WORLD MALARIA REPORT 2020

YEARS OF GLOBAL PROGRESS & CHALLENGES

World Health Organization

WORLD MALARIA REPORT 2020

YEARS OF GLOBAL PROGRESS & CHALLENGES

World Health Organization

World malaria report 2020: 20 years of global progress and challenges

ISBN 978-92-4-001579-1 (electronic version)
ISBN 978-92-4-001580-7 (print version)

Suggested citation. World malaria report 2020: 20 years of global progress and challenges. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at https://apps.who.int/iris.

Map production: WHO Global Malaria Programme and WHO Public Health Information and Geographic Systems.

Layout: Claude Cardot/designisgood.info
Cover design: Lushomo (Cape Town, South Africa)

Please consult the WHO Global Malaria Programme website for the most up-to-date version of all documents (https://www.who.int/teams/global-malaria-programme).

Printed in Luxembourg

Contents

Foreword vi
Acknowledgements ix
Abbreviations and acronyms xii
This year's report at a glance xiv
1. Introduction 1
2. Malaria milestones, 2000–2020 2
2.1 Laying the foundations 2
2.2 2000–2004 4
2.3 2005–2010 6
2.4 2011–2015 8
2.5 2016–2019 12
3. Global trends in the burden of malaria 18
3.1 Global estimates of malaria cases and deaths, 2000–2019 18
3.2 Estimated malaria cases and deaths in the WHO African Region, 2000–2019 22
3.3 Estimated malaria cases and deaths in the WHO South-East Asia Region, 2000–2019 24
3.4 Estimated malaria cases and deaths in the WHO Eastern Mediterranean Region, 2000–2019 26
3.5 Estimated malaria cases and deaths in the WHO Western Pacific Region, 2000–2019 28
3.6 Estimated malaria cases and deaths in the WHO Region of the Americas, 2000–2019 30
3.7 Estimated malaria cases and deaths in the WHO European Region, 2000–2019 31
3.8 Cases and deaths averted since 2000, globally and by WHO region 32
3.9 Burden of malaria in pregnancy 34
4. Elimination 38
4.1 Malaria elimination certification 38
4.2 E-2020 initiative 38
4.3 The Greater Mekong subregion 40
4.4 Prevention of re-establishment 41
5. High burden to high impact approach 42
5.1 Galvanizing political will, mobilizing resources and mobilizing community response 42
5.2 Using strategic information to drive impact 45
5.3 Improving WHO's malaria policy-making and dissemination processes 48
5.4 Coordinated response 48
5.5 Malaria in HBHI countries since 2018 48
5.6 Reported malaria cases in HBHI countries since 2018 and comparisons with estimated cases 48
6. Investments in malaria programmes and research 52
6.1 Funding trends for malaria control and elimination 52
6.2 Investments in malaria-related R&D 56
7. Distribution and coverage of malaria prevention, diagnosis and treatment 58
7.1 Distribution and coverage of ITNs 58
7.2 Population protected with IRS 62
7.3 Scale-up of SMC 63
7.4 Coverage of IPTp use by dose 64
7.5 Malaria diagnosis and treatment 65
8. Global progress towards the GTS milestones 70
8.1 Global progress 70
8.2 WHO African Region 74
8.3 WHO Region of the Americas 76
8.4 WHO Eastern Mediterranean Region 78
8.5 WHO South-East Asia Region 79
8.6 WHO Western Pacific Region 80

9. Biological threats 82
9.1 Deletions in *P. falciparum* histidine-rich protein 2 and protein 3 genes 82
9.2 Therapeutic efficacy of ACTs 83
9.3 The global prevalence of *PfKelch13* molecular mutations 88
9.4 Vector resistance to insecticides 88
10. Malaria response during the COVID-19 pandemic 92
10.1 The 2020 COVID-19 pandemic 92
10.2 Global workstreams on sustaining the malaria response during the COVID-19 pandemic 95
10.3 Global highlights in the malaria response during the COVID-19 pandemic 96
10.4 Country responses to mitigate global service disruptions 98
10.5 Levels of service disruption by country and implications for delivery of interventions 100
10.6 The consequences of service disruptions during the COVID-19 pandemic 104
11. Key results, context and conclusion 106
11.1 Key results 106
11.2 The enabling environment and threats to the malaria progress 107
11.3 Consequences of the COVID-19 pandemic 112
11.4 Building a more prosperous future 113
11.5 Concluding remarks 115
References 116
Annexes 123

Foreword

Dr Tedros Adhanom Ghebreyesus
Director-General
World Health Organization

In this year's *World malaria report*, WHO reflects on key milestones that have shaped the global response to the disease over the last 2 decades – a period of unprecedented success in malaria control that saw 1.5 billion cases averted and 7.6 million lives saved.

Following the end of the Global Malaria Eradication Programme in 1969, reduced political commitment and funding for malaria control led to resurgences of the disease in many parts of the world – particularly in Africa. While reliable data are scarce, hundreds of millions of people were likely infected with malaria, and tens of millions died.

Beginning in the 1990s, senior health leaders and scientists charted a course for a renewed response to malaria. Stepped-up investment in research and innovation led to the development of new disease-cutting tools, such as insecticide-treated nets, rapid diagnostic tests and more effective medicines.

The creation of new financing mechanisms – notably the Global Fund to Fight AIDS, Tuberculosis and Malaria and the US President's Malaria Initiative – coupled with a steep increase in malaria funding, enabled the wide-scale deployment of these tools, contributing to reductions in disease and death on a scale that had never been seen before.

Robust political commitment in Africa was key to success. Through the landmark 2000 Abuja Declaration, African leaders pledged to reduce malaria mortality on the continent by 50% over a 10-year timeframe.

According to our report, global malaria mortality fell by 60% over the period 2000 to 2019. The African Region achieved impressive reductions in its annual malaria death toll – from 680 000 in 2000 to 386 000 in 2019.

Countries in South-East Asia made particularly strong progress, with reductions in cases and deaths of 73% and 74%, respectively. India contributed to the largest drop in cases region-wide – from approximately 20 million to about 6 million.

Twenty-one countries have eliminated malaria over the last 2 decades and, of these, 10 countries were officially certified by WHO as malaria free. Countries of the Greater Mekong continue to make major gains, with a staggering 97% reduction in cases of *P. falciparum* malaria seen since 2000 – a primary target in view of the ongoing threat posed by antimalarial drug resistance.

A plateau in progress

Progress made since the beginning of the millennium has been truly astonishing. However, as seen in this report, the gains have levelled off – a trend observed over recent years.

In 2017, WHO warned that the global response to malaria had reached a "crossroads", and that key targets of WHO's global malaria strategy would likely be missed. Three years on, we continue to see a plateau in progress; according to our latest report, the strategy's 2020 targets for reductions in disease and death will be missed by 37% and 22%, respectively.

In 2020, COVID-19 emerged as an added – and formidable – challenge to malaria responses worldwide. In line with WHO guidance, many countries have adapted the way they deliver nets, diagnostics and medicines to ensure the safety of frontline health workers and communities. I wholeheartedly applaud these efforts, without which we would have likely seen much higher levels of mortality.

However, according to new WHO projections, even moderate disruptions in access to effective treatment could lead to a considerable loss of life. The report finds, for example, that a 25% disruption in access to effective antimalarial treatment in sub-Saharan Africa could lead to 46 000 additional deaths.

Reigniting progress

To reinvigorate progress, WHO catalysed the "high burden to high impact" (HBHI) approach in 2018, together with the RBM Partnership to End Malaria. The response is led by 11 countries – including 10 in sub-Saharan Africa – that account for approximately 70% of the world's malaria burden.

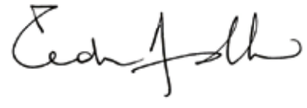
HBHI countries are moving away from a one-size-fits-all approach to malaria control – choosing instead to implement tailored responses based on local data and intelligence. While it is too early to evaluate the impact of this approach on malaria burden, important groundwork has been laid.

A recent analysis from Nigeria, for example, found that through an optimized mix of interventions the country could avert tens of millions of additional cases and thousands of additional deaths by the year 2023, compared with a business-as-usual approach.

A better targeting of malaria interventions and resources – particularly in countries like Nigeria, where the disease strikes hardest – will help speed the pace of progress towards our global malaria targets. Increased funding is also needed at domestic and international levels, together with innovations in new tools and approaches.

Crucially, efforts to combat malaria must be integrated with broader efforts to build strong health systems based on people-centred primary health care, as part of every country's journey towards universal health coverage.

It is time for leaders across Africa – and the world – to rise once again to the challenge of malaria – just as they did when they laid the foundation for the progress made since the beginning of this century. Through joint action, and a commitment to leaving no one behind, we can achieve our shared vision of a world free of malaria.



Acknowledgements

We are very grateful to the numerous people who contributed to the production of the *World malaria report 2020*. The following people collected and reviewed data from both malaria endemic and malaria free countries and areas:

Ahmad Mureed Muradi, Lutfullah Noori and Mohammad Shoaib Tamim (Afghanistan); Lammali Karima and Houria Khelifi (Algeria); Fernanda Francisco Guimarães and Fernanda Isabel Martins Da Graça Do Espirito Santo Alves (Angola); Malena Basilio and Yael Provecho (Argentina); Raja Alsaloom and Hasan Shuaib (Bahrain); Afsana Khan, Mya Ngon and Anjan K. Saha (Bangladesh); Kim Bautista (Belize); Telesphore Houansou and Aurore Ogouyomi-Hounto (Benin); Tobgyel Drukpa, Phurpa Tenzin and Sonam Wangdi (Bhutan); Raúl Marcelo Manjón Tellería (Bolivia [Plurinational State of]); Kentse Moakofhi, Mpho Mogopa, Davis Ntebela and Godira Segoea (Botswana); Cristianne Aparecida Costa Haraki, Franck Cardoso de Souza, Keyty Costa Cordeiro, Anderson Coutinho da Silva, Poliana de Brito Ribeiro Reis, Paloma Dias de Sousa, Francisco Edilson Ferreira de Lima Júnior, Klauss Kleydmann Sabino Garcia, Gilberto Gilmar Moresco, Marcela Lima Dourado, Paola Barbosa Marchesini, Márcia Helena Maximiano de Almeida, Joyce Mendes Pereira, Ronan Rocha Coelho, Edília Sâmela Freitas Santos, Pablo Sebastian Tavares Amaral and Marcelo Yoshito Wada (Brazil); Cheick S. Compaore and Laurent Moyenga (Burkina Faso); Dismas Baza and Juvénal Manirampa (Burundi); Carolina Cardoso da Silva Leite Gomes and Antonio Lima Moreira (Cabo Verde); Tol Bunkea (Cambodia); Abomabo Moise Hugue Rene and Etienne Nnomzo'o (Cameroon); Aristide Désiré Komangoya-Nzonzo and Christophe Ndoua (Central African Republic); Mahamat Idriss Djaskano and Honoré Djimrassengar (Chad); Wei Ding and Li Zhang (China); Eduin Pachón Abril (Colombia); Affane Bacar, Mohamed Issa Ibrahim and Ahamada Nassuri (Comoros); Hermann Ongouo and Jean-Mermoz Youndouka (Congo); Teresita Solano Chinchilla (Costa Rica); Tanoh Méa Antoine and N'goran Raphaël N'dri (Côte d'Ivoire); Kim Yun Chol, Nam Ju O and Gagan Sonal (Democratic People's Republic of Korea); Patrick Bahizi Bizoza, Hyacinthe Kaseya Ilunga, Bacary Sambou and Eric Mukomena Sompwe (Democratic Republic of the Congo); Basimike Mulenda (Djibouti); Keyla Urena (Dominican Republic); Monica Cañas Benavides and Julio Rivera (Ecuador); Angela Katherine Lao Seoane and Mathilde Riloha Rivas (Equatorial Guinea); Selam Mihreteab and Assefash Zehaie (Eritrea); Quinton Dhlamini, Kevin Makadzange and Zulisile Zulu (Eswatini); Henock Ejigu, Mebrahtom Haile and Bekele Worku (Ethiopia); Alice Sanna (French Guiana); Ghislaine Nkone Asseko and Okome Nze Gyslaine (Gabon); Momodou Kalleh and Sharmila Lareef-Jah (Gambia); Keziah Malm and Felicia Owusu-Antwi (Ghana); Ericka Lidia Chávez Vásquez (Guatemala); Siriman Camara and Nouman Diakite (Guinea); Inacio Alveranga and Paulo Djatá (Guinea-Bissau); Helen Imhoff (Guyana); Antoine Darlie (Haiti); Engels Banegas, Jessica Henriquez, Carlos Miranda, Jose Orlinder Nicolas, Raoul O'Connor and Nely Romero (Honduras); Neeraj Dhingra and Roop Kumari (India); Guntur Argana, Sri Budi Fajariyani, Herdiana Hasan Basri and M. Kez (Indonesia); Leila Faraji, Fatemeh Nikpoor and Ahmad Raeisi (Iran [Islamic Republic of]); James Kiarie and James Otieno (Kenya); Viengxay Vanisaveth (Lao People's Democratic Republic); Najib Achi (Lebanon); Moses Jeuronlon and Oliver J. Pratt (Liberia); Mauricette Andrianamanjara, Henintsoa Rabarijaona and Urbain Rabibizaka (Madagascar); Wilfred Dodoli, Austin Gumbo and Michael Kayange (Malawi); Jenarun Jelip (Malaysia); Sidibe Boubacar and Idrissa Cisse (Mali); Lemlih Baba and Sidina Mohamed Ghoulam (Mauritania); Frédéric Pages (Mayotte); Santa Elizabeth Ceballos Liceaga and Gustavo Sánchez Tejeda (Mexico); Balthazar Candrinho, Eva de Carvalho and Guidion Mathe (Mozambique); Md Rahman, Badri Thapa, Aung Thi and Tet Toe Tun (Myanmar); Rauha Jacob, Wilma Soroses and Petrina Uusiku (Namibia); Basu Dev Pandey, Subhash Lakhe and Prakash Prasad Shah (Nepal); Holvin Martin Gutierrez Perez (Nicaragua); Fatima Aboubakar and Hadiza Jackou (Niger); Audu Bala-Mohammed and Lynda Ozor (Nigeria); Hammad Habib (Pakistan); Lizbeth Cerezo and Santiago Cherigo (Panama); John Deli (Papua New Guinea); Cynthia Viveros (Paraguay); Cesar Bueno Cuadra (Peru); Raffy Deray, Kate Lopez and Maria Santa Portillo (Philippines); Jeong-Ran Kwon (Republic of Korea); Michee Kabera Semugunzu (Rwanda); Claudina Augusto da Cruz and Jose Alvaro Leal Duarte (Sao Tome and Principe); Mohammed

Hassan Al-Zahrani (Saudi Arabia); Ndella Diakhate and Medoune Ndiop (Senegal); Louisa Ganda and Samuel Juana Smith (Sierra Leone); John Leaburi (Solomon Islands); Abdi Abdillahi Ali, Ali Abdulrahmann, Abdikarim Hussein Hassan and Fahim Yusuf (Somalia); Mary Anne Groepe, Patrick Moonasar and Mbavhalelo Bridget Shandukani (South Africa); Harriet Akello Pasquale, Moses Jeuronlon and Moses Nganda (South Sudan); Navaratnasingam Janakan, Sumudu Karunaratna, Prasad Ranaweera and Preshila Samaraweera (Sri Lanka); Mariam Adam, Doha Elnazir and Abdalla Ibrahim (Sudan); Loretta Hardjopawiro (Suriname); Deyer Gopinath and Suravadee Kitchakarn (Thailand); Maria do Rosario de Fatima Mota, Rajesh Pandav and Manel Yapabandara (Timor-Leste); Kokou Mawule Davi and Tchassama Tchadjobo (Togo); Bayo Fatunmbi, Charles Katureebe, Paul Mbaka, John Opigo and Damian Rutazaana (Uganda); Abdullah Ali, Mohamed Haji Ali, Jovin Kitau, Anna Mahendeka, Ally Mohamed, Irene Mwoga and Ritha Njau (United Republic of Tanzania); Wesley Donald (Vanuatu); Licenciada América Rivero (Venezuela [Bolivarian Republic of]); Nguyen Quy Anh (Viet Nam); Moamer Mohammed Badi and Ryboon Saeed Al-Amoudi (Yemen); Japhet Chiwaula, Freddie Masaninga and Mutinta Mudenda (Zambia); and Anderson Chimusoro, Joseph Mberikunashe, Jasper Pasipamire and Ottias Tapfumanei (Zimbabwe).

We are grateful to the following people for their contribution:

Patrick Walker (Imperial College) contributed to the analysis of exposure to malaria infection during pregnancy and attributable low birthweight. Andre Marie Tchouatieu and Celine Audibert (Medicines for Malaria Venture [MMV]), and Paul Milligan (London School of Hygiene & Tropical Medicine) contributed to updating the section on seasonal malaria chemoprevention with the most up-to-date information on implementation and coverage. Manjiri Bhawalkar and Lisa Regis (Global Fund to Fight AIDS, Tuberculosis and Malaria [Global Fund]) supplied information on financial disbursements from the Global Fund. Adam Aspden and Nicola Wardrop (United Kingdom of Great Britain and Northern Ireland [United Kingdom] Department for International Development), and Adam Wexler and Julie Wallace (Kaiser Family Foundation) provided information on financial contributions for malaria control from the United Kingdom and the United States of America, respectively. Policy Cures Research used its G-FINDER data in the analysis of financing for malaria research and development, and wrote the associated section. John Milliner (Milliner Global Associates) provided information on long-lasting insecticidal nets delivered by manufacturers. The estimates of *Plasmodium falciparum* parasite prevalence and incidence in sub-Saharan Africa were produced by Daniel Weiss and Ewan Cameron of Malaria Atlas Project (MAP, led by Peter Gething, Curtin University and Telethon Kids Institute) and Samir Bhatt (Imperial College). Samir Bhatt, Amelia Bertozzi-Villa (Institute for Disease Modelling) and MAP collaborated to produce the estimates of insecticide-treated mosquito net (ITN) coverage for African countries using data from household surveys, ITN deliveries by manufacturers and ITNs distributed by national malaria programmes (NMPs). This research was funded by the Bill & Melinda Gates Foundation. With support from WHO, Bala Mohammed Audu, Ibrahim Maikore and Perpetua Uhomoibhi of the Nigeria National Malaria Elimination Programme (NMEP) led the subnational tailoring of interventions in Nigeria and Jaline Gerardin, Aadrita Nandi, Kamaldeen Okuneye, Ifeoma D. Ozodiegwu, Neena Parveen Dhanoa and Manuela Runge of Northwestern University, USA and Monique Ambrose and Caitlin Bever of Institute for Disease Modelling, USA assisted with the modelling of intervention impact projections in support of the Nigeria NMEP. Modelling of the impact of COVID-19 was contributed to by Peter Gething and Daniel Weiss with inputs from Samir Bhatt, Susan Rumisha (MAP) and Amelia Bertozzi-Villa. This research was funded by the Bill & Melinda Gates Foundation. Victor Alegana and Laurissa Suiyanka of Kenya Medical Research Institute (KEMRI) - Wellcome Trust Research Programme provided results of subnational analysis of concentration indices for socioeconomic equity in coverage of interventions, ITNs and treatment seeking. Tom McLean and Jason Richardson (Innovative Vector Control Consortium [IVCC]) provided national indoor residual spraying coverage and implementation data complementary to reported country information. Melanie Renshaw (African Leaders Malaria Alliance) and Marcy Erskine (Alliance for Malaria Prevention) provided information on the status of national ITN campaigns during the COVID-19 pandemic. Richard Steketee (United States President's Malaria Initiative [PMI]) reviewed the section on the malaria response during the COVID-19 pandemic. George Jagoe (MMV), Lisa Hare (PMI) and Andrea Bosman (World Health Organization [WHO] Global Malaria Programme [GMP]) contributed to the documentation of the global efforts to mitigate disruptions to diagnostics and antimalarials. Jennifer Armistead (PMI) provided insecticide resistance data on behalf of PMI. Gildas Yahouedo (WHO consultant) assisted with data compilation from publications. Colin Mathers (WHO consultant) and Bochen Cao (WHO Division of Data, Analytics and Delivery for Impact [DDI]) prepared estimates of malaria mortality in children aged under 5 years, on behalf of the Child Health Epidemiology Reference Group. Yonas Tegegn (WHO Country Representative to Uganda), Bayo Segun Fatunmbi (WHO Uganda Country Office) and Jimmy Opigo (NMP, Uganda) contributed to the documentation on the Mass Action Against Malaria (MAAM) initiative in Uganda.

The following WHO staff in regional and subregional offices assisted in the design of data collection forms; the collection and validation of data; and the review of epidemiological estimates, country profiles, regional profiles and sections:

- Ebenezer Sheshi Baba, Emmanuel Chanda, Akpaka A. Kalu, Steve Kubenga Banza and Jackson Sillah (WHO Regional Office for Africa [AFRO]);
- Spes Ntabangana (AFRO/Inter-country Support Team [IST] Central Africa);
- Khoti Gausi (AFRO/IST East and Southern Africa);
- Abderrahmane Kharchi Tfeil (AFRO/IST West Africa);
- Maria Paz Ade, Janina Chavez, Rainier Escalada, Blanca Escribano, Roberto Montoya, Dennis Navaroo Costa, Eric Ndofor and Prabhjot Singh (WHO Regional Office for the Americas);
- Samira Al-Eryani and Ghasem Zamani (WHO Regional Office for the Eastern Mediterranean);
- Elena Chulkova and Elkhan Gasimov (WHO Regional Office for Europe);
- Risintha Premaratne and Neena Valecha (WHO Regional Office for South-East Asia); and
- James Kelley (WHO Regional Office for the Western Pacific).

The maps for country and regional profiles were produced by MAP's Data Engineering team funded by the Bill & Melinda Gates Foundation. The map production was led and coordinated by Jen Rozier, with help from Joe Harris and Suzanne Keddie. Tolu Okitika coordinated MAP's contribution to this report.

We are also grateful to Kevin Marsh (University of Oxford), Emelda Okiro (Kenya Medical Research Institute – Wellcome Trust Research Programme) and Larry Slutsker (PATH) who graciously reviewed all sections and provided substantial comments for improvement; Nelly Biondi, Diana Estevez Fernandez and Jessica Chi Ying Ho (WHO) for statistics review; Tessa Edejer and Agnès Soucat (WHO) for review of economic evaluation and analysis; Egle Granziera and Claudia Nannini (WHO) for legal review; Martha Quiñones (WHO consultant) and Beatriz Galatas (WHO) for the translation of the foreword and key points into Spanish, and Amélie Latour (WHO consultant) and Laurent Bergeron (WHO) for the translation into French; and Hilary Cadman and the Cadman Editing Services team for technical editing of the report.

On behalf of the WHO Global Malaria Programme (GMP), the publication of the *World malaria report 2020* was coordinated by Abdisalan Noor. Significant contributions were made by Pedro Alonso, Laura Anderson, John Aponte, Maru Aregawi, Amy Barrette, Yuen Ching Chan, Tamara Ehler, Lucia Fernandez Montoya, Beatriz Galatas, Mwalenga Nghipumbwa, Peter Olumese, Edith Patouillard, Alastair Robb, David Schellenberg and Ryan Williams. Laurent Bergeron (WHO GMP) provided programmatic support for overall management of the project. The editorial committee for the report comprised Pedro Alonso, Andrea Bosman, Jan Kolaczinski, Kimberly Lindblade, Leonard Ortega, Pascal Ringwald, Alastair Robb and David Schellenberg from the WHO GMP. Additional reviews were received from colleagues in the GMP: Jane Cunningham, Xiao Hong Li, Charlotte Rasmussen, Silvia Schwarte, Erin Shutes and Saira Stewart. Report layout, design and production were coordinated by Laurent Bergeron.

Funding for the production of this report was gratefully received from the Bill & Melinda Gates Foundation; the Global Fund; the Government of China; the Spanish Agency for International Development Cooperation; Unitaid; the United Nations Office for Project Services (UNOPS); and the United States Agency for International Development (USAID).

Abbreviations and acronyms

ACT	artemisinin-based combination therapy
AIDS	acquired immunodeficiency syndrome
AIM	*Action and investment to defeat malaria 2016–2030*
AL	artemether-lumefantrine
ALMA	African Leaders Malaria Alliance
AMFm	Affordable Medicines Facility-malaria
An.	*Anopheles*
ANC	antenatal care
AQ	amodiaquine
AS	artesunate
BAU	business as usual
CDC	Centers for Disease Control and Prevention
CI	confidence interval
CQ	chloroquine
CRS	creditor reporting system
DAC	Development Assistance Committee
DHA-PPQ	dihydroartemisinin-piperaquine
DHIS2	District Health Information Software 2
DHS	demographic and health survey
E-2020	eliminating countries for 2020
EDCTP	European and Developing Countries Clinical Trials Partnership
FIND	Foundation for Innovative New Diagnostics
GDP	gross domestic product
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GMAP	Global Malaria Action Plan for a malaria free world
GMP	Global Malaria Programme
GMS	Greater Mekong subregion
GPARC	Global Plan for Artemisinin Resistance Containment
GTS	*Global technical strategy for malaria 2016–2030*
HBHI	high burden to high impact
HCQ	hydroxychloroquine
HIV	human immunodeficiency virus
HRP	histidine-rich protein
IPTi	intermittent preventive treatment in infants
IPTp	intermittent preventive treatment in pregnancy
IQR	interquartile range
IRS	indoor residual spraying
IST	Inter-country Support Team
ITN	insecticide-treated mosquito net
IVCC	Innovative Vector Control Consortium
LBW	low birthweight
LGA	local government authority
LLIN	long-lasting insecticidal net
LMIC	low- and middle-income countries
LSHTM	London School of Hygiene & Tropical Medicine
MAAM	Mass Action Against Malaria
MAP	Malaria Atlas Project
MCEE	Maternal and Child Health Epidemiology Estimation Group
MDG	Millennium Development Goal
MEDB	Malaria Elimination Database
MIS	malaria indicator survey
MME	Mekong Malaria Elimination
MMV	Medicines for Malaria Venture
MPAC	Malaria Policy Advisory Committee
MQ	mefloquine
NMEP	National Malaria Elimination Programme
NMP	national malaria programme
NMSP	national malaria strategic plan
OECD	Organisation for Economic Co-operation and Development
P.	*Plasmodium*
PBO	piperonyl butoxide
pfhrp	*Plasmodium falciparum* histidine-rich protein
pLDH	*Plasmodium* lactate dehydrogenase
PMI	President's Malaria Initiative
PPE	personal protective equipment
PQ	primaquine
PY	pyronaridine
R&D	research and development
RAI	Regional Artemisinin-resistance Initiative
RDT	rapid diagnostic test
SAGme	Strategic Advisory Group for Malaria Eradication
SARS-CoV2	severe acute respiratory syndrome coronavirus 2
SDG	Sustainable Development Goal
SMC	seasonal malaria chemoprevention
SP	sulfadoxine-pyrimethamine
TDR	Special Programme for Research and Training in Tropical Diseases
TES	therapeutic efficacy studies
UHC	universal health coverage
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
United Kingdom	United Kingdom of Great Britain and Northern Ireland
US	United States
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization
WHO-CHOICE	WHO-CHOosing Interventions that are Cost-Effective

This year's report at a glance

TRENDS IN THE BURDEN OF MALARIA

Malaria cases

- Globally, there were an estimated 229 million malaria cases in 2019 in 87 malaria endemic countries, declining from 238 million in 2000. At the *Global technical strategy for malaria 2016–2030* (GTS) baseline of 2015, there were 218 million estimated malaria cases.
- The proportion of cases due to *Plasmodium vivax* reduced from about 7% in 2000 to 3% in 2019.
- Malaria case incidence (i.e. cases per 1000 population at risk) reduced from 80 in 2000 to 58 in 2015 and 57 in 2019 globally. Between 2000 and 2015, global malaria case incidence declined by 27%, and between 2015 and 2019 it declined by less than 2%, indicating a slowing of the rate of decline since 2015.
- Twenty-nine countries accounted for 95% of malaria cases globally. Nigeria (27%), the Democratic Republic of the Congo (12%), Uganda (5%), Mozambique (4%) and Niger (3%) accounted for about 51% of all cases globally.
- The World Health Organization (WHO) African Region, with an estimated 215 million cases in 2019, accounted for about 94% of cases.
- Although there were fewer malaria cases in 2000 (204 million) than in 2019 in the WHO African Region, malaria case incidence reduced from 363 to 225 cases per 1000 population at risk in this period, reflecting the complexity of interpreting changing disease transmission in a rapidly increasing population. The population living in the WHO African Region increased from about 665 million in 2000 to 1.1 billion in 2019.
- The WHO South-East Asia Region accounted for about 3% of the burden of malaria cases globally. Malaria cases reduced by 73%, from 23 million in 2000 to about 6.3 million in 2019. Malaria case incidence in this region reduced by 78%, from about 18 cases per 1000 population at risk in 2000 to about four cases in 2019.
- India contributed to the largest absolute reductions in the WHO South-East Asia Region, from about 20 million cases in 2000 to about 5.6 million in 2019. Sri Lanka was certified malaria free in 2015, and Timor-Leste reported zero malaria cases in 2018 and 2019.
- Malaria cases in the WHO Eastern Mediterranean Region reduced by 26%, from about 7 million cases in 2000 to about 5 million in 2019. About a quarter of the cases in 2019 were due to *P. vivax*, mainly in Afghanistan and Pakistan.
- Over the period 2000–2019, malaria case incidence in the WHO Eastern Mediterranean Region declined from 20 to 10. Sudan is the leading contributor to malaria in this region, accounting for about 46% of cases. The Islamic Republic of Iran had no indigenous malaria cases in 2018 and 2019.
- The WHO Western Pacific Region had an estimated 1.7 million cases in 2019, a decrease of 43% from the 3 million cases in 2000. Over the same period, malaria case incidence reduced from five to two cases per 1000 population at risk. Papua New Guinea accounted for nearly 80% of all cases in this region in 2019. China has had no indigenous malaria cases since 2017. Malaysia had no cases of human malaria in 2018 and 2019.
- In the WHO Region of the Americas, malaria cases reduced by 40% (from 1.5 million to 0.9 million) and case incidence by 57% (from 14 to 6). The region's progress in recent years has suffered from the major increase in malaria in Venezuela (Bolivarian Republic of), which had about 35 500 cases in 2000, rising to over 467 000 by 2019. Brazil, Colombia and Venezuela (Bolivarian Republic of) account for over 86% of all cases in this region.
- Since 2015, the WHO European Region has been free of malaria.

Malaria deaths

- Globally, malaria deaths have reduced steadily over the period 2000–2019, from 736 000 in 2000 to 409 000 in 2019. The percentage of total malaria deaths among children aged under 5 years was 84% in 2000 and 67% in 2019. The global estimate of deaths in 2015, the GTS baseline, was about 453 000.
- Globally, the malaria mortality rate (i.e. deaths per 100 000 population at risk) reduced from about 25 in 2000 to 12 in 2015 and 10 in 2019, with the slowing of the rate of decline in the latter years.
- About 95% of malaria deaths globally were in 31 countries. Nigeria (23%), the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), Mozambique (4%), Niger (4%) and Burkina Faso (4%) accounted for about 51% of all malaria deaths globally in 2019.
- Malaria deaths in the WHO African Region reduced by 44%, from 680 000 in 2000 to 386 000 in 2019, and the malaria mortality rate reduced by 67% over the same period, from 121 to 40 deaths per 100 000 population at risk.
- In the WHO South-East Asia Region, malaria deaths reduced by 74%, from about 35 000 in 2000 to 9 000 in 2019.
- India accounted for about 86% of all malaria deaths in the WHO South-East Asia Region.
- In the WHO Eastern Mediterranean Region, malaria deaths reduced by 16%, from about 12 000 in 2000 to 10 100 in 2019, and the malaria mortality rate reduced by 50%, from four to two deaths per 100 000 population at risk.
- In the WHO Western Pacific Region, malaria deaths reduced by 52%, from about 6600 cases in 2000 to 3200 in 2019, and the mortality rate reduced by 60%, from one to 0.4 malaria deaths per 100 000 population at risk. Papua New Guinea accounted for over 85% of malaria deaths in 2019.
- In the WHO Region of the Americas, malaria deaths reduced by 39% (from 909 to 551) and mortality rate by 50% (from 0.8 to 0.4). Over 70% of malaria deaths in 2019 in this region were in Venezuela (Bolivarian Republic of).

Malaria cases and deaths averted

- Globally, an estimated 1.5 billion malaria cases and 7.6 million malaria deaths have been averted in the period 2000–2019.
- Most of the cases (82%) and deaths (94%) averted were in the WHO African Region, followed by the WHO South-East Asia Region (cases 10% and deaths 3%).

Burden of malaria in pregnancy

- In 2019, in 33 moderate to high transmission countries in the WHO African Region, there were an estimated 33 million pregnancies, of which 35% (12 million) were exposed to malaria infection during pregnancy.
- By WHO subregion, Central Africa had the highest prevalence of exposure to malaria during pregnancy (40%), closely followed by West Africa (39%), while prevalence was 24% in East and Southern Africa.
- It is estimated that malaria infection during pregnancy in these 33 countries resulted in 822 000 children with low birthweight.
- If up to 80% of pregnant women who reported using antenatal care (ANC) services once were to receive one dose of intermittent preventive treatment in pregnancy (IPTp), an additional 56 000 low birthweights would be averted in these 33 countries.

MALARIA ELIMINATION AND PREVENTION OF RE-ESTABLISHMENT

- Globally, the number of countries that were malaria endemic in 2000 and that reported fewer than 10 000 malaria cases increased from 26 in 2000 to 46 in 2019.
- In the same period, the number of countries with fewer than 100 indigenous cases increased from six to 27.
- In the period 2010–2019, total malaria cases in the 21 E-2020 countries reduced by 79%.
- There were more cases in 2019 than in 2018 in Comoros, Costa Rica, Ecuador and Suriname, which reported 1986, 25, 150 and 66 additional cases, respectively.
- Iran (Islamic Republic of), Malaysia and Timor-Leste reported zero indigenous malaria cases in 2018 and 2019. In 2019, Belize and Cabo Verde reported zero indigenous malaria cases for the first time since 2000.
- China and El Salvador had no indigenous malaria cases for a third consecutive year and have made a formal request for certification.
- Between 2000 and 2019, in the six countries of the Greater Mekong subregion (GMS) – Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – *P. falciparum* malaria cases fell by 97%, while all malaria cases fell by 90%. Of the 239 000 malaria cases reported in 2019, 65 000 were *P. falciparum* cases.
- The rate of decline has been fastest since 2012, when the Mekong Malaria Elimination (MME) programme was launched. During this period, malaria cases reduced sixfold, while *P. falciparum* cases reduced by a factor of nearly 14.
- Overall, Cambodia (58%) and Myanmar (31%) accounted for most cases of malaria in the GMS.
- This accelerated decrease in *P. falciparum* is especially critical because of increasing drug resistance; in the GMS, *P. falciparum* parasites have developed partial resistance to artemisinin, the core compound of the best available antimalarial drugs.
- Between 2000 and 2019, no country that was certified malaria free has been found to have malaria transmission re-established.

HIGH BURDEN TO HIGH IMPACT APPROACH

- Since November 2018, the high burden to high impact (HBHI) approach has been launched in 10 of the 11 countries (it has not yet been launched in Mali owing to disruptions due to the COVID-19 pandemic). However, all 11 countries have implemented HBHI-related activities across the four response elements.
- In each HBHI country initiation, there has been high-level political engagement and support. The Mass Action Against Malaria initiative in Uganda is presented as an example of a country-led process of political engagement at all levels, and multisectoral and community mobilization.
- Analysis for subnational tailoring of interventions has been completed in all countries except Mali, where this work is in progress. The example of Nigeria is presented in the report.
- All countries have committed to conduct a comprehensive exercise of urban microstratification to better target interventions and improve efficiencies given the increasing rate of urbanization.
- The WHO Global Malaria Programme (GMP) updated its technical brief to support countries to better prioritize resources, while adhering to the evidence-based recommendations that have been developed through WHO's standard, stringent processes.
- Because the HBHI response was launched in November 2018, when countries were coming to the end of their funding cycles, it is too soon to determine the impact of the response. The numbers of malaria cases in the 11 HBHI countries in 2019 were similar to 2018 (156 million versus 155 million).

PROGRESS TOWARDS THE GTS MILESTONES OF 2020

- The GTS aims for a reduction in malaria case incidence and mortality rate of at least 40% by 2020, 75% by 2025 and 90% by 2030 from a 2015 baseline.
- The 2000–2019 trends in malaria cases and deaths were used to make annual projections from 2020 to 2030, to track progress towards the targets and milestones of the GTS.
- The projections presented in this report *do not* account for potential disruptions due to the COVID-19 pandemic, which – despite commendable global and national efforts to maintain essential malaria services – is likely to lead to higher than expected malaria morbidity and mortality.
- Despite the considerable progress made since 2000, the GTS 2020 milestones for morbidity and mortality will not be achieved globally.
- Malaria case incidence of 56 cases per 1000 population at risk in 2020 instead of the expected 35 cases per 1000 if the world was on track for the 2020 GTS morbidity milestone means that, globally, we are off track by 37% at the current trajectory.
- Although relative progress in the mortality rate is greater than that in case incidence, globally projected malaria deaths per 100 000 population at risk in 2020 was 9.8, reducing from 11.9 in 2015, implying that the world was off track for the 2020 GTS mortality milestone by 22%.
- Of the 92 countries that were malaria endemic globally in 2015, 31 (34%) were estimated to be on track for the GTS morbidity milestone for 2020, having achieved 40% or more reduction in case incidence or reported zero malaria cases.
- Twenty-one countries (23%) had made progress in reducing malaria case incidence but were not on track for the GTS milestone.
- Thirty-one countries (34%) are estimated to have increased incidence, with 15 countries (16%) estimated to have an increase of 40% or more in malaria case incidence in 2020 compared with 2015.
- Malaria case incidence in nine countries (10%) in 2020 was estimated to be at levels similar to those of 2015.
- Thirty-nine countries (42%) that were malaria endemic in 2015 were on track for the GTS mortality milestone for 2020, with 28 of them reporting zero malaria cases.
- Thirty-four countries (37%) were estimated to have achieved reductions in malaria mortality rates but progress was below the 40% target.
- Malaria mortality rates remained at the same level in 2020 as 2015 in seven countries (8%), whereas there were estimated increases in another 12 countries (13%), six of which had increases of 40% or more.
- All countries in the WHO South-East Asia Region were on track for both the morbidity and mortality 2020 GTS milestones.

INVESTMENTS IN MALARIA PROGRAMMES AND RESEARCH

- The GTS sets out estimates of the funding required to achieve milestones for 2020, 2025 and 2030. Total annual resources needed were estimated at US$ 4.1 billion in 2016, rising to US$ 6.8 billion in 2020. An additional US$ 0.72 billion is estimated to be required annually for global malaria research and development (R&D).
- Total funding for malaria control and elimination in 2019 was estimated at US$ 3.0 billion, compared with US$ 2.7 billion in 2018 and US$ 3.2 billion in 2017. The amount invested in 2019 falls short of the US$ 5.6 billion estimated to be required globally to stay on track towards the GTS milestones.

- The funding gap between the amount invested and the resources needed has continued to widen dramatically over recent years, increasing from US$ 1.3 billion in 2017 to US$ 2.3 billion in 2018, and to US$ 2.6 billion in 2019.
- Over the period 2010–2019, international sources provided 70% of the total funding for malaria control and elimination, led by the United States of America (USA), the United Kingdom of Great Britain and Northern Ireland (United Kingdom) and France.
- Of the US$ 3.0 billion invested in 2019, US$ 2.1 billion came from international funders. The highest contributions in 2019 were from the government of the USA, which provided a total of US$ 1.1 billion through planned bilateral funding and contributions to multilateral funding agencies.
- This was followed by bilateral and multilateral disbursements from the United Kingdom of US$ 0.2 billion, contributions of over US$ 0.1 billion from each of France, Germany and Japan (totalling US$ 0.4 billion), and a combined US$ 0.4 billion from other countries that are members of the Development Assistance Committee and from private sector contributors.
- Governments of malaria endemic countries continued to contribute about 30% of the total funding, with investments nearing US$ 0.9 billion in 2019. Of this amount, an estimated US$ 0.2 billion was spent on malaria case management in the public sector and US$ 0.7 billion on other malaria control activities.
- Of the US$ 3.0 billion invested in 2019, nearly US$ 1.2 billion (39%) was channelled through the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund). Compared with 2018, the Global Fund's disbursements to malaria endemic countries increased by about US$ 0.2 billion in 2019.
- Of the US$ 3.0 billion invested in 2019, about 73% went to the WHO African Region, 9% to the WHO South-East Asia Region, 5% each to the WHO Region of the Americas and the WHO Western Pacific Region, and 4% to the WHO Eastern Mediterranean Region.
- Between 2007 and 2018, almost US$ 7.3 billion was invested in basic research and product development for malaria.
- The malaria R&D funding landscape has been led by investment in drugs (US$ 2.6 billion, 36% of malaria funding between 2007 and 2018), followed by relatively similar shares for basic research (US$ 1.9 billion, 26%) and vaccines R&D (US$ 1.8 billion, 25%). Investments in vector control products and diagnostics were notably lower, reaching overall totals of US$ 453 million (6.2%) and US$ 185 million (2.5%), respectively.
- Between 2007 and 2018, the public sector held a leading role in malaria R&D funding, growing from US$ 246 million in 2007 to a peak of US$ 365 million in 2017. Within the public sector and among all malaria R&D funders, the US National Institutes of Health was the largest contributor, focusing just over half of its US$ 1.9 billion investment into basic research (US$ 1.02 billion, 54% of its overall malaria investment between 2007 and 2018).
- The Bill & Melinda Gates Foundation has been another instrumental player, investing US$ 1.8 billion (25% of all malaria R&D funding) between 2007 and 2018, and supporting the clinical development of key innovations such as the RTS,S vaccine.

DISTRIBUTION AND COVERAGE OF MALARIA PREVENTION

- Manufacturers' delivery data for 2004–2019 show that nearly 2.2 billion insecticide-treated mosquito nets (ITNs) were supplied globally in that period, of which 1.9 billion (86%) were supplied to sub-Saharan Africa.
- Manufacturers delivered about 253 million ITNs to malaria endemic countries in 2019, an increase of 56 million ITNs compared with 2018. About 84% of these ITNs were delivered to countries in sub-Saharan Africa.

- By 2019, 68% of households in sub-Saharan Africa had at least one ITN, increasing from about 5% in 2000. The percentage of households owning at least one ITN for every two people increased from 1% in 2000 to 36% in 2019. In the same period, the percentage of the population with access to an ITN within their household increased from 3% to 52%.
- The percentage of the population sleeping under an ITN also increased considerably between 2000 and 2019, for the whole population (from 2% to 46%), for children aged under 5 years (from 3% to 52%) and for pregnant women (from 3% to 52%).
- The most recent household survey data from demographic and health surveys (DHS) and malaria indicator surveys (MIS) from 24 countries in sub-Saharan Africa from 2015 to 2019 were used to analyse socioeconomic equity in the use of ITNs. In most West African countries, ITN use was generally pro-poor or close to perfect equality. In contrast, ITN use was higher in wealthier households in many parts of Central and East Africa.
- Globally, the percentage of the population at risk protected by indoor residual spraying (IRS) in malaria endemic countries declined from 5% in 2010 to 2% in 2019. The percentage of the population protected by IRS decreased in all WHO regions.
- The number of people protected globally fell from 180 million in 2010 to 115 million in 2015, but declined to 97 million in 2019.
- The number of children reached with at least one dose of seasonal malaria chemoprevention (SMC) steadily increased, from about 0.2 million in 2012 to about 21.5 million in 2019.
- In the 13 countries that implemented SMC, a total of about 21.7 million children were targeted in 2019. On average, 21.5 million children received treatment.
- Using data from 33 African countries, the percentage of IPTp use by dose was computed. In 2019, 80% of pregnant women used ANC services at least once during their pregnancy. About 62% of pregnant women received IPTp1 and 49% received IPTp2. There was a slight increase in IPTp3 coverage, from 31% in 2018 to 34% in 2019.

DISTRIBUTION AND COVERAGE OF MALARIA DIAGNOSIS AND TREATMENT

- Globally, 2.7 billion rapid diagnostic tests (RDTs) for malaria were sold by manufacturers in 2010–2019, with nearly 80% of these sales being to sub-Saharan African countries. In the same period, national malaria programmes (NMPs) distributed 1.9 billion RDTs – 84% in sub-Saharan Africa.
- In 2019, 348 million RDTs were sold by manufacturers and 267 million distributed by NMPs. RDT sales and distributions in 2019 were lower than those reported in 2018, by 63 million and 24 million, respectively, with most decreases being in sub-Saharan Africa.
- More than 3.1 billion treatment courses of artemisinin-based combination therapy (ACT) were sold globally by manufacturers in 2010–2019. About 2.1 billion of these sales were to the public sector in malaria endemic countries, and the rest were sold through either public or private sector co-payments (or both), or exclusively through the private retail sector.
- National data reported by NMPs show that, in the same period, 1.9 billion ACTs were delivered to health service providers to treat malaria patients in the public health sector.
- In 2019, some 190 million ACTs were sold by manufacturers for use in the public health sector; in that same year, 183 million ACTs were distributed to this sector by NMPs, of which 90% were in sub-Saharan Africa.
- Aggregated data from household surveys conducted in sub-Saharan Africa between 2005 and 2019 in 21 countries with at least two surveys (baseline 2005–2011, and most recent 2015–2019) in this period were used to analyse coverage of treatment seeking, diagnosis and use of ACTs in children aged under 5 years.

- Comparing the baseline and latest surveys, there was little change in prevalence of fever within the 2 weeks preceding the surveys (median 24% versus 21%) and treatment seeking for fever (median 64% versus 69%).
- Comparisons of the source of treatment between the baseline and more recent surveys show that a median 63% versus 71% received care from public health facilities, and a median 39% versus 30% received care from the private sector. Use of community health workers was low in both periods, at a median of less than 2%.
- The rate of diagnosis among children aged under 5 years for whom care was sought increased considerably, from a median of 15% at baseline to 38% in the latest household surveys.
- Use of ACTs also increased more than threefold, from 39% at baseline to 81% in the latest surveys when all children with fever for whom care was sought were considered.
- Among those who received a finger or heel prick, use of ACTs was 42% in the most recent survey, suggesting that many children received ACTs without parasitological diagnosis.
- Analysis of equity of fever prevalence and treatment seeking at subnational level shows that in most countries, children in poorer households had a higher prevalence of fever in the 2 weeks preceding the household surveys.
- In contrast, treatment seeking was higher in febrile children from wealthier households in all subnational units, although in some units that difference was small.

BIOLOGICAL THREATS

Parasite deletions of *pfhrp2/3* genes

- Deletions in the *pfhrp2* and *pfhrp3* (*pfhrp2/3*) genes of the parasite renders parasites undetectable by RDTs based on histidine-rich protein 2 (HRP2).
- WHO has recommended that countries with reports of *pfhrp2/3* deletions or neighbouring countries should conduct representative baseline surveys among suspected malaria cases to determine whether the prevalence of *pfhrp2/3* deletions causing false negative RDT results has reached a threshold for RDT change (>5% *pfhrp2* deletions causing false negative RDT results).
- Alternative RDT options (e.g. based on detection of the *Plasmodium* lactate dehydrogenase [pLDH]) are limited; in particular, there are currently no WHO-prequalified non-HRP2 combination tests that can detect and distinguish between *P. falciparum* and *P. vivax*.
- WHO is tracking published reports of *pfhrp2/3* deletions using the Malaria Threats Map mapping tool, and is encouraging a harmonized approach to mapping and reporting of *pfhrp2/3* deletions through publicly available survey protocols.
- Among the 39 reports published by 39 countries, 32 (82%) reported *pfhrp2* deletions; however, variable methods in sample selection and laboratory analysis mean that the scale and scope of clinically significant *pfhrp2/3* deletions is still unclear.
- Between 2019 and September 2020, investigations for *pfhrp2/3* deletions were reported in 16 publications from 15 countries. *Pfhrp2/3* deletions were confirmed in 12 reports from 11 countries: China, Equatorial Guinea, Ethiopia, Ghana, Myanmar, Nigeria, Sudan, Uganda, United Kingdom (imported from various malaria endemic countries), the United Republic of Tanzania and Zambia. No deletions were identified in France (among returning travellers), Haiti, Kenya and Mozambique.

Parasite resistance to antimalarial drugs

- *PfKelch13* mutations have been identified as molecular markers of partial artemisinin resistance.
- In the WHO African Region, the first-line treatments for *P. falciparum* include artemether-lumefantrine (AL), artesunate-amodiaquine (AS-AQ) and dihydroartemisinin-piperaquine (DHA-PPQ). The overall average efficacy rates for *P. falciparum* – 98.0% for AL, 98.4% for AS-AQ and 99.4% for DHA-PPQ – remained consistent over time. Treatment failure rates of more than 10% were observed in four studies of AL but can be considered statistical outliers. There is no evidence of confirmed lumefantrine resistance in Africa. For all other medicines, treatment failure rates remain below 10%.
- The first-line treatments for *P. falciparum* in the WHO Region of the Americas include AL, artesunate-mefloquine (AS-MQ) and chloroquine (CQ). Efficacy of AL and AS-MQ remains high. One study of CQ from Bolivia (Plurinational State of) in 2011 detected a treatment failure rate of 10.4%.
- The first-line treatments for *P. falciparum* in the WHO South-East Asia Region include AL, artesunate-sulfadoxine-pyrimethamine (AS+SP), and DHA-PPQ. Therapeutic efficacy studies (TES) of AL demonstrated high treatment efficacy in Bhutan, India, Myanmar, Nepal and Timor-Leste. AL treatment failure rates exceeded 10% in three studies, one in Thailand and two in Bangladesh. Following high rates of AS+SP treatment failure in the north-eastern provinces, in 2013, India changed its treatment policy in those provinces to AL; AS+SP remains effective elsewhere in the country. TES findings in Thailand led to the adoption of DHA-PPQ as the first-line treatment in 2015. In Thailand, moderate to high rates of treatment failure were observed with DHA-PPQ in the eastern part of the country; thus, Thailand is currently recommending treatment with artesunate-pyronaridine (AS-PY) in this area.
- AL and AS+SP remain efficacious in the countries that use them as first-line treatment in the WHO Eastern Mediterranean Region.
- The first-line treatments for *P. falciparum* in the WHO Western Pacific Region are AL in all malaria endemic countries except China, where AS-AQ is used. AL treatment failure rates were 10% or less in four studies in Lao People's Democratic Republic, but those studies did not have the recommended sample sizes. A study with an adequate number of patients is currently underway to further investigate these high rates of treatment failure.
- Artemisinin partial resistance emerged independently in several foci in the GMS. WHO continues to monitor the situation, which has evolved rapidly since the first detections of *PfKelch13* mutations in the GMS. Some mutations have disappeared, whereas the prevalence of others has increased.
- Currently, the most prevalent markers west of Bangkok (western Thailand and Myanmar) are F446I, M476I and R561H. The most prevalent markers east of Bangkok (eastern Thailand, Cambodia, Lao People's Democratic Republic and Viet Nam) are Y493H and P553L. Two markers, R539T and C580Y, are also highly prevalent in both areas. The change in treatment policy in Cambodia from DHA-PPQ to AS-MQ resulted in a reduction in the prevalence of strains carrying both C580Y and PPQ resistance.
- Rwanda has detected an increasing prevalence of the R561H mutation, a validated marker that emerged independently in the GMS between 2012 and 2015. The presence of this mutation was confirmed in Rwanda in 2018; however, so far it seems that delayed clearance associated with this mutation has not affected the efficacy of the ACTs that are currently among those tested and used in Rwanda.
- The R622I mutation seems to be appearing independently in Africa, having been found in Eritrea, Ethiopia, Somalia and Sudan, and with increasing frequency in the Horn of Africa. The ACTs used in these four countries remain effective, despite the presence of the mutation. Further investigation of delayed parasite clearance is needed in this region.
- In Guyana, the C580Y mutation also emerged independently between 2010 and 2017. However, in recent studies (including surveys and TES), 100% of samples were found to be wild type, indicating that the mutation may be disappearing in Guyana.

Vector resistance to insecticides

- From 2010 to 2019, some 81 countries reported data on standard insecticide resistance monitoring to WHO.
- Concerningly, between 2010 and 2019, 57% of the countries that reported using IRS did not report the status of insecticide resistance for every insecticide class used in the year of implementation or the preceding one, and 14% did not report the status of resistance for any insecticide class used. Malaria endemic countries are highly encouraged to ensure adequate monitoring of insecticide resistance to classes that are in use or under consideration for use in malaria vector control interventions, and to prioritize monitoring these classes.
- Of the 82 malaria endemic countries that provided data for 2010–2019, 28 have detected resistance to all four of the most commonly used insecticide classes in at least one malaria vector and one collection site, and 73 have detected resistance to at least one insecticide class. Only eight countries have not detected resistance to any insecticide class so far.
- Globally, resistance to pyrethroids – the only insecticide class currently used in ITNs – continues to be widespread. It was detected in at least one malaria vector in 69.9% of the sites for which data were available. Resistance to organochlorines was reported in 63.4% of the sites. Resistance to carbamates and organophosphates was less prevalent, being detected in 31.7% and 24.9% of the sites that reported monitoring data, respectively.
- Based on insecticide resistance monitoring data reported to WHO by Member States, a total of 330 areas in 33 countries currently meet the WHO-recommended criteria for the deployment of pyrethroid–piperonyl butoxide nets.
- Although WHO Member States and their implementing partners have started to report insecticide resistance monitoring data for neonicotinoids and pyrroles, Member States are discouraged from using data generated by means of non-validated procedures to arrive at conclusions about the resistance status of their local vector populations to these insecticide classes. A formal WHO process to establish discriminating dosages and test procedures for these two insecticide classes is ongoing. The data reported to WHO will be evaluated according to these dosages and procedures as they become available.
- To guide resistance management, countries should develop and implement a national plan for insecticide resistance monitoring and management, drawing on the WHO *Framework for a national plan for monitoring and management of insecticide resistance in malaria vectors*. In 2019, the number of countries that had completed such plans rose to 53, and 29 countries were in the process of developing them.
- Standard insecticide resistance data reported to WHO are included in the WHO global database on insecticide resistance in malaria vectors and are available for exploration via the Malaria Threats Map. A new version of this tool with enhanced functionality and data download options was released in 2020.

MALARIA RESPONSE DURING THE COVID-19 PANDEMIC

- By April 2020, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2), causing COVID-19, had spread to all malaria endemic countries, and by the end of the second week of November 2020, about 22 million cases and 600 000 deaths had been reported in these countries.
- The COVID-19 pandemic and restrictions related to the response have caused disruptions in essential malaria services.
- Furthermore, early messaging targeted at reducing coronavirus transmission advised the public to stay at home if they had fever, potentially disrupting treatment seeking for febrile diseases such as malaria.
- In March 2020, as the COVID-19 pandemic spread rapidly around the globe, WHO convened a cross-partner effort to mitigate the negative impact of the coronavirus in malaria-affected countries and contribute to the COVID-19 response.
- The work was carried out in close collaboration with the RBM Partnership to End Malaria, the Global Fund, the US President's Malaria Initiative (PMI), several implementation and advocacy partners, and research institutions.
- The cross-partner effort led to a strong partnership alignment that resulted in various outcomes:
  - publication of technical guidance on how to safely maintain malaria control services in the context of the COVID-19 pandemic;
  - publication of a modelling analysis to quantify the potential impact of service disruptions due to the COVID-19 pandemic, to reinforce the consequences of service disruption; the analysis suggested that malaria mortality in sub-Saharan Africa was likely to double by the end of 2020, relative to a 2018 baseline, if extreme disruption in prevention and treatment occurred;
  - mitigating the pressure to shift diagnostic production away from malaria to the detection of SARS-CoV2;
  - success in resolving major global manufacturing bottlenecks for malaria medicines;
  - mitigating the disruptions in the shipment and delivery of malaria commodities;
  - resource mobilization for personal protective equipment (PPE) and other commodities to help with the implementation of prevention campaigns, diagnosis and treatment; and
  - tracking of disruptions in countries to help guide the response.
- The collective effort has led to impressive efforts by countries to complete malaria prevention campaigns involving long-lasting insecticidal nets (LLINs), IRS and SMC, and to minimize disruptions to diagnosis and treatment.
- All countries that had planned SMC campaigns were on track to complete them, despite moderate delays in some areas.
- Of the 47 countries that had IRS campaigns planned in 2020, 23 had completed them, 13 were on track to complete them, and 11 were off track or at risk of not completing them.
- Several countries have completed their LLIN campaigns and many are in the process of distributing LLINs. However, as of the third week of November, of the 222 million LLINs planned for distribution in 2020, about 105 million had been distributed.
- Many countries have also reported moderate levels of disruptions, and modelling analysis shows that reductions in access to effective antimalarial treatment of 10%, 15%, 25% and 50% in sub-Saharan Africa in 2020 could lead to an additional 19 000, 28 000, 46 000 and 100 000 malaria deaths, respectively, by the end of 2020, even if all prevention campaigns are completed.

Avant-propos

Dr Tedros Adhanom Ghebreyesus
Directeur général
de l'Organisation mondiale de la Santé (OMS)

Dans le *Rapport sur le paludisme dans le monde* de cette année, l'OMS se penche sur les principales étapes ayant marqué la riposte mondiale contre cette maladie au cours des deux dernières décennies et qui ont abouti à une période de succès sans précédent permettant d'éviter 1,5 milliard de cas et 7,6 millions de décès associés.

À l'issue du Programme mondial d'éradication du paludisme en 1969, le désengagement politique et la baisse des financements ont entraîné une résurgence de la maladie dans de nombreuses régions du monde, en particulier en Afrique. Même si les données fiables sont rares, des centaines de millions de personnes ont vraisemblablement été infectées par le paludisme et des dizaines de millions en sont mortes.

Au début des années 1990, les principaux dirigeants des services de santé et experts scientifiques ont tracé les grandes lignes d'une nouvelle réponse au paludisme. Des investissements accrus dans la recherche et l'innovation ont conduit au développement de nouveaux outils de lutte contre la maladie, notamment des moustiquaires imprégnées d'insecticide, des tests de diagnostic rapide et des médicaments plus efficaces.

Associée à une nette augmentation des investissements dans la lutte contre le paludisme, la création de nouveaux mécanismes de financement, notamment le Fonds mondial de lutte contre le sida, la tuberculose et le paludisme, et l'Initiative du Président américain contre le paludisme (PMI), a permis le déploiement à grande échelle de ces nouveaux outils, et a contribué à réduire morbidité et mortalité liées au paludisme dans des proportions inédites jusqu'alors.

Un engagement politique ferme dans les pays d'endémie palustre a constitué la clé du succès. En signant la Déclaration d'Abuja en 2000, une étape historique, les dirigeants des pays africains se sont engagés à réduire de 50 % la mortalité due au paludisme sur le continent en dix ans.

D'après notre rapport, la mortalité associée au paludisme a diminué de 60 % au niveau mondial entre 2000 et 2019. La région Afrique a enregistré une impressionnante baisse du nombre de décès annuels, passant de 680 000 en 2000 à 386 000 en 2019.

Les pays de la région Asie du Sud-Est ont également accompli de sérieux progrès, en réduisant les nombres de cas et de décès de 73 % et 74 %, respectivement. Dans cette région, l'Inde a contribué à la plus forte baisse du nombre de cas, passant de quasiment 20 millions à 6 millions de cas pendant cette période.

Vingt-un pays ont éliminé le paludisme au cours des deux dernières décennies et dix d'entre eux ont été officiellement certifiés exempts de paludisme par l'OMS. Les pays de la sous-région du Grand Mékong continuent à réaliser des avancées majeures, avec un recul de 97 % des infections à *P. falciparum* depuis 2000, un objectif prioritaire compte tenu de la menace permanente que fait peser la résistance aux médicaments antipaludiques.

Stagnation des progrès

Les progrès enregistrés depuis le début du millénaire sont vraiment stupéfiants. Toutefois, comme le décrit ce rapport, ils stagnent depuis plusieurs années.

En 2017, l'OMS avait souligné que la lutte contre le paludisme au niveau mondial était arrivée à la « croisée des chemins » et que les cibles essentielles de la stratégie mondiale contre le paludisme de l'OMS ne seraient probablement pas atteintes. Trois ans plus tard, les progrès stagnent toujours. Selon notre dernier rapport, les cibles en matière de baisse de l'incidence et de la mortalité liée au paludisme, telles que définies par la stratégie pour 2020, seront respectivement manquées de 37 % et de 22 %.

En 2020, la COVID-19 est venue s'ajouter aux obstacles de taille que la riposte contre le paludisme doit affronter au niveau mondial. Conformément aux orientations de l'OMS, de nombreux pays ont adapté leurs méthodes de distribution de moustiquaires, diagnostics et médicaments afin d'assurer la sécurité des agents de santé et des communautés en première ligne. Je salue du fond du cœur ces efforts, sans lesquels nous aurions sans doute observé des taux de mortalité beaucoup plus élevés.

Les nouvelles projections de l'OMS montrent néanmoins que des dysfonctionnements, même modérés, de l'accès aux traitements antipaludiques efficaces pourraient entraîner un nombre considérable de décès. Le rapport insiste, par exemple, sur le fait qu'un dysfonctionnement à hauteur de 25 % de l'accès au traitement antipaludique efficace en Afrique subsaharienne pourrait entraîner 46 000 décès supplémentaires.

Relance des progrès

Afin de redynamiser les progrès, l'OMS et le Partenariat RBM pour en finir avec le paludisme ont initié, en 2018, l'approche « *high burden to high impact* » (HBHI, « D'une charge élevée à un fort impact »). Cette approche est menée par 11 pays, dont 10 en Afrique subsaharienne, qui concentrent près de 70 % des cas et décès dus au paludisme dans le monde.

Les pays de l'approche HBHI ont abandonné l'idée d'une démarche « universelle », choisissant au contraire d'utiliser des données et informations collectés localement pour mettre en œuvre des réponses adaptées. Même s'il est trop tôt pour évaluer l'impact de cette approche sur la charge palustre, un important travail préparatoire a été réalisé.

Une récente analyse menée au Nigéria a révélé, par exemple, que le pays pourrait éviter des dizaines de millions de cas et des milliers de décès supplémentaires d'ici 2023 en optant pour une combinaison optimisée d'interventions plutôt qu'en recourant à une approche habituelle.

Un meilleur ciblage des ressources et des interventions antipaludiques, notamment dans des pays où la maladie sévit le plus, comme au Nigéria, va aider à accélérer le rythme des progrès vers les cibles de la stratégie mondiale de lutte contre le paludisme. Il est indispensable d'accroître les financements nationaux et internationaux, et d'innover dans le domaine des outils et des approches.

Sur la voie d'une couverture de santé universelle dans chaque pays, il est aussi essentiel d'intégrer les efforts de lutte contre le paludisme aux initiatives plus larges visant à mettre en place des systèmes de santé solides, basés sur des soins de santé primaires axés sur la personne.

Il est temps pour les dirigeants de toute l'Afrique, mais aussi du monde entier, de relever le défi du paludisme une fois encore, comme ils l'avaient fait lorsqu'ils ont jeté les bases des avancées réalisées depuis le début de ce siècle. À travers une action commune et un engagement à n'oublier personne, nous pourrons concrétiser notre vision partagée d'un monde sans paludisme.

Le rapport de cette année en un clin d'œil

POIDS DU PALUDISME : ÉVOLUTION DU NOMBRE DE CAS ET DE DÉCÈS

Cas de paludisme

- Au niveau mondial, le nombre de cas de paludisme est estimé à 229 millions en 2019 dans 87 pays d'endémie palustre, soit une baisse par rapport aux 238 millions de 2000. Lors de la définition de la *Stratégie technique mondiale de lutte contre le paludisme 2016-2030* ([le] GTS) en 2015, le nombre de cas de paludisme était estimé à 218 millions.
- Le pourcentage des infections à *Plasmodium vivax* a diminué, passant de 7 % en 2000 à 3 % en 2019.
- L'incidence du paludisme (i.e. nombre de cas pour 1 000 habitants exposés au risque de paludisme) a reculé au niveau mondial, passant de 80 en 2000 à 58 en 2015, puis 57 en 2019. De 2000 à 2015, l'incidence du paludisme au niveau mondial a donc diminué de 27 %, mais de 2 % seulement entre 2015 et 2019, ce qui reflète un net ralentissement depuis 2015.
- Vingt-neuf pays ont concentré 95 % du nombre total de cas de paludisme dans le monde. Le Nigéria (27 %), la République démocratique du Congo (12 %), l'Ouganda (5 %), le Mozambique (4 %) et le Niger (3 %) ont enregistré, à eux seuls, près de 51 % des cas.
- La région Afrique de l'Organisation mondiale de la Santé (OMS) représente à elle seule 94 % (215 millions) des cas estimés en 2019.
- Dans la région Afrique de l'OMS, même si le nombre de cas de paludisme était moins élevé (204 millions) en 2000 qu'en 2019, l'incidence du paludisme a baissé de 363 à 225 cas pour 1 000 habitants exposés au risque de paludisme sur cette période, ce qui traduit la complexité d'interpréter l'évolution de la transmission de la maladie au sein d'une population qui ne cesse de croître. La population vivant dans la région Afrique de l'OMS est passée de 665 millions en 2000 à 1,1 milliard en 2019.
- La région Asie du Sud-Est de l'OMS a concentré près de 3 % des cas de paludisme dans le monde. Le nombre de cas y a chuté de 73 %, passant de 23 millions en 2000 à près de 6,3 millions en 2019. De même, l'incidence du paludisme dans cette région a diminué de 78 %, avec quelque 18 cas pour 1 000 habitants exposés au risque de paludisme en 2000, contre 4 en 2019.
- Dans la région Asie du Sud-Est de l'OMS, l'Inde a enregistré la baisse la plus prononcée, en valeur absolue, avec près de 20 millions de cas en 2000, contre 5,6 millions environ en 2019. Le Sri Lanka a été certifié exempt de paludisme en 2015, et le Timor-Leste a rapporté zéro cas de paludisme en 2018 et 2019.
- Dans la région Méditerranée orientale de l'OMS, le nombre de cas de paludisme a baissé de 26 %, passant de près de 7 millions en 2000 à quelque 5 millions en 2019. Près d'un quart de ces cas en 2019 étaient dus à P. vivax, principalement en Afghanistan et au Pakistan.
- Sur la période 2000-2019, l'incidence du paludisme dans la région Méditerranée orientale de l'OMS a diminué de 20 à 10. Avec quasiment 46 % des cas, le Soudan est le pays le plus touché dans cette région. La République islamique d'Iran a rapporté zéro cas de paludisme indigène en 2018 et 2019.
- Dans la région Pacifique occidental de l'OMS, 1,7 million de cas ont été estimés en 2019, soit une baisse de 43 % par rapport aux 3 millions de 2000. Sur la même période, l'incidence du paludisme est passée de cinq à deux cas pour 1 000 habitants exposés au risque de paludisme. La Papouasie-Nouvelle-Guinée a enregistré près de 80 % des cas dans cette région en 2019. Depuis 2017, la Chine rapporte zéro cas de paludisme indigène. La Malaisie n'a rapporté aucun cas de paludisme humain en 2018 et 2019.
- Dans la région Amériques de l'OMS, le nombre de cas de paludisme a diminué de 40 % (passant de 1,5 million à 0,9 million) et l'incidence du paludisme de 57 % (de 14 à 6). Les progrès réalisés dans cette région ces dernières années ont souffert de la forte hausse du paludisme au Venezuela (République bolivarienne du), qui avait recensé près de 35 500 cas en 2000 contre plus de 467 000 en 2019. Le Brésil, la Colombie et le Venezuela (République bolivarienne du) concentrent plus de 86 % des cas dans cette région.
- Depuis 2015, la région Europe de l'OMS est exempte de paludisme.

Mortalité associée

- Au niveau mondial, le nombre de décès dus au paludisme a baissé de façon régulière sur la période 2000-2019, passant de 736 000 en 2000 à 409 000 en 2019. Les enfants de moins de 5 ans représentaient 84 % des décès associés au paludisme en 2000, contre 67 % en 2019. L'estimation du nombre de décès dans le monde en 2015, la référence du GTS, avoisinait les 453 000.
- La mortalité associée au paludisme (à savoir le nombre de décès pour 100 000 habitants exposés au risque de paludisme) a baissé au niveau mondial, passant de 25 en 2000 à 12 en 2015, puis 10 en 2019, ce qui traduit un ralentissement de tendance ces dernières années.
- Au niveau mondial, près de 95 % des décès dus au paludisme ont été enregistrés dans 31 pays. Le Nigéria (23 %), la République démocratique du Congo (11 %), la République-Unie de Tanzanie (5 %), le Mozambique (4 %), le Niger (4 %) et le Burkina Faso (4 %) ont concentré près de 51 % de tous les décès dus au paludisme dans le monde en 2019.
- Dans la région Afrique de l'OMS, le nombre de décès dus au paludisme a diminué de 44 %, passant de 680 000 en 2000 à 386 000 en 2019. Sur la même période, la mortalité associée a baissé de 67 %, chutant de 121 à 40 décès pour 100 000 habitants exposés au risque de paludisme.
- Dans la région Asie du Sud-Est de l'OMS, le nombre de décès dus au paludisme a diminué de 74 %, avec 35 000 décès en 2000 contre 9 000 en 2019.
- L'Inde a concentré près de 86 % des décès dus au paludisme dans la région Asie du Sud-Est de l'OMS.
- Dans la région Méditerranée orientale de l'OMS, le nombre de décès dus au paludisme a diminué de 16 %, passant de 12 000 en 2000 à 10 100 en 2019. Dans le même temps, la mortalité associée a baissé de moitié, passant de quatre à deux décès pour 100 000 habitants exposés au risque de paludisme.
- Dans la région Pacifique occidental de l'OMS, le nombre de décès dus au paludisme a diminué de 52 %, passant de 6 600 en 2000 à 3 200 en 2019. Sur la même période, la mortalité associée a baissé de 60 %, chutant de 1 à 0,4 décès pour 100 000 habitants exposés au risque de paludisme. Dans cette région, la Papouasie-Nouvelle-Guinée a enregistré près de 85 % des décès dus au paludisme en 2019.
- Dans la région Amériques de l'OMS, le nombre de décès dus au paludisme a diminué de 39 % (909 contre 551) et la mortalité associée de 50 % (0,8 contre 0,4). Plus de 70 % des décès dus au paludisme en 2019 dans cette région ont été enregistrés au Venezuela (République bolivarienne du).

Nombre de cas de paludisme et de décès évités

- Selon les estimations, 1,5 milliard de cas de paludisme et 7,6 millions de décès associés ont été évités dans le monde entre 2000 et 2019.
- La plupart des cas (82 %) et des décès (94 %) évités l'auraient été dans la région Afrique de l'OMS, suivie par la région Asie du Sud-Est (10 % des cas et 3 % des décès).

Poids du paludisme pendant la grossesse

- En 2019, sur les 33 millions de femmes enceintes vivant dans 33 pays de la région Afrique de l'OMS où la transmission est modérée à élevée, 35 % (soit 12 millions) ont été exposées à une infection palustre durant leur grossesse.
- En détaillant les sous-régions de l'OMS, l'Afrique centrale a affiché la plus forte prévalence d'exposition au paludisme durant la grossesse (40 %), suivie de près par l'Afrique de l'Ouest (39 %), alors que la prévalence était de 24 % en Afrique de l'Est et en Afrique australe.
- Conséquence de ces infections pendant la grossesse, 822 000 enfants ont présenté un faible poids à la naissance dans ces 33 pays.
- Si 80 % des femmes enceintes ayant reçu des soins prénataux avaient reçu une dose de traitement préventif intermittent pendant la grossesse (TPIp), 56 000 cas de faible poids à la naissance auraient été évités dans ces 33 pays.

ÉLIMINATION DU PALUDISME ET PRÉVENTION DE SA RÉAPPARITION

- Au niveau mondial, le nombre de pays où le paludisme était endémique en 2000 et qui ont rapporté moins de 10 000 cas a augmenté, passant de 26 en 2000 à 46 en 2019.
- Au cours de la même période, les pays comptant moins de 100 cas de paludisme indigène sont passés de 6 à 27.
- Sur la période 2010-2019, le nombre total de cas de paludisme dans les 21 pays de l'initiative « E-2020 » a diminué de 79 %.
- Les Comores, le Costa Rica, l'Équateur et le Suriname ont signalé plus de cas en 2019 qu'en 2018, avec respectivement 1 986, 25, 150 et 66 cas supplémentaires en 2019.
- La République islamique d'Iran, la Malaisie et le Timor-Leste ont rapporté zéro cas de paludisme indigène en 2018 et 2019. En 2019, le Belize et le Cabo Verde n'ont signalé aucun cas de paludisme indigène pour la première fois depuis 2000.
- La Chine et El Salvador ont rapporté zéro cas de paludisme indigène pour la troisième année consécutive et ont donc déposé une demande formelle de certification.
- Dans les six pays de la sous-région du Grand Mékong (Cambodge, Chine [province du Yunnan], République démocratique populaire lao, Myanmar, Thaïlande et Viet Nam), le nombre de cas de paludisme à *P. falciparum* a diminué de 97 % entre 2000 et 2019, alors que le nombre total de cas a chuté de 90 %. Sur les 239 000 cas de paludisme rapportés en 2019, 65 000 étaient dus à *P. falciparum*.
- Ce recul s'est accéléré depuis 2012, date à laquelle le programme « Mekong Malaria Elimination » (MME) a été lancé. Durant cette période, le nombre de cas de paludisme a été divisé par six et les cas dus à *P. falciparum* par 14 ou presque.
- Dans l'ensemble, le Cambodge (58 %) et le Myanmar (31 %) ont concentré une large majorité des cas de paludisme dans la sous-région du Grand Mékong.
- Cette accélération de la baisse des cas dus à *P. falciparum* est particulièrement importante du fait de la résistance accrue aux médicaments. En effet, dans la sous-région du Grand Mékong, les parasites *P. falciparum* ont développé une résistance partielle à l'artémisinine, le composant principal des meilleurs médicaments antipaludiques disponibles.
- De 2000 à 2019, la transmission du paludisme n'est réapparue dans aucun des pays préalablement certifiés exempts de paludisme.

APPROCHE « HIGH BURDEN TO HIGH IMPACT »

- Depuis novembre 2018, l'approche « high burden to high impact » (HBHI) a été lancée dans 10 des 11 pays concernés (elle n'a pas encore été lancée au Mali en raison des dysfonctionnements liés à la pandémie de COVID-19). Toutefois, ces 11 pays ont déjà mis en place des activités HBHI en rapport avec les quatre éléments de riposte définis.
- Dans chaque pays HBHI, le lancement a fait l'objet d'un engagement politique à haut niveau et de soutien important. L'initiative « Mass Action Against Malaria » en Ouganda est citée à titre d'exemple de processus mené par un pays avec un engagement politique à tous les niveaux, ainsi qu'une mobilisation communautaire et multisectorielle.
- L'analyse de l'adaptation infranationale des interventions a été réalisée dans tous les pays, sauf au Mali où elle est en cours. L'exemple du Nigéria est présenté dans le rapport.
- Tous les pays se sont engagés à conduire un exercice exhaustif de microstratification urbaine afin de mieux cibler les interventions et d'améliorer leur efficacité en tenant compte de l'urbanisation croissante.
- Le programme mondial de lutte antipaludique de l'OMS a actualisé son dossier technique pour aider les pays à mieux prioriser les ressources, tout en respectant les recommandations développées dans le cadre des processus normalisés et rigoureux de l'OMS.
- Comme l'approche HBHI a été lancée en novembre 2018, à une période où les pays arrivaient à la fin de leurs cycles de financement, il est trop tôt pour déterminer l'impact de la réponse. En 2019, le nombre de cas de paludisme dans les 11 pays HBHI était similaire à celui de 2018 (156 millions contre 155 millions).

PROGRÈS VERS L'ATTEINTE DES OBJECTIFS DU GTS POUR 2020

- Le GTS vise à réduire l'incidence du paludisme et la mortalité associée d'au moins 40 % d'ici 2020, 75 % d'ici 2025 et 90 % d'ici 2030 en se basant sur les données de référence de 2015.
- Les tendances 2000-2019 concernant le nombre de cas de paludisme et de décès associés ont servi à établir des projections annelles de 2020 à 2030, afin de suivre les progrès sur la voie des cibles et des objectifs intermédiaires du GTS.
- Les projections présentées dans le rapport *ne tiennent pas compte* des éventuels dysfonctionnements dus à la pandémie de COVID-19, lesquels risquent d'entraîner une morbidité et une mortalité liées au paludisme plus élevées que prévu, malgré les efforts remarquables consentis au niveau national et international pour préserver les services de base en matière de lutte contre le paludisme.
- En dépit des progrès considérables accomplis depuis 2000, les objectifs intermédiaires du GTS pour 2020 en matière de morbidité et de mortalité ne seront pas atteints au niveau mondial.
- En 2020, l'incidence du paludisme s'est établie à 56 cas pour 1 000 habitants à risque, au lieu des 35 cas représentés par l'objectif intermédiaire de morbidité fixé dans le GTS. En d'autres termes, nous sommes à 37 % en deçà de notre objectif.
- Même si la baisse de la mortalité est plus nette que la baisse de l'incidence, la projection du nombre de décès pour 100 000 habitants exposés au risque de paludisme a été établie au niveau mondial à 9,8 en 2020 contre 11,9 en 2015, soit un écart de 22 % par rapport à l'objectif intermédiaire de mortalité défini dans le GTS pour 2020.
- Sur les 92 pays où le paludisme était endémique en 2015, 31 (34 %) étaient en passe d'atteindre l'objectif intermédiaire pour 2020 en matière de morbidité. En effet, selon les estimations, ils ont réduit leur incidence de 40 % ou plus, ou ont rapporté zéro cas de paludisme.
- Vingt-deux pays (23 %) ont réalisé des progrès en termes de baisse de l'incidence, mais pas suffisamment pour atteindre l'objectif intermédiaire du GTS.
- Trente-et-un pays (34 %) ont enregistré une hausse de l'incidence, et elle était supérieure ou égale à 40 % dans 15 (16 %) d'entre eux par rapport à 2015.
- Dans neuf pays (10 %), l'incidence du paludisme en 2020 a été estimée à un niveau équivalent à celui de 2015.
- Trente-neuf pays (42 %) où le paludisme était endémique en 2015 étaient en passe d'atteindre l'objectif intermédiaire du GTS pour 2020 en matière de mortalité, et 28 d'entre eux ont rapporté zéro cas de paludisme.
- Selon les estimations, trente-quatre pays (37 %) ont réduit la mortalité due au paludisme, mais leurs progrès sont restés en-deçà de l'objectif de 40 %.
- En 2020, la mortalité due au paludisme est restée au même niveau qu'en 2015 dans sept pays (8 %), alors que 12 autres pays (13 %) semblent avoir enregistré des hausses, et même de 40 % ou plus dans six pays.
- Tous les pays de la région Asie du Sud-Est de l'OMS étaient en passe d'atteindre les objectifs intermédiaires du GTS à la fois en matière de morbidité et de mortalité pour 2020.

INVESTISSEMENTS DANS LES PROGRAMMES ET LA RECHERCHE ANTIPALUDIQUES

- Le GTS estime les fonds requis pour atteindre les objectifs intermédiaires de 2020, 2025 et 2030. Au total, les ressources annuelles nécessaires ont été estimées à US$ 4,1 milliards en 2016, avec une hausse à US$ 6,8 milliards en 2020. Toujours selon les estimations, US$ 720 000 millions supplémentaires seront requis chaque année pour la recherche et le développement (R&D) sur le paludisme au niveau mondial.
- En 2019, US$ 3 milliards ont été investis au total pour le contrôle et l'élimination du paludisme, contre US$ 2,7 milliards en 2018 et US$ 3,2 milliards en 2017. Les investissements de 2019 sont bien inférieurs aux US$ 5,6 milliards estimés nécessaires au niveau mondial pour rester sur la voie des objectifs du GTS.

