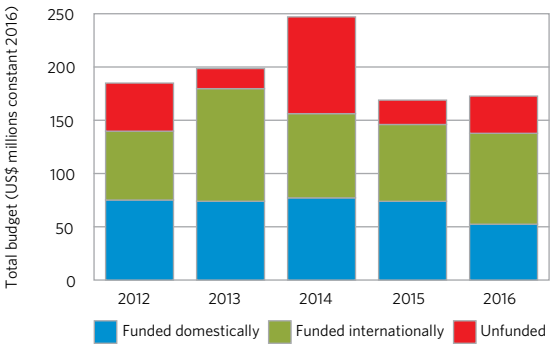
National TB budget (US$ millions)	173
Funding source	30% domestic, 49% international, 20% unfunded











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.
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[g] Data are not collected from all Member States.
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Data for all years can be downloaded from www.who.int/tb/data

WHO European Region

population 2015 :: **910 million**

WHO MEMBER STATES 53
OTHER COUNTRIES AND TERRITORIES 1

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	32 (31–33)	3.5 (3.4–3.6)
Mortality (HIV+TB only)	5 (2–10)	0.54 (0.17–1.1)
Incidence (includes HIV+TB)	323 (299–349)	36 (33–38)
Incidence (HIV+TB only)	27 (23–31)	3 (2.5–3.4)
Incidence (MDR/RR-TB)b	120 (110–140)	14 (12–15)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	12 (10–14)	99 (84–116)	111 (94–130)
Males	13 (11–14)	199 (181–219)	212 (192–233)
Total	25 (22–27)	299 (285–312)	323 (299–349)

TB case notifications, 2015

Total cases notified	297 448
Total new and relapse	250 459
— % with known HIV status	72%
— % pulmonary	86%
— % bacteriologically confirmed among pulmonary	61%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	78% (72–84)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.11 (0.1–0.13)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	16 137	9.2%
— on antiretroviral therapy	9 237	63%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			74 000 (68 000–81 000)
Estimated % of TB cases with MDR/RR-TB	16% (11–20)	48% (42–53)	
% notified tested for rifampicin resistance	44%	49%	138 048
MDR/RR-TB cases tested for resistance to second-line drugs			22 270
Laboratory-confirmed cases			MDR/RR-TB: 42 646, XDR-TB: 2 691
Patients started on treatment[d]			MDR/RR-TB: 53 396, XDR-TB: 3 920

Treatment success rate and cohort size

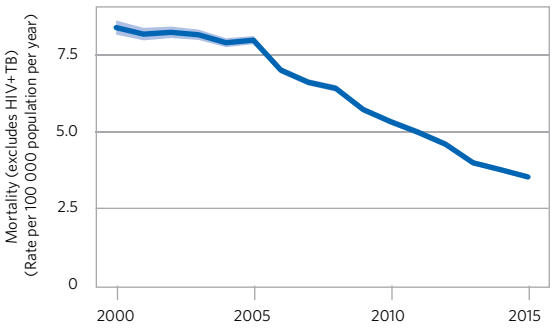
	Success	Cohort
New and relapse[e] cases registered in 2014	76%	210 244
Previously treated cases, excluding relapse, registered in 2014	63%	22 085
HIV-positive TB cases, all types, registered in 2014	41%	7 716
MDR/RR-TB cases started on second-line treatment in 2013	52%	42 463
XDR-TB cases started on second-line treatment in 2013	27%	2 756

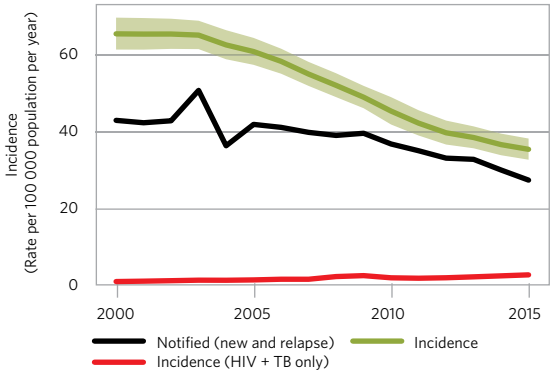
TB preventive treatment, 2015

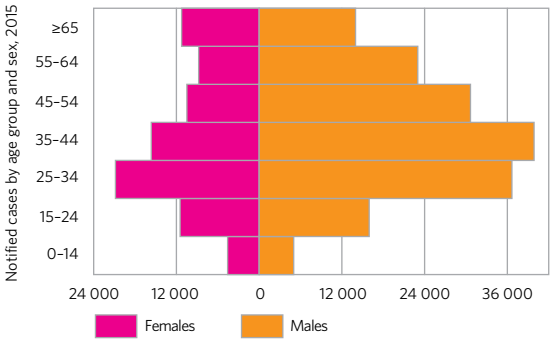
% of HIV-positive people (newly enrolled in care) on preventive treatment	36%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	42% (40–44)

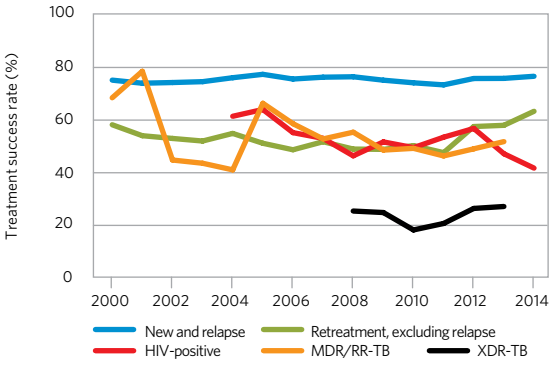
TB financing (low- and middle-income countries),[g,h] 2016

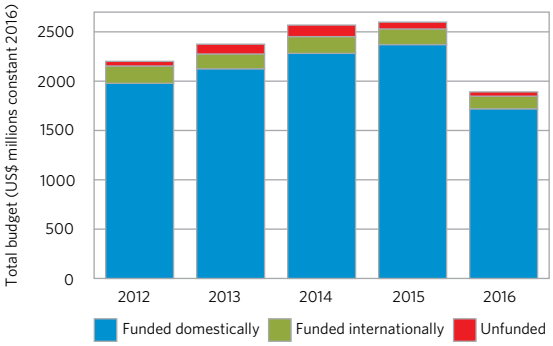
National TB budget (US$ millions)	1 891
Funding source	91% domestic, 6.8% international, 2.3% unfunded











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Data for all years can be downloaded from www.who.int/tb/data

WHO South-East Asia Region

population 2015 :: **1 928 million**

WHO MEMBER STATES 11

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	710 (600–830)	37 (31–43)
Mortality (HIV+TB only)	74 (56–95)	3.9 (2.9–4.9)
Incidence (includes HIV+TB)	4 740 (3 230–6 540)	246 (167–339)
Incidence (HIV+TB only)	227 (159–307)	12 (8.2–16)
Incidence (MDR/RR-TB)[b]	200 (150–250)	10 (7.9–13)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	211 (153–277)	1 540 (867–2 410)	1 750 (1 020–2 680)
Males	195 (153–243)	2 790 (2 150–3 510)	2 990 (2 310–3 760)
Total	406 (330–489)	4 330 (3 510–5 250)	4 740 (3 230–6 540)

TB case notifications, 2015

Total cases notified	2 656 560
Total new and relapse	2 563 325
— % with known HIV status	52%
— % pulmonary	83%
— % bacteriologically confirmed among pulmonary	63%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	54% (39–79)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.17 (0.12–0.25)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	64 238	4.9%
— on antiretroviral therapy	64 238	78%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			110 000 (100 000–120 000)
Estimated % of TB cases with MDR/RR-TB	2.6% (2.3–3)	17% (15–19)	
% notified tested for rifampicin resistance	5.1%	57%	351 942
MDR/RR-TB cases tested for resistance to second-line drugs			10 471
Laboratory-confirmed cases			MDR/RR-TB: 35 953, XDR-TB: 3 099
Patients started on treatment[d]			MDR/RR-TB: 32 648, XDR-TB: 2 171

Treatment success rate and cohort size

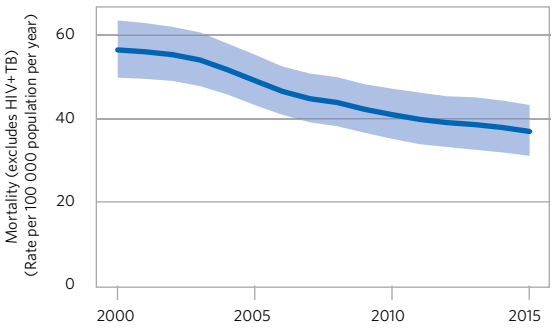
	Success	Cohort
New and relapse[e] cases registered in 2014	79%	2 469 890
Previously treated cases, excluding relapse, registered in 2014	68%	95 599
HIV-positive TB cases, all types, registered in 2014	74%	65 183
MDR/RR-TB cases started on second-line treatment in 2013	49%	18 538
XDR-TB cases started on second-line treatment in 2013	37%	261

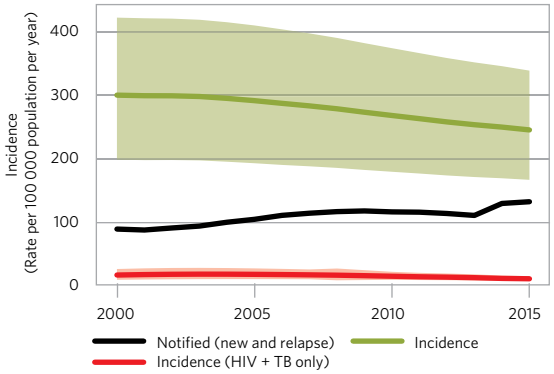
TB preventive treatment, 2015

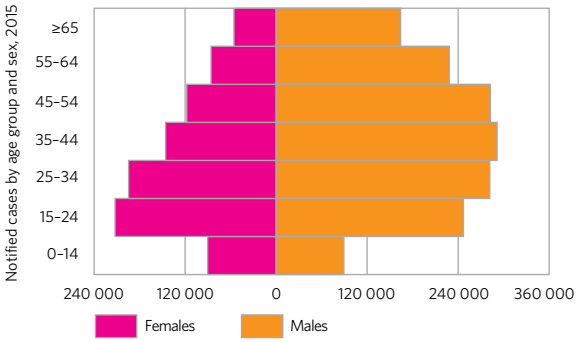
% of HIV-positive people (newly enrolled in care) on preventive treatment	8.9%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	2.3% (2.1–2.4)

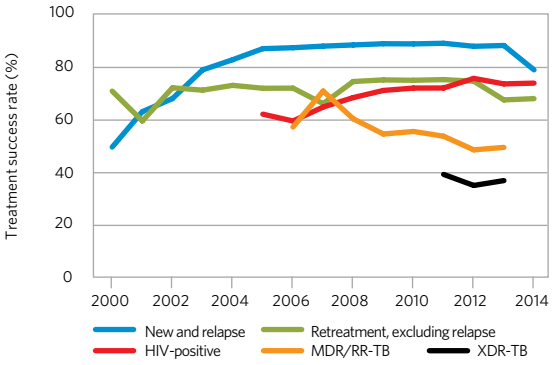
TB financing (low- and middle-income countries),[g,h] 2016

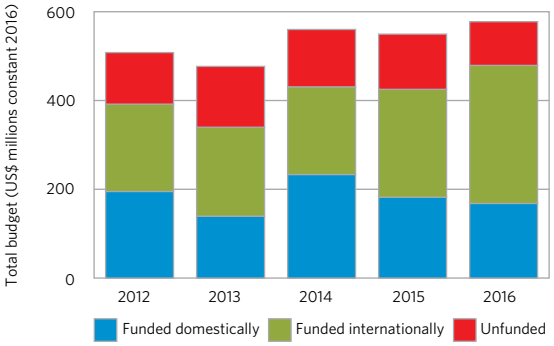
National TB budget (US$ millions)	578
Funding source	29% domestic, 54% international, 17% unfunded











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[a] Ranges represent uncertainty intervals.
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WHO Western Pacific Region

population 2015 :: **1 856 million**

WHO MEMBER STATES 27
OTHER COUNTRIES AND TERRITORIES 9

Estimates of TB burden,[a] 2015

	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	89 (81–98)	4.8 (4.4–5.3)
Mortality (HIV+TB only)	6 (4–8)	0.31 (0.2–0.44)
Incidence (includes HIV+TB)	1 590 (1 440–1 740)	86 (78–94)
Incidence (HIV+TB only)	34 (29–40)	1.8 (1.6–2.1)
Incidence (MDR/RR-TB)[b]	100 (88–120)	5.5 (4.8–6.4)

Estimated TB incidence by age and sex (thousands),[a] 2015

	0–14 years	> 14 years	Total
Females	67 (51–84)	471 (368–586)	537 (419–670)
Males	72 (59–86)	979 (849–1 120)	1 050 (908–1 200)
Total	138 (119–159)	1 450 (1 370–1 530)	1 590 (1 440–1 740)

TB case notifications, 2015

Total cases notified	1 361 430
Total new and relapse	1 336 747
— % with known HIV status	43%
— % pulmonary	92%
— % bacteriologically confirmed among pulmonary	38%

Universal health coverage and social protection

TB treatment coverage (notified/estimated incidence), 2015	84% (77–93)
TB patients facing catastrophic total costs	
TB case fatality ratio (estimated mortality/estimated incidence), 2015	0.06 (0.05–0.07)

TB/HIV care in new and relapse TB patients, 2015

	Number	(%)[f]
Patients with known HIV-status who are HIV-positive	16 816	3.0%
— on antiretroviral therapy	16 411	53%

Drug-resistant TB care, 2015

	New cases	Previously treated cases	Total number[c]
Estimated MDR/RR-TB cases among notified pulmonary TB cases			83 000 (73 000–93 000)
Estimated % of TB cases with MDR/RR-TB	5.1% (3–7.2)	26% (23–30)	
% notified tested for rifampicin resistance	8.8%	36%	180 648
MDR/RR-TB cases tested for resistance to second-line drugs			1 601
Laboratory-confirmed cases			MDR/RR-TB: 18 022, XDR-TB: 450
Patients started on treatment[d]			MDR/RR-TB: 13 722, XDR-TB: 196

Treatment success rate and cohort size

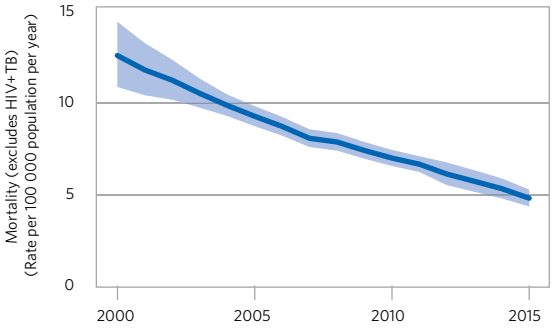
	Success	Cohort
New and relapse[e] cases registered in 2014	92%	1 277 110
Previously treated cases, excluding relapse, registered in 2014	80%	19 062
HIV-positive TB cases, all types, registered in 2014	72%	5 700
MDR/RR-TB cases started on second-line treatment in 2013	57%	6 512
XDR-TB cases started on second-line treatment in 2013	37%	282

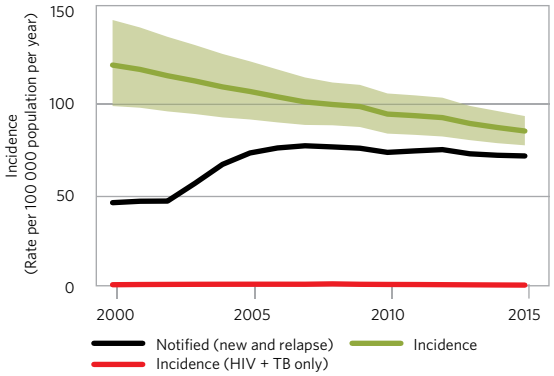
TB preventive treatment, 2015

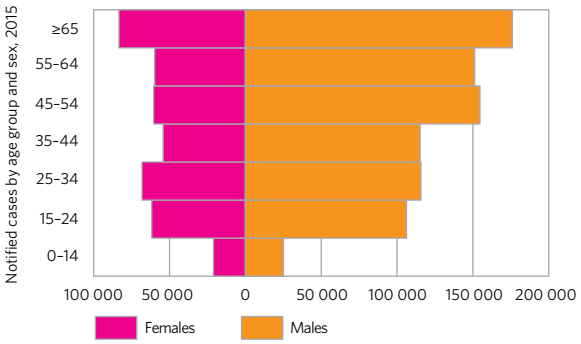
% of HIV-positive people (newly enrolled in care) on preventive treatment	50%
% of children (aged < 5) household contacts of bacteriologically-confirmed TB cases on preventive treatment	13% (12–14)

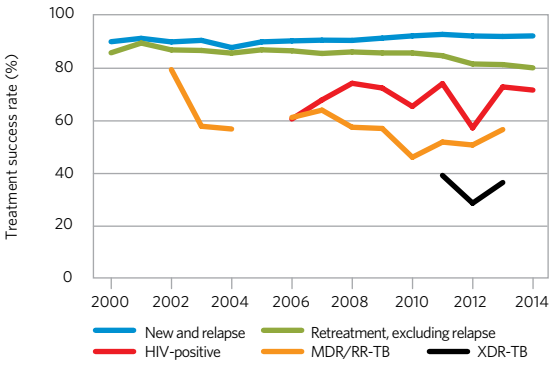
TB financing (low- and middle-income countries),[g,h] 2016

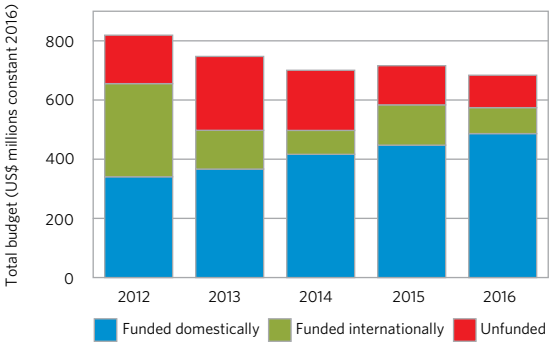
National TB budget (US$ millions)	684
Funding source	71% domestic, 13% international, 16% unfunded











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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/.

Estimated numbers are shown rounded to two significant figures. Estimated rates are shown rounded to three significant figures unless the value is under 100, in which case rates are shown rounded to two significant figures.

Data source

Data shown in this file were taken from the WHO global TB database on **21 September 2016**. Data shown in the main part of the report were taken from the database on 15 August 2016. 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

Bangladesh

Estimates of TB incidence and mortality will be reviewed once final results from the 2015/2016 national TB prevalence survey are available.

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. Data are not currently independently collected from the US Virgin Islands.

Denmark

Data for Denmark exclude Greenland.

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 are interim in nature, pending results from the national TB prevalence survey planned for 2017/2018.

Russian Federation

UN Population Division estimates are lower than the population registered by the Federal State Statistics Service of the Russian Federation. The reported number of TB patients with known HIV status (**Table A4.4**) is for new TB patients in the civilian sector only. It was not possible to calculate the percentage of all TB patients with known HIV status.

