

# GLOBAL LOSS

**Warning: This report is out-of-date. In particular, entire time-series of TB disease burden estimates are updated every year. For the latest data and analysis, please see the most recent edition of the global TB report.**

# TB REPORT

# 2019



World Health  
Organization

# GLOBAL TUBERCULOSIS REPORT



# 2016



World Health  
Organization

## WHO Library Cataloguing-in-Publication Data

Global tuberculosis report 2016.

1.Tuberculosis - epidemiology. 2.Tuberculosis, Pulmonary – prevention and control. 3.Tuberculosis – economics. 4.Tuberculosis, Multidrug-Resistant. 5.Annual Reports. I.World Health Organization.

ISBN 978 92 4 156539 4

(NLM classification: WF 300)

© World Health Organization 2016

All rights reserved. Publications of the World Health Organization are available on the WHO website (<http://www.who.int>) or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; email: [bookorders@who.int](mailto:bookorders@who.int)).

Requests for permission to reproduce or translate WHO publications – whether for sale or for non-commercial distribution – should be addressed to WHO Press through the WHO website ([http://www.who.int/about/licensing/copyright\\_form/index.html](http://www.who.int/about/licensing/copyright_form/index.html)).

The designations employed and the presentation of the material in this publication 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. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

Designed by minimum graphics

Cover designed by Irwin Law

Printed in Switzerland

WHO/HTM/TB/2016.13

# Contents

Abbreviations	iv
Acknowledgements	v
Executive summary	1
Chapter 1. Introduction	5
Chapter 2. A new era of global TB monitoring	6
Chapter 3. TB disease burden	15
Chapter 4. Diagnosis and treatment: TB, HIV-associated TB and drug-resistant TB	54
Chapter 5. TB prevention services	82
Chapter 6. Universal health coverage, social protection and addressing social determinants: Implications for TB	90
Chapter 7. TB financing	108
Chapter 8. TB research and development	122

## Annexes

1. Access to the WHO global TB database	131
2. Country profiles for 30 high TB burden countries	137
3. Regional profiles for 6 WHO regions	171
4. TB burden estimates, notifications and treatment outcomes for individual countries and territories, WHO regions and the world	179

## Abbreviations

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

## Acknowledgements

This global TB report was produced by a core team of 18 people: Laura Anderson, Hannah Monica Dias, Dennis Falzon, Katherine Floyd, Inés García Baena, Christopher Gilpin, Philippe Glaziou, Yohhei Hamada, Avinash Kanchar, Irwin Law, Christian Lienhardt, Andrew Siroka, Charalambos Sismanidis, Lana Syed, Hazim Timimi, Wayne van Gemert, Diana Weil and Matteo Zignol. The team was led by Katherine Floyd. Overall guidance was provided by the Director of the WHO Global TB Programme, Mario Raviglione.

The data collection forms (long and short versions) were developed by Philippe Glaziou and Hazim Timimi, with input from staff throughout the WHO Global TB Programme. Hazim Timimi led and organized all aspects of data management. The review and follow-up of data was done by a team of reviewers that included Anna Dean, Hannah Monica Dias, Dennis Falzon, Inés García Baena, Medea Gegia, Yohhei Hamada, Avinash Kanchar, Andrea Pantoja, Linh Nguyen, Andrew Siroka, Lana Syed, Hazim Timimi, Mukund Uplekar, Wayne van Gemert and Matteo Zignol.

Data for the European Region were collected and validated jointly by the WHO Regional Office for Europe and the European Centre for Disease Prevention and Control (ECDC); we thank in particular Encarna Gimenez, Vahur Hollo and Csaba Ködmön from ECDC for providing validated data files and Andrei Dadu from the WHO Regional Office for Europe for his substantial contribution to follow-up and validation of data for all European countries. Victoria Bendaud, Josephine Dy and Taavi Erkkola from UNAIDS managed the process of data collection from national AIDS programmes and provided access to their TB/HIV dataset. Review and validation of TB/HIV data was undertaken in collaboration with Victoria Bendaud from UNAIDS, along with UNAIDS regional and country strategic information advisers.