- L'écart entre investissements et ressources nécessaires a continué à augmenter de façon spectaculaire au cours de ces dernières années, passant de US$ 1,3 milliard en 2017 à US$ 2,3 milliards en 2018, puis US$ 2,6 milliards en 2019.
- Les partenaires internationaux ont représenté 70 % du financement total pour le contrôle et l'élimination du paludisme sur la période 2010-2019, avec les États-Unis en tête, suivis par le Royaume-Uni de Grande-Bretagne et d'Irlande du Nord (Royaume-Uni), et la France.
- Sur les US$ 3 milliards investis en 2019, US$ 2,1 milliards provenaient de bailleurs de fonds internationaux. Le gouvernement des États-Unis a été le premier bailleur de fonds en 2019, apportant US$ 1,1 milliard au travers de financements bilatéraux planifiés et de contributions à des agences de financement multilatérales.
- Des décaissements bilatéraux et multilatéraux du Royaume-Uni à hauteur de US$ 200 millions sont venus s'ajouter à ces financements, des contributions de plus de US$ 100 millions de la part de la France, de l'Allemagne et du Japon (pour un total de US$ 400 millions), ainsi que US$ 400 millions supplémentaires de la part d'autres pays membres du Comité d'aide au développement et de bailleurs de fonds du secteur privé.
- En 2019, les gouvernements des pays d'endémie ont contribué à hauteur de 30 % du financement total, soit près de US$ 900 millions. Sur ce montant, US$ 200 millions ont été investis dans la prise en charge des cas de paludisme dans le secteur public et US$ 700 millions dans d'autres activités de lutte contre le paludisme.
- Sur les US$ 3 milliards investis en 2019, près de US$ 1,2 milliard (39 %) ont transité par le Fonds mondial de lutte contre le sida, la tuberculose et le paludisme (Fonds mondial). Par rapport à 2018, les décaissements du Fonds mondial en faveur des pays d'endémie ont augmenté de près de US$ 200 millions en 2019.
- Sur les US$ 3 milliards investis en 2019, près de 73 % ont été dirigés vers la région Afrique de l'OMS, 9 % vers la région Asie du Sud-Est, 5 % vers les régions Amériques et Pacifique occidental (chacune), et 4 % vers la région Méditerranée orientale.
- De 2007 à 2018, près de US$ 7,3 milliards ont été investis dans la recherche fondamentale et le développement de produits contre le paludisme.
- Les fonds dédiés à la recherche-développement ont surtout été investis dans les médicaments (US$ 2,6 milliards, soit 36 % des fonds investis entre 2007 et 2018), suivis à parts relativement proches par la recherche fondamentale (US$ 1,9 milliard, soit 26 %) et la recherche-développement dans le domaine des vaccins (US$ 1,8 milliard, soit 25 %). Les investissements dans les produits de lutte antivectorielle et les outils de diagnostic ont été nettement plus modérés, atteignant globalement US$ 453 millions (6,2 %) et US$ 185 millions (2,5 %), respectivement.
- Entre 2007 et 2018, le secteur public a tenu un rôle majeur dans le financement de la recherche-développement antipaludique, passant de US$ 246 millions en 2007 à un pic de US$ 365 millions en 2017. Au sein du secteur public et parmi tous les bailleurs de fonds engagés dans la recherche-développement antipaludique, les US National Institutes of Health ont apporté la contribution la plus importante, en concentrant un peu plus de la moitié de leurs investissements de US$ 1,9 milliard dans la recherche fondamentale (soit US$ 1,02 milliard ou 54 % de leurs investissements totaux dans la lutte contre le paludisme entre 2007 et 2018).
- La Fondation Bill & Melinda Gates a également un tenu un rôle important, en investissant US$ 1,8 milliard (soit 25 % de tous les financements de recherche-développement antipaludique) entre 2007 et 2018, ainsi qu'en soutenant le développement clinique d'innovations essentielles, comme le vaccin RTS,S.

DISTRIBUTION ET COUVERTURE DES OUTILS DE PRÉVENTION DU PALUDISME

- Les fabricants de moustiquaires imprégnées d'insecticide (MII) ont indiqué en avoir livré près de 2,2 milliards dans le monde entre 2004 et 2019, dont 1,9 milliard (86 %) en Afrique subsaharienne.
- En 2019, ces fabricants ont livré près de 253 millions de MII à des pays d'endémie, soit une augmentation de 56 millions par rapport à 2018. Près de 84 % de ces MII ont été livrées dans des pays d'Afrique subsaharienne.

- En 2019, 68 % des ménages vivant en Afrique subsaharienne disposaient d'au moins une MII, soit une hausse d'environ 5 % par rapport à 2000. Le pourcentage des ménages disposant d'au moins une MII pour 2 membres du foyer est passé de 1 % en 2000 à 36 % en 2019. Durant la même période, le pourcentage de la population ayant accès à une MII dans son foyer a augmenté, passant de 3 % à 52 %.
- Le pourcentage de la population dormant sous MII a aussi considérablement augmenté entre 2000 et 2019, qu'il s'agisse de la population dans son ensemble (de 2 % à 46 %), des enfants de moins de 5 ans (de 3 % à 52 %) ou des femmes enceintes (de 3 % à 52 %).
- Les données les plus récentes, issues d'enquêtes démographiques et de santé et d'autres enquêtes sur les indicateurs du paludisme réalisées au sein des ménages dans 24 pays d'Afrique subsaharienne entre 2015 et 2019, ont servi à analyser l'équité socio-économique concernant l'utilisation des MII. Dans la plupart des pays d'Afrique de l'Ouest, l'utilisation des MII a été d'une manière générale plus importante parmi les plus démunis, ou alors homogène parmi les différents quintiles de richesse. À l'inverse, dans de nombreuses régions d'Afrique centrale et d'Afrique de l'Est, l'utilisation des MII a été supérieure au sein des ménages les moins démunis.
- Au niveau mondial, la part de la population à risque protégée par pulvérisation intradomiciliaire d'insecticides à effet rémanent (PID) dans les pays d'endémie a reculé de 5 % en 2010 à 2 % en 2019. Le pourcentage de la population protégée par PID a diminué dans toutes les régions de l'OMS.
- Au niveau mondial, le nombre de personnes protégées par cette intervention a chuté de 180 millions en 2010 à 115 millions en 2015, puis à 97 millions en 2019.
- Le nombre d'enfants ayant reçu au moins une dose de chimioprévention du paludisme saisonnier (CPS) n'a cessé d'augmenter, passant de quelque 0,2 million en 2012 à près de 21,5 millions en 2019.
- Dans les 13 pays ayant mis en œuvre la CPS, quelque 21,7 millions d'enfants au total ont été ciblés en 2019. En moyenne, 21,5 millions d'enfants ont reçu un traitement.
- Le pourcentage d'utilisation du TPIp par dose a été calculé sur la base des données provenant de 33 pays d'Afrique. En 2019, 80 % des femmes enceintes ont reçu des soins prénataux au moins une fois durant leur grossesse. Environ 62 % des femmes enceintes ont reçu une dose de TPIp, et 49 % ont reçu deux doses. La couverture en TPIp par trois doses a légèrement augmenté, passant de 31 % en 2018 à 34 % en 2019.

DISTRIBUTION ET COUVERTURE DES OUTILS DE DIAGNOSTIC ET DE TRAITEMENT DU PALUDISME

- De 2010 à 2019, 2,7 milliards de tests de diagnostic rapide (TDR) du paludisme ont été vendus dans le monde, dont 80 % à destination des pays d'Afrique subsaharienne. Durant la même période, 1,9 milliard de TDR ont été distribués par les programmes nationaux de lutte contre le paludisme (PNLP), dont 84 % en Afrique subsaharienne.
- En 2019, 348 millions de TDR ont été vendus et 267 millions distribués par les PNLP. Les ventes et les distributions de TDR en 2019 ont été inférieures aux chiffres rapportés pour 2018, de 63 millions et 24 millions respectivement, avec les plus fortes baisses enregistrées en Afrique subsaharienne.
- Entre 2010 et 2019, plus de 3,1 milliards de traitements par combinaison thérapeutique à base d'artémisinine (ACT) ont été vendus dans le monde. Sur ces ventes, près de 2,1 milliards de traitements ont été à destination du secteur public dans des pays d'endémie, alors que le reste correspond à des co-paiements publics ou privés (voire les deux), ou exclusivement au secteur des détaillants privés.
- Les données nationales rapportées par les PNLP montrent que, durant la même période, 1,9 milliard de traitements par ACT ont été livrés à des prestataires de santé chargés de traiter des patients atteints de paludisme dans un établissement public.
- En 2019, quelque 190 millions de traitements par ACT ont été vendus par les fabricants au secteur public. Cette même année, les PNLP ont distribué 183 millions de traitements par ACT dans ce secteur, dont 90 % en Afrique subsaharienne.
- Les données compilées à partir d'enquêtes réalisées auprès des ménages entre 2005 et 2019 dans 21 pays d'Afrique subsaharienne (ayant mené au moins deux enquêtes sur cette période, l'une entre 2005-2011 pour servir de référence et l'autre entre 2015-2019 pour les plus récentes) ont permis

d'analyser le taux de sollicitation de traitement, la couverture en diagnostic et l'utilisation des ACT chez les enfants de moins de 5 ans.

- En comparant enquêtes de référence et enquêtes plus récentes, peu de différences sont apparues concernant la prévalence de la fièvre dans les 2 semaines précédant les enquêtes (médiane de 24 % contre 21 %) et la sollicitation de traitement en cas de fièvre (médiane de 64 % contre 69 %).
- Les comparaisons de source du traitement entre enquêtes de référence et enquêtes plus récentes indiquent une médiane de 63 % contre 71% pour les soins reçus dans des établissements de santé publics, et une médiane de 39 % contre 30 % pour les soins administrés dans le secteur privé. Le recours aux agents de santé communautaires a été faible sur ces deux périodes, avec une médiane de moins de 2 %.
- Le taux de diagnostic chez les enfants de moins de 5 ans pour lesquels des soins ont été sollicités a largement progressé, d'une médiane de 15 % au départ à 38 % dans les dernières enquêtes.
- L'utilisation des ACT a également triplé, passant de 39 % à 81 % si l'on prend en compte tous les enfants fiévreux pour lesquels des soins ont été sollicités.
- Parmi les enfants fiévreux ayant subi un prélèvement sanguin au doigt ou au talon, le recours aux ACT a atteint 42 % d'après l'enquête la plus récente, suggérant que de nombreux enfants ont reçu des ACT sans diagnostic parasitologique.
- L'analyse de l'équité de la prévalence de la fièvre et de la sollicitation de soins à des niveaux infranationaux montre que, dans la plupart des pays, la prévalence de la fièvre dans les 2 semaines précédant les enquêtes était plus importante chez les enfants issus des ménages les plus démunis.
- En revanche, dans toutes les collectivités infranationales, la sollicitation de traitement était plus importante chez les enfants fiévreux issus des foyers les moins démunis et ce, même si la différence était parfois minime.

MENACES BIOLOGIQUES

Suppression des gènes *pfhrp2/3* du parasite

- La suppression des gènes *pfhrp2* et *pfhrp3* (*pfhrp2/3*) du parasite rendent ces derniers indétectables par les TDR basés sur la protéine riche en histidine 2 (HRP2).
- L'OMS a recommandé aux pays rapportant des suppressions des gènes *pfhrp2/3* ou à leurs pays voisins de mener des études de référence représentatives sur les cas suspectés de paludisme, afin de déterminer si la prévalence des suppressions *pfhrp2/3* causant des résultats de TDR négatifs avait atteint un seuil qui nécessite un changement de TDR (suppressions du gène *pfhrp2* > 5 % causant des faux résultats de TDR négatifs).
- Les alternatives aux TDR (par exemple, basées sur la détection du lactate déshydrogénase du parasite [pLDH) sont limitées. Il n'existe à l'heure actuelle aucune combinaison de tests non-HRP2 préqualifiée par l'OMS, capable de faire la distinction entre *P. falciparum* et *P. vivax*.
- L'OMS effectue un suivi des rapports publiés sur les suppressions des gènes *pfhrp2/3* par le biais de l'outil de cartographie Carte des menaces du paludisme, et encourage une approche harmonisée de cartographie et de signalement des suppressions des gènes *pfhrp2/3* grâce à des protocoles d'enquête accessibles au public.
- Sur les 39 rapports publiés par 39 pays, 32 (82 %) ont rapporté une suppression du gène *pfhrp2* ; toutefois, les méthodes différentes de sélection des échantillons et d'analyse en laboratoire signifient que l'échelle et l'envergure d'une suppression des gènes *pfhrp2/3* significative sur le plan clinique restent à clarifier.
- Entre 2019 et septembre 2020, des enquêtes sur la suppression des gènes *pfhrp2/3* ont été rapportées dans 16 publications émanant de 15 pays. La suppression des gènes *Pfhrp2/3* a été confirmée dans 12 rapports provenant de 11 pays : Chine, Guinée équatoriale, Éthiopie, Ghana, Myanmar, Nigéria, Soudan, Ouganda, Royaume-Uni (par importation depuis divers pays d'endémie), République-Unie de Tanzanie et Zambie. Aucune suppression n'a été identifiée en France (parmi les voyageurs qui y reviennent), à Haïti, au Kenya et au Mozambique.

Résistance des parasites aux antipaludiques

- Des mutations du gène *PfKelch13* ont été identifiées en tant que marqueurs moléculaires de résistance partielle à l'artémisinine.
- Dans la région Afrique de l'OMS, les traitements de première intention contre les infections à *P. falciparum* sont à base d'artéméther-luméfantrine (AL), d'artésunate-amodiaquine (AS-AQ) et de dihydroartémisinine-pipéraquine (DHA-PPQ). Les taux d'efficacité contre les infections à *P. falciparum*, à savoir 98 % pour AL, 98,4 % pour AS-AQ et 99,4 % pour DHA-PPQ, n'ont jamais faibli au fil du temps. Des taux d'échec au traitement de plus de 10 % ont été observés dans quatre études sur l'AL, mais ils peuvent être considérés comme des aberrations statistiques. Il n'existe aucune preuve d'une résistance confirmée à la luméfantrine en Afrique. Pour tous les autres médicaments, les taux d'échec au traitement restent inférieurs à 10 %.
- Les traitements de première intention contre les infections à *P. falciparum* dans la région Amériques de l'OMS sont à base d'AL, d'artésunate-méfloquine (AS-MQ) et de chloroquine (CQ). L'efficacité de l'AL et de l'AS-MQ reste élevée. Une étude sur la CQ réalisée en Bolivie (État plurinational de) en 2011 a détecté un taux d'échec au traitement de 10,4 %.
- Les traitements de première intention contre les infections à *P. falciparum* dans la région Asie du Sud-Est de l'OMS sont à base d'AL, d'artésunate-sulfadoxine-pyriméthamine (AS+SP) et de DHA-PPQ. Les études relatives à l'efficacité thérapeutique de l'AL ont prouvé la très grande efficacité de ce traitement au Bhoutan, en Inde, au Myanmar, au Népal et au Timor-Leste. Des taux d'échec au traitement par AL de plus de 10 % ont été observés dans trois études, dont une en Thaïlande et deux au Bangladesh. À la suite de forts taux d'échec au traitement par AS+SP dans les provinces du nord-est en 2013, l'Inde a modifié sa politique de traitement dans ces provinces et est passée à un traitement à base d'AL. Le traitement par AS+SP reste efficace partout ailleurs dans le pays. Les résultats des études menées en Thaïlande sur l'efficacité des traitements ont conduit, en 2015, à l'adoption de la DHA-PPQ comme traitement de première intention. Des taux d'échec au traitement modérés à élevés ont été observés avec la DHA-PPQ dans l'est de la Thaïlande. De ce fait, le pays recommande actuellement un traitement à base d'artésunate-pyronaridine (AS-PY) dans cette région.
- Dans la région Méditerranée orientale de l'OMS, les traitements à base d'AL et d'AS+SP restent efficaces dans les pays qui les utilisent en tant que traitement de première intention.
- Les traitements de première intention contre *P. falciparum* dans la région Pacifique occidental de l'OMS sont à base d'AL dans tous les pays d'endémie, hormis la Chine qui utilise l'AS-AQ. Des taux d'échec au traitement par AL de 10 % ou moins ont été observés dans quatre études en République démocratique populaire lao, mais ces études ne reposaient pas sur les tailles d'échantillons recommandées. Une étude avec un nombre de patients adéquat est actuellement en cours pour examiner de plus près ces taux élevés d'échec au traitement.
- Une résistance partielle à l'artémisinine s'est développée indépendamment dans plusieurs foyers de la sous-région du Grand Mékong. L'OMS continue de surveiller la situation, qui a évolué rapidement depuis les premières détections de mutations du gène *PfKelch13* dans la sous-région du Grand Mékong. Certaines mutations ont disparu, alors que la prévalence d'autres mutations s'est accrue.
- À présent, les marqueurs affichant la prévalence la plus élevée à l'ouest de Bangkok (Thaïlande occidentale et Myanmar) sont les marqueurs F446I, M476I et R561H. Quant aux marqueurs affichant la prévalence la plus élevée à l'est de Bangkok (Thaïlande orientale, Cambodge, République démocratique populaire lao et Viet Nam), il s'agit de Y493H et P553L. Deux marqueurs, R539T et C580Y, sont également extrêmement prévalents dans ces deux zones. Le changement de politique de traitement au Cambodge, de DHA-PPQ à AS-MQ, a provoqué la réduction de la prévalence des souches portant une résistance au marqueur C580Y et à la PPQ.
- Le Rwanda a détecté une prévalence en hausse de la mutation R561H, un marqueur validé, apparu indépendamment dans la sous-région du Grand Mékong entre 2012 et 2015. La présence de cette mutation a été confirmée au Rwanda en 2018. Toutefois, il apparaît pour l'instant que l'élimination retardée associée à cette mutation n'a pas affecté l'efficacité des ACT utilisés parmi les traitements en cours de test et de déploiement au Rwanda.
- La mutation R622I semble être apparue indépendamment en Afrique et a été détectée en Érythrée, en Éthiopie, en Somalie et au Soudan, avec une fréquence en hausse dans la Corne de l'Afrique. Les ACT utilisés dans ces quatre pays restent efficaces en dépit de la présence de cette mutation. D'autres études sur l'élimination retardée du parasite sont nécessaires dans cette région.
- Au Guyana, la mutation C580Y est également apparue indépendamment entre 2010 et 2017. Cependant, des études récentes (y compris des enquêtes et des études sur l'efficacité thérapeutique) ont découvert que 100 % des échantillons sont de souche sauvage, ce qui indique que cette mutation risque de disparaître au Guyana.

Résistance des vecteurs aux insecticides

- De 2010 à 2019, quelque 81 pays ont transmis à l'OMS des données standard de surveillance sur la résistance aux insecticides.
- Il est préoccupant de constater que 57 % des pays ayant rapporté recourir à des campagnes de PID de 2010 à 2019 n'ont pas communiqué de rapport de résistance aux insecticides pour chaque classe d'insecticides utilisés dans le courant de l'année de la mise en œuvre ou l'année précédente. De plus, 14 % n'ont pas rapporté sur la résistance aux insecticides de l'une ou l'autre classe d'insecticides utilisés. Les pays d'endémie sont vivement encouragés à assurer une surveillance adéquate de la résistance aux insecticides concernant les classes qui sont utilisées ou qui sont envisagées dans le cadre des interventions de lutte antivectorielle, ainsi qu'à donner la priorité à la surveillance de ces classes.
- Sur les 82 pays d'endémie ayant fourni des données pour la période 2010–2019, 28 ont détecté une résistance aux quatre classes d'insecticides les plus couramment utilisés chez au moins un des vecteurs du paludisme et sur un site de collecte. Par ailleurs, 73 de ces pays ont constaté une résistance à une des classes d'insecticides au moins. Seuls huit pays n'ont détecté jusqu'à présent aucune résistance à une quelconque classe d'insecticides.
- Au niveau mondial, la résistance aux pyréthoïdes, la seule classe d'insecticides actuellement utilisés dans les MII, continue de se répandre. Elle a été détectée chez au moins un des vecteurs du paludisme sur 69,9 % des sites pour lesquels des données sont disponibles. La résistance aux organochlorés a été détectée sur 63,4 % des sites. La résistance aux carbamates et aux organophosphorés a été moins prévalente, mais a été détectée, respectivement, sur 31,7 % et 24,9 % des sites disposant de données de surveillance.
- En se basant sur les données de surveillance de la résistance aux insecticides transmises à l'OMS par les États Membres, 330 zones situées dans 33 pays remplissent actuellement les critères recommandés par l'OMS pour le déploiement des moustiquaires imprégnées de butoxyde de pipéronyle (PBO).
- Même si les États Membres de l'OMS et leurs partenaires de mise en œuvre commencent à rapporter des données de surveillance sur la résistance aux néonicotinoïdes et aux pyrazoles, les États Membres sont dissuadés d'utiliser les données générées par le biais de procédures non validées pour tirer des conclusions sur l'état de résistance de leurs populations vectorielles locales face à ces classes d'insecticides. Un processus formel de l'OMS visant à établir des dosages discriminants et des procédures de tests pour ces deux classes d'insecticides est en cours de développement. Les données rapportées à l'OMS seront évaluées en tenant compte de ces dosages et procédures au fur et à mesure de leur disponibilité.
- Pour orienter la gestion de la résistance, les pays doivent développer et mettre en œuvre des plans nationaux de suivi et de gestion de la résistance aux insecticides, en se basant sur le *Cadre conceptuel d'un plan national de suivi et de gestion de la résistance aux insecticides chez les vecteurs du paludisme* élaboré par l'OMS. En 2019, le nombre de pays ayant établi un tel plan a augmenté pour atteindre 53, alors que 29 pays en étaient encore à la phase de développement.
- Les données standard sur la résistance aux insecticides rapportées à l'OMS sont intégrées à la base de données mondiales de l'OMS sur la résistance aux insecticides chez les vecteurs du paludisme, et leur accès à des fins d'exploration est possible via la Carte des menaces du paludisme. Une nouvelle version de cet outil, enrichie de fonctionnalités avancées et d'options de téléchargement, a été lancée en 2020.

LUTTE CONTRE LE PALUDISME DURANT LA PANDÉMIE DE COVID-19

- En avril 2020, le coronavirus 2 associé au syndrome respiratoire aigu sévère (SARS-CoV2), virus responsable de la COVID-19, s'est propagé dans tous les pays d'endémie palustre et, à la fin de la deuxième semaine du mois de novembre 2020, près de 22 millions de cas et 600 000 décès avaient été signalés dans ces pays.
- La pandémie de COVID-19 et les restrictions imposées par la riposte ont provoqué des dysfonctionnements des services de base pour la lutte contre le paludisme.
- De plus, les premiers messages visant à réduire la transmission du coronavirus conseillaient au public de rester à la maison en cas de fièvre, ce qui a pu nuire à la sollicitation des soins en cas de survenue de fièvres, telles que celles liées au paludisme.
- En mars 2020, comme la pandémie de COVID-19 se propageait rapidement dans le monde entier, l'OMS a appelé à un effort conjoint des partenaires en vue d'atténuer l'impact négatif du coronavirus dans les pays touchés par le paludisme et de contribuer à la riposte contre la COVID-19.
- Ce travail a été mené en étroite collaboration avec le Partenariat RBM pour en finir avec le paludisme, le Fonds mondial, l'Initiative du Président américain contre le paludisme (PMI), plusieurs partenaires de mise en œuvre et de plaidoyer, ainsi que des instituts de recherche.
- Cet effort conjoint des partenaires a permis un alignement de tous et a produit des résultats, notamment :
  - la publication d'orientations techniques sur le maintien sécurisé des services de lutte contre le paludisme dans le contexte de la pandémie de COVID-19 ;
  - la publication d'une analyse par modélisation ayant pour but de quantifier l'impact potentiel des dysfonctionnements des services liés à la pandémie de COVID-19, ainsi que d'insister sur les conséquences de ces dysfonctionnements : cette analyse a souligné le risque que la mortalité due au paludisme en Afrique subsaharienne double d'ici la fin de 2020 par rapport à la référence de 2018 en cas de dysfonctionnements sévères des services de prévention et de traitement ;
  - la baisse de la pression pour orienter la production d'outils de détection du virus SARS-CoV2 au détriment de la production d'outils de diagnostic du paludisme ;
  - la suppression des goulots d'étranglement majeurs congestionnant la fabrication mondiale de médicaments antipaludiques ;
  - une limitation des dysfonctionnements dans le transport et la livraison des produits antipaludiques ;
  - la mobilisation des ressources pour les équipements de protection individuelle (EPI) et d'autres produits, afin d'aider à la mise en œuvre des campagnes de prévention, de diagnostic et de traitement ; et
  - le suivi des dysfonctionnements dans les pays pour aider à orienter la riposte.
- Cet effort collectif a donné lieu à des efforts impressionnants dans les pays, avec pour objectif de terminer les campagnes de prévention du paludisme par le biais des moustiquaires imprégnées d'insecticide longue durée (MILD), de la PID et de la CPS, et de minimiser les dysfonctionnements des services de diagnostic et de traitement.
- Tous les pays qui avaient programmé des campagnes de CPS étaient en passe de les terminer, malgré de légers retards dans certaines régions.
- Sur les 47 pays ayant planifié des campagnes de PID en 2020, 23 les ont terminées, 13 sont en passe de les terminer, et 11 sont mal partis ou risquent de ne pas les terminer.
- Plusieurs pays ont terminé leurs campagnes de distribution de MILD et un certain nombre sont encore en train de les distribuer. Pourtant, à la fin de la troisième semaine de novembre, environ 105 millions environ de MILD avaient été distribuées sur les 222 millions prévues en 2020.
- Plusieurs pays ont également rapporté des niveaux de dysfonctionnements modérés. L'analyse par modélisation montre que la baisse de l'accès à un traitement antipaludique efficace, qu'elle soit de 10 %, de 15 %, de 25 % ou de 50 % en Afrique subsaharienne en 2020 pourrait respectivement entraîner 19 000, 28 000, 46 000 et 100 000 décès supplémentaires d'ici la fin de 2020 et ce, même si toutes les campagnes de prévention sont menées à bien.

Prefacio

Dr Tedros Adhanom Ghebreyesus
Director General
Organización Mundial de la Salud (OMS)

En el *Informe mundial sobre la malaria* de este año, la OMS reflexiona sobre los hitos clave que han dado forma a la respuesta mundial contra la enfermedad durante las últimas dos décadas -un período de éxito sin precedentes en el control de la malaria en el que se evitaron 1.500 millones de casos y se salvaron 7,6 millones de vidas.

Tras la finalización del Programa Mundial de Erradicación de la Malaria en 1969, la reducción del compromiso político y de la financiación para el control de malaria provocaron el resurgimiento de ésta enfermedad en muchas partes del mundo, especialmente en África. Si bien los datos confiables son escasos, es probable que cientos de millones de personas se hayan infectado con malaria y decenas de millones hayan muerto.

A partir de la década de 1990, líderes de alto nivel en el sector de la salud y científicos trazaron un rumbo para una respuesta renovada contra la malaria. El aumento de la inversión en investigación e innovación condujo al desarrollo de nuevas herramientas para eliminar la enfermedad, como mosquiteros tratados con insecticidas, pruebas de diagnóstico rápido y medicamentos más eficaces.

La creación de nuevos mecanismos de financiación, en particular del Fondo Mundial de Lucha contra el SIDA, la Tuberculosis y la Malaria y la Iniciativa contra la Malaria del Presidente de los Estados Unidos, junto con un fuerte aumento de la financiación para malaria, permitió la distribución a gran escala de estas herramientas, contribuyendo a la reducción de la enfermedad y de las muertes en una escala que nunca antes se había visto.

El firme compromiso político en África fue clave para el éxito. A través de la histórica Declaración de Abuja del año 2000, los líderes africanos se comprometieron a reducir la mortalidad por malaria en el continente en un 50% durante un período de 10 años.

Según nuestro informe, la mortalidad mundial por malaria se redujo en un 60% durante el período 2000 a 2019. La Región de África logró reducciones impresionantes en su número anual de muertes por malaria - de 680 000 en el año 2000 a 386 000 en el 2019.

Los países del sudeste asiático lograron avances particularmente importantes, con reducciones en el número de casos y muertes del 73% y 74%, respectivamente. India contribuyó a la mayor reducción de casos en toda la región, de aproximadamente 20 millones a cerca de 6 millones.

Veintiún países han eliminado la malaria en las últimas dos décadas y, de ellos, 10 países se han certificado oficialmente por la OMS como libres de malaria. Los países del Gran Mekong continúan obteniendo importantes avances, con una asombrosa reducción del 97% en los casos de malaria por *P. falciparum* desde el año 2000, un objetivo primordial en vista de la amenaza constante que representa la resistencia a los medicamentos antimaláricos.

Una meseta en el progreso

Los progresos obtenidos desde el comienzo del milenio han sido verdaderamente asombrosos. Sin embargo, como se ve en este informe, las ganancias se han estabilizado, tendencia observada en los últimos años.

En 2017, la OMS advirtió que la respuesta mundial contra la malaria había llegado a una "encrucijada" y que probablemente no se alcanzarían los objetivos clave de la estrategia mundial contra la malaria de la OMS. Tres años después, seguimos viendo una meseta en el progreso; según nuestro último informe, los objetivos de la estrategia para el año 2020 de reducción de la enfermedad y las muertes no se alcanzará por un 37% y 22%, respectivamente.

En 2020, COVID-19 surgió como un desafío adicional, y formidable, para las respuestas contra la malaria en todo el mundo. De acuerdo con la orientación de la OMS, muchos países han adaptado la forma en que distribuyen mosquiteros, medicamentos y realizan el diagnóstico para garantizar la seguridad de los trabajadores de salud de primera línea y las comunidades. Aplaudo de todo corazón estos esfuerzos, sin los cuales probablemente habríamos visto niveles mucho más altos en la mortalidad.

Sin embargo, según las nuevas proyecciones de la OMS, incluso alteraciones moderadas en el acceso a un tratamiento eficaz podrían provocar una considerable pérdida de vidas. El informe encuentra, por ejemplo, que una interrupción del 25% en el acceso al tratamiento antimalárico eficaz en África subsahariana podría provocar 46 000 muertes adicionales.

Reavivar el progreso

Para revitalizar el progreso, la OMS impulsó el enfoque de "Alta carga a alto impacto" (ACAI) en 2018, junto con la Alianza para Hacer Retroceder la Malaria para Ponerle Fin. La respuesta está liderada por 11 países, incluidos 10 del África subsahariana, que representan aproximadamente el 70% de la carga mundial de malaria.

Los países de ACAI se están alejando de un enfoque de "talla única" para el control de la malaria, optando, en cambio, por implementar respuestas mas particulares basadas en datos e inteligencia locales. Si bien es demasiado pronto para evaluar el impacto de este enfoque en la carga de la malaria, se han sentado bases importantes.

Un análisis reciente de Nigeria, por ejemplo, encontró que a través de una combinación optimizada de intervenciones, el país podría evitar decenas de millones de casos adicionales y miles de muertes adicionales para el año 2023, en comparación con el enfoque habitual.

Una mejor focalización de las intervenciones y los recursos contra la malaria, particularmente en países como Nigeria, donde la enfermedad golpea con más fuerza, ayudará a acelerar el ritmo del progreso hacia nuestras metas mundiales contra la malaria. También se necesita una mayor financiación a nivel nacional e internacional, junto con innovaciones en nuevas herramientas y enfoques.

Es fundamental que los esfuerzos para combatir la malaria se integren con esfuerzos más amplios para construir sistemas de salud sólidos basados en la atención primaria en salud centrada en las personas, como parte del camino de cada país hacia una cobertura universal de salud.

Es hora de que los líderes de África, y del mundo, se enfrenten una vez más al desafío de la malaria, tal como lo hicieron cuando sentaron las bases para el progreso logrado desde principios de este siglo. Mediante una acción conjunta y el compromiso de no dejar a nadie atrás, podemos lograr nuestra visión compartida de un mundo libre de malaria.

El informe de este año de un vistazo

TENDENCIAS EN LA CARGA DE MALARIA

Casos de malaria

- A nivel mundial, hubo 229 millones de casos estimados de malaria en 2019 en 87 países donde la malaria es endémica, una disminución comparado con los 238 millones en el año 2000. En la línea de base del 2015 de la *Estrategia técnica mundial contra la malaria 2016-2030*, se estimaron 218 millones de casos de malaria.
- La proporción de casos debidos a *Plasmodium vivax* se redujo de cerca del 7% en el año 2000 a un 3% en 2019.
- La incidencia de casos de malaria (es decir, casos por 1000 habitantes en riesgo) se redujo a nivel mundial de 80 en el año 2000 a 58 en 2015 y 57 en 2019. Entre los años 2000 y 2015, la incidencia mundial de casos de malaria disminuyó en un 27%, y entre el 2015 y 2019 disminuyó en menos del 2%, lo que indica una desaceleración de la tasa de disminución desde el 2015.
- En 29 países se concentra el 95% de los casos de malaria a nivel mundial. En Nigeria (27%), la República Democrática del Congo (12%), Uganda (5%), Mozambique (4%) y Níger (3%) se presentan alrededor del 51% de todos los casos a nivel mundial.
- La Región de África de la Organización Mundial de la Salud (OMS) presentó alrededor del 94% de los casos en 2019, con un estimado de 215 millones de casos.
- Aunque hubo menos casos de malaria en el año 2000 (204 millones) que en 2019 en la Región de África de la OMS, la incidencia de casos de malaria se redujo de 363 a 225 casos por 1 000 habitantes en riesgo en este período, lo que refleja la complejidad de interpretar la transmisión cambiante de la enfermedad en un población en rápido aumento. La población que vive en la Región de África de la OMS aumentó de unos 665 millones en el año 2000 a 1.100 millones en 2019.
- La Región de Asia Sudoriental de la OMS representó alrededor del 3% de la carga de casos de malaria a nivel mundial. Los casos de malaria se redujeron en un 73%, de 23 millones en el año 2000 a aproximadamente 6.3 millones en 2019. La incidencia de casos de malaria en esta región se redujo en un 78%, de aproximadamente 18 casos por 1000 habitantes en riesgo en el año 2000 a aproximadamente cuatro casos en 2019.
- India contribuyó a las mayores reducciones absolutas en la Región de Asia Sudoriental de la OMS, de cerca de 20 millones de casos en el año 2000 a unos 5.6 millones en 2019. Sri Lanka fue certificado como libre de malaria en 2015, y Timor-Leste notificó cero casos de malaria en 2018 y 2019.
- Los casos de malaria en la Región del Mediterráneo Oriental de la OMS se redujeron en un 26%, de aproximadamente 7 millones de casos en el año 2000 a cerca de 5 millones en 2019. Aproximadamente una cuarta parte de los casos en 2019 se debieron a *P. vivax*, principalmente en Afganistán y Pakistán.
- Durante el período 2000-2019, la incidencia de casos de malaria en la Región del Mediterráneo Oriental de la OMS disminuyó de 20 a 10. Sudán es el principal contribuyente a la malaria en esta región y representa alrededor del 46% de los casos. La República Islámica del Irán no tuvo casos autóctonos de malaria en 2018 y 2019.
- La Región del Pacífico Occidental de la OMS tuvo un estimado de 1,7 millones de casos en 2019, una disminución del 43% de los 3 millones de casos en el año 2000. Durante el mismo período, la incidencia de casos de malaria se redujo de cinco a dos casos por 1 000 habitantes en riesgo. Papua Nueva Guinea representó casi el 80% de todos los casos en esta región en 2019. China no ha tenido casos autóctonos de malaria desde 2017. Malasia no tuvo casos de malaria humana en 2018 y 2019.
- En la Región de las Américas de la OMS, los casos de malaria se redujeron en un 40% (de 1,5 millones a 0,9 millones) y la incidencia de casos en un 57% (de 14 a 6) entre los años 2000 y 2019. El progreso de la región en los últimos años se ha visto afectado por el importante aumento de la malaria en Venezuela (República Bolivariana de), que registró alrededor de 35 500 casos en el año 2000, llegando a más de 467 000 en 2019. En Brasil, Colombia y Venezuela (República Bolivariana de) se presentan más del 86% de todos los casos de esta región.
- Desde el 2015, la Región de Europa de la OMS está libre de malaria.

Muertes por malaria

- A nivel mundial, las muertes por malaria han disminuido continuamente durante el período 2000-2019, de 736 000 en el año 2000 a 409 000 en 2019. El porcentaje del total de muertes por malaria en niños menores de 5 años fue del 84% en el año 2000 y del 67% en 2019. La estimación mundial de muertes que se realizó en el año 2015, línea de base de la Estrategia técnica mundial, fue de alrededor de 453 000.
- A nivel mundial, la tasa de incidencia de la mortalidad por malaria (es decir, muertes por cada 100 000 habitantes en riesgo) se redujo de alrededor de 25 en el año 2000 a 12 en 2015 y 10 en 2019, con una desaceleración en la tasa de disminución en los últimos años.
- Aproximadamente el 95% de las muertes por malaria de todo el mundo sucedieron en 31 países. En Nigeria (23%), la República Democrática del Congo (11%), la República Unida de Tanzania (5%), Mozambique (4%), Níger (4%) y Burkina Faso (4%) sucedieron alrededor del 51% de todas las muertes por malaria a nivel mundial en 2019.
- Las muertes por malaria en la Región de África de la OMS se redujeron en un 44%, de 680 000 en el año 2000 a 386 000 en 2019, y la tasa de incidencia de mortalidad por malaria se redujo en un 67% durante el mismo período, de 121 a 40 muertes por 100 000 habitantes en riesgo.
- En la Región de Asia Sudoriental de la OMS, las muertes por malaria se redujeron en un 74%, de cerca de 35 000 en el año 2000 a 9 000 en 2019.
- En India sucedieron aproximadamente el 86% de todas las muertes por malaria de la Región de Asia Sudoriental de la OMS.
- En la Región del Mediterráneo Oriental de la OMS, las muertes por malaria se redujeron en un 16%, de alrededor de 12 000 en el año 2000 a 10 100 en 2019, y la tasa de incidencia de mortalidad por malaria se redujo en un 50%, de cuatro a dos muertes por 100 000 habitantes en riesgo.
- En la Región del Pacífico Occidental de la OMS, las muertes por malaria se redujeron en un 52%, de aproximadamente 6 600 casos en el año 2000 a 3 200 en 2019, y la tasa de incidencia de mortalidad se redujo en un 60%, pasando de una a 0,4 muertes por malaria por 100 000 habitantes en riesgo. En Papua Nueva Guinea sucedieron más del 85% de las muertes por malaria en 2019.
- En la Región de las Américas de la OMS, las muertes por malaria se redujeron en un 39% (de 909 a 551) y la tasa de incidencia de mortalidad en un 50% (de 0,8 a 0,4) entre el 2000 y 2019. Más del 70% de las muertes por malaria en 2019 en esta región sucedieron en Venezuela (República Bolivariana de).

Casos de malaria y muertes evitadas

- A nivel mundial, se estima que se han evitado 1.500 millones de casos de malaria y 7,6 millones de muertes por malaria en el período 2000-2019.
- La mayoría de los casos (82%) y muertes (94%) evitados fueron en la Región de África de la OMS, seguida de la Región de Asia Sudoriental de la OMS (10% de los casos y 3% de las muertes).

Carga de la malaria en el embarazo

- En 2019, en 33 países con transmisión moderada y alta en la Región de África de la OMS, hubo aproximadamente 33 millones de mujeres embarazadas, de las cuales el 35% (12 millones) estuvieron expuestas a la infección por malaria durante el embarazo.
- Por subregión de la OMS, África Central tuvo la mayor prevalencia de exposición a la malaria durante el embarazo (40%), seguida de cerca por África Occidental (39%), mientras que la prevalencia fue del 24% en África Oriental y en África del Sur.
- Se estima que la infección por malaria durante el embarazo en estos 33 países resultó en 822 000 niños con bajo peso al nacer.
- Si el 80% de las mujeres embarazadas que informaron haber utilizado los servicios de atención prenatal alguna vez, hubieran recibido una dosis de tratamiento preventivo intermitente durante el embarazo, se habrían evitado adicionalmente 56 000 nacimientos de bajo peso en estos 33 países.

ELIMINACIÓN DE LA MALARIA Y PREVENCIÓN DE SU RESTABLECIMIENTO

- A nivel mundial, el número de países que eran endémicos de malaria en el 2000 y que notificaron menos de 10 000 casos de malaria aumentó de 26 en el año 2000 a 46 en 2019.
- En el mismo período, el número de países con menos de 100 casos autóctonos aumentó de seis a 27.
- En el período 2010-2019, el total de casos de malaria en los 21 países de la E-2020 se redujo en un 79%.
- Hubo mas casos en 2019 que en 2018 en Comoras, Costa Rica, Ecuador y Surinam, los cuales informaron de 1986, 25, 150 y 66 casos adicionales, respectivamente, en 2019.
- Irán (República Islámica del), Malasia y Timor-Leste notificaron cero casos autóctonos de malaria en 2018 y 2019. En 2019, Belice y Cabo Verde notificaron cero casos autóctonos de malaria por primera vez desde el año 2000.
- China y El Salvador no tuvieron casos autóctonos de malaria por tercer año consecutivo y han presentado una solicitud formal de certificación.
- Entre 2000 y 2019, en los seis países de la subregión del Gran Mekong (SGM) - Camboya, China (provincia de Yunnan), República Democrática Popular Lao, Myanmar, Tailandia y Vietnam - los casos de malaria por *P. falciparum* disminuyeron en un 97%, mientras que todos los casos de malaria se redujeron en un 90%. De los 239 000 casos de malaria notificados en 2019, 65 000 fueron casos de *P. falciparum*.
- La tasa de disminución ha sido más rápida desde 2012, cuando se lanzó el programa de Eliminación de la Malaria del Mekong. Durante este período, los casos de malaria se redujeron seis veces, mientras que los casos de *P. falciparum* se redujeron en un factor de casi 14.
- En general, Camboya (58%) y Myanmar (31%) representaron la mayoría de los casos de malaria en la SGM.
- Esta disminución acelerada de *P. falciparum* es especialmente crítica debido al aumento de la resistencia a los medicamentos; en la SGM, los parásitos *P. falciparum* han desarrollado una resistencia parcial a la artemisinina, el compuesto principal de los mejores fármacos antimaláricos disponibles.
- Entre los años 2000 y 2019, no se ha restablecido la transmisión de la malaria en ningún país certificado como libre de malaria.

ENFOQUE "DE ALTA CARGA A ALTO IMPACTO"

- Desde noviembre de 2018, el enfoque de alta carga a alto impacto (ACAI) se ha lanzado en 10 de los 11 países (aún no se ha lanzado en Mali debido a las alteraciones por la pandemia de COVID-19). Sin embargo, los 11 países han implementado actividades relacionadas con ACAI en los cuatro elementos de la respuesta.
- En cada país donde se ha iniciado el enfoque ACAI, ha habido un alto nivel de compromiso y apoyo político. La iniciativa de Acción en Masa Contra la Malaria en Uganda se presenta como un ejemplo de un proceso liderado por un país de participación política en todos los niveles y de movilización multisectorial y comunitaria.
- Se ha completado el análisis para la adaptación sub-nacional de las intervenciones en todos los países excepto en Malí, donde este trabajo está en progreso. El ejemplo de Nigeria se presenta en el informe.
- Todos los países se han comprometido a realizar un ejercicio integral de micro-estratificación urbana para orientar mejor las intervenciones y mejorar la eficiencia dada la creciente tasa de urbanización.
- El Programa Mundial de Malaria (PMM) de la OMS actualizó su informe técnico para ayudar a los países a priorizar mejor los recursos, al tiempo que se adhieren a las recomendaciones basadas en evidencia que se han desarrollado a través de los rigurosos procesos estándar de la OMS.
- Debido a que la respuesta de ACAI se lanzó en noviembre de 2018, cuando los países estaban llegando al final de sus ciclos de financiamiento, es demasiado pronto para determinar el impacto de la respuesta. El número de casos de malaria en los 11 países de ACAI en 2019 fue similar al de 2018 (156 millones frente a 155 millones).

PROGRESO HACIA LOS OBJETIVOS DE LA ESTRATEGIA TÉCNICA MUNDIAL (ETM) DE 2020

- La ETM apunta a una reducción en la incidencia de casos de malaria y la tasa de mortalidad de al menos un 40% para 2020, un 75% para 2025 y un 90% para 2030, comparados con la línea de base de 2015.
- Las tendencias de 2000-2019 en casos y muertes por malaria se utilizaron para hacer proyecciones anuales para 2020 a 2030, con el fin de hacer un seguimiento del progreso hacia las metas y los hitos de la ETM.
- Las proyecciones presentadas en este informe no tienen en cuenta las posibles alteraciones debidas a la pandemia COVID-19, la cual, a pesar de los encomiables esfuerzos mundiales y nacionales para mantener los servicios esenciales contra la malaria, es probable que provoque una morbilidad y mortalidad por malaria más altas de lo esperado.
- A pesar de los considerables avances realizados desde el año 2000, los objetivos para la morbilidad y mortalidad de la ETM 2020 no se alcanzarán a nivel mundial.
- La incidencia de casos de malaria de 56 casos por 1 000 habitantes en riesgo en 2020 en lugar de los 35 casos por 1 000 esperados si el mundo estuviera encaminado hacia el objetivo de morbilidad de la ETM 2020 significa que, a nivel mundial, la trayectoria actual se ha desviado en un 37% de lo esperado.
- Aunque el progreso relativo en la tasa de mortalidad es mayor que en la incidencia de casos, las muertes por malaria proyectadas a nivel mundial por cada 100 000 habitantes en riesgo en 2020 fue de 9,8, comparado con 11.9 en 2015. Esto implica que el mundo está un 22% fuera de la trayectoria establecida por el ETM para el 2020.
- De los 92 países que eran endémicos de malaria a nivel mundial en 2015, se estimó que 31 (34%) estaban en camino de alcanzar el objetivo de morbilidad de la ETM para el año 2020, habiendo logrado una reducción del 40% o más en la incidencia de casos o informado de cero casos de malaria.
- Veintiún países (23%) han progresado en la reducción de la incidencia de casos de malaria, pero no están en camino de alcanzar el objetivo de la ETM.
- Se estima que 31 países (34%) tienen una mayor incidencia, y se estima que 15 países (16%) tienen un aumento del 40% o más en la incidencia de casos de malaria en 2020 en comparación con 2015.
- Se estimó que la incidencia de casos de malaria en nueve países (10%) en 2020 se encuentra en niveles similares a los de 2015.
- Treinta y nueve países (42%) que eran endémicos de malaria en 2015 estaban en camino de alcanzar el objetivo de mortalidad de la ETM para 2020, y 28 de ellos notificaron cero casos de malaria.
- Se estimó que 34 países (37%) habían logrado reducciones en las tasas de incidencia de la mortalidad por malaria, pero el progreso estuvo por debajo de la meta del 40%.
- Las tasas de incidencia de mortalidad por malaria se mantuvieron al mismo nivel en 2020 que en 2015 en siete países (8%), mientras que se estimaron aumentos en otros 12 países (13%), seis de los cuales tuvieron aumentos del 40% o más.
- Todos los países de la Región de Asia Sudoriental de la OMS están en camino de alcanzar los objetivos de la ETM 2020, tanto en morbilidad como en mortalidad.

INVERSIONES EN PROGRAMAS E INVESTIGACIÓN SOBRE MALARIA

- La ETM establece estimaciones de la financiación necesaria para alcanzar los objetivos para los años 2020, 2025 y 2030. Los recursos anuales totales necesarios se estimaron en 4.100 millones de dólares estadounidenses en 2016, y ascendieron a 6 800 millones de dólares estadounidenses en 2020. Se estima que se necesitarán otros 700 millones de dólares anuales para investigación y desarrollo (I & D) a nivel mundial en malaria.
- El financiamiento total para el control y la eliminación de la malaria en 2019 se estimó en $ 3.000 millones, en comparación con $ 2 700 millones en 2018 y $ 3 200 millones en 2017. La cantidad

invertida en 2019 no alcanza los $ 5 600 millones de dólares estimados como necesarios a nivel mundial para mantenerse encaminado hacia los hitos de la ETM.

- La brecha de financiamiento entre el monto invertido y los recursos necesarios ha seguido ampliándose drásticamente en los últimos años, pasando de 1 300 millones de dólares en 2017 a 2 300 millones de dólares en 2018 y a 2.600 millones de dólares en 2019.
- Durante el período 2010-2019, fuentes internacionales proporcionaron el 70% de la financiación total para el control y la eliminación de la malaria, encabezadas por los Estados Unidos de América (EE UU.), el Reino Unido de Gran Bretaña e Irlanda del Norte (Reino Unido) y Francia.
- De los $ 3 000 millones de dólares invertidos en 2019, $ 2 100 millones provinieron de financiadores internacionales. Las mayores contribuciones en 2019 fueron del gobierno de los EE. UU., quien proporcionó un total de $ 1,1 mil millones de dólares a través de fondos bilaterales planificados y contribuciones a agencias de financiamiento multilaterales.
- A esto le siguieron desembolsos bilaterales y multilaterales del Reino Unido por 200 millones de dólares, contribuciones de más de 100 millones de dólares de cada uno de los países de Francia, Alemania y Japón (por un total de 400 millones de dólares estadounidenses) y un total combinado de 400 millones de otros países que son miembros del Comité de Asistencia para el Desarrollo y de contribuyentes del sector privado.
- Los gobiernos de los países donde la malaria es endémica continuaron aportando alrededor del 30% del financiamiento total, con inversiones cercanas a los $ 900 millones de dólares en 2019. De esta cantidad, se estima que $ 200 millones se gastaron en el manejo de los casos de malaria en el sector público y $ 700 millones en otras actividades de control de la malaria.
- De los $ 3 000 millones de dólares invertidos en 2019, casi $ 1 200 millones (39%) se canalizaron a través del Fondo Mundial de Lucha contra el SIDA, la Tuberculosis y la Malaria (Fondo Mundial). En comparación con 2018, los desembolsos del Fondo Mundial a los países donde la malaria es endémica aumentaron en alrededor de 200 millones de dólares en 2019.
- De los $ 3 000 millones invertidos en 2019, alrededor del 73% se destinó a la Región de África de la OMS, el 9% a la Región de Asia Sudoriental de la OMS, el 5% a la Región de las Américas de la OMS y a la Región del Pacífico Occidental de la OMS, y 4% a la Región del Mediterráneo Oriental de la OMS.
- Entre 2007 y 2018, se invirtieron casi $ 7 300 millones de dólares en investigación básica y desarrollo de productos para la malaria.
- El panorama de la financiación de la I & D contra la malaria ha sido liderado por la inversión en medicamentos ($ 2,6 mil millones, 36% de la financiación contra la malaria entre 2007 y 2018), seguida de proporciones relativamente similares para la investigación básica ($ 1,9 mil millones, 26%) y la I & D sobre vacunas ($ 1.8 mil millones, 25%). Las inversiones en productos de control de vectores y diagnóstico fueron notablemente menores, alcanzando un total general de $ 453 millones (6,2%) y $ 185 millones (2,5%), respectivamente.
- Entre 2007 y 2018, el sector público ocupó un papel de liderazgo en la financiación de I & D contra la malaria, pasando de 246 millones de dólares estadounidenses en 2007 a un máximo de 365 millones de dólares estadounidenses en 2017. Dentro del sector público y entre todos los financiadores de I & D contra la malaria, los Institutos Nacionales de Salud de Estados Unidos fue el mayor contribuyente, y centró poco más de la mitad de su inversión de 1 900 millones de dólares en investigación básica (1.020 millones de dólares, el 54% de su inversión total en malaria entre 2007 y 2018).
- La Fundación Bill y Melinda Gates ha sido otro actor fundamental, invirtiendo 1.800 millones de dólares (el 25% de todos los fondos para I & D contra la malaria) entre 2007 y 2018, y apoyando el desarrollo clínico de innovaciones clave como la vacuna RTS, S.

DISTRIBUCIÓN Y COBERTURA DE LA PREVENCIÓN DE LA MALARIA

- Los datos de entrega de los fabricantes muestran que se suministraron en todo el mundo casi 2.200 millones de mosquiteros tratados con insecticidas (MTI) entre 2004 y 2019, de los cuales 1.900 millones (86%) se suministraron al África subsahariana.
- Los fabricantes entregaron alrededor de 253 millones de mosquiteros tratados con insecticidas a países endémicos de malaria en 2019, un aumento de 56 millones de mosquiteros tratados con insecticidas en comparación con 2018. Aproximadamente el 84% de estos mosquiteros tratados con insecticidas se entregaron a países del África subsahariana.
- Para el año 2019, el 68% de los hogares en África subsahariana tenían al menos un MTI, en comparación con aproximadamente un 5% en el año 2000. El porcentaje de hogares que poseen al menos un MTI por cada dos personas aumentó del 1% en el 2000 al 36% en el 2019. En el mismo período, el porcentaje de población con acceso a un MTI dentro de su hogar aumentó de 3% a 52%.
- El porcentaje de la población que duerme bajo un MTI también aumentó considerablemente entre el año 2000 y el 2019, para toda la población (del 2% al 46%), para los niños menores de 5 años (del 3% al 52%) y para las mujeres embarazadas (del 3% al 52%).
- Los datos de encuestas de hogares más recientes de las encuestas demográficas y de salud y las encuestas de indicadores de malaria de 24 países de África subsahariana de 2015 a 2019 se utilizaron para analizar la equidad socioeconómica en el uso de MTI. En la mayoría de los países de África occidental, el uso de mosquiteros tratados con insecticidas fue generalmente a favor de los pobres o estuvo cerca de una equitatividad perfecta. Por el contrario, el uso de MTI fue mayor en los hogares más ricos de muchas partes de África central y oriental.
- A nivel mundial, el porcentaje de población en riesgo protegida con rociado residual intradomiciliar (RRI) en países endémicos para malaria disminuyó del 5% en 2010 al 2% en 2019. El porcentaje de la población protegida con RRI disminuyó en todas las regiones de la OMS.
- La cantidad de personas protegidas en todo el mundo se redujo de 180 millones en 2010 a 115 millones en 2015, y disminuyó a 97 millones en 2019.
- El número de niños a los que se llegó con al menos una dosis de quimio-prevención estacional de la malaria (QPE) aumentó constantemente, de aproximadamente 0,2 millones en 2012 a aproximadamente 21,5 millones en 2019.
- En los 13 países que implementaron QPE, la intervención fue dirigida a alrededor de 21,7 millones de niños en 2019. En promedio, 21,5 millones de niños recibieron tratamiento.
- Utilizando datos de 33 países africanos, se calculó el porcentaje de uso del Tratamiento Preventivo Intermitente de la malaria durante el Embarazo (TPI) por dosis. En 2019, el 80% de las mujeres embarazadas utilizaron los servicios de atención prenatal al menos una vez durante el embarazo. Aproximadamente el 62% de las mujeres embarazadas recibió una dosis de TPI y el 49% recibió 2 dosis TPI. Hubo un ligero aumento en la cobertura de 3 dosis de TPI, del 31% en 2018 al 34% en 2019.

DISTRIBUCIÓN Y COBERTURA DEL DIAGNÓSTICO Y TRATAMIENTO DE LA MALARIA

- A nivel mundial, los fabricantes vendieron 2.700 millones de pruebas de diagnóstico rápido (PDR) para la malaria entre 2010 y 2019, y casi el 80% de estas ventas se realizaron a países del África subsahariana. En el mismo período, los programas nacionales de malaria (PNM) distribuyeron 1.900 millones de PDR, el 84% en África subsahariana.
- En 2019, los fabricantes vendieron 348 millones de PDR y los PNM distribuyeron 267 millones. La venta y distribución de PDR en 2019 fueron inferiores a las informadas en 2018, en 63 millones y 24 millones, respectivamente, y la mayoría de las disminuciones se produjeron en África subsahariana.
- Los fabricantes vendieron a nivel mundial más de 3.100 millones de tratamientos de terapia combinada con derivados de la artemisinina (TCA) en 2010-2019. Aproximadamente 2,1 mil millones de estas ventas fueron al sector público en países donde la malaria es endémica, y el resto se vendió a través de copagos del sector público o privado (o ambos), o exclusivamente a través del sector minorista privado.
- Los datos nacionales informados por los PNM muestran que, en el mismo período, se entregaron 1.900 millones de TCA a los proveedores de servicios de salud para tratar a los pacientes con malaria en el sector de la salud pública.
- En 2019, los fabricantes vendieron unos 190 millones de TCA para su uso en el sector de la salud pública; En ese mismo año, los PNM distribuyeron 183 millones de TCA a este sector, de los cuales el 90% estaban en África subsahariana.

- Los datos agregados de las encuestas de hogares realizadas en África subsahariana entre 2005 y 2019 en 21 países con al menos dos encuestas en este período (línea de base 2005-2011 y más reciente 2015-2019) se utilizaron para analizar la cobertura de la búsqueda de tratamiento, el diagnóstico y uso de TCA en niños menores de 5 años.
- Comparando las encuestas de línea de base con las más recientes, hubo pocos cambios en la prevalencia de fiebre dentro de las 2 semanas anteriores a las encuestas (mediana 24% versus 21%) y búsqueda de tratamiento para la fiebre (mediana 64% versus 69%).
- Las comparaciones de la fuente de tratamiento entre la línea de base y las encuestas más recientes muestran que una mediana del 63% frente al 71% recibió atención en instalaciones de salud pública y una mediana del 39% frente al 30% recibió atención del sector privado. El uso de trabajadores de salud comunitarios fue bajo en ambos períodos, con una mediana de menos del 2%.
- La tasa de diagnóstico entre los niños menores de 5 años para quienes se buscó atención aumentó considerablemente, de una mediana del 15% al inicio, al 38% en las últimas encuestas de hogares.
- El uso de TCA también se multiplicó por más de tres, del 39% al inicio, al 81% en las últimas encuestas, cuando se consideraron todos los niños con fiebre para quienes se buscó atención.
- Entre los que recibieron un pinchazo en el dedo o el talón, el uso de TCA fue del 42% en la encuesta más reciente, lo que sugiere que muchos niños recibieron TCA sin diagnóstico parasitológico.
- Analizando la equidad en la prevalencia de la fiebre y la búsqueda de tratamiento a nivel sub-nacional, se muestra que en la mayoría de los países, los niños de los hogares más pobres tenían una mayor prevalencia de fiebre en las 2 semanas anteriores a las encuestas de hogares.
- En contraste, la búsqueda de tratamiento fue mayor en los niños febriles de hogares más ricos en todas las unidades sub-nacionales, aunque en algunas unidades esa diferencia fue pequeña

AMENAZAS BIOLÓGICAS

Deleciones en los genes *pfhrp2 / 3* de los parásitos

- Las deleciones en los genes *pfhrp2* y *pfhrp3* (*pfhrp2 / 3*) del parásito hacen que los parásitos sean indetectables por las PDR basadas en la proteína 2 rica en histidina (HRP2).
- La OMS ha recomendado que los países con informes de deleciones de *pfhrp2 / 3* o los países vecinos deben realizar encuestas de línea de base representativas en los casos sospechosos de malaria para determinar si la prevalencia de deleciones de *pfhrp2 / 3* que causan resultados de falsos negativos de la PDR ha alcanzado un umbral para el cambio de PDR (> 5 % de deleciones de *pfhrp2* que causan resultados de falsos negativos en PDR).
- Las opciones alternativas de PDR (por ejemplo, basadas en la detección de la lactato deshidrogenasa [pLDH] del parásito) son limitadas; en particular, actualmente no existen pruebas precalificadas de las OMS que no sean pruebas de combinación de HRP2 que puedan detectar y distinguir entre *P. falciparum* y *P. vivax*.
- La OMS está rastreando reportes publicados de deleciones de *pfhrp2 / 3* utilizando la herramienta de mapeo *Mapa de los Desafíos de la Malaria* (Malaria Threats Map) y está fomentando un enfoque armonizado para mapear y notificar las deleciones de *pfhrp2 / 3* a través de protocolos de encuestas disponibles públicamente.
- Entre los 39 informes publicados por 39 países, 32 (82%) reportaron deleciones de *pfhrp2*; sin embargo, la variabilidad en los métodos de selección de muestras y análisis de laboratorio significan que la escala y el alcance de la significancia clínica de las deleciones de *pfhrp2 /3* aún no está claro.
- Entre 2019 y septiembre de 2020, se informaron investigaciones de deleciones de *pfhrp2 / 3* en 16 publicaciones de 15 países. Se confirmaron deleciones de *Pfhrp2 / 3* en 12 informes de 11 países: China, Guinea Ecuatorial, Etiopía, Ghana, Myanmar, Nigeria, Sudán, Uganda, Reino Unido (importados de varios países endémicos de malaria), República Unida de Tanzania y Zambia. No se identificaron deleciones en Francia (entre los viajeros que regresan), Haití, Kenia y Mozambique.

Resistencia de los parásitos a los medicamentos antimaláricos

- Se han identificado mutaciones de PfKelch13 como marcadores moleculares de resistencia parcial a la artemisinina.
- En la Región de África de la OMS, los tratamientos de primera línea para *P. falciparum* incluyen arteméter-lumefantrina (AL), artesunato-amodiaquina (AS-AQ) y dihidroartemisinina-piperaquina (DHA-PPQ). Las tasas de eficacia promedio general para *P. falciparum* (98,0% para AL, 98,4% para AS-AQ y 99,4% para DHA-PPQ) se mantuvieron constantes a lo largo del tiempo. Se observaron tasas de fallas del tratamiento de más del 10% en cuatro estudios de AL, pero pueden considerarse valores estadísticos atípicos. No hay evidencia de resistencia confirmada a la lumefantrina en África. Para todos los demás medicamentos, las tasas de fallas terapéuticas permanecen por debajo del 10%.
- Los tratamientos de primera línea para *P. falciparum* en la Región de las Américas de la OMS incluyen AL, artesunato-mefloquina (AS-MQ) y cloroquina (CQ). La eficacia de AL y AS-MQ sigue siendo alta. Un estudio de CQ en Bolivia (Estado Plurinacional de) en 2011 detectó una tasa de falla terapéutica del 10,4%.
- Los tratamientos de primera línea para *P. falciparum* en la Región de Asia Sudoriental de la OMS incluyen AL, artesunato-sulfadoxina-pirimetamina (AS + SP) y DHA-PPQ. Los estudios de eficacia terapéutica (EET) de AL demostraron una alta eficacia del tratamiento en Bután, India, Myanmar, Nepal y Timor-Leste. Las tasas de falla terapéutica para AL superaron el 10% en tres estudios, uno en Tailandia y dos en Bangladesh. Tras las altas tasas de falla terapéutica a AS + SP en las provincias del noreste, en 2013, India cambió su política de tratamiento en esas provincias a AL; AS + SP sigue siendo eficaz en otras partes del país. Los hallazgos de EET en Tailandia llevaron a la adopción de DHA-PPQ como tratamiento de primera línea en 2015. En Tailandia, se observaron tasas moderadas a altas de falla terapéutica con DHA-PPQ en la parte oriental del país; por lo tanto, Tailandia recomienda actualmente el tratamiento con artesunato-pironaridina (AS-PY) en esta área.
- AL y AS + SP siguen siendo eficaces en los países que los utilizan como tratamiento de primera línea en la Región del Mediterráneo Oriental de la OMS.
- Los tratamientos de primera línea para *P. falciparum* en la Región del Pacífico Occidental de la OMS son AL en todos los países donde la malaria es endémica, excepto China, donde se usa AS-AQ. Las tasas de falla terapéutica a AL fueron del 10% o menos en cuatro estudios en la República Democrática Popular Lao, pero esos estudios no tenían los tamaños de muestra recomendados. Actualmente se está realizando un estudio con un número adecuado de pacientes para investigar mas a fondo estas altas tasas de falla terapéutica.
- La resistencia parcial a la artemisinina surgió de forma independiente en varios focos de la sub-región del gran Mekong (SGM). La OMS continúa monitoreando la situación, que ha evolucionado rápidamente desde las primeras detecciones de mutaciones de *PfKelch13* en la SGM. Algunas mutaciones han desaparecido, mientras que la prevalencia de otras ha aumentado.
- Actualmente, los marcadores más frecuentes al oeste de Bangkok (oeste de Tailandia y Myanmar) son F446I, M476I y R561H. Los marcadores más frecuentes al este de Bangkok (este de Tailandia, Camboya, República Democrática Popular Lao y Viet Nam) son Y493H y P553L. Dos marcadores, R539T y C580Y, también son muy prevalentes en ambas áreas. El cambio en la política de tratamiento en Camboya de DHA-PPQ a AS-MQ resultó en una reducción en la prevalencia de cepas portadoras de resistencia tanto a C580Y como a PPQ.
- Ruanda ha detectado una prevalencia creciente de la mutación R561H, un marcador validado que surgió de forma independiente en la SGM entre 2012 y 2015. La presencia de esta mutación se confirmó en Ruanda en 2018; sin embargo, hasta ahora parece que el retraso en curar la parasitemia asociado con esta mutación no ha afectado la eficacia de la terapia combinada con derivados de la artemisinina (TCA) que se encuentran actualmente entre los evaluados y utilizados en Ruanda.
- La mutación R622I parece estar apareciendo de forma independiente en África, habiéndose encontrado en Eritrea, Etiopía, Somalia y Sudán, y con una frecuencia cada vez mayor en el Cuerno de África. La TCA utilizada en estos cuatro países sigue siendo eficaz, a pesar de la presencia de la mutación. Se necesita una mayor investigación sobre las demoras en curar la parasitemia en esta región.
- En Guyana, la mutación C580Y también surgió de forma independiente entre 2010 y 2017. Sin embargo, en estudios recientes (incluidas encuestas y EET), se encontró que el 100% de las muestras contenían en el gen de tipo silvestre, lo que indica que la mutación puede estar desapareciendo en Guyana.

Resistencia de los vectores a los insecticidas

- De 2010 a 2019, unos 81 países reportaron datos a la OMS sobre la vigilancia regular de la resistencia a los insecticidas.
- De manera preocupante, entre 2010 y 2019, el 57% de los países que informaron usar el RRI no informaron el estado de resistencia a los insecticidas para cada clase de insecticida utilizada en el año de implementación o el anterior, y el 14% no informó sobre el estado de resistencia para cualquier clase de insecticida utilizado. Se exhorta encarecidamente a los países donde la malaria es endémica a garantizar un seguimiento adecuado de la resistencia a los insecticidas de las clases que están en uso o que se están considerando para su uso en las intervenciones de control del vector de la malaria, y a priorizar el seguimiento de estas clases.
- De los 82 países con malaria endémica que proporcionaron datos para 2010–2019, 28 han detectado resistencia a las cuatro clases de insecticidas más comúnmente utilizadas en al menos un vector de la malaria y un sitio de recolección, y 73 han detectado resistencia a al menos una clase de insecticida. Hasta el momento, solo ocho países no han detectado resistencia a ninguna clase de insecticida.
- A nivel mundial, la resistencia a los piretroides – la única clase de insecticida que se usa actualmente en los MTI– continúa siendo generalizada. Se detectó en al menos un vector de la malaria en el 69,9% de los sitios para los que se disponía de datos. Se informó de resistencia a los organoclorados en el 63,4% de los sitios. La resistencia a carbamatos y organofosforados fue menos prevalente, detectándose en 31,7% y 24,9% de los sitios que reportaron datos de monitoreo, respectivamente.
- Según los datos de seguimiento de la resistencia a los insecticidas comunicados a la OMS por los Estados Miembros, un total de 330 áreas en 33 países cumplen actualmente los criterios recomendados por la OMS para implementar mosquiteros con piretroide y butóxido de piperonilo.
- Aunque los Estados Miembros de la OMS y sus socios han comenzado a notificar datos de la vigilancia de la resistencia a los insecticidas para neonicotinoides y pirroles, se desaconseja a los Estados Miembros que utilicen datos generados mediante procedimientos no validados para llegar a conclusiones sobre el estado de resistencia de sus poblaciones de vectores locales a estas clases de insecticidas. Está en curso un proceso formal de la OMS para establecer dosis discriminantes y procedimientos de prueba para estas dos clases de insecticidas. Los datos notificados a la OMS se evaluarán de acuerdo con estas dosis y procedimientos a medida que estén disponibles.
- Para guiar el manejo de la resistencia, los países deben desarrollar e implementar un plan nacional para el monitoreo y manejo de la resistencia a los insecticidas, basándose en el *Marco de la OMS para un plan nacional para el monitoreo y manejo de la resistencia a los insecticidas en los vectores de la malaria*. En 2019, el número de países que habían completado esos planes aumentó a 53, y 29 países estaban en proceso de desarrollarlos.
- Los datos estándar de resistencia a los insecticidas notificados a la OMS se incluyen en la base de datos mundial de la OMS sobre la resistencia a los insecticidas en los vectores de la malaria y están disponibles para su exploración a través del Mapa de Amenazas de la Malaria (World Malaria Threats Map). En 2020 se lanzó una nueva versión de esta herramienta con funciones mejoradas y opciones de descarga de datos.

RESPUESTA A LA MALARIA DURANTE LA PANDEMIA DE COVID-19

- Para abril de 2020, el síndrome respiratorio agudo severo coronavirus 2 (SARS-CoV2), que causa la COVID-19, se había extendido a todos los países donde la malaria es endémica, y al final de la segunda semana de noviembre de 2020, alrededor de 22 millones de casos y 600 000 muertes se habían informado en éstos países.
- La pandemia de COVID-19 y las restricciones relacionadas con la respuesta han provocado alteraciones en los servicios esenciales contra la malaria.
- Además, los primeros mensajes dirigidos a reducir la transmisión del coronavirus aconsejaron al público que se quedara en casa si tenían fiebre, lo que podría alterar la búsqueda de tratamiento para enfermedades febriles como la malaria.
- En marzo de 2020, a medida que la pandemia de COVID-19 se propagaba rápidamente por do el mundo, la OMS convocó un esfuerzo entre socios para mitigar el impacto negativo del coronavirus en los países afectados por la malaria y contribuir a la respuesta a la COVID-19.
- El trabajo se llevó a cabo en estrecha colaboración con la iniciativa Hacer Retroceder la Malaria (Roll Back Malaria) para ponerle Fin a la Malaria, el Fondo Mundial, la Iniciativa del Presidente de los Estados Unidos contra la Malaria (PMI), varios socios de implementación y promoción e instituciones de investigación.
- El esfuerzo entre socios condujo a una estrecha colaboración que dio lugar a varios resultados:
  - publicación de orientación técnica sobre cómo mantener de manera segura los servicios de control de la malaria en el contexto de la pandemia de COVID-19;
  - publicación de un análisis de modelación para cuantificar el impacto potencial de las alteraciones del servicio debido a la pandemia de COVID-19, para reforzar las consecuencias de las alteraciones del servicio. El análisis sugirió que era probable que la mortalidad por malaria en África subsahariana se duplicara para fines de 2020, en relación con la línea de base de 2018, si se produjera una interrupción extrema en la prevención y el tratamiento;
  - mitigar la presión para cambiar la producción de pruebas de diagnóstico de malaria por pruebas para la detección del virus SARS-CoV2;
  - éxito en la resolución de los principales obstáculos mundiales en la fabricación de medicamentos contra la malaria;
  - mitigar las interrupciones en el envío y entrega de productos para malaria;
  - movilización de recursos para equipos de protección personal (EPP) y otros productos básicos para ayudar con la implementación de campañas de prevención, diagnóstico y tratamiento; y
  - seguimiento de las alteraciones en los países para ayudar a orientar la respuesta.
- El esfuerzo colectivo ha llevado a los países a realizar esfuerzos impresionantes para completar campañas de prevención de la malaria que involucran mosquiteros insecticidas de larga duración (MILD), RRI y quimio-prevención estacional de la malaria (QPE), y para minimizar las interrupciones en el diagnóstico y el tratamiento.
- Todos los países que habían planificado campañas de QPE estaban en camino de completarlas a pesar de retrasos moderados en algunas áreas.
- De los 47 países que tenían campañas del RRI planificadas en 2020, 23 las habían completado, 13 estaban en camino de completarlas y 11 estaban desencaminados o en riesgo de no completarlas.
- Varios países han completado sus campañas de MILD y muchos están en proceso de distribuir MILDs. Sin embargo, a la tercera semana de noviembre, de los 222 millones de MILD planificados para su distribución en 2020, solo se habían distribuido alrededor de 105 millones.
- Muchos países también han informado de niveles moderados de alteraciones, y el análisis de modelos muestra que reducciones en el acceso al tratamiento antimalárico efectivo del 10%, 15%, 25% y 50% en África subsahariana en 2020 podrían conducir a 19 000, 28 000, 46 000 y 100 000 muertes más por malaria, respectivamente, para fines de 2020, incluso si se completan todas las campañas de prevención.

1 Introduction

The year 2020 is a milestone for several important health and development goals, including for efforts to reduce the burden of malaria overall and eliminate the disease where possible. It is 20 years since the Abuja Declaration (*1*) and the launch of the Millennium Development Goals (MDGs) (*2*); and 5 years since the global agreement on the Sustainable Development Goals (SDGs) framework (*3*) and the launch of the World Health Organization (WHO) *Global technical strategy for malaria 2016–2030* (GTS) (*4*) and the RBM Partnership to End Malaria *Action and investment to defeat malaria 2016–2030* (AIM) (*5*). The WHO *World malaria report 2020* presents both the estimates of disease burden for 2019 and a review of the updated official estimates of global progress in the fight against malaria in the first 2 decades of the 21st century (2000–2019).

To provide the historical context to help interpret the trends, the report also looks back at the key events and milestones that have shaped the global malaria effort over the past 20 years (**Section 2**). **Section 3** presents the global trends in malaria morbidity and mortality, and estimates of the burden of malaria during pregnancy. Progress towards elimination is presented in **Section 4**. An update of the trends and response in the 11 highest burden countries are presented in **Section 5**, while **Section 6** focuses on the total funding for malaria control and elimination, and for malaria research and development. The supply of key commodities to endemic countries and population-level coverage achieved through these investments is presented in **Section 7**. **Section 8** summarizes globally, by region and country, progress toward the GTS milestones for 2020 and the trajectory towards 2025 and 2030. **Section 9** describes the threats posed by *Plasmodium falciparum* parasites that no longer express histidine-rich protein 2 (HRP2), which is detected by the most widely used malaria rapid diagnostic test (RDT), and by drug and insecticide resistance. **Section 10** describes the malaria response during the COVID-19 pandemic. **Section 11** summarizes the findings of the report, and discusses the findings within the context of the COVID-19 pandemic and the future of the fight against malaria.

The main text is followed by annexes that contain data sources and methods, regional profiles and data tables. Country profiles are presented online (https://www.who.int/teams/global-malaria-programme).

2 Malaria milestones, 2000–2020

It took almost 30 years from the end of the Global Malaria Eradication Programme (in 1969) for malaria to re-emerge as a public health priority in global health and development discourse (*6–8*). Although data from 1969 to 2000 are scarce, this period was characterized by a sense of failure and abandonment in the fight against malaria. During these 3 decades, hundreds of millions of people were infected with malaria, tens of millions – mostly in sub-Saharan Africa – died, millions of households failed to emerge out of poverty as they struggled with catastrophic health expenditures, hundreds of thousands of pregnant women died during delivery due to malaria-related complications, and millions of children were born with low birthweight, potentially leading to early death or lifelong disability. Millions of children who survived struggled with learning as they dealt with frequent absenteeism due to multiple episodes of malaria, chronic anaemia, seizures or cognitive impairment – consequences of infection and severe disease. Huge blows were dealt to the growth of already weak post-independence national economies, and their attempts to build viable health systems were hampered by lost productivity and high demand for health care.

Against this background, the first 2 decades of the 21st century represent a golden era in the history of malaria control. The world pulled together to fight malaria, delivering one of the biggest returns on investment in global health. The unprecedented scale-up of malaria interventions over this period has led to considerable reductions in disease incidence and mortality. These efforts coincided with other trends and changes that have had a positive impact on malaria, including a period of considerable economic growth and development, infrastructure and housing improvements, rapid urbanization, and general improvements in health systems and population health. By the end of 2019, about 1.5 billion malaria cases and nearly 7.6 million deaths had been averted since the beginning of the century (**Section 3**). The indirect effect of these gains on the overall health of populations and economies is poorly documented, but is likely to be substantial. In recent years, however, progress has stalled, at a time when we are still dealing with very high levels of malaria burden, re-emphasizing the need to do a lot more to sustain the gains, accelerate progress and achieve the global ambition of a malaria free world (*9*).

This section reflects on the key malaria milestones in the past 2 decades and the preceding events that laid the foundation. The aim is not to present a comprehensive review of the malaria journey across this period, but rather to highlight some of the major global and regional events that shaped the direction we have travelled. A summary timeline is presented in **Fig. 2.1**.

2.1 LAYING THE FOUNDATIONS

Following decades of not being a global priority, the 1990s laid both the political and scientific foundations for a renewed response to malaria. There were no reliable estimates of the global burden, but the situation was considered alarming, particularly in sub-Saharan Africa, because the disease was seen both as the biggest killer of children and a major obstacle to socioeconomic development (*1*). Malaria control programmes were weak, little effective vector control was being deployed, and access to treatment was limited. Furthermore, the efficacy of chloroquine (CQ), the most commonly used antimalarial for both treatment and prevention, was rapidly declining, resulting in further increases in malaria mortality (*10*).

This situation triggered key political events in the 1990s that helped to shape progress in the following 2 decades. The Ministerial Conference on Malaria, held in Amsterdam, the Netherlands, in 1992, endorsed a new WHO Global Strategy Malaria Control to guide the response (*11*). In 1996, the WHO Member States at the 49th World Health Assembly called for the establishment of a special programme on malaria, considering malaria control as an integral part of primary health care (*12*). This led to an initial investment of US$ 20 million[1] from WHO (from unspecified funds of the Director-General), to launch the "Accelerated Implementation of Malaria Control" in Africa (*13*). In June 1997, at its Assembly of Heads of State and Government, the Organization of African Unity (OAU) released the Harare Declaration on Malaria Prevention and Control (*6*) – the first formal political commitment in Africa to place malaria within the context of African economic recovery and development. Two months later, the Multilateral Initiative on Malaria (MIM) was launched in Dakar, Senegal, at the first Pan-African Malaria Conference (*14*). This unprecedented gathering brought together leading researchers and academics working on malaria, heads of African malaria control programmes and key international research institutions. In October 1998, the Director-General of WHO, Dr Gro Harlem Brundtland, launched the Roll Back Malaria (RBM) initiative, established through a partnership between WHO, the World Bank, the United Nations Children's Fund (UNICEF) and the United Nations Development Programme (UNDP) (*15*).

During the 1990s, and in the face of limited capacity and financial resources for research and development, the WHO-hosted Special Programme for Research and Training in Tropical Diseases (TDR) (*16*), and some of the leading international research funders supported the early seminal malaria trials and studies. Large-scale trials in Africa documented the efficacy of pyrethroid-impregnated insecticide-treated mosquito nets (ITNs) in preventing malaria and mortality (*17, 18*). Early trials of artemisinin-based combination therapies (ACTs) also suggested that these therapies were efficacious and were expected to reduce the risk of resistance developing and spreading (*19, 20*). Research on the use of malaria medicines for chemoprevention to reduce severe disease and death among the key target groups (infants, children aged under 5 years and pregnant women) was in progress (*21–23*). The search for a malaria vaccine intensified, and clinical trials of candidate products began in Africa (*24*).

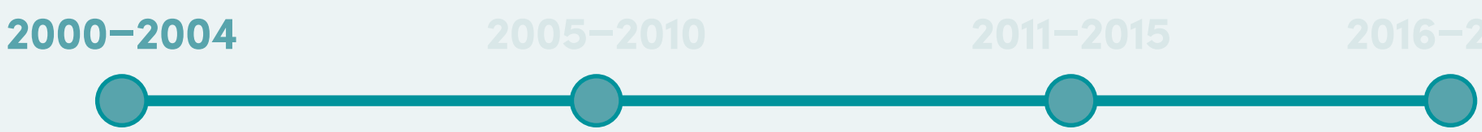
In 1998, the INDEPTH Network was established as a network of health and demographic surveillance systems that provide detailed and accurate data on health and population problems in low- and middle-income countries (LMICs) (*25*). Many of the members of the INDEPTH Network were those that undertook the early ITN and antimalarial trials and studies that helped inform malaria control subsequently. By 1998, WHO had made a recommendation for the use of sulfadoxine-pyrimethamine (SP) for intermittent preventive treatment in pregnancy (IPTp) (*26*). By 1999, the WHO Pesticides Evaluation Scheme (WHOPES) had recommended the use of pyrethroid-impregnated nets for malaria prevention on the basis of safety, efficacy and quality (*27, 28*). In 1999, a study confirming the presence of vector resistance to pyrethroids, already extensively used in agriculture and in coils and aerosols for vector control, was published (*29*). To tackle the rapidly evolving threat of CQ resistance, many countries adopted SP as their first-line treatment of uncomplicated malaria. SP was used widely across Africa through a largely presumptive approach to malaria treatment. However, evidence of failure of SP in the treatment of clinical malaria soon emerged in many malaria endemic countries (*30*).

Resistance to CQ and SP emerged at a time when there were hardly any antimalarial drugs in the development pipeline, and pharmaceutical companies considered that it was not commercially attractive to invest in such drugs. In recognition of the looming lack of efficacious alternative drugs, the Medicines for Malaria Venture (MMV) was established in November 1999; the aim was to facilitate the discovery, development and delivery of efficacious and affordable antimalarial drugs (*31*). MMV has since been a leader in the product development partnership for drugs for the prevention and treatment of malaria.

By the end of the 20th century, momentum for a global response to malaria had started, but most malaria endemic countries did not have the resources to mount such a response.

[1] All US$ figures used in this section have been converted to constant 2019 US$.

2.2



Renewed political commitment, the establishment of RBM as a cabinet project of the WHO Director-General and the growing availability of better tools to fight the disease were all instrumental in the signing of the Abuja Declaration at the African Heads of States and Governments Summit, held in Abuja, Nigeria, on 24–25 April 2000 (*1*). The overarching aim of the Abuja Declaration was to "Halve the malaria mortality for Africa's people by 2010, through implementing the strategies and actions for Roll Back Malaria". This was to be achieved through multiple approaches to ensure that, in malaria endemic Africa, 60% of malaria patients had access to prompt effective treatment, 60% of children aged under 5 years and pregnant women were protected with ITNs, and 60% of pregnant women received presumptive intermittent treatment to alleviate the consequences of malaria infection to the mother and her unborn child. African countries had also committed to achieving expenditure of 15% of gross domestic product (GDP) on health by 2015. They urged donor countries to "fulfil the yet to be met target of 0.7%" of their gross national product (GNP) as official development assistance (ODA) to developing countries (*1*). The Abuja Declaration was further reinforced by the Group of Eight (G8) countries, during the Okinawa Summit in Japan in July 2000, committing to the target of reducing malaria mortality by 50% by 2010 (*32*).