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, 2015

	Population (millions)	Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
		Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Afghanistan	33	61 (40–88)	189 (122–270)	0.46 (0.28–0.68)	1.4 (0.86–2.1)	3 (1.8–4.1)	9.2 (5.5–13)
Albania	3	0.55 (0.46–0.63)	19 (16–22)	0.01 (<0.1–<0.1)	0.27 (0.21–0.34)	0.015 (<0.01–0.027)	0.52 (0.10–0.93)
Algeria	40	30 (23–37)	75 (58–94)	0.2 (0.14–0.27)	0.51 (0.36–0.68)	0.47 (0.14–0.80)	1.2 (0.35–2.0)
American Samoa	< 1	0 (0–<0.1)	8.3 (7.1–9.5)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	0.43 (0.25–0.63)
Andorra	< 1	0 (0–<0.1)	6.5 (5.6–7.5)			0 (0–0)	0 (0–0)
Angola	25	93 (60–132)	370 (240–529)	28 (17–41)	111 (68–165)	4.1 (0.36–7.8)	16 (1.4–31)
Anguilla	< 1	0 (0–0)	21 (14–31)			0 (0–0)	0 (0–0)
Antigua and Barbuda	< 1	0.01 (<0.1–<0.1)	7.5 (6.4–8.6)	0 (0–0)	2.1 (1.8–2.4)	<0.01 (<0.01–<0.01)	0.17 (0.11–0.24)
Argentina	43	11 (9.5–13)	25 (22–29)	0.79 (0.61–0.99)	1.8 (1.4–2.3)	0.53 (0.37–0.69)	1.2 (0.85–1.6)
Armenia	3	1.2 (1.1–1.4)	41 (36–46)	0.11 (0.10–0.13)	3.7 (3.3–4.2)	0.27 (0.20–0.34)	8.9 (6.6–11)
Aruba	< 1	0.01 (<0.1–<0.1)	12 (11–14)			<0.01 (<0.01–<0.01)	0.29 (0.18–0.39)
Australia	24	1.4 (1.2–1.7)	6 (5.2–6.9)	0.03 (<0.1–<0.1)	0.12 (0.10–0.14)	0.062 (0.039–0.085)	0.26 (0.16–0.35)
Austria	9	0.65 (0.56–0.75)	7.6 (6.5–8.8)	0.02 (<0.1–<0.1)	0.19 (0.14–0.23)	0.02 (<0.01–0.032)	0.23 (<0.1–0.37)
Azerbaijan	10	6.8 (5.5–8.1)	69 (57–83)	0.11 (<0.1–0.16)	1.1 (0.72–1.6)	2.5 (2.0–3.0)	26 (21–31)
Bahamas	< 1	0.07 (<0.1–<0.1)	18 (16–21)	0.02 (<0.1–<0.1)	5.7 (4.9–6.6)	<0.01 (<0.01–0.018)	2.4 (0.28–4.6)
Bahrain	1	0.25 (0.21–0.28)	18 (15–21)	0.01 (<0.1–<0.1)	0.84 (0.71–0.99)	<0.01 (0–<0.01)	0.33 (0–0.71)
Bangladesh	161	362 (234–517)	225 (146–321)	0.63 (0.39–0.94)	0.39 (0.24–0.59)	9.7 (5.4–14)	6 (3.4–8.7)
Barbados	< 1	0	0	0	0	0 (0–0)	0 (0–0)
Belarus	9	5.2 (3.9–6.8)	55 (41–71)	0.3 (0.20–0.44)	3.2 (2.1–4.6)	3.5 (2.8–4.2)	37 (29–44)
Belgium	11	1.1 (0.92–1.2)	9.4 (8.1–11)	0.08 (<0.1–0.10)	0.74 (0.61–0.88)	0.023 (<0.01–0.038)	0.2 (<0.1–0.34)
Belize	< 1	0.09 (<0.1–0.10)	25 (21–29)	0.02 (<0.1–<0.1)	5.8 (5.0–6.8)	0.01 (<0.01–0.012)	2.8 (2.4–3.3)
Benin	11	6.6 (4.2–9.4)	60 (39–86)	1 (0.64–1.4)	9.2 (5.9–13)	0.1 (<0.01–0.20)	0.92 (<0.1–1.8)
Bermuda	< 1	0	0			0 (0–0)	0 (0–0)
Bhutan	< 1	1.2 (0.93–1.5)	155 (120–196)	0.11 (<0.1–0.14)	14 (9.8–18)	0.052 (0.043–0.062)	6.7 (5.5–8.0)
Bolivia (Plurinational State of)	11	13 (8.1–18)	117 (76–167)	0.55 (0.35–0.79)	5.1 (3.3–7.4)	0.5 (0.25–0.74)	4.7 (2.3–6.9)
Bonaire, Saint Eustatius and Saba	< 1	0 (0–0)	1 (0.90–1.2)			0 (0–0)	0 (0–0)
Bosnia and Herzegovina	4	1.4 (1.1–1.8)	37 (29–47)	0 (0–<0.1)	0.1 (<0.1–0.15)	0.01 (<0.01–0.019)	0.26 (<0.1–0.50)
Botswana	2	8 (5.2–11)	356 (230–508)	4.8 (3.1–6.9)	213 (136–306)	0.47 (0.30–0.63)	21 (13–28)
Brazil	208	84 (72–97)	41 (35–47)	13 (11–15)	6.3 (5.3–7.3)	2.3 (1.9–2.8)	1.1 (0.91–1.3)
British Virgin Islands	< 1	0	0			0 (0–0)	0 (0–0)
Brunei Darussalam	< 1	0.24 (0.21–0.28)	58 (49–66)	0 (0–0)	0.15 (0.13–0.18)	0 (0–0)	0 (0–0)
Bulgaria	7	1.7 (1.5–1.8)	24 (22–26)	0 (0–0)	<0.1 (<0.1–<0.1)	0.1 (0.075–0.13)	1.4 (1.0–1.8)
Burkina Faso	18	9.4 (6.1–13)	52 (34–74)	0.89 (0.57–1.3)	4.9 (3.2–7.1)	0.4 (0.018–0.77)	2.2 (<0.1–4.3)
Burundi	11	14 (8.8–19)	122 (79–174)	1.9 (1.2–2.7)	17 (11–24)	0.5 (0.21–0.80)	4.5 (1.9–7.2)
Cabo Verde	< 1	0.72 (0.47–1.0)	139 (90–198)	0.08 (<0.1–0.12)	16 (10–23)	0.027 (0–0.055)	5.2 (0–11)
Cambodia	16	59 (38–85)	380 (246–543)	1.4 (0.92–2.1)	9.2 (5.9–13)	1.3 (0.59–2.1)	8.3 (3.8–13)
Cameroon	23	49 (32–71)	212 (137–303)	18 (11–26)	76 (48–110)	1.9 (0.87–3.0)	8.1 (3.7–13)
Canada	36	1.8 (1.6–2.1)	5.1 (4.3–5.8)	0.15 (0.12–0.17)	0.4 (0.33–0.48)	0.031 (0.016–0.045)	<0.1 (<0.1–0.13)
Cayman Islands	< 1	0.01 (<0.1–<0.1)	13 (12–15)			0 (0–0)	0 (0–0)
Central African Republic	5	19 (12–27)	391 (253–558)	8.6 (5.3–13)	176 (107–262)	0.21 (0–0.45)	4.3 (0–9.2)
Chad	14	21 (14–30)	152 (98–217)	6.4 (3.9–9.5)	45 (28–68)	0.89 (0.031–1.7)	6.3 (0.22–12)
Chile	18	3 (2.5–3.4)	16 (14–19)	0.15 (0.11–0.19)	0.82 (0.63–1.0)	0.061 (0.040–0.082)	0.34 (0.22–0.46)
China	1 376	918 (788–1 060)	67 (57–77)	15 (12–19)	1.1 (0.86–1.4)	70 (55–84)	5.1 (4.0–6.1)
China, Hong Kong SAR	7	5.2 (4.4–6.0)	71 (61–82)	0.03 (<0.1–<0.1)	0.46 (0.39–0.54)	0.077 (0.051–0.10)	1.1 (0.70–1.4)
China, Macao SAR	< 1	0.43 (0.37–0.49)	72 (62–83)	0 (0–0)	0.36 (0.31–0.42)	0.016 (<0.01–0.025)	2.7 (1.2–4.3)
Colombia	48	15 (11–19)	31 (24–39)	2.1 (1.6–2.7)	4.4 (3.3–5.5)	0.56 (0.38–0.73)	1.2 (0.79–1.5)
Comoros	< 1	0.27 (0.18–0.39)	35 (22–49)	0.01 (<0.1–<0.1)	1.1 (0.70–1.6)	<0.01 (0–0.020)	1.2 (0–2.5)
Congo	5	18 (11–25)	379 (246–542)	6.4 (3.9–9.5)	138 (84–205)	0.67 (0.29–1.0)	15 (6.3–22)
Cook Islands	< 1	0 (0–0)	7.8 (5.0–11)	0 (0–0)	<0.1 (0–<0.1)	0 (0–0)	0 (0–0)
Costa Rica	5	0.53 (0.41–0.67)	11 (8.5–14)	0.04 (<0.1–<0.1)	0.86 (0.66–1.1)	0.012 (<0.01–0.022)	0.25 (<0.1–0.46)
Côte d'Ivoire	23	36 (23–52)	159 (103–227)	8.5 (5.5–12)	38 (24–54)	1.4 (0.57–2.3)	6.2 (2.5–10)
Croatia	4	0.56 (0.48–0.64)	13 (11–15)	0.01 (0–<0.1)	0.15 (0.12–0.19)	0 (0–0)	0 (0–0)
Cuba	11	0.8 (0.69–0.92)	7 (6.0–8.1)	0.07 (<0.1–<0.1)	0.65 (0.55–0.75)	0.025 (0.011–0.040)	0.22 (<0.1–0.35)
Curaçao	< 1	0.01 (0–<0.1)	3.7 (3.2–4.3)	0 (0–0)	1.9 (1.6–2.2)	0 (0–0)	0 (0–0)
Cyprus	1	0.07 (<0.1–<0.1)	6.2 (5.3–7.2)	0 (0–0)	0.12 (<0.1–0.15)	0 (0–0)	0 (0–0)
Czechia	11	0.55 (0.47–0.63)	5.2 (4.4–6.0)	0.01 (0–<0.1)	<0.1 (<0.1–<0.1)	0.015 (<0.01–0.026)	0.14 (<0.1–0.25)
Democratic People's Republic of Korea	25	141 (109–178)	561 (432–706)	0.45 (0.32–0.60)	1.8 (1.3–2.4)	6 (3.4–8.6)	24 (14–34)
Democratic Republic of the Congo	77	250 (162–357)	324 (210–463)	39 (23–57)	50 (30–74)	10 (4.6–15)	13 (6.0–19)
Denmark	6	0.34 (0.29–0.39)	6 (5.1–6.9)	0.01 (<0.1–<0.1)	0.19 (0.14–0.23)	<0.01 (0–<0.01)	<0.1 (0–<0.1)
Djibouti	< 1	3.4 (2.6–4.2)	378 (291–476)	0.2 (0.15–0.25)	22 (17–28)	0.18 (0.089–0.27)	20 (10–30)
Dominica	< 1	0.01 (<0.1–<0.1)	11 (9.5–13)	0 (0–0)	<0.1 (<0.1–<0.1)	0 (0–0)	0 (0–0)
Dominican Republic	11	6.3 (4.7–8.3)	60 (44–78)	1.6 (1.0–2.3)	15 (9.5–21)	0.28 (0.16–0.39)	2.7 (1.5–3.7)
Ecuador	16	8.4 (5.5–12)	52 (34–75)	1 (0.64–1.4)	6.2 (4.0–9.0)	0.75 (0.45–1.0)	4.6 (2.8–6.2)
Egypt	92	13 (12–15)	15 (13–16)	0.05 (<0.1–<0.1)	<0.1 (<0.1–<0.1)	2.2 (1.8–2.6)	2.4 (2.0–2.8)
El Salvador	6	2.7 (2.4–2.9)	43 (40–47)	0.21 (0.19–0.23)	3.5 (3.2–3.8)	0.04 (0.014–0.067)	0.65 (0.23–1.1)
Equatorial Guinea	< 1	1.5 (1.3–1.6)	172 (150–194)	0.73 (0.62–0.84)	86 (74–99)	0.066 (<0.01–0.12)	7.8 (1.0–14)

[a] Rates are per 100 000 population.

:: TABLE A4.1
TB incidence estimates, 2015

		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	5	3.4 (1.6–5.9)	65 (30–113)	0.18 (<0.1–0.32)	3.5 (1.6–6.1)	0.14 (0–0.29)	2.7 (0–5.5)
Estonia	1	0.24 (0.20–0.27)	18 (15–21)	0.02 (<0.1–<0.1)	1.8 (1.6–2.1)	0.071 (0.050–0.092)	5.4 (3.8–7.0)
Ethiopia	99	191 (141–249)	192 (142–250)	16 (10–23)	16 (10–23)	6.2 (3.5–8.9)	6.2 (3.5–9.0)
Fiji	< 1	0.45 (0.35–0.57)	51 (39–64)	0.01 (<0.1–<0.1)	0.93 (0.71–1.2)	0 (0–0)	0 (0–0)
Finland	6	0.31 (0.26–0.35)	5.6 (4.8–6.4)	0.01 (0–<0.1)	0.1 (<0.1–0.13)	0.017 (<0.01–0.028)	0.31 (0.11–0.51)
France	64	5.3 (4.7–6.0)	8.2 (7.2–9.3)	0.41 (0.32–0.50)	0.63 (0.49–0.78)	0.088 (0.063–0.11)	0.14 (<0.1–0.17)
French Polynesia	< 1	0.05 (<0.1–<0.1)	19 (16–22)			<0.01 (<0.01–<0.01)	1.7 (0.39–3.0)
Gabon	2	8 (5.9–10)	465 (344–604)	0.25 (0.15–0.37)	14 (8.8–21)	0.4 (0.23–0.56)	23 (13–32)
Gambia	2	3.5 (2.6–4.4)	174 (131–223)	0.6 (0.39–0.86)	30 (19–43)	0.12 (0–0.25)	6 (0–13)
Georgia	4	4 (3.2–4.8)	99 (80–120)	0.26 (0.16–0.38)	6.4 (3.9–9.5)	0.98 (0.81–1.1)	25 (20–28)
Germany	81	6.5 (5.6–7.5)	8.1 (6.9–9.3)	0.2 (0.15–0.25)	0.24 (0.19–0.30)	0.23 (0.11–0.34)	0.29 (0.14–0.42)
Ghana	27	44 (21–75)	160 (77–273)	9.9 (4.6–17)	36 (17–62)	1.5 (0–3.4)	5.5 (0–12)
Greece	11	0.49 (0.42–0.56)	4.5 (3.8–5.1)	0.02 (<0.1–<0.1)	0.18 (0.14–0.22)	0.011 (0–0.028)	0.1 (0–0.26)
Greenland	< 1	0.09 (<0.1–0.11)	164 (141–189)			<0.01 (<0.01–<0.01)	5.5 (4.1–6.9)
Grenada	< 1	0.01 (0–<0.1)	5.4 (4.6–6.2)	0 (0–0)	2.2 (1.8–2.5)	<0.01 (<0.01–<0.01)	0.16 (<0.1–0.25)
Guam	< 1	0.09 (<0.1–0.10)	51 (44–59)	0 (0–0)	<0.1 (<0.1–<0.1)	0 (0–0)	0 (0–0)
Guatemala	16	4.2 (3.2–5.2)	25 (20–32)	0.27 (0.21–0.34)	1.7 (1.3–2.1)	0.23 (0.15–0.31)	1.4 (0.92–1.9)
Guinea	13	22 (14–32)	177 (114–252)	5.4 (3.5–7.9)	43 (27–63)	0.78 (0–1.7)	6.2 (0–13)
Guinea-Bissau	2	6.9 (4.5–9.8)	373 (241–533)	1.8 (1.1–2.6)	97 (60–142)	0.21 (0–0.49)	11 (0–27)
Guyana	< 1	0.71 (0.55–0.90)	93 (72–117)	0.17 (0.13–0.22)	22 (17–28)	0.043 (0.029–0.058)	5.6 (3.8–7.6)
Haiti	11	21 (17–25)	194 (156–235)	3.4 (2.2–4.9)	32 (21–46)	0.79 (0.45–1.1)	7.4 (4.2–10)
Honduras	8	3.5 (2.9–4.1)	43 (36–51)	0.36 (0.23–0.52)	4.5 (2.9–6.5)	0.11 (0.058–0.17)	1.4 (0.72–2.1)
Hungary	10	0.92 (0.79–1.1)	9.3 (8.0–11)	0.01 (<0.1–<0.1)	0.12 (<0.1–0.15)	0.037 (0.023–0.052)	0.38 (0.23–0.53)
Iceland	< 1	0.01 (<0.1–<0.1)	2.4 (2.1–2.8)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
India	1 311	2 840 (1 470–4 650)	217 (112–355)	113 (58–186)	8.6 (4.4–14)	130 (88–180)	9.9 (6.7–14)
Indonesia	258	1 020 (658–1 450)	395 (255–564)	78 (48–116)	30 (18–45)	32 (19–45)	12 (7.4–17)
Iran (Islamic Republic of)	79	13 (9.8–16)	16 (12–20)	0.35 (0.25–0.46)	0.44 (0.31–0.58)	0.25 (0.15–0.35)	0.32 (0.19–0.44)
Iraq	36	16 (14–18)	43 (38–49)	0.02 (<0.1–<0.1)	<0.1 (<0.1–<0.1)	1.2 (0.88–1.5)	3.3 (2.4–4.1)
Ireland	5	0.34 (0.29–0.39)	7.2 (6.2–8.3)	0.01 (<0.1–<0.1)	0.31 (0.24–0.39)	<0.01 (0–0.011)	<0.1 (0–0.23)
Israel	8	0.32 (0.28–0.37)	4 (3.4–4.6)	0.02 (<0.1–<0.1)	0.23 (0.20–0.27)	0.032 (0.017–0.048)	0.4 (0.21–0.60)
Italy	60	3.5 (3.0–4.0)	5.8 (5.0–6.7)	0.21 (0.16–0.26)	0.35 (0.27–0.44)	0.12 (0.074–0.16)	0.2 (0.12–0.27)
Jamaica	3	0.13 (0.10–0.16)	4.6 (3.5–5.8)	0.03 (<0.1–<0.1)	1.1 (0.83–1.4)	<0.01 (0–<0.01)	<0.1 (0–0.24)
Japan	127	21 (18–24)	17 (14–19)	0.09 (<0.1–0.11)	<0.1 (<0.1–<0.1)	0.27 (0.18–0.36)	0.21 (0.14–0.28)
Jordan	8	0.53 (0.41–0.67)	7 (5.4–8.8)	0 (0–0)	<0.1 (0–<0.1)	0.039 (0.012–0.067)	0.51 (0.16–0.88)
Kazakhstan	18	16 (14–17)	89 (80–99)	0.5 (0.32–0.72)	2.8 (1.8–4.1)	8.8 (7.1–10)	50 (40–57)
Kenya	46	107 (87–129)	233 (189–281)	36 (29–43)	78 (63–94)	2 (1.3–2.8)	4.3 (2.8–6.1)
Kiribati	< 1	0.62 (0.48–0.78)	551 (425–695)	0 (0–0)	2.3 (1.7–3.0)	0.041 (0.025–0.056)	36 (22–50)
Kuwait	4	0.86 (0.74–0.99)	22 (19–25)	0 (0–0)	<0.1 (<0.1–<0.1)	0.014 (<0.01–0.024)	0.36 (0.13–0.62)
Kyrgyzstan	6	8.5 (7.1–10)	144 (120–170)	0.26 (0.17–0.37)	4.4 (2.8–6.3)	5 (4.1–5.9)	84 (69–99)
Lao People's Democratic Republic	7	12 (8.0–18)	182 (118–260)	0.59 (0.36–0.88)	8.7 (5.3–13)	0.76 (0.39–1.1)	11 (5.7–16)
Latvia	2	0.8 (0.69–0.92)	41 (35–47)	0.21 (0.17–0.24)	10 (8.8–12)	0.099 (0.075–0.12)	5 (3.8–6.1)
Lebanon	6	0.75 (0.65–0.87)	13 (11–15)	0.01 (<0.1–<0.1)	0.15 (0.12–0.19)	0.028 (<0.01–0.049)	0.48 (0.12–0.84)
Lesotho	2	17 (11–24)	788 (510–1 120	12 (7.7–18)	566 (359–820)	1.1 (0.76–1.5)	52 (36–70)
Liberia	5	14 (9.0–20)	308 (199–440)	1.8 (1.1–2.6)	40 (25–58)	0.43 (0–0.99)	9.5 (0–22)
Libya	6	2.5 (1.6–3.6)	40 (26–57)	0.05 (<0.1–<0.1)	0.87 (0.55–1.3)	0.12 (0.069–0.16)	1.9 (1.1–2.5)
Lithuania	3	1.6 (1.4–1.8)	56 (48–64)	0.06 (<0.1–<0.1)	2 (1.7–2.4)	0.36 (0.30–0.41)	13 (10–14)
Luxembourg	< 1	0.03 (<0.1–<0.1)	6.1 (5.2–7.0)	0 (0–0)	0.51 (0.40–0.65)	0 (0–0)	0 (0–0)
Madagascar	24	57 (37–82)	236 (153–337)	3.6 (2.2–5.4)	15 (9.1–22)	0.46 (0.12–0.81)	1.9 (0.50–3.3)
Malawi	17	33 (18–53)	193 (104–310)	18 (9.4–29)	104 (55–168)	0.44 (0.12–0.75)	2.6 (0.70–4.4)
Malaysia	30	27 (23–31)	89 (77–103)	1.5 (1.2–1.7)	4.8 (4.1–5.6)	0.53 (0.41–0.64)	1.7 (1.4–2.1)
Maldives	< 1	0.19 (0.15–0.24)	53 (41–66)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	1.6 (1.2–2.0)
Mali	18	10 (6.5–14)	57 (37–81)	1.4 (0.85–2.0)	7.7 (4.8–11)	0.61 (0.14–1.1)	3.5 (0.80–6.3)
Malta	< 1	0.04 (<0.1–<0.1)	8.8 (7.5–10)	0.01 (<0.1–<0.1)	1.6 (1.4–1.9)	0 (0–0)	0 (0–0)
Marshall Islands	< 1	0.18 (0.15–0.22)	344 (281–413)	0 (0–0)	0.67 (0.50–0.86)	0 (0–0)	0 (0–0)
Mauritania	4	4.3 (2.8–6.2)	107 (69–152)	0.44 (0.27–0.66)	11 (6.6–16)	0.15 (0–0.32)	3.7 (0–7.9)
Mauritius	1	0.28 (0.18–0.39)	22 (14–31)	0.03 (<0.1–<0.1)	2.7 (1.7–3.9)	<0.01 (0–0.012)	0.39 (0–0.94)
Mexico	127	27 (22–32)	21 (17–25)	3 (1.9–4.3)	2.3 (1.5–3.4)	0.91 (0.75–1.1)	0.72 (0.59–0.87)
Micronesia (Federated States of)	< 1	0.13 (0.10–0.16)	124 (96–157)			<0.01 (<0.01–0.011)	7.8 (4.6–11)
Monaco	< 1	0	0			0 (0–0)	0 (0–0)
Mongolia	3	13 (6.5–21)	428 (220–703)	0.01 (<0.1–<0.1)	0.34 (0.26–0.44)	0.63 (0.37–0.89)	21 (13–30)
Montenegro	< 1	0.13 (<0.1–0.19)	21 (13–30)	0 (0–0)	0.17 (0.11–0.25)	<0.01 (0–<0.01)	0.5 (0–1.2)
Montserrat	< 1	0	0			0 (0–0)	0 (0–0)
Morocco	34	37 (34–40)	107 (98–117)	0.79 (0.63–0.96)	2.3 (1.8–2.8)	0.58 (0.32–0.84)	1.7 (0.93–2.4)
Mozambique	28	154 (100–220)	551 (356–787)	79 (50–115)	284 (179–412)	7.3 (4.1–10)	26 (15–36)
Myanmar	54	197 (144–258)	365 (267–479)	17 (11–25)	32 (21–47)	14 (8.9–18)	26 (17–33)
Namibia	2	12 (9.3–15)	489 (376–616)	4.9 (3.8–6.2)	199 (153–252)	1.1 (0.84–1.3)	45 (34–53)