Many people contributed to the analyses, preparation of figures and tables, and writing required for the main chapters of the report. Chapter 1 (Introduction) and Chapter 2 (A new era of global TB monitoring) were prepared by Katherine Floyd. Chapter 3 (TB disease burden) was prepared by Katherine Floyd, Philippe Glaziou, Irwin Law, Charalambos Sismanidis and Matteo Zignol, with contributions from Laura Anderson, Anna Dean, Peter Dodd and Helen Jenkins. The writing of Chapter 4 (Diagnosis and treatment of TB, HIV-associated TB and drug-resistant TB) was led by Dennis Falzon and Wayne van Gemert and the preparation of figures and tables was led by Hazim Timimi; other chapter contributors included Hannah Monica Dias, Katherine Floyd, Yohhei Hamada, Avinash Kanchar, Knut Lönnroth, Lana Syed and Mukund Uplekar. Chapter 5 (TB

prevention services) was prepared by Yohhei Hamada, Avinash Kanchar and Haileyesus Getahun, with contributions from Katherine Floyd and Philippe Glaziou. The production of Chapter 6 (Universal health coverage, social protection and social determinants) was led by Diana Weil, with contributions from Amy Collins, Jahn timer Curlin, Inés García Baena, Cornelia Hennig, Knut Lönnroth, Andrew Siroka, Szabolcs Szigeti, Mukund Uplekar and Martin van den Boom. Chapter 7 (TB financing) was prepared by Katherine Floyd, Inés García Baena and Andrew Siroka. Chapter 8 (TB research and development) was prepared by Christian Lienhardt (new TB drugs and new TB vaccines) and Christopher Gilpin (new TB diagnostics), with input from Katherine Floyd, Nebiat Gebreselassie and Karin Weyer. Irwin Law coordinated the finalization of figures and tables for all chapters and subsequent review of proofs, was the focal point for communications with the graphic designer and designed the report cover.

The report team is grateful to various internal and external reviewers for their useful comments and suggestions on advanced drafts of the main chapters of the report. Particular thanks are due to Cherise Scott and Mel Spigelman (new TB drugs) and Jonathan Daniels (new TB vaccines) for their reviews of and input to Chapter 8.

Annex 1, which explains how to use the online global TB database, was written by Hazim Timimi. The country profiles that appear in Annex 2, the regional profiles that appear in Annex 3 and the detailed tables showing data for key indicators for all countries in the latest year for which information is available (Annex 4) were also prepared by Hazim Timimi. The online technical appendix that explains the methods used to estimate the burden of disease caused by TB was prepared by Philippe Glaziou, Charalambos Sismanidis and Matteo Zignol. We thank Colin Mathers and Daniel Hogan of the WHO Mortality and Burden of Disease team for their careful review.

We thank Valérie Robert in the Global TB Programme's monitoring and evaluation unit for impeccable administrative support, Doris Ma Fat from the WHO Mortality and Burden of Disease team for providing TB mortality data extracted from the WHO Mortality Database, and Juliana Daher and Mary Mahy (UNAIDS) for providing epidemiological data that were used to estimate HIV-associated TB mortality.

The entire report was edited by Hilary Cadman, who we thank for her excellent work. We also thank, as usual, Sue Hobbs for her excellent work on the design and layout of this report. Her contribution, as always, was very highly appreciated.

The principal source of financial support for WHO's work on global TB monitoring and evaluation is the United States Agency for International Development (USAID), without which it would be impossible to produce the *Global Tuberculosis Report*. Production of the report was also supported by the governments of Japan and the Republic of Korea. We acknowledge with gratitude their support.

In addition to the core report team and those mentioned above, the report benefited from the input of many staff working in WHO regional and country offices and hundreds of people working for national TB programmes or within national surveillance systems who contributed to the reporting of data and to the review of report material

prior to publication. These people are listed below, organized by WHO region. We thank them all for their invaluable contribution and collaboration, without which this report could not have been produced.