In September 2000, the framework of eight MDGs was launched during the Millennium Summit at the United Nations (UN) headquarters in New York (*2*). Under the MDGs, there was a clear articulation that malaria was a global development issue, with emerging research documenting more clearly the considerable toll of the disease on economic development in endemic countries (*33*). MDG target 6C required the halting of the malaria epidemic and the reversal of incidence and death rates associated with malaria (*34*). This strengthened the calls made in the Harare and Abuja declarations, and by the RBM initiative, for a globally funded partnership to fight malaria, to save lives and to accelerate economic growth in affected countries.

In 2000, in response to reduced efficacy of CQ and SP for the treatment of clinical malaria, WHO published recommendations for the use of ACTs (*35*). In 2001, the initial evidence of delayed parasite clearance with artesunate was reported in Cambodia (*36*). The previous year, WHO also recommended the use of RDTs in health facilities, as increasingly accurate and affordable tests became available (*37*). This led to a major shift away from what had been a predominantly syndromic approach – with the presumptive treatment of all fevers for malaria – to an approach based on pretreatment parasitological confirmation of malaria. This improved the rational use of ACTs and has also subsequently enhanced the value of routinely reported data on malaria burden. However, parasitological diagnosis continues to be used at modest levels, especially in sub-Saharan Africa (**Section 7**).

In 2000, the Bill & Melinda Gates Foundation was established; it is now one of the largest private foundations in the world (*38*). In its work on malaria, the foundation has focused on development of new vaccines, diagnostics, medicines and vector control products and their delivery and use in public health, while advancing improved surveillance systems and data analytics.

Several new institutions, programmes and initiatives soon followed. In May 2001, the European Union launched the "Programme for accelerated action on HIV/AIDS, malaria and tuberculosis in the context of poverty reduction", which also led to the creation of the European and Developing Countries Clinical Trials Partnership (EDCTP). Founded as a public–public partnership between countries in Europe and sub-Saharan Africa, the EDCTP is supported by the European Union (*39*). The EDCTP aims to accelerate clinical development of vaccines, diagnostics and medicines for infectious diseases of the poor, and has been a major investor in malaria clinical trials (*40*), several of which have contributed to the development of global normative guidance by WHO. In 2003, the Foundation for Innovative New Diagnostics (FIND) was established as a global non-profit organization, with the aim of accelerating innovation in the development and delivery of diagnostics of infectious diseases of the poor (*41*). As a WHO Collaborating Centre for Laboratory Strengthening and Diagnostic Technology Evaluation, FIND has supported the generation of evidence for malaria diagnosis policies, producing regular reports on the quality and performance on RDTs.

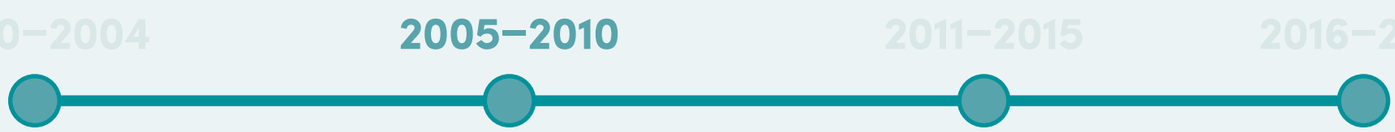
In 2002, the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund) was created, marking the beginning of an unprecedented period for malaria funding (*42*). The Global Fund was originally conceived as a financing mechanism for HIV/AIDS but ministers of health, especially from the WHO African Region, called for it to be extended to malaria (*34*, *43*).

In recognition of the terrible toll of malaria on children and pregnant women, UNICEF stepped up its key role in the malaria response, in addition to being one of the founders of RBM. UNICEF's focus was on strengthening community-based and local action to improve child health and nutrition. By the early 2000s, it was one of the world's largest global procurers of ACTs, ITNs and subsequently long-lasting insecticidal nets (LLINs), supporting the delivery of nets during routine and mass vaccination campaigns (*44*). UNICEF continues to support the scale-up of diagnosis and treatment of malaria at the community level, through integrated delivery platforms and support for the delivery of seasonal malaria chemoprevention (SMC) (*45*).

The path from the promising results from the field trials of the efficacy of ITNs and ACTs to scaling these up in malaria endemic countries remained challenging. There were the limited supply of ITNs and ACTs, their high costs and the lack of substantial domestic or external funding for malaria control to scale-up new interventions for prevention and treatment. In 2002, the WHO RBM initiative published a framework for scaling up ITNs in Africa. The framework proposed two key elements: sustained subsidies strictly targeted to vulnerable groups, and a strengthened and expanded commercial market that would provide ITNs at the lowest possible prices for the general population (*46*). The consensus at the time was not in favour of delivering ITNs to the whole population or providing ITNs at no cost, even to vulnerable groups, mainly because of concerns about the financial sustainability of doing so. Instead, subsidized distribution through social marketing and mother and child clinics became the norm. The overarching aim was to catalyse the growth of commercial markets to meet the demand for ITNs and reduce commodity prices (*46*).

The *Africa malaria report*, a precursor to the world malaria report, was published in 2003 (*47*). Despite many important developments, by the end of 2004, most mosquito nets were still conventional ITNs (i.e. they required frequent retreatment), and their use by children aged under 5 years was only 2% (*48*). Although recommended by WHO since 1998, IPTp scale-up had barely started, only 42% of children with fever sought treatment and received antimalarials, and most malaria treatment was presumptive and predominantly with CQ or SP, which were no longer recommended for treatment by WHO.

2.3



In March 2005, the first meeting on the replenishment of the Global Fund took place in Stockholm, Sweden (*49*). At the end of the replenishment process, US$ 3.7 billion was pledged to the Global Fund for the period 2006–2007, of which about US$ 760 million was eventually committed to malaria control (*50*). In June 2005, the United States President's Malaria Initiative (PMI) was launched, targeting support to Angola, Uganda and the United Republic of Tanzania (*51*). By the end of the decade, PMI had extended its support to 12 additional countries in Africa (*52*).

The injection of funding came at an important time. At the end of 2005, WHO released the first world malaria report, presenting global progress on malaria in the period 2000–2004 (*48*). The report showed that the malaria burden remained high, with 1 million estimated deaths, mainly in sub-Saharan Africa, and that access to malaria prevention and treatment had barely improved since 2000. In 2005, the WHO RBM initiative published a strategy for improving access to treatment through home management of malaria (*53*). In the same year, WHO also published a recommendation to use artesunate and artemisinin suppositories for pre-referral treatment of severe malaria (*54*).

Measuring the burden of malaria and progress in intervention was proving to be a difficult task. Also, as funding increased, a credible measure of the impact of the investment was increasingly seen as critical to make the case for further funding. Surveillance systems in malaria endemic countries remained weak, and most reported malaria case data were not based on parasitological diagnosis. There was limited understanding of the subnational malaria epidemiology to effectively guide investments. In 2004, the RBM Monitoring and Evaluation Reference Group (MERG), with funding support from the United States Agency for International Development (USAID), began the process of developing a malaria indicator survey toolkit (*55*). The toolkit was intended to support standalone malaria-specific surveys or malaria modules included in standard demographic and health surveys (DHS) (*56*) or UNICEF-supported multiple indicator cluster surveys (MICS) (*57*). These surveys have since been the backbone of understanding infection prevalence and malaria intervention coverage in communities in Africa, and in the tracking of global progress annually through the world malaria report. Since 2006, over 100 surveys with malaria-related information have been conducted, mainly in sub-Saharan Africa.

Creation of new partnerships and initiatives continued. To respond to the threat of insecticide resistance, innovation was needed to develop new vector control solutions. In 2005, the Innovative Vector Control Consortium (IVCC) was established as a partnership of industry, the public sector and academia (*58*). As the main product development partnership for malaria vector control, IVCC has worked with a range of partners to facilitate the development of novel and improved public health insecticides, formulations and products to address these challenges. It has also supported field research and efforts to improve access to these tools through its global access strategy (*59*). In 2006, Unitaid was established as an agency that is hosted and administered by WHO; Unitaid's mission is to scale up access to treatment for HIV/AIDS, malaria and tuberculosis in developing countries through price reductions of drugs and diagnostics, and improved availability (*60*). Unitaid has used an innovative financing approach – the solidarity levy on airline tickets imposed by France and other countries. Since its establishment, Unitaid's investment in malaria prevention, diagnosis and treatment has developed into a large portfolio (*61*).

Faced with weak health systems and low domestic funding, approaches to scale-up of interventions remained challenging. Until 2007, the recommendation was still to prioritize coverage of ITNs to key target groups in sub-Saharan Africa; however, it was estimated that by 2007 only 15% of children aged under 5 years and pregnant women were sleeping under an ITN (*50*). The dominant channels for ITN distributions were social marketing of nets and continuous distributions in health facilities, with the latter moving from being highly subsidized to being free in some countries from around this time (*62*). General case management practice was also to treat any febrile child as a malaria case, often presumptively, because RDTs had not been widely scaled up and microscopy was limited mainly to large urban health facilities.

In August 2007, supported by evidence from Kenya (*63*), the WHO Global Malaria Programme (GMP) released a position statement in which it recommended that "insecticidal nets be long-lasting, and distributed either free or highly subsidized and used by all community members" and noted that "... free mass distribution of LLINs is a powerful way to quickly and dramatically increase coverage, particularly among the poorest people" (*64*). This statement laid the foundation for ITNs becoming by far the largest investment in a single malaria intervention. Free mass campaigns to cover individuals of all ages with LLINs, and continuous distribution channels to sustain coverage, were launched and marked the beginning of a rapid increase in ITN coverage in sub-Saharan Africa (**Section 7**). Although studies showed significant reduction in parasite prevalence following universal coverage, the decision to implement universal coverage was driven primarily by coverage and equity aims rather than comprehensive cost–benefit analysis.

For decades, fuelled by the sense of failure following the first eradication campaign of the 1950s and 1960s, the world had shied away from placing eradication of malaria within its goals (*24*). However, buoyed by the increasing global commitment to fight malaria, the opportunities to rapidly expand the scale-up of interventions and results from the development of new tools, including vaccines – Bill and Melinda Gates (of the Bill & Melinda Gates Foundation) made a global call for a renewed commitment to eradicate malaria (*65*) and WHO Director-General Dr Margaret Chan publicly endorsed that vision. This triggered a global discussion on the feasibility of malaria eradication and its critical dependence on the development of new and improved tools. No timeline for that effort was defined.

Shortly after, the RBM Partnership – by now a partnership entity hosted within WHO – released the Global Malaria Action Plan for a malaria free world (GMAP) (*66*). This plan built on the WHO call for universal coverage and the emerging discussions on malaria eradication. A 2010 target was assigned to achieve universal coverage, reduce malaria morbidity and mortality by half from a 2000 baseline, and eliminate malaria in 8–10 countries. Also explicitly stated in the GMAP was a target of achieving near-zero preventable deaths by 2015, and of malaria eradication through progressive elimination in countries, without a defined date for its achievement. The plan outlined three strategic components with research as a supporting component: scale-up for impact, sustained control and elimination.

Following the first, second and third replenishments (in 2005, 2007 and 2010, respectively), Global Fund resources for malaria increased considerably (*67*). External investment in malaria was estimated to be US$ 450 million in 2005, with an estimated US$ 1 billion spent in the period 2000–2005 (**Section 6**). Increasing access remained the key challenge. Although ITNs were moving from a social marketing scheme towards mass distribution campaigns, new delivery mechanisms were being developed with regard to ACTs (*68*, *69*). In 2008, the Global Fund assumed funding responsibilities, with support from Unitaid, for the Affordable Medicines Facility-malaria (AMFm) as a pilot programme that aimed to take advantage of the relative high use of the private retail sector for treatment of fever, and thus expand access to quality-assured ACTs (*68*, *69*). An evaluation funded by the Global Fund showed that positive achievements included increased availability of ACTs, reduced prices, increased market share and minimal disruption of supplies to the public sector (*70*). However, given the low levels of parasitological diagnosis and by not subsidizing diagnostic testing in the private sector, the AMFm failed to fully target the subsidized ACTs to those with malaria.

In 2007, confirmation of what was then called partial artemisinin resistance was established in the area of the Thai–Cambodia border, and in 2008 the first clinical cases due to malaria parasites containing gene deletions causing false negative RDTs were described in Peru (*36*, *71*). Since then, monitoring and mitigating ACT resistance has become a major focus of the global malaria community; also, deletions in the *P. falciparum* genes for HRP2 (*pfhrp2*) have emerged in sub-Saharan Africa, and recent evidence suggests worrying levels of prevalence in Horn of Africa countries (**Section 9.1**).

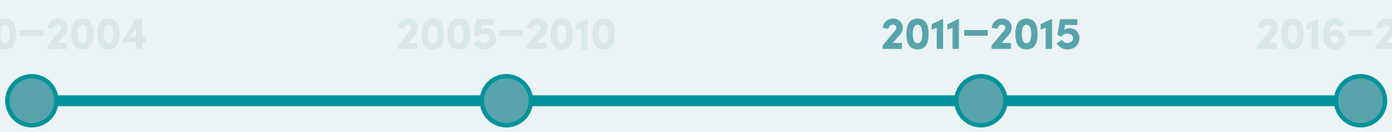
In 2009, the African Leaders Malaria Alliance (ALMA) was established as a forum to provide visibility at high levels of political leadership for the response against malaria in Africa (*72*).

On the policy front, WHO released a recommendation on the use of intermittent preventive treatment in infants with SP (IPTi-SP) in 2010, following evidence of modest efficacy from pooled analysis of randomized control trials in Gabon, Ghana, Kenya, Mozambique and the United Republic of Tanzania (*73*).

In 2010, the US National Institute of Allergy and Infectious Diseases established 10 International Centers for Excellence for Malaria Research to support multidisciplinary malaria research across diverse settings in Africa, Asia Pacific and South America (*74*).

The high-level attention, increased funding and successful implementation of technical strategies were beginning to contribute to a positive impact. By 2010, it was estimated that, globally, substantial reductions in malaria morbidity and mortality had been reported (*75*). WHO certified United Arab Emirates in 2007 and Morocco and Turkmenistan in 2010 as malaria free (**Section 4**).

2.4



In 2011, WHO established the Malaria Policy Advisory Committee (MPAC) to provide independent advice to WHO on developing policy recommendations to control and eliminate malaria, and thus improve the quality and independence of the malaria policy-making process. The MPAC is an independent advisory group that aims to bring together the world's foremost experts on malaria to provide strategic technical guidance to the WHO Director-General as part of a transparent, responsive and credible policy-setting process on malaria (*76*).

In 2011, PMI added the countries of the Greater Mekong subregion (GMS), the Democratic Republic of the Congo, Guinea, Nigeria and Zimbabwe to its list of countries to receive support; this brought its tally of support to 20 high burden African countries (*52*).

By the end of 2011, global sales of ACTs had exceeded 500 million treatment doses, marking a period of sustained scale-up of effective malaria interventions (*77*). However, artemisinin resistance was expanding in the GMS and was considered as a potential threat to the global malaria enterprise (*36*, *78*). Learning from the experience of poor mitigation of resistance to previous antimalarials, WHO mobilized the global community by launching the Global Plan for Artemisinin Resistance Containment (GPARC) (*79*).

In 2012, WHO and partners launched the Mekong Malaria Elimination (MME) programme (*78*, *80*). This is a multi-country (Cambodia, China, Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam) programme to fight artemisinin resistance, primarily through accelerated progress towards malaria elimination by 2025, focusing especially on *P. falciparum* malaria. To support the MME programme, the Global Fund launched the Mekong Regional Artemisinin-resistance Initiative (RAI) in 2013, and has invested considerable resources (nearly US$ 600 million) in the subregion since then (*81*). Dramatic progress has been achieved in the GMS since the launch of the MME programme, and most countries are on target to achieve *P. falciparum* elimination by 2025 (**Section 4**); also, there is to date no evidence of a spread of artemisinin resistance from the GMS to other parts of the world (**Section 9**).

In 2012, the Global Fund launched its second strategy for achieving impact through its investments across five strategic objectives: invest more strategically, evolve the funding model, actively support grant implementation success, protect and promote human rights, and sustain the gains and mobilize resources (*82*). Also in 2012, the Global Fund decided to integrate AMFm into core grant management processes through an orderly transition in 2013, allowing countries to use some of their core grants to implement AMFm as part of a co-payment mechanism (*83*).

On the global policy front, in 2012 WHO published a recommendation for the use of SMC in children in high burden and highly seasonal malaria transmission areas, in response to evidence of the strong impact on malaria morbidity (*84*). In support of the scale-up of SMC, Unitaid launched the ACCESS-SMC project in 2013 (*85*), the Global Fund mainstreamed the intervention into core grants in 2017 (*86*), and PMI expanded its support for SMC activities in Benin, Burkina Faso, Cameroon, Ghana, Guinea, Mali, Niger, northern Nigeria and Senegal (*87*).

In 2012, WHO published the Global Plan for Insecticide Resistance Management in Malaria Vectors (*88*) as a response to mitigate the spread of insecticide resistance. Adding to the list of biological threats to the global malaria fight, 2014 saw the first evidence of the presence of an *Anopheles stephensi*, an efficient urban malaria species in Asia and Persian Gulf, being reported in sub-Saharan Africa, in Djibouti, where it was implicated in a malaria epidemic (*89*). Since then, *An. stephensi* has been reported to be established in Ethiopia and is efficient in transmission of both *P. vivax* and *P. falciparum* (*90*).

Following the call for malaria eradication by Bill and Melinda Gates, several scientific publications – for example, those from the Malaria Eradication Scientific Alliance published in *PLoS Medicine* (*91*) and the Lancet series on malaria elimination (*92*) – re-energized the debate on feasibility, approaches and innovation towards malaria elimination and its eventual eradication. At the same time, the application of novel geospatial methods to the growing number of community parasite prevalence surveys in sub-Saharan Africa began to create a clearer picture of the geographical distribution of *P. falciparum* malaria subnationally (*93–96*). This increased granularity of malaria risk mapping exposed underlying heterogeneity and the need for strategic planning and resource allocation at subnational levels (**Section 5**).

Some 15 years after the launch of the MDGs, analysis presented in the *World malaria report 2015* (*97*) suggested that the target of reversing the malaria trends had been achieved. It was estimated that malaria case incidence had reduced by 37% and mortality rate by 60% between 2000 and 2015. An estimated 438 000 people had died of malaria in 2015; thus, the near-zero death target of the GMAP had not been achieved (*66*). These major declines in the malaria burden were considered conclusive evidence of achieving, or even surpassing, the MDG target 6C, and were hailed as showing the remarkable strides that could be made with adequate investment and political commitment. Three years earlier, in anticipation of the end of the MDGs, the UN Conference on Sustainable Development was convened in Rio de Janeiro, Brazil, where Member States decided to develop a set of SDGs to build on the MDGs, and to establish the UN High-level Political Forum on Sustainable Development (*98*). Progress in malaria incidence and mortality rate were recognized as key indicators in SDG Goal 3, target 3.3, which stated "By

2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, waterborne diseases and other communicable diseases"; that goal had a target of halving malaria case incidence by 2020, and contributing to the ending of preventable deaths of neonates and children aged under 5 years by 2030, from a baseline of 2015 (*3, 99*).

Among the global malaria community, there was now consensus on the need to develop a coherent and even more ambitious global strategy, not only to sustain the gains, but also to ensure accelerated progress and align with the SDGs. In 2012, the MPAC discussed the proposal to develop a global technical strategy, and recommended it to the WHO Director-General. The GTS was formally adopted by the Sixty-eighth World Health Assembly in May 2015, in resolution WHA68.2 (*4*). With a vision of a world free of malaria, and underpinned by five guiding principles, the GTS included three pillars, two supporting elements and four impact goals across three milestone years (2020, 2025 and 2030) using a 2015 baseline (**Table 2.1**). For the first time, transforming surveillance systems was affirmed as a core intervention, recognizing the critical function of reliable information in improving the efficiency and effectiveness of interventions to prevent and treat malaria.

As an investment case for the GTS, the RBM Partnership to End Malaria developed the investment plan AIM (*5*). Anchored in a strong partnership, with a multisectoral and coordinated approach, the plan outlines core areas of focus: mobilizing resources; strengthening multisectoral and intercountry collaboration; keeping people at the centre of the response; strengthening the enabling environment; fostering and sharing innovations and solutions; and facilitating change. Both the GTS and the AIM acknowledged that strengthened health systems would be needed, because these would determine the rate of progress towards the bold targets. It was hoped that the adoption by countries of the GTS and AIM would also contribute to the post-2015 SDGs.

By 2015, over 1 billion ITNs had been distributed globally, accounting for the largest proportion of donor investment in malaria. Modelling analysis suggested that, among malaria interventions, use of ITNs was the largest contributor to the reduction in the burden of malaria in sub-Saharan Africa (*93*). By the end of this period, however, pyrethroid resistance had increased both in terms of geography and intensity (*100*).

Armenia and Maldives were certified by WHO as free of malaria in 2011 and 2015, respectively. The *Malaria Elimination Strategy in the GMS 2015–2030* was endorsed by the MPAC and adopted by health ministers in GMS countries in 2015; its goals were to eliminate *P. falciparum* malaria in 2025 and all malaria in 2030 in the subregion (*101*).

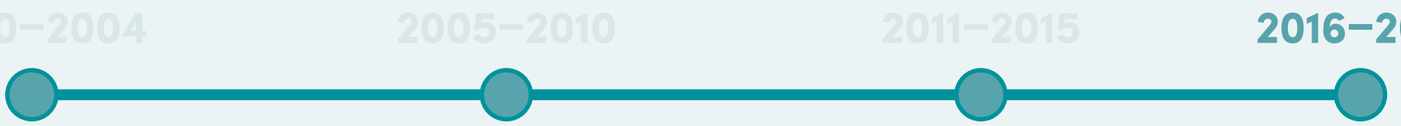
TABLE 2.1.

GTS: global targets for 2030 and milestones for 2020 and 2025 *Source: GTS (4).*

Vision – A world free of malaria			
Principles			
1. All countries can accelerate efforts towards elimination through combinations of interventions tailored to local contexts			
2. Country ownership and leadership, with involvement and participation of communities, are essential to accelerating progress through a multisectoral approach			
3. Improved surveillance, monitoring and evaluation, as well as stratification by malaria burden, are required to optimize the implementation of malaria interventions			
4. Equity in access to health services, especially for the most vulnerable and hard-to-reach populations, is essential			
5. Innovation in tools and implementation approaches will enable countries to maximize their progression along the path to elimination			
Pillars			
Pillar 1	Ensure universal access to malaria prevention, diagnosis and treatment		
Pillar 2	Accelerate efforts towards elimination and attainment of malaria free status		
Pillar 3	Transform malaria surveillance into a core intervention		
Supporting elements			
Supporting element 1. Harnessing innovation and expanding research			
Supporting element 2. Strengthening the enabling environment			
Goals	**Milestones 2020**	**2025**	**Targets 2030**
1. Reduce malaria mortality rates globally compared with 2015	At least 40%	At least 75%	At least 90%
2. Reduce malaria case incidence globally compared with 2015	At least 40%	At least 75%	At least 90%
3. Eliminate malaria from countries in which malaria was transmitted in 2015	At least 10 countries	At least 20 countries	At least 35 countries
4. Prevent re-establishment of malaria in all countries that are malaria free	Re-establishment prevented	Re-establishment prevented	Re-establishment prevented

GTS: *Global technical strategy for malaria 2016–2030.*

2.5



Following the launch of the GTS and AIM, many WHO regions and national programmes launched their own aligned strategies. In June 2016, the RBM initiative previously hosted by WHO was renamed the RBM Partnership to End Malaria, with new hosting arrangements under the UN Office for Project Services (*102*). In 2017, the Global Fund launched its new strategy for the period 2017–2022, titled Investing to end epidemics, with four strategic objectives: maximizing impact, promoting and protecting human rights and gender equality, building resilient and sustainable systems for health for all, and mobilizing increased resources (*103*). Building on the ALMA experience, the Asia Pacific Leaders Malaria Alliance (APLMA) was launched in 2017 (*104*). In the same year, PMI extended its support to include the GMS and five additional African countries (*52*).

As part of the commitment to achieving Goal 3 of the GTS (i.e. ensuring at least 10 countries reach malaria elimination by 2020), in April 2017, WHO launched the "eliminating countries for 2020" (E-2020) initiative (*105*). Twenty-one countries that had made substantial progress over the past decade and were considered close to elimination were selected to take part in the E-2020 (**Section 4**). By 2018, the Goal 3 milestone for 2020 was already on target, with 10 countries that were malaria endemic in 2015 expected to be malaria free by 2020 (*77*). Since 2015, Kyrgyzstan (2016), Sri Lanka (2016) and Uzbekistan (2018) have been certified by WHO as malaria free. Paraguay (2018) and Algeria (2019), both E-2020 countries, each became the first country in their respective region to be certified malaria free since 1973. Argentina (2019) followed Paraguay to become the next country in the WHO Region of the Americas to be certified. The *Ministerial Declaration on Accelerating and Sustaining Malaria Elimination in South-East Asia Region* was signed in November 2017, to accelerate malaria elimination in this region (*106*).

In contrast to the impressive progress on the GTS elimination goal, estimates published in the *World malaria report 2017* showed that the morbidity and mortality goals were off track, and that gains were beginning to reverse in some countries (*107*). The main theme of the report was that the malaria world was at a "crossroads", and an urgent response was required to kickstart the stalling progress (*8*, *104*). The Director-General of WHO, Dr Tedros Ghebreyesus, declared:

> ***The data showed that less than half of countries with ongoing transmission were on track to reach critical targets for reductions in the death and disease caused by malaria. Progress appeared to have stalled … The choice before us is clear. If we continue with a 'business as usual' approach – employing the same level of resources and the same interventions – we will face near-certain increases in malaria cases and deaths.***

This call led to the formation of the high burden to high impact (HBHI) response coordinated by WHO and the RBM Partnership to End Malaria and led by endemic countries (*108*). The formal launch of the HBHI approach was held in Maputo, Mozambique, in November 2018, during the 20th anniversary of the RBM Partnership. The approach is based on four response elements: galvanizing political will nationally and globally to reduce malaria deaths; using strategic information to drive impact; implementing best global guidance, policies and strategies suitable for all malaria endemic countries; and applying a coordinated country response (*108*). This approach has been led by 11 countries that accounted for 70% of the global burden of malaria: Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, India, Mali, Mozambique, Niger, Nigeria, Uganda and the United Republic of Tanzania. Since then, the launch of the HBHI approach has been formally initiated in all countries except in Mali (where HBHI-related activities are underway). In all initiation meetings, there was high-level government and partnership participation, with strong commitment to support the approach.

Since 2018, WHO, the RBM Partnership to End Malaria and collaborating partners have supported the HBHI countries to develop robust national malaria strategic plans (NMSPs), and to prioritize resources using subnational tailoring of interventions, driven by epidemiological, ecological and health system data, and other information (**Section 5**). WHO has embarked on a process to improve the predictability, timeliness and transparency of its policy-making process, and to produce the first set of WHO consolidated malaria guidelines. The aim is to re-position its policy recommendations, moving away from a prescriptive set of statements to instead providing problem-solving tools for countries to adapt, and inculcating an approach of subnational tailoring of interventions based on local data. As a first step, WHO published a compendium of all policies, clarifying the distinction between actual *recommendations*, which are based on thorough, systematic reviews of the evidence by a guideline development group (*109*), and *best practice statements*, which are designed to help countries implement policies but should not be considered restrictive. These concepts were further crystallized through a technical brief (*110*) to countries, to support national malaria programmes (NMPs) making funding requests to the Global Fund and other organizations.

In October 2019, during its Sixth Replenishment Conference in Lyon, France, the Global Fund managed to raise the highest level of funding since its inception, with a commitment of US$ 14 billion (*111*). Of this amount, US$ 4.8 billion was allocated to malaria, an increase of over US$ 1 billion from the previous allocation period. PMI funding also increased to US$ 755 billion in 2019 (*52*).

Incremental improvements to the tools available for malaria control have continued; for example, another ACT (pyronaridine-artesunate) has been developed (*112*), as have mosquito nets treated with insecticides other than pyrethroids (these are currently undergoing evaluation). In 2016, WHO released a position paper on the world's first malaria vaccine to have received a positive recommendation from the European Medicines Agency (EMA). As part of a collaboration between WHO, PATH, GlaxoSmithKline (GSK), the Global Fund, Gavi and Unitaid, GSK's RTS,S vaccine is undergoing a phased pilot introduction through routine

childhood immunization services in parts of Malawi, Ghana and Kenya, which started in 2019. Some 12 months on, about 500 000 children have been reached with their first dose of the vaccine. An ongoing evaluation is assessing the public health value of the vaccine as a complementary tool that could be added to the existing preventive, diagnostic and treatment measures recommended by WHO.

At about the same time as evidence was emerging that progress towards GTS milestones for burden reduction had stalled and the global community was grappling with ways to support countries to get back on track, active discussions were happening about whether malaria eradication with a defined timeline was feasible (*113*). In 2016, the then Director-General of WHO, Dr Margaret Chan, established a strategic advisory group tasked with analysing future scenarios for malaria, including the feasibility and expected cost of eradication. The Strategic Advisory Group for Malaria Eradication (SAGme) concluded its work in 2019. Based on SAGme's work, WHO reaffirmed its position on malaria eradication and the importance of investing in universal health coverage (UHC) through a statement by the Director-General, Dr Tedros Ghebreyesus:

WHO continues to unequivocally support the goal of malaria eradication. To achieve this vision, we must deliver on our promises: to increase domestic and international investments in health; reduce malaria in the highest-burden countries; achieve universal health coverage; ensure no child dies from a preventable disease; and leave no one behind in pursuit of health and development goals because they were born poor. By delivering on these promises and investing in the development of transformative new tools, the world can achieve the health-related Sustainable Development Goals and eradicate malaria.

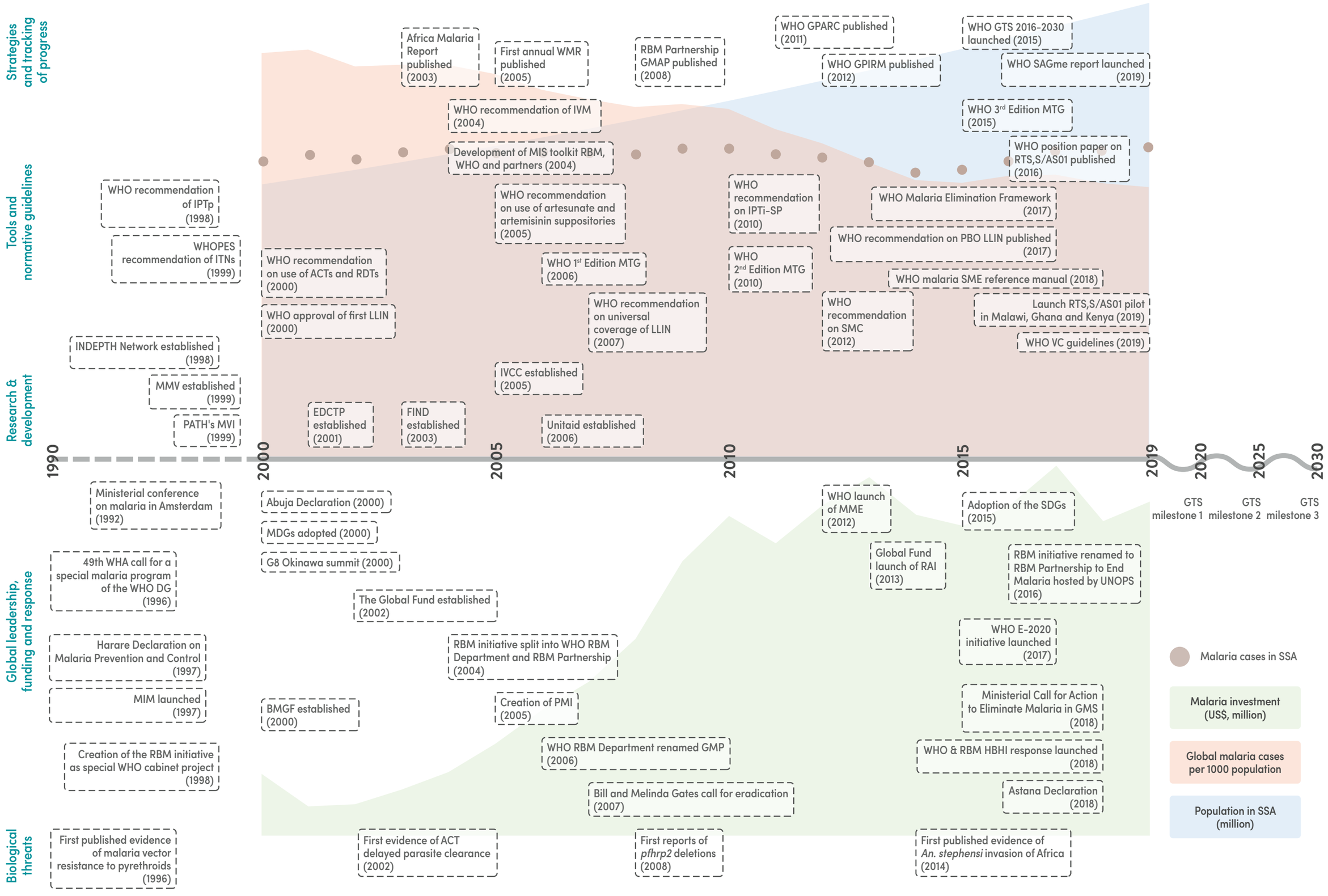
This statement was released as part of the WHO push to renew the momentum, to ensure the establishment of strong primary health care systems through the UHC approach encapsulated in the Astana Declaration of 2018 (*114*). This declaration was signed by heads of state and government, ministers, and representatives of states and governments during the Global Conference on Primary Health Care held in Astana, Kazakhstan, on 25–26 October 2018. WHO did not define a specific timeline for malaria eradication; instead, it identified a focus on burden reduction and sequential elimination in malaria endemic countries and regions as a logical path forward. To this end, SAGme proposed focused efforts in four areas: research and development of new tools; improved access to affordable, quality, people-centred health services; enhanced surveillance and response; and formulation of subnational, national and regional strategies (*113*). At around the time that WHO released the SAGme report, the Lancet Commission on Malaria Eradication published a collection of work on the feasibility and affordability of malaria eradication by 2050 (*115*).

In September 2019, at the UN high-level meeting "Universal Health Coverage: Moving Together to Build a Healthier World", the political commitment was secured for implementing high-impact health interventions to combat diseases, protect women's and children's health, and ensure no one suffers financial hardship. There was commitment for investing in everyone's health, expanding quality health services and reaching the most marginalized populations. This would require improved efficiency and equity in the allocation and use of existing resources – based on local context and priorities, and governed by data to identify those in need of interventions (*116*).

Although major system weaknesses and data quality issues remain, the period 2016–2019 has also been one of considerable progress in the strengthening of health information systems in malaria endemic countries. By 2018, more than 50 malaria endemic countries had installed District Health Information Software 2 (DHIS2) either for direct data entry at health facilities or as the backbone of aggregated data systems (*77*). Combined with increasing use of RDTs and increased reporting, the volume and quality of data have improved steadily, with DHIS2 offering flexible data analysis and use capabilities. These improvements have been major contributors to the efforts on subnational tailoring of malaria interventions in HBHI countries (**Section 5**).

By the end of 2019, with the emergence of COVID-19 and its subsequent pandemic spread, much of the progress against malaria was under enormous risk, with the potential to wipe out 20 years of malaria gains (*117*). To mitigate disruptions of essential malaria services, global and national partners joined forces to support countries to mount a response. The nature of this response and the consequences of the pandemic are described in **Section 10**.

FIG. 2.1. Key milestones in the fight against malaria in the past 2 decades



ACT: artemisin-based combination therapy; *An.: Anopheles;* BMGF: Bill & Melinda Gates Foundation; DG: Director-General; EDCTP: European & Developing Countries Clinical Trials Partnership; FIND: Foundation for Innovative New Diagnostics; G8: Group of Eight; GMAP: Global Malaria Action Plan; GMP: Global Malaria Programme; GMS: Greater Mekong subregion; GPARC: Global Plan for Artemisinin Resistance Containment; GPIRM: Global Plan for Insecticide Resistance Management in Malaria; GTS: Global technical strategy for malaria 2016–2030; HBHI: high burden high impact; IPTi-SP: intermittent preventive treatment in infants using sulfadoxine-pyrimethamine; IPTp: intermittent preventive treatment in pregnancy; IPTp-SP: intermittent preventive treatment in pregnancy using sulfadoxine-pyrimethamine; ITN: insecticide-treated mosquito net; IVCC: Innovative Vector Control Consortium; IVM: integrated vector management; LLIN: long-lasting insecticidal net; MDG: Millennium Development Goal; MIM: Multilateral Initiative on Malaria; MIS: malaria indicator survey; MME: Malaria Mekong Elimination; MMV: Medicines for Malaria Venture; MTG: malaria treatment guidelines; MVI-PATH: Malaria Vaccine Initiative, PATH; PBO: piperonyl butoxide; PMI: President's Malaria Initiative; RAI: Regional Artemisinin-resistance Initiative; RBM: Roll Back Malaria (before 2016); RDT: rapid diagnostic test; SAGme: Strategic Advisory Group for Malaria Eradication; SDG: Sustainable Development Goal; SMC: seasonal malaria chemoprevention; SME: surveillance, monitoring & evaluation; SSA: sub-Saharan Africa; UNOPS: United Nations Office for Project Services; VC: vector control; WHA: World Health Assembly; WHO: World Health Organization; WHOPES: WHO Pesticides Evaluation Scheme; WMR: world malaria report.

3 Global trends in the burden of malaria

The burden estimates presented in this section are the number of cases and deaths estimated to have occurred between 2000 and 2019, as well as case incidence and malaria mortality rates in the same period. These estimates are then used to compute the number of cases and deaths averted, globally and by WHO region, since 2000. An analysis of the prevalence of exposure to malaria and low birthweights is also presented.

◆ ◆ ◆

Estimation of the burden of malaria cases and deaths relies on several methods, depending on the quality of the national surveillance systems and the availability of data over time (**Annex 1**). Moderate to high transmission countries in sub-Saharan Africa account for most of the global malaria burden, but they generally have weak surveillance systems. For these countries, estimates of cases are derived using an approach that transforms modelled community parasite prevalence into case incidence within a geospatial framework. Malaria deaths for these countries are also estimated from a cause of death fraction for malaria applied to the trends in all-cause mortality in children aged under 5 years, and to which a factor for malaria deaths among those aged over 5 years is applied. For other countries with stronger surveillance systems, data are used as reported or cases are estimated by adjusting national data for treatment seeking, testing and reporting rates. Where adjustments are applied to national case data, a species-specific case fatality rate is applied to these data to estimate malaria deaths.

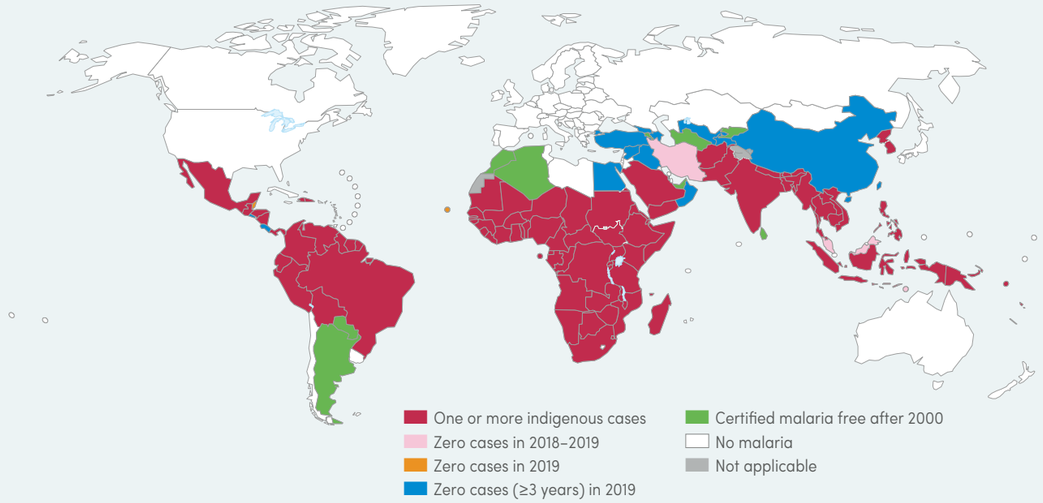
Because these estimates are updated each year, computed malaria cases and deaths change across the period of analysis, and estimates over time may vary in the annual world malaria reports from different years. Also, partly because of the separate methods used to compute malaria cases and deaths in sub-Saharan Africa, trends in the two measures of burden may be different for a given country; thus, caution should be applied in their comparison.

3.1 GLOBAL ESTIMATES OF MALARIA CASES AND DEATHS, 2000–2019

Globally, there were an estimated 229 million malaria cases in 2019 in 87 malaria endemic countries, declining from 238 million in 2000 (**Table 3.1**) across 108 countries that were malaria endemic in 2000 (**Fig. 3.1**). At the GTS baseline of 2015, there were 218 million estimated malaria cases. The proportion of cases due to *P. vivax* reduced from about 7% in 2000 to 3% in 2019.

FIG. 3.1.

Countries with indigenous cases in 2000 and their status by 2019 Countries with zero indigenous cases over at least the past 3 consecutive years are considered to have eliminated malaria. In 2019, China and El Salvador reported zero indigenous cases for the third consecutive year and have applied for WHO certification of malaria elimination; also, the Islamic Republic of Iran, Malaysia and Timor-Leste reported zero indigenous cases for the second time. *Source: WHO database.*



WHO: World Health Organization.

TABLE 3.1.

Global estimated malaria cases and deaths, 2000–2019 Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**238 000**	222 000	259 000	6.9%	**736 000**	697 000	782 000
2001	**244 000**	228 000	265 000	7.4%	**739 000**	700 000	786 000
2002	**239 000**	223 000	260 000	7.1%	**736 000**	698 000	783 000
2003	**244 000**	226 000	268 000	7.8%	**723 000**	681 000	775 000
2004	**248 000**	227 000	277 000	8.0%	**759 000**	708 000	830 000
2005	**247 000**	229 000	272 000	8.3%	**708 000**	662 000	765 000
2006	**242 000**	223 000	268 000	7.2%	**716 000**	675 000	771 000
2007	**241 000**	222 000	265 000	6.8%	**685 000**	644 000	735 000
2008	**240 000**	222 000	264 000	6.5%	**638 000**	599 000	685 000
2009	**246 000**	226 000	271 000	6.5%	**620 000**	572 000	681 000
2010	**247 000**	226 000	273 000	7.0%	**594 000**	546 000	658 000
2011	**239 000**	218 000	262 000	7.2%	**545 000**	505 000	596 000
2012	**234 000**	213 000	258 000	6.6%	**517 000**	481 000	568 000
2013	**225 000**	206 000	248 000	5.3%	**487 000**	451 000	538 000
2014	**217 000**	201 000	236 000	4.3%	**471 000**	440 000	511 000
2015	**218 000**	203 000	238 000	3.9%	**453 000**	422 000	496 000
2016	**226 000**	210 000	247 000	4.0%	**433 000**	403 000	478 000
2017	**231 000**	213 000	252 000	3.4%	**422 000**	396 000	467 000
2018	**228 000**	211 000	250 000	3.2%	**411 000**	389 000	458 000
2019	**229 000**	211 000	252 000	2.8%	**409 000**	387 000	460 000

P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

Malaria case incidence (i.e. cases per 1000 population at risk) reduced from 80 in 2000 to 58 in 2015 and 57 in 2019 (**Fig. 3.2**). Between 2000 and 2015, malaria case incidence declined by 27% and then by less than 2% in the period 2015–2019, indicating a slowing of the rate of decline since 2015 (**Fig. 3.2**).

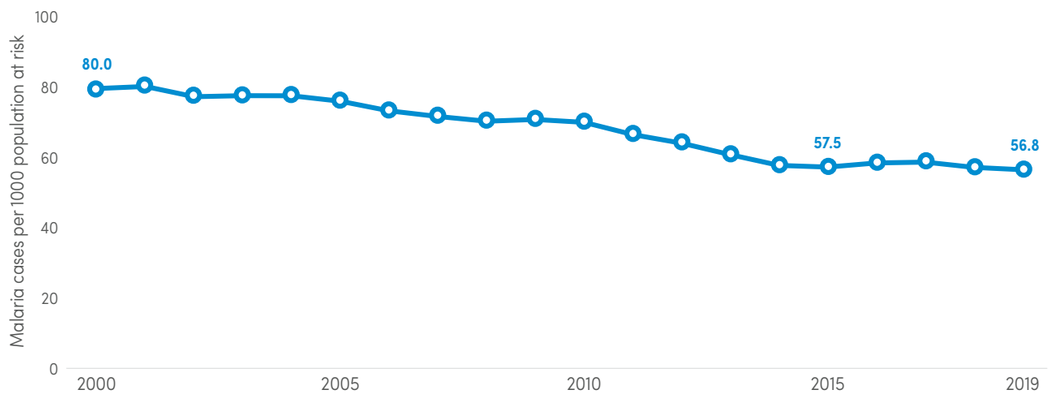
Malaria deaths have reduced steadily over the period 2000–2019, from 736 000 in 2000 to 409 000 in 2019 (**Table 3.1**). The percentage of total malaria deaths among children aged under 5 years was 84% in 2000 and 67% in 2019. The estimate of deaths in 2015, the GTS baseline, was about 453 000. The malaria mortality rate (i.e. deaths per 100 000 population at risk) reduced from about 25 in 2000 to 12 in 2015 and 10 in 2019, with the slowing of the rate of decline in the latter years similar to that seen in number of cases (**Fig. 3.2a**).

Of the 87 countries that were malaria endemic in 2019, 29 accounted for 95% of malaria cases globally (**Fig. 3.2b**). Nigeria (27%), the Democratic Republic of the Congo (12%), Uganda (5%), Mozambique (4%) and Niger (3%) accounted for about 51% of all cases globally. About 95% of malaria deaths were in 32 countries (**Fig. 3.2c**). Nigeria (23%), the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), Burkina Faso (4%), Mozambique (4%) and Niger (4%) accounted for about 51% of all malaria deaths globally in 2019 (**Fig. 3.2c**).

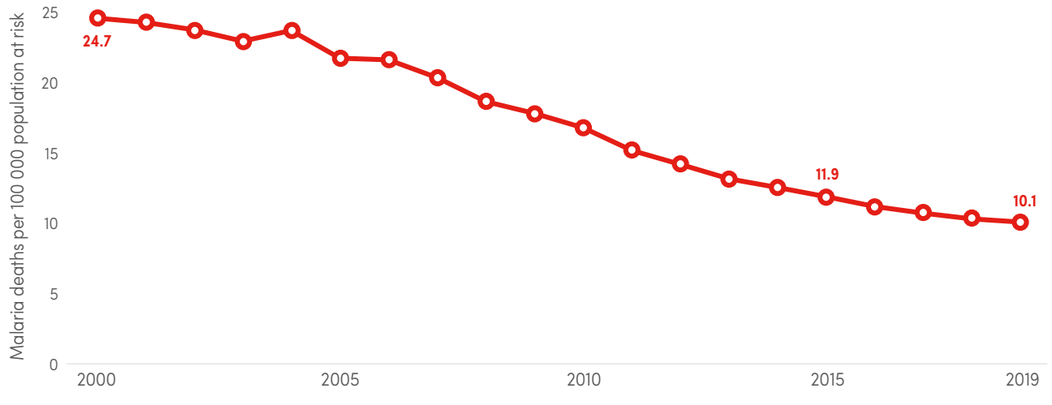
FIG. 3.2.

Global trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019, c) distribution of malaria cases and d) deaths by country, 2019 *Source: WHO estimates.*

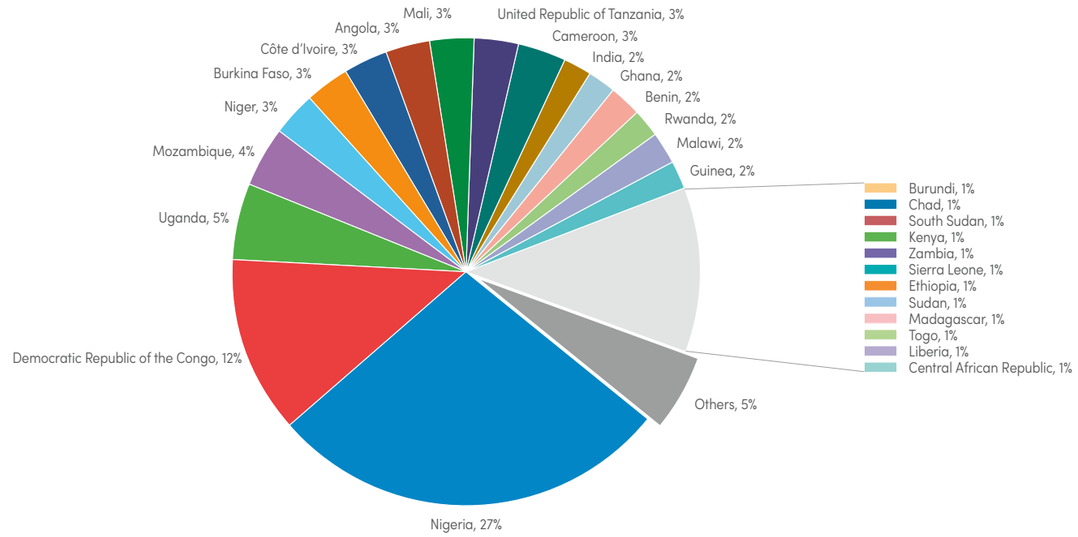
a)



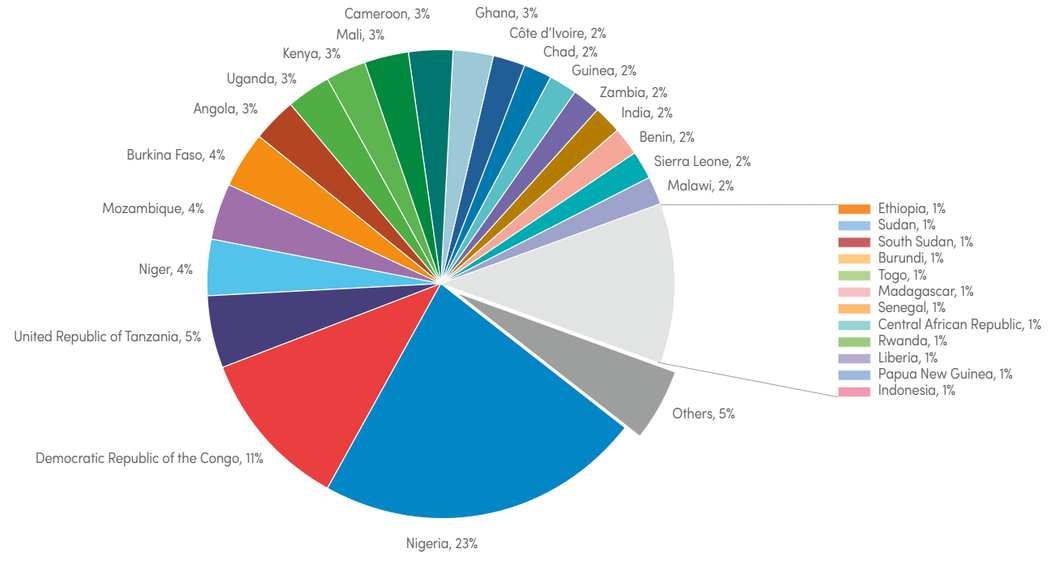
b)



c)



d)



WHO: World Health Organization.

3.2 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO AFRICAN REGION, 2000–2019

With an estimated 215 million malaria cases and 386 000 malaria deaths in 2019 (**Table 3.2**), the WHO African Region accounted for about 94% of cases and deaths globally. Although there were fewer malaria cases in 2000 (204 million) than in 2019, malaria case incidence reduced from 363 to 225 cases per 1000 population at risk in this period (**Fig. 3.3**), reflecting the complexity of interpreting changing disease transmission in a rapidly increasing population. The population living in sub-Saharan Africa increased from about 665 million in 2000 to 1.1 billion in 2019 (**Section 11**). Malaria deaths in the WHO African Region reduced by 44%, from 680 000 in 2000 to 386 000 in 2019, and the malaria mortality rate reduced by 67% over the same period, from 121 to 40 per 100 000 population at risk (**Fig. 3.3**). Since 2014, however, the rate of progress in both cases and deaths has slowed, attributed mainly to the stalling of progress in several countries with moderate or high transmission (**Fig. 3.3**). Distributions of malaria cases by country are shown in **Fig. 3.3**. It can be seen that 27 of the 29 countries that account for 95% of malaria cases globally (**Fig. 3.2c**) are in the WHO African Region.

TABLE 3.2.

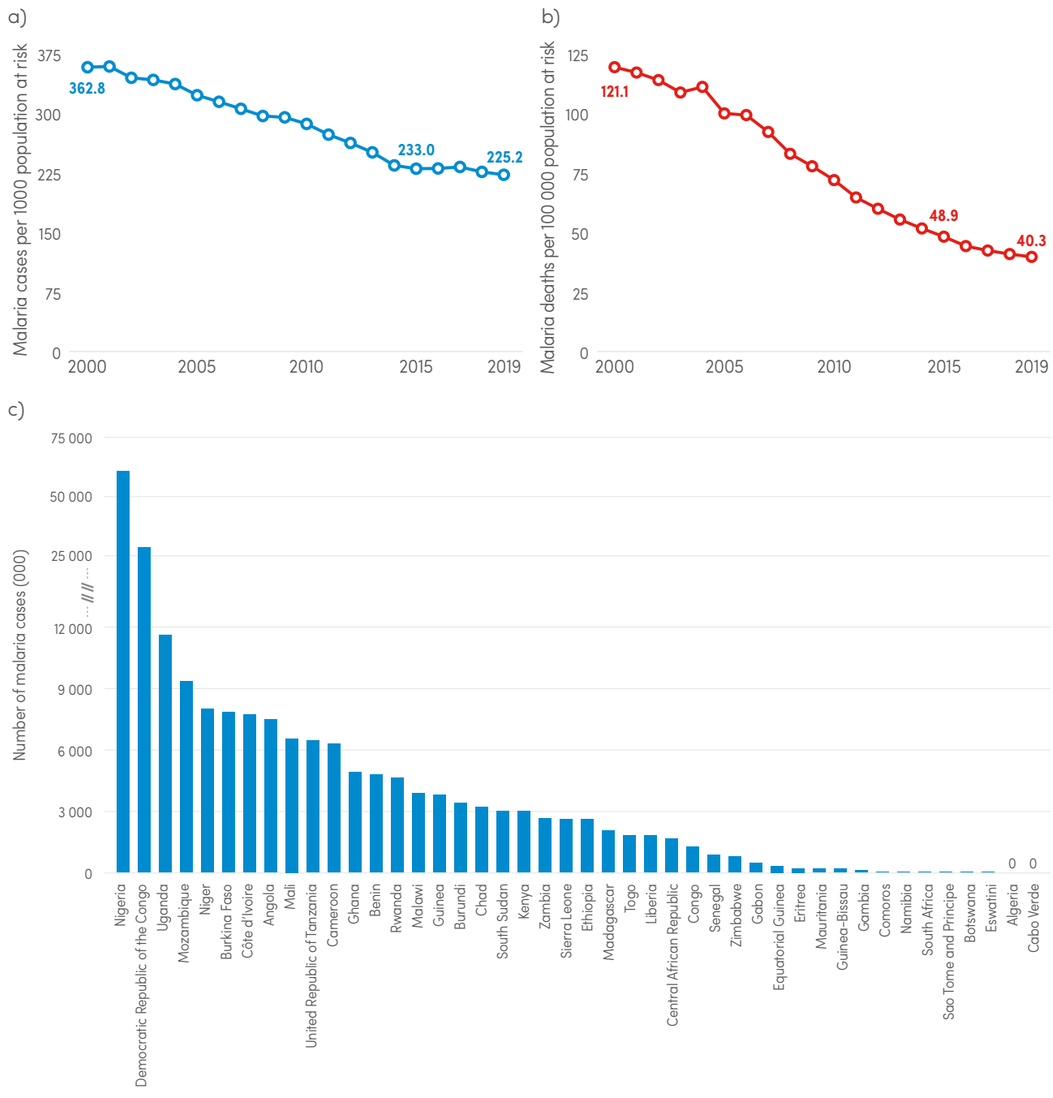
Estimated malaria cases and deaths in the WHO African Region, 2000–2019 Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**204 000**	189 000	223 000	0.9%	**680 000**	657 000	713 000
2001	**210 000**	194 000	230 000	1.4%	**686 000**	662 000	720 000
2002	**207 000**	191 000	227 000	1.3%	**686 000**	661 000	721 000
2003	**211 000**	194 000	234 000	1.7%	**672 000**	644 000	717 000
2004	**214 000**	194 000	242 000	1.9%	**706 000**	671 000	771 000
2005	**211 000**	193 000	234 000	1.3%	**653 000**	624 000	703 000
2006	**211 000**	193 000	235 000	1.5%	**667 000**	637 000	713 000
2007	**211 000**	193 000	234 000	1.5%	**638 000**	610 000	678 000
2008	**211 000**	193 000	232 000	1.2%	**591 000**	567 000	625 000
2009	**215 000**	196 000	239 000	1.4%	**569 000**	538 000	618 000
2010	**215 000**	195 000	239 000	1.7%	**542 000**	509 000	597 000
2011	**211 000**	192 000	234 000	2.2%	**502 000**	474 000	544 000
2012	**209 000**	190 000	231 000	2.2%	**478 000**	449 000	522 000
2013	**205 000**	186 000	227 000	1.9%	**454 000**	424 000	500 000
2014	**197 000**	182 000	215 000	1.1%	**436 000**	414 000	469 000
2015	**199 000**	183 000	218 000	0.9%	**418 000**	397 000	453 000
2016	**205 000**	189 000	225 000	0.6%	**395 000**	376 000	430 000
2017	**212 000**	196 000	234 000	0.5%	**390 000**	369 000	428 000
2018	**212 000**	195 000	234 000	0.2%	**386 000**	367 000	429 000
2019	**215 000**	197 000	237 000	0.3%	**386 000**	365 000	433 000

P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

FIG. 3.3.

Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO African Region, 2019
Source: WHO estimates.



WHO: World Health Organization.

3.3 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO SOUTH-EAST ASIA REGION, 2000–2019

The WHO South-East Asia Region had nine malaria endemic countries in 2019, and contributed to about 3% of the burden of malaria cases globally. Malaria cases reduced by 74%, from 23.0 million in 2000 to about 6.3 million in 2019 (**Table 3.3**). India contributed to the largest absolute reductions, from about 20 million cases in 2000 to about 5.6 million in 2019. Malaria case incidence reduced by 78%, from about 18 to 4 per 1000 population at risk in the period 2000–2019 (**Fig. 3.4**). Malaria deaths reduced by 74%, from about 35 000 in 2000 to 9 000 in 2019. India accounted for 88% of malaria cases and 86% of malaria deaths in this region in 2019. Sri Lanka was certified malaria free in 2015, and Timor-Leste reported zero malaria cases in 2018 and 2019.

TABLE 3.3.

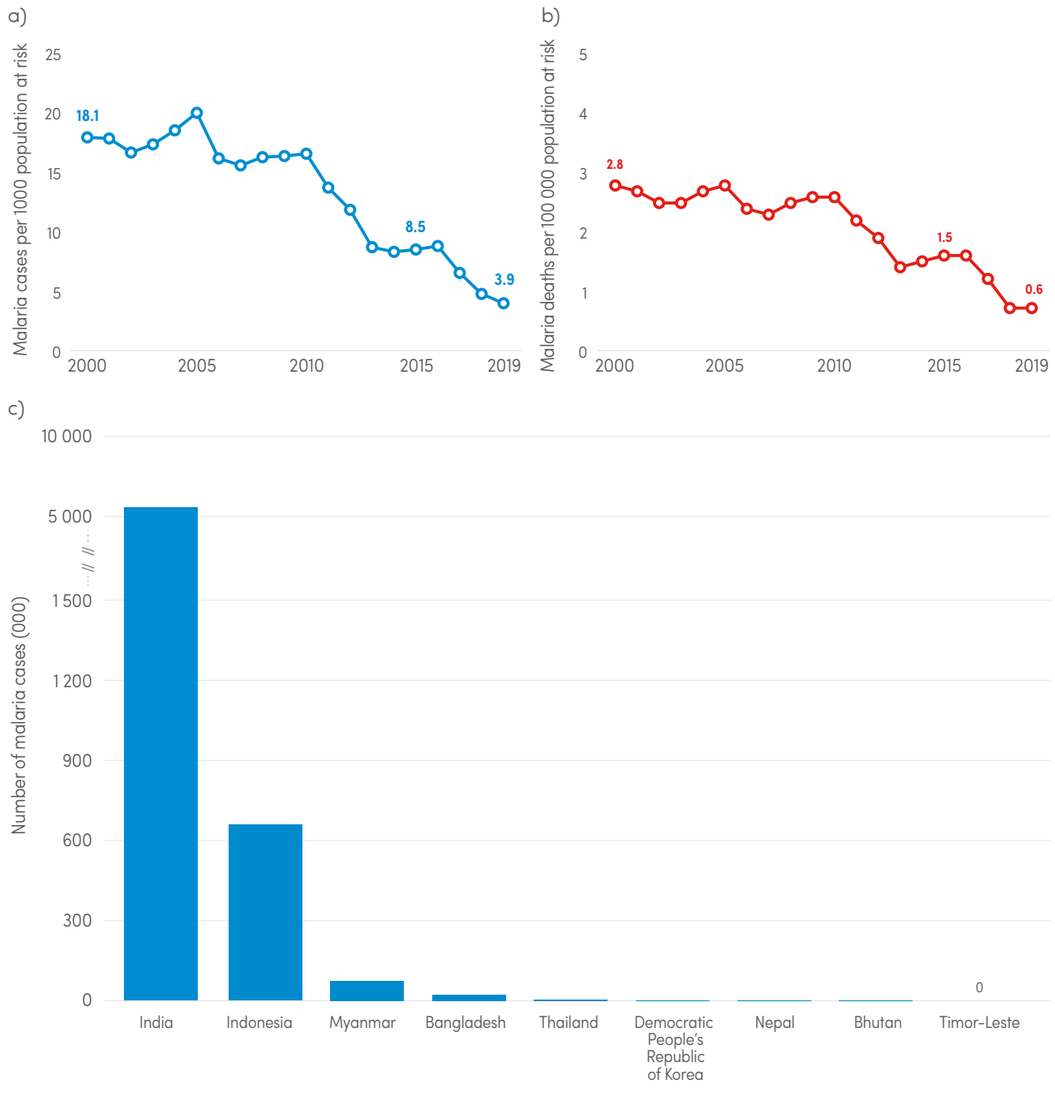
Estimated malaria cases and deaths in the WHO South-East Asia Region, 2000–2019 Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**23 000**	18 700	29 100	47.8%	**35 000**	8 000	59 000
2001	**23 300**	19 100	29 200	50.6%	**34 000**	7 000	57 000
2002	**22 200**	17 900	28 000	50.0%	**33 000**	7 000	55 000
2003	**23 400**	18 900	29 300	52.4%	**33 000**	7 000	55 000
2004	**25 400**	20 200	32 400	52.0%	**36 000**	8 000	62 000
2005	**27 800**	21 600	36 700	53.8%	**39 000**	9 000	66 000
2006	**22 700**	17 500	30 400	51.5%	**33 000**	7 000	57 000
2007	**22 200**	17 100	30 300	49.6%	**33 000**	7 000	58 000
2008	**23 600**	18 000	32 200	47.5%	**36 000**	7 000	64 000
2009	**24 000**	18 100	33 500	45.3%	**38 000**	7 000	69 000
2010	**24 600**	19 400	33 100	46.0%	**38 000**	9 000	66 000
2011	**20 700**	16 200	27 900	47.7%	**31 000**	7 000	55 000
2012	**18 000**	14 200	24 000	47.6%	**27 000**	7 000	46 000
2013	**13 300**	10 500	17 400	46.2%	**21 000**	4 000	36 000
2014	**12 900**	10 100	17 300	35.2%	**23 000**	3 000	41 000
2015	**13 300**	10 400	17 700	34.4%	**24 000**	3 000	43 000
2016	**13 900**	10 400	19 500	34.9%	**25 000**	3 000	47 000
2017	**10 400**	7 800	14 100	37.3%	**18 000**	3 000	34 000
2018	**7 600**	5 500	10 300	50.5%	**11 000**	2 000	20 000
2019	**6 300**	4 500	8 600	51.7%	**9 000**	2 000	16 000

P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

FIG. 3.4.

Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO South-East Asia Region, 2019 *Source: WHO estimates.*



WHO: World Health Organization.

3.4 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO EASTERN MEDITERRANEAN REGION, 2000–2019

Malaria cases in the WHO Eastern Mediterranean Region reduced by 26%, from 7 million cases in 2000 to about 5 million in 2019 (**Table 3.4**). About a quarter of the cases in 2019 were due to *P. vivax*, mainly in Pakistan and Afghanistan. Malaria deaths also reduced by 16%, from about 12 000 in 2000 to 10 100 in 2019. Over the period 2000–2019, malaria case incidence declined from 21 to 10 and mortality incidence rate from 4 to 2 (**Fig. 3.5**). Sudan is the leading contributor to malaria in this region, accounting for about 46% of cases (**Fig. 3.5**), followed by Yemen, Somalia, Pakistan, Afghanistan and Djibouti. Saudi Arabia reported only 38 indigenous malaria cases in 2019, and the Islamic Republic of Iran had no indigenous malaria cases in 2018 and 2019. Iraq, Oman and Syrian Arab Republic have last reported indigenous malaria cases in 2009, 2011 and 2004, respectively (**Annex 3-F**).

TABLE 3.4.

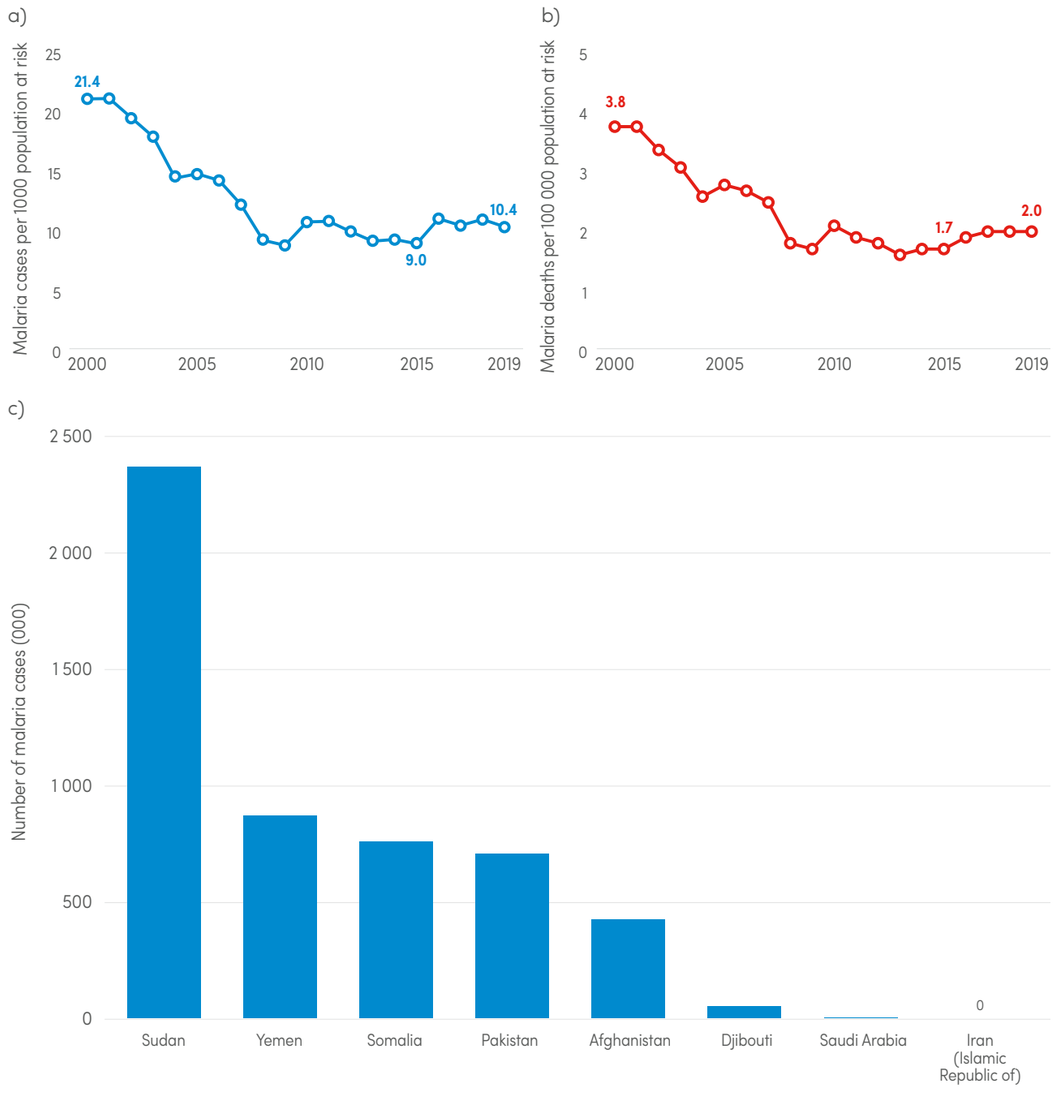
Estimated malaria cases and deaths in the WHO Eastern Mediterranean Region, 2000–2019
Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**7 000**	5 500	11 500	27.3%	**12 000**	4 000	22 000
2001	**7 200**	5 600	12 000	27.3%	**12 700**	4 200	22 500
2002	**6 800**	5 300	12 300	28.2%	**11 600**	4 400	20 000
2003	**6 400**	5 000	11 000	29.3%	**10 800**	3 800	18 600
2004	**5 300**	4 100	9 000	24.9%	**9 400**	2 800	16 300
2005	**5 500**	4 300	9 800	21.9%	**10 300**	3 200	17 800
2006	**5 500**	4 100	10 300	20.2%	**10 100**	3 300	17 400
2007	**4 800**	3 700	6 600	23.4%	**9 800**	3 600	17 000
2008	**3 700**	2 900	5 200	27.9%	**7 200**	2 500	12 300
2009	**3 600**	2 700	5 300	29.5%	**6 900**	2 500	12 200
2010	**4 500**	3 400	6 500	28.6%	**8 700**	3 500	14 800
2011	**4 600**	3 500	6 600	39.0%	**7 900**	3 200	12 800
2012	**4 300**	3 300	6 100	33.1%	**8 000**	3 000	12 900
2013	**4 000**	3 200	5 500	35.0%	**7 300**	2 800	11 700
2014	**4 200**	3 300	5 700	36.1%	**7 500**	2 800	12 200
2015	**4 100**	3 200	5 500	29.6%	**7 900**	2 600	13 100
2016	**5 200**	4 200	6 700	37.1%	**9 100**	3 400	15 000
2017	**5 000**	4 000	6 600	30.5%	**9 500**	3 200	16 500
2018	**5 400**	4 200	7 200	30.3%	**9 800**	3 100	17 600
2019	**5 200**	3 900	7 300	23.3%	**10 100**	2 900	19 000

P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

FIG. 3.5.

Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Eastern Mediterranean Region, 2019 *Source: WHO estimates.*



WHO: World Health Organization.

3.5 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO WESTERN PACIFIC REGION, 2000–2019

The WHO Western Pacific Region had an estimated 1.7 million cases in 2019, a decrease of 43% from the 3 million cases in 2000 (**Table 3.5**). Malaria deaths reduced by 52%, from about 6600 cases in 2000 to 3200 in 2019. Over the same period, malaria case incidence reduced from 5 to 2 cases per 1000 population at risk (**Fig. 3.6**), and malaria mortality rate reduced from 1 to 0.4 deaths per 100 000 population at risk. Papua New Guinea accounted for nearly 80% of all cases in this region in 2019. China has had no indigenous malaria cases since 2017. Malaysia had no cases of human malaria in 2018 and 2019, but reported 3212 cases of *P. knowlesi*, considered to be zoonotic malaria, in 2019. Three countries had fewer than 10 000 cases in 2019: Republic of Korea (485), Vanuatu (1047) and Viet Nam (9702).

TABLE 3.5.

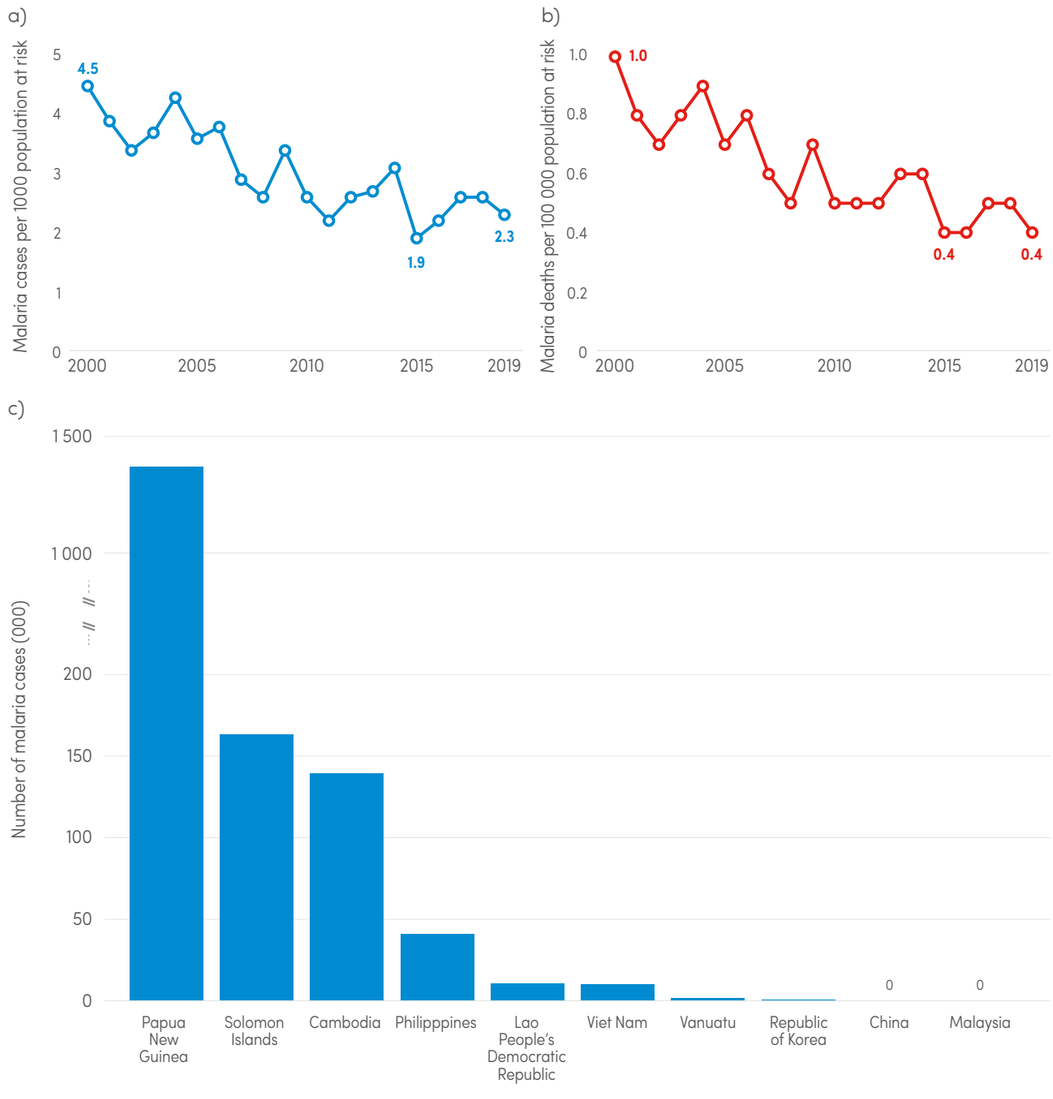
Estimated malaria cases and deaths in the WHO Western Pacific Region, 2000–2019 Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**2 990**	1 894	4 289	16.9%	**6 600**	2 200	11 800
2001	**2 631**	1 621	3 850	19.7%	**5 600**	1 800	10 300
2002	**2 334**	1 411	3 427	20.0%	**5 000**	1 600	9 300
2003	**2 526**	1 523	3 674	19.6%	**5 400**	1 700	10 000
2004	**2 936**	1 718	4 350	21.9%	**6 100**	1 800	11 700
2005	**2 509**	1 455	3 787	28.5%	**4 900**	1 500	9 500
2006	**2 659**	1 585	3 987	26.8%	**5 300**	1 600	9 800
2007	**2 018**	1 109	3 145	23.7%	**4 100**	1 100	8 400
2008	**1 845**	964	2 949	21.5%	**3 900**	900	7 900
2009	**2 436**	1 341	3 760	21.6%	**5 100**	900	10 200
2010	**1 839**	1 058	2 816	23.6%	**3 800**	800	7 500
2011	**1 576**	927	2 343	21.7%	**3 300**	600	6 700
2012	**1 888**	969	3 273	23.9%	**3 800**	700	8 800
2013	**1 964**	1 269	2 860	14.1%	**4 400**	600	8 800
2014	**2 321**	1 603	3 326	31.7%	**4 300**	700	8 200
2015	**1 431**	1 122	1 820	28.3%	**2 800**	500	4 800
2016	**1 676**	1 291	2 134	25.7%	**3 300**	500	6 000
2017	**1 961**	1 503	2 538	29.0%	**3 800**	600	6 700
2018	**1 981**	1 495	2 577	34.9%	**3 600**	500	6 600
2019	**1 739**	1 394	2 181	33.9%	**3 200**	500	5 600

P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

FIG. 3.6.

Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Western Pacific Region, 2019 *Source: WHO estimates.*



WHO: World Health Organization.

3.6 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO REGION OF THE AMERICAS, 2000–2019

In the WHO Region of the Americas, malaria cases and case incidence reduced by 40% (from 1.5 million to 0.9 million) and 53% (from 14 to 6), respectively (**Table 3.6**, **Fig. 3.7**). Over the same period, malaria deaths and mortality rate reduced by 39% (from 909 to 551) and 50% (from 0.8 to 0.4), respectively. The region's progress in recent years has suffered from the major increase in malaria in Venezuela (Bolivarian Republic of), which had about 35 500 cases in 2000, rising to over 467 000 by 2019. Brazil, Colombia and Venezuela (Bolivarian Republic of) account for 86% of all cases in this region.

TABLE 3.6.

Estimated malaria cases and deaths in the WHO Region of the Americas, 2000–2019 Estimated cases and deaths are shown with 95% upper and lower confidence intervals. *Source: WHO estimates.*

Year	Number of cases (000)				Number of deaths		
	Point	Lower bound	Upper bound	% *P. vivax*	Point	Lower bound	Upper bound
2000	**1 540**	1 392	1 701	71.4%	**909**	666	1 168
2001	**1 297**	1 171	1 432	67.6%	**832**	593	1 090
2002	**1 183**	1 078	1 298	67.9%	**764**	514	1 030
2003	**1 159**	1 067	1 262	68.4%	**725**	480	992
2004	**1 146**	1 067	1 234	69.4%	**710**	460	986
2005	**1 283**	1 211	1 371	70.3%	**692**	443	968
2006	**1 106**	1 042	1 181	68.4%	**586**	348	852
2007	**994**	912	1 080	70.4%	**503**	297	744
2008	**699**	645	762	71.0%	**471**	224	756
2009	**687**	634	751	70.8%	**463**	227	740
2010	**821**	745	906	70.9%	**507**	250	791
2011	**611**	567	667	68.8%	**468**	206	733
2012	**580**	542	627	69.4%	**416**	211	622
2013	**562**	520	612	66.1%	**436**	227	642
2014	**477**	447	512	69.5%	**348**	196	484
2015	**561**	525	602	71.3%	**398**	216	551
2016	**677**	625	736	67.5%	**515**	252	731
2017	**915**	852	998	74.2%	**655**	287	947
2018	**926**	861	1 007	75.7%	**602**	243	880
2019	**889**	822	970	72.3%	**551**	220	813

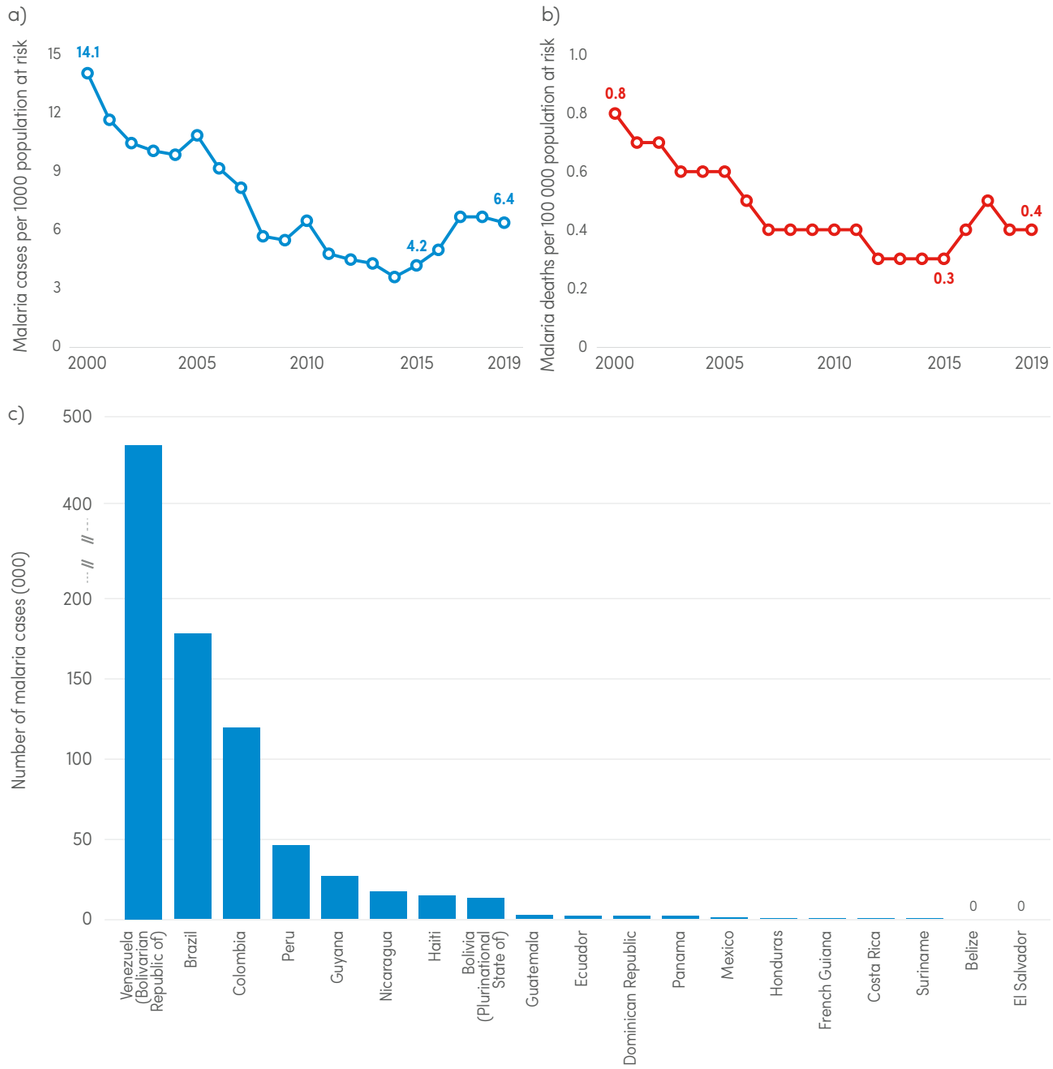
P. vivax: *Plasmodium vivax*; WHO: World Health Organization.