[a] Rates are per 100 000 population.

:: TABLE A4.1
TB incidence estimates, 2015

		Incidence (including HIV)		Incidence (HIV-positive)		Incidence (MDR/RR-TB)	
	Population (millions)	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]	Number (thousands)	Rate[a]
Nauru	< 1	0.01 (<0.1–<0.1)	113 (97–130)			<0.01 (<0.01–<0.01)	16 (13–18)
Nepal	29	44 (39–50)	156 (137–176)	1.9 (1.5–2.4)	6.7 (5.3–8.4)	1.5 (0.95–2.1)	5.3 (3.3–7.4)
Netherlands	17	0.98 (0.84–1.1)	5.8 (5.0–6.7)	0.07 (<0.1–<0.1)	0.42 (0.35–0.50)	0.023 (0.010–0.036)	0.14 (<0.1–0.21)
New Caledonia	< 1	0.06 (<0.1–<0.1)	24 (21–28)			0 (0–0)	0 (0–0)
New Zealand	5	0.34 (0.29–0.39)	7.4 (6.4–8.5)	0 (0–0)	<0.1 (<0.1–<0.1)	0.01 (<0.01–0.019)	0.22 (<0.1–0.42)
Nicaragua	6	3.1 (2.4–3.9)	51 (39–64)	0.15 (0.12–0.20)	2.5 (1.9–3.2)	0.078 (0.034–0.12)	1.3 (0.56–2.0)
Niger	20	19 (12–27)	95 (62–136)	1 (0.65–1.5)	5.2 (3.3–7.5)	0.71 (0–1.5)	3.6 (0–7.5)
Nigeria	182	586 (345–890)	322 (189–488)	100 (56–155)	55 (31–85)	29 (15–43)	16 (8.2–24)
Niue	< 1	0 (0–0)	8.1 (5.2–12)			0 (0–0)	0 (0–0)
Northern Mariana Islands	< 1	0.03 (<0.1–<0.1)	58 (50–67)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (0–<0.01)	3.6 (0–9.3)
Norway	5	0.33 (0.28–0.38)	6.3 (5.4–7.3)	0.01 (<0.1–<0.1)	0.15 (0.12–0.19)	0.01 (<0.01–0.019)	0.19 (<0.1–0.36)
Oman	4	0.38 (0.32–0.43)	8.4 (7.2–9.7)	0 (0–0)	<0.1 (<0.1–0.10)	0.015 (<0.01–0.024)	0.33 (0.13–0.53)
Pakistan	189	510 (330–729)	270 (175–386)	8.8 (5.4–13)	4.6 (2.8–6.9)	26 (16–36)	14 (8.5–19)
Palau	< 1	0.02 (<0.1–<0.1)	76 (65–87)	0 (0–0)	<0.1 (<0.1–<0.1)	0 (0–0)	0 (0–0)
Panama	4	2 (1.5–2.5)	50 (38–63)	0.23 (0.17–0.29)	5.7 (4.3–7.3)	0.089 (0.055–0.12)	2.3 (1.4–3.1)
Papua New Guinea	8	33 (27–40)	432 (352–521)	4.9 (3.0–7.3)	64 (39–96)	1.9 (1.2–2.5)	25 (16–33)
Paraguay	7	2.7 (2.3–3.1)	41 (35–47)	0.24 (0.20–0.28)	3.6 (3.0–4.2)	0.087 (0.044–0.13)	1.3 (0.66–2.0)
Peru	31	37 (29–47)	119 (92–150)	2.3 (1.7–2.9)	7.2 (5.5–9.1)	3.2 (2.7–3.8)	10 (8.6–12)
Philippines	101	324 (279–373)	322 (277–370)	4.3 (3.3–5.4)	4.3 (3.3–5.4)	17 (14–20)	17 (14–20)
Poland	39	7.2 (6.2–8.3)	19 (16–21)	0.14 (0.11–0.18)	0.37 (0.28–0.46)	0.07 (0.049–0.091)	0.18 (0.13–0.24)
Portugal	10	2.4 (2.1–2.8)	23 (20–27)	0.35 (0.29–0.41)	3.4 (2.8–3.9)	0.033 (0.019–0.047)	0.32 (0.18–0.45)
Puerto Rico	4	0.06 (<0.1–<0.1)	1.6 (1.4–1.9)	0.01 (<0.1–<0.1)	0.28 (0.24–0.32)	0 (0–0)	0 (0–0)
Qatar	2	0.76 (0.65–0.87)	34 (29–39)	0 (0–0)	<0.1 (<0.1–<0.1)	0.01 (0–0.024)	0.45 (0–1.1)
Republic of Korea	50	40 (37–43)	80 (74–85)	0.48 (0.38–0.58)	0.95 (0.76–1.2)	2.9 (2.4–3.4)	5.8 (4.8–6.8)
Republic of Moldova	4	6.2 (4.0–8.8)	152 (98–217)	0.55 (0.35–0.79)	13 (8.5–19)	3.9 (2.9–4.8)	96 (71–118)
Romania	20	16 (14–19)	84 (72–97)	0.42 (0.35–0.50)	2.2 (1.8–2.5)	0.94 (0.73–1.1)	4.8 (3.7–5.6)
Russian Federation	143	115 (98–132)	80 (69–92)	11 (9.3–13)	7.9 (6.5–9.4)	60 (49–71)	42 (34–49)
Rwanda	12	6.6 (5.6–7.6)	56 (48–65)	1.8 (1.1–2.5)	15 (9.8–22)	0.16 (0.10–0.21)	1.4 (0.86–1.8)
Saint Kitts and Nevis	< 1	0 (0–0)	5.1 (4.4–5.9)	0 (0–0)	0.7 (0.54–0.87)	<0.01 (<0.01–<0.01)	0.31 (0.16–0.45)
Saint Lucia	< 1	0.02 (<0.1–<0.1)	8.8 (7.6–10)	0 (0–0)	1.4 (0.89–2.0)	0 (0–0)	0 (0–0)
Saint Vincent and the Grenadines	< 1	0.01 (<0.1–<0.1)	7.4 (6.3–8.5)	0 (0–0)	1.1 (0.90–1.2)	<0.01 (<0.01–<0.01)	0.22 (0.10–0.34)
Samoa	< 1	0.02 (<0.1–<0.1)	11 (9.7–13)			0 (0–0)	0 (0–0)
San Marino	< 1	0 (0–0)	2.5 (2.1–2.8)			0 (0–0)	0 (0–0)
Sao Tome and Principe	< 1	0.18 (0.18–0.19)	97 (94–100)	0.03 (<0.1–<0.1)	15 (9.7–21)	0.036 (0.026–0.046)	19 (14–24)
Saudi Arabia	32	3.8 (3.3–4.4)	12 (10–14)	0.14 (0.11–0.16)	0.43 (0.36–0.51)	0.15 (0.12–0.18)	0.48 (0.38–0.57)
Senegal	15	21 (14–30)	139 (90–198)	1.4 (0.92–2.1)	9.5 (6.1–14)	0.41 (0.25–0.57)	2.7 (1.7–3.8)
Serbia	9	1.9 (1.6–2.1)	21 (19–24)	0.03 (<0.1–<0.1)	0.33 (0.26–0.41)	0.028 (0.013–0.043)	0.32 (0.15–0.49)
Seychelles	< 1	0.01 (<0.1–<0.1)	9.5 (8.2–11)	0 (0–0)	<0.1 (<0.1–<0.1)	0 (0–0)	0 (0–0)
Sierra Leone	6	20 (13–28)	307 (198–438)	2.6 (1.7–3.8)	41 (26–59)	0.7 (0–1.5)	11 (0–23)
Singapore	6	2.5 (2.1–2.9)	44 (38–51)	0.05 (<0.1–<0.1)	0.81 (0.69–0.94)	0.034 (0.018–0.050)	0.61 (0.32–0.89)
Sint Maarten (Dutch part)	< 1	0 (0–0)	5.9 (5.1–6.8)			<0.01 (<0.01–<0.01)	0.14 (<0.1–0.19)
Slovakia	5	0.35 (0.30–0.41)	6.5 (5.6–7.5)	0 (0–0)	<0.1 (0–<0.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Slovenia	2	0.15 (0.13–0.17)	7.2 (6.2–8.3)	0 (0–0)	<0.1 (0–<0.1)	0 (0–0)	0 (0–0)
Solomon Islands	< 1	0.52 (0.40–0.65)	89 (69–112)			0.032 (0.019–0.045)	5.5 (3.3–7.7)
Somalia	11	30 (19–42)	274 (177–391)	0.53 (0.33–0.77)	4.9 (3.1–7.1)	3.1 (1.8–4.4)	29 (17–41)
South Africa	54	454 (294–649)	834 (539–1 190	258 (165–370)	473 (303–680)	20 (13–27)	37 (24–50)
South Sudan	12	18 (12–26)	146 (95–209)	2.1 (1.3–3.0)	17 (11–24)	0.76 (0.37–1.2)	6.2 (3.0–9.7)
Spain	46	5.5 (4.7–6.4)	12 (10–14)	0.4 (0.34–0.48)	0.87 (0.73–1.0)	0.042 (0.016–0.069)	<0.1 (<0.1–0.15)
Sri Lanka	21	13 (9.7–18)	65 (47–86)	0.04 (<0.1–<0.1)	0.21 (0.13–0.30)	0.089 (0–0.19)	0.43 (0–0.92)
Sudan	40	35 (21–53)	88 (52–133)	1.6 (0.84–2.6)	4 (2.1–6.5)	1.6 (0.089–3.0)	4 (0.22–7.5)
Suriname	< 1	0.18 (0.14–0.23)	33 (26–42)	0.05 (<0.1–<0.1)	10 (7.8–13)	0.024 (0.011–0.037)	4.4 (2.0–6.8)
Swaziland	1	7.3 (4.7–10)	565 (366–807)	5.2 (3.4–7.5)	408 (261–586)	0.89 (0.46–1.3)	69 (36–101)
Sweden	10	0.9 (0.77–1.0)	9.2 (7.9–11)	0.03 (<0.1–<0.1)	0.27 (0.21–0.34)	0.045 (0.026–0.064)	0.46 (0.27–0.65)
Switzerland	8	0.61 (0.52–0.70)	7.4 (6.3–8.5)	0.03 (<0.1–<0.1)	0.39 (0.30–0.50)	0.029 (0.013–0.045)	0.35 (0.16–0.54)
Syrian Arab Republic	19	3.6 (2.8–4.6)	20 (15–25)			0.34 (0.21–0.47)	1.8 (1.1–2.5)
Tajikistan	8	7.4 (5.7–9.3)	87 (67–109)	0.2 (0.15–0.25)	2.4 (1.8–3.0)	1.9 (1.5–2.2)	22 (18–26)
Thailand	68	117 (69–176)	172 (102–259)	15 (8.0–25)	22 (12–37)	4.5 (2.9–6.2)	6.6 (4.3–9.1)
The Former Yugoslav Republic of Macedonia	2	0.27 (0.26–0.28)	13 (12–14)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–0.016)	0.44 (0.12–0.77)
Timor-Leste	1	5.9 (3.8–8.4)	498 (322–712)	0.09 (<0.1–0.13)	7.3 (4.5–11)	0.22 (0.15–0.29)	19 (13–24)
Togo	7	3.8 (2.7–5.1)	52 (37–69)	0.82 (0.53–1.2)	11 (7.2–16)	0.13 (0–0.28)	1.8 (0–3.8)
Tokelau	< 1	0	0			0 (0–0)	0 (0–0)
Tonga	< 1	0.02 (<0.1–<0.1)	15 (13–17)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	0.79 (0.44–1.1)
Trinidad and Tobago	1	0.23 (0.19–0.26)	17 (14–19)	0.04 (<0.1–<0.1)	2.9 (2.4–3.3)	0.01 (<0.01–0.012)	0.74 (0.59–0.88)
Tunisia	11	4.2 (3.2–5.3)	37 (29–47)	0.03 (<0.1–<0.1)	0.26 (0.18–0.34)	0.025 (<0.01–0.043)	0.22 (<0.1–0.38)
Turkey	79	14 (12–17)	18 (16–21)	0.1 (<0.1–0.11)	0.12 (0.10–0.15)	0.71 (0.60–0.83)	0.9 (0.76–1.1)
Turkmenistan	5	3.8 (2.9–4.8)	70 (54–88)			0.85 (0.67–1.0)	16 (12–19)

[a] Rates are per 100 000 population.