Among the WHO staff not already mentioned above, we thank in particular Samiha Baghdadi, Hendrik Bekedam, Mirtha Del Granado, Khurshid Alam Hyder, Daniel Kibuga, Rafael López Olarte, André Ndongosieme, Nobu Nishikiori, Martiani Oktavis, Kefas Samson, Karam Shah, Achuthan Nair Sreenivas, Anna Volz, Lungten Wangchuk and Henriette Wembanyama for their major contribution to data collection and validation, and review and clearance of report material by countries in advance of publication.

## **WHO staff in Regional and Country Offices**

### **WHO African Region**

Boubacar Abdel Aziz, Abdoulaye Mariama Baïssa, Esther Aceng-Dokotum, Harura Adamu, Samuel Hermas Andrianarisoa, Javier Aramburu, Augusto Da Cruz Claudina, Ayodele Awe, Nayé Bah, Marie Catherine Barouan, Babou Bazie, Siriman Camara, Malang Coly, Davi Kokou Mawule, Eva De Carvalho, Noel Djemadji, Sithembile Dlamini-Nqeketo, Ismael Hassen Endris, Louisa Ganda, Boingotlo Gasennelwe, Carolina Cardoso da Silva Gomes, Patrick Hazangwe, Cornelia Hennig, Télesphore Houansou, Jean Iragena, Moses Jeuronlon, Michael Jose, Joel Kangangi, Kassa Hailu, Nzuzi Katondi, Khelifi Houria, Daniel Kibuga, Hillary Kipruto, Aristide Désiré Komangoya Nzonzo, Katherine Lao, Sharmila Lareef-Jah, Mwendaweli Maboshe, Leonard Mbemba, Mbumba Ngimbi Richard, Julie Mugabekazi, Christine Musanhu, Ahmada Nassuril, Andre Ndongosieme, Denise Nkezimana, Wilfred Nkhoma, Nicolas Nkiere, Abel Nkolo, Ghislaine Nkone Asseko, Ishmael Nyasulu, Samuel Ogiri, Daniel Olusoti, Amos Omoniyi, Hermann Ongouo, Philip Onyebujoh, Chijioke Osakwe, Felicia Owusu-Antwi, Philip Patrobas, Kalpesh Rahevar, Richard Oleko Rehan, Kefas Samson, Babatunde Sanni, Simkoko Neema Gideon, Susan Zimba-Tembo, Traore Tieble, Desta Tiruneh, Hubert Wang, Henriette Wembanyama, Addisalem Yilma, Assefash Zehaie.

### **WHO Region of the Americas**

Jean Seme Fils Alexandre, Monica Alonso Gonzalez, Angel Manuel Alvarez, Miguel Angel Aragón, Denise Arakaki, Pedro Avedillo, Carlos Ayala, Eldonna Boisson, Gustavo Bretas, Margarette Bury, David Chavarri, Beatriz Cohenca, Mirtha Del Granado, Thais dos Santos, Marcos Espinal, Ingrid García, Yitades Gebre, Massimo Ghidinelli, Guillermo Gonzalez, Percy Halkyer, Franklin Hernandez, Kathryn Vogel Johnston, Sandra Jones, Francisco Leon Bravo, Rafael Lopez Olarte, Fabio Moherdau, Roberto Montoya, Romeo Montoya, Alina Perez, Enrique Perez, Soledad Pérez, Giovanni Ravasi, Katia Romero, Jean Marie Rwangabwoba, Hans Salas, Alba Lidia Sánchez, Alfonso Tenorio, Jorge Victoria, Marcelo Vila, Anna Volz.

### **WHO Eastern Mediterranean Region**

Mohamed Abdel Aziz, Rehab Abdelhai, Ali Akbar, Samiha Baghdadi, Mai Eltigany Mohammed, Qutbuddin Kakar, Ali Reza Aloudel, Sindani Ireneaus Sebit, Sayed Karam Shah, Bashir Suleiman, Rahim Taghizadeh.