3.7 ESTIMATED MALARIA CASES AND DEATHS IN THE WHO EUROPEAN REGION, 2000–2019

Since 2015, the WHO European Region has been free of malaria. The last country to report an indigenous malaria case was Tajikistan in 2014. Also, no indigenous malaria deaths have been reported since 2000. Throughout the period 2000–2019, no indigenous malaria deaths were reported in the WHO European Region.

FIG. 3.7.

Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Region of the Americas, 2019 *Source: WHO estimates.*



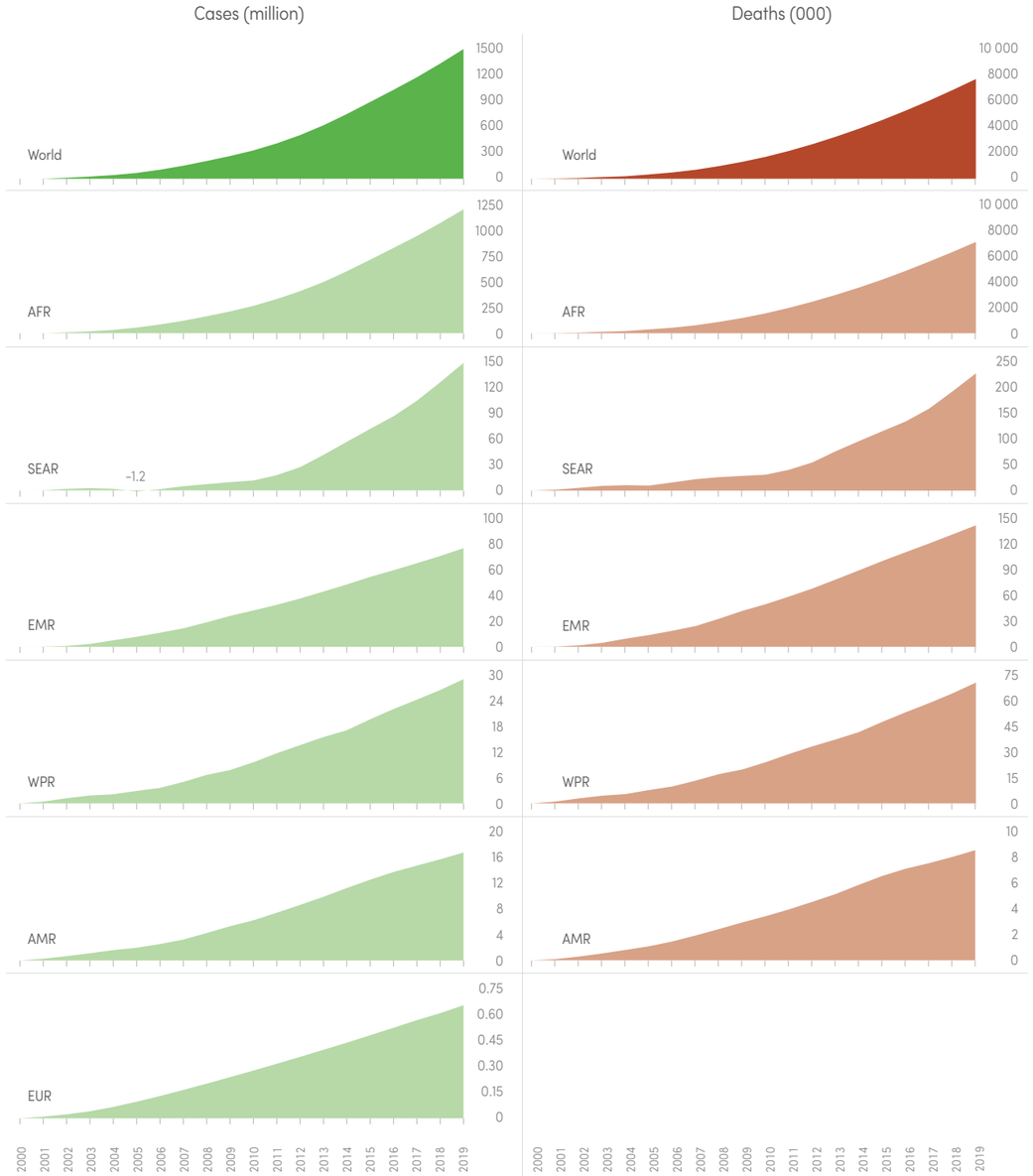
WHO: World Health Organization.

3.8 CASES AND DEATHS AVERTED SINCE 2000, GLOBALLY AND BY WHO REGION

Cases and deaths averted in the period 2000–2019 were calculated by comparing the current annual estimated burden of malaria to a counterfactual that was computed by holding the 2000 malaria case incidence and mortality rates constant throughout the period 2000–2019. The analysis shows that 1.5 billion malaria cases and 7.6 million malaria deaths have been averted globally in the period 2000–2019. Most of the cases (82%) and deaths (94%) averted were in the WHO African Region, followed by the South-East Asia Region (cases 10% and deaths 3%) (**Fig. 3.8**, **Fig. 3.9**). In addition to malaria interventions, cases and deaths averted could also be due to other factors that modify malaria transmission or disease, such as improvements in socioeconomic status, malnutrition, infrastructure, housing and urbanization.

FIG. 3.8.

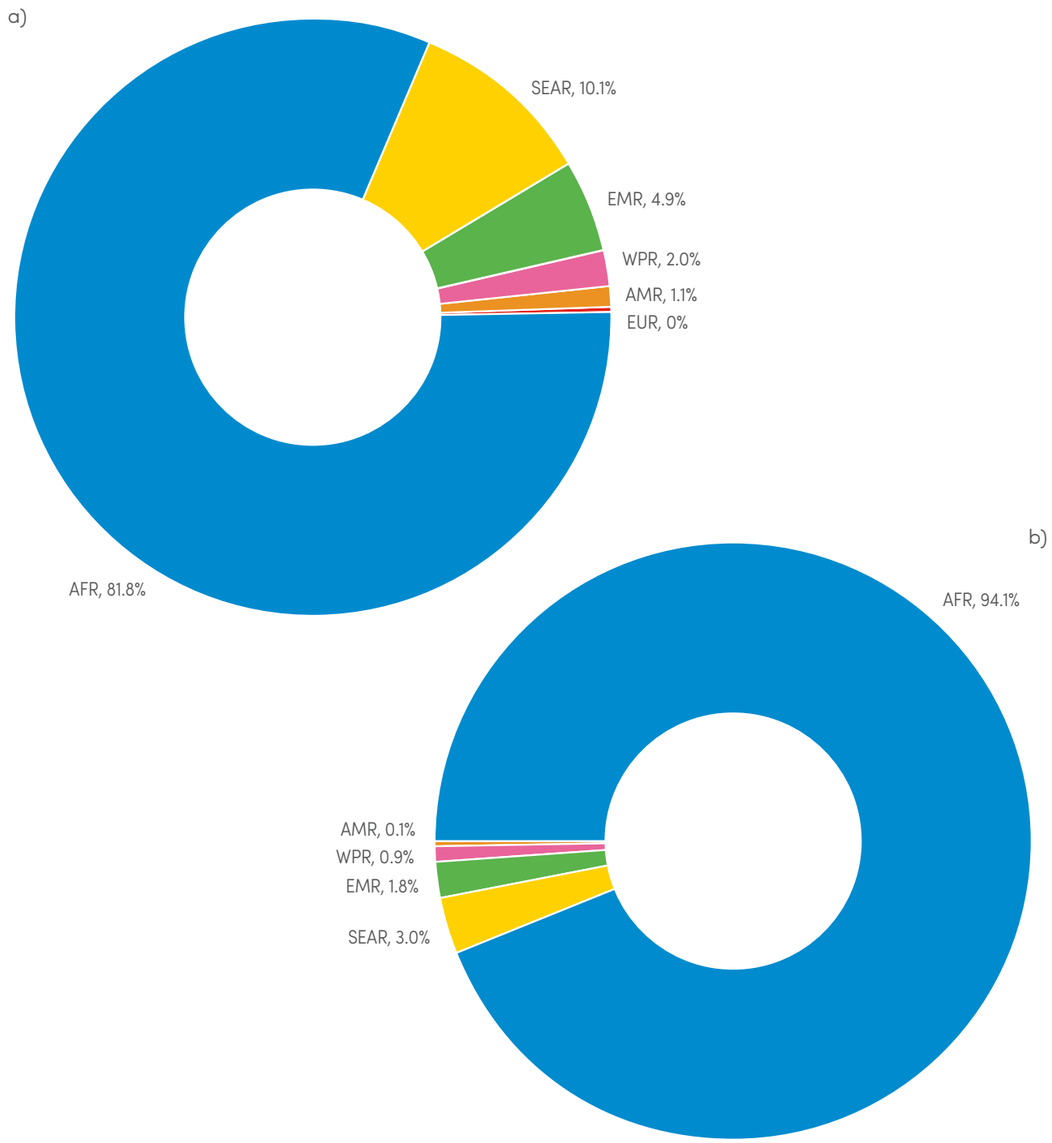
Cumulative number of cases and deaths averted globally and by WHO region, 2000–2019 *Source: WHO estimates.*



AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.

FIG. 3.9.

Percentage of a) cases and b) deaths averted by WHO region, 2000–2019 *Source: WHO estimates.*



AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.

3.9 BURDEN OF MALARIA IN PREGNANCY

Malaria infection during pregnancy has substantial risks for the pregnant woman, her fetus and the newborn child. For the pregnant woman, malaria infection can lead to severe disease and death, and placental sequestration of the parasite which can lead to maternal anaemia; it also puts the mother at increased risk of death before and after childbirth, and is an important contributor to stillbirth and preterm birth. Placental infection can also lead to poor fetal growth and low birthweight, which in turn can lead to child growth retardation and poor cognitive outcomes, as well as being a major risk factor for perinatal, neonatal and infant mortality (*118–120*).

To avert the consequences to women and children of malaria infections, WHO recommends – in combination with vector control, and prompt diagnosis and effective treatment of malaria – the use of IPTp with SP as part of antenatal care (ANC) (**Section 7.4**) in areas of moderate to high transmission in sub-Saharan Africa.

The *World malaria report 2019* presented, for the first time, an analysis of the prevalence of malaria in pregnancy and the resulting burden of low birthweight (*77*). This section presents a follow-up analysis of the exposure to malaria infections during pregnancy and the prevalence of low birthweight. It also presents an analysis of the number of low birthweights averted if coverage of the first dose of IPTp was optimized, by ensuring that all women attending ANC clinics for the first time received the first dose.

The analysis in this section is restricted to moderate to high transmission countries in the WHO African Region (**Annex 1**), where the burden of malaria in pregnancy is most pronounced.

3.9.1 Prevalence of exposure to malaria infections during pregnancy and contribution to low birthweight newborn

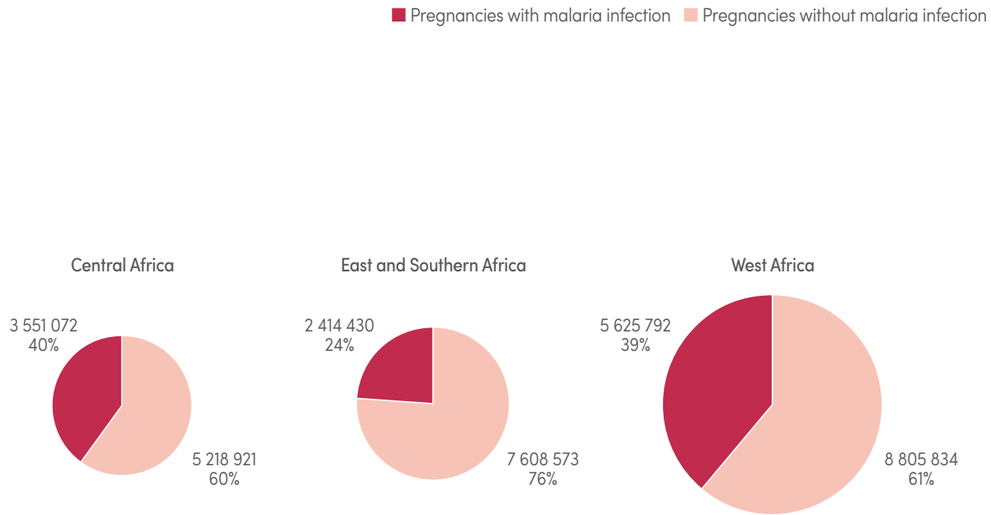
Malaria infection exposure during pregnancy (measured as cumulative prevalence over 40 weeks) was estimated from mathematical models (*121*) that relate estimates of the geographical distribution of *P. falciparum* exposure by age across Africa in 2019 with patterns of infections in placental histology by age and parity (*122*) (**Annex 1**). Country-specific age- and gravidity-specific fertility rates, stratified by urban or rural status, were obtained from DHS and malaria indicator surveys (MIS) (*55*), where such surveys had been carried out since 2014 and were available from the DHS programme website (*56*). For countries where surveys were not available, fertility patterns were allocated based on survey data from a different country, matched on the basis of total fertility rate (*123*) and proximity. The exposure prevalence and the expected number of pregnant women who would have been exposed to infection were computed by country and subregion.

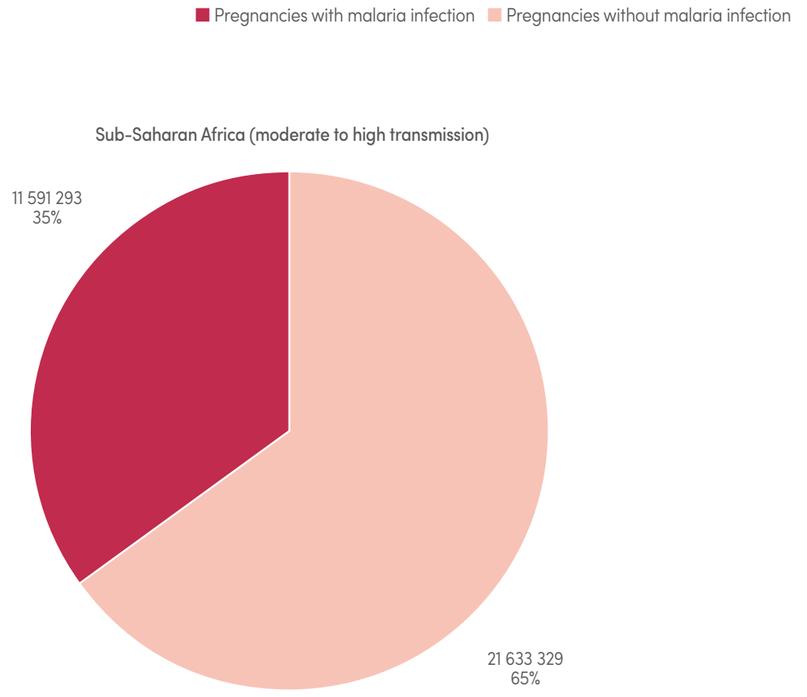
In 2019, in 33 moderate to high transmission countries[1] in the WHO African Region, there were an estimated 33.2 million pregnancies, of which 35% (11.6 million) were exposed to malaria infection (**Fig. 3.10**). By WHO subregion, Central Africa had the highest prevalence of exposure to malaria during pregnancy (40%) closely followed by West Africa (39%), while prevalence was 24% in East and Southern Africa.

[1] Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Equatorial Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Togo, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

FIG. 3.10.

Estimated prevalence of exposure to malaria infection during pregnancy, overall and by subregion in 2019, in moderate to high transmission countries in the WHO African Region *Source: Imperial College and WHO estimates.*





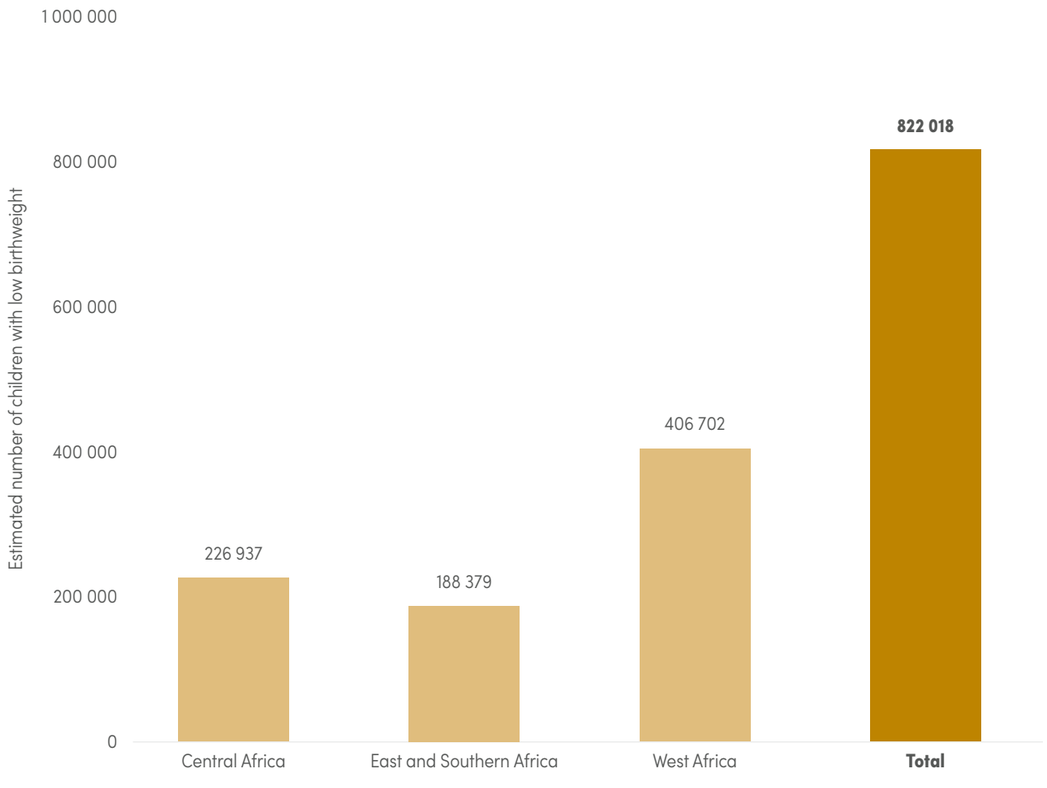
WHO: World Health Organization.

It is estimated that malaria infection during pregnancy in these 33 countries resulted in 822 000 children with low birthweight (**Table 3.8**) with almost half of these children (49%) being in the subregion of West Africa (**Table 3.8**, **Fig. 3.11**).

In the 33 countries, on average, 80% of all pregnant women visited ANC clinics at least once during their pregnancy, 62% received at least one dose of IPTp, 49% received at least two doses of IPTp and 34% received at least three doses of IPTp (**Section 7.4**). At current levels of IPTp coverage across all doses, an estimated 426 000 low birthweights were averted in 2019. If the 80% of pregnant women visiting ANC clinics at least once during pregnancy received a single dose of IPTp, assuming they were all eligible, an additional 56 000 low birthweights would be averted, representing a significant missed opportunity under current levels of ANC use (**Fig. 3.12**). Urgent attention is clearly needed to optimize these missed opportunities while at the same time ensuring high coverage of subsequent doses of IPTp. It is hoped that the recent call from the RBM Partnership to End Malaria to leaders and health policy-makers to increase protection of mothers and newborn children will result in an accelerated increase in IPTp coverage (*124*).

FIG. 3.11.

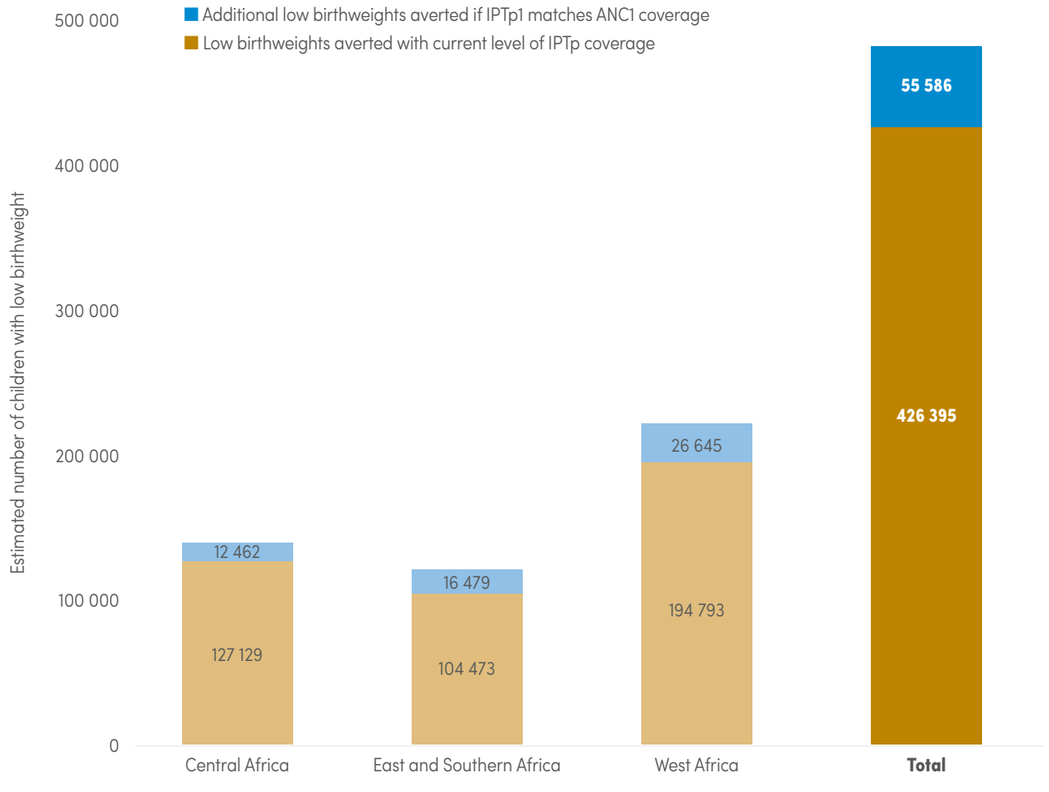
Estimated number of low birthweights due to exposure to malaria infection during pregnancy, overall and by subregion in 2019, in moderate to high transmission countries in sub-Saharan Africa *Sources: Imperial College and WHO estimates.*



WHO: World Health Organization.

FIG. 3.12.

Estimated number of low birthweights averted if current levels of IPTp coverage are maintained and the additional number averted if coverage of first dose of IPTp was optimized to match levels of coverage of first ANC visit in 2019, in moderate to high transmission countries in the WHO African Region *Sources: Imperial College and WHO estimates.*



ANC: antenatal care; ANC1: first ANC visit; IPTp: intermittent preventive treatment in pregnancy; IPTp1: first dose of IPTp; WHO: World Health Organization.

4 Elimination

Globally, the number of countries that were malaria endemic in 2000 and that reported fewer than 10 000 malaria cases increased from 26 in 2000 to 46 in 2019. In the same period, the number of countries with fewer than 100 indigenous cases increased from 6 to 27. Between 2015 and 2019, the number of countries with fewer than 10 indigenous cases increased from 20 to 24 (**Fig. 4.1**).

4.1 MALARIA ELIMINATION CERTIFICATION

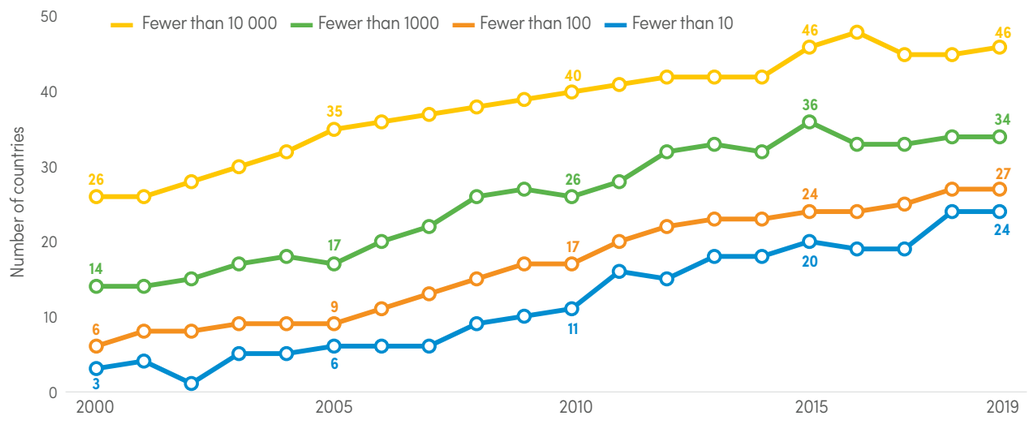
Between 2000 and 2019, 21 countries had achieved 3 consecutive years of zero indigenous malaria cases; 10 of these countries were certified malaria free by WHO (**Table 4.1**). Algeria is the first country in the WHO African Region to be certified malaria free since 1973. The process to certify El Salvador is underway and would probably have been completed had the COVID-19 pandemic not disrupted the evaluation process.

4.2 E-2020 INITIATIVE

Progress in the reduction of malaria cases since 2010 in the 21 countries that are part of the E-2020 initiative is shown in **Table 4.2**. In the period 2010–2019, total malaria cases in the 21 countries reduced by 79%. No indigenous cases were reported in Paraguay and Algeria, which were certified malaria free by WHO in 2018 and 2019, respectively.

FIG. 4.1.

Number of countries that were malaria endemic in 2000, with fewer than 10, 100, 1000 and 10 000 indigenous malaria cases between 2000 and 2019 *Sources: NMP reports and WHO estimates.*



NMP: national malaria programme; WHO: World Health Organization.

TABLE 4.1.

Countries eliminating malaria since 2000 Countries are shown by the year that they attained 3 consecutive years of zero indigenous cases; countries that have been certified as malaria free are shown in green (with the year of certification in parentheses). *Sources: Country reports and WHO.*

2000	Egypt	United Arab Emirates (2007)		
2001				
2002				
2003				
2004	Kazakhstan			
2005				
2006				
2007	Morocco (2010)	Syrian Arab Republic	Turkmenistan (2010)	
2008	Armenia (2011)			
2009				
2010				
2011	Iraq			
2012	Georgia	Turkey		
2013	Argentina (2019)	Kyrgyzstan (2016)	Oman	Uzbekistan (2018)
2014	Paraguay (2018)			
2015	Azerbaijan	Sri Lanka (2016)		
2016	Algeria (2019)			
2017	Tajikistan			
2018				
2019	China	El Salvador		

WHO: World Health Organization.
Note: Although Maldives was certified in 2015, it was already malaria free before 2000.

TABLE 4.2.

Number of indigenous malaria cases in E-2020 countries, 2010–2019 *Source: NMP reports.*

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Algeria	1	1	55	8	0	0	0	0	0	0
Belize	150	72	33	20	19	9	4	7	3	0
Bhutan	436	194	82	15	19	34	15	11	6	2
Botswana	1 046	432	193	456	1 346	284	659	1 847	534	169
Cabo Verde	47	7	1	22	26	7	48	423	2	0
China	4 990	1 308	244	83	53	39	1	0	0	0
Comoros	36 538	24 856	49 840	53 156	2 203	1 884	1 467	3 896	15 613	17 599
Costa Rica	110	10	6	0	0	0	4	12	70	95
Ecuador	1 888	1 218	544	368	242	618	1 191	1 275	1 653	1 803
El Salvador	17	7	13	6	6	5	12	0	0	0
Eswatini	268	379	409	728	389	318	250	440	686	239
Iran (Islamic Republic of)	1 847	1 632	756	479	358	167	81	57	0	0
Malaysia	5 194	4 164	2 050	1 092	604	242	266	85	0	0
Mexico	1 226	1 124	833	495	656	517	551	736	803	618
Nepal	3 894	3 414	3 230	1 974	832	591	507	623	493	127
Paraguay	18	1	0	0	0	0	0	0	0	0
Republic of Korea	1 267	505	394	383	557	627	602	436	501	485
Saudi Arabia	29	69	82	34	30	83	272	177	61	38
South Africa	8 060	9 866	6 621	8 645	11 705	4 959	4 323	23 381	9 540	3 096
Suriname	1 771	795	569	729	401	81	76	19	29	95
Timor-Leste	48 137	19 739	5 518	1 223	411	80	81	16	0	0
Total	**116 934**	**69 793**	**71 473**	**69 916**	**19 857**	**10 545**	**10 410**	**33 441**	**29 994**	**24 366**

E-2020: eliminating countries for 2020; NMP: national malaria programme.

China and El Salvador had no indigenous malaria cases for a third consecutive year and have made a formal request for certification. Iran (Islamic Republic of), Malaysia and Timor-Leste reported zero indigenous malaria cases in 2018 and 2019. In 2019, Belize and Cabo Verde reported zero indigenous malaria cases for the first time since 2000. There were more cases in 2019 than in 2018 in Comoros, Costa Rica, Ecuador and Suriname, which reported 1986, 25, 150 and 66 additional cases, respectively. A malaria outbreak in Timor-Leste in 2020 is under investigation to determine whether any cases should be classified as indigenous.

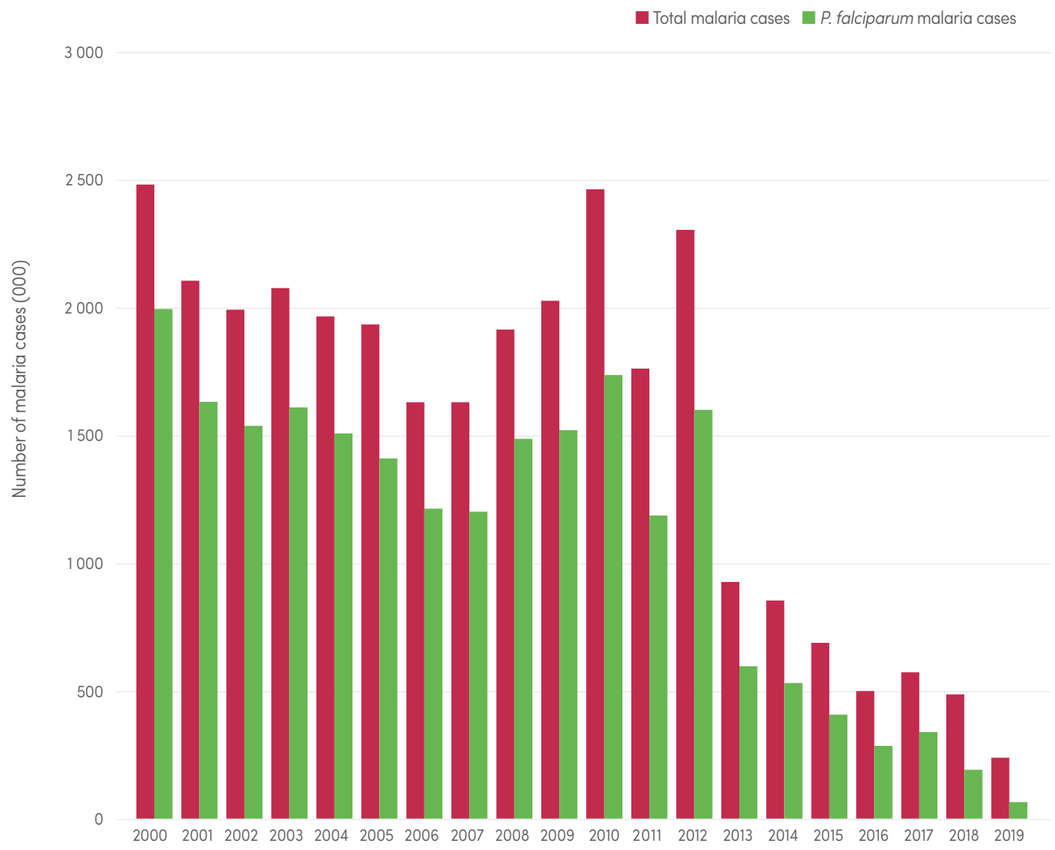
4.3 THE GREATER MEKONG SUBREGION

The six countries of the GMS – Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – have made huge gains against malaria as they aim for *P. falciparum* malaria elimination by 2025 (**Fig. 4.2**, **Fig. 4.3**) and elimination of all malaria by 2030. Between 2000 and 2019, the reported number of *P. falciparum* malaria cases fell by 97%, while all malaria cases fell by 90%. Of the 239 000 malaria cases reported in 2019, 65 000 were *P. falciparum* cases. Overall, Cambodia (58%) and Myanmar (31%) accounted for most cases of malaria in the GMS.

The rate of decline has been fastest since 2012, when the MME programme was launched. During this period, malaria cases reduced sixfold, while *P. falciparum* cases reduced by a factor of nearly 14.

FIG. 4.2.

Total malaria and *P. falciparum* cases in the GMS, 2000–2019 *Sources: MME programme database and NMP reports.*



GMS: Greater Mekong subregion; MME: Mekong Malaria Elimination; NMP: national malaria programme; *P. falciparum*: *Plasmodium falciparum*.

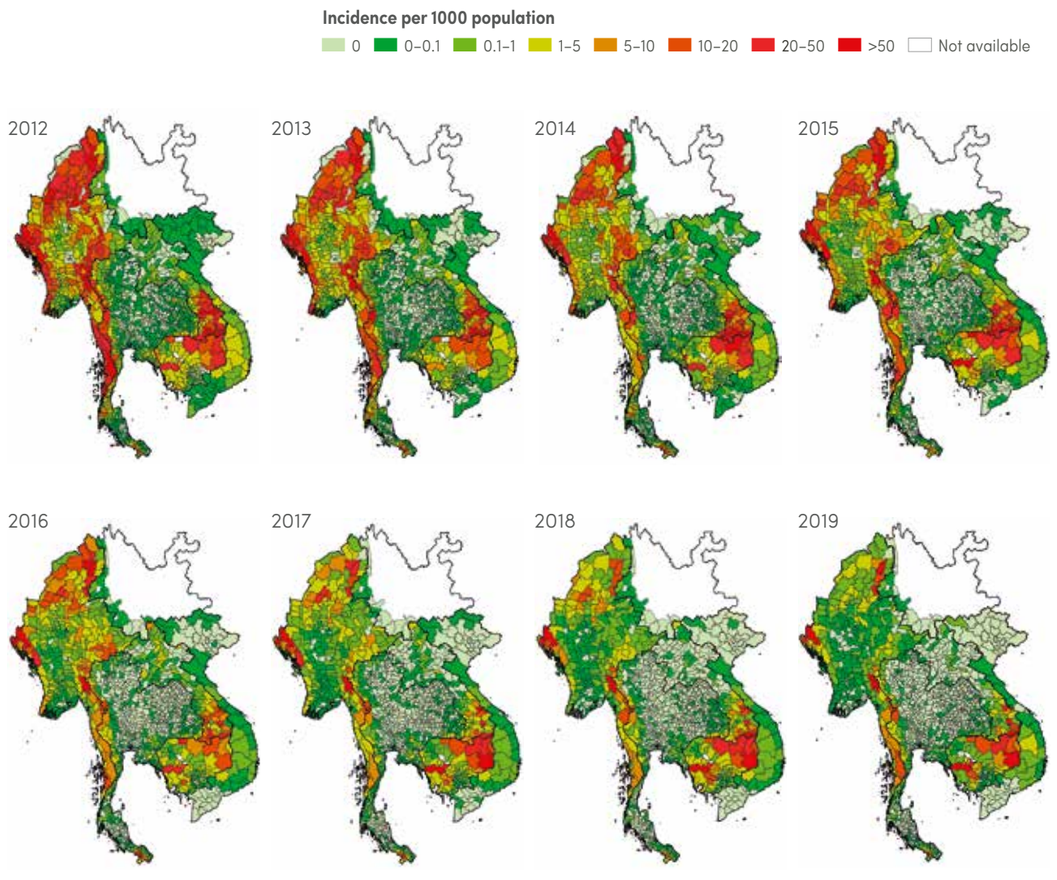
This accelerated decrease in *P. falciparum* is especially critical because of the increasing drug resistance; in the GMS, *P. falciparum* parasites have developed partial resistance to artemisinin, the core compound of the best available antimalarial drugs.

4.4 PREVENTION OF RE-ESTABLISHMENT

Once countries have eliminated malaria, re-establishment of transmission must be prevented through continued preventive measures in areas with malariogenic potential (risk of importation in areas receptive to transmission), vigilance to identify suspected malaria cases in the health system, quality-assured diagnosis and treatment, and follow-up to ensure complete cure and no onward transmission. After elimination, imported cases of malaria are expected, while any introduced or indigenous cases signify local transmission and warn of deficiencies with prevention and surveillance strategies that must be addressed. Transmission of malaria may be considered re-established when at least three indigenous cases of malaria of the same species are found in the same transmission focus for 3 consecutive years. Between 2000 and 2019, no country that was certified malaria free has been found to have malaria transmission re-established.

FIG. 4.3.

Regional map of malaria incidence in the GMS by area, 2012–2019 *Source: NMP reports.*



GMS: Greater Mekong subregion; NMP: national malaria programme.

5 High burden to high impact approach

In November 2018, WHO and the RBM Partnership to End Malaria launched the high burden to high impact (HBHI) country-led approach (*108*), as a mechanism to support the 11 highest burden countries to get back on track to achieve the GTS 2025 milestones (*4*). The approach includes the four key response elements shown in **Fig. 5.1**. These 11 countries (Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, India, Mali, Mozambique, Niger, Nigeria, Uganda and the United Republic of Tanzania) account for 70% of the global estimated case burden and 71% of global estimated deaths from malaria. Several countries with a smaller population but with high malaria incidence have also adopted the HBHI approach.

Since November 2018, the HBHI response has been launched in 10 of the 11 countries (it has not yet been launched in Mali owing to disruptions due to the COVID-19 pandemic). However, all 11 countries have implemented HBHI-related activities across the four response elements. This section presents a summary of key activities and case studies for each of the first three response elements: political will, strategic information and better guidance.

5.1 GALVANIZING POLITICAL WILL, MOBILIZING RESOURCES AND MOBILIZING COMMUNITY RESPONSE

In each HBHI country initiation, there has been high-level political engagement and support. Several countries have begun adapting the RBM Partnership to End Malaria campaign, 'Zero Malaria Starts with Me' (*125*), through high-level national committees and councils, community mobilization and engagement activities, including the private sector.

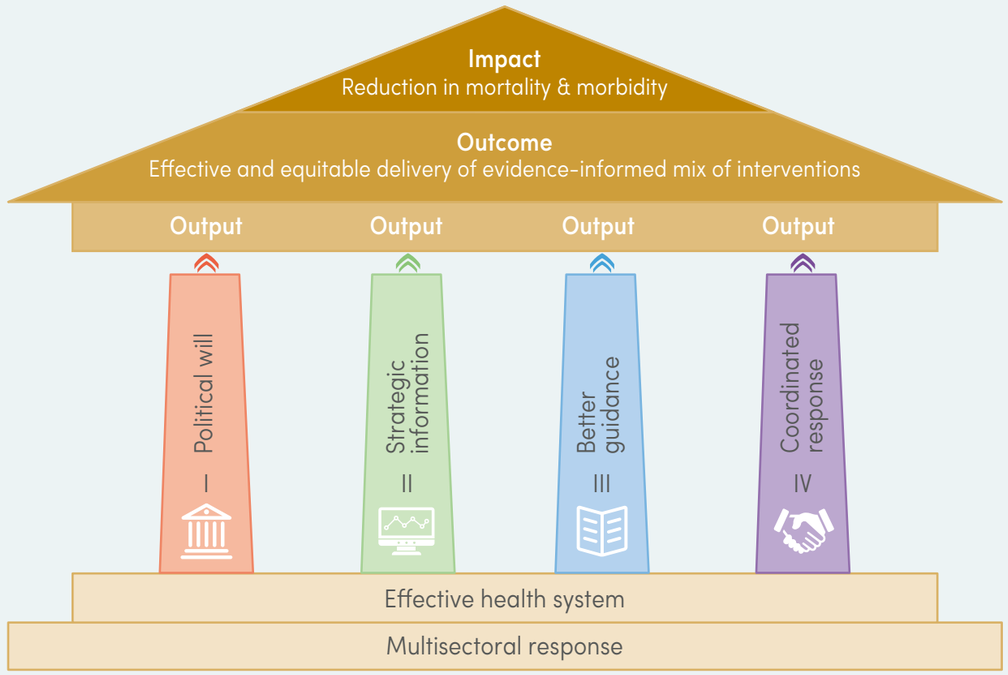
Following the sixth replenishment of the Global Fund in October 2019, the global malaria allocation for the period 2020–2022 was US$ 4.8 billion, an increase of about US$ 1 billion from the previous allocation period. Of this, US$ 2.1 billion was allocated to the 11 HBHI countries, an increase of about US$ 500 million from the previous allocation in the period 2017–2019 (*126*).

In 2020, all HBHI countries except Mali submitted funding requests to the Global Fund, based on the analysis of subnational tailoring of interventions described in **Section 5.2**. At the same time, PMI increased its overall allocation to malaria in 2020 to about US$ 770 million (from about US$ 755 million in 2019), with most of the funds allocated to HBHI countries (*52*).

This section presents the Mass Action Against Malaria (MAAM) initiative in Uganda as an example of a country-led process of political engagement at all levels, and of multisectoral and community mobilization (**Box 5.1** on next page).

FIG. 5.1.

HBHI: a targeted malaria response to get countries back on track to achieve the GTS 2025 milestones
Sources: WHO GMP and RBM Partnership to End Malaria.



GMP: Global Malaria Programme; GTS: *Global technical strategy for malaria 2016–2030*; HBHI: high burden to high impact; WHO: World Health Organization.

BOX 5.1.

Uganda's MAAM *Source: Uganda NMP.*

Background

With a slogan of "Am I free of malaria today?" MAAM was launched in April 2018 in Kampala by the President of Uganda, His Excellency President Yoweri Museveni. To address the high malaria burden in the country, and its impact on individual and community development, MAAM was targeted at high-level state leadership, parliamentarians, government civil servants, religious and cultural leaders, media personnel, private sector, district health teams, health facilities, schoolteachers, community leaders, and households and the public at large. A handbook to guide MAAM has been developed, detailing the roles and responsibilities of all key stakeholders (*127*).

Key stakeholders

- The cabinet
- Parliamentarians
- Government ministries, parastatals and departments
- National and regional leaders (religious and cultural)
- Private sector
- Media
- Regional health directors and administrators
- District leaders
- Health care facility service providers
- Community leaders
- School administrators, teachers and other staff
- Households

Expectations from stakeholders at all levels

- To have a re-orientation of one's own values, to think about malaria prevention as a public health action to save lives
- To acknowledge that one's actions or inaction affects others
- To have full commitment to and accountability for the fight against malaria
- To support the scaling up of interventions against malaria
- To have a sense of urgency, acknowledging that each minute delayed or wasted costs lives, with negative consequences for the individual, the community and the economy

Achievements

- High-level launch and widespread media dissemination
- Development of MAAM handbook
- Incorporation of malaria agenda into the 2021–2025 National Development Plan III, Health Sector Development Plan III
- Establishment of Uganda Parliamentary Forum for Malaria (UPFM), supported by government
- Establishment of the UPFM scorecard for periodic rating of performance at constituency level
- Malaria agenda included in the political party manifesto for the 2021 national election
- Establishment of district task forces, and support for malaria operational interventions and local dissemination through music, dance and drama
- Increase in domestic malaria financing, through institutions such as the Ministry of Finance, Planning and Economic Development, with a budget call circular to all sectors to prioritize the malaria agenda
- Establishment of Malaria Free Uganda Initiative – a private mechanism to drive the malaria agenda
- Establishment of Rotary Malaria Partnership

Challenges

- Sustained funding for MAAM is required to ensure high impact
- Domestic financing is increasing but is not yet optimal
- Accountability at subnational level requires capacity-building
- Operationalization of initiatives is often delayed and slow paced

5.2 USING STRATEGIC INFORMATION TO DRIVE IMPACT

The HBHI Response Element 2 set out to implement work under five main areas in two phases (**Table 5.1**), with Phase 1 to be achieved by the end of 2020 and Phase 2 by the end of 2021. The HBHI countries have successfully implemented all the Phase 1 activities, with support from a collaborative partnership coordinated by WHO.

TABLE 5.1.

HBHI Response Element 2: work areas and status update *Source: WHO.*

	Work area	Status
Phase 1 (by end of 2020)	**Progress review:** Country-level malaria situation analysis, and review of malaria programmes to understand progress and bottlenecks	Malaria programme reviews have been completed in all countries except Mali, where a review is in progress
	Analysis of stratification, intervention mixes and prioritization: Data analysis for stratification, optimal intervention mixes and prioritization for NMSP development and implementation	Subnational tailoring of interventions has been completed in all countries except Mali, where tailoring is in progress. The example of Nigeria is shown in **Fig. 5.3** New NMSPs have been developed in all countries using analysis for subnational tailoring of interventions, and is in progress in Mali New NMSP have been used to develop funding requests to the Global Fund and other funders; these requests have been submitted for review and are in the grant-making process
Phase 2 (by end of 2021)	**National malaria data repositories:** Functioning national malaria data repositories, with programme tracking dashboards	WHO has developed a master indicators list for national integrated malaria databases WHO has developed a generic DHIS2 national repository platform that can be linked directly with HMIS DHIS2 instances An integrated malaria database repository has been launched in Nigeria, and repositories are under development in Ghana, Mozambique, Uganda and the United Republic of Tanzania Other countries have not yet started repositories, but discussions among countries and partners are ongoing
	Subnational operational plans: Subnational operational plans linked to subnational health plans	New NMSP have 5-year workplans Specific workplans will be developed once discussions with the Global Fund and other donors are complete WHO and partners will work with countries to develop annual workplans
	Monitoring and evaluation: Ongoing national and subnational monitoring and evaluation of programmatic activities (including data systems) and impact	Discussions are ongoing between WHO and each country and partners on enhanced monitoring and evaluation processes Learning from experience in Benin and Nigeria, countries will be encouraged to digitalize their ITN, IRS and SMC campaigns, to ensure efficient micro planning and distribution, with real-time data availability Comprehensive surveillance assessments are planned in Burkina Faso, the Democratic Republic of the Congo and Ghana; rapid surveillance system assessments are planned in other countries

DHIS2: District Health Information Software 2; Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; HBHI: high burden to high impact; HMIS: health management information system; IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; NMSP: national malaria strategic plan; SMC: seasonal malaria chemoprevention; WHO: World Health Organization.

The process for analysing subnational tailoring of malaria interventions in the HBHI countries starts with the identification and mapping of operational units in each HBHI country. Demographic, epidemiological, entomological, climatic, health system and other contextual information is assembled for the operational units. Using flexible, context-specific criteria for the targeting of each WHO-approved intervention (*4*), countries then identify operational units that meet the criteria for each intervention. At the end of the process, each unit will have a mix of interventions tailored to its context. At various stages of the process, mathematical models are used to help countries understand the impact on malaria of the scenarios with different combinations of interventions. This information is then used to review and refine the goals of the NMSP, and to help with costing and prioritization of resources during funding requests to the government, the Global Fund, PMI and other donors. WHO coordinates this process; WHO also led the analysis support to countries and collaborated with several mapping and modelling groups to support the HBHI countries.[1]

The example of intervention mixes for each local government authority in Nigeria is presented in **Fig. 5.2**. This intervention-mix map was used to inform Nigeria's new NMSP, and funding requests to the Global Fund and PMI. It also helped with anticipating interventions that would be implemented if a joint malaria loan from the World Bank and Islamic Development Bank is approved, to target states that do not receive support from the Global Fund, PMI or other donors.

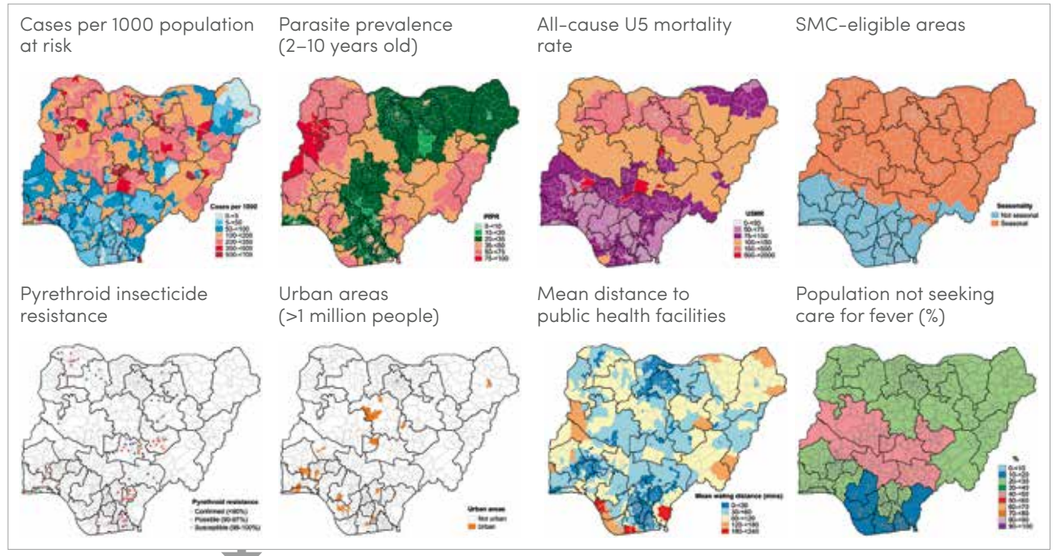
The main highlights of the analysis of subnational tailoring of intervention mixes in Nigeria were an increase in SMC-targeted states, from 114 to 395 local government authorities (LGAs), with actual planned implementation increasing from 114 to 305 LGAs based on available funding, increasing the number of children targeted for SMC from about 4 million to 16 million; funding for new-generation piperonyl butoxide (PBO) nets to cover more than 160 million people; and a recognition that, before the next ITN campaign, a comprehensive exercise of urban microstratification to better target interventions and improve efficiencies will be implemented by the National Malaria Elimination Programme (NMEP), with support from WHO and partners, given that just over half of the 215 million people in Nigeria live in urban areas.

A modelling analysis of the impact of four intervention scenarios was implemented: business as usual (BAU), which is the pre-HBHI approach; a fully funded NMSP updated using the HBHI approach, where 80% or more of coverage of core interventions is achieved in areas where they are targeted; a funding request based on updated NMSPs that limits SMC to five states; and one that increases SMC to an additional five states (**Fig. 5.2**). The analysis shows that the BAU approach will lead to very small reductions in malaria prevalence in Nigeria, whereas full implementation of the subnationally tailored NMSP will lead to substantial reductions in malaria prevalence – by 2023, infection prevalence in children aged under 5 years will be about 16%, a reduction from the estimated prevalence of 28% in 2020. For the period 2020–2023, preliminary analysis by the NMEP of Nigeria shows that US$ 2.75 billion is needed to achieve high coverage of interventions in targeted areas, and full availability of diagnosis and treatment in public health facilities. Additional funding is required to cover all SMC eligible populations as well as major improvements in treatment seeking behaviour, access to care, compliance with SMC and use of LLINs. Currently, available funding for LLINs, RDTs and ACTs for the period 2020–2023 is about US$ 1.75 billion. If the current gap in funding is filled through to 2023, it is projected that, compared with BAU, about 73 million malaria cases and 66 000 deaths will be averted.

[1] The Swiss Tropical and Public Health Institute supported five countries (Cameroon, Ghana, Mozambique, Uganda and the United Republic of Tanzania), PATH supported three countries (the Democratic Republic of the Congo, Mali and Niger), and Northwestern University and the Institute for Disease Modeling supported two countries (Burkina Faso and Nigeria). Subnational maps of parasite prevalence and all-cause mortality in children aged under 5 years were received from the Malaria Atlas Project (MAP) and the Institute for Health Metrics and Evaluations, respectively.

FIG. 5.2.

Example of subnational tailoring of malaria intervention mixes and their projected impacts implemented as part of the HBHI response (in Nigeria) *Sources: NMEP, WHO, Northwestern University, IDM.*



No. of LGAs	IPTp	IPTi	SMC	LLIN distributions	Urban microstratification
5	Yes	No	No	Pyrethroid only	Yes
19	Yes	No	Yes	Pyrethroid only	Yes
43	Yes	Eligible	No	Pyrethroid only	Yes
322	Yes	Eligible	No	Pyrethroid+PBO	No
385	Yes	No	Yes	Pyrethroid+PBO	No

Scenario	Cases and deaths averted compared to a business as usual scenario, 2020–2023			
	Cases: all ages	Cases: U5	Deaths: all ages	Deaths: U5
Full implementation of NMSP	103 000 000	32 000 000	90 000	75 000
Funded scenario with prioritized above allocation request (PAAR) SMC LGAs	73 000 000	24 000 000	66 000	54 000
Funded scenario without PAAR SMC LGAs	71 000 000	23 000 000	64 000	53 000

BAU: business as usual; HBHI: high burden to high impact; IDM: Institute for Disease Modeling; IPTi: intermittent preventive treatment in infants; IPTp: intermittent preventive treatment in pregnancy; LGA: local government authority; LLIN: long-lasting insecticidal net; NMEP: National Malaria Elimination Programme; NMSP: national malaria strategic plan; PAAR: prioritized above allocation request; PBO: piperonyl butoxide; *Pf*PR: *Plasmodium falciparum* parasite rate; SMC: seasonal malaria chemoprevention; U5: aged under 5 years; WHO: World Health Organization.

5.3 IMPROVING WHO'S MALARIA POLICY-MAKING AND DISSEMINATION PROCESSES

Before the launch of HBHI, the GMP had already begun an extensive review of the WHO process for developing and disseminating policy guidance on malaria (*128*). The overall aim was to improve the transparency, consistency, efficiency and predictability of the policy-making process, to make policies timely and more readily adaptable by countries. The resulting pathway was structured as a three-tier process: better anticipate, develop policy and optimize uptake. The HBHI response has added further urgency to this process (*128*).

In 2019, WHO created a compendium of its malaria guidance (*109*), to list all WHO recommendations and associated guidance on malaria in a single resource, and to inform programme managers, and national and international stakeholders. The compendium also references relevant WHO handbooks, manuals and other resources, to guide readers on how these global recommendations can best be implemented. In the same year, WHO updated its technical brief to countries, to support them in the development of robust funding proposals that are tailored to their context (*110*). The document provided information on the process of stratification, which guides tailoring of interventions to the local context and the prioritization of resources, while adhering to the evidence-based recommendations that have been developed through WHO's standard, stringent processes.

Based on the new WHO policy pathway, in 2020, the GMP established several guideline development groups focusing on vector control, case management, chemoprevention and elimination strategies. The results from the deliberations of these groups are expected in early 2021.

5.4 COORDINATED RESPONSE

Several areas of focus were identified for the HBHI fourth response element: stakeholder landscaping; identification of in-country processes requiring coordination; strengthening coordination structures; and aligning partner support around the national strategic and implementation plans.

Although countries have undertaken some assessment of the status of coordination during the initiation phase, most have not formally evaluated their needs. Early feedback from some countries shows that, although they are grateful for the support they receive from partners and WHO, gaps remain; for example:

- weak NMP organizational and staff capacities;
- weak cross-partner coordination structures;
- weak subnational coordination structures;
- potential risks of partner misalignment with NMSPs and operational research priorities;
- issues around the sustainability of project-driven interventions and activities;
- challenges of complex emergencies, including the COVID-19 pandemic.

5.5 MALARIA IN HBHI COUNTRIES SINCE 2018

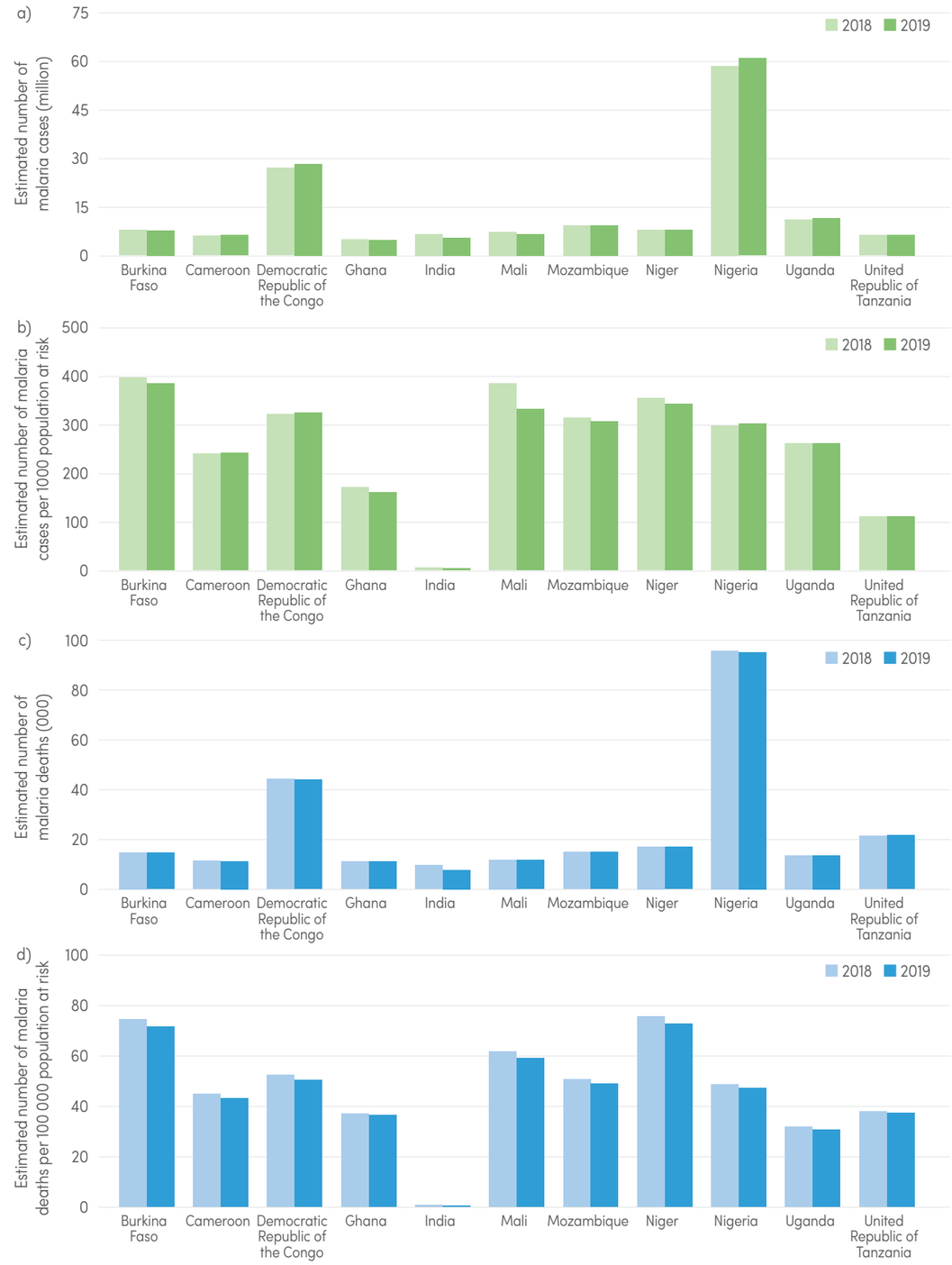
Comparisons of malaria cases, case incidence, deaths and mortality rates in 2018 (the year HBHI was launched) and 2019 are presented in **Fig. 5.3**. Overall, there have been no major changes in the burden of malaria in these countries since 2018. Although cases in India reduced by 1.2 million and Mali by 0.8 million, increases were estimated in Nigeria (2.4 million) and the Democratic Republic of the Congo (1.2 million). Overall, cases increased slightly from 155 million to 156 million between the two years, and deaths reduced from 263 000 to 226 000. In 2015, at GTS baseline, there were 148 million estimated malaria cases in the 11 HBHI countries.

5.6 REPORTED MALARIA CASES IN HBHI COUNTRIES SINCE 2018 AND COMPARISONS WITH ESTIMATED CASES

The methods used in this report to estimate the burden of malaria cases and deaths have several limitations. These methods are elaborated in **Annex 1**. The implications of the limitations become stark in the HBHI countries because they account for 70% or more of the burden of malaria morbidity and mortality. In moderate to high malaria transmission countries in Africa, including the HBHI countries in this region, WHO uses a parasite rate-to-incidence model to estimate malaria cases (**Annex 1, Section 3**). The process of estimation relies on community parasite surveys, interventions and climatic data to quantify parasite prevalence, which is then transformed to incidence using epidemiological methods (*93*). The estimates are often different from cases reported by countries, and this difference has been an important

FIG. 5.3.

Estimated malaria a) cases, b) cases per 1000 population at risk, c) deaths and d) deaths per 100 000 population at risk, 2018 and 2019, in HBHI countries *Source: WHO estimates.*



HBHI: high burden to high impact; WHO: World Health Organization.

source of unease among NMPs. Another method used for Southern African countries and those outside Africa where malaria transmission is low is the adjustment of reported data, mainly from the public health sector, for reporting, testing and treatment seeking rates (**Annex 1**).

Table 5.2 compares the results of two methods used to estimate burden: the parasite-rate-to-incidence method (*107*) used by WHO and the approach based on adjustment of routine data. The WHO method estimates about 150 million cases in 2019 but the method based on adjustment of routine data estimates about 265 million cases. Previous analysis showed that similar differences (i.e. with the routine data method generally resulting in more cases) are seen in most of the 20 sub-Saharan countries that use the parasite rate-to-incidence method. These discrepancies could be explained by data quality, epidemiological and methodological issues (*129*). However, improving national data systems (e.g. in terms of granularity, frequency and quality) is the clear path towards a better understanding of the malaria burden.

TABLE 5.2.

Comparisons of estimated malaria cases (millions) using the parasite rate-to-incidence model (Annex 1) and the reported data from the routine public health sector in high burden countries of the WHO African Region, 2019 *Sources: WHO estimates and NMP reports.*

Country	Estimated cases using parasite rate-to-incidence model (population-wide estimate)	Reported cases from the routine system (public health sector)	Reported cases adjusted for reporting and testing rates (public health sector)	Reported cases adjusted for reporting and testing rates and treatment seeking (population-wide estimate)	Population at risk 2019
Burkina Faso[a]	7.9	10.3	12.2	14.9	20.3
Cameroon	6.3	1.2	1.5	6.3	25.9
Democratic Republic of the Congo	28.3	20.5	21.6	80.9	86.8
Ghana	4.9	5.0	5.6	14.0	30.4
Mali	6.6	2.7	3.1	9.0	19.7
Mozambique	9.4	11.7	12.5	15.7	30.4
Niger	8.0	3.7	3.9	6.3	23.3
Nigeria	61.0	17.8	22.8	72.0	201.0
Uganda	11.6	12.3	14.0	33.8	44.3
United Republic of Tanzania	6.5	5.9	6.3	11.8	58.0
Total	**150.3**	**91.0**	**103.5**	**264.8**	**540.0**

[a] For Burkina Faso, monthly data from 2018 was used due to major disruptions of the surveillance system due to the 2019 health workers' strikes in 2019.

Investments in malaria programmes and research

The GTS sets out estimates of the funding required to achieve milestones for 2020, 2025 and 2030. Total annual resources needed were estimated at US$ 4.1 billion in 2016, rising to US$ 6.8 billion in 2020. An additional US$ 0.72 billion is estimated to be required annually for global malaria research and development (R&D) (*4*). **Section 6.1** presents the most up-to-date funding trends for malaria control and elimination (by source and channel of funding) for the period 2000–2019, where permitted through available data, both globally and for major country groupings. **Section 6.2** presents investments in malaria-related R&D for the period 2007–2018.

6.1 FUNDING TRENDS FOR MALARIA CONTROL AND ELIMINATION

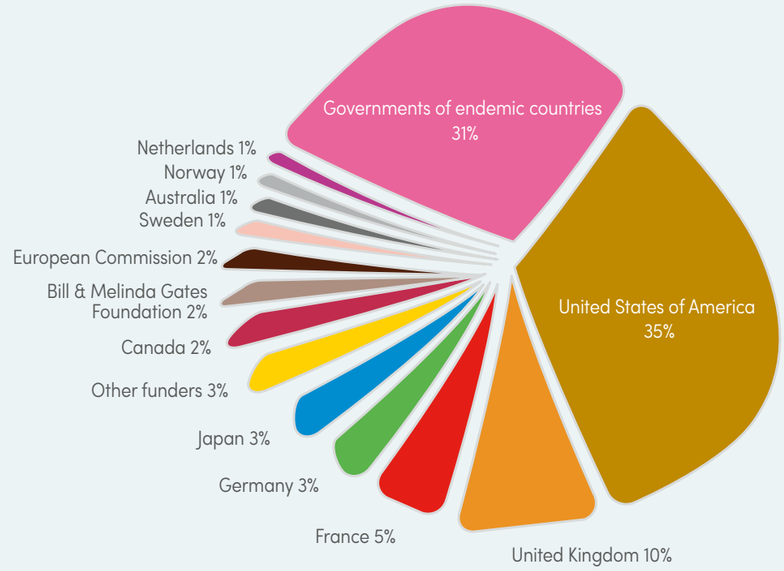
Malaria-related annual funding from donors through multilateral agencies was estimated from donors' contributions to the Global Fund from 2010 through 2019. Organisation for Economic Co-operation and Development (OECD) contributions were available from 2011 through 2018, with 2010 estimates using 2011 data and 2019 estimates using 2018 data. In addition, contributions from malaria endemic countries to multilateral agencies were allocated to governments of endemic countries for the years 2010 through 2019.

For the 91 countries analysed in this section, total funding for malaria control and elimination in 2019 was estimated at US$ 3.0 billion, compared with US$ 2.7 billion in 2018 and US$ 3.2 billion in 2017. The amount invested in 2019 falls short of the US$ 5.6 billion estimated to be required globally to stay on track towards the GTS milestones (*4*). Moreover, the funding gap between the amount invested and the resources needed has continued to widen significantly over recent years, increasing from US$ 1.3 billion in 2017 to US$ 2.3 billion in 2018, and to US$ 2.6 billion in 2019. Over the period 2010–2019, international sources provided 70% of the total funding for malaria control and elimination, led by the US, the United Kingdom of Great Britain and Northern Ireland (United Kingdom) and France over this period (**Fig. 6.1**). Of the US$ 3.0 billion invested in 2019, US$ 2.1 billion came from international funders. The highest contributions in 2019 were from the government of the United States of America (USA), which provided a total of US$ 1.1 billion through planned bilateral funding and contributions to multilateral funding agencies. This was followed by bilateral and multilateral disbursements from the United Kingdom of US$ 0.2 billion; contributions of over US$ 0.1 billion from each of France, Germany and Japan totalling US$ 0.4 billion; and a combined US$ 0.4 billion from other countries that are members of the Development Assistance Committee and from private sector contributors (**Fig. 6.2**). Governments of malaria endemic countries contributed 31% of the total funding (**Fig. 6.1**), with investments nearing US$ 0.9 billion in 2019 (**Fig. 6.2**). Of this amount, an estimated US$ 0.2 billion was spent on malaria case management in the public sector and US$ 0.7 billion on other malaria control activities.

To analyse malaria investment since 2000, international bilateral funding data were obtained from several sources, with the historical availability varying across donors. From the USA, data on total annual planned funding from the Centers for Disease Control and Prevention (CDC), Department of Defense and USAID are available from 2001 through 2019. Total annual planned funding for USAID was utilized from 2001 through 2005, until the introduction of country-specific funding in 2006. The country recipient for funding has been labelled as "unspecified" for all years where country-specific data are not available.

FIG. 6.1.

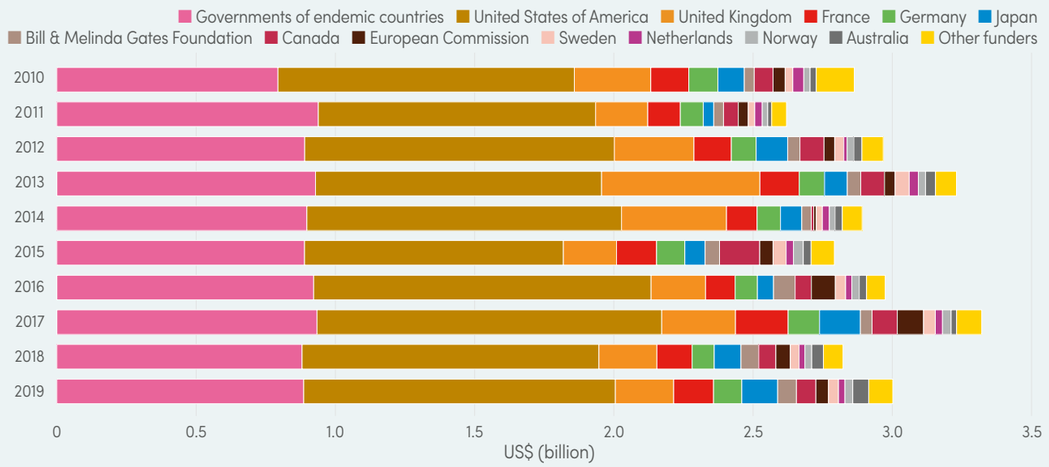
Funding for malaria control and elimination, 2010–2019 (% of total funding), by source of funds (constant 2019 US$) *Sources: ForeignAssistance.gov, Global Fund, NMP reports, OECD CRS database, United Kingdom Department for International Development, WHO estimates and World Bank DataBank.*



Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; United Kingdom: United Kingdom of Great Britain and Northern Ireland; WHO: World Health Organization.

FIG. 6.2.

Funding for malaria control and elimination, 2010–2019, by source of funds (constant 2019 US$) *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD CRS database, the World Bank Data Bank and WHO estimates.*



CRS: creditor reporting system; Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; United Kingdom: United Kingdom of Great Britain and Northern Ireland; WHO: World Health Organization.

Data on annual disbursements by the Global Fund to malaria endemic countries are available from 2003 through 2019. For the government of the United Kingdom, funding data towards malaria control are available from 2007 through 2019: for the years 2007 through 2016, disbursement data were obtained through the OECD creditor reporting system (CRS) on aid activity; for 2017 through 2019, disbursement data were sourced from *Statistics on International Development: final UK aid spend 2019* (*130*). For all other donors, disbursement data were also obtained from the OECD CRS database for the period 2002–2018. For years with no data available for a particular funder, no imputation was conducted; hence, the trends presented throughout **Figs 6.3–6.5** should be interpreted carefully.

Contributions from governments of endemic countries were estimated as the sum of contributions reported by NMPs for the world malaria report of the relevant year plus the estimated costs of patient care delivery services at public health facilities. From 2000 to 2019, where available, government expenditures were used for their contributions (if unavailable, then government budgets or estimates were used), whereas patient care delivery costs were estimated using unit cost estimates from WHO-CHOosing Interventions that are Cost-Effective (WHO-CHOICE) 2010, with values included for the years 2010 through 2019.

Of the US$ 3.0 billion invested in 2019, nearly US$ 1.2 billion (39%) was channelled through the Global Fund (**Fig. 6.4**). Compared with 2018, the Global Fund's disbursements to malaria endemic countries increased by about US$ 0.2 billion in 2019. This difference reflects the cyclical distribution of ITNs supported by the Global Fund combined with an increase in disbursements in 2019, which corresponded to the end of most malaria grants in that year (**Fig. 6.4**).

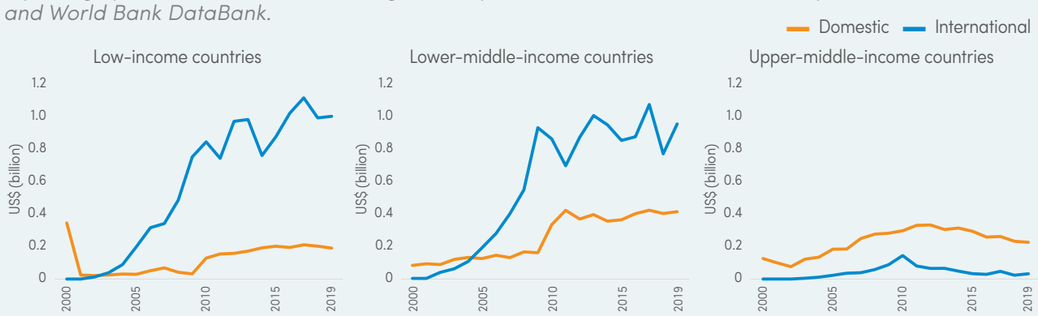
Planned bilateral funding from the government of the USA amounted to US$ 0.8 billion in 2019, which matched the levels of funding in 2017 and 2018, but is higher than the levels of all other annual planned contributions from 2001, when data first became available, to 2016 (**Fig. 6.3**). The United Kingdom remains the second largest bilateral funder, with less than US$ 0.1 billion in 2019, followed by the World Bank and other Development Assistance Committee members (**Fig. 6.3**). The total contribution from governments of malaria endemic countries remained constant, at US$ 0.9 billion invested, in both 2018 and 2019.

Fig. 6.3 shows the substantial variation across country income groups in the share of funding received from domestic and international sources. The 27 low-income countries accounted for 41% of total malaria funding in 2019, down from 47% in 2018 (corresponding to >90% of global malaria cases and deaths), with 84% of their funding coming from international sources. International funding also dominated in the group of 37 lower-middle-income countries (48% of total funding in 2019), accounting for 69% of the amount invested in these countries. In contrast, in the group of 20 upper-middle-income countries (10% of the total funding in 2019), 13% of their malaria funding came from international sources, and 87% from domestic public funding. Lastly, the three high-income countries accounted for 1% of total malaria funding, with 100% of their funding coming from domestic sources.

Of the US$ 3.0 billion invested in 2019, 73% benefited the WHO African Region, 9% went to the WHO South-East Asia Region, 5% each to the WHO Region of the Americas and the WHO Western Pacific Region, and 4% to the WHO Eastern Mediterranean Region (**Fig. 6.5**). Funding flows for which no geographical information on recipients was available represented 4% of the total funding in 2019 (**Fig. 6.5**).

FIG. 6.3.

Funding for malaria control and elimination, 2000–2019, by World Bank 2019 income group and source of funding (constant 2019 US$)[a] *Sources: ForeignAssistance.gov, Global Fund, NMP reports, OECD creditor reporting system database, United Kingdom Department for International Development, WHO estimates and World Bank DataBank.*

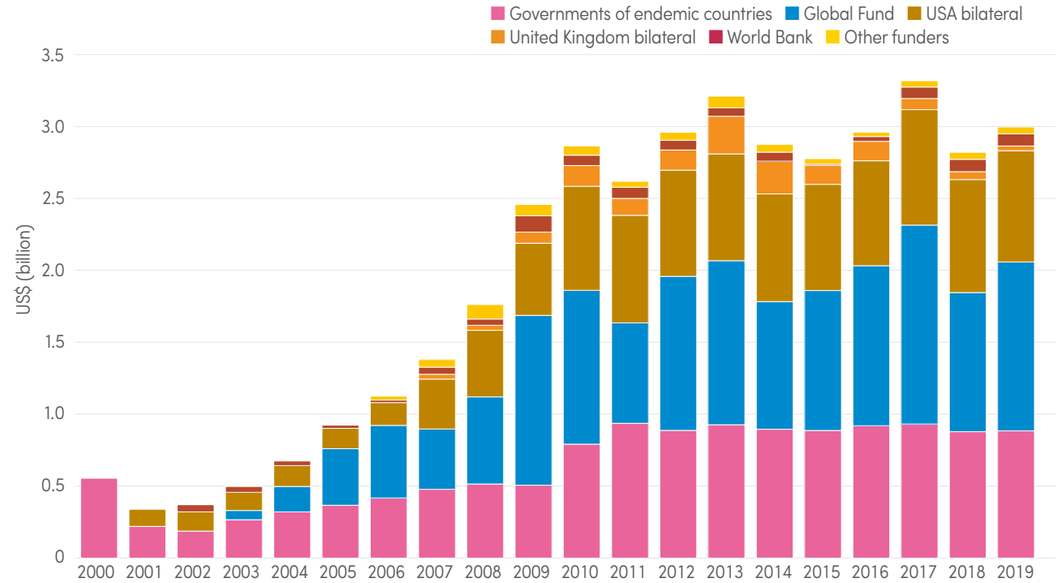


Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; United Kingdom: United Kingdom of Great Britain and Northern Ireland; WHO: World Health Organization.

[a] Domestic excludes out-of-pocket spending by households.

FIG. 6.4.

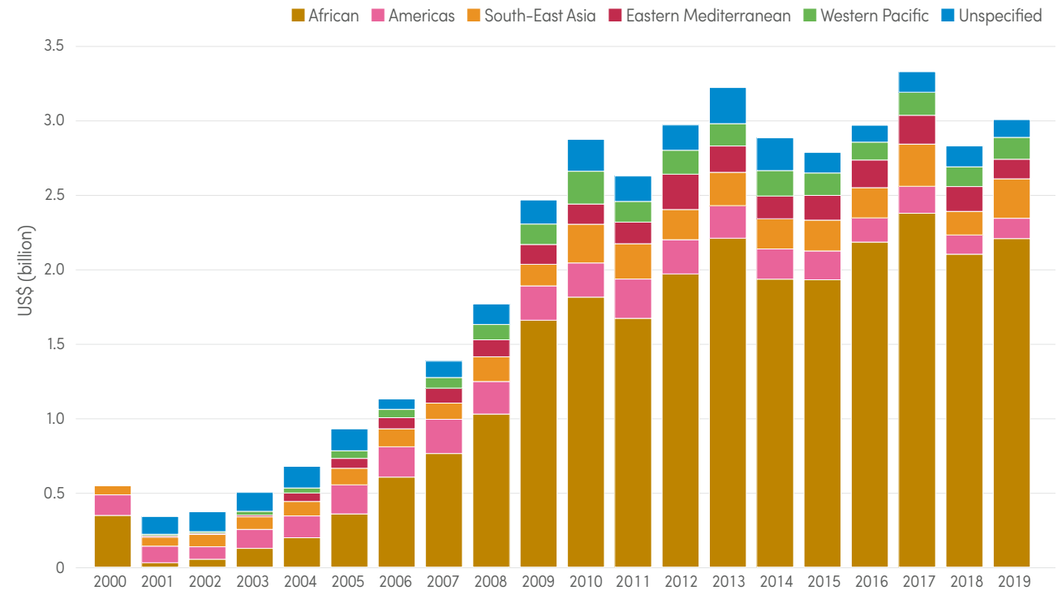
Funding for malaria control and elimination, 2000–2019, by channel (constant 2019 US$) *Sources: ForeignAssistance.gov, Global Fund, NMP reports, OECD creditor reporting system database, United Kingdom Department for International Development, WHO estimates and World Bank DataBank.*



Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; United Kingdom: United Kingdom of Great Britain and Northern Ireland; USA: United States of America; WHO: World Health Organization.

FIG. 6.5.

Funding for malaria control and elimination, 2000–2019, by WHO region (constant 2019 US$)[a] *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD creditor reporting system database, World Bank Data Bank and WHO estimates.*



Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; United Kingdom: United Kingdom of Great Britain and Northern Ireland; WHO: World Health Organization.

[a] "Unspecified" category refers to funding flows, with no information on the geographical localization of their recipients.