:: TABLE A4.1

TB incidence estimates, 2015

	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 (0–0)	6.7 (5.7–7.7)	0 (0–0)	6.7 (5.5–8.0)	<0.01 (<0.01–<0.01)	0.15 (<0.1–0.21)
Tuvalu	< 1	0.02 (<0.1–<0.1)	232 (199–267)	0 (0–0)	0.23 (0.18–0.29)	<0.01 (<0.01–<0.01)	12 (6.9–17)
Uganda	39	79 (47–119)	202 (120–304)	26 (16–37)	66 (42–94)	1.9 (1.0–2.8)	4.9 (2.6–7.2)
Ukraine	45	41 (26–58)	91 (59–130)	9 (5.7–13)	20 (13–29)	22 (17–27)	49 (38–60)
United Arab Emirates	9	0.14 (<0.1–0.21)	1.6 (1.0–2.2)	0.01 (0–<0.1)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
United Kingdom of Great Britain and Northern Ireland	65	6.6 (6.0–7.2)	10 (9.2–11)	0.31 (0.25–0.38)	0.48 (0.38–0.59)	0.11 (0.072–0.15)	0.17 (0.11–0.23)
United Republic of Tanzania	53	164 (78–281)	306 (146–525)	57 (27–100)	107 (50–186)	2.6 (0.56–4.7)	4.9 (1.0–8.8)
United States of America	322	10 (8.9–12)	3.2 (2.8–3.7)	0.58 (0.49–0.67)	0.18 (0.15–0.21)	0.18 (0.14–0.23)	<0.1 (<0.1–<0.1)
Uruguay	3	1 (0.89–1.2)	30 (26–35)	0.16 (0.14–0.19)	4.7 (4.0–5.5)	<0.01 (<0.01–0.014)	0.21 (<0.1–0.41)
US Virgin Islands	< 1	0.01 (<0.1–<0.1)	7.7 (6.8–8.7)			0 (0–0)	0 (0–0)
Uzbekistan	30	24 (17–31)	79 (57–105)	1.2 (0.74–1.7)	3.9 (2.5–5.7)	10 (7.6–12)	33 (25–40)
Vanuatu	< 1	0.17 (0.14–0.20)	63 (52–74)			0 (0–0)	0 (0–0)
Venezuela (Bolivarian Republic of)	31	8.9 (6.9–11)	29 (22–36)	0.96 (0.73–1.2)	3.1 (2.3–3.9)	0.34 (0.19–0.49)	1.1 (0.61–1.6)
Viet Nam	93	128 (103–155)	137 (110–166)	5.5 (3.5–7.9)	5.9 (3.8–8.4)	7.3 (5.2–9.5)	7.8 (5.6–10)
Wallis and Futuna Islands	< 1	0	0			0 (0–0)	0 (0–0)
West Bank and Gaza Strip	5	0.05 (<0.1–<0.1)	1.1 (0.85–1.4)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Yemen	27	13 (11–15)	48 (42–54)	0.15 (0.11–0.18)	0.55 (0.42–0.68)	0.34 (0.16–0.52)	1.3 (0.60–1.9)
Zambia	16	63 (41–91)	391 (253–558)	38 (24–55)	235 (149–339)	2.3 (1.4–3.2)	14 (8.6–20)
Zimbabwe	16	38 (28–49)	242 (179–314)	26 (17–37)	167 (107–240)	1.8 (1.0–2.5)	12 (6.4–16)
WHO regions							
African Region	989	2 720 (2 360–3 110)	275 (239–314)	834 (710–969)	84 (72–98)	110 (88–120)	11 (8.9–13)
Region of the Americas	991	268 (250–287)	27 (25–29)	32 (29–35)	3.2 (2.9–3.5)	11 (10–12)	1.1 (1.0–1.2)
Eastern Mediterranean Region	648	749 (561–965)	116 (86–149)	13 (9.5–17)	2 (1.5–2.7)	39 (30–50)	6 (4.6–7.7)
European Region	910	323 (299–349)	36 (33–38)	27 (23–31)	3 (2.5–3.4)	120 (110–140)	14 (12–15)
South-East Asia Region	1 928	4 740 (3 230–6 540)	246 (167–339)	227 (159–307)	12 (8.2–16)	200 (150–250)	10 (7.9–13)
Western Pacific Region	1 856	1 590 (1 440–1 740)	86 (78–94)	34 (29–40)	1.8 (1.6–2.1)	100 (88–120)	5.5 (4.8–6.4)
Global	7 323	10 400 (8 740–12 200)	142 (119–166)	1 170 (1 020–1 320)	16 (14–18)	580 (520–640)	7.9 (7.2–8.7)

[a] Rates are per 100 000 population.

:: TABLE A4.2

Estimates of TB mortality, 2015. 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	33	12 (7.1–18)	37 (22–55)	0.17 (0.14–0.21)	0.53 (0.44–0.63)	12 (7.3–18)	37 (22–56)
Albania	3	0.01 (<0.01–0.015)	0.35 (0.22–0.51)	<0.01 (<0.01–<0.01)	<0.1 (0–0.17)	0.012 (<0.01–0.017)	0.4 (0.25–0.59)
Algeria	40	3.2 (2.1–4.6)	8.2 (5.3–12)	0.035 (<0.01–0.13)	<0.1 (0–0.32)	3.3 (2.1–4.6)	8.2 (5.4–12)
American Samoa	< 1	<0.01 (<0.01–<0.01)	0.68 (0.42–1.0)	0 (0–0)	0 (0–<0.1)	<0.01 (<0.01–<0.01)	0.68 (0.42–1.0)
Andorra	< 1	<0.01 (<0.01–<0.01)	0.54 (0.33–0.79)	0	0	<0.01 (<0.01–<0.01)	0.54 (0.33–0.79)
Angola	25	11 (6.6–17)	45 (27–67)	7.2 (1.6–17)	29 (6.5–67)	18 (10–29)	73 (41–115)
Anguilla	< 1	0	0	0	0	0	0
Antigua and Barbuda	< 1	<0.01 (<0.01–<0.01)	1.3 (1.1–1.5)	<0.01 (0–<0.01)	0.28 (0–1.4)	<0.01 (<0.01–<0.01)	1.6 (0.90–2.5)
Argentina	43	0.7 (0.670–0.730)	1.6 (1.5–1.7)	0.1 (<0.01–0.52)	0.24 (0–1.2)	0.81 (0.540–1.1)	1.9 (1.3–2.6)
Armenia	3	0.092 (0.077–0.110)	3 (2.6–3.6)	0.014 (<0.01–0.074)	0.46 (0–2.4)	0.11 (0.067–0.150)	3.5 (2.2–5.1)
Aruba	< 1	<0.01 (<0.01–<0.01)	1 (0.63–1.5)	0	0	<0.01 (<0.01–<0.01)	1 (0.63–1.5)
Australia	24	0.044 (0.044–0.044)	0.18 (0.18–0.19)	<0.01 (0–0.019)	<0.1 (0–<0.1)	0.048 (0.038–0.059)	0.2 (0.16–0.25)
Austria	9	0.078 (0.077–0.079)	0.91 (0.90–0.92)	<0.01 (0–0.010)	<0.1 (0–0.12)	0.08 (0.074–0.086)	0.94 (0.87–1.0)
Azerbaijan	10	0.038 (0.035–0.042)	0.39 (0.36–0.43)	0.02 (<0.01–0.055)	0.21 (<0.1–0.56)	0.058 (0.034–0.089)	0.6 (0.35–0.91)
Bahamas	< 1	<0.01 (<0.01–<0.01)	0.49 (0.49–0.49)	<0.01 (<0.01–<0.01)	0.93 (0.32–1.9)	<0.01 (<0.01–<0.01)	1.4 (0.75–2.3)
Bahrain	1	<0.01 (<0.01–<0.01)	0.44 (0.38–0.50)	<0.01 (0–<0.01)	0.11 (0–0.56)	<0.01 (<0.01–0.012)	0.55 (0.28–0.90)
Bangladesh	161	73 (43–110)	45 (27–68)	0.23 (0.19–0.29)	0.14 (0.12–0.18)	73 (44–110)	45 (27–68)
Barbados	< 1	<0.01 (<0.01–<0.01)	0.33 (0.33–0.34)	0	0	<0.01 (<0.01–<0.01)	0.33 (0.33–0.34)
Belarus	9	0.45 (0.420–0.490)	4.8 (4.5–5.1)	0.072 (0.021–0.15)	0.76 (0.22–1.6)	0.53 (0.460–0.600)	5.5 (4.8–6.3)
Belgium	11	0.054 (0.052–0.055)	0.47 (0.46–0.49)	0.011 (<0.01–0.055)	0.1 (0–0.49)	0.065 (0.038–0.098)	0.57 (0.34–0.87)
Belize	< 1	<0.01 (<0.01–<0.01)	2.4 (2.4–2.4)	<0.01 (<0.01–0.010)	0.85 (<0.1–2.9)	0.012 (<0.01–0.018)	3.3 (1.9–4.9)
Benin	11	1 (0.620–1.6)	9.5 (5.7–14)	0.29 (0.11–0.56)	2.7 (1.0–5.2)	1.3 (0.860–1.9)	12 (7.9–17)
Bermuda	< 1	0	0	0	0	0	0
Bhutan	< 1	0.12 (0.079–0.170)	16 (10–22)	0.024 (0.018–0.030)	3.1 (2.4–3.9)	0.14 (0.100–0.200)	19 (13–25)
Bolivia (Plurinational State of)	11	0.34 (0.220–0.500)	3.2 (2.0–4.6)	0.17 (0.10–0.26)	1.6 (0.93–2.4)	0.51 (0.370–0.690)	4.8 (3.4–6.4)
Bonaire, Saint Eustatius and Saba	< 1	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.13)	0	0	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.13)
Bosnia and Herzegovina	4	0.12 (0.100–0.130)	3 (2.7–3.4)	<0.01 (<0.01–<0.01)	<0.1 (0–<0.1)	0.12 (0.100–0.130)	3.1 (2.7–3.4)
Botswana	2	0.59 (0.350–0.900)	26 (15–40)	1.4 (0.67–2.5)	63 (30–110)	2 (1.2–3.1)	90 (53–136)
Brazil	208	5.5 (5.2–5.9)	2.7 (2.5–2.8)	2.2 (1.2–3.6)	1.1 (0.56–1.7)	7.7 (6.5–9.0)	3.7 (3.1–4.4)
British Virgin Islands	< 1	0	0	0	0	0	0
Brunei Darussalam	< 1	0.023 (0.021–0.025)	5.3 (4.9–5.8)	0	0	0.023 (0.021–0.025)	5.3 (4.9–5.8)
Bulgaria	7	0.09 (0.088–0.092)	1.3 (1.2–1.3)	<0.01 (0–<0.01)	0 (0–<0.1)	0.09 (0.088–0.093)	1.3 (1.2–1.3)
Burkina Faso	18	1.6 (0.970–2.4)	9 (5.4–14)	0.27 (0.12–0.48)	1.5 (0.67–2.7)	1.9 (1.2–2.7)	11 (6.7–15)
Burundi	11	2.7 (1.6–4.0)	24 (14–36)	0.66 (0.32–1.1)	5.9 (2.9–10)	3.3 (2.2–4.8)	30 (19–43)
Cabo Verde	< 1	0.027 (0.026–0.029)	5.3 (4.9–5.6)	0.037 (0.024–0.051)	7 (4.7–9.9)	0.064 (0.051–0.079)	12 (9.8–15)
Cambodia	16	8.6 (6.1–12)	55 (39–74)	0.44 (0.19–0.79)	2.8 (1.2–5.0)	9.1 (6.5–12)	58 (42–77)
Cameroon	23	6.9 (4.1–10)	30 (18–45)	6.2 (3.4–9.7)	27 (15–42)	13 (9.0–18)	56 (39–77)
Canada	36	0.11 (0.100–0.110)	0.29 (0.29–0.30)	0.019 (<0.01–0.096)	<0.1 (0–0.27)	0.12 (0.078–0.180)	0.35 (0.22–0.51)
Cayman Islands	< 1	0	0	0	0	0	0
Central African Republic	5	2.2 (1.3–3.4)	45 (26–70)	2.7 (1.0–5.3)	55 (20–107)	4.9 (2.8–7.6)	101 (58–156)
Chad	14	3.2 (1.9–4.8)	23 (13–35)	2.5 (2.0–3.0)	18 (14–21)	5.7 (4.2–7.3)	40 (30–52)
Chile	18	0.47 (0.460–0.470)	2.6 (2.6–2.6)	0.02 (<0.01–0.097)	0.11 (0–0.54)	0.49 (0.430–0.540)	2.7 (2.4–3.0)
China	1 376	35 (34–37)	2.6 (2.5–2.7)	2.6 (1.2–4.5)	0.19 (<0.1–0.33)	38 (36–40)	2.8 (2.6–2.9)
China, Hong Kong SAR	7	0.18 (0.180–0.180)	2.5 (2.4–2.5)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.11)	0.19 (0.180–0.190)	2.6 (2.5–2.6)
China, Macao SAR	< 1	0.035 (0.022–0.051)	5.9 (3.7–8.7)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.15)	0.035 (0.022–0.051)	6 (3.7–8.7)
Colombia	48	1 (0.990–1.0)	2.1 (2.1–2.1)	0.42 (0.13–0.88)	0.87 (0.26–1.8)	1.4 (1.1–1.8)	3 (2.2–3.8)
Comoros	< 1	0.061 (0.036–0.092)	7.8 (4.6–12)	<0.01 (<0.01–<0.01)	0.38 (0.16–0.68)	0.064 (0.039–0.095)	8.1 (4.9–12)
Congo	5	2.3 (1.3–3.5)	49 (29–75)	2.4 (2.0–2.9)	53 (44–63)	4.7 (3.6–5.9)	102 (79–129)
Cook Islands	< 1	<0.01 (<0.01–<0.01)	1.4 (0.86–2.1)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	1.4 (0.86–2.1)
Costa Rica	5	0.049 (0.046–0.052)	1 (0.96–1.1)	<0.01 (<0.01–0.025)	0.15 (<0.1–0.52)	0.056 (0.044–0.071)	1.2 (0.91–1.5)
Côte d'Ivoire	23	5 (3.0–7.5)	22 (13–33)	2.5 (1.1–4.4)	11 (4.9–20)	7.5 (4.9–11)	33 (22–46)
Croatia	4	0.033 (0.033–0.033)	0.78 (0.78–0.78)	<0.01 (0–<0.01)	<0.1 (0–0.10)	0.034 (0.032–0.036)	0.8 (0.75–0.86)
Cuba	11	0.047 (0.046–0.048)	0.41 (0.41–0.42)	0.01 (<0.01–0.045)	<0.1 (0–0.39)	0.057 (0.035–0.084)	0.5 (0.31–0.74)
Curaçao	< 1	<0.01 (<0.01–<0.01)	0.15 (<0.1–0.22)	<0.01 (0–<0.01)	0.25 (0–1.2)	<0.01 (<0.01–<0.01)	0.4 (<0.1–1.3)
Cyprus	1	<0.01 (<0.01–<0.01)	0.1 (<0.1–0.11)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	<0.01 (<0.01–<0.01)	0.11 (<0.1–0.16)
Czechia	11	0.039 (0.039–0.039)	0.37 (0.37–0.37)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.04 (0.038–0.042)	0.38 (0.36–0.40)
Democratic People's Republic of Korea	25	15 (10–22)	61 (40–87)	0.037 (0.016–0.065)	0.15 (<0.1–0.26)	16 (10–22)	62 (40–88)
Democratic Republic of the Congo	77	51 (30–77)	66 (39–99)	16 (13–20)	21 (17–26)	67 (45–93)	87 (59–120)
Denmark	6	0.02 (0.019–0.021)	0.35 (0.33–0.37)	<0.01 (0–<0.01)	<0.1 (0–0.12)	0.021 (0.018–0.025)	0.38 (0.31–0.45)
Djibouti	< 1	0.35 (0.230–0.490)	39 (26–56)	0.035 (<0.01–0.11)	4 (0.26–13)	0.38 (0.250–0.540)	43 (28–61)
Dominica	< 1	<0.01 (<0.01–<0.01)	4.7 (4.6–4.7)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	4.7 (4.6–4.7)
Dominican Republic	11	0.49 (0.270–0.770)	4.6 (2.6–7.3)	0.38 (0.12–0.78)	3.6 (1.1–7.4)	0.87 (0.500–1.3)	8.2 (4.8–13)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