### **WHO European Region**

Andrei Dadu, Masoud Dara, Jamshid Gadoev, Saliya Karymbaeva, Valiantsin Rusovich, Bogdana Shcherbak-Verlan, Szabolcs Sziget, Gazmend Zhuri.

### **WHO South-East Asia Region**

Mohammad Akhtar, Vikarunnesa Begum, Hendrik Bekedam, Maria Regina Christian, Anupama Hazarika, Md Khurshid Alam Hyder, Navaratnasingam Janakan, Setiawan Jati Laksono, Partha Pratim Mandal, Giampaolo Mezzabotta, O Hyang Song, Martiani Oktavia, Ikushi Onozaki, Pant Sushil Dev, Malik Parmar, Ranjani Ramachandran, Mukta Sharma, Achuthan Nair Sreenivas, Dadang Supriyadi, Ugyen Wangchuk, Keshav Yogi.

### **WHO Western Pacific Region**

Shalala Ahmadova, Lepaitai Hansell, Cornelia Hennig, Tom Hiatt, Tauhid Islam, Narantuya Jadambaa, Ridha Jebeniani, Nobuyuki Nishikiori, Katsunori Osuga, Khanh Pham, Fabio Scano, Jacques Sebert, Yanni Sun, Mathida Thongseng, Subhash Yadav, Rajendra-Prasad Yadav.

## National respondents who contributed to reporting and verification of data

### WHO African Region

Abderramane Abdelrahim, Jean Louis Abena Foe, Felix Kwami Afutu, Gabriel Akang, Arlindo Amaral, Anagonou Séverin, Rado Andrianasolo, Aw Boubacar, Martha Awet, Georges Bakaswa Ntambwe, Ballé Boubakar, Adama Marie Bangoura, Jorge Noel Barreto, Wilfried Bekou, Serge Bisuta Fueza, Frank Adae Bonsu, Chiaa Khattry, Evangelista Chisakaitwa, Catherine Thomas Cooper, Abdoul Karim Coulibaly, Coulibaly Adjobi Fatou Tiépé, Isaias Dambe, Abdoulaye Diallo, Awa Helene Diop, Marie Sarr Diouf, Sicelo Samuel Dlamini, Themba Dlamini, Antoine De Padoue Etoundi Evouna, Alfred Etwom, Juan Eyene Acuresila, Lelisa Fekadu, Lynda Foray, Gilberto Frota, Evariste Gasana, Rahwa Tekle Gebreyesus, Abu George, Ntahizaniye Gérard, Belaineh Girma, Boukoulmé Hainga, Georges Hermana, Hainikoye Aoua Hima Oumarou, Adama Jallow, Lou Joseph, Madou Kane, Kanyerere Henry Shardreck, Nathan Kapata, Clara Chola Kasapo, James Katta, Dedeh Kesselly, Botshelo Tebogo Kgwaadira, Sidney Kololo, Aristide Désiré Komangoya-Nzonzo, Bakary Konaté, Patrick Konwloh, Kouakou Jacquemin, Kuye Oluwatoyin Joseph, Joseph Lasu, Gertrude Lay Ofali, Llang Maama, Mahoumbou Jocelyn, Lerole David Mametja, Ivan Manhica, Tseliso Marata, Josue Martins, Masini Enos, Sanele Masuku, Farai Mavhunga, Amanuel Hadgu Mebrahtu, Agnès Pascaline Mezene, Patrick Migambi, Louine Morel, Isidore Moyenga, Mpunga James Upile, Frank Mugabe Rwabinumi, Clifford Munyandi, Beatrice Mutayoba, Lindiwe Mvusi, Fulgence Ndayikengurukiye, Euphrasie Ndihekubwayo, Thaddée Ndikumana, Jacques Ndion-Ngandziens, Norbert Ndjeka, Faith Ngari, Lourenço Nhocuana, Emmanuel Nkiligi, Okemba-Okombil Franck Hardain, Seydou Mohamed Ouedraogo, Oumar Abdelhadi, Emile Rakotondramananana, Martin Rakotonjanahary, Thato Raleting, Adulai Gomes Rodrigues, Rujeedawa Mohammed Fezul, Samey Agbenyegan, Hamadi Samia, Charles Sandy, Kebba D Sanneh, Tandaogo Saouadogo, Siziba Nicholas, Alihalassa Sofiane, Addisalem Tefera, Celstino Francisco Teixeira, Albertina Thomas, Thusoyaone Titi Tsholofelo, Eric Ismaël Zoungrana.