6.2 INVESTMENTS IN MALARIA-RELATED R&D

6.2.1 Overarching trends

Between 2007 and 2018, almost US$ 7.3 billion was invested in basic research and product development for malaria. The malaria R&D funding landscape has been led by investment in drugs (US$ 2.6 billion, 36% of malaria funding between 2007 and 2018), followed by relatively similar shares for basic research (US$ 1.9 billion, 26%) and vaccines R&D (US$ 1.8 billion, 25%). Investments in vector control products and diagnostics were notably lower, reaching overall totals of US$ 453 million (6.2%) and US$ 185 million (2.5%), respectively (**Fig. 6.6**).

Changes in total malaria funding have largely reflected the progression of the overall pipeline. For example, a spike in vaccine funding in 2008–2009 – related to a surge of funding for Phase III trials of the RTS,S malaria vaccine candidate – was followed by a sharp drop and some subsequent stagnation in malaria R&D funding between 2010 and 2015. Driven in part by increased public sector investments in discovery and preclinical R&D for drugs and vaccines, as well as increased industry investment in several Phase II trials of new chemical entities with potential for single-exposure radical cure, overall funding has climbed again since 2016, steadily returning to near-peak levels in 2018.

Between 2007 and 2018, the public sector held a leading role in malaria R&D funding, growing from US$ 246 million in 2007 to a peak of US$ 365 million in 2017. Within the public sector and among all malaria R&D funders, the US National Institutes of Health was the largest contributor, focusing just over half of its US$ 1.9 billion investment into basic research (US$ 1.02 billion, 54% of their overall malaria investment between 2007 and 2018).

The Bill & Melinda Gates Foundation has been another instrumental player, investing US$ 1.8 billion (25% of all malaria R&D funding) between 2007 and 2018, and supporting the clinical development of key innovations such as the RTS,S vaccine. The Bill & Melinda Gates Foundation has given more funding to malaria than any other disease-specific investment reported by G-FINDER.

The industry sector has played a prominent role in advancing malaria drug development. From an overall investment of US$ 1.4 billion between 2007 and 2018, most of the funding (US$ 932 million, 68%) went towards drug R&D. Overall industry investment has increased in recent years, related mainly to an expanded focus on clinical development as drug candidates advanced through clinical trials from 2015 onwards. This change in focus, combined with declines in philanthropic funding during the same period, led to funding from industry surpassing philanthropic funding in 2017 for the first time in the past decade.

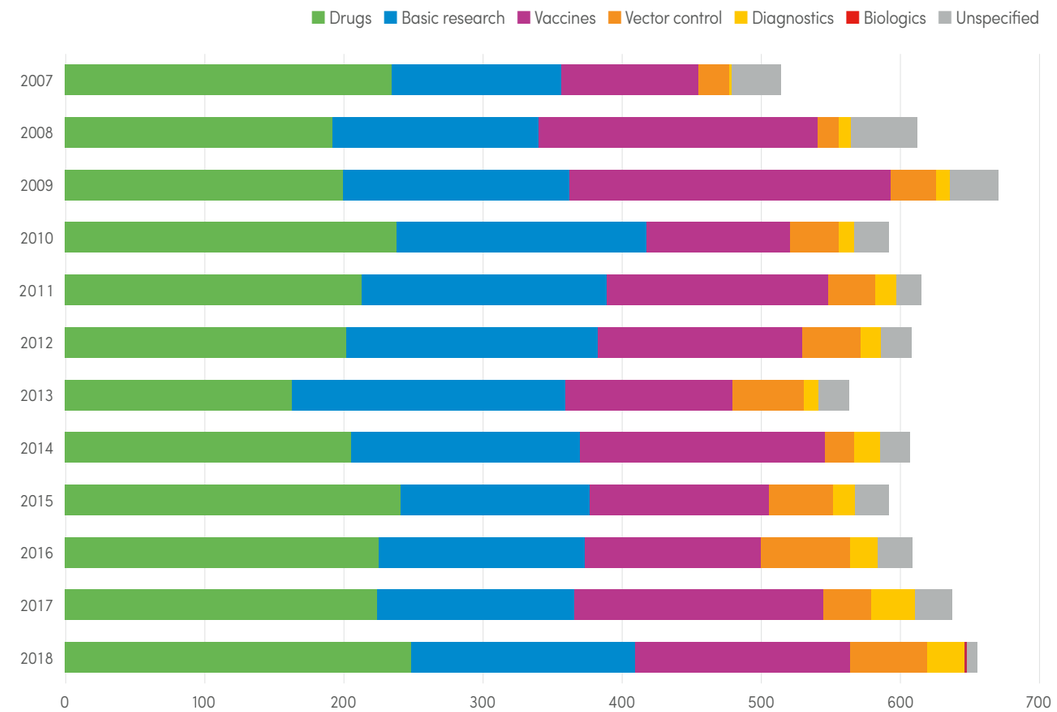
6.2.2 Funding flows

Two thirds (US$ 4.9 billion, 67%) of all funding for malaria basic research and product development between 2007 and 2018 was given externally in the form of grants or contracts, with internal investments (US$ 2.4 billion, 33%) making up the remainder (**Fig. 6.7**). Academic and nongovernment research institutes received the largest share of direct, external funding (US$ 2.4 billion, 49%), 54% (US$ 1.3 billion) of which went to basic research between 2007 and 2018. Most internal investment, on the other hand, was accounted for by industry (US$ 1.4 billion, 58%), followed by the public sector (US$ 972 million, 40%). About 74% (US$ 722 million) of the public sector funds came from intramural funding by the US Department of Defense and US National Institutes of Health.

Product development partnerships and other intermediaries received US$ 1.7 billion (23%) of overall external malaria R&D funding, which was used primarily for investment in drugs (US$ 867 million, 51% of their overall funding) and vaccines (US$ 522 million, 31%). During this period, multiple product development partnerships – including PATH's Malaria Vaccine Initiative (MVI), MMV, FIND and IVCC – have worked to advance development of key malaria product innovations, including numerous drugs, next-generation vector control tools, and, of course, the world's first malaria vaccine to provide partial protection against malaria in young children.

FIG. 6.6.

Funding for malaria-related R&D, 2007–2018, by product type (constant 2019 US$)[a] *Sources: Policy Cures Research G-FINDER data portal (104).*

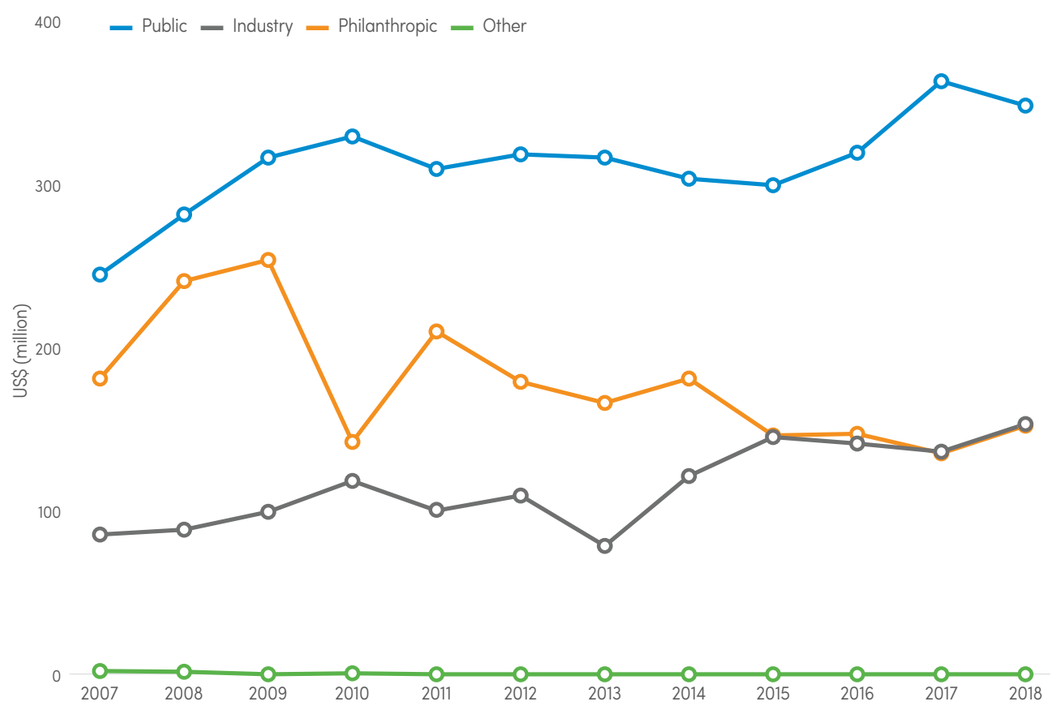


R&D: research and development.

[a] "Unspecified" category refers to funding flows, with no information on the geographical localization of their recipients.

FIG. 6.7.

Malaria R&D funding from 2007 to 2018, by sector (constant 2019 US$) *Source: Policy Cures Research, G-FINDER data portal (104).*



R&D: research and development.

7 Distribution and coverage of malaria prevention, diagnosis and treatment

WHO recommends several interventions for the prevention, diagnosis and treatment of malaria (*106*). The prevention interventions tracked in this report are ITNs, indoor residual spraying (IRS), SMC and IPTp, discussed here in **Sections 7.1–7.4**. To measure progress in access to prompt case management, **Section 7.5** presents the latest results on distribution of RDTs and ACTs, and population-level coverage of malaria diagnosis and treatment.

7.1 DISTRIBUTION AND COVERAGE OF ITNs

Manufacturers delivered about 253 million ITNs to malaria endemic countries in 2019, an increase of 56 million ITNs compared with 2018 (**Fig. 7.1**). About 84% of these ITNs were delivered to countries in sub-Saharan Africa. About 46% of the ITNs delivered by manufacturers were received in Nigeria (33.4 million), the Democratic Republic of the Congo (28.0 million), Ethiopia (15.1 million), Mali (10.4 million), Mozambique (10.2 million), Sudan (10.1 million) and Benin (9.7 million). Data from 2010–2019 are presented here; however, manufacturers' delivery data for 2004–2019 show that nearly 2.2 billion ITNs were supplied globally in that period, of which 1.9 billion (86%) were supplied to sub-Saharan Africa.

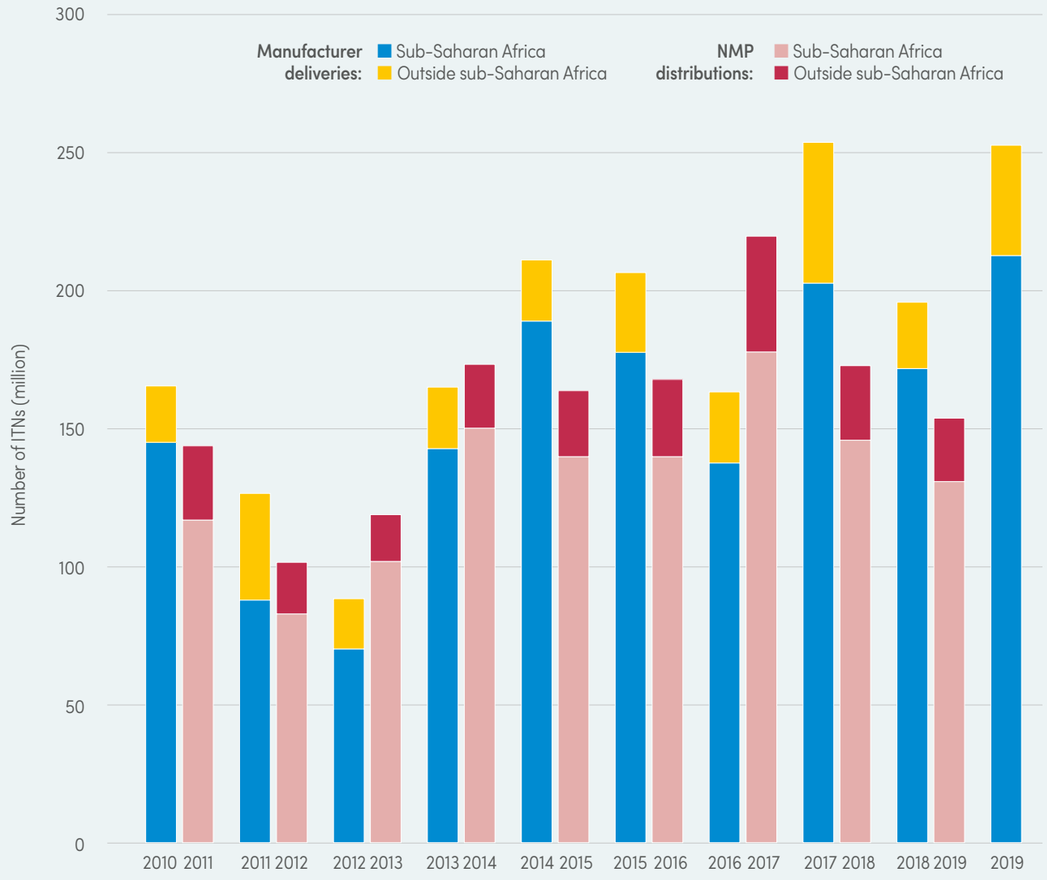
In 2019, 154 million ITNs were distributed globally by NMPs in malaria endemic countries. Of these ITNs, 140 million were distributed in sub-Saharan Africa, with a combined total of about 103 million ITNs being distributed in seven countries: Nigeria (31 million), the Democratic Republic of the Congo (21 million), Ethiopia (11 million), Guinea (9 million), Senegal (9 million), Burundi (8 million) and Cameroon (8 million). Outside of sub-Saharan Africa, the largest distribution was in Myanmar (11 million).

Indicators of population-level coverage of ITNs were estimated for sub-Saharan African countries in which ITNs are the main method of vector control. Household surveys were used, together with manufacturer deliveries and NMP distributions, to estimate the following main indicators:

- ITN use (i.e. percentage of a given population group that slept under an ITN the night before the survey);
- ITN ownership (i.e. percentage of households that owned at least one ITN);
- percentage of households with at least one ITN for every two people; and
- percentage of the population with access to an ITN within their household (i.e. percentage of the population that could be protected by an ITN, if each ITN in a household could be used by two people).

FIG. 7.1.

Number of ITNs delivered by manufacturers and distributed[a] by NMPs, 2010–2019 *Sources: Milliner Global Associates and NMP reports.*



ITN: insecticide-treated mosquito net; NMP: national malaria programme.

[a] A lag between manufacturer deliveries to countries and NMP distributions of about 6–12 months is expected; thus, deliveries by manufacturers in a given year are often not reflected in distributions by NMPs in that year. Also, distributions of ITNs reported by NMPs do not always reflect all the nets that have been distributed to communities, depending on completeness of reporting. These issues should be considered when interpreting the relationship between manufacturer deliveries, NMP distributions and likely population coverage. Additional considerations include nets that are in storage in country but have not yet been distributed by NMPs, and those sold through the private sector that are not reported by programmes.

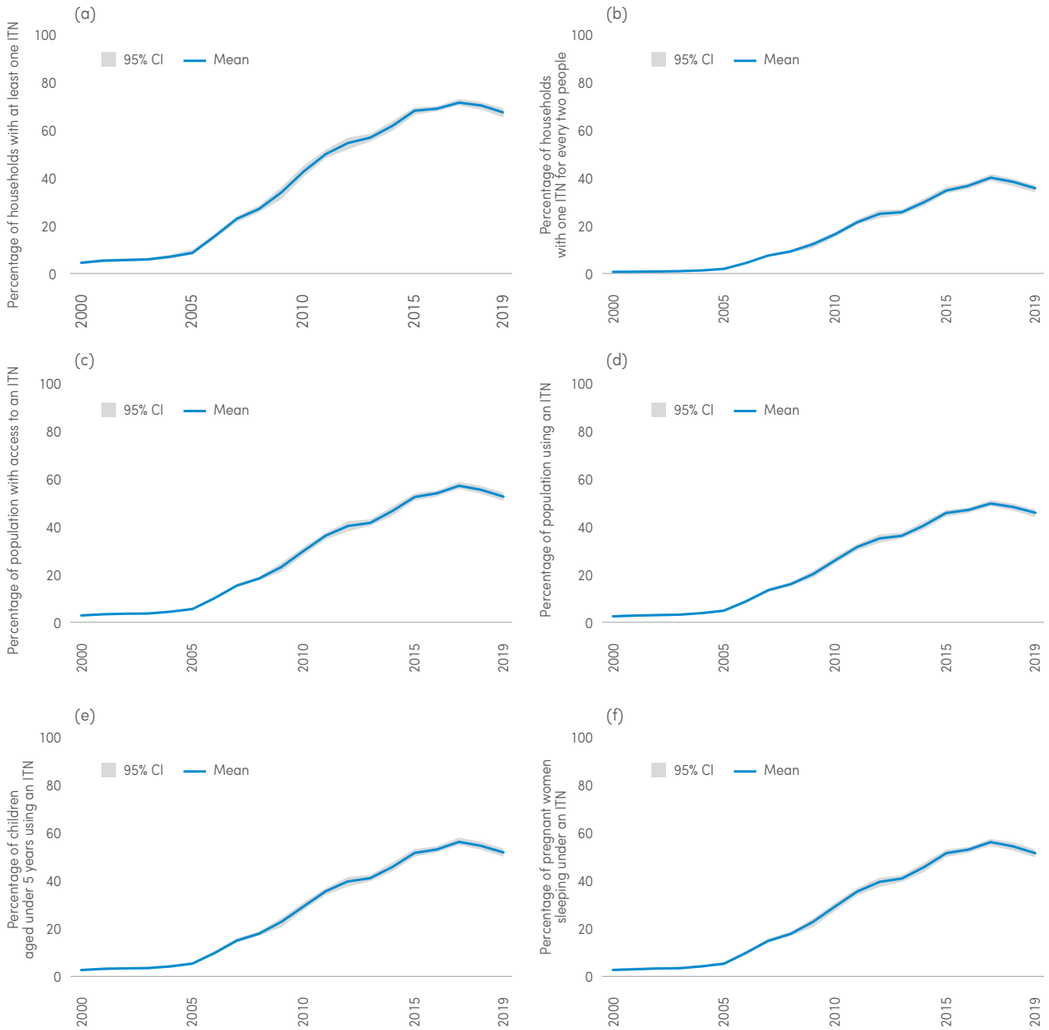
By 2019, 68% of households in sub-Saharan Africa had at least one ITN, increasing from about 5% in 2000. The percentage of households owning at least one ITN for every two people increased from 1% in 2000 to 36% in 2019. In the same period, the percentage of the population with access to an ITN within their household increased from 3% to 52%. The percentage of the population sleeping under an ITN also increased considerably between 2000 and 2019, for the whole population (from 2% to 46%), for children aged under 5 years (from 3% to 52%) and for pregnant women (from 3% to 52%). These indicators represent impressive progress since 2000, although coverage peaked in 2017 (**Fig. 7.2**).

Using concentration indices, socioeconomic equity of ITN use by the children aged under 5 years at the subnational level was analysed. The most recent household survey data from DHS and MIS from 24 countries[1] for 2015–2019 were used (**Fig. 7.3**). In most West African countries, ITN use was generally pro-poor (i.e. concentration index <0) (**Fig. 7.3**). The concentration index varies from -1 to +1, with a value of zero indicating perfect equality. In this analysis, negative and positive values suggest that ITN use is concentrated in the poorest and richest households. In contrast, ITN use was higher in wealthier households (i.e. concentration index >0) in many parts of the Democratic Republic of the Congo, Kenya, Mozambique, Uganda and the United Republic of Tanzania.

[1] Angola (DHS 2018), Benin (DHS 2017–2018), Burkina Faso (MIS 2017–2018), Burundi (DHS 2016–2017), Cameroon (DHS 2018), Ethiopia (DHS 2016), Ghana (MIS 2019), Guinea (DHS 2018), Kenya (MIS 2015), Liberia (MIS 2016), Madagascar (MIS 2016), Malawi (MIS 2017), Mali (DHS 2018), Mozambique (MIS 2018), Nigeria (DHS 2018), Rwanda (MIS 2017), Senegal (DHS 2018), Sierra Leone (MIS 2016), Togo (MIS 2017), Uganda (MIS 2018–2019), United Republic of Tanzania (MIS 2017), Zambia (DHS 2018) and Zimbabwe (DHS 2015).

FIG. 7.2.

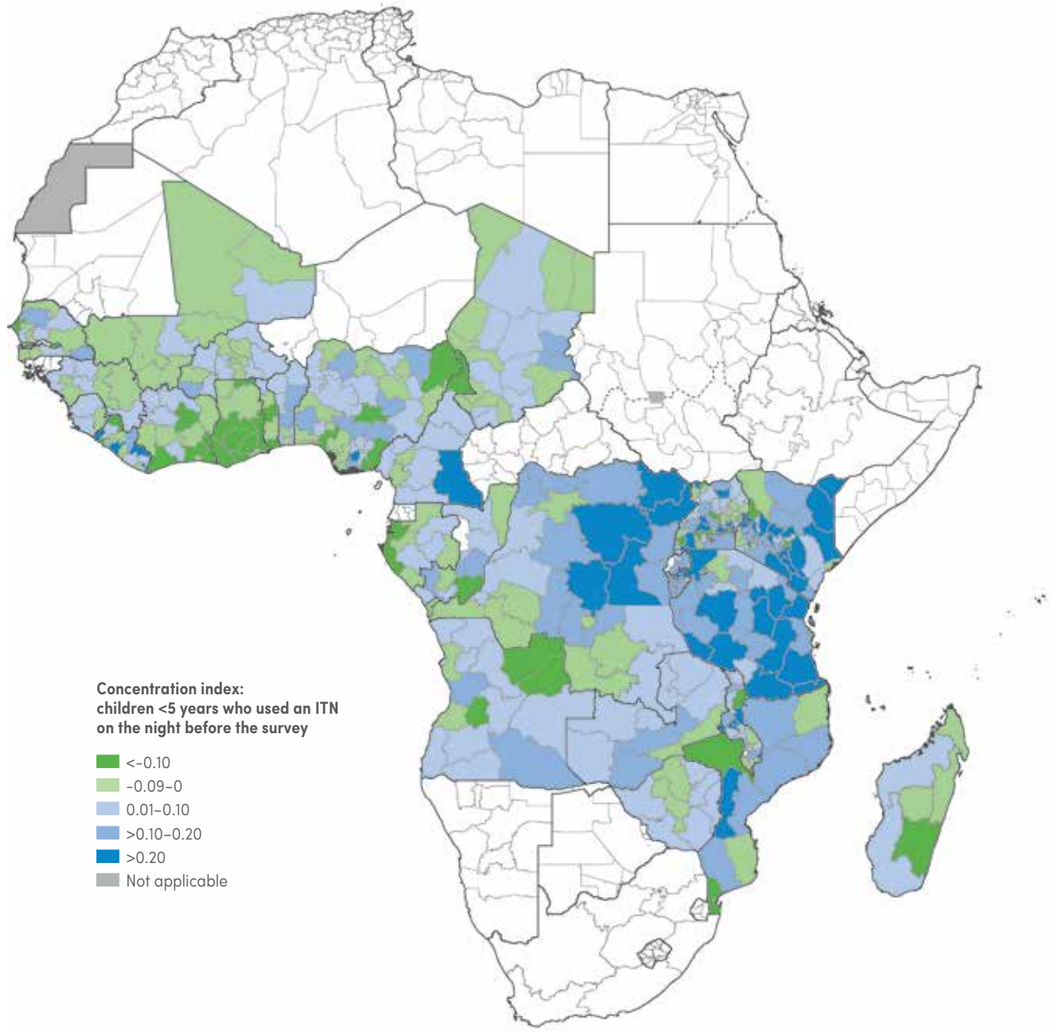
Indicators of population-level coverage of ITNs, sub-Saharan Africa, 2000–2019: a) percentage of households with at least one ITN, b) percentage of households with one ITN for every two people, c) percentage of population with access to an ITN, d) percentage of population using an ITN, e) percentage of children aged under 5 years using an ITN and f) percentage of pregnant women sleeping under an ITN *Sources: ITN coverage model from MAP (131).*



CI: confidence interval; ITN: insecticide-treated mosquito net; MAP: Malaria Atlas Project.

FIG. 7.3.

Concentration index of ITN use by children aged under 5 years, sub-Saharan Africa at administrative level 1 *Source: Most recent household surveys from the period 2015–2019. Kenya Medical Research Institute – Wellcome Trust Research Programme.*



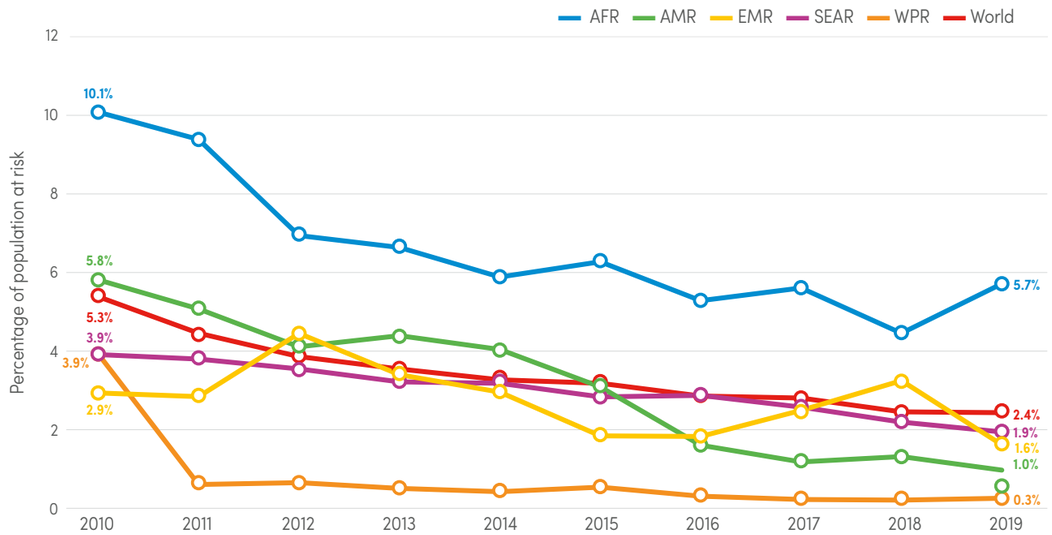
ITN: insecticide-treated mosquito net.

7.2 POPULATION PROTECTED WITH IRS

Globally, the percentage of the populations at risk protected by IRS in malaria endemic countries declined from 5% in 2010 to 2% in 2019. The percentage of the population protected by IRS decreased in all WHO regions (**Fig. 7.4**). The number of people protected globally fell from 180 million in 2010 to 115 million in 2015, but declined to 97 million in 2019. By country, Burundi, Ethiopia, India and Somalia each had the number of people protected with IRS reducing by a million or more when 2019 was compared with 2018.

FIG. 7.4.

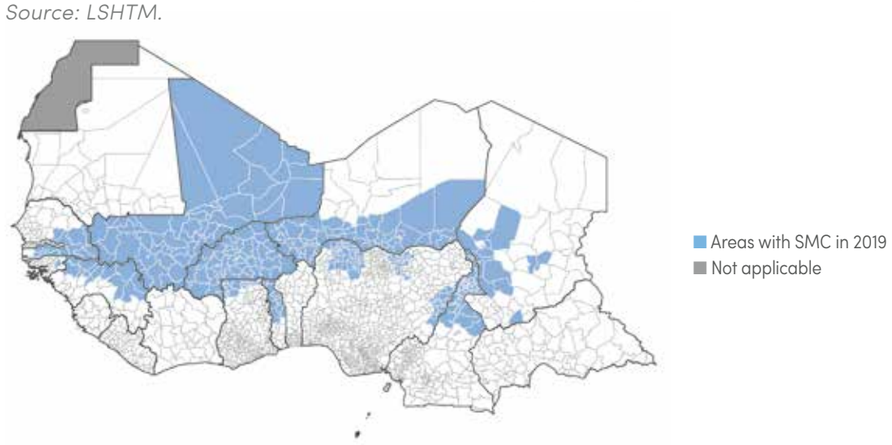
Percentage of the population at risk protected by IRS, by WHO region, 2010–2019 *Source: IVCC data and NMP reports.*



AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; IRS: indoor residual spraying; IVCC: Innovative Vector Control Consortium; NMP: national malaria programme; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: Western Pacific Region.

FIG. 7.5.

Subnational areas where SMC was delivered in implementing countries in sub-Saharan Africa, 2019 *Source: LSHTM.*



LSHTM: London School of Hygiene & Tropical Medicine; SMC: seasonal malaria chemoprevention.

7.3 SCALE-UP OF SMC

In Benin, SMC was scaled up for the first time, taking the number of countries in the Sahel that implement SMC to 13. The number of children reached with at least one dose of SMC steadily increased, from about 0.2 million in 2012 to about 21.5 million in 2019 (**Table 7.1**). Subnational areas in each country where SMC was targeted in 2019 are shown in **Fig. 7.5**. In the 13 countries, a total of about 21.7 million children were targeted in 2019. On average, 21.5 million children received treatment each month (**Table 7.2**), but household surveys are needed to establish coverage gaps.

TABLE 7.1.

Average number of children treated with at least one dose of SMC by year in countries implementing SMC, 2012–2019 *Sources: NMPs, LSHTM and MMV.*

Country	2012	2013	2014	2015	2016	2017	2018	2019
Benin	0	0	0	0	0	0	0	114 165
Burkina Faso	0	0	307 770	860 058	2 648 083	2 949 901	3 298 397	3 298 397
Cameroon	0	0	0	0	1 070 865	1 581 183	1 636 658	1 681 737
Chad	10 000	263 972	27 307	322 493	824 806	899 320	1 184 706	1 491 905
Gambia	0	0	48 953	76 450	73 710	76 726	101 511	110 870
Ghana	0	0	0	115 309	151 510	327 446	329 953	964 956
Guinea	0	0	0	201 283	442 177	575 927	840 120	750 903
Guinea-Bissau	0	0	0	1 999 987	36 681	166 162	90 998	82 918
Mali	160 000	537 294	699 880	646 173	3 849 672	3 990 096	4 278 401	3 767 205
Niger	0	225 970	518 110	787 399	1 994 345	2 545 885	3 810 884	4 151 103
Nigeria	0	209 451	370 280	471 803	1 579 229	2 284 915	3 460 733	4 110 152
Senegal	0	55 709	446 809	0	477 614	485 717	0	671 132
Togo	0	119 222	127 624	5 480 954	308 858	382 319	325 621	296 332
Total	**170 000**	**1 411 618**	**2 546 733**	**10 961 909**	**13 457 550**	**16 265 597**	**19 357 982**	**21 491 775**

TABLE 7.2.

Average number of children targeted and treated, and total treatment doses targeted and delivered, in countries implementing SMC, 2019 *Sources: NMPs, LSHTM and MMV.*

Country	Average number of children targeted	Average number of children treated	Total treatments targeted	Total treatments delivered
Benin	117 470	114 165	469 881	456 660
Burkina Faso	3 588 271	3 298 397	14 353 085	13 193 588
Cameroon	1 687 880	1 681 737	6 751 520	6 726 948
Chad	1 424 920	1 491 905	5 699 681	5 967 620
Gambia	142 695	110 870	570 780	443 480
Ghana	1 074 214	964 956	4 296 856	3 859 824
Guinea	726 402	750 903	2 905 606	3 003 612
Guinea-Bissau	93 364	82 918	373 456	331 672
Mali	3 548 968	3 767 205	14 195 872	15 068 820
Niger	4 188 304	4 151 103	16 753 217	16 604 412
Nigeria	3 989 073	4 110 152	15 956 290	16 440 608
Senegal	821 473	671 132	3 285 893	2 684 528
Togo	346 259	296 332	1 385 035	1 185 328
Total	**21 749 293**	**21 491 774**	**86 997 172**	**85 967 096**

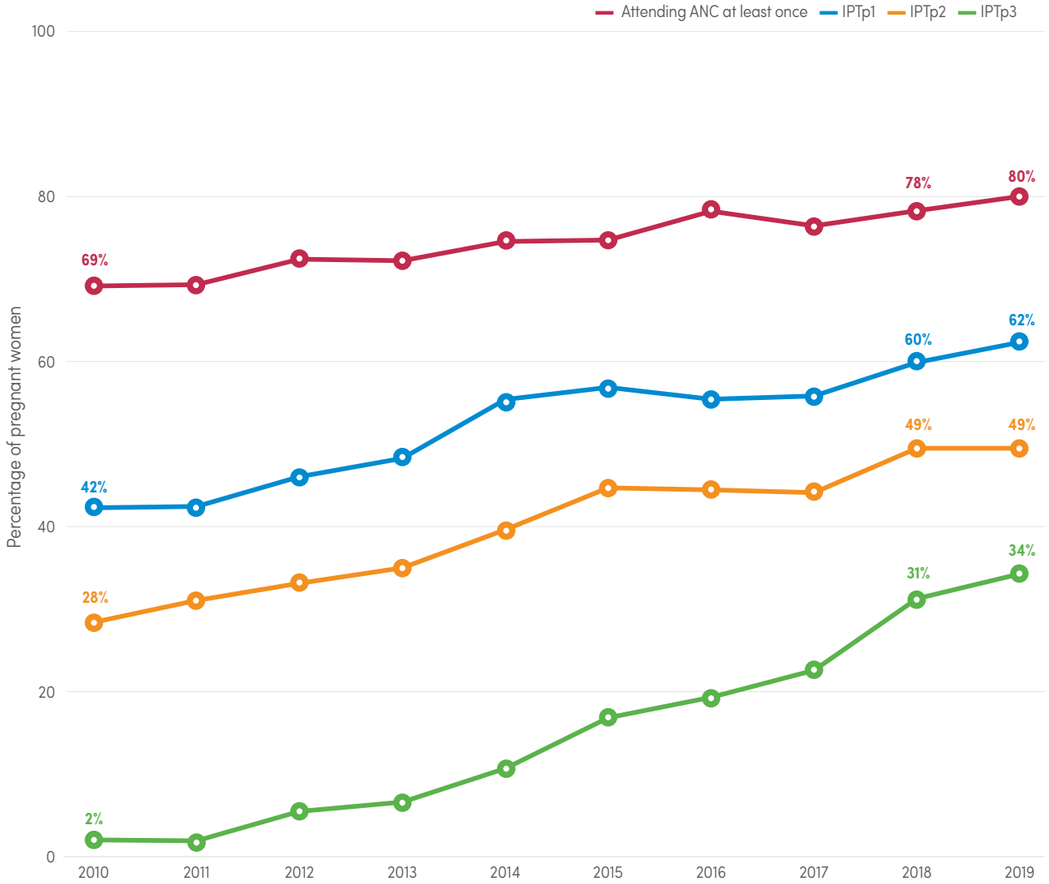
LSHTM: London School of Hygiene & Tropical Medicine; MMV: Medicines for Malaria Venture; NMP: national malaria programme; SMC: seasonal malaria chemoprevention.

7.4 COVERAGE OF IPTp USE BY DOSE

To date, 33 African countries have adopted IPTp to reduce the burden of malaria during pregnancy. These countries reported routine data from health facilities in the public sector on the number of women visiting ANC clinics, and the number receiving the first, second, third and fourth doses of IPTp (i.e. IPTp1, IPTp2, IPTp3 and IPTp4). Using annual expected pregnancies as the denominator (adjusted for fetal loss and stillbirths), the percentage of IPTp use by dose was computed. Despite a slight increase in IPTp3 coverage from 31% in 2018 to 34% in 2019, coverage remains well below the target of at least 80% and underscores the substantial number of missed opportunities, given that 62% of women receive IPTp1 (**Fig. 7.6**).

FIG. 7.6.

Percentage of pregnant women attending an ANC clinic at least once and receiving IPTp, by dose, sub-Saharan Africa, 2010–2019 *Source: NMP reports, US CDC and Prevention estimates and WHO estimates.*



ANC: antenatal care; CDC: Centers for Disease Control and Prevention; IPTp: intermittent preventive treatment in pregnancy; IPTp1: first dose of IPTp; IPTp2: second dose of IPTp; IPTp3: third dose of IPTp; NMP: national malaria programme; US: United States; WHO: World Health Organization.

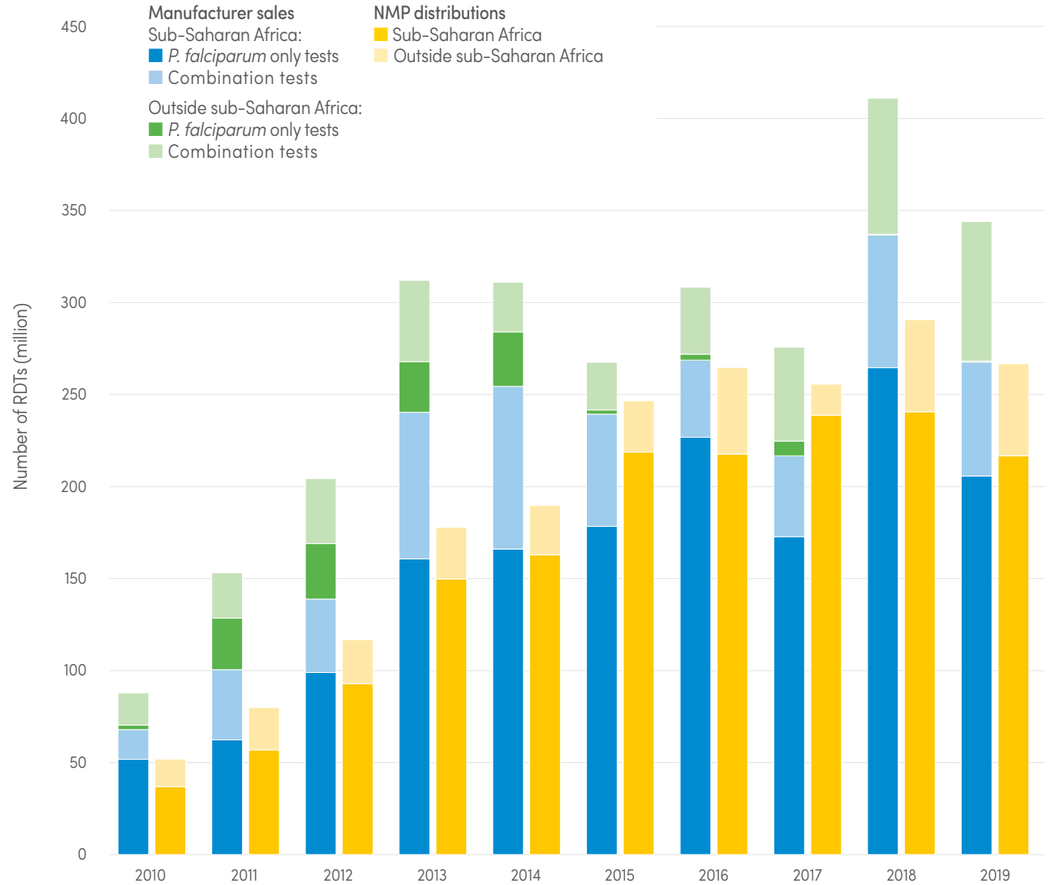
7.5 MALARIA DIAGNOSIS AND TREATMENT

This section presents information on manufacturer sales and deliveries and national distribution of RDTs and ACTs, treatment seeking for fever in children aged under 5 years, and population-level coverage of malaria diagnosis and treatment with ACTs. RDT data shown in this section reflect sales by manufacturers eligible for procurement (i.e. under the Malaria RDT Product Testing Programme) from 2010 to 2017, and since 2018 for WHO Prequalification, and NMP distributions of RDTs. The types of ACTs tracked are those recommended by WHO for use in the treatment of clinical malaria.

Globally, 2.7 billion RDTs for malaria were sold by manufacturers in 2010–2019, with nearly 80% of these sales being to sub-Saharan African countries. In the same period, NMPs distributed 1.9 billion RDTs – 84% in sub-Saharan Africa (**Fig. 7.7**). In 2019, 348 million RDTs were sold by manufacturers and 267 million distributed by NMPs. RDT sales and distributions in 2019 were lower than those reported in 2018, by 63 million and 24 million, respectively, with most decreases being in sub-Saharan Africa.

FIG. 7.7.

Number of RDTs sold by manufacturers and distributed by NMPs for use in testing suspected malaria cases, 2010–2019[a] *Sources: NMP reports and sales data from manufacturers eligible for the WHO Malaria RDT Product Testing Programme.*



NMP: national malaria programme; *P. falciparum*: *Plasmodium falciparum*; RDT: rapid diagnostic test; WHO: World Health Organization.
[a] NMP distributions do not reflect those RDTs still in storage that have yet to be delivered to health facilities and community health workers.

More than 3.1 billion treatment courses of ACT were sold globally by manufacturers in 2010–2019 (**Fig. 7.8**). About 2.1 billion of these sales were to the public sector in malaria endemic countries, and the rest were sold through either public or private sector co-payments (or both), or exclusively through the private retail sector. National data reported by NMPs show that, in the same period, 1.9 billion ACTs were delivered to health service providers to treat malaria patients in the public health sector. In 2019, some 190 million ACTs were sold by manufacturers to the public health sector; in that same year, 183 million ACTs were distributed to this sector by NMPs, of which 90% were in sub-Saharan Africa.

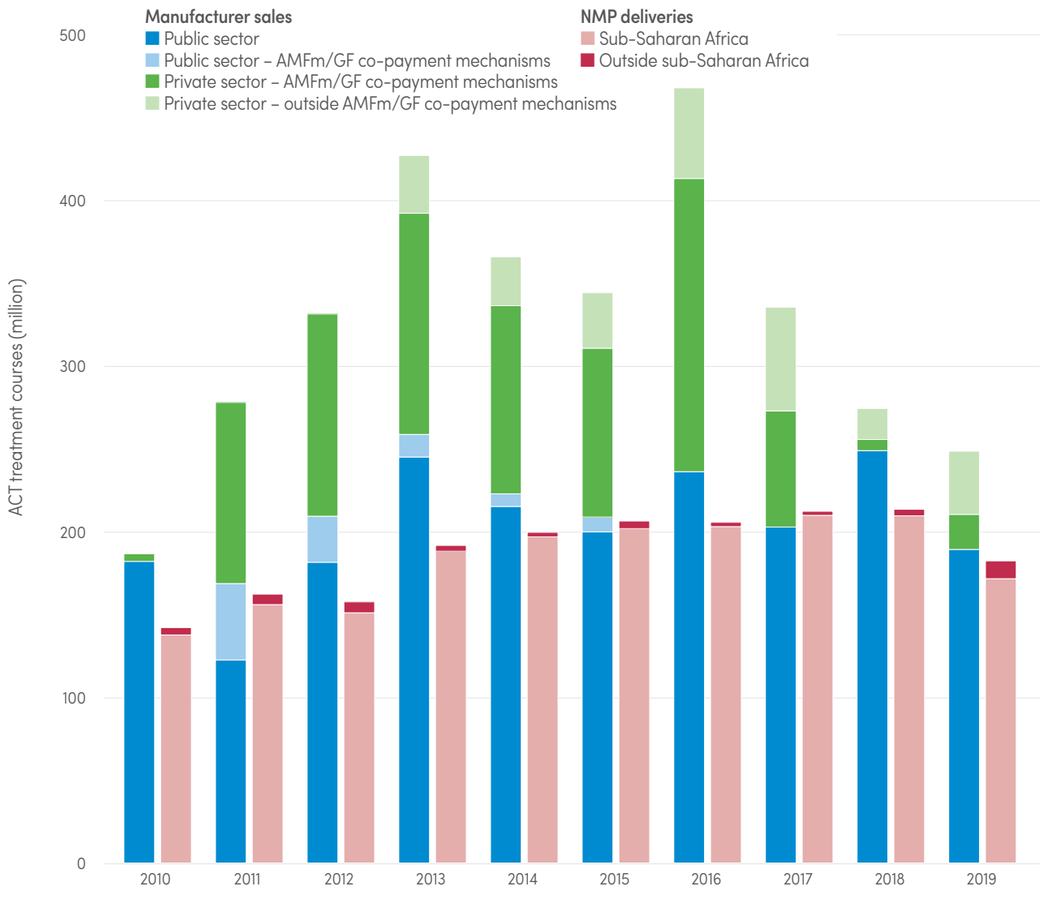
Aggregated data from household surveys conducted in sub-Saharan Africa between 2005 and 2019 in 21 countries[1] with at least two surveys (baseline – 2005–2011 and most recent – 2015–2019) in this period were used to analyse coverage of treatment seeking, diagnosis and use of ACTs by children aged under 5 years (**Table 7.3**). Comparing baseline and latest surveys, there was little change in prevalence of fever within the 2 weeks preceding surveys (median 24% versus 21%) and treatment seeking for fever (median 64% versus 69%). Comparisons of the source of treatment between baseline and more recent surveys shows that a median 63% versus 71% received care from public health facilities, and a median 39% versus 30% from the private sector. Use of community health workers was low in both periods, at a median of less than 2%.

The rate of diagnosis among children aged under 5 years for whom care was sought increased considerably, from a median of 15% at baseline to 38% in the latest household surveys. Use of ACTs also increased more than twofold, from 39% at baseline to 81% in the latest surveys when all children with fever for whom care was sought were considered. Among those who received a finger or heel prick, use of ACTs was 42% in the most recent survey, suggesting that many children received ACTs without parasitological diagnosis.

[1] Angola (MIS 2011; DHS 2018), Benin (DHS 2006; DHS 2017–2018), Burkina Faso (DHS 2010; MIS 2017–2018), Burundi (DHS 2010; DHS 2016–2017), Cameroon (DHS 2011, DHS 2018), Ghana (DHS 2008; MIS 2019), Guinea (DHS 2005; DHS 2018), Kenya (DHS 2008–2009; MIS 2015), Liberia (MIS 2011; MIS 2016), Madagascar (MIS 2011; MIS 2016), Malawi (DHS 2010; MIS 2017), Mali (DHS 2006; DHS 2018), Mozambique (DHS 2011; MIS 2018), Nigeria (MIS 2010; DHS 2018), Rwanda (DHS 2010; MIS 2017), Senegal (DHS 2010–2011; DHS 2018), Sierra Leone (DHS 2008; MIS 2016), Uganda (DHS 2011; MIS 2018–2019), United Republic of Tanzania (DHS 2010; MIS 2017), Zambia (DHS 2007; DHS 2018) and Zimbabwe (DHS 2010–2011; DHS 2015).

FIG. 7.8.

Number of ACT treatment courses delivered by manufacturers and distributed by NMPs to patients, 2010–2019[a,b] *Sources: Companies eligible for procurement by WHO/UNICEF and NMP reports.*



ACT: artemisinin-based combination therapy; AMFm: Affordable Medicines Facility–malaria; GF: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; UNICEF: United Nations Children's Fund; WHO: World Health Organization.

[a] NMP deliveries to patients reflect consumption reported in the public health sector.

[b] AMFm/GF indicates that the AMFm operated from 2010 to 2013, with the GF co-payment mechanism operating from 2014.

TABLE 7.3.

Summary of coverage of treatment seeking for fever, diagnosis and use of ACTs for children aged under 5 years from household surveys in sub-Saharan Africa, at baseline (2005–2011) and most recent (2015–2019) *Source: household surveys.*

Children aged under 5 years	Baseline (2005-2011)			Most recent survey (2015-2019)		
Indicator	**Median estimate**	**Lower bound**	**Upper bound**	**Median estimate**	**Lower bound**	**Upper bound**
Prevalence of fever						
With fever in past 2 weeks	24.1%	18.3%	34.3%	20.6%	16.1%	30.9%
Treatment seeking for fever						
With fever in past 2 weeks for whom treatment was sought	63.5%	57.7%	71.6%	69.1%	56.3%	73.8%
Source of treatment for fever among those who were treated						
Public sector (health facility)	62.9%	52.8%	80.3%	71.0%	49.0%	85.0%
Public sector (community health worker)	2.0%	0.2%	3.4%	1.3%	0.4%	4.9%
Private sector (formal and informal)	39.1%	21.6%	50.3%	30.2%	16.3%	51.9%
Diagnosis among those with fever and for whom care was sought						
Received a finger or heel prick	15.4%	6.5%	26.9%	37.7%	17.8%	49.1%
Use of ACTs among those for whom care was sought						
Received treatment with ACTs	38.9%	23.6%	68.2%	80.5%	30.6%	93.4%
Use of ACTs among those for whom care was sought and received a finger or heel prick						
Received ACTs	18.9%	14.3%	37.7%	42.4%	17.1%	58.7%

ACT: artemisinin-based combination therapy.

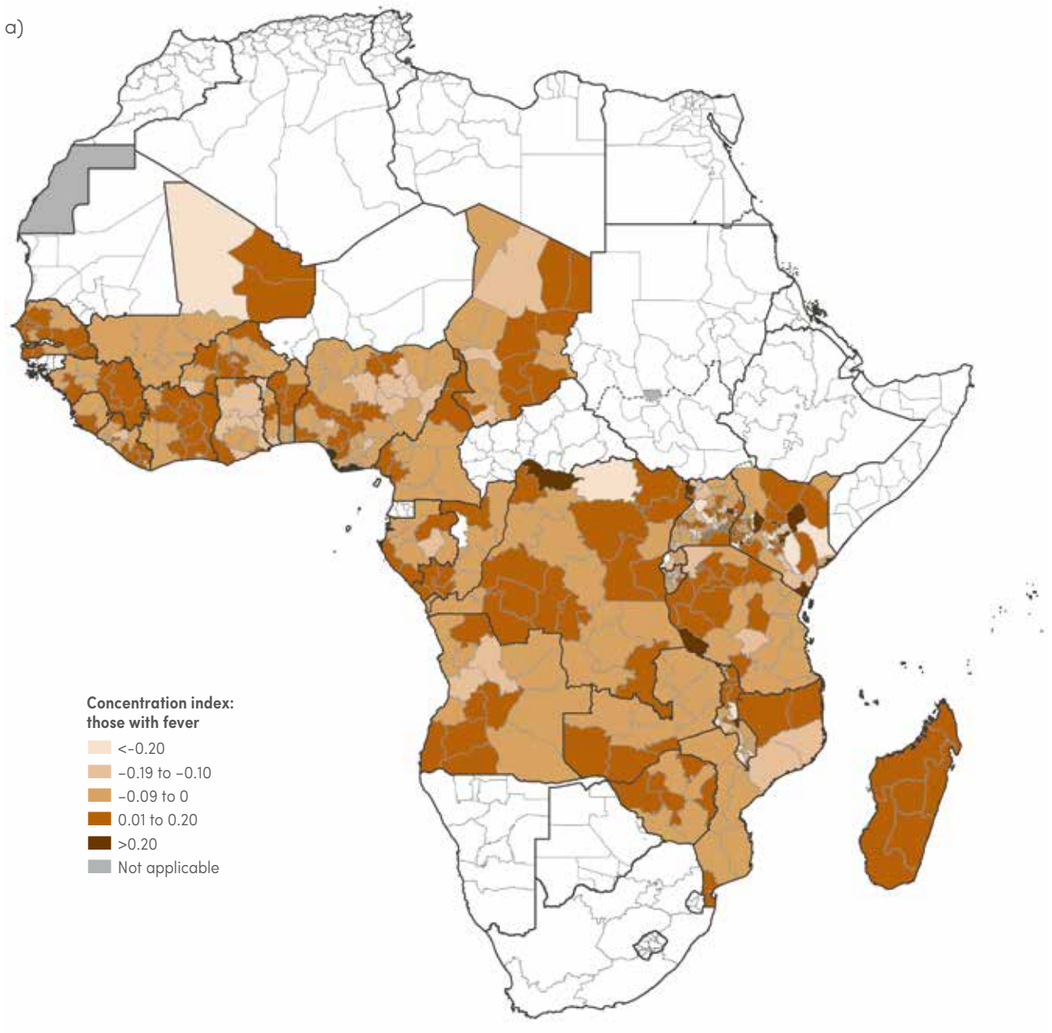
Analysis of equity of fever prevalence and treatment seeking at subnational level was conducted using the most recent household survey data for 2015–2019, from 23 countries[1] (**Fig. 7.9**). In most countries, children in poorer households had a higher prevalence of having a fever in the 2 weeks preceding the household surveys (i.e. concentration index <0). In contrast, treatment seeking was higher in febrile children from wealthier households in all subnational units, although in some units the difference was small.

[1] Angola (DHS 2018), Benin (DHS 2017–2018), Burkina Faso (MIS 2017–2018), Burundi (DHS 2016–2017), Cameroon (DHS 2018), Ethiopia (DHS 2016), Ghana (MIS 2019), Guinea (DHS 2018), Kenya (MIS 2015), Liberia (MIS 2016), Madagascar (MIS 2016), Malawi (MIS 2017), Mali (DHS 2018), Mozambique (MIS 2018), Nigeria (DHS 2018), Rwanda (MIS 2017), Senegal (DHS 2018), Sierra Leone (MIS 2016), Togo (MIS 2017), Uganda (MIS 2018–2019), United Republic of Tanzania (MIS 2017), Zambia (DHS 2018) and Zimbabwe (DHS 2015).

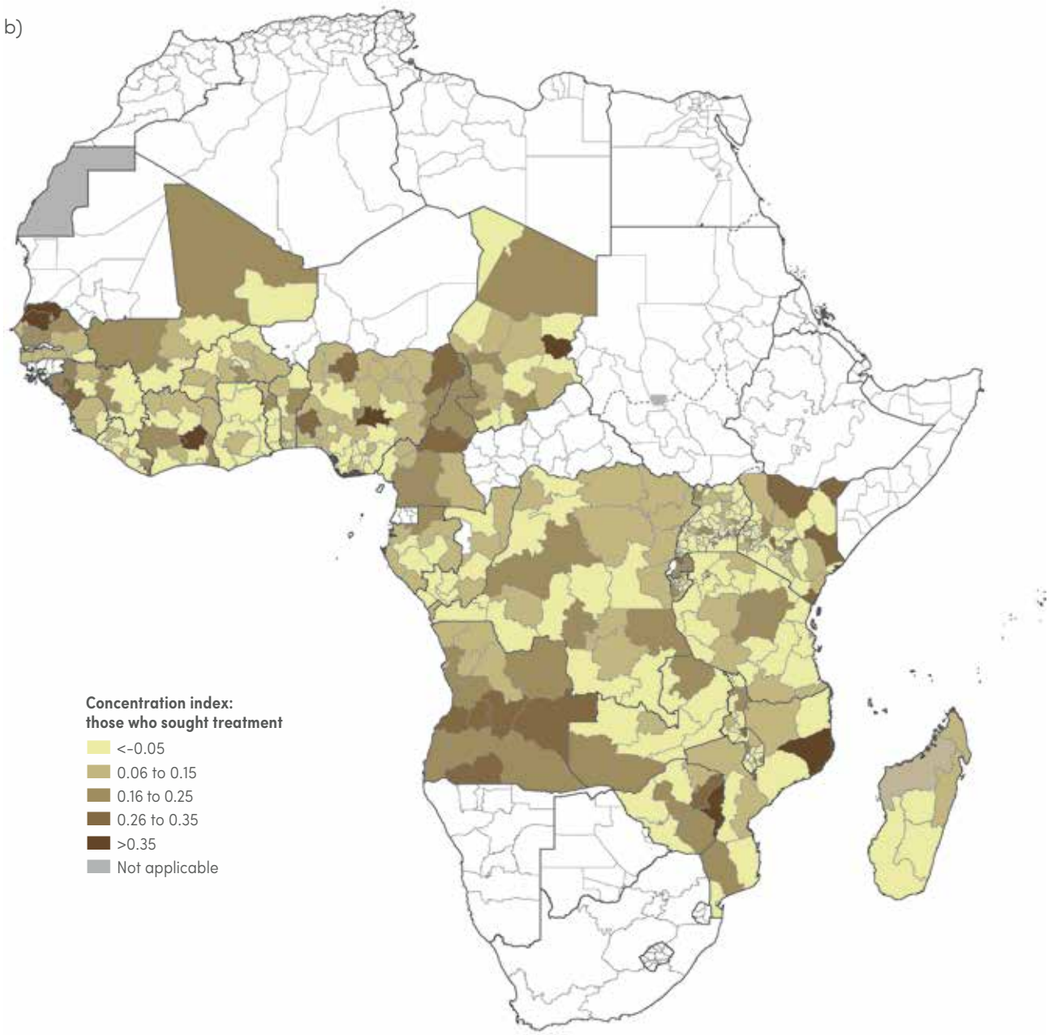
FIG. 7.9.

Concentration index of a) prevalence of fever in, and b) care seeking for children aged under 5 years at administrative level 1, sub-Saharan Africa *Source: most recent household surveys from the period 2015–2019, Kenya Medical Research Institute – Wellcome Trust Research Programme.*

a)



b)



8 Global progress towards the GTS milestones

The GTS aims for a reduction in malaria case incidence and mortality rate of at least 40% by 2020, 75% by 2025 and 90% by 2030 from a 2015 baseline (*4*). Trends in malaria cases and deaths were used to make annual projections from 2020 to 2030, to track progress towards the targets and milestones of the GTS as mandated to WHO by the World Health Assembly (*4*). The projections presented here do not account for potential disruptions due to the COVID-19 pandemic, which – despite commendable global and national efforts to maintain essential malaria services – is likely to lead to higher than expected malaria morbidity and mortality (**Section 10**).

8.1 GLOBAL PROGRESS

Despite the considerable progress made since 2000, the GTS 2020 milestones for morbidity and mortality will not be achieved globally (**Fig. 8.1**). Without actions to reverse this trend, the 2030 GTS and SDG targets for malaria morbidity and mortality will also not be met (**Fig. 8.1**). The malaria case incidence of 56 per 1000 population at risk in 2020 instead of the expected 35 cases per 1000 means that, globally, we are off track by 37%; at the current trajectory, we could be off track by 87% in 2030 (**Fig. 8.1a**). Although relative progress in the mortality rate is greater than that in case incidence (see **Section 3** for potential methodological reasons), globally projected malaria deaths per 100 000 population at risk in 2020 was projected to be 9.8, reducing from 11.9 in 2015. This implied that globally we were off track by 22% (**Fig. 8.1b**).

Fig. 8.2 and **Fig. 8.3** on the next page present progress in all countries considered to be malaria endemic in 2015. Countries were ranked into eight categories of reduction of case incidence and mortality rates in 2020 from a 2015 baseline:

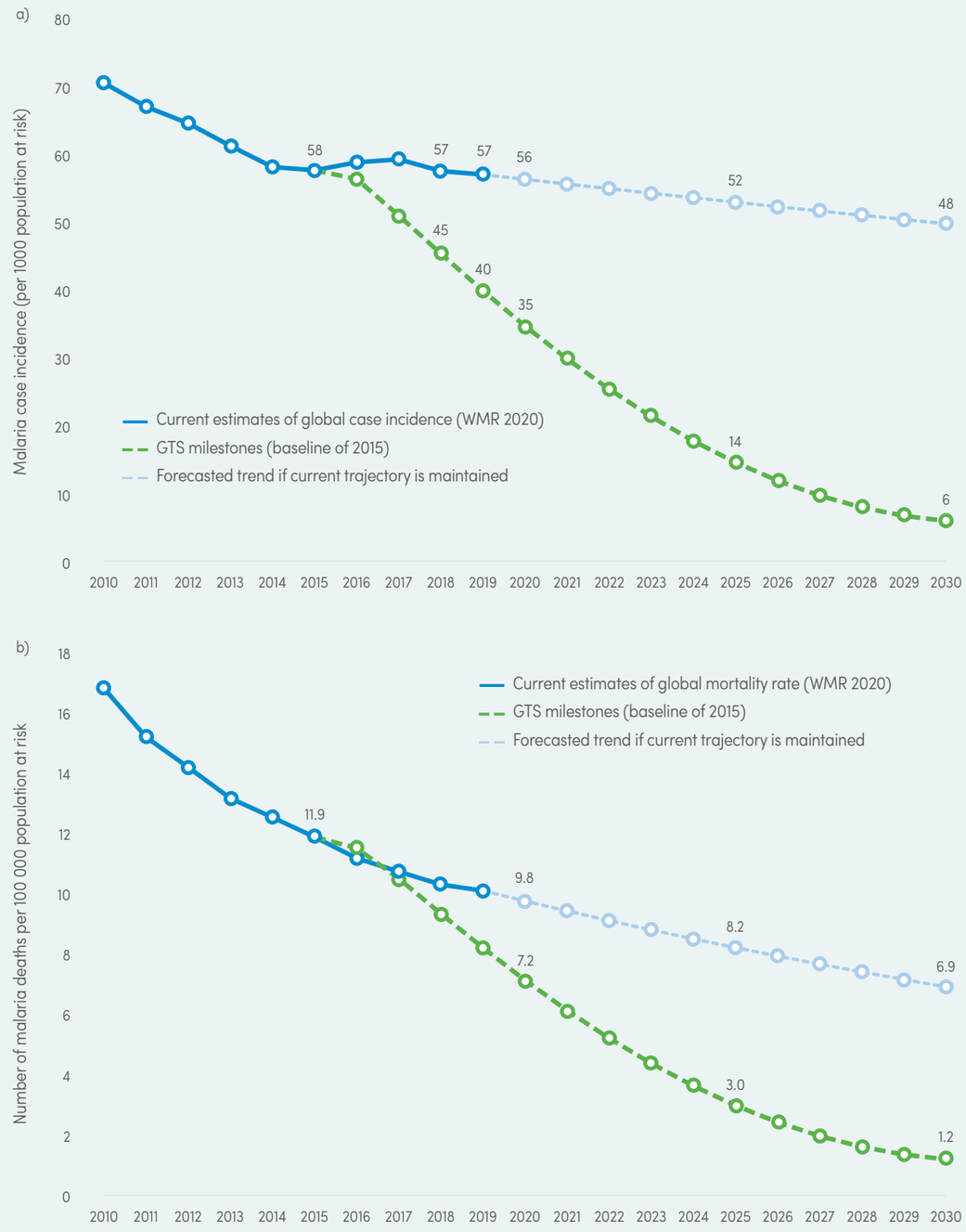
- achieved zero malaria by 2020;
- reduced by 40% or more;
- reduced by between 25% and less than 40%;
- reduced by less than 25%;
- no change since 2015 (less than 5% increase or decrease in case incidence or mortality rate);
- increased by less than 25%;
- increased by between 25% and less than 40%; and
- increased by 40% or more.

Of the 92 countries that were malaria endemic globally in 2015, 31 (34%) were estimated to be on track for the GTS morbidity milestone for 2020, having achieved 40% or more reduction in case incidence or reported zero malaria cases. Another 21 (23%) had made progress in reducing malaria case incidence but were not on track for the GTS milestone. Thirty-one countries (34%) are estimated to have experienced increased incidence, with 15 countries (16%) estimated to have experienced an increase of 40% or more in malaria case incidence in 2020 compared with 2015. Malaria case incidence in nine (10%) countries in 2020 was estimated to be at levels similar to those of 2015.

Thirty-nine (42%) countries that were malaria endemic in 2015 were on track for the GTS mortality milestone for 2020, with 28 of them reporting zero malaria cases. An additional 34 countries (37%) were estimated to have achieved reductions in mortality rate but progress was below the 40% target. Malaria mortality rates remained at the same level in 2020 as in 2015 in seven countries (8%), while another 12 countries (13%) had estimated increases, with six of these countries having increases of 40% or more.

FIG. 8.1.

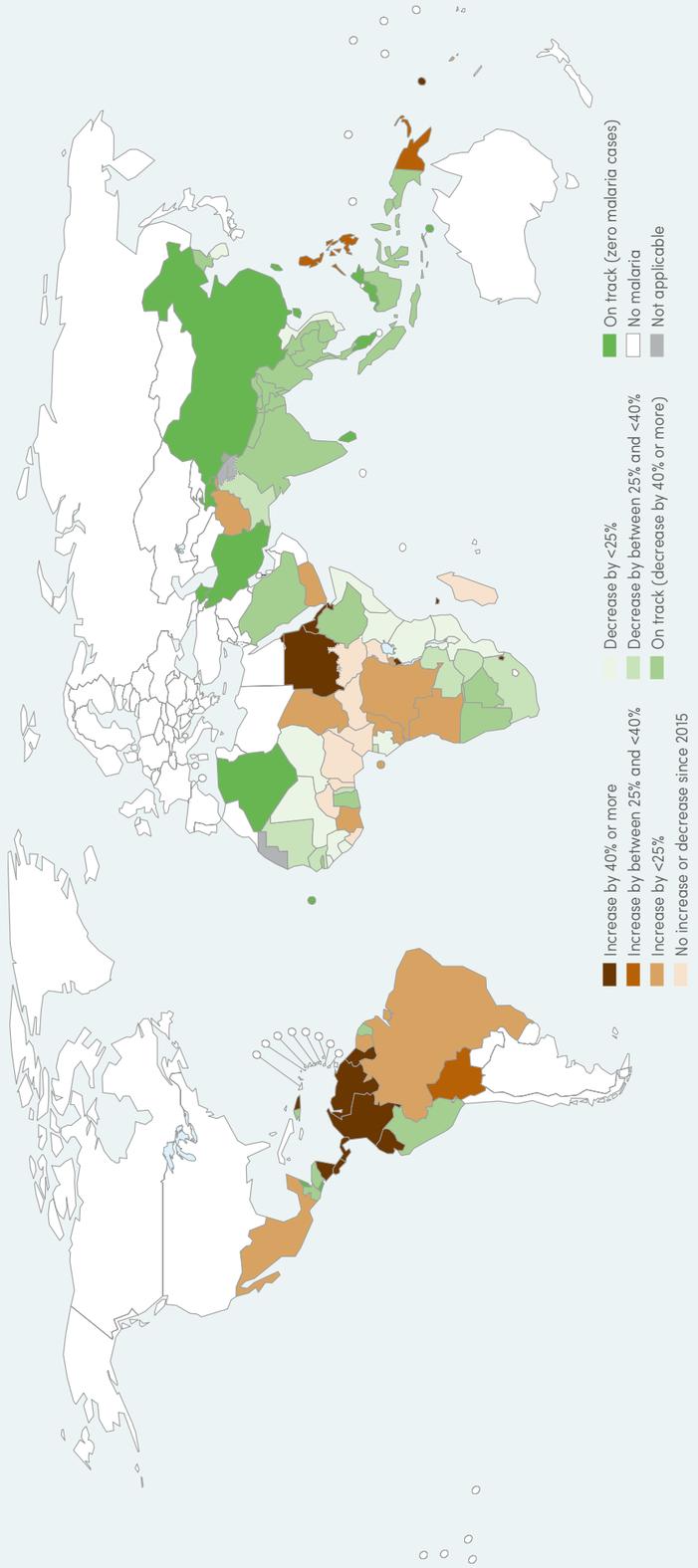
Comparison of global progress in malaria: a) case incidence and b) mortality rate, considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green) *Source: WHO estimates.*



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

FIG. 8.2.

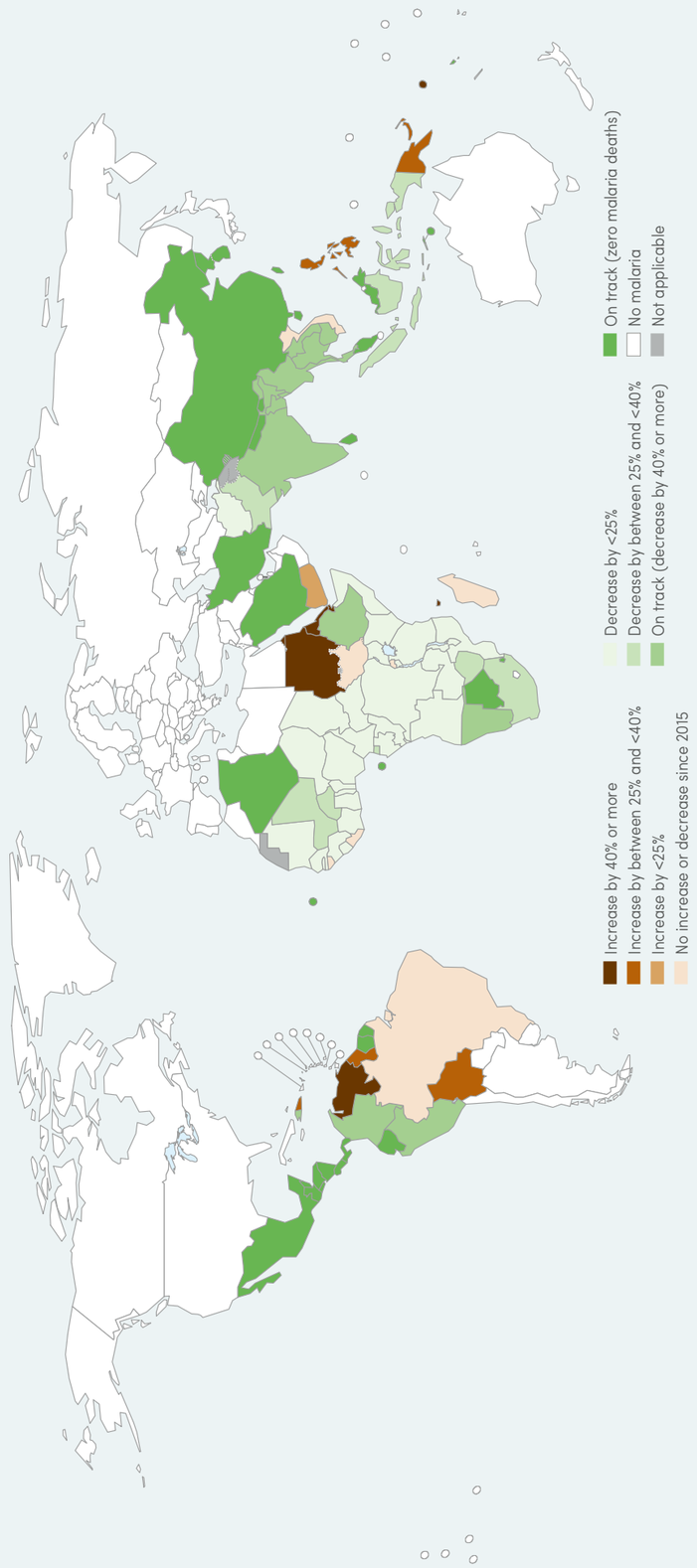
Map of malaria endemic countries showing progress towards the GTS 2020 malaria case incidence milestone of at least 40% reduction from a 2015 baseline *Source: WHO estimates.*



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization.

FIG. 8.3.

Map of malaria endemic countries showing progress towards the GTS 2020 malaria mortality rate milestone of at least 40% reduction from a 2015 baseline *Source: WHO estimates.*



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization.

8.2 WHO AFRICAN REGION

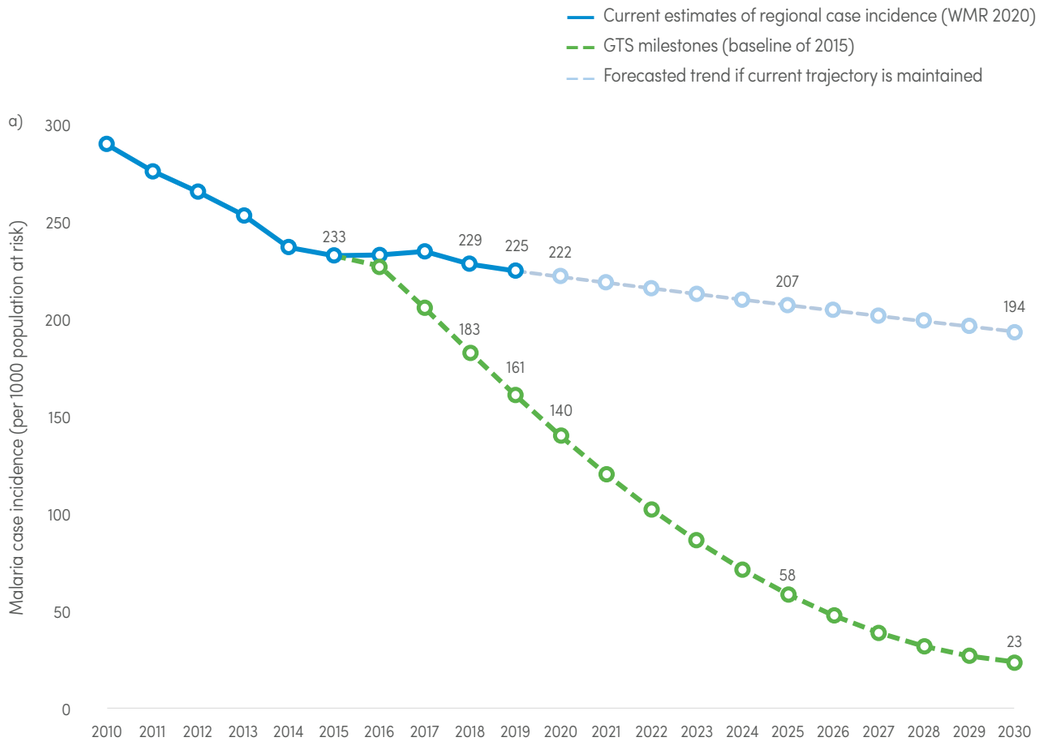
Analysis of the trends by region shows that the WHO African Region is off track for both the malaria morbidity and mortality 2020 GTS milestones, by 37% and 25%, respectively (**Fig. 8.4**). Only Botswana, Cabo Verde, Ethiopia, the Gambia, Ghana and Namibia are on track to achieve the GTS 2020 target of a 40% reduction in malaria case incidence, and Algeria has already been certified malaria free.

Although not on track, 17 countries (Equatorial Guinea, Gabon, Guinea, Guinea-Bissau, Kenya, Malawi, Mali, Mauritania, Mozambique, Niger, Senegal, Sierra Leone, South Africa, Togo, United Republic of Tanzania, Zambia and Zimbabwe) were estimated to have achieved reductions in malaria case incidence by 2020 compared with 2015 (**Fig. 8.2**). There was no difference (<5% increase or decrease) in case incidence in 2020 compared with 2015 in Benin, Burkina Faso, Cameroon, Central African Republic, Liberia, Madagascar, Nigeria, South Sudan and Uganda. Case incidence was higher in 2020 than in 2015 by less than 25% in Angola, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Rwanda, and Sao Tome and Principe, and increased by 40% or more in Burundi, Comoros, Eritrea and Eswatini.

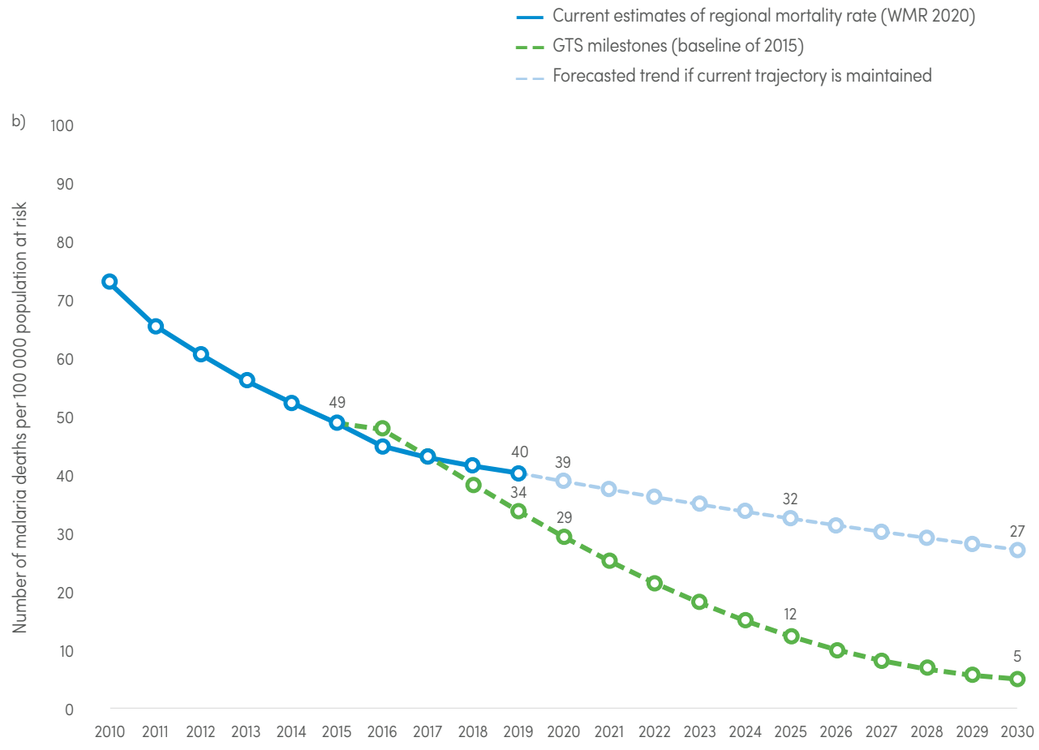
Botswana, Cabo Verde, Eswatini, and Sao Tome and Principe reported zero malaria deaths in 2019 and were projected to maintain this in 2020 (**Fig. 8.3**). Ethiopia and Namibia were estimated to have achieved a reduction in mortality rate of more than 40%. Although not on track for the GTS 2020 mortality milestones, 30 countries (Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Kenya, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, Uganda, United Republic of Tanzania, Zambia and Zimbabwe) had achieved mortality rate reductions of less than 40%. Guinea-Bissau, Liberia, Madagascar, Rwanda and South Sudan showed no change in levels of mortality rate (<5% decrease or increase) in 2020 compared with 2015, whereas increases in mortality rate of more than 40% were reported in Comoros, Eritrea and Sudan.

FIG. 8.4.

Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO African Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)
Source: WHO estimates.



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

8.3 WHO REGION OF THE AMERICAS

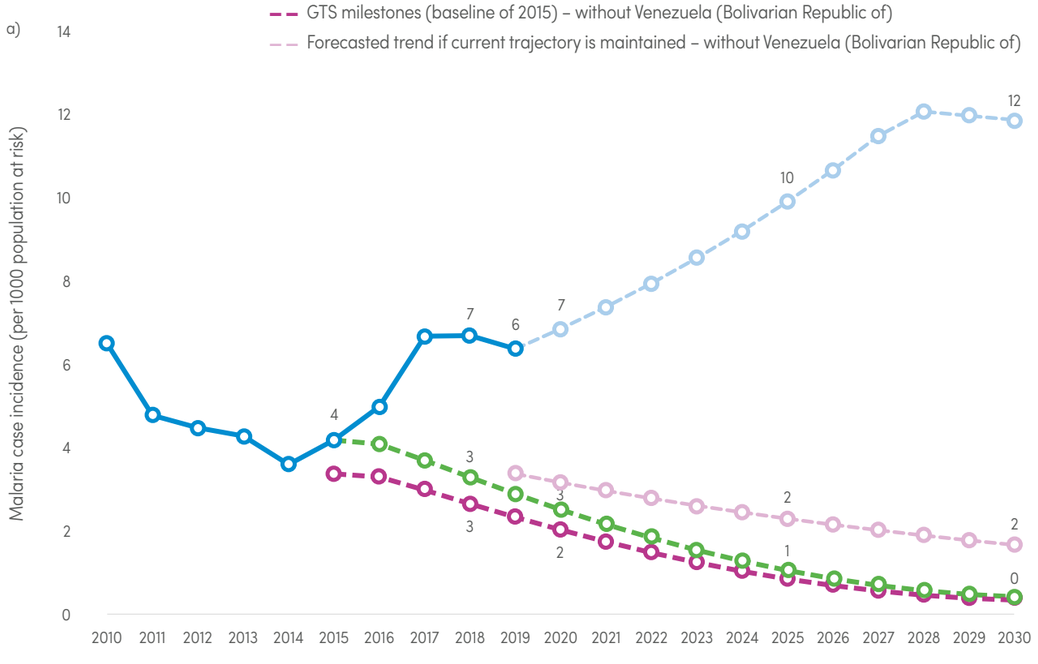
In the WHO Region of the Americas, both Belize and El Salvador had zero malaria cases in 2019 and are projected to remain unchanged in 2020. Belize, French Guiana, Guatemala, Haiti, Honduras and Peru were all on target for the 2020 malaria morbidity GTS milestone of a reduction of at least 40% in case incidence (**Fig. 8.5**). Bolivia (Plurinational State of), Brazil, Mexico and Suriname are estimated to have reduced malaria case incidence by less than 25% in 2020 compared with 2015. Colombia, Costa Rica, Dominican Republic, Ecuador, Guyana, Nicaragua, Panama and Venezuela (Bolivarian Republic of) are estimated to have increases in case incidence of more than 40% in 2020 compared with 2015.