:: TABLE A4.2

Estimates of TB mortality, 2015. 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	16	0.49 (0.410–0.590)	3.1 (2.5–3.6)	0.3 (0.13–0.54)	1.9 (0.83–3.3)	0.8 (0.590–1.0)	4.9 (3.6–6.4)
Egypt	92	0.22 (0.200–0.240)	0.24 (0.21–0.26)	0.018 (0.012–0.025)	<0.1 (<0.1–<0.1)	0.24 (0.210–0.260)	0.26 (0.23–0.28)
El Salvador	6	0.12 (0.085–0.150)	1.9 (1.4–2.5)	0.024 (<0.01–0.12)	0.39 (0–1.9)	0.14 (0.078–0.220)	2.3 (1.3–3.6)
Equatorial Guinea	< 1	0.063 (0.040–0.092)	7.5 (4.8–11)	0.12 (0.032–0.27)	14 (3.8–32)	0.18 (0.083–0.330)	22 (9.8–39)
Eritrea	5	0.6 (0.280–1.1)	12 (5.3–20)	0.053 (0.018–0.11)	1 (0.34–2.0)	0.66 (0.320–1.1)	13 (6.2–21)
Estonia	1	0.025 (0.025–0.025)	1.9 (1.9–1.9)	<0.01 (<0.01–0.015)	0.25 (0–1.2)	0.028 (0.021–0.037)	2.2 (1.6–2.8)
Ethiopia	99	25 (15–38)	26 (15–38)	3.9 (1.6–7.3)	4 (1.6–7.4)	29 (19–42)	30 (19–43)
Fiji	< 1	0.064 (0.063–0.065)	7.1 (7.0–7.3)	<0.01 (<0.01–<0.01)	0.17 (<0.1–0.54)	0.065 (0.062–0.068)	7.3 (7.0–7.6)
Finland	6	0.037 (0.037–0.037)	0.68 (0.67–0.68)	<0.01 (<0.01–<0.01)	<0.1 (0–<0.1)	0.038 (0.036–0.040)	0.69 (0.66–0.72)
France	64	0.52 (0.490–0.550)	0.8 (0.76–0.85)	0.056 (<0.01–0.27)	<0.1 (0–0.41)	0.57 (0.430–0.730)	0.89 (0.67–1.1)
French Polynesia	< 1	<0.01 (<0.01–<0.01)	1.5 (0.96–2.3)	0	0	<0.01 (<0.01–<0.01)	1.5 (0.96–2.3)
Gabon	2	1.1 (0.680–1.7)	65 (39–97)	0.054 (<0.01–0.15)	3.2 (0.38–8.8)	1.2 (0.720–1.7)	68 (42–101)
Gambia	2	0.4 (0.240–0.590)	20 (12–30)	0.15 (0.080–0.24)	7.5 (4.0–12)	0.54 (0.370–0.760)	27 (18–38)
Georgia	4	0.16 (0.130–0.190)	3.9 (3.1–4.8)	0.055 (0.031–0.085)	1.4 (0.78–2.1)	0.21 (0.170–0.260)	5.3 (4.3–6.4)
Germany	81	0.32 (0.310–0.320)	0.39 (0.39–0.40)	0.026 (<0.01–0.13)	<0.1 (0–0.16)	0.34 (0.280–0.420)	0.43 (0.34–0.52)
Ghana	27	10 (4.6–18)	37 (17–65)	5.1 (4.2–6.1)	19 (15–22)	15 (9.2–23)	56 (34–83)
Greece	11	0.092 (0.086–0.098)	0.84 (0.79–0.89)	<0.01 (0–0.013)	<0.1 (0–0.12)	0.094 (0.086–0.100)	0.86 (0.78–0.95)
Greenland	< 1	<0.01 (<0.01–0.011)	13 (8.4–20)	0	0	<0.01 (<0.01–0.011)	13 (8.4–20)
Grenada	< 1	<0.01 (<0.01–<0.01)	0.97 (0.96–0.98)	<0.01 (0–<0.01)	0.29 (0–1.4)	<0.01 (<0.01–<0.01)	1.3 (0.60–2.1)
Guam	< 1	<0.01 (<0.01–0.011)	4.2 (2.6–6.2)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–0.011)	4.2 (2.6–6.2)
Guatemala	16	0.32 (0.300–0.350)	2 (1.8–2.2)	0.05 (<0.01–0.14)	0.31 (<0.1–0.85)	0.37 (0.300–0.450)	2.3 (1.9–2.8)
Guinea	13	3.6 (2.1–5.4)	28 (17–43)	1.9 (1.3–2.8)	15 (10–22)	5.5 (3.8–7.4)	44 (30–59)
Guinea-Bissau	2	1.6 (0.910–2.4)	85 (49–129)	0.95 (0.79–1.1)	51 (43–61)	2.5 (1.8–3.3)	136 (98–180)
Guyana	< 1	0.11 (0.093–0.120)	14 (12–15)	0.033 (<0.01–0.074)	4.4 (1.2–9.6)	0.14 (0.110–0.180)	18 (14–23)
Haiti	11	2 (1.2–3.0)	18 (11–28)	0.66 (0.12–1.7)	6.2 (1.1–15)	2.6 (1.6–4.0)	25 (15–37)
Honduras	8	0.085 (0.085–0.086)	1.1 (1.0–1.1)	0.067 (0.027–0.13)	0.83 (0.33–1.6)	0.15 (0.110–0.210)	1.9 (1.3–2.6)
Hungary	10	0.076 (0.076–0.076)	0.77 (0.77–0.77)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.078 (0.074–0.082)	0.79 (0.75–0.83)
Iceland	< 1	<0.01 (<0.01–<0.01)	2.1 (2.1–2.1)	0 (0–<0.01)	0 (0–0)	<0.01 (<0.01–<0.01)	2.1 (2.1–2.1)
India	1 311	480 (380–590)	36 (29–45)	37 (21–57)	2.8 (1.6–4.3)	510 (410–630)	39 (32–48)
Indonesia	258	100 (67–150)	40 (26–57)	26 (20–34)	10 (7.6–13)	130 (92–170)	50 (36–67)
Iran (Islamic Republic of)	79	1.4 (0.890–1.9)	1.7 (1.1–2.5)	0.071 (0.029–0.13)	<0.1 (<0.1–0.16)	1.4 (0.960–2.0)	1.8 (1.2–2.5)
Iraq	36	0.86 (0.018–3.3)	2.4 (<0.1–8.9)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.86 (0.019–3.3)	2.4 (<0.1–8.9)
Ireland	5	0.017 (0.017–0.017)	0.36 (0.36–0.36)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.019 (0.018–0.020)	0.41 (0.39–0.44)
Israel	8	0.016 (0.015–0.016)	0.19 (0.19–0.20)	<0.01 (0–0.012)	<0.1 (0–0.15)	0.018 (0.012–0.026)	0.22 (0.15–0.32)
Italy	60	0.33 (0.320–0.330)	0.55 (0.54–0.55)	0.028 (<0.01–0.14)	<0.1 (0–0.23)	0.35 (0.280–0.430)	0.59 (0.47–0.73)
Jamaica	3	<0.01 (<0.01–<0.01)	0.24 (0.24–0.24)	<0.01 (<0.01–0.014)	0.21 (<0.1–0.49)	0.013 (<0.01–0.020)	0.45 (0.25–0.71)
Japan	127	3.2 (3.0–3.3)	2.5 (2.4–2.6)	0.012 (<0.01–0.059)	<0.1 (0–<0.1)	3.2 (3.0–3.3)	2.5 (2.4–2.6)
Jordan	8	0.027 (0.026–0.027)	0.35 (0.35–0.36)	<0.01 (<0.01–<0.01)	0 (0–0)	0.027 (0.026–0.027)	0.35 (0.35–0.36)
Kazakhstan	18	1.4 (1.1–1.7)	7.8 (6.3–9.5)	0.069 (<0.01–0.22)	0.39 (<0.1–1.2)	1.4 (1.2–1.8)	8.2 (6.6–10)
Kenya	46	9 (6.1–12)	20 (13–27)	7.2 (0.71–21)	16 (1.5–45)	16 (7.1–29)	35 (15–63)
Kiribati	< 1	0.03 (0.021–0.040)	27 (19–36)	<0.01 (<0.01–<0.01)	0.47 (0.18–0.90)	0.03 (0.022–0.041)	27 (19–36)
Kuwait	4	<0.01 (<0.01–<0.01)	0.14 (0.14–0.14)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	<0.01 (<0.01–<0.01)	0.15 (0.13–0.17)
Kyrgyzstan	6	0.68 (0.670–0.700)	12 (11–12)	0.044 (<0.01–0.14)	0.74 (<0.1–2.4)	0.73 (0.660–0.810)	12 (11–14)
Lao People's Democratic Republic	7	3.3 (2.0–5.1)	49 (29–75)	0.25 (0.14–0.39)	3.6 (2.0–5.7)	3.6 (2.2–5.3)	53 (32–78)
Latvia	2	0.063 (0.062–0.063)	3.2 (3.2–3.2)	0.027 (<0.01–0.14)	1.4 (0–6.9)	0.09 (0.032–0.180)	4.6 (1.6–9.1)
Lebanon	6	0.061 (0.038–0.090)	1 (0.65–1.5)	<0.01 (<0.01–<0.01)	<0.1 (0–<0.1)	0.063 (0.039–0.091)	1.1 (0.67–1.6)
Lesotho	2	1.2 (0.630–1.9)	55 (29–89)	4.8 (3.0–7.0)	223 (139–328)	5.9 (4.0–8.3)	279 (188–386)
Liberia	5	3.2 (1.9–4.8)	70 (41–107)	0.84 (0.70–1.0)	19 (16–22)	4 (2.7–5.6)	89 (59–125)
Libya	6	0.68 (0.400–1.0)	11 (6.3–16)	0.022 (0.012–0.035)	0.35 (0.19–0.56)	0.7 (0.420–1.1)	11 (6.7–17)
Lithuania	3	0.23 (0.230–0.230)	7.9 (7.8–8.0)	<0.01 (<0.01–0.039)	0.27 (0–1.3)	0.24 (0.210–0.260)	8.2 (7.4–8.9)
Luxembourg	< 1	<0.01 (<0.01–<0.01)	0.16 (0.16–0.16)	<0.01 (0–<0.01)	<0.1 (0–0.34)	<0.01 (<0.01–<0.01)	0.23 (<0.1–0.45)
Madagascar	24	12 (7.1–18)	49 (29–75)	1.5 (1.3–1.8)	6.3 (5.2–7.4)	13 (8.5–20)	56 (35–81)
Malawi	17	2.3 (1.3–3.6)	13 (7.7–21)	6.6 (3.5–11)	38 (20–62)	8.9 (5.5–13)	52 (32–76)
Malaysia	30	2.4 (1.4–3.8)	7.9 (4.5–12)	0.23 (0.059–0.52)	0.77 (0.19–1.7)	2.6 (1.6–4.0)	8.7 (5.1–13)
Maldives	< 1	0.02 (0.016–0.023)	5.4 (4.4–6.4)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.02 (0.016–0.023)	5.4 (4.4–6.4)
Mali	18	1.7 (0.990–2.5)	9.4 (5.6–14)	0.44 (0.28–0.64)	2.5 (1.6–3.7)	2.1 (1.4–2.9)	12 (7.9–17)
Malta	< 1	<0.01 (<0.01–<0.01)	0.24 (0.24–0.24)	<0.01 (<0.01–<0.01)	0.24 (<0.1–0.77)	<0.01 (<0.01–<0.01)	0.48 (0.17–0.95)
Marshall Islands	< 1	0.023 (0.016–0.032)	44 (30–60)	<0.01 (0–<0.01)	0.13 (<0.1–0.41)	0.023 (0.016–0.032)	44 (30–60)
Mauritania	4	0.84 (0.500–1.3)	21 (12–31)	0.14 (0.054–0.27)	3.5 (1.3–6.7)	0.98 (0.620–1.4)	24 (15–35)
Mauritius	1	0.019 (0.019–0.019)	1.5 (1.5–1.5)	0.013 (<0.01–0.021)	1 (0.55–1.6)	0.032 (0.026–0.039)	2.5 (2.0–3.1)
Mexico	127	2.6 (2.6–2.7)	2.1 (2.0–2.1)	0.51 (0.030–1.7)	0.4 (<0.1–1.3)	3.1 (2.3–4.1)	2.5 (1.8–3.2)
Micronesia (Federated States of)	< 1	0.014 (<0.01–0.020)	14 (8.9–19)	0	0	0.014 (<0.01–0.020)	14 (8.9–19)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

:: TABLE A4.2

Estimates of TB mortality, 2015. 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]
Monaco	< 1	0	0	0	0	0	0
Mongolia	3	0.64 (0.420–0.910)	22 (14–31)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.17)	0.64 (0.420–0.920)	22 (14–31)
Montenegro	< 1	<0.01 (<0.01–<0.01)	0.41 (0.38–0.44)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–0.10)	<0.01 (<0.01–<0.01)	0.46 (0.40–0.52)
Montserrat	< 1	<0.01 (<0.01–<0.01)	21 (20–22)	0	0	<0.01 (<0.01–<0.01)	21 (20–22)
Morocco	34	3.2 (0.043–13)	9.4 (0.13–37)	0.14 (0.044–0.30)	0.42 (0.13–0.88)	3.4 (0.062–13)	9.8 (0.18–38)
Mozambique	28	21 (12–32)	74 (43–115)	34 (21–50)	120 (73–178)	54 (38–74)	194 (136–263)
Myanmar	54	27 (16–40)	49 (30–74)	4.8 (3.5–6.5)	9 (6.4–12)	31 (21–45)	58 (38–83)
Namibia	2	0.78 (0.510–1.1)	32 (21–45)	0.88 (0.062–2.8)	36 (2.5–112)	1.7 (0.550–3.4)	68 (22–138)
Nauru	< 1	<0.01 (<0.01–<0.01)	9.2 (5.7–14)	0	0	<0.01 (<0.01–<0.01)	9.2 (5.7–14)
Nepal	29	5.6 (3.9–7.5)	20 (14–26)	0.5 (0.39–0.62)	1.7 (1.4–2.2)	6.1 (4.4–8.0)	21 (15–28)
Netherlands	17	0.034 (0.033–0.035)	0.2 (0.20–0.21)	<0.01 (<0.01–0.047)	<0.1 (0–0.28)	0.044 (0.022–0.073)	0.26 (0.13–0.43)
New Caledonia	< 1	<0.01 (<0.01–<0.01)	2 (1.3–2.9)	0	0	<0.01 (<0.01–<0.01)	2 (1.3–2.9)
New Zealand	5	0.01 (0.010–0.010)	0.22 (0.22–0.22)	<0.01 (0–<0.01)	0 (0–<0.1)	0.01 (<0.01–0.011)	0.23 (0.22–0.24)
Nicaragua	6	0.15 (0.120–0.190)	2.5 (1.9–3.1)	0.028 (<0.01–0.086)	0.46 (<0.1–1.4)	0.18 (0.130–0.240)	3 (2.1–4.0)
Niger	20	3.8 (2.3–5.7)	19 (11–29)	0.37 (0.25–0.51)	1.9 (1.2–2.6)	4.2 (2.6–6.1)	21 (13–31)
Nigeria	182	180 (96–290)	99 (53–160)	57 (43–74)	31 (24–40)	240 (150–350)	130 (82–190)
Niue	< 1	<0.01 (<0.01–<0.01)	3.5 (2.0–5.4)	0	0	<0.01 (<0.01–<0.01)	3.5 (2.0–5.4)
Northern Mariana Islands	< 1	<0.01 (<0.01–<0.01)	4.8 (3.0–7.0)	0 (0–<0.01)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	4.8 (3.0–7.0)
Norway	5	0.011 (0.011–0.011)	0.21 (0.20–0.22)	<0.01 (0–<0.01)	<0.1 (0–0.10)	0.012 (<0.01–0.015)	0.23 (0.18–0.29)
Oman	4	0.024 (0.015–0.034)	0.52 (0.33–0.76)	<0.01 (0–<0.01)	<0.1 (0–<0.1)	0.024 (0.015–0.035)	0.54 (0.34–0.77)
Pakistan	189	44 (9.3–110)	23 (4.9–56)	1.6 (1.1–2.1)	0.83 (0.60–1.1)	46 (10–110)	24 (5.5–57)
Palau	< 1	<0.01 (<0.01–<0.01)	6.2 (3.9–9.1)	0 (0–0)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	6.2 (3.9–9.1)
Panama	4	0.24 (0.220–0.250)	6.1 (5.6–6.5)	0.039 (<0.01–0.14)	1 (<0.1–3.5)	0.28 (0.210–0.360)	7 (5.3–9.1)
Papua New Guinea	8	3.1 (1.8–4.6)	40 (24–61)	0.67 (0.40–1.0)	8.8 (5.2–13)	3.7 (2.4–5.3)	49 (32–70)
Paraguay	7	0.26 (0.220–0.310)	4 (3.3–4.7)	0.035 (<0.01–0.11)	0.53 (<0.1–1.7)	0.3 (0.230–0.380)	4.5 (3.4–5.7)
Peru	31	2 (1.6–2.4)	6.2 (4.9–7.7)	0.49 (0.34–0.67)	1.6 (1.1–2.2)	2.5 (2.0–2.9)	7.8 (6.4–9.4)
Philippines	101	14 (8.8–19)	13 (8.7–19)	0.44 (0.24–0.70)	0.44 (0.24–0.70)	14 (9.2–20)	14 (9.1–20)
Poland	39	0.54 (0.520–0.570)	1.4 (1.4–1.5)	0.019 (<0.01–0.093)	<0.1 (0–0.24)	0.56 (0.510–0.620)	1.5 (1.3–1.6)
Portugal	10	0.21 (0.210–0.220)	2.1 (2.0–2.1)	0.046 (<0.01–0.23)	0.45 (0–2.2)	0.26 (0.150–0.400)	2.5 (1.4–3.9)
Puerto Rico	4	<0.01 (<0.01–0.010)	0.27 (0.27–0.27)	<0.01 (<0.01–<0.01)	<0.1 (0–0.13)	0.011 (<0.01–0.014)	0.31 (0.25–0.38)
Qatar	2	<0.01 (<0.01–0.011)	0.32 (0.19–0.49)	<0.01 (0–<0.01)	0 (0–<0.1)	<0.01 (<0.01–0.011)	0.32 (0.19–0.49)
Republic of Korea	50	2.6 (2.4–2.7)	5.1 (4.8–5.4)	0.046 (0–0.33)	<0.1 (0–0.65)	2.6 (2.4–2.9)	5.2 (4.7–5.7)
Republic of Moldova	4	0.31 (0.300–0.330)	7.7 (7.3–8.1)	0.18 (0.11–0.27)	4.5 (2.8–6.6)	0.49 (0.420–0.580)	12 (10–14)
Romania	20	1.1 (1.1–1.1)	5.5 (5.5–5.6)	0.063 (<0.01–0.20)	0.32 (<0.1–1.0)	1.1 (1.0–1.2)	5.8 (5.3–6.4)
Russian Federation	143	15 (15–16)	11 (10–11)	1.5 (<0.01–7.4)	1 (0–5.2)	17 (13–21)	12 (8.9–15)
Rwanda	12	0.44 (0.260–0.670)	3.8 (2.2–5.8)	0.28 (0.010–0.97)	2.4 (<0.1–8.3)	0.72 (0.280–1.4)	6.2 (2.4–12)
Saint Kitts and Nevis	< 1	<0.01 (<0.01–<0.01)	2.5 (2.1–2.9)	<0.01 (0–<0.01)	<0.1 (0–0.46)	<0.01 (<0.01–<0.01)	2.6 (2.2–3.1)
Saint Lucia	< 1	<0.01 (<0.01–<0.01)	0.74 (0.67–0.82)	<0.01 (<0.01–<0.01)	0.22 (<0.1–0.50)	<0.01 (<0.01–<0.01)	0.97 (0.74–1.2)
Saint Vincent and the Grenadines	< 1	<0.01 (<0.01–<0.01)	1.5 (1.5–1.5)	<0.01 (0–<0.01)	0.14 (0–0.69)	<0.01 (<0.01–<0.01)	1.6 (1.3–2.0)
Samoa	< 1	<0.01 (<0.01–<0.01)	0.93 (0.58–1.4)	0	0	<0.01 (<0.01–<0.01)	0.93 (0.58–1.4)
San Marino	< 1	0	0	0	0	0	0
Sao Tome and Principe	< 1	<0.01 (<0.01–0.013)	3.6 (1.4–6.9)	<0.01 (0–0.015)	1.3 (0–8.0)	<0.01 (<0.01–0.022)	5 (1.1–12)
Saudi Arabia	32	0.66 (0.210–1.4)	2.1 (0.66–4.3)	0.018 (<0.01–0.090)	<0.1 (0–0.28)	0.68 (0.220–1.4)	2.2 (0.71–4.4)
Senegal	15	3.4 (2.1–5.2)	23 (14–34)	0.41 (0.16–0.77)	2.7 (1.0–5.1)	3.8 (2.4–5.6)	25 (16–37)
Serbia	9	0.11 (0.099–0.120)	1.2 (1.1–1.3)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.11 (0.100–0.120)	1.3 (1.2–1.4)
Seychelles	< 1	0	0	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Sierra Leone	6	3.3 (1.9–4.9)	51 (30–76)	0.82 (0.40–1.4)	13 (6.2–21)	4.1 (2.7–5.8)	63 (41–90)
Singapore	6	0.07 (0.058–0.083)	1.2 (1.0–1.5)	<0.01 (<0.01–0.030)	0.11 (0–0.53)	0.076 (0.057–0.098)	1.4 (1.0–1.7)
Sint Maarten (Dutch part)	< 1	<0.01 (<0.01–<0.01)	0.49 (0.30–0.72)	0	0	<0.01 (<0.01–<0.01)	0.49 (0.30–0.72)
Slovakia	5	0.032 (0.031–0.032)	0.59 (0.58–0.59)	<0.01 (<0.01–<0.01)	0 (0–0)	0.032 (0.032–0.032)	0.59 (0.58–0.59)
Slovenia	2	0.016 (0.015–0.016)	0.75 (0.75–0.76)	<0.01 (<0.01–<0.01)	0 (0–0)	0.016 (0.015–0.016)	0.75 (0.75–0.76)
Solomon Islands	< 1	0.057 (0.037–0.081)	9.8 (6.4–14)	0	0	0.057 (0.037–0.081)	9.8 (6.4–14)
Somalia	11	7 (4.1–11)	65 (38–98)	0.21 (0.15–0.28)	2 (1.4–2.6)	7.2 (4.3–11)	67 (40–100)
South Africa	54	25 (21–29)	46 (39–53)	73 (27–140)	133 (50–256)	97 (49–160)	179 (90–297)
South Sudan	12	3.4 (2.0–5.2)	28 (17–42)	0.76 (0.50–1.1)	6.1 (4.1–8.6)	4.2 (2.7–5.9)	34 (22–48)
Spain	46	0.26 (0.260–0.270)	0.57 (0.57–0.58)	0.054 (<0.01–0.27)	0.12 (0–0.58)	0.32 (0.190–0.480)	0.69 (0.41–1.0)
Sri Lanka	21	1.2 (0.930–1.4)	5.6 (4.5–6.9)	0.011 (<0.01–0.020)	<0.1 (<0.1–<0.1)	1.2 (0.940–1.4)	5.7 (4.5–7.0)
Sudan	40	7.3 (3.8–12)	18 (9.5–30)	0.64 (0.52–0.76)	1.6 (1.3–1.9)	8 (4.4–13)	20 (11–31)
Suriname	< 1	0.014 (0.014–0.015)	2.6 (2.5–2.8)	0.011 (<0.01–0.024)	2 (0.54–4.4)	0.025 (0.016–0.037)	4.6 (2.9–6.8)
Swaziland	1	0.4 (0.230–0.610)	31 (18–48)	1.5 (0.52–3.1)	120 (41–242)	1.9 (0.850–3.5)	151 (66–271)
Sweden	10	0.027 (0.027–0.028)	0.28 (0.28–0.28)	<0.01 (0–0.017)	<0.1 (0–0.18)	0.031 (0.022–0.041)	0.32 (0.23–0.42)
Switzerland	8	0.016 (0.016–0.017)	0.2 (0.19–0.20)	<0.01 (<0.01–0.022)	<0.1 (0–0.26)	0.021 (0.011–0.034)	0.25 (0.13–0.41)

[a] Rates are per 100 000 population.
[b] All calculations are made before numbers are rounded.