### WHO Region of the Americas

Rosmond Adams, Sarita Aguirre García, Shalauddin Ahmed, Valentina Antonieta Alarcon Guizado, Xochil Alemán de Cruz, Mirian Alvarez, Aisha Andrewin, A. Alister Antoine, Denise Arakaki, Christopher Archibald, Carlos Alberto Marcos Ayala Luna, Patricia Bartholomay, Beltrame Soledad, Maria Bermudez, Martín Castellanos Joya, Jorge Castillo Carbajal, Cedeño Ugalde Annabell, Gemma Chery, Karolyn April Chong Castillo, Eric Commiesie, Mariela Contrera, Yaren Cruz, Carlos Vital Cruz Lesage, Ofelia Cuevas, Clara De la Cruz, Nilda De Romero, Dy-Juan DeRoza, Mercedes España Cedeño, Fernandez Hugo, Cecilia Ruth Figueroa Benites, Greta Franco, Victor Gallant, Julio Garay Ramos, Margarita Godoy, Roscio Gomez, Angela Graham, Tanya Green Douglas, Dorothea Hazel, Maria Henry, Tania Herrera, Olga T Joglar, Diana Khan, Adam Langer, Athelene Linton, Cecilia Lyons de Arango, Andrea Y Maldonado Saavedra, Marvin Manzanero, Belkys Marcelino, Antonio Marrero Figueroa, Ma. de Lourdes Martínez O, Timothy McLaughlin-Munroe, Angelica Medina, Mary Mercedes, Leilawati Mohammed, Jeetendra Mohanlall, Ernesto Moreno Naranjo, Francis Morey, Willy Morose, Denis Danny Mosqueira Salas, Slivia Yolanda Nazar, Alice Neymour, Cheryl Peek-Ball, Tomasa Portillo, Irad Potter, Robert Pratt, Manohar Singh Rajamanickam, Norma Lucrecia Ramirez Sagastume, Dottin Ramoutar, Anna Esther Reyes Godoy, Paul Ricketts, Andres Rincon, Ferosa Roache, Maria Rodriguez, Adalberto Rodriguez, Marcela Rojas Diaz, Myrian Román, Arelisabel Ruiz Guido, Hilda María Salazar Bolaños, Maritza Samayoa Peláez, Karla María Sánchez Mendoza, Nestor Segovia, Silva Tapia Guido Jonnathan, Joan Simon, Nicola Skyers, Natalia Sosa, Diana Sotto, Stijnberg Deborah, Suarez Alvarez Lourdes, Jackurlyn Sutton, Melissa Valdez, Daniel Vázquez, Ana María Vinuesa, Dorothea Bergen Weichselberger, Iyanna Wellington, Samuel Williams, Oritta Zachariah.

### WHO Eastern Mediterranean Region

Tariq Abdalla Abdallahim. Mohammad Abouzeid. Sonia Abu Loz. Nadia Abu Sabrah. Khawaia Laeeq Ahmad. Ahmadi

预览已结束，完整报告链接和二维码如下：

[https://www.yunbaogao.cn/report/index/report?reportId=5\\_26692](https://www.yunbaogao.cn/report/index/report?reportId=5_26692)