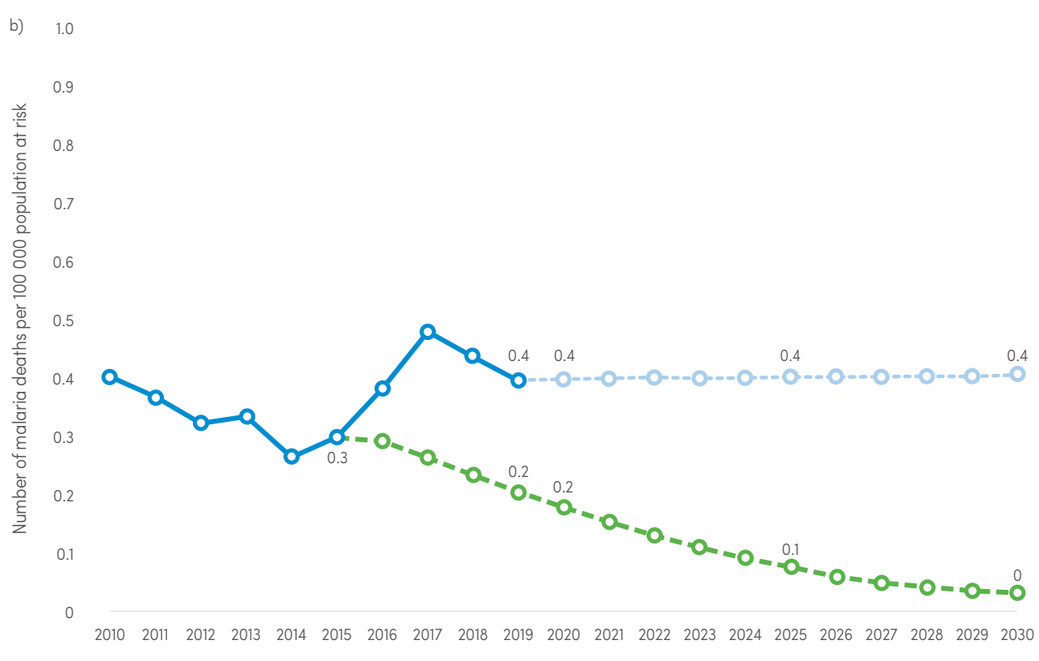
At regional level, most of the worsening of the trend is attributable to the epidemic in Venezuela (Bolivarian Republic of). Progress analysis in the WHO Region of the Americas shows that the region would be about 43% off the GTS 2020 malaria case incidence milestones *with* the estimated cases in Venezuela (Bolivarian Republic of) and 15% off *without* those estimated cases (**Fig. 8.5**). Urgent control of the epidemic in Venezuela (Bolivarian Republic of) is required to get the region back on track.

There are few malaria deaths in the WHO Region of the Americas, and changes in 2020 relative to the 2015 GTS baseline should be interpreted with caution. For example, although the mortality rate in Bolivia (Plurinational State of), Dominican Republic and Nicaragua has increased by more than 40% (**Fig. 8.3**), it is estimated that the actual number of deaths would be fewer than 15 in all these countries. Malaria deaths in Venezuela (Bolivarian Republic of), however, are estimated to have doubled and there have been more than 400 cases in 2020.

FIG. 8.5.

Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Region of the Americas considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green) *Source: WHO estimates.*





GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

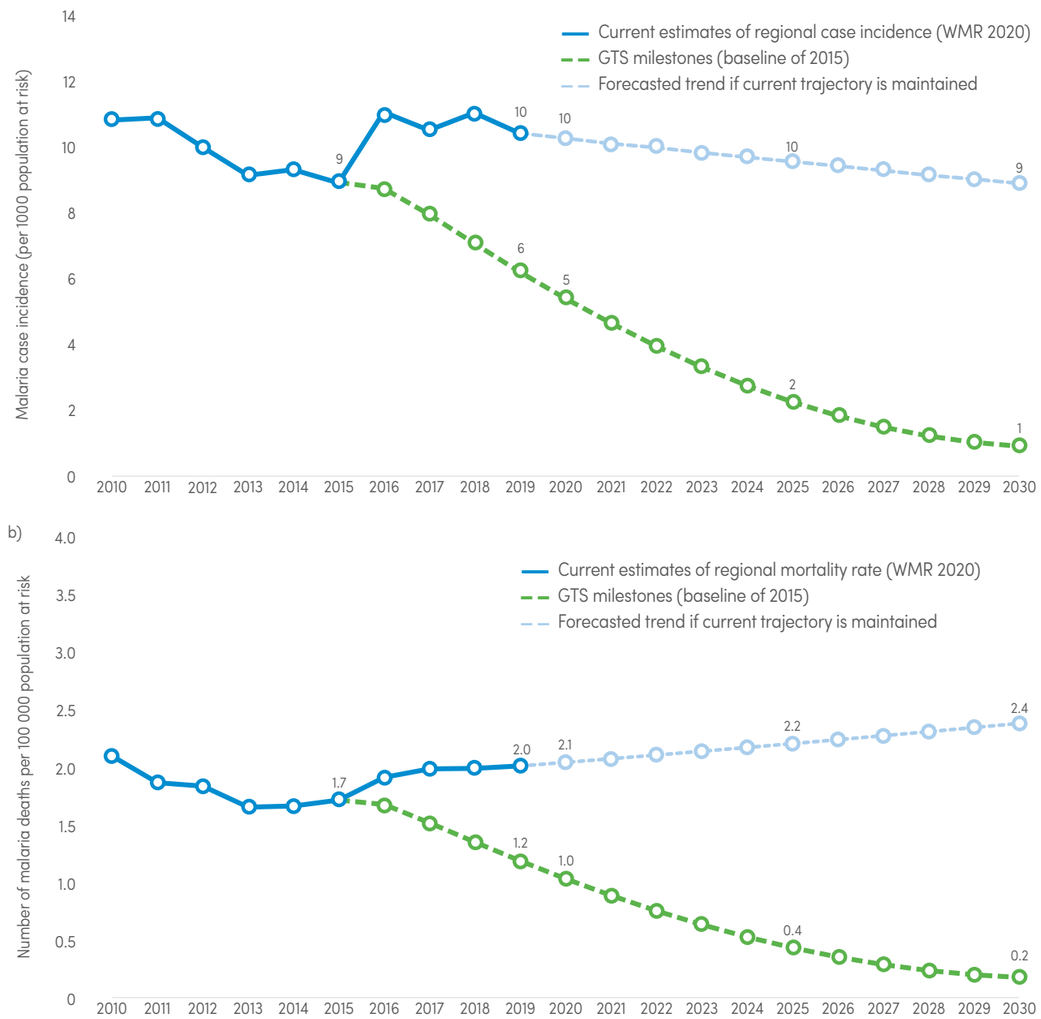
GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

8.4 WHO EASTERN MEDITERRANEAN REGION

Overall, the WHO Eastern Mediterranean Region is off track for both the 2020 GTS milestone for malaria morbidity and mortality, by twice the expected levels (**Fig. 8.6**). However, the Islamic Republic of Iran has reported no indigenous malaria cases in 2018 and 2019, and Saudi Arabia has reduced case incidence by more than 40%. Although not on track for the GTS 2020 case incidence milestones, Pakistan and Somalia have reduced case incidence, but by less than 40% in 2020 compared with 2015. Djibouti and Sudan were both off track, with malaria case incidence higher by more than 40% in 2020 compared with 2015. Afghanistan and Yemen's case incidence was higher in 2020 than in 2015, but by less than 25% in Afghanistan and by 25% to less than 40% in Yemen (**Fig. 8.3**). Malaria mortality rate had decreased by less than 25% in Afghanistan and Somalia, and by between 25% and 40% in Pakistan in 2020 compared with 2015.

FIG. 8.6.

Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Eastern Mediterranean Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green) *Source: WHO estimates.*



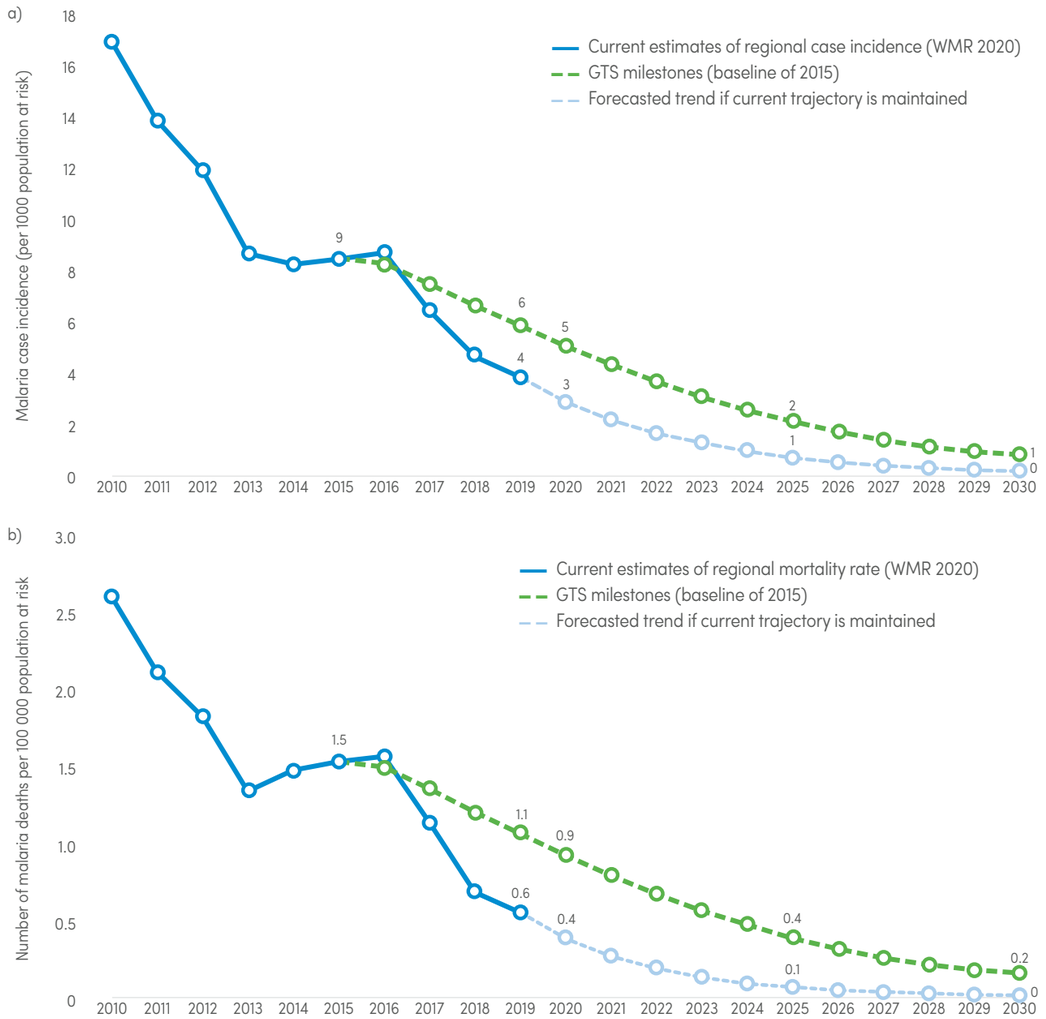
GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

8.5 WHO SOUTH-EAST ASIA REGION

The WHO South-East Asia Region is on track for both the mortality and morbidity milestones (**Fig. 8.2**, **Fig. 8.3**, **Fig. 8.7**). Sri Lanka was certified malaria free in 2015 and remains malaria free. Timor-Leste reported zero malaria cases and deaths in 2019. All other countries reduced malaria case incidence by 40% or more, and mortality rate by more than 40%, except Indonesia where the rate reduced by between 25% and less than 40% in 2020 compared with 2015 (**Fig. 8.2**, **Fig. 8.3**).

FIG. 8.7.

Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO South-East Asia Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green) *Source: WHO estimates.*



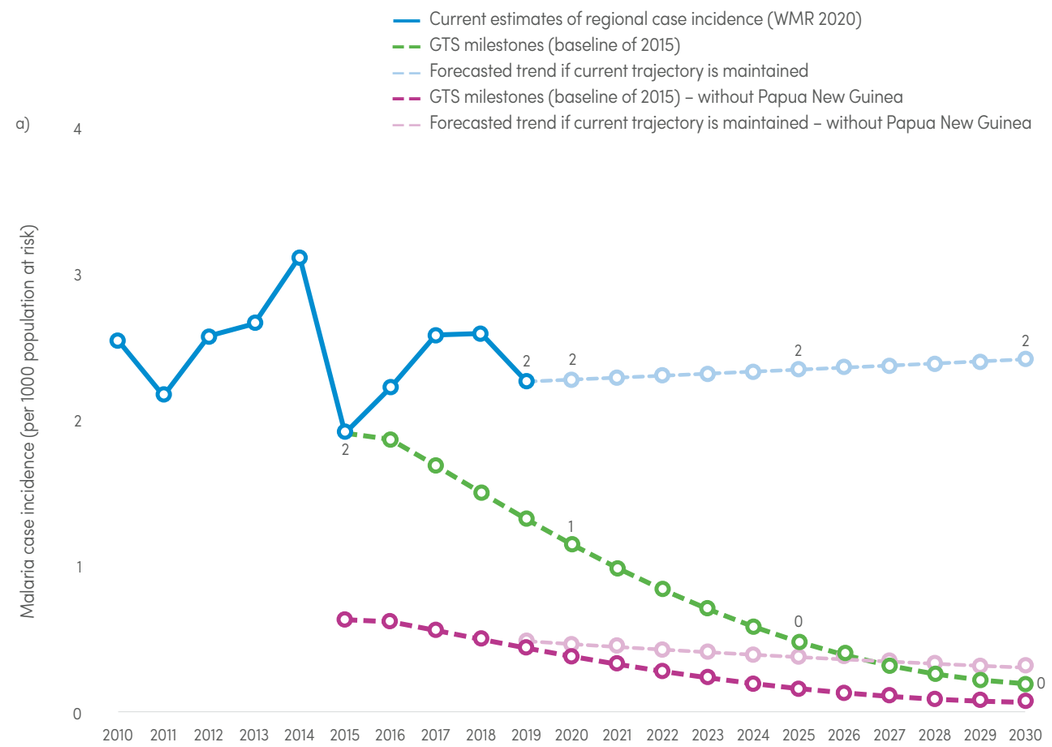
GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

8.6 WHO WESTERN PACIFIC REGION

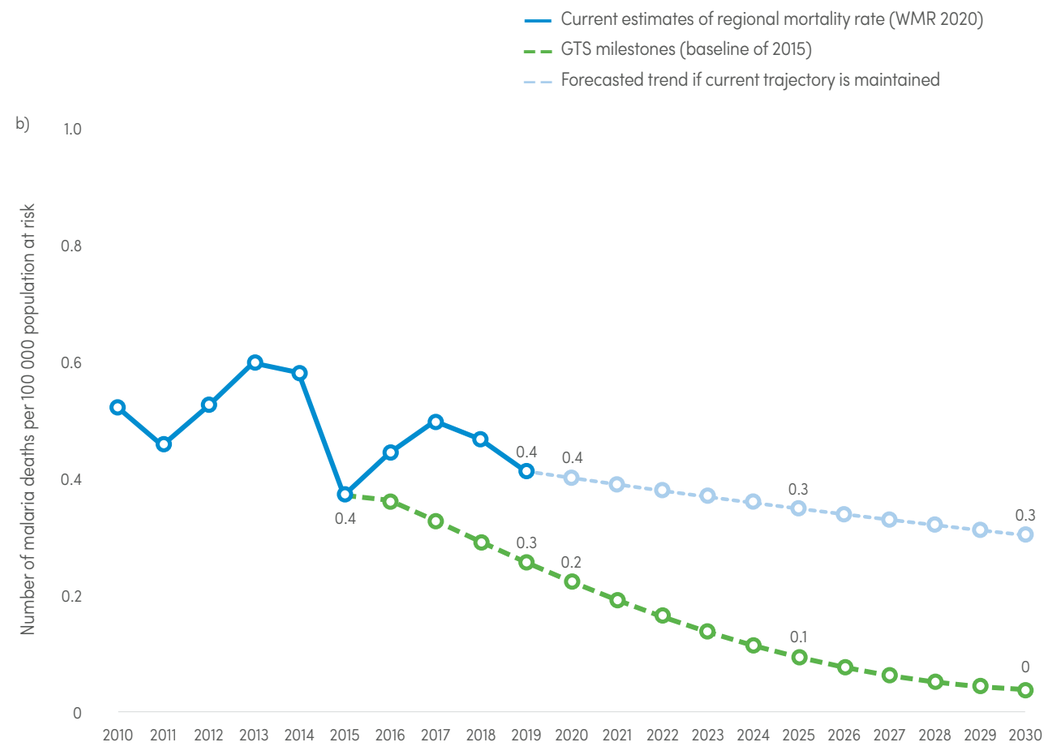
Overall, the WHO Western Pacific Region was off track for both the malaria morbidity and mortality 2020 GTS milestones by 50%, and at the current trajectory the burden could increase through to 2030 (**Fig. 8.8**). However, most of this increase in burden is attributable to Papua New Guinea, which accounts for about 80% of the burden of malaria in the region. Malaria case incidence was higher by 25% or less in Vanuatu, by between 25% and 40% in Papua New Guinea and the Philippines, and by 40% or more in the Solomon Islands (**Fig. 8.2**). However, China and Malaysia both reported zero malaria cases in 2019 and were expected to maintain this into 2020. Case incidence reduced by 40% or more from the 2015 baseline in Cambodia and Lao People's Democratic Republic, and by between 5% and 25% in the Republic of Korea and Viet Nam. When Papua New Guinea is excluded from analysis, the projections suggest that the region is almost on track for the 2020 GTS incidence milestones (**Fig. 8.8**).

FIG. 8.8.

Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Western Pacific Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green) *Source: WHO estimates.*



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.



GTS: *Global technical strategy for malaria 2016–2030*; WHO: World Health Organization; WMR: world malaria report.

9 Biological threats

9.1 DELETIONS IN *P. FALCIPARUM* HISTIDINE-RICH PROTEIN 2 AND PROTEIN 3 GENES

Histidine-rich protein 2 (HRP2) is the predominant target of the 345 million *P. falciparum*-detecting malaria RDTs sold annually. Parasites that no longer express HRP2 may not be detectable by RDTs based on HRP2, and those that no longer express HRP2 and histidine-rich protein 3 (HRP3) are completely undetectable by these RDTs. Deletions in the *P. falciparum* genes for HRP2 (*pfhrp2*) and HRP3 (*pfhrp3*) in clinical isolates were first identified in 2010 in the Peruvian Amazon basin, by researchers characterizing blood samples that were negative by HRP2-based RDTs but positive by microscopy (*71*). In recent years, *pfhrp2/3*-deleted parasites have been documented outside of South America, including in Asia, the Middle East, and Central, East, Southern and West Africa. Prevalence estimates vary widely both within and between countries. The examples of Eritrea and Peru – where the prevalence of dual *pfhrp2* and *pfhrp3* deleted parasites among symptomatic patients reached as high as 80% – demonstrate that these parasites can become dominant in the population, posing a serious global threat to patients and to the efficacy of HRP2-based RDTs.

WHO has published guidance on investigating suspected *pfhrp2/3* deletions (*132*), and recommends that countries that have reports of *pfhrp2/3* deletions, and their neighbouring countries, should conduct representative baseline surveys among suspected malaria cases, to determine whether the prevalence of *pfhrp2/3* deletions causing false negative RDT results has reached a threshold for RDT change (>5% *pfhrp2* deletions causing false negative RDT results). Alternative RDT options (e.g. based on detection of the *Plasmodium* lactate dehydrogenase [pLDH]) are limited; in particular, there are currently no WHO-prequalified non-HRP2 combination tests that can detect and distinguish between *P. falciparum* and *P. vivax*.

WHO is tracking published reports of *pfhrp2/3* deletions using the Malaria Threats Map mapping tool (*100*, *133*), and is encouraging a harmonized approach to mapping and reporting of *pfhrp2/3* deletions through publicly available survey protocols. Among the 39 reports published by 39 countries, 32 (82%) reported *pfhrp2* deletions, but variable methods in sample selection and laboratory analysis mean that the scale and scope of clinically significant *pfhrp2/3* deletions is still unclear. Between 2019 and September 2020, investigations for *pfhrp2/3* deletions were reported in 16 publications from 15 countries. *Pfhrp2/3* deletions were confirmed in 12 reports from 11 countries: China, Equatorial Guinea, Ethiopia, Ghana, Myanmar, Nigeria, Sudan, Uganda, United Kingdom (imported from various malaria endemic countries), the United Republic of Tanzania and Zambia. No deletions were identified in France (among returning travellers), Haiti, Kenya and Mozambique.

The WHO Global Response Plan for *pfhrp2/3* deletions outlines several areas for action beyond scaling up surveillance. The plan includes identifying new biomarkers, improving the performance of non-HRP2-based RDTs, market forecasting and strengthening laboratory networks to support the demands of molecular characterization to determine the presence or absence of these gene deletions.

9.2 THERAPEUTIC EFFICACY OF ACTs

Effective treatment for malaria is a critical component of malaria control and elimination. The emergence of multidrug resistance, including resistance to artemisinin and partner drugs, threatens the global effort to reduce the burden of malaria. The GTS calls on countries and global malaria partners to monitor the efficacy of antimalarial medicines, to ensure that the most appropriate and effective treatments are selected for national treatment policies (*4*).

Therapeutic efficacy studies (TES) track clinical and parasitological outcomes in patients after they have received antimalarial treatment. When conducted according to the WHO protocol, TES offer a consistent measure of treatment efficacy over time. These studies provide NMPs with the data required to evaluate their treatment policies and make changes where necessary. In areas of malaria elimination, the routine surveillance system incorporates the treatment and follow-up of all malaria cases. In this context, the data generated on patient outcomes become part of integrated drug efficacy surveillance (iDES) (*135*).

This section summarizes TES findings from studies conducted on patients infected with *P. falciparum* and *P. vivax* for each WHO region between 2010 and 2019.

Given that ACTs are currently the recommended first-line treatment in all malaria endemic countries, and artesunate (injectable) is the main treatment for severe malaria, **Section 9.3** summarizes the prevalence of *PfKelch13* molecular mutations associated with artemisinin partial resistance. The latest available information and references can be found online in the Malaria Threats Map, which provides a geographical representation of drug efficacy and resistance data.[1] The data from the most recent TES are also summarized in reports available online.[2]

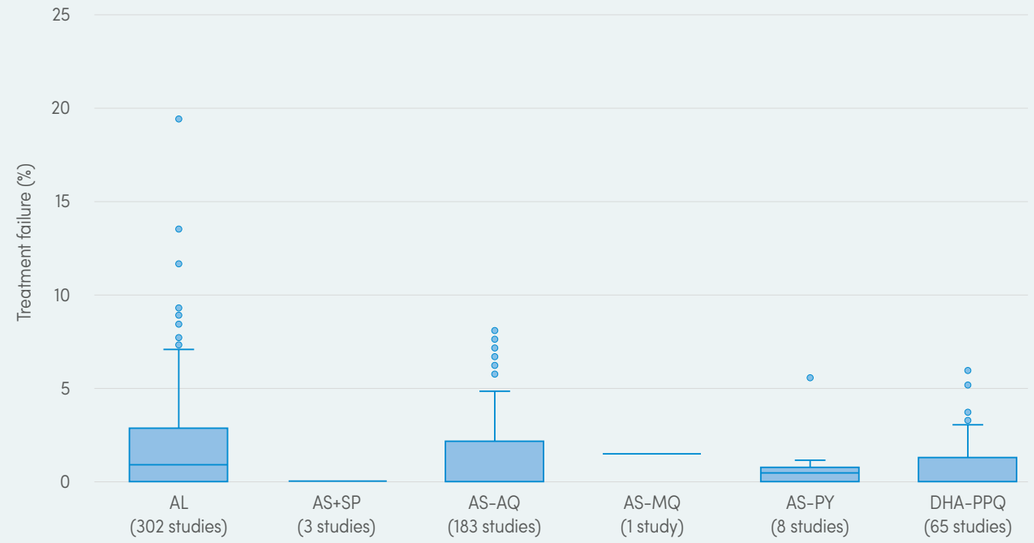
9.2.1 WHO African Region

In the WHO African Region, the first-line treatments for *P. falciparum* include artemether-lumefantrine (AL), artesunate-amodiaquine (AS-AQ) and dihydroarte-misinin-piperaquine (DHA-PPQ). The overall average efficacy rates for *P. falciparum* – 98.0% for AL, 98.4% for AS-AQ and 99.4% for DHA-PPQ – remained consistent over time (**Fig. 9.1**). Treatment failure rates of more than 10% were observed in four studies of AL but can be considered statistical outliers. There is no evidence of confirmed lumefantrine resistance in Africa. For all other medicines, treatment failure rates remain below 10%.

[1] See https://www.who.int/malaria/maps/threats-about/en/.
[2] See https://www.who.int/malaria/areas/drug_resistance/drug_efficacy_database/en/.

FIG. 9.1.

Treatment failure rates among patients with *P. falciparum* malaria, WHO African Region, 2010–2019
Source: WHO Global database on antimalarial drug efficacy and resistance.



AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; AS-MQ: artesunate-mefloquine; AS-PY: artesunate-pyronaridine; AS+SP: artesunate-sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine; *P. falciparum*: *Plasmodium falciparum*; WHO: World Health Organization.

P. vivax is only endemic in a few countries in the WHO African Region. In Ethiopia, the AL efficacy rate was low in one study, probably due to lumefantrine's short half-life, which does not protect against early relapse. In most studies of CQ in Ethiopia, treatment failure rates were consistently below 10% except in one study that had a treatment failure of 22.0%. No treatment failures were observed in TES of AS-AQ in Madagascar and CQ in Mauritania.

9.2.2 WHO Region of the Americas

The first-line treatments for *P. falciparum* in the WHO Region of the Americas include AL (in Bolivia [Plurinational State of], Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Suriname and Venezuela [Bolivarian Republic of]), AS-MQ (in Brazil, Peru and Venezuela [Bolivarian Republic of]) and CQ (in Dominican Republic, Guatemala, Haiti, Honduras and Nicaragua). Efficacy of AL and AS-MQ remains high in Brazil, Colombia and Suriname.

In all malaria endemic countries in the WHO Region of the Americas, the first-line treatment policy for *P. vivax* is CQ but some ACTs were tested. Countries conducted studies of CQ alone or of CQ combined with primaquine (PQ) (**Fig. 9.2**). One study of CQ from Bolivia (Plurinational State of) in 2011 detected a treatment failure rate of 10.4%.

9.2.3 WHO South-East Asia Region

The first-line treatments for *P. falciparum* in the WHO South-East Asia Region include AL (in Bangladesh, Bhutan, India, Myanmar, Nepal and Timor-Leste), AS-MQ (in Myanmar), AS+SP (in India) and DHA-PPQ (in Bangladesh, Indonesia, Myanmar and Thailand). TES of AL demonstrated high treatment efficacy in Bhutan, India, Myanmar, Nepal and Timor-Leste, with treatment failure of less than 10% in all studies (**Fig. 9.3**). AL treatment failure rates exceeded 10% in three studies: one in Thailand (11.3% in 2012) and two in Bangladesh (11.1% in 2013 and 14.3% in 2017). Both of the studies in Bangladesh had small sample sizes (n<10). All TES of AS+SP were conducted in India. Following high rates of treatment failure in the north-eastern provinces, in 2013, India changed its treatment policy in those provinces to AL; AS+SP remains effective elsewhere in the country. TES of AS-AQ were conducted in Indonesia in 2011 and 2012, with a treatment failure rate of 16.7% observed in the 2012 study of 24 patients. TES of AS-MQ were conducted in Myanmar, where the treatment remains effective, and in Thailand, where high rates of treatment failure were observed. TES findings in Thailand led to the adoption of DHA-PPQ as the first-line treatment in 2015. Among the four TES of AS-PY in Myanmar, no treatment failures were observed. Studies of DHA-PPQ were conducted in Indonesia, Myanmar and Thailand. All results from Indonesia and Myanmar demonstrated high rates of treatment efficacy, with treatment failure rates of less than 5%. In Thailand, high rates of treatment failure were observed with DHA-PPQ in two of five studies: 86.7% in a study of 15 patients and 100% in a study of two patients. Both studies were completed in 2018 in the eastern part of the country; Thailand is currently recommending treatment with AS-PY in this area.

The first-line treatments for *P. vivax* are CQ (in Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Myanmar, Nepal, Sri Lanka and Thailand), AL (in Timor-Leste) and DHA-PPQ (in Indonesia). High treatment efficacy was found in studies of CQ conducted in Bangladesh, Bhutan, the Democratic People's Republic of Korea, India, Myanmar and Nepal except in two studies from Myanmar (11.9% in 2010 and 21.7% in 2012) and one from Timor-Leste (17.5% in 2011). There was high efficacy of AL in the Democratic People's Republic of Korea and Timor-Leste, AS-PY in Myanmar and DHA-PPQ in Indonesia.

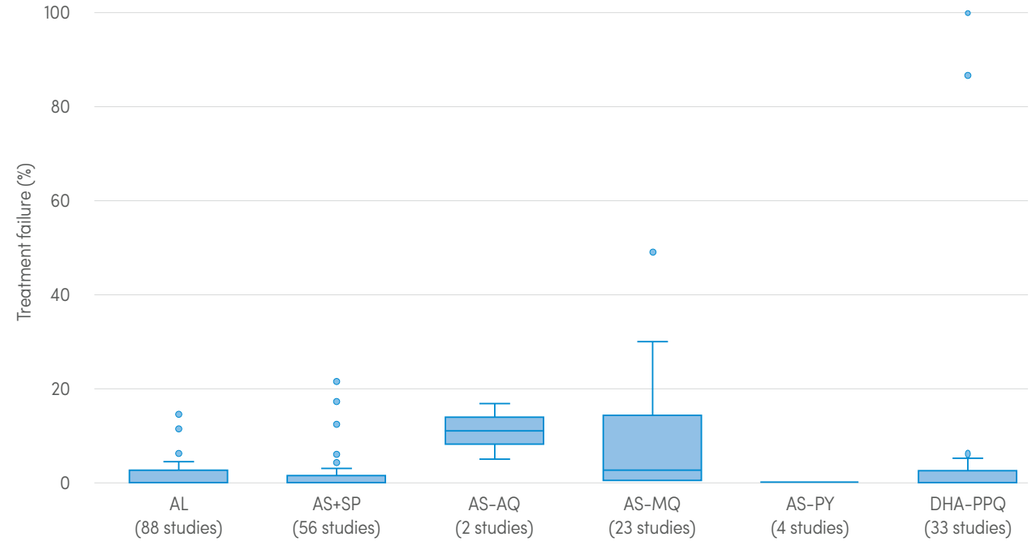
FIG. 9.2.

Treatment failure rates among patients with *P. vivax* malaria, WHO Region of the Americas, 2010–2019
Source: WHO Global database on antimalarial drug efficacy and resistance.

CQ: chloroquine; CQ+PQ: chloroquine plus primaquine; *P. vivax*: *Plasmodium vivax*; WHO: World Health Organization.

FIG. 9.3.

Treatment failure rates among patients with *P. falciparum* malaria, WHO South-East Asia Region, 2010–2019
Source: WHO Global database on antimalarial drug efficacy and resistance.



AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; AS-MQ: artesunate-mefloquine; AS+SP: artesunate+sulfadoxine-pyrimethamine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine; *P. falciparum*: *Plasmodium falciparum*; WHO: World Health Organization.

9.2.4 WHO Eastern Mediterranean Region

The first-line treatments for *P. falciparum* in the WHO Eastern Mediterranean Region are AL (in Afghanistan, Pakistan, Somalia and Sudan) and AS+SP (in Iran [Islamic Republic of], Saudi Arabia and Yemen). The TES of AL from Afghanistan, Pakistan, Somalia, Sudan and Yemen all demonstrated good treatment efficacy, with treatment failure rates below 10% (**Fig. 9.4**). The TES of AS+SP from Somalia and Sudan, conducted from 2011 to 2016, found low efficacy, with treatment failure rates as high as 22.2% in Somalia in 2011 and 18.1% in Sudan in 2014 (**Fig. 9.4**). This prompted a subsequent change in treatment policy to the use of AL in both countries. Elsewhere, TES of AS+SP from Afghanistan, Iran (Islamic Republic of), Pakistan and Yemen all demonstrated high treatment efficacy, with fewer than 5% of patients failing treatment.

The first-line treatments for *P. vivax* are AL (in Somalia and Sudan) and CQ in all other countries. TES of CQ were conducted in Afghanistan (n=1), Iran (Islamic Republic of) (n=1) and Pakistan (n=1), all of which showed high treatment efficacy. In addition, TES of AL in Afghanistan (n=4), Somalia (n=1) and Sudan (n=1) demonstrated high treatment efficacy.

9.2.5 WHO Western Pacific Region

The first-line treatments for *P. falciparum* in the WHO Western Pacific Region are AL (in Lao People's Democratic Republic, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Vanuatu), AS-MQ (in Cambodia), DHA-PPQ (in China and Viet Nam) and AS-AQ (in China) (**Fig. 9.5**).

TES of AL were conducted in Cambodia, Lao People's Democratic Republic, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Viet Nam. Treatment failure rates were 10% or less in four studies in Lao People's Democratic Republic but those studies did not have the recommended sample sizes. A study with an adequate number of patients is currently underway to further investigate these high rates of treatment failure.

All other studies of AL in the region demonstrated high treatment efficacy. TES of AS-MQ conducted in Cambodia, Lao People's Democratic Republic, Malaysia and Viet Nam showed that the treatment efficacy of AS-MQ has remained high over the past 10 years, except in one 2019 study from Cambodia, where treatment failed in two of 16 patients.

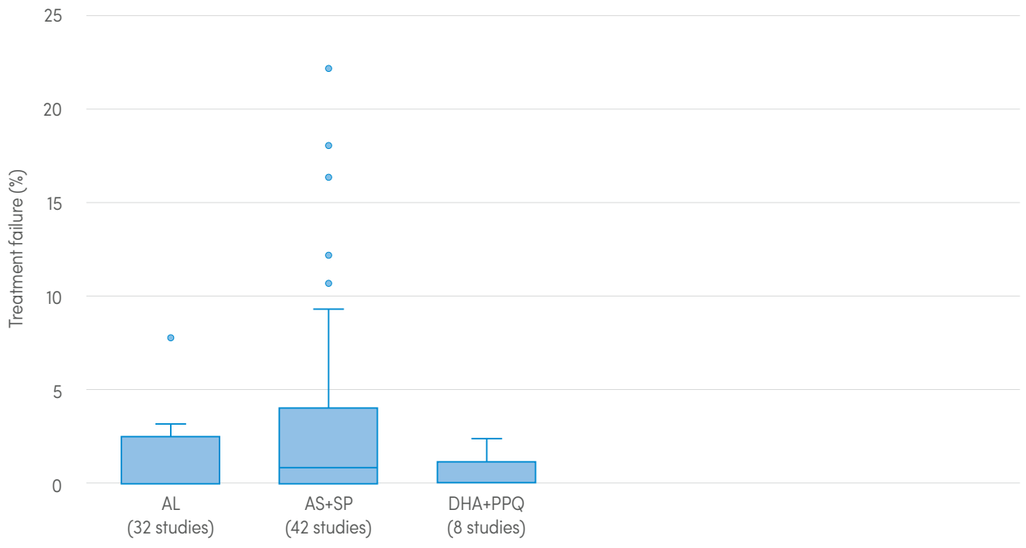
TES of AS-PY were conducted in Cambodia, Lao People's Democratic Republic and Viet Nam. High rates of treatment failure were observed in two studies from Cambodia in 2014, of 10.2% and 18.0%, but subsequent studies have found treatment failure rates below 5.0%. In one study in Viet Nam from 2017, treatment failed in three of 19 patients; all other studies in Viet Nam and Lao People's Democratic Republic found treatment failure rates of 5.0% or less.

Studies of DHA-PPQ were conducted in Cambodia, China, Lao People's Democratic Republic, Papua New Guinea and Viet Nam. Following high rates of treatment failure, Cambodia removed DHA-PPQ from its treatment policy. High rates of failure for treatment with DHA-PPQ were also observed in Lao People's Democratic Republic and Viet Nam. AS-PY has become the first-line treatment in the Viet Nam provinces where treatment failures with DHA-PPQ were observed.

The first-line treatments for *P. vivax* in the WHO Western Pacific Region are AL (in Lao People's Democratic Republic, Malaysia, Papua New Guinea, Solomon Islands and Vanuatu), AS-MQ (in Cambodia) and CQ (in China, Philippines, Republic of Korea and Viet Nam). TES of AL were conducted in Papua New Guinea, Solomon Islands and Vanuatu between 2011 and 2014. High failure rates for treatment with AL were observed in each country: 35.0% in Papua New Guinea, 31.6% in Solomon Islands and 12.1% in Vanuatu. These high failure rates are probably due to the short half-life of lumefantrine, which does not protect against early relapse. TES of AS-MQ conducted in Cambodia, Lao People's Democratic Republic and Malaysia demonstrated 100% efficacy. TES of AS-PY in Cambodia and Lao People's Democratic Republic found treatment failure rates below 5%.

FIG. 9.4.

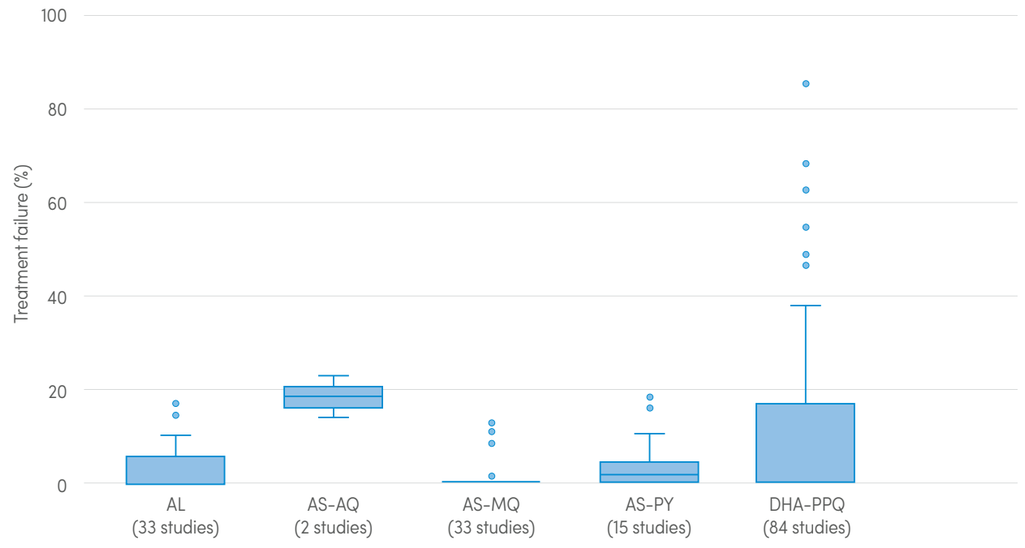
Treatment failure rates among patients with *P. falciparum* malaria, WHO Eastern Mediterranean Region, 2010–2019 *Source: WHO Global database on antimalarial drug efficacy and resistance.*



AL: artemether-lumefantrine; AS+SP: artesunate+sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine; *P. falciparum*: *Plasmodium falciparum*; WHO: World Health Organization.

FIG. 9.5.

Treatment failure rates among patients with *P. falciparum* malaria, WHO Western Pacific Region, 2010–2019 *Source: WHO Global database on antimalarial drug efficacy and resistance.*



AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; AS-MQ: artesunate-mefloquine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine; *P. falciparum*: *Plasmodium falciparum*; WHO: World Health Organization.

9.3 THE GLOBAL PREVALENCE OF *PFKELCH13* MOLECULAR MUTATIONS

Molecular marker studies help to identify and track the prevalence of molecular mutations associated with drug resistance. WHO has established the following list of validated *PfKelch13* markers of partial resistance to artemisinin: F446I, N458Y, M476I, Y493H, R539T, I543T, P553L, R561H, P574L and C580Y. The candidate markers are P441L, G449A, C469F/Y, A481V, R515K, P527H, N537I/D, G538V, V568G, R622I and A675V. In some areas, there is evidence of a clonal expansion of *PfKelch13* mutations associated with artemisinin partial resistance, as discussed below.

Artemisinin partial resistance emerged independently in several foci in the GMS. WHO continues to monitor the situation, which has evolved rapidly since the first detections of *PfKelch13* mutations in the GMS. Some mutations have disappeared, whereas the prevalence of others has increased. Currently, the most prevalent markers west of Bangkok (western Thailand and Myanmar) are F446I, M476I and R561H. The most prevalent markers east of Bangkok (eastern Thailand, Cambodia, Lao People's Democratic Republic and Viet Nam) are Y493H and P553L. Two markers, R539T and C580Y, are also highly prevalent in both areas. The change in treatment policy in Cambodia from DHA-PPQ to AS-MQ resulted in a reduction in the prevalence of strains carrying both C580Y and PPQ resistance.

Rwanda has detected an increasing prevalence of the R561H mutation, a validated marker that emerged independently in the GMS between 2012 and 2015. The presence of this mutation was confirmed in Rwanda in 2018, but so far it seems that delayed clearance associated with this mutation has not affected the efficacy of the ACTs that are currently among those tested and used in Rwanda. The R622I mutation seems to be appearing independently in Africa, having been found in Eritrea, Ethiopia, Somalia and Sudan, and with increasing frequency in the Horn of Africa. The ACTs used in these four countries remain effective, despite the presence of the mutation. Further investigation of delayed parasite clearance is needed in this region.

In Guyana, the C580Y mutation also emerged independently between 2010 and 2017. However, in recent studies (including surveys and TES), 100% of samples were found to be wild type, indicating that the mutation may be disappearing in Guyana.

9.4 VECTOR RESISTANCE TO INSECTICIDES

Resistance of malaria vectors to pyrethroid insecticides that are commonly used for malaria vector control – namely, pyrethroids, organophosphates, carbamates and the rarely used organochlorine dichlorodiphenyl-trichloroethane (DDT) – threatens malaria control and elimination efforts.

9.4.1 Update on the status of data reporting

From 2010 through 2019, a cumulative total of 82 countries reported data. The extent and frequency of insecticide resistance monitoring continues to vary considerably between countries, despite continued increases in the number of sites from which standard resistance monitoring data were reported, from 3143 in 2010–2018 to 3559 in 2010–2019. The number of sites per country for which resistance monitoring data were reported between 2010 and 2019 varied widely, from 1 to 287. Pyrethroids continue to be the most frequently monitored insecticide class.

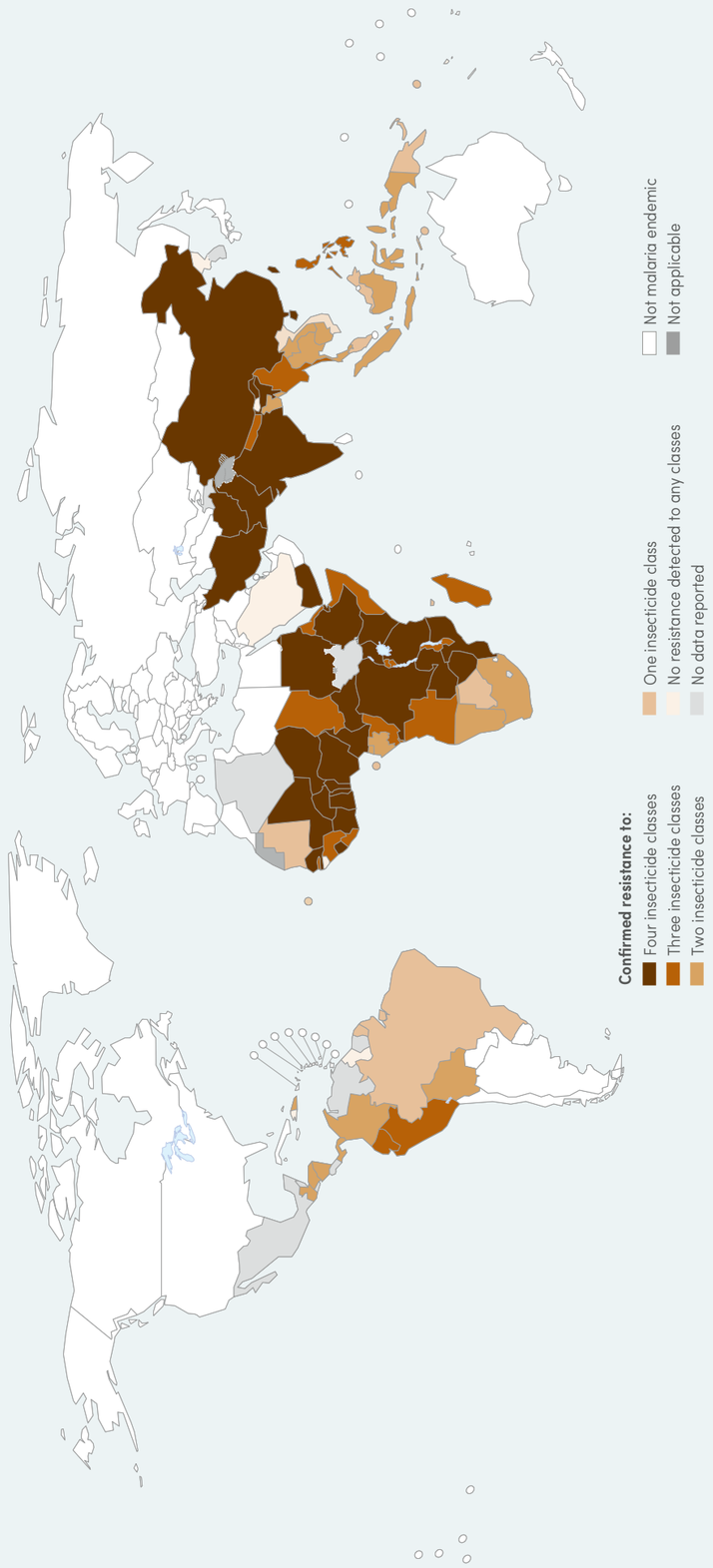
A total of 66 countries reported insecticide resistance monitoring data at least once over the past 3 years and 16 did not report such data. Among 82 countries, only 28 have reported on their insecticide resistance status consistently every year for the past 3 years. Low reporting in 2019 was probably due to competing priorities arising from the COVID-19 pandemic. Although 29% of the countries that used IRS reported the status of insecticide resistance for every insecticide class used in the year of implementation or the preceding year, concerningly, 57% of countries did not report the status for at least one of the insecticide classes used and 14% did not report the status for any insecticide class used. Although this may reflect a gap in data reporting to WHO, malaria endemic countries are highly encouraged to ensure adequate monitoring of resistance to insecticide classes that are either in use or under consideration for use in malaria vector control interventions, and to prioritize monitoring of these classes.

9.4.2 Update on the status of insecticide resistance

Of the 82 countries that reported resistance monitoring data to WHO, 73 confirmed resistance to at least one insecticide in one malaria vector species from one mosquito collection site in 2010–2019. The number of countries that reported insecticide resistance to all four main insecticide classes in at least one malaria vector species increased from 26 in 2010–2018 to 28 in 2010–2019, and among those 28, 17 reported resistance to three of the four classes between 2010 and 2019 (**Fig. 9.6**). Of those countries that reported insecticide resistance monitoring data to WHO, the proportion of

FIG. 9.6.

Number of classes to which resistance was confirmed in at least one malaria vector in at least one monitoring site, 2010–2019 *Source: national health institutes, national implementation partners, NMPs, research institutions and scientific publications.*



NMP: national malaria programme.

countries that confirmed resistance to these insecticide classes was as follows: 86.4% for pyrethroids, 80.6% for organochlorines, 68.8% for carbamates and 58.8% for organophosphates. Only nine countries that reported data did not confirm resistance to any insecticide class.

Resistance to the four main insecticide classes was detected in all WHO regions except the WHO European Region. Globally, resistance to pyrethroids was detected in at least one malaria vector in 69.9% of the sites for which data were available, while resistance to organochlorines was reported in 63.4% of the sites. Resistance to carbamates and to organophosphates was less prevalent, being detected in 31.7% and 24.9%, respectively, of the sites that reported monitoring data. However, the geographical extent of confirmed resistance to each insecticide class differed considerably across regions (**Fig. 9.7**). Maps showing the status of insecticide resistance to different insecticides at each site are available on the Malaria Threats Map website (*100*).

There is continued improvement in the collection and reporting of data to guide deployment of recently prequalified vector control tools covered by WHO policy recommendations. The number of countries that monitored the involvement of metabolic resistance mechanisms by means of PBO pre-exposure bioassays increased from 23 in 2010–2018 to 30 in 2010–2019. All 30 countries detected partial or full involvement of metabolic resistance mechanism in phenotypic resistance to pyrethroids in at least one monitoring site for at least one vector species and one pyrethroid insecticide. The number of sites where the involvement of metabolic resistance mechanisms in pyrethroid resistance was monitored by means of PBO pre-exposure bioassays increased by more than twofold, reaching 438 by 2019. Full or partial involvement of metabolic resistance mechanisms for at least one vector species and one pyrethroid insecticide was reported in 392 sites.

Results of biochemical and molecular assays conducted to detect metabolic resistance mechanisms were available for 35 countries and 308 sites for 2010–2019. Of the sites for which reports were available, mono-oxygenases were detected in 66.9%, glutathione-S-transferases in 74.6%, esterases in 74.8% and acetylcholinesterases in 73.2%. Results of assays conducted to detect target-site resistance mechanisms were available for 39 countries and 539 sites. *Kdr L1014F* was detected in 76.3% of the sites and *Kdr L1014S* in 48.9% of the sites.

Recently, WHO Member States and their implementing partners have started to explore insecticide dosages to monitor resistance to neonicotinoid and pyrrole insecticides using two assays: the WHO tube test and the US CDC bottle bioassay. To date, WHO has received a total of 1326 test results from 323 sites in 23 countries from the WHO regions of Africa and the Western Pacific. A formal WHO process to establish discriminating dosages and test procedures for these two insecticide classes is ongoing. The data reported so far to WHO on mosquito mortality after exposure to neonicotinoid and pyrrole insecticides will be assessed against these discriminating dosages once they have been fully defined. Also, WHO test procedures for insecticide resistance monitoring will be updated to incorporate the new discriminating dosages and potential changes to the methodology. Until that time, Member States are discouraged from using data generated by means of non-validated procedures to arrive at conclusions regarding the resistance status of their local vector populations to these insecticide classes.

All the standard insecticide resistance data reported to WHO are included in the WHO global insecticide resistance database (*136*) and are available for exploration via the online interactive data visualization tool Malaria Threats Map (*100*). The latest version of this tool, launched in 2020, provides a summary table with the status of phenotypic resistance and resistance mechanisms for each country; presents maps to inform discussions on the deployment of pyrethroid-PBO nets; allows for download of selected datasets; and includes an animation of the evolution of insecticide resistance, as per reports received by WHO.

9.4.3 Mitigating and managing insecticide resistance

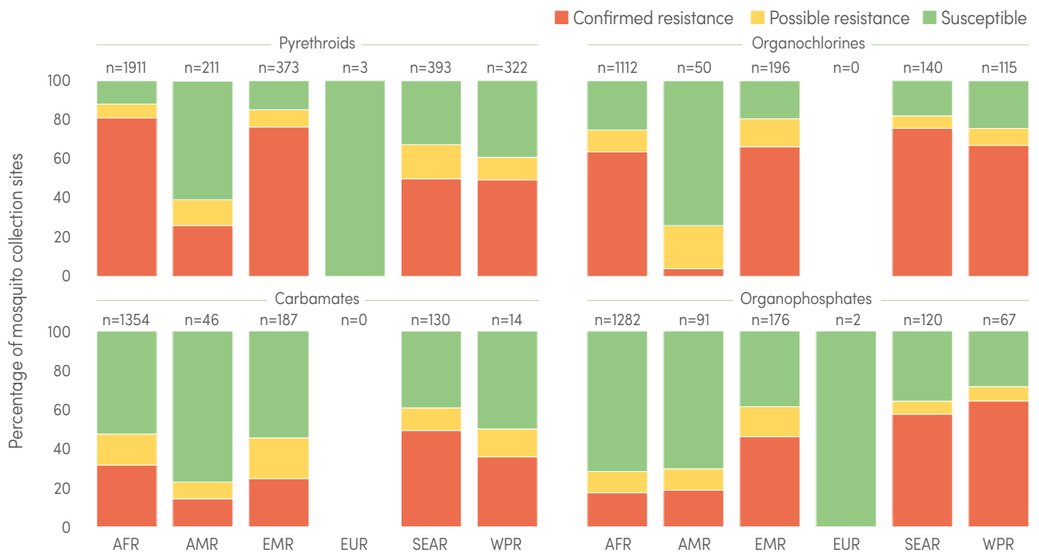
The selection of effective vector control interventions needs to be based in part on representative data on the susceptibility of local vectors to insecticides that are covered by a policy recommendation and prequalified by WHO. In addition, insecticide resistance data are crucial for assessing the potential impact that resistance may have on the effectiveness of malaria vector control, an area that continues to be poorly understood. To meet these data needs, countries and their implementing partners are advised to conduct regular insecticide resistance monitoring following the WHO-recommended *Test procedures for insecticide resistance monitoring in malaria vector mosquitoes* (*137*), and to report and share results in a timely manner. To facilitate reporting, WHO has developed data reporting templates (*138*) and DHIS2 modules (*139*) for use by its Member States and their implementing partners, and is supporting the rollout of these tools.

The impact of insecticide resistance on the effectiveness of malaria vector control interventions continues to be poorly understood; however, it is highly likely that such resistance reduces the efficacy of currently available interventions. Countries should therefore not delay in implementing effective policies and practices for the prevention, mitigation and management of resistance. Two relatively new vector control options that should be considered as part of an insecticide resistance management strategy – pyrethroid-PBO nets and neonicotinoid insecticides for IRS – have been recommended by WHO, and a number of prequalified products that fall into these classes are available. Based on insecticide resistance monitoring data reported to WHO by Member States, and considering recent data from each site, a total of 330 areas in 33 countries currently meet WHO-recommended criteria for pyrethroid-PBO net deployment. Maps showing these sites, along with higher level maps highlighting areas and countries where these sites are present, have been incorporated into the Malaria Threats Map to inform discussions on the deployment of pyrethroid-PBO nets.

To guide resistance management, WHO recommends that countries develop and implement national insecticide resistance monitoring and management plans, drawing on the WHO *Framework for a national plan for monitoring and management of insecticide resistance in malaria vectors* (*140*). Up to the end of 2019, countries have made considerable progress in developing such plans, with 53 countries having completed plans for resistance monitoring and management, and 28 currently in the process of developing such plans. Further effort and support will be required to ensure that every malaria endemic country has such a plan in place, updates it regularly and has the necessary resources to implement it.

FIG. 9.7.

Reported insecticide resistance status as a proportion of sites for which monitoring was conducted, by WHO region, 2010–2019: pyrethroids, organochlorines, carbamates and organophosphates Status was based on mosquito mortality, where <90% = confirmed resistance, 90–97% = possible resistance and ≥98% = susceptibility. Where multiple insecticide classes or types, mosquito species or time points were tested at an individual site, the highest resistance status was considered. Numbers above bars indicate the total number of sites (n) for which data were reported. *Sources: national health institutes, national implementation partners, NMPs, research institutions and scientific publications.*



AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; n: number; NMP: national malaria programme; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.

10 Malaria response during the COVID-19 pandemic

10.1 THE 2020 COVID-19 PANDEMIC

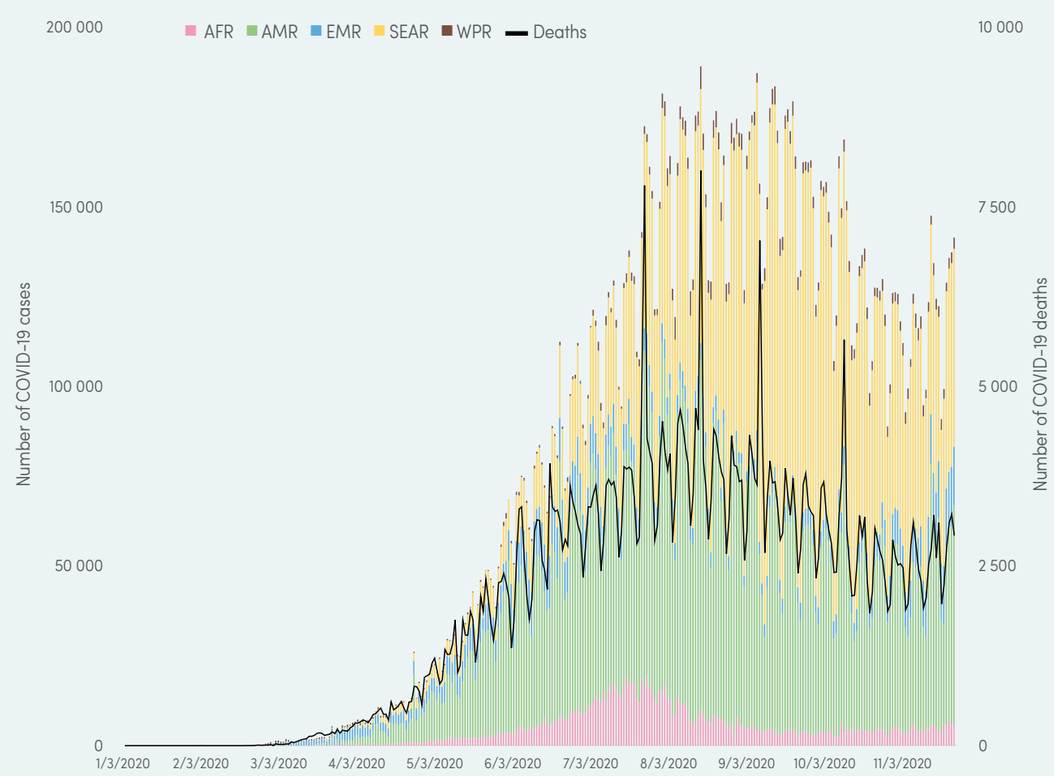
On 31 December 2019, Chinese authorities alerted WHO to an outbreak of pneumonia cases of unknown cause in Wuhan City, Hubei Province, China. These cases were later confirmed as cases of COVID-19; by the end of January 2020, China had more than 7700 confirmed cases, 12 000 suspected cases and 170 deaths (*141*). On 30 January 2020, the Director-General of WHO declared the novel coronavirus outbreak a public health emergency of international concern (PHEIC), WHO's highest level of alarm under the International Health Regulations (IHR) (2005) (*142*). By the first quarter of 2019, COVID-19 – caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) – had started spreading aggressively outside China. It became clear that the pandemic would be a major test of the resilience of health systems, even those considered strong and well resourced. Unfortunately, the pandemic continued to spread rapidly, with all countries soon affected. By the second week of November 2020, the COVID-19 pandemic had resulted in more than 54 million cases and more than 1.3 million deaths (*143*). Older patients and those with certain pre-existing morbidities had a higher risk of severe disease and death (*144*). Outside of China, several malaria endemic countries in the WHO South-East Asia Region had reported COVID-19 cases by January 2020. By April 2020, the virus had spread globally to all malaria endemic countries, and by the third week of November 2020, 24 million cases and about 636 000 deaths had been reported (**Fig. 10.1**).

Brazil and India accounted for more than 64% of all cases reported from malaria endemic countries. In sub-Saharan Africa, a region that accounts for over 90% of malaria infections, the spread of the disease was much slower and case fatality rates were lower than had first been feared. Factors that are being considered as possible contributors to the slower spread in this region include early adoption of aggressive control strategies, prior experience in the control of disease outbreaks, a youthful population, a relatively high proportion of rural population with limited mobility and higher ambient temperatures (*145*, *146*).

In several high-income countries, health systems have become overwhelmed with the efforts required to stop the transmission of the coronavirus, and hospitals have struggled to cope with increasing numbers of severe COVID-19 cases. This led to global concerns about the potential consequences of the pandemic, including disruptions of essential health services, especially in LMICs, where the population was already dealing with a considerable burden of other infectious diseases.

FIG. 10.1.

Trends in COVID-19 cases and deaths in malaria endemic countries globally and by WHO region (as of 23 November 2020) *Source: WHO Coronavirus disease (COVID-19) dashboard* (*143*).

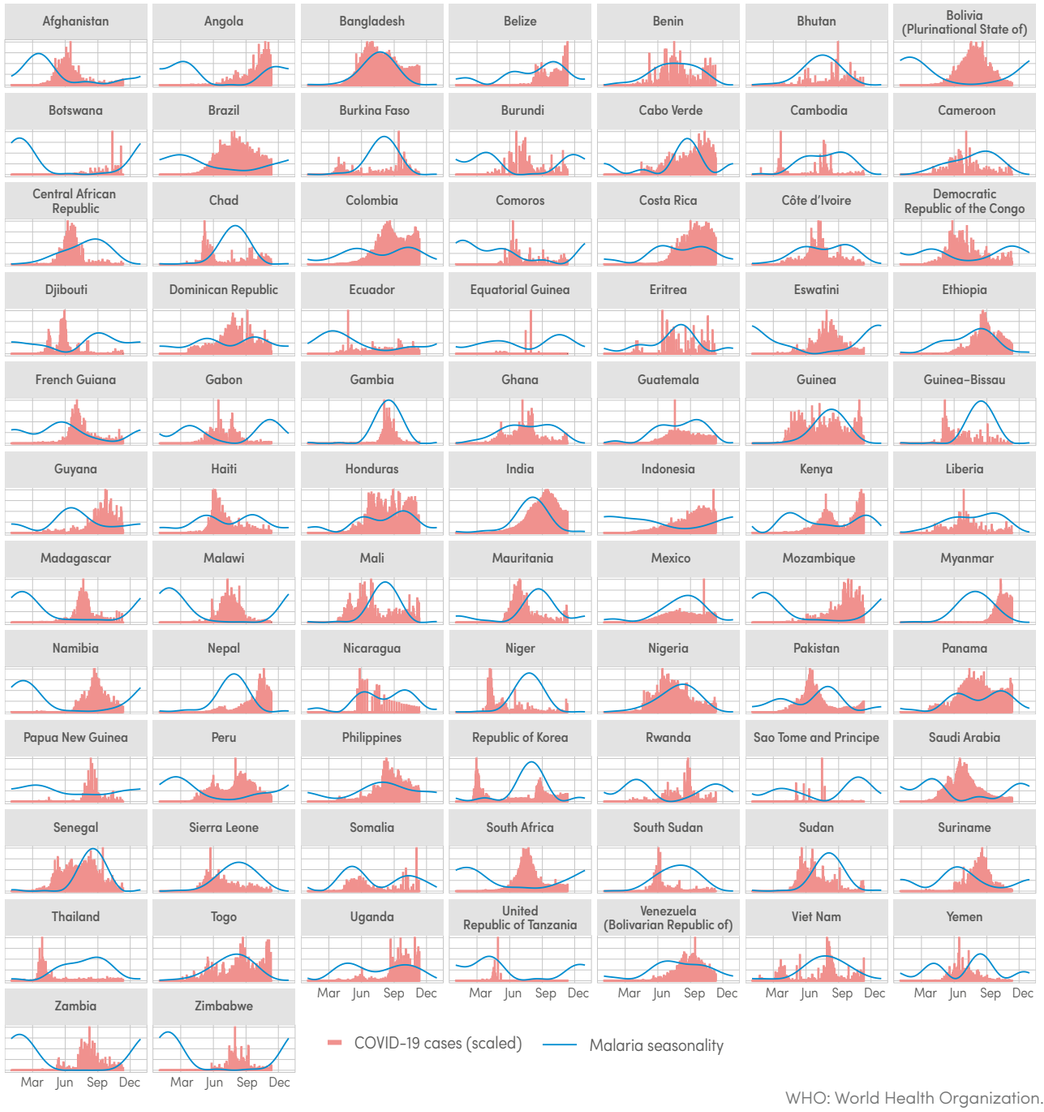


AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.

Indeed, the COVID-19 pandemic and restrictions related to the response have caused major disruptions in essential malaria services. Furthermore, early messaging targeted at reducing SARS-CoV2 transmission advised the public to stay at home if they had fever, potentially disrupting treatment seeking for febrile diseases such as malaria. At the same time, many high malaria burden countries had plans to implement large prevention campaigns before the peak malaria transmission season (which was likely to coincide with peak COVID-19 cases). These plans needed to be adapted to conform with COVID-19 restrictions (**Fig. 10.2**).

FIG. 10.2.

Malaria seasonality and trends of COVID-19 cases in malaria endemic countries and areas, 2020 (as of 23 November 2020) *Source: WHO Coronavirus disease (COVID-19) dashboard (143) and PATH.*



WHO: World Health Organization.

10.2 GLOBAL WORKSTREAMS ON SUSTAINING THE MALARIA RESPONSE DURING THE COVID-19 PANDEMIC

In March 2020, as the COVID-19 pandemic spread rapidly around the globe, WHO convened a cross-partner effort to mitigate the negative impact of the coronavirus in malaria-affected countries and contribute to the COVID-19 response. The work was carried out in close collaboration with the RBM Partnership to End Malaria, the Global Fund, PMI, several implementation and advocacy partners, and research institutions.

This collaborative work was implemented across seven cross-partner workstreams set up to address various thematic areas (**Table 10.1**).

TABLE 10.1.

The global workstreams on the malaria response during the COVID-19 pandemic

Workstream	Areas of work
Clinical trials of COVID-19 treatment with antimalarials and product development	■ Develop a generic protocol to evaluate anti-COVID-19 prophylaxis in malaria endemic settings ■ Coordinate with researchers ■ Disseminate information
Modelling, surveillance and clinical epidemiology	■ Establish a network of sites involved in clinical epidemiology in countries with malaria transmission ■ Consider potential scenarios for COVID-19–malaria interactions and feed these into other workstreams ■ Model the impact of service disruptions ■ Track country-level service disruptions using routine health information systems
Supplies and commodities	■ Assess and monitor commodity stocks and supply-chain bottlenecks ■ Estimate potential demand for key malaria commodities ■ Work with international partners to consider how to use global purchasing power to stimulate ongoing production – and potential stockpiling – of key commodities ■ Coordinate and collaborate to optimize global stocks and distribution through careful prioritization ■ Work with international financiers to ensure that the necessary resources for the global COVID-19 response do not divert resources away from malaria or other public health priorities
Malaria response and guidance	■ Develop integrated guidance to support maintenance of essential malaria services ■ Ensure the continuation of the effective delivery of malaria interventions within a COVID-19 transmission setting ■ Anticipate that the demand for health services may outstrip the ability to deliver routine care ■ Consider resource requirements (e.g. commodities and workforce) for extraordinary measures
Communications	■ Communicate to avoid conflicting advice and misinformation ■ Ensure that current advice and public messaging intended to curb coronavirus transmission is appropriate in malaria endemic settings
Coordination	■ Identify early warning signs of increased costs for implementing malaria programmes or decreased funding for the global malaria response, as both donor and malaria endemic countries respond to COVID-19 ■ Protect and ensure follow-through on existing commitments (e.g. to the Global Fund) as resources are allocated to the COVID-19 response ■ Develop proposals and conduct donor outreach during the COVID-19 pandemic, to fill near-term health system gaps, including critical commodities for malaria and other communicable diseases
Resource mobilization	Under the leadership of the RBM Partnership to End Malaria, support countries to mobilize resources, through channels such as the Global Fund and others, to: ■ purchase PPE to help protect health workers in the provision of services at clinics and during campaigns ■ provide emergency resources to adapt the response during COVID-19 ■ ensure gains are sustained despite the pandemic

Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; PPE: personal protective equipment.

10.3 GLOBAL HIGHLIGHTS IN THE MALARIA RESPONSE DURING THE COVID-19 PANDEMIC

10.3.1 Partnership alignment and technical guidance

The cross-partner global response achieved several important milestones, starting with an initial urgent call to countries to maintain core malaria control services while protecting health workers and communities against COVID-19 transmission. A WHO statement, shared widely in March 2020, was issued in response to reports that some countries in sub-Saharan Africa had suspended mass ITN campaigns (*147*). This statement encouraged countries to move forward with ITN, IRS and SMC campaigns, and to advise the public to avoid delays in seeking treatment for illnesses.

To support malaria-affected countries to maintain essential services, in April 2020, WHO issued technical guidance on how to safely maintain malaria control services in the context of the COVID-19 pandemic. This document was developed in close collaboration with partners, and was consistent with broader guidance on maintaining essential services in COVID-19 settings and on facilitating the role of community-based health care during the pandemic. It provided specific malaria guidance on the prevention of infection through vector control and chemoprevention, testing, treatment of cases, clinical services, supply chains and laboratory activities (*148*).

10.3.2 Modelling the potential impact of service disruptions on the burden of malaria

To reinforce the urgent call to maintain essential malaria control services during the pandemic, the WHO GMP, in collaboration with the Malaria Atlas Project (MAP), conducted modelling to quantify the potential impact of service disruptions due to the COVID-19 pandemic (*117*). This analysis showed that, under the worst-case scenario – in which all ITN campaigns are suspended and there is a 75% reduction in access to effective antimalarial medicines – a staggering 769 000 people in sub-Saharan Africa could die from malaria by the end of 2020. This figure represents a doubling in the number of malaria deaths compared with 2018 and a return to mortality levels last seen 20 years ago. These dire projections were extensively communicated through the media, and directly to the governments of malaria endemic countries and their partners, catalysing an impressive response, with countries tailoring the delivery of essential malaria services to the COVID-19 response, as described below.

10.3.3 Responding to the pressure to shift diagnostic production away from malaria

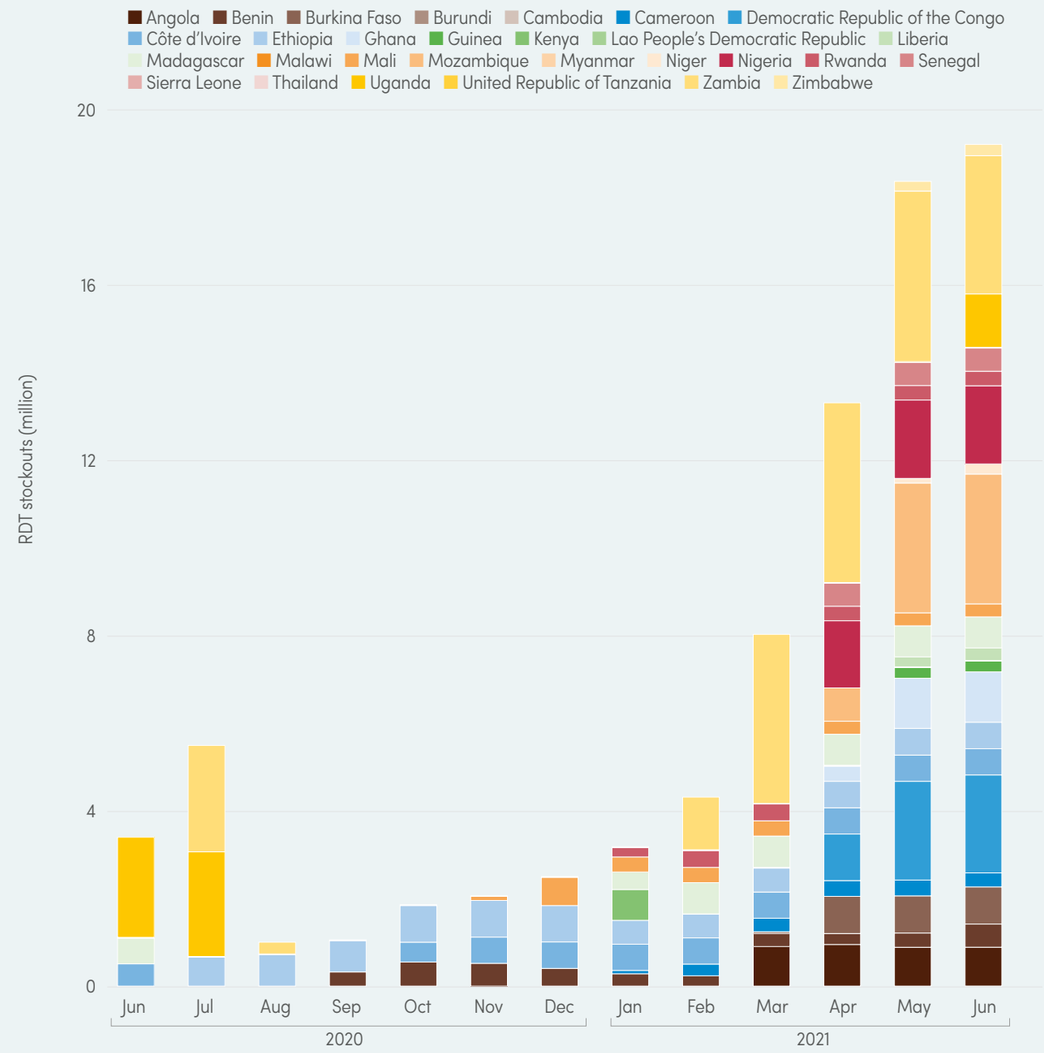
As early as February or March 2020, during the initial acceleration wave of the pandemic, international demand for the development and large-scale production of SARS-CoV2 antigen-detecting rapid immunoassays increased dramatically, driven by the need to diagnose and track the pandemic. By April, some of the world's leading RDT suppliers announced plans to reallocate manufacturing capacity away from malaria RDTs and towards the production of COVID-19 tests. To avoid a potentially devastating shortfall of more than 100 million RDTs, the malaria RDT task force, which involves 15 organizations,[1] began immediate discussion with suppliers that led to the convening of a suppliers' summit in June 2020, attended by 12 companies,[2] including all major manufacturers. In response, the Global Fund and PMI announced tenders to secure unallocated volumes for the remainder of 2020, allowing some flexibility in price offers. The floating of these tenders in July and August secured the malaria RDT requirements for the remainder of 2020, minimizing the risk of stockouts. Since then, PMI and the Global Fund have been expanding their collaborative focus "downstream", tracking RDT supply levels in countries they support and, together with UNICEF and UNDP, coordinating orders and deliveries to minimize disruptions at the country level (**Fig. 10.3**).

10.3.4 Resolving global manufacturing bottlenecks for malaria medicines

In February 2020, preliminary results from small trials employing CQ and hydroxychloroquine (HCQ) for COVID-19 treatment created high expectations for the therapeutic and prophylactic properties of these medicines. These early expectations led to CQ/HCQ treatment of hospitalized COVID-19 patients, and multiple stockpiling initiatives nationally and globally, fed in part by interest from the media, the general public and heads of governments. Unregulated demand by consumers led to instances of cardiotoxicity and death through self-administration of these medicines in several countries. The massive spike in demand for these medicines – normally used for the treatment of *P. vivax* malaria, and conditions such as rheumatoid arthritis and lupus – generated high demand for their active pharmaceutical ingredients. Sales of a key starting material (4,7-dichloroquinoline) increased up to sixfold from April to June 2020. This key starting material is essential for producing other antimalarial drugs, such as piperaquine and amodiaquine; thus, the supply of other critical artemisinin-combination treatments was also constrained. At the time of spike in demand, a major donor sought to ensure that over 120 million tablets of CQ would remain available for deployment for COVID-19 treatment in LMICs, after WHO validation of properly conducted solidarity trials. Following the release of data showing no benefits of CQ/HCQ for COVID-19, these medicines have been donated to countries in need of CQ for treating their high burden of *P. vivax* malaria (e.g. in Ethiopia, India and certain countries in Latin America).

FIG. 10.3.

Potential RDT stockouts forecast in June 2020, if country orders were not delivered The July tenders address all but the immediate stockouts through early 2021. *Sources: PMI and Global Fund.*



Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; PMI: President's Malaria Initiative; RDT: rapid diagnostic test.

[1] Bill & Melinda Gates Foundation; Clinton Health Access Initiative (CHAI); FIND; Global Fund; Global Health Supply Chain Program – Procurement and Supply Management (GHSC-PSM); Médecins Sans Frontières (MSF); PATH; PMI; RBM Partnership to End Malaria; UNDP; UNICEF; Unitaid; US CDC; USAID; and WHO GMP and WHO Prequalification Programme.

[2] Abbott, Access Bio Inc., Advy Chemicals, Arkray, Hangzhou Biotest, J. Mitra, Meril, Mologic, Premier Medical Corp, Rapigen, SD Biosensor and Tulip Group.

10.3.5 Mitigating the disruptions in the shipment and delivery of malaria commodities

The COVID-19 pandemic also impacted ITNs and insecticides for IRS, affecting the availability of raw starting materials and production, and the shipment or movement of product between and within countries. Increasing costs of raw materials and freight for many manufacturers, especially in India, could no longer be absorbed in the price of final products. Lockdown measures in countries led to increasing restrictions that limited movement of people and goods; these in turn affected the timely production, packaging, shipment, customs clearance and in-country delivery of goods from countries of manufacture to customer countries. Requirements for COVID-19 testing of drivers who transport goods across borders led to backlogs at ports and borders, and delayed import of goods. Similar factors delayed pre-shipment inspection by limiting movement of personnel. Quality assurance and quality control for ITNs and insecticides were also delayed due to closed laboratories. The availability of and prices for procuring personal protective equipment (PPE) were also affected by the COVID-19 pandemic, because there was high national and international demand for these supplies, especially for N95 masks, which are essential for sprayers engaged in IRS campaigns in 2020 and early 2021. The collaboration of over 20 organizations in tracking progress in ITN and IRS campaigns led to early resolution of bottlenecks, coordinated procurement and delivery, and mobilization of resources for PPE.

10.3.6 Supplementing funding for countries

The Global Fund has established an overall response fund of US$ 1 billion, and has allowed countries to access an amount equivalent to up to 10% of their allocations to help with the response (*149*). This support includes providing funding to countries to purchase personal protective equipment such as masks, gloves and gowns that are critical for the continuation of non-COVID-19 health care services including malaria. PMI, the second largest donor to the fight against malaria, has also made significant investments, particularly across its 24 focus countries in sub-Saharan Africa (including in all the HBHI African countries). The investments are for both for enhanced routine programming and flexibilities within existing allocation, to help countries support and adapt their malaria programmes while responding to their COVID-19 situation. Additional specific resource mobilization has also been supported by several other partners.[1]

10.3.7 Tracking malaria service disruptions during the COVID-19 pandemic

COVID-19 overwhelmed health delivery systems across the world, requiring adaptation or, in some cases, suspension of routine and elective services. However, many countries are compromised by the lack of accurate and timely data for tracking and monitoring the extent of disruptions to essential health services. This is limiting the understanding of the scale of the problem and hampering the development of locally appropriate mitigation strategies.

A range of global trackers, implemented at different intervals, have been developed by various agencies to monitor disruptions in broader essential health services during the COVID-19 pandemic, including some developed specifically for malaria. Information from these trackers was assembled to inform the level of malaria service disruption by country.[2] Trackers, other than those for campaign-type interventions, had important limitations related to periodicity, scope and reliability. In particular, information on disruptions of clinical management of malaria (diagnosis and treatment) was not adequately captured by all the trackers. Where attempts were made to capture such information, the responses were qualitative and difficult to validate. This exercise highlights the need to ensure that countries' health information systems can capture critical data elements related to service disruptions and mechanisms, and complement these with low-cost sentinel surveillance and rapid community surveys.

10.4 COUNTRY RESPONSES TO MITIGATE GLOBAL SERVICE DISRUPTIONS

Several malaria endemic countries with moderate or high transmission had plans to implement campaigns to distribute LLINs, IRS and SMC in 2020. The COVID-19 pandemic threatened the safe and effective delivery of these interventions. Faced with the possibility that most of the gains over the past 20 years could be reversed in a single year if major malaria intervention programmes were disrupted (**Section 10.3.2**), many malaria endemic countries mounted an impressive response by adapting service delivery approaches while still adhering to the restrictions imposed by national attempts to curb the spread of SARS-CoV2 infections. The guidance provided by the WHO GMP (with support from partners) (*148*) coupled with documents developed by partners to support implementation, were critical in helping countries tailor their responses to the COVID-19 pandemic.

In their mitigation response, countries faced several challenges: lack of funds and delays in procurement of PPE; delays in procurement and delivery to country of adequate nets, insecticides, diagnostics and drugs because of global supply chain disruptions (**Sections 10.3.3–10.3.5**); delays in shipping due to mobility restrictions; and the need to acquire high-level political support in an environment where most of the focus was on direct efforts to fight COVID-19.

A case study of Benin, as an example of a country adapting and maintaining malaria services during the COVID-19 pandemic, is presented in **Box 10.1**.

BOX 10.1.

Benin: Country example for sustaining malaria programming during COVID-19

In March 2020, the first cases of COVID-19 were recorded in Benin, just as the country was planning its LLIN campaign. Following the WHO recommendation to continue with the implementation of malaria control interventions in the face of COVID-19 (*148*), and with strong support from the RBM Partnership, the Ministry of Health was authorized to continue with the implementation of the planned LLIN campaign. Working closely with the RBM Partnership through the Alliance for Malaria Prevention (AMP), Benin's National Malaria Control Programme reviewed and revised their distribution strategy to mitigate the risks of COVID-19 transmission[a] during the campaign. The AMP guidance for distribution of ITNs during COVID-19 transmission facilitated adaptation of the distribution strategy, with the adoption of a door-to-door distribution approach rather than distribution from a fixed point. The change in approach meant an increase in the number of days needed for community mobilization, modifications to briefings, training and supervision, plus the purchase of PPE. The Global Fund rapidly approved the release of funds from Benin's existing grant to cover any increased costs.

The strong leadership from the Government of Benin, the Ministry of Health and the NMP, and effective collaboration with international and implementing partners facilitated the door-to-door distribution of 7 638 192 nets in just 20 days, ensuring that Benin's population of 14 million were protected from malaria. Benin was the first country to proceed with its planned LLIN campaign in the face of COVID-19, providing a valuable "proof of concept" for other countries to follow. Other countries across Africa subsequently adopted the approach pioneered by Benin to ensure that life-saving mosquito nets were distributed.

Benin also successfully conducted IRS during the COVID-19 pandemic, spraying a total of 350 349 structures. With support from partners, the NMP updated the IRS strategy and training to include COVID-19 prevention measures. Additional protection measures were established, including increasing the number of handwashing stations for frontline workers and provision of additional vehicles to transport spray personnel in accordance with national travel recommendations. Measures were put in place for COVID-19 testing of spray personnel and for managing any suspected cases among the spray teams.

Benin also successfully completed four rounds of SMC in four health zones. With support from partners, the NMP adapted the SMC strategy to include COVID-19 prevention measures. Sensitization of communities and compliance with the government's protective measures (wearing a mask, using sanitizing gels and physical distancing), as well as limiting the number of participants in meetings and trainings, helped to build confidence in the community.