:: TABLE A4.2

Estimates of TB mortality, 2015. 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]
Syrian Arab Republic	19	0.021 (0.019–0.022)	0.11 (0.10–0.12)	0	0	0.021 (0.019–0.022)	0.11 (0.10–0.12)
Tajikistan	8	0.22 (0.150–0.310)	2.6 (1.8–3.6)	0.034 (<0.01–0.13)	0.41 (<0.1–1.5)	0.25 (0.160–0.370)	3 (1.9–4.3)
Thailand	68	8.4 (6.9–10)	12 (10–15)	5.4 (3.3–8.1)	8 (4.9–12)	14 (11–17)	20 (16–25)
The Former Yugoslav Republic of Macedonia	2	<0.01 (<0.01–<0.01)	0.41 (0.37–0.44)	<0.01 (<0.01–<0.01)	0 (0–<0.1)	<0.01 (<0.01–<0.01)	0.41 (0.38–0.45)
Timor-Leste	1	1.2 (0.710–1.8)	100 (60–151)	<0.01 (0–0.019)	0.32 (0–1.6)	1.2 (0.710–1.8)	100 (60–151)
Togo	7	0.46 (0.280–0.700)	6.4 (3.8–9.5)	0.2 (0.047–0.47)	2.8 (0.64–6.4)	0.67 (0.400–1.0)	9.1 (5.5–14)
Tokelau	< 1	0	0	0	0	0	0
Tonga	< 1	<0.01 (<0.01–<0.01)	1.2 (0.77–1.8)	0 (0–0)	0 (0–0)	<0.01 (<0.01–<0.01)	1.2 (0.78–1.8)
Trinidad and Tobago	1	0.021 (0.019–0.023)	1.5 (1.4–1.7)	<0.01 (<0.01–0.014)	0.46 (0.12–1.0)	0.027 (0.021–0.034)	2 (1.5–2.5)
Tunisia	11	0.24 (0.049–0.570)	2.1 (0.44–5.0)	<0.01 (<0.01–0.013)	<0.1 (<0.1–0.12)	0.24 (0.053–0.570)	2.2 (0.47–5.1)
Turkey	79	0.74 (0.630–0.850)	0.94 (0.80–1.1)	0.015 (<0.01–0.044)	<0.1 (0–<0.1)	0.75 (0.640–0.870)	0.96 (0.82–1.1)
Turkmenistan	5	0.46 (0.420–0.490)	8.5 (7.8–9.2)	0	0	0.46 (0.420–0.490)	8.5 (7.8–9.2)
Turks and Caicos Islands	< 1	0	0	<0.01 (<0.01–<0.01)	1 (0.20–2.6)	<0.01 (<0.01–<0.01)	1 (0.20–2.6)
Tuvalu	< 1	<0.01 (<0.01–<0.01)	19 (12–28)	0 (0–<0.01)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	19 (12–28)
Uganda	39	5.5 (3.3–8.3)	14 (8.5–21)	6.4 (1.7–14)	16 (4.3–36)	12 (6.1–20)	30 (16–50)
Ukraine	45	5 (4.9–5.1)	11 (11–11)	2.1 (0.93–3.8)	4.7 (2.1–8.4)	7.1 (5.7–8.6)	16 (13–19)
United Arab Emirates	9	0.043 (0.034–0.052)	0.47 (0.38–0.56)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	0.045 (0.036–0.054)	0.49 (0.40–0.59)
United Kingdom of Great Britain and Northern Ireland	65	0.3 (0.290–0.300)	0.46 (0.46–0.46)	0.038 (<0.01–0.21)	<0.1 (0–0.32)	0.34 (0.230–0.460)	0.52 (0.36–0.71)
United Republic of Tanzania	53	30 (13–53)	56 (25–99)	25 (16–35)	47 (31–66)	55 (35–79)	103 (65–148)
United States of America	322	0.59 (0.580–0.590)	0.18 (0.18–0.18)	0.077 (<0.01–0.38)	<0.1 (0–0.12)	0.66 (0.470–0.890)	0.21 (0.15–0.28)
Uruguay	3	0.069 (0.065–0.073)	2 (1.9–2.1)	0.026 (<0.01–0.060)	0.75 (0.16–1.8)	0.095 (0.069–0.130)	2.8 (2.0–3.6)
US Virgin Islands	< 1	0	0	0	0	0	0
Uzbekistan	30	2.6 (2.3–3.0)	8.8 (7.6–10)	0.32 (0.19–0.50)	1.1 (0.62–1.7)	2.9 (2.6–3.3)	9.8 (8.6–11)
Vanuatu	< 1	0.017 (0.011–0.024)	6.4 (4.2–9.0)	0	0	0.017 (0.011–0.024)	6.4 (4.2–9.0)
Venezuela (Bolivarian Republic of)	31	0.73 (0.720–0.730)	2.3 (2.3–2.3)	0.18 (0.025–0.48)	0.58 (<0.1–1.5)	0.9 (0.680–1.2)	2.9 (2.2–3.7)
Viet Nam	93	16 (11–22)	17 (12–23)	1.1 (0.20–2.7)	1.1 (0.21–2.8)	17 (12–23)	18 (13–25)
Wallis and Futuna Islands	< 1	0	0	0	0	0	0
West Bank and Gaza Strip	5	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)	<0.01 (<0.01–<0.01)	0 (0–0)	<0.01 (<0.01–<0.01)	<0.1 (<0.1–<0.1)
Yemen	27	1.6 (1.1–2.1)	5.9 (4.0–8.0)	0.05 (0.038–0.065)	0.19 (0.14–0.24)	1.6 (1.1–2.2)	6 (4.2–8.2)
Zambia	16	5 (2.9–7.7)	31 (18–47)	12 (6.9–20)	77 (42–121)	17 (11–25)	108 (70–153)
Zimbabwe	16	1.7 (0.990–2.5)	11 (6.3–16)	6.3 (2.2–13)	40 (14–81)	8 (3.6–14)	51 (23–91)
WHO regions							
African Region	989	450 (350–560)	45 (35–57)	300 (230–360)	30 (24–37)	740 (630–870)	75 (63–88)
Region of the Americas	991	19 (17–20)	1.9 (1.8–2.0)	5.9 (4.2–7.9)	0.59 (0.42–0.79)	24 (22–27)	2.5 (2.3–2.7)
Eastern Mediterranean Region	648	80 (38–140)	12 (5.8–21)	3 (2.5–3.5)	0.46 (0.38–0.54)	83 (40–140)	13 (6.2–22)
European Region	910	32 (31–33)	3.5 (3.4–3.6)	4.9 (1.5–10)	0.54 (0.17–1.1)	37 (33–41)	4.1 (3.6–4.6)
South-East Asia Region	1 928	710 (600–830)	37 (31–43)	74 (56–95)	3.9 (2.9–4.9)	790 (670–910)	41 (35–47)
Western Pacific Region	1 856	89 (81–98)	4.8 (4.4–5.3)	5.7 (3.8–8.1)	0.31 (0.20–0.44)	95 (87–100)	5.1 (4.7–5.6)
Global	7 323	1 400 (1 200–1 600)	19 (17–21)	390 (320–460)	5.3 (4.4–6.3)	1 800 (1 600–2 000)	24 (22–27)

[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								
Albania	2012	Surveillance	National	2.3 (0.64–5.8)	2012	Surveillance	National	6.7 (0.17–32)
Algeria	2002	Survey	National	1.4 (0.33–2.5)	2002	Survey	National	9.1 (0–23)
American Samoa								
Andorra	2015	Surveillance	National	0 (0–84)	2015	Surveillance	National	0 (0–0)
Angola								
Anguilla								
Antigua and Barbuda								
Argentina	2005	Survey	National	2.3 (1.1–3.6)	2005	Survey	National	18 (11–25)
Armenia	2007	Survey	National	11 (8.0–14)	2007	Survey	National	47 (41–53)
Aruba								
Australia	2015	Surveillance	National	3.6 (2.2–5.4)	2015	Surveillance	National	24 (9.4–45)
Austria	2015	Surveillance	National	2.3 (0.84–4.9)	2015	Surveillance	National	17 (2.1–48)
Azerbaijan	2013	Survey	National	13 (10–16)	2013	Survey	National	29 (23–35)
Bahamas	2012	Surveillance	National	11 (2.4–29)	2015	Surveillance	National	50 (1.3–99)
Bahrain	2012	Surveillance	National	1.9 (0.39–5.4)	2012	Surveillance	National	100 (2.5–100)
Bangladesh	2011	Survey	National	1.6 (0.59–2.6)	2011	Survey	National	29 (24–34)
Barbados	2014	Surveillance	National	0 (0–71)	2014	Surveillance	National	0 (0–0)
Belarus	2015	Surveillance	National	37 (35–39)	2015	Surveillance	National	69 (66–72)
Belgium	2015	Surveillance	National	1.6 (0.66–3.3)	2015	Surveillance	National	8.8 (1.9–24)
Belize					2013	Surveillance	National	100 (29–100)
Benin	2010	Survey	National	1.2 (0–2.6)	2014	Surveillance	National	8.1 (4.6–13)
Bermuda	2012	Surveillance	National	0 (0–84)	2012	Surveillance	National	0 (0–0)
Bhutan					2015	Surveillance	National	38 (19–59)
Bolivia (Plurinational State of)					2015	Surveillance	National	12 (9.5–16)
Bonaire, Saint Eustatius and Saba					2011	Surveillance	National	100 (2.5–100)
Bosnia and Herzegovina	2015	Surveillance	National	0.51 (0.11–1.5)	2013	Surveillance	National	1.6 (<0.1–8.5)
Botswana	2008	Survey	National	3.6 (2.4–4.8)	2008	Survey	National	13 (7.4–19)
Brazil	2008	Survey	Sub-national	1.5 (1.1–1.9)	2008	Survey	Sub-national	8 (5.9–10)
British Virgin Islands								
Brunei Darussalam	2015	Surveillance	National	0 (0–2.3)	2015	Surveillance	National	0 (0–37)
Bulgaria	2012	Surveillance	National	3.3 (2.1–5.0)	2012	Surveillance	National	25 (18–33)
Burkina Faso								
Burundi								
Cabo Verde								
Cambodia	2007	Survey	National	1.8 (0.77–2.8)	2007	Survey	National	11 (1.4–20)
Cameroon								
Canada	2014	Surveillance	National	1.4 (0.72–2.4)	2014	Surveillance	National	1.8 (<0.1–9.6)
Cayman Islands	2013	Surveillance	National	0 (0–71)	2013	Surveillance	National	0 (0–0)
Central African Republic	2009	Survey	Sub-national	0.4 (0–1.6)				
Chad								
Chile	2015	Surveillance	National	1.5 (0.88–2.3)	2015	Surveillance	National	5.6 (2.6–10)
China	2007	Survey	National	6.6 (5.3–7.9)	2007	Survey	National	30 (25–34)
China, Hong Kong SAR	2011	Surveillance	National	1.2 (0.73–1.7)	2011	Surveillance	National	3.4 (1.4–6.8)
China, Macao SAR	2015	Surveillance	National	2.5 (0.91–5.3)	2015	Surveillance	National	16 (4.5–36)
Colombia	2005	Survey	National	2.4 (1.4–3.4)	2012	Surveillance	National	14 (11–18)
Comoros								
Congo								
Cook Islands	2015	Surveillance	National	0 (0–98)	2015	Surveillance	National	0 (0–0)
Costa Rica	2006	Survey	National	1.9 (0–3.9)	2012	Surveillance	National	9.1 (1.1–29)
Côte d'Ivoire	2006	Survey	National	3.1 (1.0–5.3)				
Croatia	2015	Surveillance	National	0 (0–1.4)	2015	Surveillance	National	0 (0–16)
Cuba	2012	Surveillance	National	2.2 (0.82–4.8)	2014	Surveillance	National	4.2 (0.51–14)
Curaçao	2014	Surveillance	National	0 (0–60)	2014	Surveillance	National	0 (0–0)
Cyprus	2015	Surveillance	National	0 (0–10)	2015	Surveillance	National	0 (0–0)
Czechia	2014	Surveillance	National	1.7 (0.56–4.0)	2014	Surveillance	National	13 (1.7–40)
Democratic People's Republic of Korea	2014	Survey	Sub-national	2.2 (0.51–3.9)	2014	Survey	Sub-national	16 (8.4–24)
Democratic Republic of the Congo								
Denmark	2014	Surveillance	National	0.51 (<0.1–2.8)	2014	Surveillance	National	0 (0–19)

[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.

Data for all years can be downloaded from www.who.int/tb/data

:: 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
Djibouti	2015	Survey	National	4.3 (1.8–6.8)	2015	Survey	National	34 (21–46)
Dominica	2013	Surveillance	National	0 (0–98)	2013	Surveillance	National	0 (0–0)
Dominican Republic								
Ecuador	2002	Survey	National	7.3 (5.4–9.2)	2012	Surveillance	National	28 (25–31)
Egypt	2011	Survey	National	14 (12–16)	2015	Surveillance	National	23 (20–27)
El Salvador	2001	Survey	National	1.1 (0.17–2.1)	2014	Surveillance	National	4.1 (1.3–9.2)
Equatorial Guinea								
Eritrea								
Estonia	2015	Surveillance	National	16 (10–23)	2015	Surveillance	National	54 (37–71)
Ethiopia	2005	Survey	National	2.7 (1.5–4.0)	2005	Survey	National	14 (5.6–23)
Fiji	2006	Surveillance	National	0 (0–8.2)	2006	Surveillance	National	0 (0–98)
Finland	2015	Surveillance	National	5.1 (2.2–9.8)	2015	Surveillance	National	0 (0–60)
France	2014	Surveillance	National	1 (0.65–1.5)	2014	Surveillance	National	10 (7.1–15)
French Polynesia	2015	Surveillance	National	0 (0–11)	2015	Surveillance	National	50 (1.3–99)
Gabon								
Gambia								
Georgia	2015	Surveillance	National	12 (11–14)	2015	Surveillance	National	33 (29–37)
Germany	2015	Surveillance	National	2.2 (0.82–4.8)	2015	Surveillance	National	23 (16–30)
Ghana					2015	Surveillance	National	7.2 (5.7–9.0)
Greece	2010	Surveillance	National	1.5 (<0.1–8.0)	2010	Surveillance	National	9.1 (0.23–41)
Greenland								
Grenada								
Guam	2012	Surveillance	National	0 (0–11)	2012	Surveillance	National	0 (0–0)
Guatemala	2002	Survey	National	4.2 (2.6–5.8)	2002	Survey	National	29 (21–37)
Guinea								
Guinea-Bissau								
Guyana								
Haiti								
Honduras	2004	Survey	National	2.2 (0.69–3.7)	2004	Survey	National	21 (10–31)
Hungary	2010	Surveillance	National	2.9 (1.6–4.8)	2010	Surveillance	National	8.1 (3.3–16)
Iceland	2015	Surveillance	National	0 (0–71)	2015	Surveillance	National	0 (0–0)
India	2001, 2004, 2006, 2009	Multiple surveys		2.5 (2.1–3.1)	2006, 2009	Multiple surveys		16 (14–18)
Indonesia	2004, 2006, 2010	Multiple surveys		2.8 (2.2–3.5)	2006, 2010	Multiple surveys		16 (10–20)
Iran (Islamic Republic of)	2014	Survey	National	1.3 (0.60–2.0)	2014	Survey	National	12 (6.1–19)
Iraq	2013	Survey	National	6.1 (4.4–7.8)	2013	Survey	National	24 (16–32)
Ireland	2015	Surveillance	National	1.1 (<0.1–5.8)	2015	Surveillance	National	0 (0–31)
Israel	2015	Surveillance	National	8.8 (4.8–15)	2015	Surveillance	National	33 (4.3–78)
Italy	2015	Surveillance	National	2.8 (1.8–4.3)	2015	Surveillance	National	13 (7.7–21)
Jamaica	2013	Surveillance	National	1.7 (<0.1–9.1)	2013	Surveillance	National	0 (0–0)
Japan	2002	Surveillance	National	1 (0.69–1.5)	2002	Surveillance	National	11 (8.2–14)
Jordan	2009	Surveillance	National	6.3 (2.4–13)	2009	Surveillance	National	29 (3.7–71)
Kazakhstan	2015	Surveillance	National	25 (24–26)	2015	Surveillance	National	43 (42–45)
Kenya	2014	Survey	National	1.3 (0.68–1.9)	2014	Surveillance	National	9.4 (8.7–10)
Kiribati								
Kuwait	2015	Surveillance	National	1.7 (0.76–3.1)	2015	Surveillance	National	0 (0–0)
Kyrgyzstan	2011	Survey	National	32 (28–36)	2013	Surveillance	National	56 (53–59)
Lao People's Democratic Republic								
Latvia	2015	Surveillance	National	7.9 (5.6–11)	2015	Surveillance	National	30 (21–41)
Lebanon	2003	Survey	National	2.6 (0–5.4)	2013	Surveillance	National	43 (9.9–82)
Lesotho	2014	Survey	National	4.8 (3.7–5.9)	2014	Survey	National	14 (9.3–18)
Liberia								
Libya								
Lithuania	2015	Surveillance	National	12 (10–15)	2015	Surveillance	National	47 (41–53)
Luxembourg	2014	Surveillance	National	0 (0–0)	2014	Surveillance	National	0 (0–0)
Madagascar	2007	Survey	National	0.49 (0–1.1)	2007	Survey	National	5.9 (0–14)
Malawi	2011	Survey	National	0.75 (0–1.6)	2011	Survey	National	6.4 (3.8–8.9)