Finally, the country has worked to sustain case management of malaria during the COVID-19 pandemic. This has included ensuring sufficient supplies of essential malaria commodities (e.g. diagnostics and treatment) at health facility level.

Through strong leadership, and coordinated partnership, Benin has successfully implemented the LLIN, IRS and SMC campaigns planned for 2020, while working to sustain access to case management. All this has been achieved under the very difficult circumstances of the COVID-19 pandemic.

[a] https://allianceformalariaprevention.com/wp-content/uploads/2020/10/Key-guidance-EN.pdf

[1] RBM Partnership to End Malaria. *Best practices in mitigating the effect of COVID-19 on malaria at country and sub-regional level.* October 2020, report in preparation.

[2] RBM Country/Regional Support Partner Committee (CRSPC) tracker (*150*), Workstream 3 trackers (ITN, IRS and SMC), RBM MERG routine data tracker (*151*) and WHO essential health services survey (*152*).

10.5 LEVELS OF SERVICE DISRUPTION BY COUNTRY AND IMPLICATIONS FOR DELIVERY OF INTERVENTIONS

According to available information,[1] all 31 countries (25 in sub-Saharan Africa) that had ITN campaigns planned in 2020 aimed to complete them by the end of the year. As of 23 November 2020, five countries had completed on time (within the planned period before the pandemic), seven had completed with moderate delays (within the second quarter of the original planned period), 12 had ongoing campaigns with moderate delays, and another seven had campaigns in progress but with major delays (beyond the second quarter of the original planned period). Of the 222 million ITNs expected to be distributed in 2020, 105 million had been distributed by 23 November 2020. Of the 47 countries that planned IRS campaigns in 2020, 23 had completed them, with eight of those countries doing so with delays. Thirteen countries are on track to complete their IRS campaigns, six of them with delays. Eleven countries, eight of them in sub-Saharan Africa, were either off track or at risk of not completing their IRS campaigns. By the third week of November 2020, all countries that had planned SMC campaigns were on track to complete them, despite moderate delays in some areas.

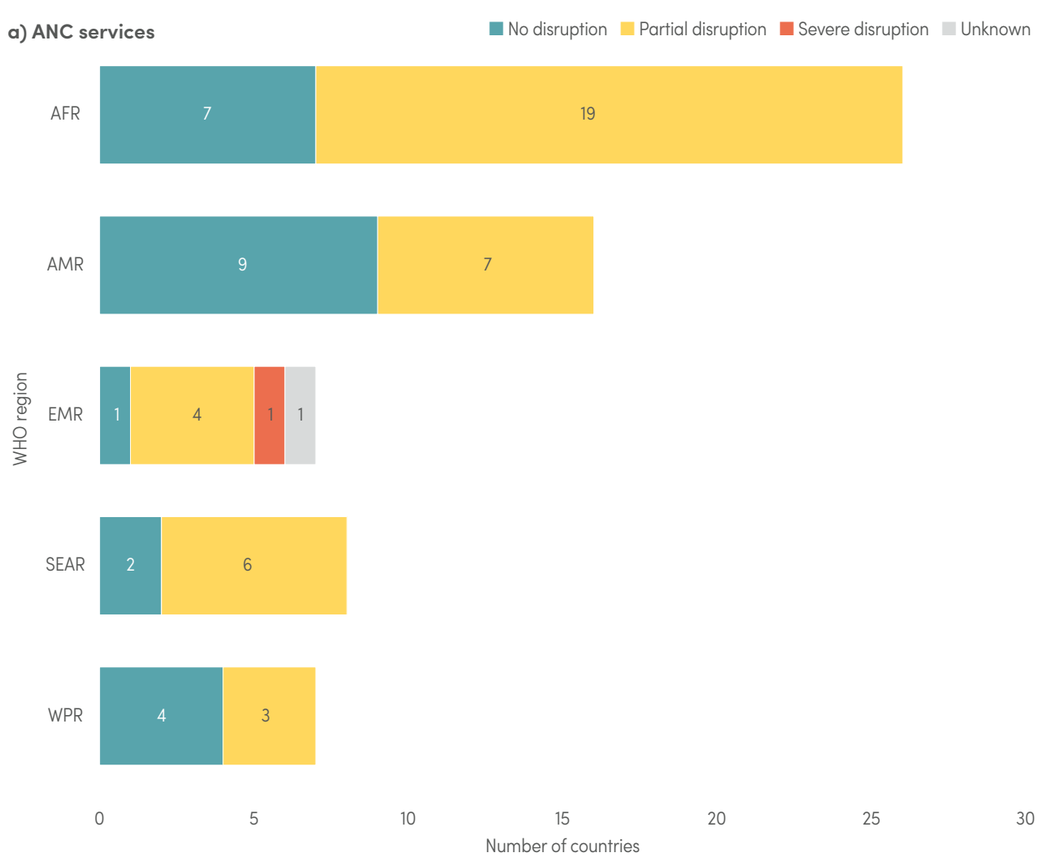
[1] RBM Country/Regional Support Partner Committee (CRSPC) tracker (*150*) and Workstream 3 trackers (ITN, IRS and SMC).

Understanding the disruptions in malaria case management is difficult because it requires data from multiple household surveys of disruptions to treatment seeking for fevers, combined with information at health facility level about changes in patient caseloads. In addition, disruptions varied greatly within countries by geography and over time, making it difficult to draw conclusions from point-in-time data. These data should be combined with detailed country information on supply chains, and stockouts of diagnosis and treatment commodities in order to identify not only disruptions but also their potential causes and solutions. In the absence of such data, several proxies have been explored.

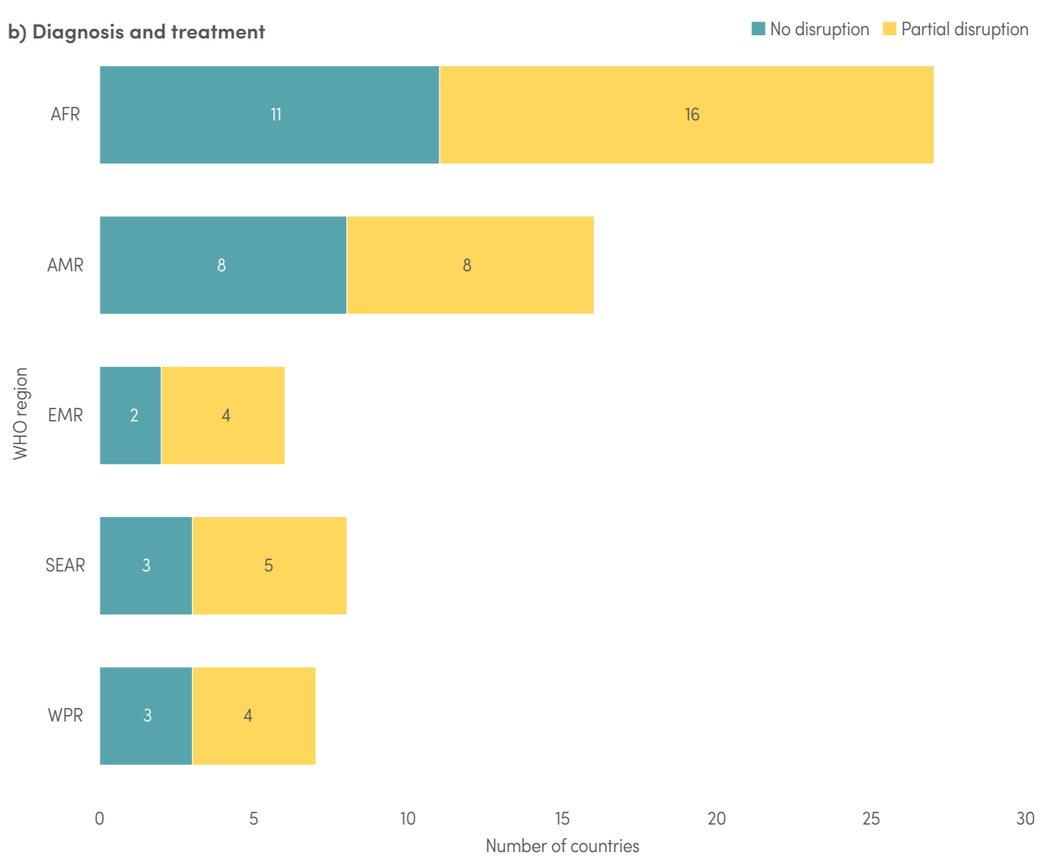
Figure 10.4 shows responses from countries on the extent of disruptions of malaria diagnosis and treatment, collected through the WHO Essential Health Service pulse survey from mid-May to September 2020. The findings suggest that among the 64 malaria endemic countries that responded, 39 experienced partial disruption (of between 5% and 50%) of ANC services (**Fig. 10.4a**), and 37 experienced similar disruptions of malaria diagnosis and treatment (**Fig. 10.4b**). Djibouti reported severe disruptions of ANC services. This information is similar to that shown on other more recent surveys implemented by the Global Fund (*153*), suggesting that most malaria endemic countries surveyed have experienced at least moderate levels of

FIG. 10.4.

Results from WHO surveys on disruptions of malaria-related services during the COVID-19 pandemic: a) ANC services and b) diagnosis and treatment No disruption (<5%); partial disruption (< 50%); severe disruption (>50%). Surveys were conducted in May-September 2020 *Sources: WHO Integrated Health Services.*



AFR: WHO African Region; AMR: WHO Region of the Americas; ANC: antenatal care; EMR: WHO Eastern Mediterranean Region; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.



AFR: WHO African Region; AMR: WHO Region of the Americas; ANC: antenatal care; EMR: WHO Eastern Mediterranean Region; SEAR: WHO South-East Asia Region; WHO: World Health Organization; WPR: WHO Western Pacific Region.

disruption of malaria case management, of up to 50% based on the knowledge of the respondents.

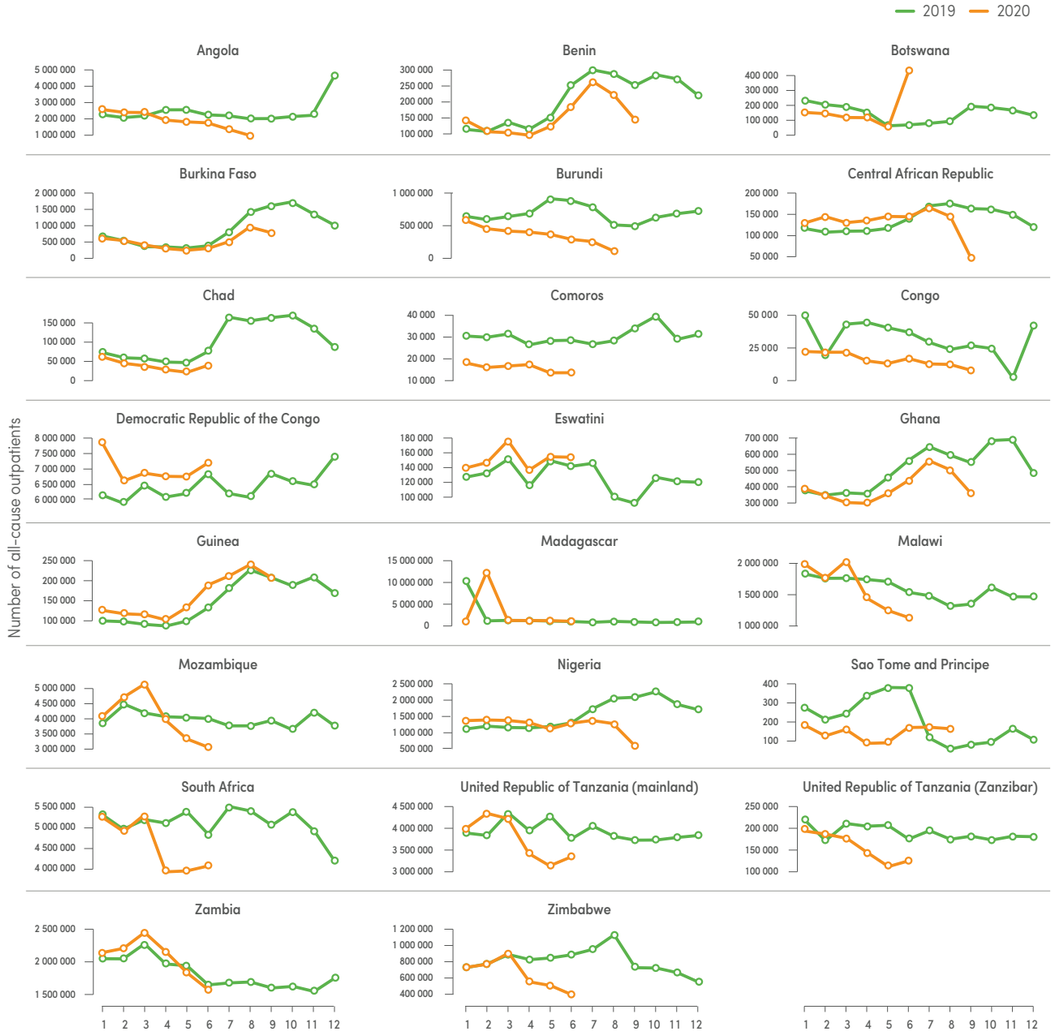
Analysis of routine aggregate data, while potentially biased by many factors related to the quality of the surveillance system, may add value to our understanding of disruptions to clinical services. **Fig. 10.5** shows monthly trends in all-cause outpatients in 2019, and up to June or September 2020 in the public health sector, for 23 countries in sub-Saharan Africa. Most of the countries show reductions in outpatient attendances from March 2020 onwards, compared with a similar period in 2019, suggesting a general decline in use of health services.

A similar analysis of malaria outpatient data shows that, despite decreasing overall attendance at public health facilities, malaria cases were generally higher in 2020 than in 2019 in 10 countries, and were lower in the remaining 14 countries (**Fig. 10.6**). There are several potential reasons for discordance in the trends in all-cause and malaria outpatient data, such as changes in diagnostic practice or reporting of presumptively treated cases as parasitologically confirmed. However, a potential concern would be that there is increasing malaria transmission, whereby there is more malaria among those patients using services at a time when use of services has generally reduced due to COVID-19 disruptions.

FIG. 10.5.

Monthly trends in all-cause outpatients attendances in 23 countries in sub-Saharan Africa in 2019 and 2020

Source: NMP reports.



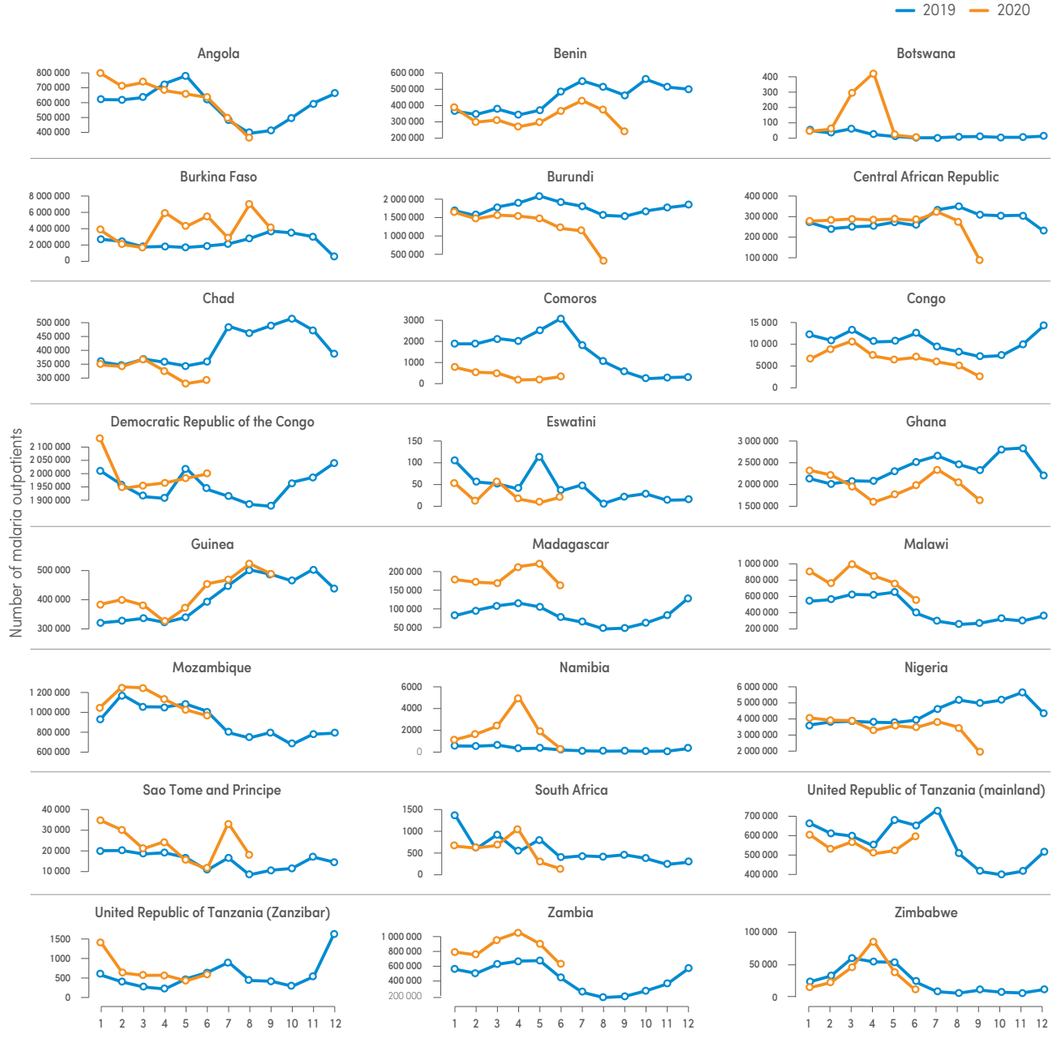
NMP: national malaria programme.

Note: For Burkina Faso, monthly data from 2018 were used due to major disruptions of the surveillance system due to the 2019 health workers' strikes in 2019.

FIG. 10.6.

Monthly trends in malaria outpatients attendances in 24 countries in sub-Saharan Africa in 2019 and 2020

Source: NMP reports.



NMP: national malaria programme.

Note: For Burkina Faso, monthly data from 2018 were used due to major disruptions of the surveillance system due to the 2019 health workers' strikes in 2019.

10.6 THE CONSEQUENCES OF SERVICE DISRUPTIONS DURING THE COVID-19 PANDEMIC

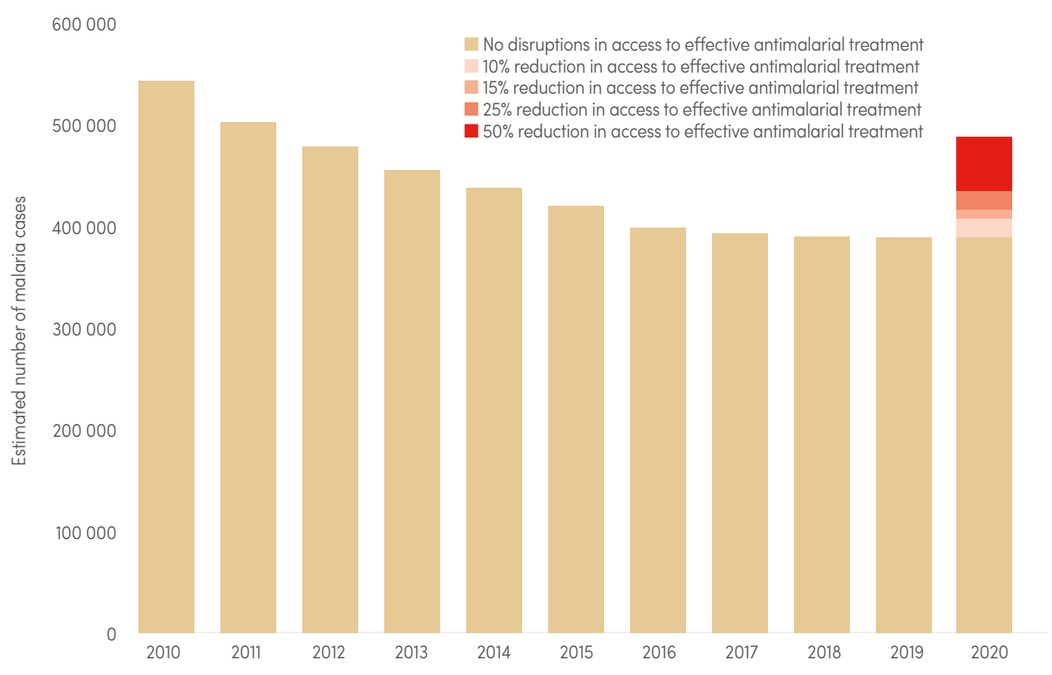
The analysis in this report of the consequences of disruption of services focuses on sub-Saharan Africa, a region that accounts for more than 90% of the burden of malaria morbidity and mortality. Within this region, the analysis further focuses on mortality because it is assumed that most of the prevention campaigns will be completed by the end of 2020, averting major increases in cases. Delays in the campaigns in 2020 have been included in the analysis of the effect of vector control coverage on infection and malaria cases. Different scenarios of disruptions of access to effective antimalarial treatment were applied to each country, to estimate the number of untreated cases. A uniform *P. falciparum* case fatality rate was then applied to the untreated cases, to estimate mortality by country (**Annex 1**).

The analysis shows that, even with completion of the prevention campaigns, relatively small disruptions in access to effective antimalarial treatments (similar to those suggested by the various trackers) can lead to considerable loss of life (**Fig. 10.7**). Thus, a disruption in access to treatment of 10% in sub-Saharan Africa is likely to lead to an estimated 19 000 additional deaths among people of all ages. This is likely to increase to 28 000, 46 000 and 100 000 deaths if access is reduced by 15%, 25% and 50%, respectively.

Had the ITN, IRS and LLIN campaigns not happened in 2020 as planned, mortality would have increased several times more than currently projected.

FIG. 10.7.

Estimated potential increase in malaria deaths in sub-Saharan Africa (excluding Botswana, Eswatini, Namibia and South Africa) corresponding to varying levels of disruptions of access to effective antimalarial treatment *Source: WHO estimates.*



WHO: World Health Organization.

11 Key results, context and conclusion

This concluding section of the *World malaria report 2020* highlights some of the progress made against malaria in the past 2 decades, calls out the major current challenges and threats (including the COVID-19 pandemic), and draws attention to opportunities for the global malaria community to work together to ensure even greater achievements in the next decade of the GTS.

11.1 KEY RESULTS

Following years of neglect, remarkable progress was made in malaria during the MDG era and that progress should be considered one of the first great public health success stories of the millennium. Despite modest levels of investment in research and development (R&D), new tools became available in the form of ITNs, ACTs and RDTs. New strategies to deploy existing tools were developed, including various forms of chemoprevention (e.g. IPTp, IPTi and SMC), the use of community health workers and greater engagement with the private sector.

A range of financing mechanisms were developed to augment the national investments of endemic countries: between 2000 and 2019, about US$ 39 billion was invested in the fight against malaria, of which US$ 26 billion represented funds from external donors (**Section 6**). These developments led to an unprecedented scale-up of effective malaria interventions (**Section 7**). Over 2.2 billion ITNs, 3.1 billion ACTs and 2.7 billion RDTs have been delivered to malaria endemic countries. In sub-Saharan Africa, between 2000 and 2019, the percentage of children aged under 5 years and of pregnant women sleeping under an ITN both increased from below 3% to over 50%. More than 21 million children aged under 5 years have received SMC, and about 23 million (62%) pregnant women received at least one dose of IPTp in 2019 alone. The percentage of children being diagnosed using a parasitological test increased from 14% before the large rollout of RDTs to, on average, 40% in the most recent household surveys conducted in sub-Saharan Africa.

By 2019, there were 229 million malaria cases and 409 000 deaths globally, reducing from 238 million and 736 000 since 2000, respectively. It is estimated that 1.5 billion malaria cases and 7.6 million deaths had been averted since 2000 (**Section 3**). Since 2000, 21 countries had achieved malaria free status or were certified by WHO as having interrupted malaria transmission (**Section 4**). Thirty-one and 35 countries were on target for the 2020 GTS morbidity and mortality reduction targets, respectively (**Section 8**). Each WHO region had shown reductions in malaria case incidence and mortality rates since 2000, and the entire WHO European Region had been free of malaria since 2015 (**Section 3**). Under the HBHI approach, the 11 highest burden countries globally had concluded an intensive initial exercise to use their local data to develop and implement evidence-based subnationally tailored malaria interventions plans (**Section 5**). Through support from the Global Fund and PMI, these countries are expected to receive more funding in the period 2020-2022 than in the preceding 3 years.

Despite the overall progress made in the first 15 years of this century, global trends in malaria case and mortality rates have been plateauing since 2015 (**Section 3**), particularly in the highest burden countries that account for most of the cases and deaths globally (**Section 5**).

11.2 THE ENABLING ENVIRONMENT AND THREATS TO THE MALARIA PROGRESS

The unprecedented investment in malaria and the scale-up of interventions coincided with a period of considerable demographic and socioeconomic change in malaria endemic countries. In sub-Saharan Africa, where over 90% of the malaria burden occurs, the population increased from 665 million in 2000 to 1.1 billion in 2019, and it is projected to rise to 1.5 billion by 2030 (*154*). The proportion of this population that resides in urban areas increased from 31% in 2000 to 41% in 2019, and is projected to increase to 47% by 2030. GDP growth has averaged 4% since 2000, with several countries exceeding an average of 5% in this period (*155*), and the percentage of the population considered poor (i.e. living on <US$ 1.90 a day at 2011 international prices) reducing from 60% in 2000 to 40% in 2018 (*156*). The level of rural electrification rose from 11% to 32% of households, giving those households better economic opportunities, connectivity and access to information (*157*). The 11 million mobile cellular subscriptions in 2000 increased dramatically to 537 million subscriptions in 2019 (*158*). Major improvements in socioeconomic growth and development have also occurred in many malaria endemic countries outside sub-Saharan Africa (*159*). These factors have no doubt contributed to general improvements in health and – both directly and in combination with the massive scale-up of malaria interventions – to the progress made against malaria since 2000.

The plateauing of the burden of malaria at what is still a very high level is a wake-up call, drawing attention not only to the need to innovate against the vector and the parasite – by developing new tools, strategies and problem-solving approaches at the frontline of malaria control - but also to ensure that the global response evolves. Sustained, strengthened and coordinated investments and actions are needed to build on earlier successes.

The efficacy of most of the current malaria prevention tools remains modest. High levels of coverage and user compliance remain challenging, and the different approaches are threatened by emerging resistance (**Section 9**). The spread of resistance to insecticides used in ITNs and IRS is extensive and, although the epidemiological impact of such resistance remains inconclusive, reinforces the need for vigilance and development of new insecticides (**Section 9**). The emerging spread of *pfhrp2* deletions means that the most widely used malaria diagnostic test is no longer reliable in most countries in the Horn of Africa, and this situation could spread rapidly to other countries. ACT resistance; it has not spread from the GMS to the rest of the world as was previously feared; nevertheless, it remains a threat to which WHO continues to pay attention.

Funding for malaria has plateaued since 2010 (**Section 6**) and, despite the welcome increase in Global Fund replenishment in 2019, per capita investments for populations at risk are unlikely to change greatly in the period 2020–2022. The 2019 malaria funding of about US$ 3 billion is considerably below the US$ 5.6 billion estimated as being needed to achieve the GTS targets. Despite impressive economic growth in malaria endemic countries, domestic funding for malaria has also stagnated over the past decade.

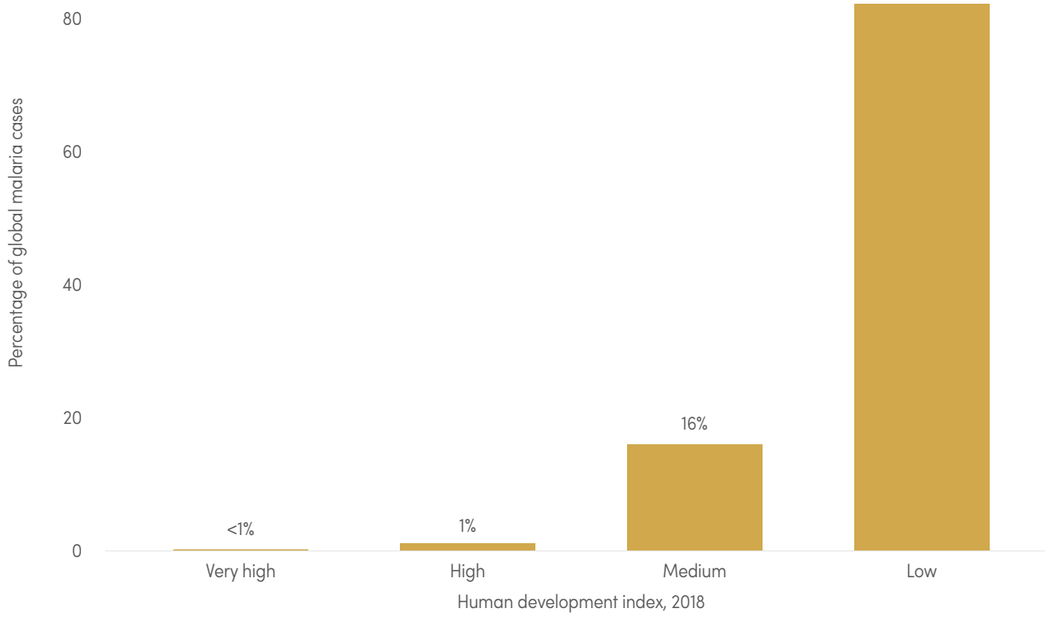
Inadequate funding and inefficiencies in service delivery systems have resulted in some people failing to access and use malaria interventions. In sub-Saharan Africa, the population sleeping under ITNs has remained similar to 2015 levels (and actually declined slightly between 2018 and 2019), with important inequities in several countries (**Section 7.1**). Nearly 30% of children with fever are still not receiving care and less than half of those who seek care are not diagnosed using a parasitological test (**Section 7.5**). A third of these children use private health facilities (**Section 7**), with households incurring expenses they can barely afford. This draws further attention to the importance of UHC and of ensuring that mechanisms exist to deliver interventions without creating financial hardship.

The link between improving human development and reducing the burden of infectious diseases is strong (*160*). It is anticipated that as the world strives for a future without malaria, human development, in all its facets, will be one of the biggest drivers for this change (*113*). At the same time, reducing the burden of malaria through prevention and treatment is likely to contribute to accelerated development. Currently, however, more than 80% of the burden of malaria is concentrated in countries with low human development indices (**Fig. 11.1**), assessed using dimensions of health, education and standard of living indicators (*159*), impairing the capacity and resilience of communities to respond to the burden of malaria.

About 90% of the burden of malaria occurs in countries where health expenditure as a percentage of GDP is less than 7%, and 75% of the burden is in countries where health expenditure is less than 5% of GDP (**Fig. 11.2**). In these countries, more than 70% of funding for malaria is from external sources, mainly from the Global Fund and PMI (**Section 6**). Among moderate to high transmission countries in sub-Saharan Africa, progress towards the target of 15% expenditure on health as a percentage of GDP by 2015 committed to by countries under the Abuja Declaration (*1*) remains elusive, with no country achieving it by 2017 (*161*).

FIG. 11.1.

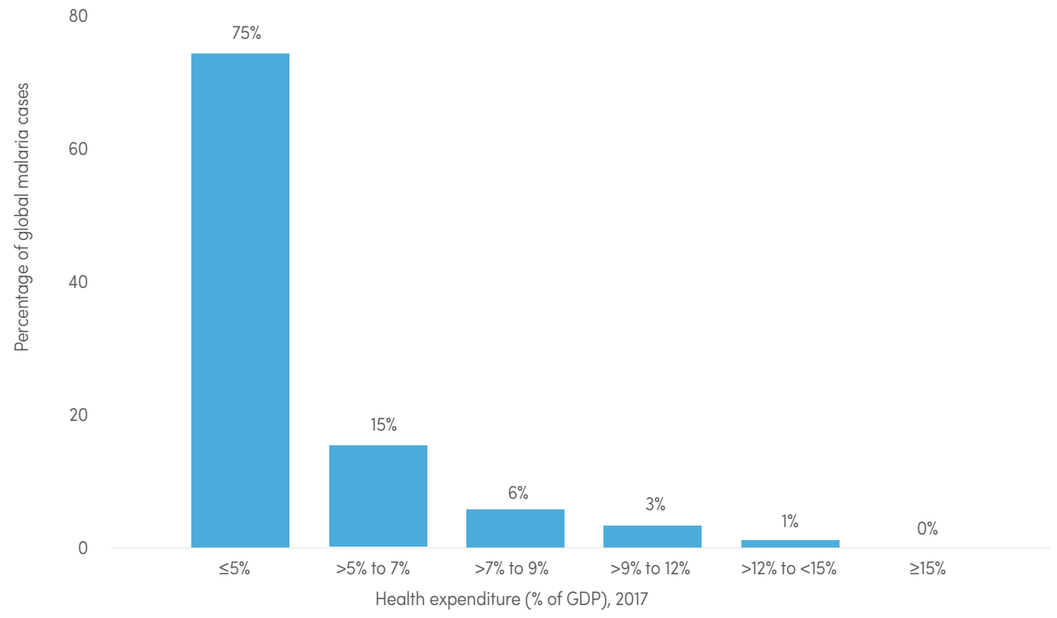
Distribution of malaria cases in 2019 by human development index in 2018 *Sources: WHO estimates, UNDP.*



UNDP: United Nations Development Programme; WHO: World Health Organization.

FIG. 11.2.

Distribution of malaria cases in 2019 by current health expenditure as a percentage of GDP in 2017 *Sources: WHO estimates, World Bank.*



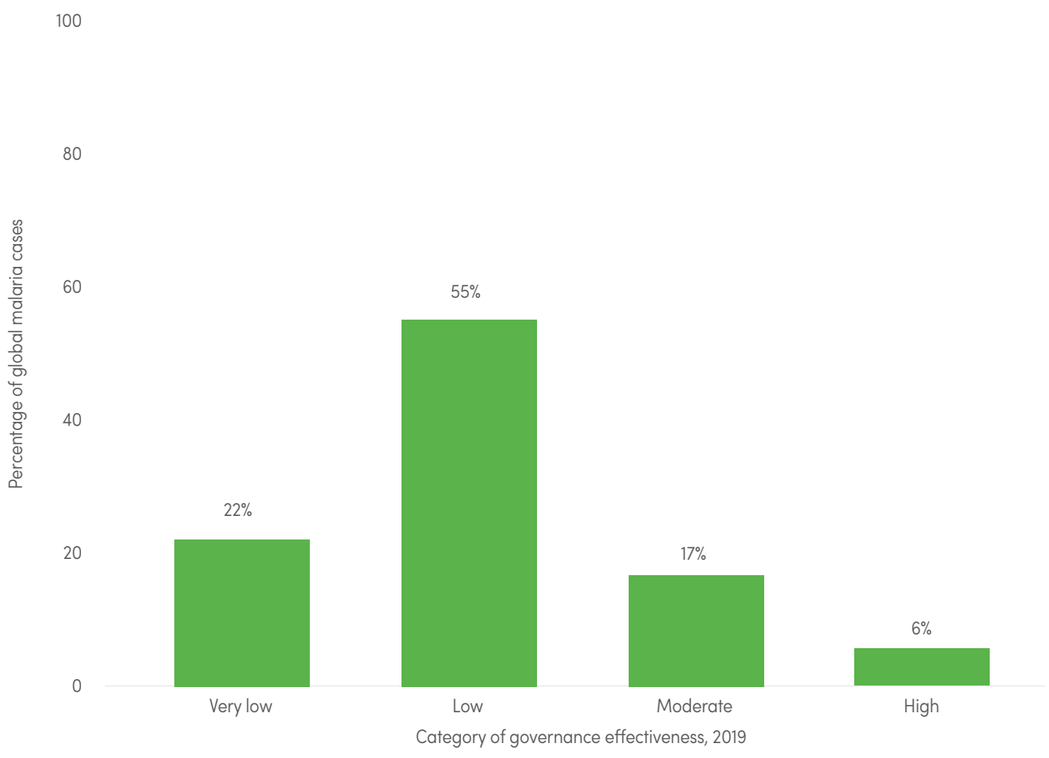
GDP: gross domestic product; WHO: World Health Organization.

There are no reliable data measuring the status of health system governance. **Fig. 11.3** presents the distribution of burden by level of general governance effectiveness, as analysed by the World Bank (*162*). The index of governance effectiveness reflects respondent perceptions of the quality of public services, the quality of the civil service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to policies. Information on governance effectiveness for malaria endemic countries was extracted and countries were grouped into qualitative categories by government effectiveness as very low, low, moderate or high (**Fig. 11.3**). About 77% of all malaria case burden is accounted for by countries with very low or low governance effectiveness.

An analysis of the UHC service coverage index by country was undertaken by WHO for the period 2000–2017 (*163*). This index was computed using information on 16 tracer indicators across four service coverage categories: reproductive, maternal, newborn and child health; infectious diseases; noncommunicable diseases; and service capacity and access, and health security (*164*). The burden of malaria and access to malaria interventions were also included in the composite index of effective service coverage. The potential circularity notwithstanding, there is a clear pattern in the relationship between the UHC service coverage index and malaria burden (**Fig. 11.4**). About 90% of the burden of malaria globally in 2019 was concentrated in countries that were classified as having a low UHC service coverage index (i.e. <50).

FIG. 11.3.

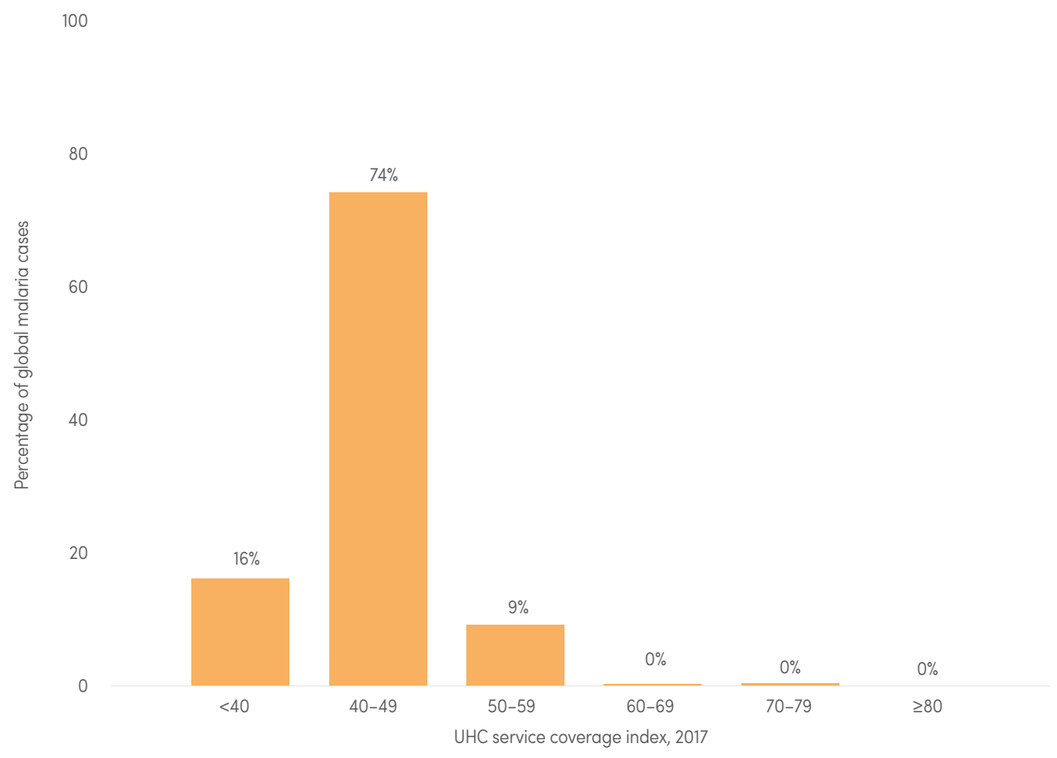
Distribution of malaria cases in 2019 by category of governance effectiveness in 2019 *Sources: WHO estimates, World Bank.*



WHO: World Health Organization.

FIG. 11.4.

Distribution of malaria cases in 2019 by category of UHC service coverage index in 2017 *Sources: WHO estimates, World Bank.*



UHC: universal health coverage; WHO: World Health Organization.

Reliable health information is critical for developing sound strategic and operational plans, efficiently and equitably targeting resources and reliably measuring the impact of interventions (**Section 3**, **Section 5**). Considerable improvements have been made in recent years, building on the introduction of parasitological diagnosis, which have improved the value of the data on malaria cases, and the use of digital solutions (e.g. DHIS2), which in turn have improved data transmission, validation and analysis. In many moderate to high burden countries, especially in sub-Saharan Africa, the available routine data are increasing in volume, but there are still considerable issues with data quality. Consequently, for 30 countries in this region – which account for over 85% of the burden of malaria cases for this report – malaria case totals are computed using a method that derives case incidence from intermittent community parasite prevalence data (**Section 3**, **Annex 1**). Mortality estimation also relies on verbal autopsy data to define causes of death; however, such data have been shown to be unreliable in identifying malaria deaths (*165*). Facility-level electronic data entry is non-existent in most of the countries in sub-Saharan Africa, making data transmission and aggregation labour intensive, and increasing the likelihood of transcription errors and significant delays. These weaknesses have been most starkly demonstrated by the difficulties in tracking service disruptions during the COVID-19 pandemic (**Section 10**).

Over the past 2 decades, malaria endemic countries have also had to deal with numerous complex emergencies – both natural and human made – undermining progress in these countries and resulting in a heavy toll on already fragile health and livelihoods. As recently as 2018–2020, many high burden malaria endemic countries have been afflicted with major storms or flooding, including, for example, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Uganda and the United Republic of Tanzania (*166–168*). Many countries are also dealing with local active conflicts (*170*) that limit the population's access to care, and the ability of government and stakeholders to reach people. In addition, frequent outbreaks and epidemics of non-malaria diseases in malaria endemic settings have resulted in major disruptions to malaria services (**Section 10**). Despite their frequency and impact, these emergencies are unpredictable; in fact, they are missing entirely from quantitative global projections of the future trajectory of malaria (*113*, *115*).

Between 2007 and 2018, almost US$ 7.3 billion was invested in basic research and product development for malaria, rising from about US$ 500 million in 2007 to slightly over US$ 650 million in 2018 (**Section 6**). A lot of knowledge has been generated and many tools are in the pipeline. However, progress against malaria in the past 2 decades has been delivered by the continued dependence of countries on a combination of several imperfect tools delivered to communities through relatively expensive mechanisms (**Section 7**), resulting in persistent gaps in coverage. Many of the tools currently in use were developed in the 1980s and 1990s. There have been progressive improvements, such as new ITNs/LLINs, new ACTs, and new formulations of existing ACTs and the advent of RDTs (an important innovation that enhances case management), the targeted use of ACTs the value of routine malaria case data. The next major innovation may be a malaria vaccine, introduced as part of routine control efforts. Pilot implementation of RTS,s/AS01 in three African countries started in 2019. In late 2021, WHO is expected to review evaluation data from the pilots together with the results of several studies conducted since 2015, and consider the advisability of broader use of this vaccine. This would open a new paradigm in the approach to malaria control.

11.3 CONSEQUENCES OF THE COVID-19 PANDEMIC

COVID-19 has exposed the fragility of today's society and systems, shaken the global economy and begun to reverse the progress made in reducing poverty and fighting disease (*171*). It is estimated that COVID-19 will push about 100 million people into extreme poverty in 2020 and will have a prolonged economic legacy (*172*). At the time of writing, almost 50 million cases of COVID-19 have been reported to WHO, and more than 1.2 million people have lost their lives. millions more are likely to have died due to disruption of essential health services.

Health sectors across the world are facing a triple challenge: minimizing the immediate health impact of COVID-19, reducing disruption to other essential services and managing the health of their nation while reorienting their economies for recovery. The limited fiscal space in many parts of sub-Saharan Africa has compromised spending on COVID-19 and continues to threaten other health priorities. Early lockdown measures in many malaria endemic countries may have protected people from COVID-19, but they have also affected people's access to health care and other services. On the demand side, fewer patients are presenting to outpatient care (**Section 10**), fearing the risk of becoming infected with COVID-19, and hindered by lockdowns and lack of transport. On the supply side, elective care has frequently been cancelled, and commodity supply chains both within and beyond malaria endemic countries have been disrupted. COVID-19 highlighted the severe shortages in the health workforce in LMICs, compromising clinical and social care and public health services. Health worker redeployment, fear of returning to work without PPE, sickness and death have further hampered service delivery (*173*).

The lack of infection prevention in facilities, including PPE, has had dire personal and public health consequences. A disproportionate number of health workers have been infected with COVID-19, compromising the capacity to deliver essential services, putting patients at risk of COVID-19 and deterring people from seeking care. Based on reports from key informants, the most frequently disrupted areas included routine immunization-outreach services (70%) and facility-based services (61%), non-communicable diseases diagnosis and treatment (69%), family planning and contraception (68%), treatment for mental health disorders (61%), and cancer diagnosis and treatment (55%) (*152*). Thirty-seven (58%) of 64 malaria endemic countries surveyed have also reported disruptions to malaria diagnosis and treatment (**Section 10**). Although disrupted or delayed, many of the campaigns for ITNs and SMC were conducted safely. However, the analysis suggests that even if malaria prevention campaigns are completed in 2020 as planned, disruptions to access to effective antimalarial treatment could lead to considerable loss of life (**Section 10**).

The pandemic is clearly a global crisis that requires a concerted global response. The sheer scale of the pandemic and the broader disruptions it has caused requires strong leadership and citizenship to chart a new way forward. In an interconnected world, this pandemic has highlighted the critical importance of global solidarity in addressing the divisions, fragilities and inequities that COVID-19 and other infectious diseases thrive upon. The ACT Accelerator (*174*) is a good example of the collective resolve necessary to rapidly develop quality assured vaccines, diagnostics and therapeutics, and to allocate them fairly. Building on the GTS principles, these positive lessons from COVID-19 need to be extended to the malaria response.

11.4 BUILDING A MORE PROSPEROUS FUTURE

The challenge of getting back on track during such difficult times is daunting, but there are reasons to be hopeful. Over the past 2 decades the malaria community has shown what it can do when faced with adversity. Looking forward, as we learn from COVID-19 and the early progress on HBHI, the principles outlined in the GTS become even more relevant for the challenges we are facing today.

11.4.1 Country ownership and leadership, with involvement and participation of communities, are essential to accelerating progress through a multisectoral approach

The major public health challenges, including malaria, require a whole of government, whole of society approach. Trusted, accountable national political leadership is essential, using the best knowledge and science to galvanize the many actors around a common narrative and unified response. Their political commitment will need to translate into resources and actions to ensure that all those in need have access to the appropriate mix of interventions for malaria prevention and quality health care, without financial hardship. As with other health priorities, this relies upon the inclusion and participation of many stakeholders, including the most vulnerable communities, women and children. Empowered and incentivized individuals are at the heart of primary health care, as people and their communities are advocates for policies that promote and protect health and well-being, are co-developers of health and social services, and act as self-carers and caregivers to others (*114*).

11.4.2 Improved surveillance, monitoring and evaluation, as well as stratification by malaria disease burden, are required to optimize the implementation of malaria interventions

Effective and efficient malaria programming and the containment of outbreaks such as the COVID-19 pandemic rely on effective data and surveillance systems. Data and local intelligence are critical for adapting to constantly evolving local disease patterns, and for optimizing the choice and delivery of interventions. Data are also needed to ensure that no one is left behind, helping to identify the least served and to understand and overcome the barriers they face. This data-driven approach is at the heart of the HBHI approach and is applicable to all malaria endemic countries. As the COVID-19 pandemic takes a toll on global economies, the data-driven approach will be even more critical in achieving more with less.

Bold actions are needed to ensure that surveillance systems are ready for efficient routine operations and future epidemics. Seven broad areas require investment: **i)** assessing the status of surveillance systems to understand bottlenecks and use evidence to guide investments in the system; **ii)** ensuring availability of parasitological tests in all health facilities and increasing adherence to test results; **iii)** moving away from aggregate tallying of cases by hand from registers to using personal electronic records in all malaria endemic countries, thus improving the efficiency, quality and value of surveillance – this will apply to the broader health information system, including the private sector, and will be achieved if gains in electrification, renewable energy, increased connectivity and reduced costs of computing hardware are optimized; **iv)** developing integrated databases that are governed by national authorities and analytical capacity at all programmatic levels, to ensure countries can use and act on their data; **v)** adapting surveillance systems and analytics to the changing socioeconomic and demographic environment – in particular, to respond to malaria in an increasingly urbanized population; **vi)** using the data to inform communities about the services that are available to them, their rights to access those services and the risks they are exposed to; and **vii)** enhancing innovation in the use of digital solutions, data science and genomics in malaria surveillance.

11.4.3 Equity in access to health services especially for the most vulnerable and hard-to-reach populations is essential

All citizens, wherever malaria is present, should have access to quality services to prevent, diagnose and treat the disease without facing financial hardship. However, as this report documents, many people living in countries where malaria remains a major public health challenge still lack access to essential health services, and some people are still pushed into extreme poverty by paying the costs of malaria prevention and treatment. Well-functioning, resilient health systems based on primary health care are critical for progress towards the interrelated goals of health security and UHC. The global commitments on UHC made in September 2019, at the UN high-level meeting on UHC (*116*) need to be translated into resources for implementing high-impact health interventions to combat malaria and other diseases, protecting women's and children's health, and ensuring no one suffers financial hardship because they have had to pay for their health care. This will require strengthening of integrated frontline delivery channels – primary care and emergency care, equipped with essential medicines and commodities to provide people with diagnosis and treatment when and wherever they need it. These platforms deliver benefits across a range of conditions and reap economies of scale.

11.4.4 Strengthen health workforce and malaria expert base

In most countries where malaria is endemic, there is a chronic shortage of skilled health professionals. Robust expansion of malaria interventions requires significantly expanded human resource capacities at national, district and community levels, and the deployment of health workers to cater for remote and underserved populations. A strengthening of the workforce across a variety of technical and service delivery areas based on a sound analysis and national plan should be recognized as an essential part of health systems strengthening.

11.4.5 Innovation in tools and implementation approaches will enable countries to accelerate their progression along the path to elimination

Continued investment in R&D is needed to develop the tools required to stay ahead of resistance and other effects of biological selection pressures. Periodic reviews of unmet public health needs and the types of products required to address those needs should be set alongside the development pipelines. This will make it easier to identify opportunities to intensify effort and investments to accelerate the availability of products where they are needed. Finance is required to generate solid evidence of the epidemiological and public health benefits of new interventions. Only with such information can programmes tailor the introduction of new technologies and be confident that they are maximizing the impact of available resources. Innovation is needed in the global financing architecture to incentivize R&D of products intended primarily for LMICs. Similarly, forethought is needed to avoid the bottlenecks that prevent production and delivery at scale of newly developed products. To keep product developers and donors engaged, it is essential to show a path to market and public health impact. For too long, operational and implementation research has been too neglected. Additional investments can help to unlock the full potential impact of the tools that are already available.

11.5 CONCLUDING REMARKS

The malaria problem is evolving, dynamic and diverse. The lessons of the past 2 decades show that success in malaria is possible when the world pulls together. They also show that there are enormous data, biological, political, governance, socioeconomic and financial challenges. It is now understood that a one-size-fits-all approach cannot be expected to address the problem in any one country. Compounding the challenges are weak coordination structures that do not always put the national decision-making processes at the core of public health governance. Both within endemic countries and across the broader malaria architecture, we need to take stock of and improve our approaches to responding to malaria.

The GTS principles, agreed by Member States and the wider malaria community, remain as relevant to the future of malaria control and elimination as they have been in the past. WHO promotes the GTS milestones as staging posts that help us to reflect on our past – and plan our future – contributions to the malaria response. The GTS recognizes that there are needs specific to malaria while acknowledging that success is only achievable through strong primary health care. Now that we are at the first milestone in the GTS, we must commit to doing a better job or delivering on its promise through our collective resolve.

References

1. The Abuja Declaration and the plan of action. An extract from the African Summit on Roll Back Malaria, Abuja, 25 April 2000. Geneva: World Health Organization; 2000 (http://whqlibdoc.who.int/hq/2003/WHO_CDS_RBM_2003.46.pdf).
2. Millennium Development Goals [website]. New York City: United Nations (https://www.un.org/millenniumgoals/).
3. Sustainable Development Goals: 17 goals to transform our world [website]. United Nations 2015 (https://www.un.org/sustainabledevelopment/sustainable-development-goals).
4. Global technical strategy for malaria 2016–2030 (last update: 22 January 2016). Geneva: World Health Organization; 2015 (http://apps.who.int/iris/bitstream/10665/176712/1/9789241564991_eng.pdf).
5. Roll Back Malaria Partnership Secretariat. Action and investment to defeat malaria 2016–2030. For a malaria-free world. Geneva: World Health Organization; 2015 (https://endmalaria.org/sites/default/files/RBM_AIM_Report_0.pdf).
6. Declarations and decisions adopted by the Thirty-Third Assembly of Heads of States and Government: Assembly of Heads of State and Government, Thirty-Third Ordinary Session, June. OAU Secretariat; 1997 (https://au.int/sites/default/files/decisions/9542-1997_ahg_dec_120-123_xxxiii_e.pdf).
7. Kidson C. Global malaria challenge: the Amsterdam summit. Southeast Asian J Trop Med Public Health. 1992;23(4):635–40 (https://pubmed.ncbi.nlm.nih.gov/1298069/).
8. Snow RW, Amratia P, Kabaria CW, Noor AM, Marsh K. The changing limits and incidence of malaria in Africa: 1939–2009. Adv Parasitol. 2012;78:169–262 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3521063/).
9. Alonso P, Noor AM. The global fight against malaria is at crossroads. Lancet. 2017;390(10112):2532–4 (https://pubmed.ncbi.nlm.nih.gov/29195688).
10. Trape J-F. The public health impact of chloroquine resistance in Africa. Am J Trop Med Hyg. 2001;64(1-2 Suppl):12–7 (https://pubmed.ncbi.nlm.nih.gov/11425173/).
11. Ministerial Conference on Malaria: report by the Director-General. Geneva: World Health Organization; 1992 (https://apps.who.int/iris/bitstream/handle/10665/171067/EB91_4_eng.pdf).
12. Forty-ninth World Health Assembly: Resolutions and decisions annexes. Geneva: World Health Organization; 1996 (https://apps.who.int/iris/bitstream/handle/10665/178941/WHA49_1996-REC-1_eng.pdf).
13. Accelerated implementation of malaria control. Geneva: Roll Back Malaria, World Health Organization; 2000 (https://apps.who.int/iris/bitstream/handle/10665/66635/WHO_CDS_RBM_2000.27.pdf).
14. Heddini A, Keusch GT, Davies CS. The multilateral initiative on malaria: past, present, and future. Am J Trop Med Hyg. 2004;71:279–82 (https://www.ncbi.nlm.nih.gov/books/NBK3741/pdf/Bookshelf_NBK3741.pdf).
15. Nabarro DN, Tayler EM. The "Roll Back Malaria" campaign. Science. 1998;280(5372):2067–8 (https://pubmed.ncbi.nlm.nih.gov/9669961/).
16. TDR (Special Programme for Research and Training in Tropical Diseases) [website]. Geneva: United Nations Children's Fund, United Nations Development Programme, World Bank, World Health Organization; 2020 (https://www.who.int/tdr/about/en/).
17. Alonso PL, Lindsay SW, Armstrong J, De Francisco A, Shenton F, Greenwood B et al. The effect of insecticide-treated bed nets on mortality of Gambian children. Lancet. 1991;337(8756):1499–502 (https://pubmed.ncbi.nlm.nih.gov/1675368/).
18. Snow R, Lindsay S, Hayes R, Greenwood B. Permethrin-treated bed nets (mosquito nets) prevent malaria in Gambian children. Trans R Soc Trop Med Hyg. 1988;82(6):838–42.
19. White N. Antimalarial drug resistance and combination chemotherapy. Philos Trans R Soc Lond B Biol Sci. 1999;354(1384):739–49 (https://pubmed.ncbi.nlm.nih.gov/10365399/).
20. White N. Delaying antimalarial drug resistance with combination chemotherapy. Parassitologia. 1999;41(1–3):301–8 (https://pubmed.ncbi.nlm.nih.gov/10697872/).
21. Schellenberg JRA, Maokola W, Shirima K, Manzi F, Mrisho M, Mushi A et al. Cluster-randomized study of intermittent preventive treatment for malaria in infants (IPTi) in southern Tanzania: evaluation of impact on survival. Malar J. 2011;10(1):387.
22. Greenwood BM, Greenwood AM, Bradley AK, Snow RW, Byass P, et al. (1988) Comparison of two strategies for control of malaria within a primary health care programme in The Gambia. Lancet. 1: 1121–1127.
23. Steketee RW, Wirima JJ, Hightower AW, Slutsker L, Heymann DL, Breman JG. The effect of malaria and malaria prevention in pregnancy on offspring birthweight, prematurity, and intrauterine growth retardation in rural Malawi. Am J Trop Med Hyg. 1996;55(1_Suppl):33–41.
24. Alonso PL, Sacarlal J, Aponte JJ, Leach A, Macete E, Milman J et al. Efficacy of the RTS,S/AS02A vaccine against *Plasmodium falciparum* infection and disease in young African children: randomised controlled trial. Lancet. 2004;364(9443):1411–20 (https://pubmed.ncbi.nlm.nih.gov/15488216/).
25. INDEPTH Network. http://www.indepth-network.org/about-us
26. Guidelines for the treatment of malaria, third edition. Geneva: World Health Organization; 2015 (https://www.who.int/publications/i/item/9789241549127).
27. Safety of pyrethroid-treated mosquito nets: WHOPES (WHO Pesticide Evaluation Scheme) fact sheet (WHO/CDS/CPE/WHOPES/99.5). Geneva: World Health Organization/Department of Communicable Disease Prevention, Control and Eradication; 1999 (https://www.who.int/whopes/resources/who_cds_cpe_whopes_99.5/en/).
28. Lengeler C. Insecticide-treated bed nets and curtains for preventing malaria. Cochrane Database Sys Rev. 2004;(2):CD000363 (https://www.ncbi.nlm.nih.gov/pubmed/15106149).
29. Chandre F, Darrier F, Manga L, Akogbeto M, Faye O, Mouchet J et al. Status of pyrethroid resistance in Anopheles gambiae sensu lato. Bull World Health Org. 1999;77(3):230 (https://pubmed.ncbi.nlm.nih.gov/10212513/).
30. Sibley CH, Hyde JE, Sims PF, Plowe CV, Kublin JG, Mberu EK et al. Pyrimethamine–sulfadoxine resistance in Plasmodium falciparum: what next? Trends Parasitol. 2001;17(12):570–1 (https://pubmed.ncbi.nlm.nih.gov/11756042/).
31. Developing antimalarials to save lives [website]. Geneva: Medicines for Malaria Venture (https://www.mmv.org/about-us/what-we-do/our-history).
32. G8 Summit [website]. Okinawa, 2000 (http://www.g8.utoronto.ca/summit/2000okinawa/)
33. Gallup JL, Sachs JD. The economic burden of malaria. Am J Trop Med Hyg. 2001;64:85–96 (https://www.ncbi.nlm.nih.gov/books/NBK2624/).
34. MDG 6: combat HIV/AIDS, malaria and other diseases. Geneva: World Health Organization; 2014 (https://www.who.int/topics/millennium_development_goals/diseases/en/).
35. The use of antimalarial drugs: report of a WHO informal consultation. Geneva: World Health Organization; 2000 (https://apps.who.int/iris/bitstream/handle/10665/66961/WHO_CDS_RBM_2001.33.pdf).
36. Global report on antimalarial efficacy and drug resistance: 2000-2010 [website]. Geneva: World Health Organization; 2010 (http://whqlibdoc.who.int/publications/2010/9789241500470_eng.pdf).
37. New perspectives: malaria diagnosis – report of a joint WHO/USAID informal consultation 25–27 October 1999. Geneva: World Health Organization; 2000 (https://apps.who.int/iris/bitstream/handle/10665/66321/WHO_CDS_RBM_2000.14.pdf).
38. Bill & Melinda Gates Foundation: who we are [website]. Seattle: Bill & Melinda Gates Foundation; 2020 (https://www.gatesfoundation.org/Who-We-Are).
39. EDCTP: about us [website]. The Hague: European & Developing Countries Clinical Trials Partnership (EDCTP); 2020 (https://www.edctp.org/get-know-us/#).
40. EDCTP malaria portfolio: large investments in treatment and vaccines [website]. The Hague: European & Developing Countries Clinical Trials Partnership (EDCTP); 2019 (http://www.edctp.org/news/edctp-malaria-portfolio-large-investments-in-treatment-and-vaccine/).
41. FIND – At a glance [website]. Geneva: Foundation for Innovative New Diagnostics (FIND); 2020 (https://www.finddx.org/at-a-glance/).
42. The Global Fund overview [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria (https://www.theglobalfund.org/en/overview/).
43. Bruno J-M, Feacham R, Godal T, Nchinda T, Ogilvie B, Mons B et al. The spirit of Dakar: a call for action on malaria (correspondence). Nature. 1997;386:541 (https://www.nature.com/articles/386541a0.pdf).
44. World malaria report 2005 – UNICEF's role. Geneva: United Nations Children's Fund; 2005 (https://www.unicef.org/media/files/UNICEFinmalaria.pdf).
45. Malaria [website]. Geneva: United Nations Children's Fund; 2020 (https://www.unicef.org/topics/malaria).
46. Scaling up insecticide-treated netting programmes in Africa (2nd edition, Revision 23). Geneva: Roll Back Malaria, World Health Organization; 2005 (https://www.who.int/publications/m/item/scaling-up-insecticide-treated-netting-programmes-in-africa).
47. The Africa malaria report 2003. Geneva: World Health Organization, United Nations Children's Fund; 2003 (https://apps.who.int/iris/bitstream/handle/10665/67869/WHO_CDS_MAL_2003.1093.pdf).
48. World malaria report 2005. Geneva: World Health Organization; 2005 (http://whqlibdoc.who.int/publications/2005/9241593199_eng.pdf).
49. The Global Fund's first replenishment 2006–2007 [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2005 (https://www.theglobalfund.org/media/1489/replenishment_pledges2006and2007_report_en.pdf).
50. World malaria report 2008. Geneva: World Health Organization; 2008 (http://whqlibdoc.who.int/publications/2008/9789241563697_eng.pdf).
51. PMI: About page [website]. U.S. President's Malaria Initiative (PMI) (https://www.pmi.gov/about).
52. PMI. 14th annual report to congress. Washington, DC: U.S. President's Malaria Initiative (PMI); 2020 (https://www.pmi.gov/docs/default-source/default-document-library/pmi-reports/2020-pmi-fourteenth-annual-report.pdf).
53. The Roll Back Malaria strategy for improving access to treatment through home management of malaria. Geneva: World Health Organization; 2005 (http://whqlibdoc.who.int/hq/2005/WHO_HTM_MAL_2005.1101.pdf).
54. Guidelines for the treatment of malaria. Geneva: World Health Organization; 2006 (https://archives.who.int/publications/2006/9241546948_eng.pdf).
55. Malaria indicator surveys [website]. Rockville, MD: RBM Partnership to End Malaria (https://www.malariasurveys.org/).

56. The DHS Program: demographic and health surveys [website]. Washington, DC: United States Agency for International Development (https://dhsprogram.com/).

57. MICS surveys [website]. Geneva: United Nations Children's Fund (https://mics.unicef.org/surveys).

58. About IVCC [website]. Liverpool, United Kingdom: IVCC (https://www.ivcc.com/about/).

59. Market access [website]. Liverpool, United Kingdom: IVCC; 2020 (https://www.ivcc.com/market-access/).

60. Unitaid constitution. Geneva: Unitaid; 2018 (https://unitaid.org/assets/UNITAID-Constitution-revised-version-15-June-2018.pdf).

61. Unitaid's malaria portfolio is expanding to support world elimination targets [website]. Geneva: Unitaid; 2018 (https://unitaid.org/news-blog/unitaids-malaria-portfolio-is-expanding-to-support-world-elimination-targets/#en).

62. Willey BA, Paintain LS, Mangham L, Car J, Schellenberg JA. Strategies for delivering insecticide-treated nets at scale for malaria control: a systematic review. Bull World Health Organ. 2012;90:672–84 (https://www.who.int/bulletin/volumes/90/9/11-094771/en/).

63. Noor AM, Amin AA, Akhwale WS, Snow RW. Increasing coverage and decreasing inequity in insecticide-treated bed net use among rural Kenyan children. PLoS Med. 2007;4(8):e255 (https://pubmed.ncbi.nlm.nih.gov/17713981/).

64. Insecticide-treated mosquito nets: a WHO position statement [website]. Geneva: World Health Organization (http://medi-guide.meditool.cn/ymtpdf/FBACA171-AF95-DCFA-673E-3FA3AFEB79AE.pdf).

65. Bill and Melinda Gates call for new global commitment to chart a course for malaria eradication. Seattle: Bill & Melinda Gates Foundation; 2007 (https://www.gatesfoundation.org/Media-Center/Press-Releases/2007/10/Chart-a-Course-for-Malaria-Eradication).

66. Global Malaria Action Plan for a malaria-free world. Roll Back Malaria Partnership; 2008 (https://www.afro.who.int/sites/default/files/2017-06/Gmapfull.pdf).

67. Malaria [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria (https://www.theglobalfund.org/en/malaria/).

68. Talisuna AO, Adibaku S, Amojah CN, Amofah GK, Aubyn V, Dodoo A et al. The affordable medicines facility-malaria – a success in peril. Malar J. 2012;11(1):370 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3506461/pdf/1475-2875-11-370.pdf).

69. AMFm Independent Evaluation Team. Independent Evaluation of Phase 1 of the Affordable Medicines Facility - malaria (AMFm), Multi-country independent evaluation report: final report. Calverton, Maryland and London: ICF International and London School of Hygiene and Tropical Medicine; 2012.

70. Independent evaluation of the affordable medicines facility – malaria (AMFm) Phase 1. Calverton, Maryland and London: International Classification of Functioning, Disability and Health (ICF) & London School of Hygiene and Tropical Medicine; 2012 (https://www.theglobalfund.org/media/3011/terg_evaluation2013-2014thematicreviewamfm2012iephase1_report_en.pdf).

71. Gamboa D, Ho MF, Bendezu J, Torres K, Chiodini PL, Barnwell JW et al. A large proportion of *P. falciparum* isolates in the Amazon region of Peru lack pfhrp2 and pfhrp3: implications for malaria rapid diagnostic tests. PLoS One. 2010;5(1):e8091 (https://www.ncbi.nlm.nih.gov/pubmed/20111602).

72. About ALMA [website]. African Leaders Malaria Alliance (ALMA); 2020 (https://alma2030.org/about-alma/).

73. Intermittent preventive treatment for infants using sulfadoxine-pyrimethamine (SP-IPTi) for malaria control in Africa: implementation field guide. Geneva: World Health Organization; 2011 (http://whqlibdoc.who.int/hq/2011/WHO_IVB_11.07_eng.pdf).

74. Rao M. The International Centers of Excellence for Malaria Research. Am J Trop Med Hyg. 2015;93(3 Supple):1–4 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4574268/).

75. World malaria report 2011. Geneva: World Health Organization; 2011 (http://apps.who.int/iris/bitstream/10665/44792/2/9789241564403_eng_full.pdf).

76. Malaria Policy Advisory Committee [website]. Geneva: World Health Organization (https://www.who.int/groups/malaria-policy-advisory-committee).

77. World malaria report 2019. Geneva: World Health Organization; 2019 (https://www.who.int/publications/i/item/9789241565721).

78. Dondorp AM, Yeung S, White L, Nguon C, Day NP, Socheat D et al. Artemisinin resistance: current status and scenarios for containment. Nat Rev Microbiol. 2010;8(4):272–80 (https://pubmed.ncbi.nlm.nih.gov/20208550/).

79. Global Plan for Artemisinin Resistance Containment (GPARC). Geneva: Roll Back Malaria, World Health Organization; 2011 (https://apps.who.int/iris/bitstream/handle/10665/44482/9789241500838_eng.pdf).

80. Countries of the Greater Mekong zero in on falciparum malaria [website]. Geneva: World Health Organization; 2019 (https://www.who.int/malaria/areas/greater_mekong/en/).

81. Focus on Regional Artemisinin-resistance Initiative (RAI). Geneva: The Global Fund to Fight AIDS, Tuberculosis and Malaria; 2019 (https://www.theglobalfund.org/media/6509/publication_regionalartemisininresistanceinitiative_focuson_en.pdf).

82. The Global Fund Strategy 2012–2016: investing for impact. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2011 (https://www.theglobalfund.org/media/1179/core_globalfundstrategy2012-2016_strategy_en.pdf).

83. Board approves integration of AMFm into core global fund grant processes. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2012 (https://www.theglobalfund.org/en/news/2012-11-15-board-approves-integration-of-amfm-into-core-global-fund-grant-processes/).

84. Seasonal malaria chemoprevention (SMC) [website]. Geneva: World Health Organization; 2017 (https://www.who.int/teams/global-malaria-programme/prevention/preventive-chemotherapies).

85. Unitaid. The project [website]. 2018 (https://www.access-smc.org/pages/access-smc/context).

86. Overview: funding model [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; (https://www.theglobalfund.org/en/funding-model/).

87. PMI. Seasonal malaria chemoprevention. Washington, DC: U.S. President's Malaria Initiative (PMI); 2020 (https://www.pmi.gov/how-we-work/technical-areas/seasonal-malaria-chemoprevention).

88. Global plan for insecticide resistance management in malaria vectors [website]. Geneva: World Health Organization; 2012 (https://www.who.int/iris/bitstream/10665/44846/1/9789241564472_eng.pdf).

89. Faulde MK, Rueda LM, Khaireh BA. First record of the Asian malaria vector *Anopheles stephensi* and its possible role in the resurgence of malaria in Djibouti, Horn of Africa. Acta Trop. 2014;139:39–43.

90. Ashine T, Teka H, Esayas E, Messenger LA, Chali W, Meerstein-Kessel L et al. *Anopheles stephensi* as an emerging malaria vector in the Horn of Africa with high susceptibility to Ethiopian *Plasmodium vivax* and *Plasmodium falciparum* isolates. bioRxiv. 2020.

91. malERA – A research agenda for malaria eradication [website]. San Francisco: PLOS (https://collections.plos.org/malera).

92. Malaria elimination [website]. The Lancet; 2010 (https://www.thelancet.com/malaria-elimination).

93. Bhatt S, Weiss DJ, Cameron E, Bisanzio D, Mappin B, Dalrymple U et al. The effect of malaria control on *Plasmodium falciparum* in Africa between 2000 and 2015. Nature. 2015;526(7572):207–11 (https://pubmed.ncbi.nlm.nih.gov/26375008).

94. Hay SI, Guerra CA, Gething PW, Patil AP, Tatem AJ, Noor AM et al. A world malaria map: *Plasmodium falciparum* endemicity in 2007. PLoS Med. 2009;6(3):e1000048 (https://pubmed.ncbi.nlm.nih.gov/19323591/).

95. Noor AM, Kinyoki DK, Mundia CW, Kabaria CW, Mutua JW, Alegana VA et al. The changing risk of *Plasmodium falciparum* malaria infection in Africa: 2000–10: a spatial and temporal analysis of transmission intensity. Lancet. 2014;383(9930):1739–47 (https://pubmed.ncbi.nlm.nih.gov/24559537/).

96. Snow RW, Sartorius B, Kyalo D, Maina J, Amratia P, Mundia CW et al. The prevalence of *Plasmodium falciparum* in sub-Saharan Africa since 1900. Nature. 2017;550(7677):515–8 (https://pubmed.ncbi.nlm.nih.gov/29019978/).

97. World malaria report 2015. Geneva: World Health Organization; 2015 (http://apps.who.int/iris/bitstream/10665/200018/1/9789241565158_eng.pdf).

98. Sustainable Development Goals: the 17 goals [website]. New York City: United Nations, Department of Economic and Social Affairs – Sustainable Development; (https://sdgs.un.org/goals).

99. Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development. New York City: United Nations; 2020 (https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202020%20review_Eng.pdf).

100. Malaria threats map [website]. Geneva: World Health Organization (https://apps.who.int/malaria/maps/threats/).

101. Strategy for malaria elimination in the Greater Mekong subregion: 2015–2030. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/handle/10665/208203).

102. RBM Partnership. RBM Partnership to End Malaria overview [website]. 2020 (https://endmalaria.org/about-us/overview).

103. The Global Fund Strategy 2017–2022: investing to end epidemics. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2016 (https://www.theglobalfund.org/en/strategy/).

104. Policy Cures Research: G-FINDER data portal [website]. Sydney, Australia: Policy Cures Research (https://gfinderdata.policycuresresearch.org).

105. Eliminating malaria: 21 countries, a common goal [website]. Geneva: World Health Organization (https://www.who.int/teams/global-malaria-programme/elimination/e-2020-initiative-of-malaria-eliminating-countries).

106. Ministerial Declaration on Accelerating and Sustaining Malaria Elimination in the South-East Asia Region [website]. New Delhi: WHO South-East Asia Region; 2017 (http://origin.searo.who.int/entity/malaria/sea_declaration_malaria_elimination.pdf).

107. World malaria report 2017. Geneva: World Health Organization; 2017 (https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2017).

108. High burden to high impact: a targeted malaria response. Geneva: World Health Organization; 2019 (http://apps.who.int/iris/bitstream/handle/10665/275868/WHO-CDS-GMP-2018.25-eng.pdf).

109. Compendium of WHO malaria guidance – prevention, diagnosis, treatment, surveillance and elimination. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/handle/10665/312082/WHO-CDS-GMP-2019.03-eng.pdf).

110. WHO technical brief for countries preparing malaria funding requests for the Global Fund (2020–2022). Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/9789240004139).

111. Sixth Global Fund's Replenishment Conference [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2019 (https://www.theglobalfund.org/en/specials/2019-10-09-global-fund-sixth-replenishment-conference/).

112. The use of artesunate-pyronaridine for the treatment of uncomplicated malaria. Geneva: World Health Organization; 2019 (https://www.who.int/publications/i/item/use-of-artesunate-pyronaridine-for-the-treatment-of-uncomplicated-malaria).

113. Malaria eradication: benefits, future scenarios and feasibility. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/malaria-eradication-benefits-future-scenarios-feasibility).

114. Astana Declaration on Primary Health Care. Geneva: World Health Organization; 2018 (https://www.who.int/teams/primary-health-care/conference/declaration).

115. Report overview and technical briefs [website]. The Lancet Commission on Malaria Eradication (http://malariaeradicationcommission.com/report/report-overview-and-technical-briefs).

116. Universal health coverage: moving together to build a healthier world – UN high-level meeting on universal health coverage, 23 September 2019, New York [website]. New York City: United Nations (https://www.un.org/pga/73/event/universal-health-coverage/).

117. The potential impact of health service disruptions on the burden of malaria. A modelling analysis for countries in sub-Saharan Africa. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/the-potential-impact-of-health-service-disruptions-on-the-burden-of-malaria).

118. Guyatt HL, Snow RW. Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. Clin Microbiol Rev. 2004;17(4):760–9 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC523568/).

119. Guyatt HL, Snow RW. Malaria in pregnancy as an indirect cause of infant mortality in sub-Saharan Africa. Trans R Soc Trop Med Hyg. 2001;95(6):569–76 (https://academic.oup.com/trstmh/article-abstract/95/6/569/1905057?redirectedFrom=fulltext).

120. Malaria in pregnant women [website]. Geneva: World Health Organization; 2017 (https://www.who.int/malaria/areas/high_risk_groups/pregnancy/en/).

121. Walker PG, ter Kuile FO, Garske T, Menendez C, Ghani AC. Estimated risk of placental infection and low birthweight attributable to Plasmodium falciparum malaria in Africa in 2010: a modelling study. Lancet Glob Health. 2014;2(8):e460–e7 (https://pubmed.ncbi.nlm.nih.gov/25103519).

122. Walker PG, Griffin JT, Cairns M, Rogerson SJ, Van Eijk AM, Ter Kuile F et al. A model of parity-dependent immunity to placental malaria. Nat Commun. 2013;4(1):1–11 (https://www.nature.com/articles/ncomms2605).

123. Total fertility rate (live births per woman) [website]. United Nations Statistics Division (http://data.un.org/Data.aspx?d=PopDiv&f=variableID%3A54).

124. Global call to boost access to lifesaving malaria treatment for pregnant women in Africa. Geneva: RBM Partnership to End Malaria; 2020 (https://endmalaria.org/news/global-call-boost-access-lifesaving-malaria-treatment-pregnant-women-africa).

125. Zero Malaria Starts with Me [website]. RBM Partnership to End Malaria and the African Union Commission (https://zeromalaria.africa/).

126. Funding model: allocation [website]. Global Fund to Fight AIDS, Tuberculosis and Malaria; 2019 (https://www.theglobalfund.org/en/funding-model/before-applying/allocation/).

127. Mass action for a malaria free Uganda – handbook for leaders. Government of Uganda; 2020 (https://www.afro.who.int/publications/mass-action-malaria-free-uganda-handbook-leaders).

128. Improving WHO's malaria policy-making and dissemination processes. Geneva: World Health Organization; 2020 (https://www.who.int/teams/global-malaria-programme/policy-making-process).

129. Meeting report of the WHO Evidence Review Group on malaria burden estimation methods [website]. Geneva: World Health Organization; 2018 (https://www.who.int/publications/m/item/WHO-CDS-GMP-MPAC-2018.10).

130. Statistics on international development: final UK aid spend 2019. United Kingdom: Foreign, Commonwealth & Development Office; 2019 (https://www.gov.uk/government/statistics/statistics-on-international-development-final-uk-aid-spend-2019).

131. Malaria Atlas Project [website]. (https://malariaatlas.org).

132. False-negative RDT results and implications of new reports of P. falciparum histidine-rich protein 2/3 gene deletions. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/10665/258972/1/WHO-HTM-GMP-2017.18-eng.pdf).

133. Thomson R, Parr JB, Cheng Q, Chenet S, Perkins M, Cunningham J. Prevalence of *Plasmodium falciparum* lacking histidine-rich proteins 2 and 3: a systematic review. Bull World Health Organ. 2020;98(8):558 (http://dx.doi.org/10.2471/BLT.20.250621).

134. Template protocol for therapeutic efficacy studies. Geneva: World Health Organization; 2019 (https://www.who.int/teams/global-malaria-programme/case-management/drug-efficacy-and-resistance/tools-for-monitoring-antimalarial-drug-efficacy).

135. Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization; 2018 (http://apps.who.int/iris/bitstream/handle/10665/272284/9789241565578-eng.pdf).

136. Insecticide resistance [website]. Geneva: World Health Organization; 2020 (https://www.who.int/teams/global-malaria-programme/prevention/insecticide-resistance).

137. Test procedures for insecticide resistance monitoring in malaria vector mosquitoes (second edition). Geneva: World Health Organization; 2018 (http://apps.who.int/iris/bitstream/10665/250677/1/9789241511575-eng.pdf).

138. Insecticide resistance in malaria vectors [website]. Geneva: World Health Organization (https://www.who.int/teams/global-malaria-programme/prevention/insecticide-resistance/insecticide-resistance-in-malaria-vectors).

139. DHIS2-based entomology and vector control data collection and collation tools [website]. Geneva: World Health Organization; 2020 (https://www.who.int/teams/global-malaria-programme/prevention/vector-control/dhis-data-collection-and-collation-tools).

140. Framework for a national plan for monitoring and management of insecticide resistance in malaria vectors. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/254916/9789241512138-eng.pdf)

141. Timeline: WHO's COVID-19 response [website]. Geneva: World Health Organization; (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#event-5).

142. International Health Regulations (2005). Geneva: World Health Organization; 2014 (https://www.who.int/publications/i/item/9789241580496).

143. Coronavirus disease (COVID-19) dashboard [website]. Geneva: World Health Organization; 2020 (https://covid19.who.int/).

144. Q&As on COVID-19 and related health topics [website]. Geneva: World Health Organization; 2020 (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub).

145. Massinga Loembe M, Tshangela A, Salyer SJ, Varma JK, Ouma AEO, Nkengasong JN. COVID-19 in Africa: the spread and response. Nat. Med. 2020;26(7):999–1003 (https://pubmed.ncbi.nlm.nih.gov/32528154/).

146. COVID-19: examining theories for Africa's low death rates [website]. Australia: The Conversation; (https://theconversation.com/covid-19-examining-theories-for-africas-low-death-rates-147393).

147. WHO urges countries to ensure the continuity of malaria services in the context of the COVID-19 pandemic [website]. Geneva: World Health Organization; 2020 (https://www.who.int/news/item/25-03-2020-who-urges-countries-to-ensure-the-continuity-of-malaria-services-in-the-context-of-the-covid-19-pandemic).

148. Tailoring malaria interventions in the COVID-19 response. Geneva: World Health Organization; 2020 (https://www.who.int/docs/default-source/documents/publications/gmp/tailoring-malaria-interventions-covid-19.pdf).

149. COVID-19 response mechanism [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria (https://www.theglobalfund.org/en/covid-19/response-mechanism/).

150. Country/Regional Support Partner Committee (CRSPC) [website]. United Nations Office for Project Services, RBM Partnership to End Malaria (https://endmalaria.org/about-us-governance-partner-committees/countryregional-support-partner-committee-crspc).