[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
Malaysia	2014	Surveillance	National	1.5 (1.2–1.9)	2014	Surveillance	National	3.1 (1.3–5.9)
Maldives					2015	Surveillance	National	0 (0–52)
Mali								
Malta	2015	Surveillance	National	0 (0–25)	2015	Surveillance	National	0 (0–0)
Marshall Islands	2014	Surveillance	National	0 (0–4.4)	2015	Surveillance	National	0 (0–41)
Mauritania								
Mauritius	2015	Surveillance	National	1.7 (0.20–5.9)	2015	Surveillance	National	0 (0–71)
Mexico	2009	Survey	National	2.6 (2.3–2.9)	2009	Survey	National	11 (9.2–13)
Micronesia (Federated States of)								
Monaco								
Mongolia	2007	Survey	National	2.2 (1.1–3.3)	2013	Surveillance	National	33 (29–38)
Montenegro	2015	Surveillance	National	1.9 (<0.1–10)	2015	Surveillance	National	0 (0–60)
Montserrat								
Morocco	2014	Survey	National	1 (0.30–1.7)	2014	Survey	National	8.7 (4.8–13)
Mozambique	2007	Survey	National	3.7 (2.4–5.0)	2007	Survey	National	20 (1.9–37)
Myanmar	2013	Survey	National	5.1 (3.2–7.0)	2013	Survey	National	27 (15–39)
Namibia	2015	Survey	National	5 (4.1–5.9)	2015	Survey	National	12 (9.3–14)
Nauru								
Nepal	2011	Survey	National	2.2 (0.98–3.4)	2011	Survey	National	15 (9.2–22)
Netherlands	2015	Surveillance	National	1.6 (0.60–3.5)	2015	Surveillance	National	18 (5.2–40)
New Caledonia	2014	Surveillance	National	0 (0–28)	2014	Surveillance	National	0 (0–84)
New Zealand	2014	Surveillance	National	2.6 (0.70–6.4)	2014	Surveillance	National	20 (0.51–72)
Nicaragua	2006	Survey	National	0.94 (0–2.3)	2010	Surveillance	National	12 (7.3–18)
Niger								
Nigeria	2010	Survey	National	4.3 (3.2–5.4)	2010	Survey	National	25 (19–31)
Niue								
Northern Mariana Islands	2014	Surveillance	National	5.3 (0.13–26)	2014	Surveillance	National	0 (0–98)
Norway	2015	Surveillance	National	2.6 (0.86–6.0)	2015	Surveillance	National	4.8 (0.12–24)
Oman	2014	Surveillance	National	3.5 (1.5–6.7)	2015	Surveillance	National	0 (0–37)
Pakistan	2013	Survey	National	4.2 (3.2–5.3)	2015	Surveillance	National	16 (15–17)
Palau	2013	Surveillance	National	0 (0–41)	2013	Surveillance	National	0 (0–0)
Panama								
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 (0–2.2)	2008	Survey	National	15 (4.0–25)
Peru	2015	Surveillance	National	5.9 (5.6–6.3)	2015	Surveillance	National	21 (19–22)
Philippines	2012	Survey	National	2.6 (1.8–3.3)	2012	Survey	National	29 (21–38)
Poland	2015	Surveillance	National	0.66 (0.42–0.98)	2015	Surveillance	National	3.7 (2.1–5.9)
Portugal	2012	Surveillance	National	0.98 (0.51–1.7)	2012	Surveillance	National	6.9 (2.8–14)
Puerto Rico	2014	Surveillance	National	0 (0–9.3)	2015	Surveillance	National	0 (0–98)
Qatar	2014	Surveillance	National	1.3 (0.16–4.7)				
Republic of Korea	2004	Survey	National	3.7 (3.0–4.5)	2004	Survey	National	17 (12–22)
Republic of Moldova	2015	Surveillance	National	32 (29–34)	2015	Surveillance	National	69 (66–72)
Romania	2015	Survey	National	3 (2.1–3.9)	2015	Survey	National	12 (9.3–15)
Russian Federation	2013	Oblasts		22 (14–25)	2013	Oblasts		53 (40–59)
Rwanda	2015	Survey	National	1.5 (0.77–2.2)	2015	Survey	National	11 (3.3–18)
Saint Kitts and Nevis								
Saint Lucia	2013	Surveillance	National	0 (0–52)	2013	Surveillance	National	0 (0–0)
Saint Vincent and the Grenadines					2014	Surveillance	National	0 (0–98)
Samoa	2013	Surveillance	National	0 (0–28)	2013	Surveillance	National	0 (0–0)
San Marino								
Sao Tome and Principe					2012	Surveillance	National	88 (47–100)
Saudi Arabia	2010	Survey	National	2.6 (2.0–3.2)	2010	Survey	National	20 (16–25)
Senegal	2014	Survey	National	0.9 (0.24–1.6)	2014	Survey	National	19 (12–25)
Serbia	2013	Surveillance	National	1.1 (0.49–2.2)	2013	Surveillance	National	4.7 (1.3–11)
Seychelles	2015	Surveillance	National	0 (0–46)	2015	Surveillance	National	0 (0–0)
Sierra Leone								
Singapore	2015	Surveillance	National	1 (0.52–1.8)	2015	Surveillance	National	0.99 (<0.1–5.4)
Sint Maarten (Dutch part)								
Slovakia	2012	Surveillance	National	0 (0–2.6)	2012	Surveillance	National	3.7 (<0.1–19)

[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.

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:: 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
Slovenia	2015	Surveillance	National	0 (0–4.1)	2015	Surveillance	National	0 (0–41)
Solomon Islands					2013	Surveillance	National	0 (0–41)
Somalia	2011	Survey	National	8.7 (5.9–11)	2011	Survey	National	47 (29–65)
South Africa	2014	Survey	National	3.5 (2.8–4.2)	2014	Survey	National	7.1 (5.3–8.9)
South Sudan								
Spain	2001, 2005	Multiple surveys		0.44 (0.12–1.1)	2001, 2005	Multiple surveys		7.1 (3.3–13)
Sri Lanka	2006	Survey	National	0.54 (0–1.3)	2013	Surveillance	National	1.7 (0.64–3.7)
Sudan								
Suriname	2015	Surveillance	National	9.9 (4.1–19)	2015	Surveillance	National	25 (0.63–81)
Swaziland	2009	Survey	National	8 (3.1–13)	2009	Survey	National	36 (31–42)
Sweden	2015	Surveillance	National	4 (2.3–6.3)	2015	Surveillance	National	18 (3.8–43)
Switzerland	2015	Surveillance	National	3.2 (1.3–6.4)	2015	Surveillance	National	26 (9.1–51)
Syrian Arab Republic	2003	Survey	National	8 (4.9–11)	2015	Surveillance	National	18 (11–27)
Tajikistan	2014	Surveillance	National	14 (12–15)	2014	Surveillance	National	77 (73–80)
Thailand	2012	Survey	National	2.2 (1.5–2.9)	2012	Survey	National	24 (18–30)
The Former Yugoslav Republic of Macedonia	2015	Surveillance	National	2.4 (0.65–6.0)	2015	Surveillance	National	6.7 (0.17–32)
Timor-Leste								
Togo					2013	Surveillance	National	12 (7.0–19)
Tokelau								
Tonga								
Trinidad and Tobago								
Tunisia	2015	Surveillance	National	0.54 (0.20–1.2)	2015	Surveillance	National	17 (7.2–32)
Turkey	2015	Surveillance	National	3.6 (3.1–4.2)	2015	Surveillance	National	21 (17–24)
Turkmenistan	2013	Survey	National	14 (11–17)	2013	Survey	National	38 (31–46)
Turks and Caicos Islands								
Tuvalu								
Uganda	2011	Survey	National	1.6 (0.78–2.4)	2011	Survey	National	12 (5.9–18)
Ukraine	2014	Survey	National	25 (21–28)	2014	Survey	National	58 (53–64)
United Arab Emirates					2013	Surveillance	National	0 (0–52)
United Kingdom of Great Britain and Northern Ireland	2015	Surveillance	National	1.4 (0.98–2.0)	2015	Surveillance	National	3.4 (1.1–7.9)
United Republic of Tanzania	2007	Survey	National	1.3 (0.47–2.1)	2007	Survey	National	4.7 (0.37–9.0)
United States of America	2015	Surveillance	National	1.5 (1.2–1.8)	2015	Surveillance	National	5.5 (3.2–8.8)
Uruguay	2015	Surveillance	National	0.55 (0.11–1.6)	2015	Surveillance	National	0 (0–17)
US Virgin Islands								
Uzbekistan	2011	Survey	National	24 (18–30)	2011	Survey	National	63 (54–71)
Vanuatu	2006	Surveillance	National	0 (0–12)				
Venezuela (Bolivarian Republic of)								
Viet Nam	2012	Survey	National	4.1 (2.6–5.5)	2015	Surveillance	National	25 (24–26)
Wallis and Futuna Islands								
West Bank and Gaza Strip								
Yemen	2011	Survey	National	2.3 (0.92–3.7)	2011	Survey	National	18 (11–25)
Zambia	2008	Survey	National	1.1 (0.13–2.1)	2008	Survey	National	18 (11–26)
Zimbabwe								

[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, 2015

		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
Afghanistan	37 001	35 878		39	75	66
Albania	415	415		44	72	71
Algeria	23 879	23 705	1		36	85
American Samoa	4	4			100	100
Andorra	4	4	75	0	50	100
Angola	61 060	59 705		23	93	51
Anguilla	0	0				
Antigua and Barbuda						
Argentina	10 506	9 601		19	86	70
Armenia	1 104	1 090	18	100	72	45
Aruba						
Australia	1 254	1 254		79	63	88
Austria	583	564	53		78	87
Azerbaijan	7 501	5 456	43	128	80	60
Bahamas	62	62		90	90	54
Bahrain						
Bangladesh	209 438	206 915		0	79	72
Barbados	0	0				
Belarus	4 177	3 765	72	99	92	78
Belgium	988	928	0	46	70	85
Belize	84	78		90	91	59
Benin	4 092	3 985		101	91	91
Bermuda	0	0				
Bhutan	975	963		67	52	89
Bolivia (Plurinational State of)	7 893	7 789		83	79	91
Bonaire, Saint Eustatius and Saba						
Bosnia and Herzegovina	1 095	1 092	100	19	89	70
Botswana	5 073	4 972		91	81	52
Brazil	81 137	73 221	23	82	87	73
British Virgin Islands	0	0				
Brunei Darussalam	212	212		100	83	96
Bulgaria	1 660	1 619	1		74	65
Burkina Faso	5 808	5 594	2	97	85	84
Burundi	6 969	6 892	8	95	70	88
Cabo Verde	272	269		100	90	82
Cambodia	35 638	35 169		84	63	48
Cameroon	26 570	26 117	2	92	84	74
Canada	1 640	1 640		44	70	80
Cayman Islands	7	7		0	100	100
Central African Republic	10 799	10 459	1	48	82	61
Chad	12 026	11 471	1	69	85	54
Chile	2 657	2 569	1	63	80	86
China	804 163	798 439		47	96	31
China, Hong Kong SAR	4 498	4 498		73	77	61
China, Macao SAR	372	370	25	88	87	82
Colombia	12 749	11 895	3	93	81	79
Comoros						
Congo	10 119	9 937	3	13	75	51
Cook Islands	1	1		100	100	100
Costa Rica	424	424		98	86	75
Côte d'Ivoire	22 879	22 458		95	78	84
Croatia	486	484	0		93	85
Cuba	753	698	7	100	90	82
Curaçao						
Cyprus	63	63	8		87	78
Czechia	518	508	46	36	87	85
Democratic People's Republic of Korea	120 722	112 840		0	82	50
Democratic Republic of the Congo	120 508	119 213	10	50	82	83
Denmark	357	320	0		81	82

[a] Includes cases for which the treatment history is unknown.

:: TABLE A4.4

TB case notifications, 2015

		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
Djibouti	2 692	2 686	51	90	57	78
Dominica	7	7		100	100	71
Dominican Republic	4 690	4 504		79	88	69
Ecuador	5 215	5 097		93	82	93
Egypt	8 155	7 860	10	23	63	82
El Salvador	2 461	2 452	15	97	86	90
Equatorial Guinea	1 286	1 242	17	73	91	72
Eritrea	2 094	2 060		100	65	59
Estonia	217	206	73	96	91	87
Ethiopia	137 960	135 951	6	77	70	54
Fiji	371	363	30	90	65	67
Finland	271	267	31		76	82
France						
French Polynesia	51	46		0	83	87
Gabon	6 293	5 727		49	92	54
Gambia	2 551	2 531		90	93	63
Georgia	3 611	3 152	64	89	79	83
Germany	5 865	5 671	54		77	81
Ghana	14 999	14 460	11	83	92	62
Greece	482	438	43		88	85
Greenland	80	80	89	45	88	76
Grenada	5	5	0	100	60	100
Guam	76	76	46	93	97	55
Guatemala	3 381	3 325	5	92	93	83
Guinea	12 242	12 154	1	79	78	84
Guinea-Bissau	2 141	2 133		70	95	74
Guyana	668	571	8	85	93	60
Haiti	16 431	16 431	6	90	90	78
Honduras	2 919	2 906		88	89	84
Hungary	906	858	0		97	49
Iceland	7	7	43		71	60
India	1 740 435	1 667 136		67	82	64
Indonesia	330 729	328 895		11	93	64
Iran (Islamic Republic of)	10 399	10 215		37	72	80
Iraq	8 255	8 183		51	61	59
Ireland	312	295	0	25	67	73
Israel	280	280		100	72	79
Italy	3 769	3 476	0		72	80
Jamaica	103	103	38	64	98	66
Japan	18 280	18 280		8	77	87
Jordan	437	424	39	85	64	35
Kazakhstan	14 631	14 006	83	99	88	81
Kenya	81 518	81 292	10	97	82	59
Kiribati	516	496		42	86	68
Kuwait	748	748	72	100	75	97
Kyrgyzstan	7 833	7 027	21	96	74	61
Lao People's Democratic Republic	4 638	4 534	37	90	91	85
Latvia	721	697	0	63	93	85
Lebanon	666	656	36	27	60	63
Lesotho	7 892	7 594		96	86	49
Liberia	5 849	5 814		73	78	61
Libya	1 014	966		100	63	76
Lithuania	1 507	1 395	0	71	90	85
Luxembourg	30	30	0		80	83
Madagascar	29 939	29 464		33	78	89
Malawi	17 104	15 737	6	93	75	58
Malaysia	24 220	23 565	2	98	87	75
Maldives	153	153	14	100	73	100
Mali	7 015	5 998		67	79	100

[a] Includes cases for which the treatment history is unknown.

:: TABLE A4.4

TB case notifications, 2015

		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
Malta	32	32	3	81	62	85
Marshall Islands	138	138	29	21	80	43
Mauritania	2 352	2 329			77	82
Mauritius	129	128	95	97	95	100
Mexico	22 294	21 600	1	89	81	83
Micronesia (Federated States of)	108	104		66	86	33
Monaco	0	0				
Mongolia	4 935	4 685	13	80	57	78
Montenegro	80	80		91	96	74
Montserrat	0	0				
Morocco	31 403	30 636		47	53	85
Mozambique	61 559	58 344	7	99	89	50
Myanmar	140 700	138 447	22	65	88	39
Namibia	9 944	9 614		98	83	76
Nauru	18	10		0	80	50
Nepal	34 122	33 199	14	7	74	73
Netherlands	867	850	58	58	56	85
New Caledonia	56	56		43	79	84
New Zealand	297	292		82	55	89
Nicaragua	2 705	2 465		94	87	79
Niger	10 625	10 383	0	74	85	85
Nigeria	90 584	87 211	58	100	94	68
Niue	0	0				
Northern Mariana Islands	28	28	93	89	93	62
Norway	318	286	0		70	89
Oman	328	328	100	100	67	100
Pakistan	331 809	323 856		4	81	51
Palau	14	14	86	86	86	67
Panama	1 658	1 566		89	83	62
Papua New Guinea	28 696	26 347		36	54	31
Paraguay	2 536	2 358	14	86	91	78
Peru	30 988	29 833	86	81	81	82
Philippines	286 544	276 672	20	13	97	36
Poland	6 430	6 237	12	0	94	76
Portugal	2 124	2 087	14	72	71	87
Puerto Rico	52	52	42	96	96	66
Qatar						
Republic of Korea	40 847	37 541			80	67
Republic of Moldova	4 211	3 608	85	95	90	64
Romania	15 195	14 225	0	75	83	81
Russian Federation	130 904	99 590			93	49
Rwanda	5 637	5 534	39	96	86	86
Saint Kitts and Nevis						
Saint Lucia	14	14		100	100	100
Saint Vincent and the Grenadines	7	7		100	100	100
Samoa	19	19		5	79	93
San Marino						
Sao Tome and Principe	207	178		100	89	38
Saudi Arabia	3 464	3 346	23	51	76	84
Senegal	13 599	13 300		83	88	84
Serbia	1 658	1 649		6	81	66
Serbia (without Kosovo)	*888*	*879*				
Kosovo	*770*	*770*				
Seychelles	8	8	88	100	75	83
Sierra Leone	12 103	11 861		97	95	69
Singapore	2 171	2 166	50	87	85	64
Sint Maarten (Dutch part)	2	2			50	0
Slovakia	317	308	22		83	66
Slovenia	130	129	54	83	77	96

[a] Includes cases for which the treatment history is unknown.

:: TABLE A4.4

TB case notifications, 2015

		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
Solomon Islands	417	416	15	20	61	68
Somalia	14 203	13 982		78	77	65
South Africa	294 603	287 224	64	97	90	60
South Sudan	10 250	9 657	2	79	81	56
Spain	4 191	4 026	11		74	82
Sri Lanka	9 575	9 305	3	84	71	69
Sudan	20 006	18 800		43	76	46
Suriname	150	144	78	97	83	77
Swaziland	4 567	4 266	60	111	85	70
Sweden	821	782	71		62	91
Switzerland	564	531			72	85
Syrian Arab Republic	2 992	2 908	3	1	58	79
Tajikistan	6 232	5 894		95	73	70
Thailand	66 179	62 135		98	84	64
The Former Yugoslav Republic of Macedonia	284	282		66	79	87
Timor-Leste	3 532	3 337	25	83	85	58
Togo	2 671	2 613	3	100	87	91
Tokelau	2	2			50	0
Tonga	14	14	100	100	43	100
Trinidad and Tobago	218	196		100	94	71
Tunisia	3 357	3 357	7	80	40	85
Turkey	12 772	12 550		70	64	77
Turkmenistan						
Turks and Caicos Islands	2	2		50	100	100
Tuvalu	20	20		95	85	53
Uganda	43 736	41 912		100	91	71
Ukraine	35 304	30 151	77	99	90	68
United Arab Emirates	64	63	33	90	78	94
United Kingdom of Great Britain and Northern Ireland	6 240	5 854	5	81	53	76
United Republic of Tanzania	62 180	60 895		93	79	53
United States of America	9 551	9 058		93	79	83
Uruguay	909	900		93	91	75
US Virgin Islands						
Uzbekistan	19 055	16 315	24	80	87	34
Vanuatu	136	136		38	46	55
Venezuela (Bolivarian Republic of)	7 278	7 136	7	76	84	68
Viet Nam	102 676	100 780	11	79	82	69
Wallis and Futuna Islands	0	0				
West Bank and Gaza Strip	41	41		100	71	38
Yemen	7 699	7 654	9	15	67	55
Zambia	41 588	36 741	100	95	79	49
Zimbabwe	28 225	26 990		96	87	54
WHO regions						
African Region	1 333 504	1 296 122		81	84	64
Region of the Americas	232 156	218 718		82	85	78
Eastern Mediterranean Region	484 733	472 587		17	77	56
European Region	307 202	259 659		70	86	61
South-East Asia Region	2 656 560	2 563 325		52	83	63
Western Pacific Region	1 361 430	1 336 747		43	92	38
Global	6 375 585	6 147 158		55	85	57

[a] Includes cases for which the treatment history is unknown.

:: TABLE A4.5

Treatment outcomes by TB case type, 2014 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2013

	New and relapse, 2014 cohort		Previously treated, excluding relapse, 2014 cohort		HIV-positive TB, 2014 cohort		MDR/RR-TB, 2013 cohort		XDR-TB, 2013 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Afghanistan	31 746	87	966	80			46	63	0	
Albania	406	88	0		2	100				
Algeria*	6 765	88	167	57						
American Samoa										
Andorra	6	83	0		0		0		0	
Angola	53 552	34	1 654	66			116	74		
Anguilla*	1	100					0		0	
Antigua and Barbuda										
Argentina	9 441	52	1 107	37	468	34	88	15	3	0
Armenia	1 228	78	14	50	77	60	104	43	10	20
Aruba										
Australia	1 343	79	13	0	17	47	21	86	0	
Austria	553	74	12	67			13	77	3	67
Azerbaijan*	1 623	83	2 374	74			647	59	95	26
Bahamas	50	84	1	100	21	67	0		0	
Bahrain										
Bangladesh	191 141	93	5 497	88	45	62	686	75	3	0
Barbados	5	100	0		0		0		0	
Belarus	2 706	88	249	73	135	74	2 136	54	60	38
Belgium	867	81	70	73	34	71	14	79	0	
Belize	72	35			25	28	2	50	0	
Benin*	3 749	89	223	78			14	93		
Bermuda	0		0		0		0		0	
Bhutan	1 066	90	71	79	1 066	90	37	92		
Bolivia (Plurinational State of)	8 079	83	122	57			44	61	0	
Bonaire, Saint Eustatius and Saba										
Bosnia and Herzegovina	1 196	77					1	100		
Botswana	6 439	77	103	57	3 537	77	102	71	2	50
Brazil	74 117	71	7 532	39	6 891	49	759	52	17	12
British Virgin Islands	0		0		0		0		0	
Brunei Darussalam	198	65	0		0		1	0	0	
Bulgaria	1 789	86	39	56	3	33	33	52	4	0
Burkina Faso	5 322	81	456	75	564	74	42	62	0	
Burundi	7 309	91	83	82	901	86	38	89	0	
Cabo Verde	276	92	19	58	27	85	0		0	
Cambodia	43 139	93					121	75		
Cameroon	26 022	84	489	65	8 731	78	76	92	0	
Canada	1 612	82			65	74	15	67	1	100
Cayman Islands	0		0		0		0		0	
Central African Republic*	9 209	70	476	64	2 056	68	16	81	0	
Chad*	11 600	68	705	49						
Chile	2 353	58	57	14	225	40	14	21	0	
China	817 318	94	6 679	88	2 169	86	2 184	55	159	22
China, Hong Kong SAR					25	64	24	62	1	0
China, Macao SAR	385	86	0		6	67	8	88	0	
Colombia	11 631	76	684	43	1 481	54	148	62	4	25
Comoros										
Congo	4 108	69	182	94						
Cook Islands*	3	0	0		0		0		0	
Costa Rica	455	89	0		36	64	0		0	
Côte d'Ivoire	21 495	79	556	51	5 145	69	311	85		
Croatia	494	10	0							
Cuba	729	82	13	23	87	67	3	100	0	
Curaçao										
Cyprus	39	59	2	50	0					
Czechia	467	76	37	65	1	0				
Democratic People's Republic of Korea	103 045	91	7 245	82	0		170	84	0	
Democratic Republic of the Congo*	112 969	89	1 099	65			268	63	0	

[a] Relapses included in the previously treated cohort.

:: TABLE A4.5

Treatment outcomes by TB case type, 2014 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2013

	New and relapse, 2014 cohort		Previously treated, excluding relapse, 2014 cohort		HIV-positive TB, 2014 cohort		MDR/RR-TB, 2013 cohort		XDR-TB, 2013 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Denmark	291	52	27	63	4	25	0		1	100
Djibouti	1 240	81								
Dominica	1	100	0		1	100	0		0	
Dominican Republic	2 770	83	200	58	291	69	94	73	4	75
Ecuador	5 072	77	176	52			132	45	0	
Egypt	7 177	84	290	56	0		60	57	0	
El Salvador	2 206	91	14	43	203	75	10	90	0	
Equatorial Guinea	551	58	78	14	287	28				
Eritrea	2 389	91	34	88	128	83	6	83	0	
Estonia	194	84	1	100	14	71	44	70	10	40
Ethiopia*	121 563	89					397	68		
Fiji	315	87	8	88	11	91	0		0	
Finland	250	45	5	40						
France										
French Polynesia	58	76	2	100	0		0		0	
Gabon	4 843	58	479	50						
Gambia*	1 475	88								
Georgia	2 862	83	509	69	21	76	411	43	70	21
Germany	4 283	63	143	64			105	39	0	
Ghana	14 662	85	614	81	2 753	76	26	69	0	
Greece										
Greenland	99	68	0		1	100	0		0	
Grenada	0		0		0		0		0	
Guam	56	89	4	75	0		0		0	
Guatemala	2 756	85	55	53	194	71	27	78	0	
Guinea	11 117	83	270	66	2 067	77	53	58	0	
Guinea-Bissau	2 234	81	1	100			15	40		
Guyana	545	69	103	38	111	59	0		0	
Haiti	15 779	78	157	52	2 588	67	81	83		
Honduras	1 810	89	180	68	256	63	4	75	0	
Hungary	795	73	52	50	2	100	10	40	1	0
Iceland	9	89	0		0					
India	1 609 547	74	74 368	65	44 257	76	21 093	46	392	33
Indonesia	322 806	84	1 733	63	2 548	56	809	51	10	40
Iran (Islamic Republic of)	10 172	87	202	76	265	63	54	74	1	100
Iraq	8 268	92	73	79	0		84	58		
Ireland	288	56	21	48	17	47	3	33	0	
Israel	322	89	0		22	73	7	57	1	0
Italy										
Jamaica	89	18	0		19	5				
Japan*	15 130	53			26	38				
Jordan	385	88	20	90	0		13	77	0	
Kazakhstan	12 473	90	330	77	381	71	6 527	72	360	30
Kenya	89 294	87	227	78	30 107	82	266	82	1	0
Kiribati	415	87	17	88	1	0	0		0	
Kuwait	734	97	0		1	100	7	100	0	
Kyrgyzstan	5 731	84	915	79			1 064	57	43	28
Lao People's Democratic Republic	4 198	86	23	61	292	57	7	71	0	
Latvia	675	83	15	67	74	66	64	67	15	73
Lebanon	671	76	10	80	3	33	7	86	0	
Lesotho	9 000	70	936	59	5 466	69	163	63	3	33
Liberia	4 998	74	37	49						
Libya	1 153	57	33	48	54	26				
Lithuania	1 282	81	46	46	25	72	227	40	47	0
Luxembourg										
Madagascar*	18 822	83	1 949	78			14	64	0	
Malawi	16 267	85	1 456	75			19	53	0	
Malaysia	23 982	78	637	58	1 400	52	68	62	1	

[a] Relapses included in the previously treated cohort.

:: TABLE A4.5

Treatment outcomes by TB case type, 2014 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2013

	New and relapse, 2014 cohort		Previously treated, excluding relapse, 2014 cohort		HIV-positive TB, 2014 cohort		MDR/RR-TB, 2013 cohort		XDR-TB, 2013 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Maldives	126	37	0		0		0		0	
Mali	5 177	73	789	70	240	57	12	42	0	
Malta							1	100	0	
Marshall Islands	152	86	1	0	0		1	100	0	
Mauritania	2 420	70	13	62	0		7	43	0	
Mauritius	126	90	1	100	15	60	0		0	
Mexico	21 193	80	685	53	1 318	48	167	60	4	75
Micronesia (Federated States of)	166	94	8	0			0		0	
Monaco	0		0		0		0		3	100
Mongolia	4 483	86	288	74	8	75	181	56	0	
Montenegro	113	89	0		0		0		0	
Montserrat										
Morocco	29 992	86	881	63			65	42	0	
Mozambique	55 703	89	2 567	94			313	52		
Myanmar	135 984	87	3 677	73	10 782	70	667	83		
Namibia*	7 981	87	2 068	78	3 112	80	184	64	6	0
Nauru	8	100	4	100	0		0		0	
Nepal	34 764	92	1 286	87	15	73	257	71		
Netherlands	796	85	10	70	21	76	17	100	0	
New Caledonia	30	20					0		0	
New Zealand	296	82	6	33	2	100	3	100	0	
Nicaragua	1 577	85	77	78			9	78	0	
Niger	10 815	79	251	63	490	62	31	81	0	
Nigeria	86 464	87	4 890	83	17 014	79	339	77	2	0
Niue*	0		0		0		0		0	
Northern Mariana Islands	26	62	0		0		0		0	
Norway	293	84	20	80	13	77	6	83	0	
Oman	358	96	0		3	100	2	100	0	
Pakistan	308 327	93	8 005	82			1 484	69	64	30
Palau	14	57	0		0		0		0	
Panama	1 483	79	97	49	178	68	4	50	0	
Papua New Guinea*	4 077	70	728	62						
Paraguay	2 240	71	164	51	179	39	6	33	0	
Peru*	15 171	87	2 363	74	996	68	1 261	55	53	66
Philippines	219 737	92	6 062	83	174	52	1 968	49	6	50
Poland	6 500	58	149	49			46	22	1	0
Portugal	2 198	72	52	60	210	57	14	57	4	50
Puerto Rico*	44	66	0		6	50	1	100	0	
Qatar										
Republic of Korea	38 654	81	2 841	69			951	59	113	56
Republic of Moldova	3 459	79	292	47	241	53	943	57		
Romania	14 525	85	752	45	270	69	601	41	56	16
Russian Federation	77 136	69	5 790	42			18 213	48	1 965	26
Rwanda	5 846	86	94	80			43	81	0	
Saint Kitts and Nevis										
Saint Lucia										
Saint Vincent and the Grenadines							0		0	
Samoa	23	78	1	0	0		0		0	
San Marino										
Sao Tome and Principe	149	74	9	56	24	54	6	83	0	
Saudi Arabia	3 248	62	88	33	63	27				
Senegal	13 226	87	264	79	481	71				
Serbia	1 281	81	14	50	9	78	13	77	0	
Seychelles	13	69	0		1	0	0		0	
Sierra Leone	12 191	85	227	62						
Singapore	2 143	78	0		50	82	15	27	0	
Sint Maarten (Dutch part)*	7	100	0							
Slovakia	318	88	14	71	0		2	0	0	

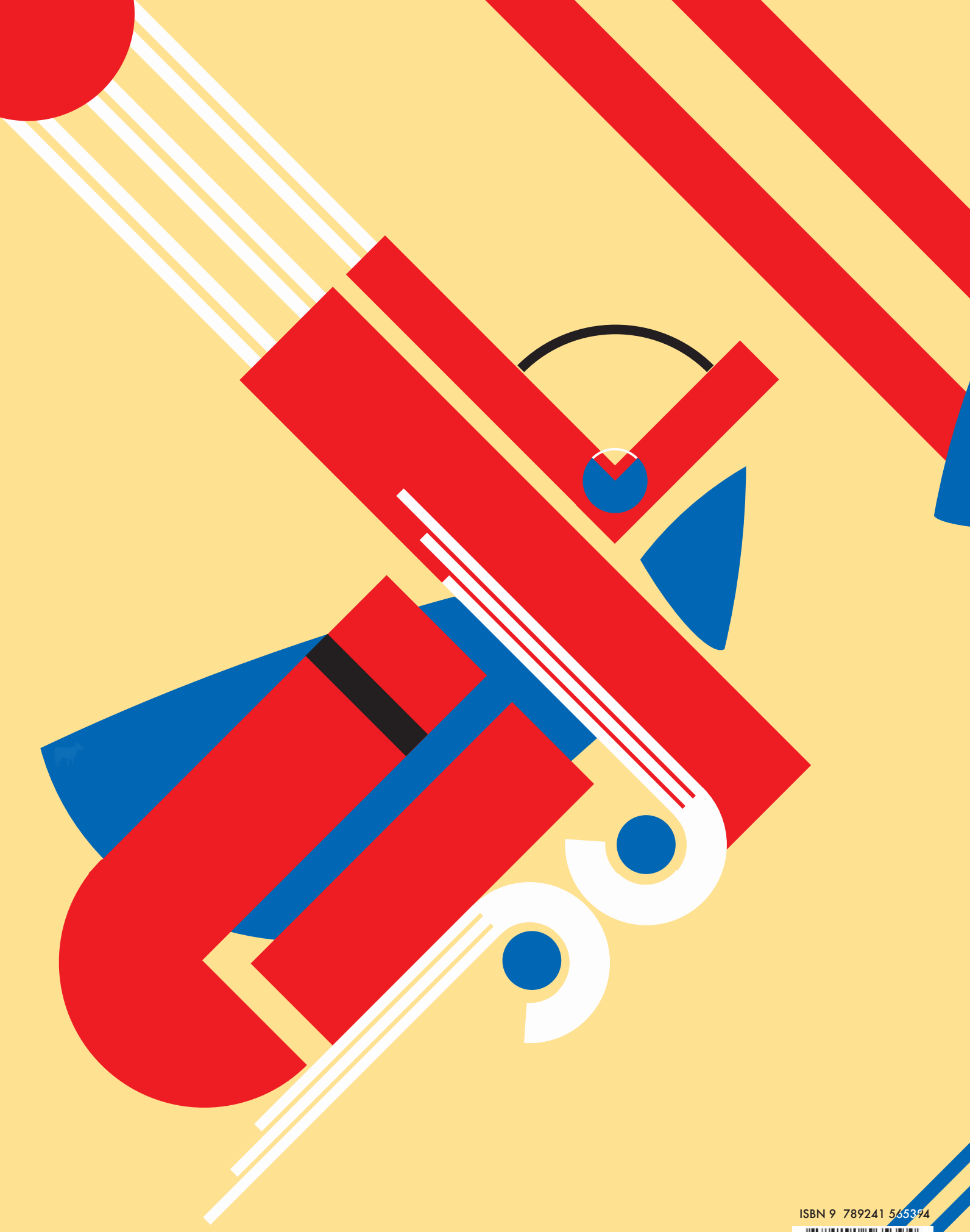
[a] Relapses included in the previously treated cohort.

:: TABLE A4.5

Treatment outcomes by TB case type, 2014 and treatment outcomes for MDR/RR-TB and XDR-TB cases, 2013

	New and relapse, 2014 cohort		Previously treated, excluding relapse, 2014 cohort		HIV-positive TB, 2014 cohort		MDR/RR-TB, 2013 cohort		XDR-TB, 2013 cohort	
	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)	Cohort (Number)	Success (%)
Slovenia	142	77	2	50	0					
Solomon Islands	345	91	1	0	0		0		0	
Somalia	12 903	86	227	59			30	77	0	
South Africa	319 752	78	4 652	63	183 697	76	10 614	48	611	24
South Sudan	8 335	71	521	69	859	71				
Spain	4 689	58	228	52	200	39				
Sri Lanka	8 980	84	168	62	19	63	4	50	0	
Sudan	5 769	82					73	64	2	
Suriname	146	77	12	33	37	68	0		0	
Swaziland	5 455	78	381	66	3 925	78	331	60	5	60
Sweden	610	87	31	84			8	75	2	50
Switzerland										
Syrian Arab Republic	3 390	70	95	69			2	100	0	
Tajikistan	5 149	89	355	82			625	60	4	75
Thailand	58 774	80	1 433	63	6 451	67				
The Former Yugoslav Republic of Macedonia	281	87	1	100	1	0	2	50	0	
Timor-Leste	3 657	84	121	66			2	50	0	
Togo*	2 415	88	162	76			16	56	0	
Tokelau										
Tonga	13	100	0		0		0		0	
Trinidad and Tobago	251	64	42	29	63	44	7	71	0	
Tunisia	3 134	91	39	64	12	100	14	79	0	
Turkey	12 933	87	192	50	41	66	228	65	3	33
Turkmenistan										
Turks and Caicos Islands	1	0	0		1	0	0		0	
Tuvalu	15	47	0		0		0		0	
Uganda	43 628	75	2 438	67	16 670	73	214	73	0	
Ukraine	22 294	72	5 269	66	6 104	35	7 633	39		
United Arab Emirates	40	80	1	0	3	0	0		0	
United Kingdom of Great Britain and Northern Ireland	6 512	81	450	72			77	65	3	33
United Republic of Tanzania	61 573	90	1 578	81	20 658	87	92	68	0	
United States of America	8 237	85	397	79	467	80	39	79	1	100
Uruguay	843	75	26	88	130	51	1	100	0	
US Virgin Islands										
Uzbekistan	16 328	87	3 947	81			2 647	53		
Vanuatu	39	87	1	100	0		0		0	
Venezuela (Bolivarian Republic of)	6 353	80	223	73	482	79	19	53	4	50
Viet Nam	100 349	91	1 738	76	1 519	75	959	69		
Wallis and Futuna Islands*	0		0		0		0		2	100
West Bank and Gaza Strip	43	91	0		0		0		0	
Yemen	9 437	86	65	66			9	67		
Zambia	37 930	85	4 786	80			58	33	0	
Zimbabwe*	29 653	81	2 363	51	19 290	68	351	59		
WHO regions										
African Region	1 274 882	81	40 347	72	328 245	77	14 553	54	630	24
Region of the Americas	197 119	76	14 487	48	16 819	56	2 935	55	91	53
Eastern Mediterranean Region	438 187	91	10 995	79	404	53	1 950	68	67	30
European Region	216 485	76	22 429	63	7 923	41	42 486	52	2 761	27
South-East Asia Region	2 469 890	79	95 599	68	65 183	74	23 725	49	405	33
Western Pacific Region	1 277 110	92	19 062	80	5 700	72	6 512	57	282	37
Global	5 873 673	83	202 919	69	424 274	75	92 161	52	4 236	28

[a] Relapses included in the previously treated cohort.



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