151. Monitoring and evaluation [website]. RBM Partnership to End Malaria; 2020 (https://endmalaria.org/our-work-working-groups/monitoring-and-evaluation).

152. Pulse survey on continuity of essential health services during the COVID-19 pandemic: interim report, 27 August 2020 [website]. World Health Organization; 2020 (https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS_continuity-survey-2020.1).

153. Data updates [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria; 2020 (https://www.theglobalfund.org/en/updates/data/).

154. World population prospects [website]. New York City: United Nations; 2020 (https://population.un.org/wpp/).

155. GDP per capita (current US%) [website]. Washington DC: World Bank; 2020 (https://data.worldbank.org/indicator/NY.GDP.PCAP.CD).

156. Poverty [website]. Washington DC: World Bank; 2020 (https://data.worldbank.org/topic/11).

157. Access to electricity, rural (% of rural population) [website]. Washington DC: World Bank; 2020 (https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS).

158. Mobile cellular subscriptions (per 100 people) [website]. Washington DC: World Bank; 2020 (https://data.worldbank.org/indicator/IT.CEL.SETS.P2).

159. Human development index (HDI) [website]. Geneva: United Nations Development Programme (UNDP); 2020 (http://www.hdr.undp.org/en/content/human-development-index-hdi).

160. WHO guide to identifying the economic consequences of disease and injury. Geneva: World Health Organization; 2009 (https://www.who.int/choice/publications/d_economic_impact_guide.pdf).

161. Current health expenditure (% of GDP) [website]. Washington DC: World Bank; 2020 (https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS).

162. Kaufmann D, Kraay A, Mastruzzi M. The worldwide governance indicators: methodology and analytical issues: World Bank Policy Research Working Paper No. 5430. Washington, DC: The World Bank; 2010 (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130).

163. The Global Health Observatory: UHC service coverage index [website]. Geneva: World Health Organization; 2020 (https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4834).

164. Hogan D, Hosseinpoor, AR, Boerma T. Technical note: developing an index for the coverage of essential health services. Geneva: World Health Organization; 2005 (https://www.who.int/healthinfo/universal_health_coverage/UHC_WHS2016_TechnicalNote_May2016.pdf).

165. Snow R, Winstanley M, Marsh V, Newton C, Waruiru C, Mwangi I et al. Childhood deaths in Africa: uses and limitations of verbal autopsies. Lancet. 1992;340(8815):351–5.

166. Information Bulletin Africa: Floods. Geneva: International Federation of the Red Cross; 2020 (https://reliefweb.int/sites/reliefweb.int/files/resources/IB%20Africa%20Region_Floods.pdf).

167. West and Central Africa: Weekly regional humanitarian snapshot [website]. United Nations Office for the Coordination of Humanitarian Affairs (OCHA); 2020 (https://reliefweb.int/sites/reliefweb.int/files/resources/External%20Weekly%2011-17%20August%202020.pdf).

168. Africa under water: heightened "mega" crises [website]. United Nations Office for the Coordination of Humanitarian Affairs (OCHA); 2020 (https://unocha.exposure.co/africa-under-water-heightened-mega-crises).

169. West Africa – floods hit Burkina Faso and Northern Ghana [website]. Floodlist; 2020 (http://floodlist.com/africa/west-africa-burkinafaso-ghana-september-2020).

170. UCDP dataset download center [website]. Uppsala: Uppsala Conflict Data Program; 2020 (https://ucdp.uu.se/downloads/).

171. Global economic prospects [website]. Washington DC: World Bank; 2020 (https://www.worldbank.org/en/publication/global-economic-prospects).

172. A UN framework for the immediate socio-economic response to COVID-19. Geneva: United Nations; 2020 (https://unsdg.un.org/resources/un-framework-immediate-socio-economic-response-covid-19).

173. Talisuna A, Yoti Z, Lee C, et al. The urgent need for a global commitment to protect healthcare workers. BMJ Global Health 2020;5:e004077. doi:10.1136/ bmjgh-2020-004077

174. ACT Accelerator: an economic investment case & financing requirements [website]. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/an-economic-investment-case-financing-requirements).

Annexes

Annex 1 - Data sources and methods

Annex 2 - Regional profiles

- A. WHO African Region
  - a. West Africa
  - b. Central Africa
  - c. Countries with high transmission in East and Southern Africa
  - d. Countries with low transmission in East and Southern Africa
- B. WHO Region of the Americas
- C. WHO Eastern Mediterranean Region
- D. WHO South-East Asia Region
- E. WHO Western Pacific Region

Annex 3 - Data tables

- A. Policy adoption, 2019
- B. Antimalarial drug policy, 2019
- C. Funding for malaria control, 2017–2019
- D. Commodities distribution and coverage, 2017–2019
- Ea. Household survey results, 2015–2019, compiled through STATcompiler
- Eb. Household survey results, 2015–2019, compiled through WHO calculations
- F. Population denominator for case incidence and mortality rate, and estimated malaria cases and deaths, 2000–2019
- G. Population denominator for case incidence and mortality rate, and reported malaria cases by place of care, 2019
- H. Reported malaria cases by method of confirmation, 2010–2019
- I. Reported malaria cases by species, 2010–2019
- J. Reported malaria deaths, 2010–2019

Annex 1 – Data sources and methods

Table 2.1. GTS: global targets for 2030 and milestones for 2020 and 2025

Targets and milestones are as described in the *Global technical strategy for malaria 2016–2030* (GTS) (*1*) and *Action and investment to defeat malaria 2016–2030* (AIM) (*2*).

Fig. 2.1. Key milestones in the fight against malaria in the past 2 decades

An overview presentation of key milestones over the past 2 decades in the fight against malaria. Information was obtained from published and grey literature. Relevant original information sources are provided in the reference list.

Fig. 3.1. Countries with indigenous cases in 2000 and their status by 2019

Data on the number of indigenous cases (an indicator of whether countries are endemic for malaria) were as reported to the World Health Organization (WHO) by national malaria programmes (NMPs). Countries with 3 consecutive years of zero indigenous cases are considered to have eliminated malaria.

Table 3.1. Global estimated malaria cases and deaths, 2000–2019

a) Global estimated malaria cases

The number of malaria cases was estimated by one of the two methods described below.

Method 1

Method 1 was used for countries and areas outside Africa, and for low-transmission countries and areas in Africa: Afghanistan, Bangladesh, Bolivia (Plurinational State of), Botswana, Brazil, Cambodia, Colombia, Dominican Republic, Eritrea, Ethiopia, French Guiana, Gambia, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Lao People's Democratic Republic, Madagascar, Mauritania, Myanmar, Namibia, Nepal, Nicaragua, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Rwanda, Senegal, Solomon Islands, Timor-Leste, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen and Zimbabwe.

Estimates were made by adjusting the number of reported malaria cases for completeness of reporting, the likelihood that cases were parasite positive, and the extent of health service use. The procedure, which is described in the *World malaria report 2008* (*3*), combines data reported by NMPs (i.e. reported cases, reporting completeness and likelihood that cases are parasite positive) with data obtained from nationally representative household surveys on health service use. Briefly:

$T = (a + (c \times e))/d \times (1+f/g+(1-g-f)/2/g)$

where:

a is malaria cases confirmed in public sector

b is suspected cases tested

c is presumed cases (not tested but treated as malaria)

d is reporting completeness

e is test positivity rate (malaria positive fraction) = a/b

f is fraction seeking treatment in private sector

g is fraction seeking treatment in public sector

No treatment seeking factor: (1-*g*-*f*)

Cases in public sector: $(a + (c \times e))/d$

Cases in private sector: $(a + (c \times e))/d \times f/g$

To estimate the uncertainty around the number of cases, the *test positivity rate* was assumed to have a normal distribution centred on the test positivity rate value and standard deviation – defined as $0.244 \times f^{0.5547}$, and truncated to be in the range 0, 1. *Reporting completeness* (*d*), when reported as a range or below 80%, was assumed to have one of three distributions, depending on the value reported by the NMP. If the value was greater than 80%, the distribution was assumed to be triangular, with limits of 0.8 and 1.0, and the peak at 0.8. If the value was greater than 50% but less than 80%, the distribution was assumed to be rectangular, with limits of 0.5 and 0.8. Finally, if the value was lower than 50%, the distribution was assumed to be triangular, with limits of 0 and 0.5, and the peak at 0.5 (*4*). If the reporting completeness was reported as a value and was greater than 80%, a beta distribution was assumed with a mean value of the reported value (maximum of 95%) and confidence intervals (CIs) of 5% around the mean value. The fraction of children brought for care in the public sector and in the private sector was assumed to have a beta distribution, with the mean value being the estimated value in the survey and the standard deviation calculated from the range of the estimated 95% CIs. The fraction of children not brought for care was assumed to have a rectangular distribution, with the lower limit being 0 and the upper limit calculated as 1 minus the proportion that were brought for care in the public and private sectors. The three distributions (fraction seeking treatment in public sector, fraction seeking treatment in private sector only and fraction not seeking treatment) were constrained to add up to 1.

Values for the fractions seeking care were linearly interpolated between the years that had a survey, and were extrapolated for the years before the first or after the last survey. Missing values for the distributions were imputed in a similar way or, if there was no value for any year in the country or area, were imputed as a mixture of the distribution of the region for that year. CIs were obtained from 10 000 draws of the convoluted distributions. The data were analysed using R statistical software (*5*).

For India, the values were obtained at subnational level using the same methodology, but adjusting the private sector for an additional factor because of the active case detection, estimated as the ratio of the test positivity rate in active case detection over the test positivity rate for passive case detection. This factor was assumed to have a normal distribution, with mean value and standard deviation calculated from the values reported in 2010.

No adjustment for private sector treatment seeking was made for the following countries and areas, because they report cases from the private and public sector together: Bangladesh, Bolivia (Plurinational State of), Botswana, Brazil, Colombia, Dominican Republic, French Guiana, Guatemala, Guyana, Haiti, Honduras, Myanmar (since 2013), Nicaragua, Panama, Peru, Rwanda, Senegal (70% of private sector reported together with public sector in 2018) and Venezuela (Bolivarian Republic of).

Method 2

Method 2 was used for high-transmission countries in Africa and for countries in the WHO Eastern Mediterranean Region in which the quality of surveillance data did not permit a robust estimate from the number of reported cases: Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Malawi, Mali, Mozambique, Niger, Nigeria, Sierra Leone, Somalia, South Sudan, Sudan, Togo, Uganda, United Republic of Tanzania and Zambia. In this method, estimates of the number of malaria cases were derived from information on parasite prevalence obtained from household surveys.

First, data on parasite prevalence from nearly 60 000 survey records were assembled within a spatio-temporal Bayesian geostatistical model, along with environmental and sociodemographic covariates, and data distribution on interventions such as insecticide-treated mosquito nets (ITNs), antimalarial drugs and indoor residual spraying (IRS) (*6*). The geospatial model enabled predictions of *Plasmodium falciparum* prevalence in children aged 2–10 years, at a resolution of 5 × 5 km^2, throughout all malaria endemic African countries for each year from 2000 to 2019. Second, an ensemble model was developed to predict malaria incidence as a function of parasite prevalence (*7*). The model was then applied to the estimated parasite prevalence in order to obtain estimates of the malaria case incidence at 5 × 5 km^2 resolution for each year from 2000 to 2019.[1] Data for each 5 × 5 km^2 area were then aggregated within country and regional boundaries, to obtain both national and regional estimates of malaria cases (*9*).

Other methods

For most of the elimination countries and countries at the stage of prevention of reintroduction, the number of indigenous cases registered by NMPs are reported without further adjustments. The countries in this category were Algeria, Argentina, Armenia, Azerbaijan, Belize, Bhutan, Cabo Verde, China, Comoros, Costa Rica, Democratic People's Republic of Korea, Djibouti, Ecuador, Egypt, El Salvador, Eswatini, Georgia, Iran (Islamic Republic of), Iraq, Kazakhstan, Kyrgyzstan, Malaysia, Mexico, Morocco, Oman, Paraguay, Republic of Korea, Sao Tome and Principe, Saudi Arabia, South Africa, Sri Lanka, Suriname, Syrian Arab Republic, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates and Uzbekistan.

For some years, information was not available or was not of sufficient quality to be used. For those countries, the number of cases was imputed from other years where the quality of the data was better, adjusting for population growth, as follows: for Afghanistan, values for 2000 and 2001 were imputed from 2002–2003; and for Bangladesh, values for 2001–2005 were imputed from 2006–2008. For Ethiopia, the values for 2000–2019 were taken from a mixed distribution between values from Method 1 and Method 2 (50% from each method). For Gambia, values for 2000–2010 were imputed from 2011–2013; for Haiti, values for 2000–2005, 2009 and 2010 were imputed from 2006–2008; for Indonesia, values for 2000–2003 and 2007–2009 were imputed from 2004–2006; for Mauritania, values for 2000–2010 were imputed from a mixture of Method 1 and Method 2, starting with 100% values from Method 2 for 2001 and 2002, and increasing to 90% values from Method 1 in 2010. For Myanmar, values for 2000–2005 were imputed from 2007–2009; for Namibia, values for 2000 were imputed from 2001–2003, and for 2012 from 2011 and 2013. For Pakistan, values for 2000 were imputed from 2001–2003; for Papua New Guinea, values for 2012 were imputed from 2009–2011. For Rwanda, values for 2000–2006 were imputed from a mixture of Method 1 and Method 2, starting with 100% values from Method 2 in 2000, with that percentage decreasing to 10% in 2006. For Senegal, values for 2000–2006 were imputed from a mixture of Method 1 and Method 2, with 90% of Method 2 in 2000, decreasing to 10% of Method 2 in 2006. For Thailand, values for 2000 were imputed from 2001–2003; for Timor-Leste, values for 2000–2001 were imputed from 2002–2004; and for Zimbabwe, values for 2000–2006 were imputed from 2007–2009. For Burkina Faso, Mali and Niger, values for 2000–2019 were imputed from the estimated series in the *World malaria report 2019* (*10*). For Côte d'Ivoire and Uganda, values were obtained from a combination of the values from the *World malaria report 2019* (*10*) and the current series, extrapolated as the trend from the most

[1] See the Malaria Atlas Project website for methods on the development of maps (*8*).

recent years for the 2019 estimation for Côte d'Ivoire and from the last incidence value for Uganda.

The number of malaria cases caused by *P. vivax* in each country was estimated by multiplying the country's reported proportion of *P. vivax* cases (computed as 1 – *P. falciparum*) by the total number of estimated cases for the country. For countries where the estimated proportion was not 0 or 1, the proportion of *P. falciparum* cases was assumed to have a beta distribution and was estimated from the proportion of *P. falciparum* cases reported by NMPs.

To transform malaria cases into incidence, an estimate of population at risk was used. The proportion of the population at high, low or no risk of malaria was provided by NMPs. This was applied to United Nations (UN) population estimates, to compute the number of people at risk of malaria.

b) Global estimated malaria deaths

Numbers of malaria deaths were estimated using methods from Category 1, 2 or 3, as outlined below.

Category 1 method

The Category 1 method was used for low-transmission countries and areas, both within and outside Africa: Afghanistan, Bangladesh, Bolivia (Plurinational State of), Botswana, Cambodia, Comoros, Djibouti, Eritrea, Eswatini, Ethiopia, French Guiana, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Lao People's Democratic Republic, Madagascar, Myanmar, Namibia, Nepal, Pakistan, Papua New Guinea, Peru, Philippines, Solomon Islands, Somalia, Sudan, Timor-Leste, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen and Zimbabwe. A case fatality rate of 0.256% was applied to the estimated number of *P. falciparum* cases, which represents the average of case fatality rates reported in the literature (*11-13*) and rates from unpublished data from Indonesia, 2004–2009.[1] The proportion of deaths then follows a categorical distribution of 0.01%, 0.19%, 0.30%, 0.38% and 0.40%, each one with equal probability.

A case fatality rate of 0.0375% was applied to the estimated number of *P. vivax* cases, representing the midpoint of the range of case fatality rates reported in a study by Douglas et al. (*14*), following a rectangular distribution between 0.012% and 0.063%. Following the nonlinear association explained for the Category 2 method below, the proportion of deaths in children aged under 5 years was estimated as:

$$\text{Proportion of deaths}_{\text{under 5}} = -0.2288 \times \text{Mortality}_{\text{overall}}^2 + 0.823 \times \text{Mortality}_{\text{overall}} + 0.2239$$

where $\text{Mortality}_{\text{overall}}$ is the number of estimated deaths over the estimated population at risk per 1000 (see **Annex 3.F** for national estimates of population at risk).

Category 2 method

The Category 2 method was used for countries in Africa with a high proportion of deaths due to malaria: Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Malawi, Mali, Mauritania, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Sudan, Togo, Uganda, United Republic of Tanzania and Zambia.

In this method, child malaria deaths were estimated using a verbal autopsy multicause model that was developed by the WHO Maternal and Child Health Epidemiology Estimation Group (MCEE) to estimate causes of death in children aged 1–59 months (*15*). Mortality estimates (and 95% CI) were derived for seven causes of post-neonatal death (pneumonia, diarrhoea, malaria, meningitis, injuries, pertussis and other disorders), four causes arising in the neonatal period (prematurity, birth asphyxia and trauma, sepsis, and other conditions of the neonate), and other causes (e.g. malnutrition). Deaths due to measles, unknown causes and HIV/AIDS were estimated separately. The resulting cause-specific estimates were adjusted, country by country, to fit the estimated mortality envelope of 1–59 months (excluding HIV/AIDS and measles deaths) for corresponding years. Estimated prevalence of malaria parasites (see methods notes for **Table 3.1**) was used as a covariate within the model. It was assumed that the number of deaths follows a rectangular distribution, with limits being the estimated 95% CI. The malaria mortality rate in children aged under 5 years estimated with this method was then used to infer malaria-specific mortality in those aged over 5 years, using the relationship between levels of malaria mortality in a series of age groups and the intensity of malaria transmission (*16*), and assuming a nonlinear association between under-5-years mortality and over-5-years mortality, as follows:

$$\text{Proportion of deaths}_{\text{over 5}} = -0.293 \times \text{Mortality}_{\text{under 5}}^2 + 0.8918 \times \text{Mortality}_{\text{under 5}} + 0.2896$$

where $\text{Mortality}_{\text{under 5}}$ is estimated from the number of deaths from the MCEE model over the population at risk per 1000.

Category 3 method

For the Category 3 method, the number of indigenous malaria deaths registered by NMPs is reported without further adjustments. This category is used in the following countries: Algeria, Argentina, Armenia, Azerbaijan, Belize, Bhutan, Brazil, Cabo Verde, China, Colombia, Costa Rica, Democratic People's Republic of Korea, Dominican Republic, Ecuador, Egypt, El Salvador, Georgia, Iran (Islamic Republic of), Iraq, Kazakhstan, Kyrgyzstan, Malaysia, Mexico, Morocco, Nicaragua, Oman, Panama, Paraguay, Republic of Korea, Sao Tome and Principe, Saudi Arabia, South Africa, Sri Lanka, Suriname, Syrian Arab Republic, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates and Uzbekistan.

[1] Dr Ric Price, Menzies School of Health Research, Australia, personal communication (November 2014).

Fig. 3.2. Global trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019, c) distribution of malaria cases and d) deaths by country, 2019

See methods notes for **Table 3.1**.

Table 3.2. Estimated malaria cases and deaths in the WHO African Region, 2000–2019

See methods notes for **Table 3.1**.

Fig. 3.3. Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO African Region, 2019

See methods notes for **Table 3.1**.

Table 3.3. Estimated malaria cases and deaths in the WHO South-East Asia Region, 2000–2019

See methods notes for **Table 3.1**.

Fig. 3.4. Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO South-East Asia Region, 2019

See methods notes for **Table 3.1**.

Table 3.4. Estimated malaria cases and deaths in the WHO Eastern Mediterranean Region, 2000–2019

See methods notes for **Table 3.1**.

Fig. 3.5. Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Eastern Mediterranean Region, 2019

See methods notes for **Table 3.1**.

Table 3.5. Estimated malaria cases and deaths in the WHO Western Pacific Region, 2000–2019

See methods notes for **Table 3.1**.

Fig. 3.6. Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Western Pacific Region, 2019

See methods notes for **Table 3.1**.

Table 3.6. Estimated malaria cases and deaths in the WHO Region of the Americas, 2000–2019

See methods notes for **Table 3.1**.

Fig. 3.7. Trends in a) malaria case incidence rate (cases per 1000 population at risk), b) mortality rate (deaths per 100 000 population at risk), 2000–2019 and c) malaria cases by country in the WHO Region of the Americas, 2019

See methods notes for **Table 3.1**.

Fig. 3.8. Cumulative number of cases and deaths averted globally and by WHO region, 2000–2019

See methods for information on estimation of cases and deaths. Estimated cases and deaths averted were computed by comparing current estimates for each year since 2000 with estimates computed by holding the 2000 case incidence and mortality rates constant throughout the period 2000–2019.

Fig. 3.9. Percentage of a) cases and b) deaths averted by WHO region, 2000–2019

See methods for information on estimation of cases and deaths. See **Fig. 3.8** for methods to estimate cases and deaths averted. The percentage of cases and deaths averted was estimated using overall global cases and deaths averted as denominator, and regional cases and deaths averted as numerator.

Fig. 3.10. Estimated prevalence of exposure to malaria infection during pregnancy, overall and by subregion in 2019, in moderate to high transmission countries in the WHO African Region

Estimates of malaria-exposed pregnancies and preventable malaria-attributable low birthweight (LBW) deliveries in the absence of pregnancy-specific malaria prevention (i.e. long-lasting insecticidal net [LLIN] delivery based on intermittent preventive treatment in pregnancy [IPTp] or antenatal care [ANC]) were obtained using a model of the relationship between these outcomes with slide microscopy prevalence in the general population and age- and gravidity-specific fertility patterns. This model

was developed by fitting an established model of the relationship between malaria transmission and malaria infection by age (*17*) to patterns of infection in placental histology (*18*) and attributable LBW risk by gravidity in the absence of IPTp or other effective chemoprevention (*19*). The model was run across a 0.2 degree (5 km^2) longitude/latitude grid for 100 realizations of the Malaria Atlas Project (MAP) joint posterior estimated slide prevalence in children aged 2–10 years in 2018 (*9*). Country-specific, age-specific or gravidity-specific fertility rates, stratified by urban rural status, were obtained from demographic health surveys (DHS) and malaria indicator surveys (MIS), where such surveys had been carried out since 2014 and were available from the DHS program website (*20*). Countries where surveys were not available were allocated fertility patterns from a survey from another country, matched on the basis of total fertility rate (*21*) and geography. Fertility patterns of individual women within simulations at each grid-point were simulated according to the proportion of women estimated to be living in urban or rural locations. Urban or rural attribution at a 1 km^2 scale was conducted based on WorldPop 1 km^2 population estimates from 2018 (*22*) and an urban/rural threshold of 386/km^2 (*23*); the estimates were then aggregated to the 0.2 degree (5 km^2) resolution of the MAP surfaces. This provided a risk of malaria infection and malaria-attributable LBW in the absence of prevention, along with a modelled per capita pregnancy rate for each grid-point, which was aggregated to country level (using WorldPop population estimates) to provide a per pregnancy risk of malaria infection and per livebirth estimate of malaria-attributable LBW in the absence of prevention. These were then multiplied by country-level estimates of pregnancies and estimates of LBW in 2019 (**Fig. 3.11**).

Fig. 3.11. Estimated number of low birthweights due to exposure to malaria infection during pregnancy overall and by subregion in 2019, in moderate to high transmission countries in sub-Saharan Africa

Methods for estimating malaria infection in pregnancy and malaria-attributable LBWs are described in Walker et al. (*19*). Numbers of pregnancies were estimated from the latest UN population-estimated number of births and adjusted for the rate of abortion, miscarriage and stillbirths (*24*, *25*). The underlying *P. falciparum* parasite prevalence estimates were from the updated MAP series, using methods described in Bhatt et al. (2015) (*9*).

Fig. 3.12. Estimated number of low birthweights averted if current levels of IPTp coverage are maintained and the additional number averted if coverage of first dose of IPTp was optimized to match levels of coverage of first ANC visit in 2019, in moderate to high transmission countries in the WHO African Region

Efficacy of IPTp was modelled as a per-sulfadoxine-pyrimethamine (SP) dose reduction in the attributable risk of LBW and fitted to data from trials of IPTp-SP efficacy before the implementation of the intervention as policy; thus, they reflect impact on drug-sensitive parasites, with our central estimate being based on an assumed malaria-attributable LBW fraction of 40% within these trials. The modelling produced estimates of 48.5%, 73.5% and 86.3% efficacy in preventing malaria-attributable LBW for women receiving one, two or three doses of SP through IPTp, respectively. See the methods for **Fig. 3.11**.

Fig. 4.1. Number of countries that were malaria endemic in 2000, with fewer than 10, 100, 1000 and 10 000 indigenous malaria cases between 2000 and 2019

The figure is based on the countries where malaria was endemic in 2000 and had cases of malaria in 2000. The number of estimated cases was tabulated.

Table 4.1. Countries eliminating malaria since 2000

Countries are shown by the year in which they attained zero indigenous cases for 3 consecutive years, according to reports submitted by NMPs.

Table 4.2. Number of indigenous malaria cases in E-2020 countries, 2010–2019

Data were derived from NMP reports.

Fig. 4.2. Total malaria and *P. falciparum* cases in the GMS, 2000–2019

Data were derived from NMP reports to the Greater Mekong subregion (GMS) Malaria Elimination Database (MEDB).

Fig. 4.3. Regional map of malaria incidence in the GMS by area, 2012–2019

Data were derived from NMP reports to the GMS MEDB.

Fig. 5.1. HBHI: a targeted malaria response to get countries back on track to achieve the GTS 2025 milestones

This figure on high burden high impact (HBHI) was taken from a recent WHO publication (*26*).

Table 5.1. HBHI Response Element 2: work areas and status update

The work areas shown in the table were developed by WHO and the RBM Partnership in consultation with countries and stakeholders as part of the HBHI response (*26*).

Fig. 5.2. Example of subnational tailoring of malaria intervention mixes and their projected impacts implemented as part of the HBHI response (in Nigeria)

This is an example from Nigeria of analysis resulting from the HBHI Response Element 2 support involving subnational tailoring of malaria interventions using granular data on epidemiology and other factors developed by GMP. A mathematical model developed by the Institute for Disease Modeling[1] was used to assess the impact of various scenarios, with different mixes of interventions.

Fig. 5.3. Estimated malaria a) cases, b) cases per 1000 population at risk, c) deaths and d) deaths per 100 000 population at risk, 2018 and 2019, in HBHI countries

See methods notes for **Table 3.1**.

Table 5.2. Comparisons of estimated malaria cases (millions) using the parasite rate-to-incidence model (Annex 1) and the reported data from the routine public health sector in high-burden countries of the WHO African Region, 2019

See methods notes for **Table 3.1**. The analysis compares, for 10 HBHI countries in Africa, the estimated number of malaria cases in 2019 if results from Method 2 (officially used to estimated cases in these countries) were compared with those in Method 1.

Fig. 6.1. Funding for malaria control and elimination, 2010–2019 (% of total funding), by source of funds (constant 2019 US$)

Total funding for malaria control and elimination over the period 2000–2019 was estimated using data obtained from several sources, where available. The methodology below describes the collection and analysis for all available domestic and international funding for **Figs. 6.1–6.5.** For **Figs. 6.1–6.5**, data are represented for the years 2010–2019, because the Organisation for Economic Co-operation and Development (OECD) use of the multilateral system and the country-specific unit cost estimates were not available before 2010. **Figs. 6.3–6.5** reflect data available for 2000–2019, where, when there are no data available for a specific funder, no imputation was conducted and thus the trends presented in the main text should be interpreted carefully.

Contributions from governments of endemic countries were estimated as the sum of government contributions reported by NMPs for the world malaria report of the relevant year plus the estimated costs of patient care delivery services at public health facilities. If NMP contributions were missing for 2019, data reported from previous years were used after conversion to constant 2019 US$. The number of reported malaria cases attending public health facilities was sourced from NMP reports, adjusted for diagnosis and reporting completeness. Between 1% and 3% of uncomplicated reported malaria cases were assumed to have moved to the severe stage of disease, and 50–80% of these severe cases were assumed to have been hospitalized. Costs of outpatient visits and inpatient bed-stays were estimated from the perspective of the public health care provider, using unit cost estimates from WHO-CHOosing Interventions that are Cost-Effective (WHO-CHOICE) (*27*). For each country, the 2010 unit cost estimates from WHO-CHOICE, expressed in the national currency, were estimated for the period 2011–2019 using the gross domestic product (GDP) annual price deflator published by the World Bank (*28*) on 7 July 2020, and converted in base year 2010. Country-specific unit cost estimates were then converted from national currency to constant 2019 US$ for each year during 2010–2019. For each country, the number of adjusted reported malaria cases attending public health facilities was then multiplied by the estimated unit costs. In the absence of information on the level of care at which malaria patients attend public facilities, uncertainty around unit cost estimates was handled through probabilistic uncertainty analysis. The mean total cost of patient care service delivery was calculated from 1000 estimations. Contributions from governments of endemic countries as reported by NMPs were available for 2000-2019.

International bilateral funding data were obtained from several sources. Data on planned funding from the government of the United States of America (USA) were sourced from the US government Foreign Assistance website (*29*), with the technical assistance of the Kaiser Family Foundation. Country-level funding data were available for the US Agency for International Development (USAID) for the period 2006–2019. Country-specific planned funding data from other agencies, such as the US Centers for Disease Control and Prevention (CDC) and the US Department of Defense, were not available; therefore, data on total annual planned funding from each of these two agencies were used for the period 2001–2019, as well as total annual planned funding from USAID for 2001–2005 until the introduction of country-specific funding from 2006 through 2019. For the government of the United Kingdom of Great Britain and Northern Ireland

[1] https://idmod.org/documentation

(United Kingdom), funding data towards malaria control for 2017, 2018 and 2019 were sourced from the *Statistics on International Development: final UK aid spend 2019* (*30*) (*UK aid spend*) with the technical assistance of the United Kingdom Department for International Development. The *UK aid spend* data do not capture all spending from the United Kingdom that may affect malaria outcomes. The United Kingdom supports malaria control and elimination through a broad range of interventions; for example, via support to overall health systems in malaria endemic countries, and through research and development (R&D), which are not included in these data. For the period 2010–2016, United Kingdom spending data were sourced from the OECD creditor reporting system (CRS) database on aid activity (*31*). For all other donors, disbursement data were also obtained from the OECD CRS database on aid activity for the period 2002–2018. For each year and each funder, the country- and regional-level project-type interventions and other technical assistance were extracted. All data were converted to constant 2019 US$. For years with no data available for a particular funder, no imputation was conducted so trends presented in the main text figures should be interpreted carefully.

Malaria-related annual funding from donors through multilateral agencies was estimated from data on (i) donors' contributions published by the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) (*32*) from 2010 to 2019, and annual disbursements by the Global Fund to malaria endemic countries between 2003 and 2019, as reported by the Global Fund; and (ii) donors' disbursements to malaria endemic countries published in the OECD CRS and in the OECD Development Assistance Committee (DAC) members' total use of the multilateral system from 2011 through 2018 (*31*). All funding flows were converted to constant 2019 US$.

For (i), the amount of funding contributed by each donor was estimated as the proportion of funding paid by each donor out of the total amount received by the Global Fund in a given year, multiplied by the total amount disbursed by the Global Fund in that same year.

For (ii), contributions from donors to multilateral channels were estimated by calculating the proportion of the core contributions received by a multilateral agency each year by each donor, then multiplying that amount by the multilateral agency's estimated investment in malaria control in that same year.

Contributions from malaria endemic countries to multilateral agencies were allocated to governments of endemic countries under the "funding source" category. Contributions from non-DAC countries and other sources to multilateral agencies were not available and were therefore not included.

Annual estimated investments were summed to estimate the total amount each funder contributed to malaria control and elimination over the period 2010–2019, and the relative percentage of the total spending contributed by each funder was calculated for the period 2010–2019.

Fig. 6.1 excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.2. Funding for malaria control and elimination, 2010–2019, by source of funds (constant 2019 US$)

See methods notes for **Fig. 6.1** for sources of information on total funding for malaria control and elimination from governments of malaria endemic countries and on international funding flows. **Fig. 6.2** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.3. Funding for malaria control and elimination, 2000–2019, by World Bank 2019 income group and source of funding (constant 2019 US$)

See methods notes for **Fig. 6.1** for sources of information on total funding for malaria control and elimination from governments of malaria endemic countries and on international funding flows. Data on income group classification for 2019 were sourced from the World Bank (*33*). For years with no data available for a particular funder, no imputation was conducted so trends presented in the main text figures should be interpreted carefully. **Fig. 6.3** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.4. Funding for malaria control and elimination, 2000–2019, by channel (constant 2019 US$)

See methods notes for **Fig. 6.1** for sources of information on total funding for malaria control and elimination from governments of malaria endemic countries and on international funding flows. For years with no data available for a particular funder, no imputation was conducted so trends presented in the main text figures should be interpreted carefully. **Fig. 6.4** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.5. Funding for malaria control and elimination, 2000–2019, by WHO region (constant 2019 US$)

See methods notes for **Fig. 6.1** for sources of information on total funding for malaria control and elimination from governments of malaria endemic countries and on international funding flows. The "Unspecified" category includes all funding data for which there was no geographical information on the recipient. For years with no data available for a particular funder, no imputation was conducted so trends presented in the main text figures should be interpreted carefully. **Fig. 6.5** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.6. Funding for malaria-related R&D, 2007–2018, by product type (constant 2019 US$)

Data on funding for malaria-related R&D for 2007–2018 were sourced directly from Policy Cures Research through the G-FINDER data portal (*34*).

Fig. 6.7. Malaria R&D funding from 2007 to 2018, by sector (constant 2019 US$)

See methods notes for **Fig. 6.6**.

Fig. 7.1. Number of ITNs delivered by manufacturers and distributed by NMPs, 2010–2019

Data on the number of ITNs delivered by manufacturers to countries were provided to WHO by Milliner Global Associates. Data from NMP reports were used for the number of ITNs distributed within countries.

Fig. 7.2. Indicators of population-level coverage of ITNs, sub-Saharan Africa, 2000–2019: a) percentage of households with at least one ITN, b) percentage of households with one ITN for every two people, c) percentage of population with access to an ITN, d) percentage of population using an ITN, e) percentage of children aged under 5 years using an ITN and f) percentage of pregnant women sleeping under an ITN

Estimates of ITN coverage were derived from a model developed by MAP (*8*), using a two-stage process. First, a mechanism was designed for estimating net crop (i.e. the total number of ITNs in households in a country at a given time), taking into account inputs to the system (e.g. deliveries of ITNs to a country) and outputs (e.g. loss of ITNs from households). Second, empirical modelling was used to translate estimated net crops (i.e. total number of ITNs in a country) into resulting levels of coverage (e.g. access within households, use in all ages and use among children aged under 5 years).

The model incorporates data from three sources:

- the number of ITNs delivered by manufacturers to countries, as provided to WHO by Milliner Global Associates;
- the number of ITNs distributed within countries, as reported to WHO by NMPs; and
- data from nationally representative household surveys from 39 countries in sub-Saharan Africa, from 2001 to 2018.

Countries for analysis

The main analysis covered 40 of the 47 malaria endemic countries or areas of sub-Saharan Africa. The islands of Mayotte (for which no ITN delivery or distribution data were available) and Cabo Verde (which does not distribute ITNs) were excluded, as were the low-transmission countries of Eswatini, Namibia, Sao Tome and Principe, and South Africa, for which ITNs comprise a small proportion of vector control. Analyses were limited to populations categorized by NMPs as being at risk.

Estimating national net crops through time

As described by Flaxman et al. (*35*), national ITN systems were represented using a discrete-time stock-and-flow model. Nets delivered to a country by manufacturers were modelled as first entering a "country stock" compartment (i.e. stored in-country but not yet distributed to households). Nets were then available from this stock for distribution to households by the NMP or through other distribution channels. To accommodate uncertainty in net distribution, the number of nets distributed in a given year was specified as a range, with all available country stock (i.e. the maximum number of nets that could be delivered) as the upper end of the range and the NMP-reported value (i.e. the assumed minimum distribution) as the lower end. The total household net crop comprised new nets reaching households plus older nets remaining from earlier times, with the duration of net retention by households governed by a loss function. However, rather than the loss function being fitted to a small external dataset – as per Flaxman et al. (*35*) – the loss function was fitted directly to the distribution and net crop data within the stock-and-flow model itself. Loss functions were fitted on a country-by-country basis, were allowed to vary through time, and were defined separately for conventional ITNs (cITNs) and LLINs. The fitted loss functions were compared with existing assumptions about rates of net loss from households. The stock-and-flow model was fitted using Bayesian inference and Markov chain Monte Carlo methods, which provided time-series estimates of national household net crop for cITNs and LLINs in each country, and an evaluation of under-distribution, all with posterior credible intervals.

Estimating indicators of national ITN access and use from the net crop

Rates of ITN access within households depend not only on the total number of ITNs in a country (i.e. the net crop), but also on how those nets are distributed among households. One factor that is known to strongly influence the

relationship between net crop and net distribution patterns among households is the size of households, which varies among countries, particularly across sub-Saharan Africa. Many recent national surveys report the number of ITNs observed in each household surveyed. Hence, it is possible not only to estimate net crop, but also to generate a histogram that summarizes the household net ownership pattern (i.e. the proportion of households with 0, 1 or 2 nets, etc). In this way, the size of the net crop was linked to distribution patterns among households while accounting for household size, making it possible to generate ownership distributions for each stratum of household size. The bivariate histogram of net crop to distribution of nets among households by household size made it possible to calculate the proportion of households with at least one ITN. Also, because the numbers of both ITNs and people in each household were available, it was possible to directly calculate two additional indicators: the proportion of households with at least one ITN for every two people, and the proportion of the population with access to an ITN within their household. For the final ITN indicator – the proportion of the population who slept under an ITN the previous night – the relationship between ITN use and access was defined using 62 surveys in which both these indicators were available ($ITN_{use\ all\ ages}$ = 0.8133 × $ITN\ access_{all\ ages}$ + 0.0026, R2 = 0.773). This relationship was applied to the MAP's country–year estimates of household access, to obtain ITN use among all ages. The same method was used to obtain the country–year estimates of ITN use in children aged under 5 years ($ITN\ use_{children\ under\ 5}$ = 0.9327 x $ITN\ access_{children\ under\ 5}$ + 0.0282, R2 = 0.754).

Fig. 7.3. Concentration index of ITN use by children aged under 5 years, sub-Saharan Africa at administrative level 1

The distribution of ITN usage related to the distribution of wealth index was analysed from household surveys using the concindex command in Stata (*36*). The concentration index (*37*) has a value of 0 if there is no difference in the distribution of the usage related to the distribution of wealth, a positive value if the usage is concentrated among the high-wealth population and a negative value if the usage is concentrated among the low-wealth population.

Fig. 7.4. Percentage of the population at risk protected by IRS, by WHO region, 2010–2019

The number of people protected by IRS was reported to WHO by NMPs. The total population of each country was taken from the 2017 revision of the *World population prospects* (*21*), and the proportion at risk of malaria was derived from NMP reports.

Fig. 7.5. Subnational areas where SMC was delivered in implementing countries in sub-Saharan Africa, 2019

Data were provided by the Seasonal Malaria Chemoprevention (SMC) Working Group.

Table 7.1. Average number of children treated with at least one dose of SMC by year in countries implementing SMC, 2012-2019

Data were provided by the London School of Hygiene & Tropical Medicine (LSHTM) and MMV.

Table 7.2. Average number of children targeted and treated, and total treatment doses targeted and delivered, in countries implementing SMC, 2019

Data were provided by LSHTM and MMV.

Fig. 7.6. Percentage of pregnant women attending an ANC clinic at least once and receiving IPTp, by dose, sub-Saharan Africa, 2010–2019

The total number of pregnant women eligible for IPTp was calculated by adding total live births calculated from UN population data and spontaneous pregnancy loss (specifically, miscarriages and stillbirths) after the first trimester (*24*). Spontaneous pregnancy loss has previously been calculated by Dellicour et al. (*25*). Country-specific estimates of IPTp coverage were calculated as the ratio of pregnant women receiving IPTp at ANC clinics to the estimated number of pregnant women eligible for IPTp in a given year. ANC attendance rates were derived in the same way, using the number of initial ANC visits reported through routine information systems. Local linear interpolation or information for national representative surveys was used to compute missing values. Annual aggregate estimates exclude countries for which a report or interpolation was not available for the specific year. Dose coverage could be calculated for 34 of the 38 countries with an IPTp policy.

Diagnostic testing and treatment

The analysis is based on the latest nationally representative household surveys (DHS and MIS) conducted between 2015 and 2019, and surveys (latest from 2000–2005) considered baseline surveys from sub-Saharan African countries where data on malaria case management were available. Data are only available for children aged under 5 years because DHS and MIS focus on the most vulnerable population groups. Interviewers ask caregivers whether the child has had fever in the 2 weeks preceding the interview and, if so, where care was sought; whether the child received a finger or heel stick as part of the care; what treatment was received for the fever and when; and, in particular, whether the child received an artemisinin-based combination therapy (ACT) or other antimalarial medicine. In addition to self-reported data, DHS and MIS also include biomarker testing for malaria, using rapid diagnostic tests (RDTs) that detect *P. falciparum* histidine-rich protein 2 (HRP2). Percentages and 95% CIs were calculated for each country each year, taking into account the survey design. Median values and interquartile ranges (IQRs) were calculated using country percentages for the latest and baseline surveys.

The following indicators are presented in **Table 7.3**:

Indicator	Numerator	Denominator
Median prevalence of fever in the past 2 weeks	Children aged under 5 years with a history of fever in the past 2 weeks	Children aged under 5 years
Median prevalence of fever in the past 2 weeks for whom treatment was sought	Children aged under 5 years with a history of fever in the past 2 weeks for whom treatment was sought	Children aged under 5 years with fever in the past 2 weeks
Median prevalence of treatment seeking by source of treatment for fever (public health facility, private health facility or community health worker)	Children aged under 5 years with a history of fever in the past 2 weeks for whom treatment was sought in the public sector or private sector or community health worker	Children aged under 5 years with fever in the past 2 weeks for whom treatment was sought
Median prevalence of receiving finger or heel prick	Children aged under 5 years with a history of fever in the past 2 weeks for whom treatment was sought and who received a finger or heel prick	Children aged under 5 years with fever in the past 2 weeks for whom treatment was sought
Median prevalence of treatment with ACTs	Children aged under 5 years with a history of fever in the past 2 weeks for whom treatment was sought and who were treated with ACTs	Children aged under 5 years with fever in the past 2 weeks for whom treatment was sought in public, private or community health services
Median prevalence of treatment with ACTs among those who received a finger or heel prick	Received ACT treatment	Children aged under 5 years with fever in the past 2 weeks for whom treatment was sought and who received a finger or heel prick

The use of household survey data has several limitations. One issue is that, because of difficulty recalling past events, respondents may not provide reliable information, especially on episodes of fever and the identity of prescribed medicines, resulting in a misclassification of drugs. Also, because respondents can choose more than one source of care for one episode of fever, and because the diagnostic test and treatment question is asked broadly and hence is not linked to any specific source of care, it has been assumed that the diagnostic test and treatment were received in all the selected sources of care. However, only a low percentage (<5%) of febrile children were brought for care in more than one source of care. Data may also be biased by the seasonality of survey data collection, because DHS are carried out at various times during the year and MIS are usually timed to correspond with the high malaria transmission season. Another limitation, when undertaking trend analysis, is that DHS and MIS are done intermittently, or not at all in some countries, resulting in a relatively small number of countries in sub-Saharan Africa or for any particular 4-year period. Countries are also not the same across each 4-year period. In addition, depending on the sample size of the survey, the denominator for some indicators can be small – countries where the number of children in the denominator was less than 30 were excluded from the calculation.

Fig. 7.7. Number of RDTs sold by manufacturers and distributed by NMPs for use in testing suspected malaria cases, 2010–2019

The numbers of RDTs distributed by WHO region are the annual totals reported as having been distributed by NMPs. Numbers of RDT sales between 2010 and 2019 reflect sales by companies eligible for procurement. From 2010 to 2017, WHO received reports from up to 44 (cumulative number; figure differs from year to year) manufacturers that participated in the RDT Product Testing Programme by WHO, the Foundation for Innovative New Diagnostics (FIND), the CDC, and the Special Programme for Research and Training in Tropical Diseases. Since WHO Prequalification became a selection criterion for procurement, 2018 and 2019 sales data mainly focus on sales by the 11 eligible companies. The number of RDTs reported by manufacturers represents total sales to the public and private sectors worldwide.

Fig. 7.8. Number of ACT treatment courses delivered by manufacturers and distributed by NMPs to patients, 2010–2019

Data on ACT sales were provided by 10 manufacturers eligible for procurement by WHO and United Nations Children's Fund (UNICEF). ACT sales were categorized as being to either the public sector or the private sector, also

taking into account the Global Fund co-payment mechanism and the Affordable Medicines Facility–malaria (AMFm) initiative. Data on ACTs distributed within countries through the public sector were taken from NMP reports.

Table 7.3. Summary of coverage of treatment seeking for fever, diagnosis and use of ACTs for children aged under 5 years, from household surveys in sub-Saharan Africa, at baseline (2005–2011) and most recent (2015-2019)

See the information provided in the section titled Diagnostic testing and treatment (above).

Fig. 7.9. Concentration index of a) prevalence of fever in, and b) care seeking for children aged under 5 years at administrative level 1, sub-Saharan Africa

The distribution of prevalence of fever in, and care seeking for children aged under 5 years related to the distribution of wealth index was analysed from DHS using the concindex command in Stata (*36*); see **Fig. 7.3** for details.

Fig. 8.1. Comparison of global progress in malaria: a) case incidence and b) mortality rate, considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

The GTS target is a 90% reduction of malaria incidence and mortality rate by 2030, with milestones of 40% and 75% reductions in both indicators for the years 2020 and 2025, respectively (*1*). A curve based on a quadratic fit is used for the malaria incidence milestones. For projection of malaria incidence under current estimated trends, the same year-on-year trend observed from recent years (2017–2019) is forecast up to 2030.

Fig. 8.2. Map of malaria endemic countries showing progress towards the GTS 2020 malaria case incidence milestone of at least 40% reduction from a 2015 baseline

See methods notes for **Fig. 8.1**.

Fig. 8.3. Map of malaria endemic countries showing progress towards the GTS 2020 malaria mortality rate milestone of at least 40% reduction from a 2015 baseline

See methods notes for **Fig. 8.1**.

Fig. 8.4. Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO African Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

See methods notes for **Fig. 8.1**.

Fig. 8.5. Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Region of the Americas considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

See methods notes for **Fig. 8.1**.

Fig. 8.6. Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Eastern Mediterranean Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

See methods notes for **Fig. 8.1**.

Fig. 8.7. Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO South-East Asia region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

See methods notes for **Fig. 8.1**.

Fig. 8.8. Comparison of progress in malaria: a) case incidence and b) mortality rate in the WHO Western Pacific Region considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)

See methods notes for **Fig. 8.1**.

Fig. 9.1. Treatment failure rates among patients with *P. falciparum* malaria, WHO African Region, 2010–2019

The box-and-whisker plots show the distribution of values for each drug, with the boxes extending from the 25th to the 75th percentile, and the middle line indicating the median. The whiskers denote adjacent values extending from the top of the box to the largest data element, which is ≤1.5 times the IQR (i.e. the distance from the 25th to the 75th percentile), and down from the bottom of the box to the smallest data element, which is ≥1.5 times the IQR. The dots denote observations outside the range of adjacent values.

Fig. 9.2. Treatment failure rates among patients with *P. vivax* malaria, WHO Region of the Americas, 2010–2019

See methods notes for **Fig. 9.1**.

Fig. 9.3. Treatment failure rates among patients with *P. falciparum* malaria, WHO South-East Asia Region, 2010–2019

See methods notes for **Fig. 9.1**.

Fig. 9.4. Treatment failure rates among patients with *P. falciparum* malaria, WHO Eastern Mediterranean Region, 2010–2019

See methods notes for **Fig. 9.1**.

Fig. 9.5. Treatment failure rates among patients with *P. falciparum* malaria, WHO Western Pacific Region, 2010–2019

See methods notes for **Fig. 9.1**.

Fig. 9.6. Number of classes to which resistance was confirmed in at least one malaria vector in at least one monitoring site, 2010–2019

Resistance to an insecticide class was considered to be confirmed in a country if at least one vector species exhibited resistance to one insecticide in the class in at least one collection site in the country, as measured by standard WHO tube tests or CDC bottle bioassays conducted with validated discriminating concentrations in 2010–2019. The map was developed based on data contained in the WHO global database for insecticide resistance in malaria vectors. These data were reported to WHO by NMPs, national public health institutes, universities and research centres, the African Network for Vector Resistance, MAP (*8*), VectorBase and the US President's Malaria Initiative (PMI), or extracted from scientific publications.

Fig. 9.7. Reported insecticide resistance status as a proportion of sites for which monitoring was conducted, by WHO region, 2010–2019: pyrethroids, organochlorines, carbamates and organophosphates

The status of resistance at each mosquito collection site for each insecticide class was assessed based on the lowest mosquito mortality reported across all standard WHO tube tests or CDC bottle bioassays conducted at the site during 2010–2019, with validated discriminating concentrations of the insecticides in the class. If multiple insecticides and mosquito species were tested between 2010 and 2019 at the collection site, the lowest mosquito mortality was considered. If the lowest mosquito mortality was below 90%, resistance was considered to be confirmed at the site; if the lowest mosquito mortality was 90% or more but below 98%, resistance was considered to be possible at the site; if the lowest mortality was more than 98%, vectors at the site were considered to be susceptible to the insecticide class. The figure was developed based on data in the WHO global database for insecticide resistance in malaria vectors. These data were reported to WHO by NMPs, national public health institutes, universities and research centres, the African Network for Vector Resistance, MAP, VectorBase and PMI, or extracted from scientific publications.

Fig. 10.1. Trends in COVID-19 cases and deaths in malaria endemic countries globally and by WHO region (as of 23 November 2020)

This graph is built on daily numbers of COVID-19 cases and deaths as reported to WHO (*38*).

Fig. 10.2. Malaria seasonality and trends of COVID-19 cases in malaria endemic countries and areas, 2020 (as of 23 November 2020)

For each country, the monthly average of seasonality at administrative level 1 and the daily number of COVID-19 cases reported to WHO are presented (*38*). To compare both trends over time, each series has been scaled to have similar maximum values in every country.

Table 10.1. The global workstreams on the malaria response during the COVID-19 pandemic

The table summarizes the various WHO-convened workstreams on the malaria response during the COVID-19 pandemic (*39*).

Fig. 10.3. Potential RDT stockouts forecast in June 2020, if country orders were not delivered

The figure shows forecast RDT needs and potential stock-outs developed by PMI and the Global Fund as part of activities under the workstream on supplies and commodities (see **Table 10.1**).

Fig. 10.4 Results from WHO surveys on disruptions of malaria related services during the COVID-19 pandemic: a) ANC services and b) diagnosis and treatment

Data were obtained from surveys conducted in May–September 2020 by the WHO Department of Integrated Health Services. Structured online questionnaires were sent to each country office for completion by relevant national respondents (*40*).

Fig. 10.5. Monthly trends in all-cause outpatients attendances in 23 countries in sub-Saharan Africa in 2019 and 2020

Graphs of all-cause outpatient attendances were developed using data submitted by NMPs.

Fig. 10.6. Monthly trends in malaria outpatients attendances in 24 countries in sub-Saharan Africa in 2019 and 2020

Graphs of malaria outpatient attendances were developed using data submitted by NMPs.

Fig. 10.7. Estimated potential increase in malaria deaths in sub-Saharan Africa (excluding Botswana, Eswatini, Namibia and South Africa) corresponding to varying levels of disruptions of access to effective antimalarial treatment

The figure shows projected estimates of the impact of disruptions on effective treatment with antimalarial services, using methods described by WHO (*41*).

Fig. 11.1. Distribution of malaria cases in 2019 by human development index in 2018

For malaria cases see method for **Table 3.1**. The human development index estimates were obtained from the United Nations Development Programme (UNDP) (*42*).

Fig. 11.2. Distribution of malaria cases in 2019 by current health expenditure as percentage of GDP in 2017

For malaria cases, see method for **Table 3.1**. The information on current health expenditure as percentage of GDP in 2017 was obtained from the World Bank data on health expenditure (*43*).

Fig. 11.3. Distribution of malaria cases in 2019 by category of governance effectiveness in 2019

For malaria cases, see method for **Table 3.1**. The governance effectiveness estimates were obtained from the World Bank data on governance (*43*).

Fig. 11.4. Distribution of malaria cases in 2019 by category of UHC service coverage index in 2017

For malaria cases see method for **Table 3.1**. The universal health coverage (UHC) service coverage index was obtained from the WHO Global Health Observatory (*44*); methods for its estimation are also provided online (*45*).

References for Annex 1

1. Global technical strategy for malaria 2016–2030 (last update: 22 January 2016). Geneva: World Health Organization; 2015 (https://www.who.int/malaria/areas/global_technical_strategy/en/).
2. Roll Back Malaria Partnership Secretariat. Action and investment to defeat malaria 2016–2030. For a malaria-free world. Geneva: World Health Organization; 2015 (https://endmalaria.org/sites/default/files/RBM_AIM_Report_0.pdf).
3. World malaria report 2008. Geneva: World Health Organization; 2008 (https://www.who.int/malaria/publications/atoz/9789241563697/en/).
4. Cibulskis RE, Aregawi M, Williams R, Otten M, Dye C. Worldwide incidence of malaria in 2009: estimates, time trends, and a critique of methods. PLoS Med. 2011;8(12):e1001142.
5. The R Core Team. R: A language and environment for statistical computing: reference index. Vienna: R Foundation for Statistical Computing.
6. Weiss DJ, Mappin B, Dalrymple U, Bhatt S, Cameron E, Hay SI et al. Re-examining environmental correlates of *Plasmodium falciparum* malaria endemicity: a data-intensive variable selection approach. Malar J. 2015;14(1):68.
7. Cameron E, Battle KE, Bhatt S, Weiss DJ, Bisanzio D, Mappin B et al. Defining the relationship between infection prevalence and clinical incidence of *Plasmodium falciparum* malaria. Nat Commun. 2015;6:8170.
8. Malaria Atlas Project [website]. (https://malariaatlas.org).
9. Bhatt S, Weiss DJ, Cameron E, Bisanzio D, Mappin B, Dalrymple U et al. The effect of malaria control on *Plasmodium falciparum* in Africa between 2000 and 2015. Nature. 2015;526(7572):207–11 (https://pubmed.ncbi.nlm.nih.gov/26375008).
10. World malaria report 2019. Geneva: World Health Organization; 2019 (https://www.who.int/publications/i/item/9789241565721).
11. Alles HK, Mendis KN, Carter R. Malaria mortality rates in South Asia and in Africa: implications for malaria control. Parasitol Today. 1998;14(9):369–75.
12. Luxemburger C, Ricci F, Nosten F, Raimond D, Bathet S, White NJ. The epidemiology of severe malaria in an area of low transmission in Thailand. Trans R Soc Trop Med Hyg. 1997;91(3):256–62.
13. Meek SR. Epidemiology of malaria in displaced Khmers on the Thai-Kampuchean border. Southeast Asian J Trop Med Public Health. 1988;19(2):243–52.
14. Douglas NM, Pontororing GJ, Lampah DA, Yeo TW, Kenangalem E, Poespoprodjo JR et al. Mortality attributable to *Plasmodium vivax* malaria: a clinical audit from Papua, Indonesia. BMC Med. 2014;12(1):217.
15. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet. 2015;385(9966):430–40.
16. Ross A, Maire N, Molineaux L, Smith T. An epidemiologic model of severe morbidity and mortality caused by *Plasmodium falciparum*. Am J Trop Med Hyg. 2006;75(2 Suppl):63–73.
17. Griffin JT, Ferguson NM, Ghani AC. Estimates of the changing age-burden of *Plasmodium falciparum* malaria disease in sub-Saharan Africa. Nat Commun. 2014;5(1):1–10.
18. Walker PG, Griffin JT, Cairns M, Rogerson SJ, Van Eijk AM, Ter Kuile F et al. A model of parity-dependent immunity to placental malaria. Nat Commun. 2013;4(1):1–11 (https://www.nature.com/articles/ncomms2605).
19. Walker PG, ter Kuile FO, Garske T, Menendez C, Ghani AC. Estimated risk of placental infection and low birthweight attributable to *Plasmodium falciparum* malaria in Africa in 2010: a modelling study. Lancet Glob Health. 2014;2(8):e460–e7 (https://pubmed.ncbi.nlm.nih.gov/25103519).
20. The DHS Program: demographic and health surveys [website]. Washington, DC: United States Agency for International Development (https://dhsprogram.com/).
21. World population prospects [website]. New York City: United Nations; 2020 (https://population.un.org/wpp/).
22. WorldPop [website]. (https://www.worldpop.org/).
23. Cairns M, Roca-Feltrer A, Garske T, Wilson AL, Diallo D, Milligan PJ et al. Estimating the potential public health impact of seasonal malaria chemoprevention in African children. Nat Commun. 2012;3:881.
24. Adekanbi AO, Olayemi OO, Fawole AO, Afolabi KA. Scourge of intra-partum foetal death in Sub-Saharan Africa. World J Clin Cases. 2015;3(7):635 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4517338/).
25. Dellicour S, Tatem AJ, Guerra CA, Snow RW, ter Kuile FO. Quantifying the number of pregnancies at risk of malaria in 2007: a demographic study. PLoS Med. 2010;7(1):e1000221.
26. High burden to high impact: a targeted malaria response. Geneva: World Health Organization; 2019 (https://www.who.int/malaria/publications/atoz/high-impact-response/en/).
27. Cost effectiveness and strategic planning (WHO-CHOICE) [website]. Geneva: World Health Organization; (https://www.who.int/choice/en/).
28. Indicators [website]. Washington (DC): The World Bank; 2020 (https://data.worldbank.org/indicator).
29. Foreign assistance [website]. US government (https://foreignassistance.gov/).
30. Statistics on international development: final UK aid spend 2019. United Kingdom: Foreign, Commonwealth & Development Office; 2019 (https://www.gov.uk/government/statistics/statistics-on-international-development-final-uk-aid-spend-2019).
31. Creditor reporting system (CRS) [website]. Organisation for Economic Co-operation and Development (https://stats.oecd.org/Index.aspx?DataSetCode=CRS1).
32. Financials [website]. Geneva: Global Fund to Fight AIDS, Tuberculosis and Malaria (https://www.theglobalfund.org/en/financials/).
33. World Bank country and lending groups [website]. Washington DC: World Bank (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups).
34. Policy Cures Research: G-FINDER data portal [website]. Sydney, Australia: Policy Cures Research (https://gfinderdata.policycuresresearch.org).
35. Flaxman AD, Fullman N, Otten MW, Menon M, Cibulskis RE, Ng M et al. Rapid scaling up of insecticide-treated bed net coverage in Africa and its relationship with development assistance for health: a systematic synthesis of supply, distribution, and household survey data. PLoS Med. 2010;7(8):e1000328.
36. O'Donnell O, O'Neill S, Van Ourti T, Walsh B. Conindex: estimation of concentration indices. Stata J. 2016;16(1):112–38.
37. O'Donnell O, Van Doorslaer E, Wagstaff A, Lindelow M. Analyzing health equity using household survey data: a guide to techniques and their implementation. The World Bank; 2007 (https://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-6933-3).
38. WHO Coronavirus Disease (COVID-19) Dashboard [website]. Geneva: World Health Organization (https://covid19.who.int/).
39. Jointly addressing endemic malaria and pandemic COVID-19. Geneva: World Health Organization; 2019 (https://www.who.int/malaria/areas/epidemics_emergencies/covid-19/who-gmp-response-covid-19.pdf).
40. Pulse survey on continuity of essential health services during the COVID-19 pandemic: interim report, 27 August 2020. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS_continuity-survey-2020.1).
41. The potential impact of health service disruptions on the burden of malaria. A modelling analysis for countries in sub-Saharan Africa. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/the-potential-impact-of-health-service-disruptions-on-the-burden-of-malaria).
42. Human development index (HDI) [website]. Geneva: United Nations Development Programme (UNDP); 2020 (http://www.hdr.undp.org/en/content/human-development-index-hdi).
43. Kaufmann D, Kraay A, Mastruzzi M. The worldwide governance indicators: methodology and analytical issues: World Bank Policy Research Working Paper No. 5430. Washington, DC: The World Bank; 2010 (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130).
44. WHO Global Health Observatory data repository: Index of service coverage (https://apps.who.int/gho/data/view.main.INDEXOFESSENTIALSERVICECOVERAGE).
45. Hogan D, Hosseinpoor, AR, Boerma T. Technical note: developing an index for the coverage of essential health services. Geneva: World Health Organization; 2005 (https://www.who.int/healthinfo/universal_health_coverage/UHC_WHS2016_TechnicalNote_May2016.pdf).

Annex 2 - A. WHO African Region, a. West Africa

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 394 million

Parasites: *P. falciparum* (almost 100%) and other (<1%)

Vectors: *An. arabiensis, An. coluzzii, An. funestus s.l., An. gambiae s.l., An. hispaniola, An. labranchiae, An. melas, An. moucheti, An. multicolor, An. nili s.l., An. pharoensis* and *An. sergentii s.l.*

FUNDING (US$), 2010–2019

557.1 million (2010), 568.6 million (2015), 792.0 million (2019); increase 2010–2019: 42%

Proportion of domestic source[a] in 2019: 10%

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2019

Countries with ≥80% coverage with either LLIN or IRS in 2019: Cabo Verde and Ghana

Countries with ≥50% coverage with either LLIN or IRS in 2019: Burkina Faso, Côte d'Ivoire, Guinea, Liberia, Mali, Niger, Senegal, Sierra Leone and Togo

Countries that implemented IPTp in 2019: Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo

Countries with >30% IPTp3+ in 2019: Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Senegal, Sierra Leone and Togo

Percentage of suspected cases tested (reported): 50% (2010), 79% (2015), 90% (2019)

Number of ACT courses distributed: 32.2 million (2010), 47.4 million (2015), 65.1 million (2019)

Number of any antimalarial treatment courses (incl. ACT) distributed: 32.2 million (2010), 49.3 million (2015), 66.9 million (2019)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 30.6 million (2010), 56.8 million (2015), 64.1 million (2019)

Confirmed cases: 6.8 million (2010), 36.4 million (2015), 56.1 million (2019)

Percentage of total cases confirmed: 22.1% (2010), 64.1% (2015), 87.5% (2019)

Deaths: 39 000 (2010), 23 000 (2015), 18 700 (2019)

Children aged under 5 years, presumed and confirmed cases: 11.9 million (2010), 21.0 million (2015), 27.7 million (2019)

Children aged under 5 years, percentage of total cases: 39.0% (2010), 37.0% (2015), 43.2% (2019)

Children aged under 5 years, deaths: 214 100 (2010), 22 100 (2015), 38 700 (2019)

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 116.1 million (2010), 105.5 million (2015), 112.1 million (2019); decrease 2010–2019: 3%

Deaths: 306 000 (2010), 224 500 (2015), 196 100 (2019); decrease 2010–2019: 36%

ACCELERATION TO ELIMINATION

Countries with subnational/territorial elimination programme: Senegal

Countries with nationwide elimination programme: Cabo Verde

Zero indigenous cases for 3 consecutive years (2017, 2018 and 2019): Algeria

Zero indigenous cases in 2019: Cabo Verde

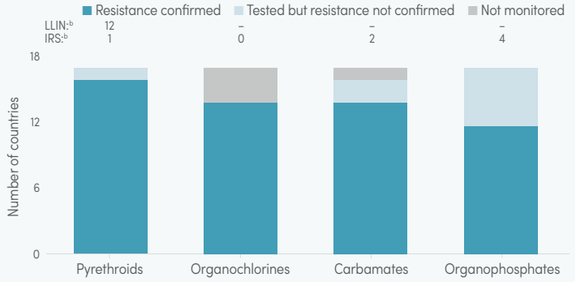
Certified as malaria free since 2010: Algeria (since May 2019)

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2019	113	0.0	0.0	11.9	0.0	2.2
AS–AQ	2010–2019	91	0.0	0.0	8.0	0.0	1.8
AS–PY	2011–2016	7	0.0	0.5	1.2	0.0	0.6
DHA–PPQ	2010–2018	27	0.0	0.0	2.4	0.0	0.0

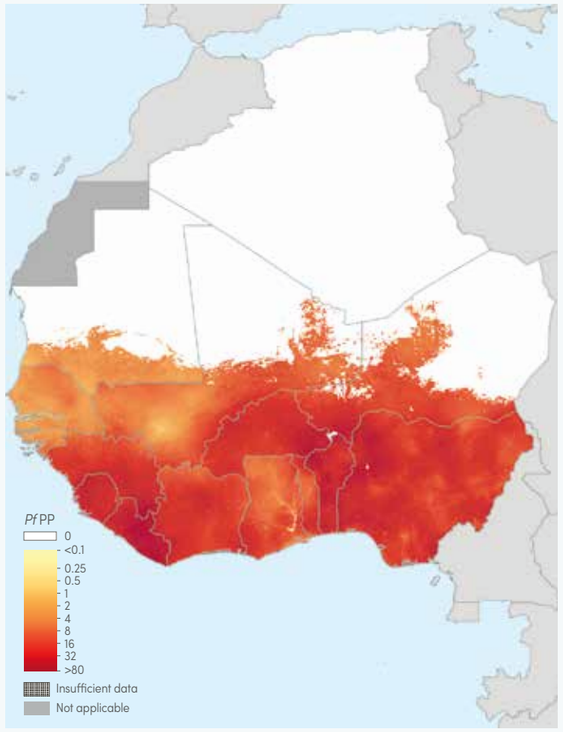
AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

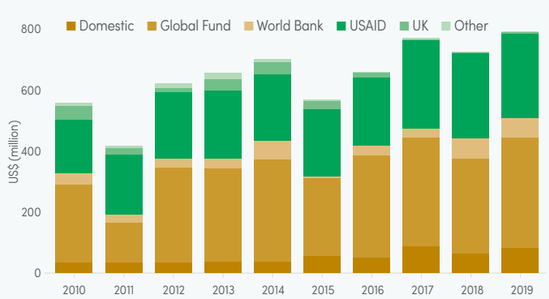


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2019

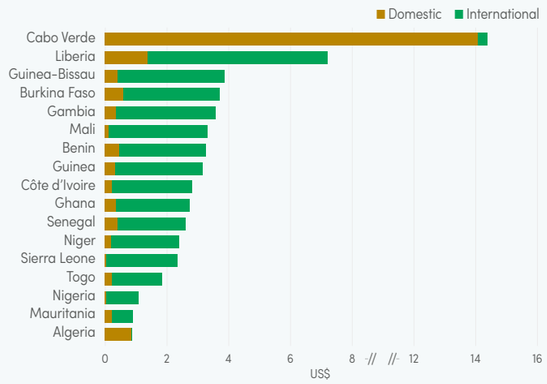


B. Malaria funding[a] by source, 2010–2019



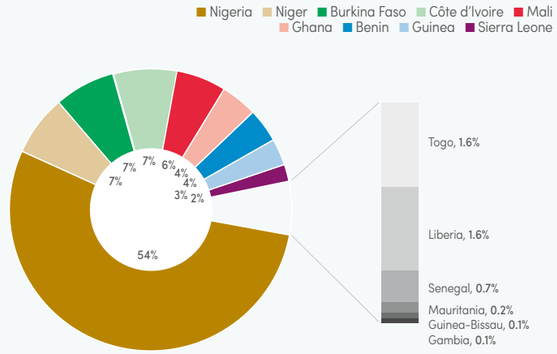
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019



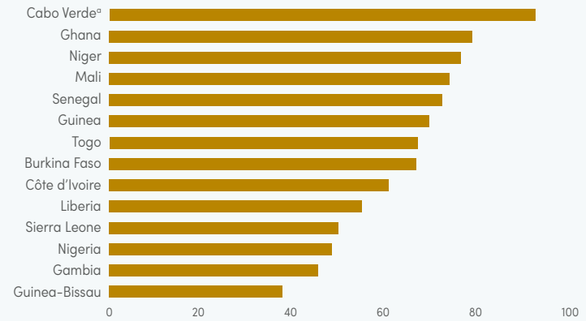
[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2019



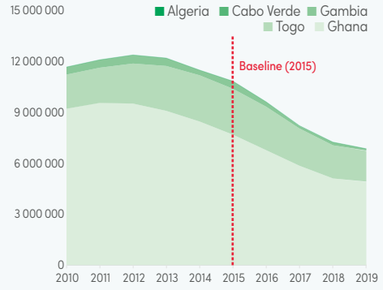
E. Percentage of population with access to either LLINs or IRS, 2019

Source: ITN coverage model from MAP

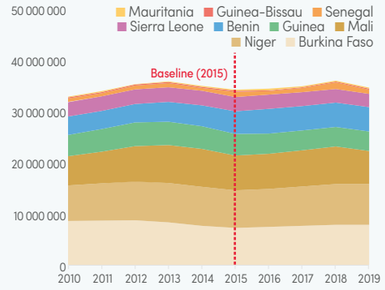


IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.
[a] Cabo Verde is an E-2020 country; vector control targeted at foci.

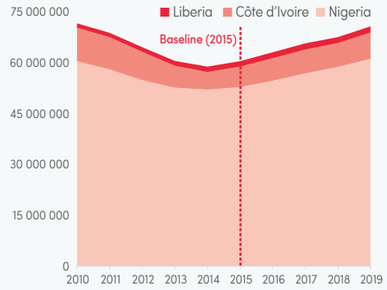
F. Estimated number of cases in countries on track to reduce case incidence by ≥40% by 2020



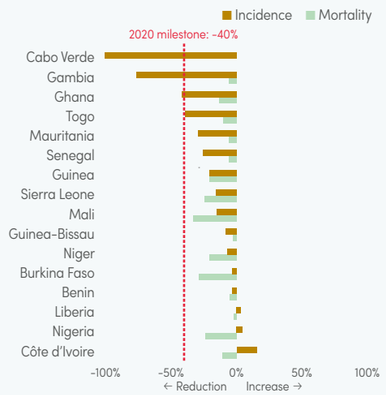
G. Estimated number of cases in countries likely to reduce case incidence by <40% by 2020



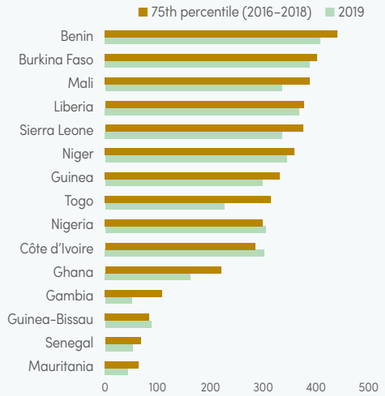
H. Estimated number of cases in countries with an increase in case incidence, 2015–2019



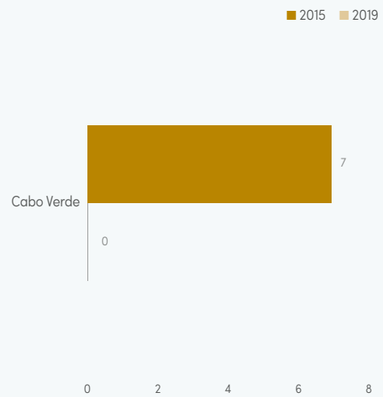
I. Change in estimated malaria incidence and mortality rates, 2015–2019



J. Incidence in 2019 compared to baseline (2016–2018)



K. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



KEY MESSAGES

- About 394 million people living in the 17 countries of West Africa are at high risk of malaria. Algeria was certified malaria free in May 2019, following 3 consecutive years with zero indigenous cases. Cabo Verde has had zero indigenous cases since February 2018 and since then has started its preparation for the certification process. The high burden to high impact (HBHI) initiative was initiated in Burkina Faso, Ghana, Niger and Nigeria in 2019, leading to evidence-based national strategic plans and funding requests. In countries of this subregion, except for Algeria and Cabo Verde, malaria transmission is year-round and almost exclusively due to *P. falciparum*, with strong seasonality in the Sahelian countries.
- The subregion had about 112 million estimated cases and about 196 000 estimated deaths – a 3% and 36% decrease compared with 2010, respectively. Five countries accounted for over 80% of the estimated cases: Nigeria (54%), Côte d'Ivoire (7%), Niger (7%), Burkina Faso (7%) and Mali (6%). More than 64 million cases were reported in the public and private sectors, and in the community, of which 43.2% were in children aged under 5 years, and 56 million (87.5%) were confirmed. The proportion of total cases that were confirmed has improved substantially over time, being only 22.1% in 2010. A total of 38 697 malaria deaths were reported in children aged under 5 years; this figure exceeded the total malaria deaths, indicating challenges in the surveillance of malaria mortality in some countries.
- In nine of the 17 countries in this subregion, where routine distribution of LLINs or use of IRS is still applicable, 50% or more of the population had access to the interventions. Five countries are on track to meet the GTS target by reducing case incidence by at least 40% by 2020 compared with 2015 (Algeria, which is already certified malaria free, Cabo Verde, the Gambia, Senegal and Togo). In nine countries, although there is progress towards meeting the target, efforts need to be accelerated to achieve the 40% reduction (Benin, Burkina Faso, Ghana, Guinea, Mali, Niger, Nigeria, Mauritania and Sierra Leone). In Côte d'Ivoire, Guinea-Bissau and Liberia, incidence increased in 2019 compared with 2015. After a large increase in indigenous cases in Cabo Verde between 2016 and 2017, the country has been reporting zero indigenous cases since February 2018. In addition to Algeria and Cabo Verde, Burkina Faso and Mali are on track to reduce malaria mortality rates by at least 40%. However, the estimation from Burkina Faso is affected by the decline in reporting completeness, from 98% in 2018 to 60% in 2019.
- The Nouakchott Declaration was adopted in 2013 and the new Sahel Malaria Elimination Initiative (SaME) was launched in 2018 by ministers of the eight Sahelian countries (Burkina Faso, Cabo Verde, Chad, the Gambia, Mali, Mauritania, Niger and Senegal) to accelerate implementation of high-impact strategies towards eliminating malaria by 2030. In line with these initiatives, an action plan was adopted in 2019. In addition to Cabo Verde as an eliminating country, the Gambia, Mauritania, Niger and Senegal have reoriented their programmes towards malaria subnational elimination.
- Vector resistance to pyrethroids was confirmed in 91% of the sites, to organochlorines in 95%, to carbamates in 42% and to organophosphates in 24%. Eight countries have developed their insecticide resistance monitoring and management plans.
- Challenges include inadequate political commitment and leadership, weak malaria programme management, insufficient prioritization and sustainability of interventions, inappropriate application of larviciding, inadequate domestic financing and weak surveillance systems, including a lack of well-functioning vital registration systems.

Annex 2 - A. WHO African Region, b. Central Africa

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 186 million

Parasites: *P. falciparum* (100%)

Vectors: *An. arabiensis, An. funestus s.l., An. gambiae s.l., An. melas, An. moucheti, An. nili s.l.* and *An. pharoensis.*

FUNDING (US$), 2010–2019

250.5 million (2010), 376.4 million (2015), 422.5 million (2019); increase 2010–2019: 69%

Proportion of domestic source[a] in 2019: 17%

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2019

Countries with ≥80% coverage with either LLIN or IRS in 2019: Sao Tome and Principe

Countries with ≥50% coverage with either LLIN or IRS in 2019: Burundi, Cameroon, Central African Republic, Congo and Democratic Republic of the Congo

Countries that implemented IPTp in 2019: Angola, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon and Sao Tome and Principe

Countries with >30% IPTp3+ in 2019: Burundi, Cameroon, Chad, Democratic Republic of the Congo and Gabon

Percentage of suspected cases tested (reported): 46% (2010), 92% (2015), 93% (2019)

Number of ACT courses distributed: 18.2 million (2010), 22.4 million (2015), 34.0 million (2019)

Number of any antimalarial treatment courses (incl. ACT) distributed: 19.0 million (2010), 22.4 million (2015), 34.2 million (2019)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 20.4 million (2010), 26.6 million (2015), 46.4 million (2019)

Confirmed cases: 6.1 million (2010), 23.4 million (2015), 44.6 million (2019)

Percentage of total cases confirmed: 30.1% (2010), 87.9% (2015), 96.1% (2019)

Deaths: 40 400 (2010), 58 200 (2015), 45 400 (2019)

Children aged under 5 years, presumed and confirmed cases: 9.1 million (2010), 11.3 million (2015), 22.8 million (2019)

Children aged under 5 years, percentage of total cases: 44.9% (2010), 42.6% (2015), 49.2% (2019)

Children aged under 5 years, deaths: 26 000 (2010), 37 100 (2015), 22 500 (2019)

Children aged under 5 years, percentage of total deaths: 64% (2010), 64% (2015), 50% (2019)

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 43.4 million (2010), 42.1 million (2015), 52.3 million (2019); increase 2010–2019: 21%

Deaths: 118 200 (2010), 92 100 (2015), 89 300 (2019); decrease 2010–2019: 24%

ACCELERATION TO ELIMINATION

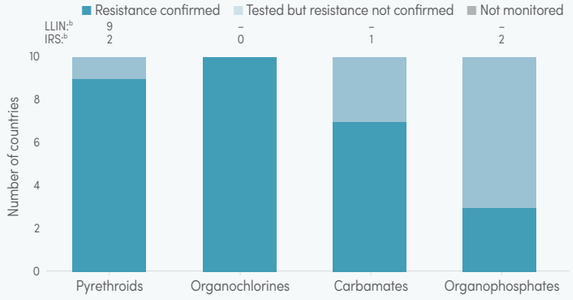
Countries with subnational/territorial elimination programme: Sao Tome and Principe

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2019	40	0.0	1.7	13.6	0.0	3.5
AS-AQ	2010–2019	44	0.0	1.7	8.2	0.0	4.4
DHA-PPQ	2010–2017	12	0.0	0.0	5.2	0.0	2.6

AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; DHA-PPQ: dihydroartemisinin-piperaquine.

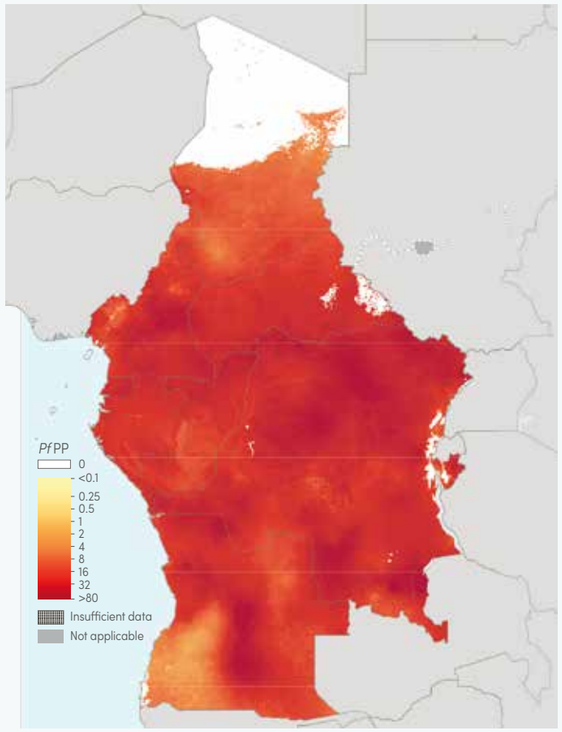
STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)



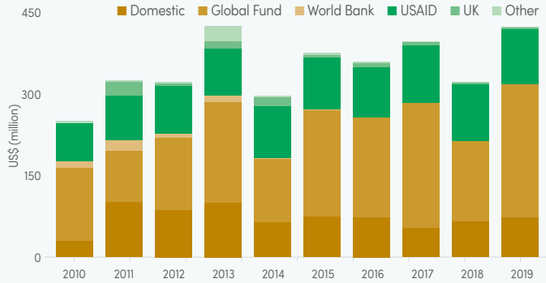
[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.

[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2019



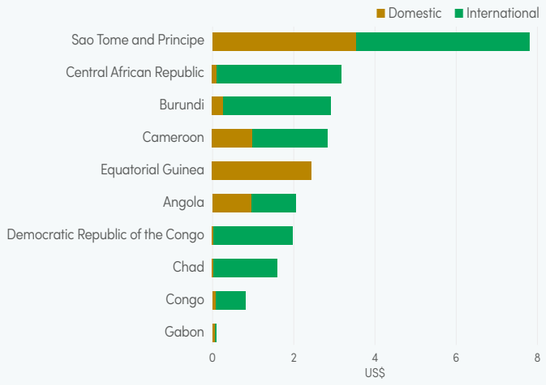
B. Malaria funding[a] by source, 2010–2019



Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.

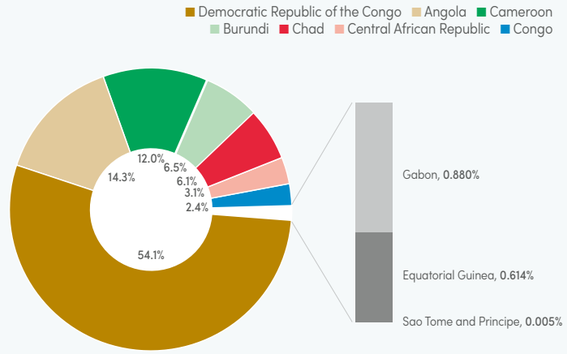
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019



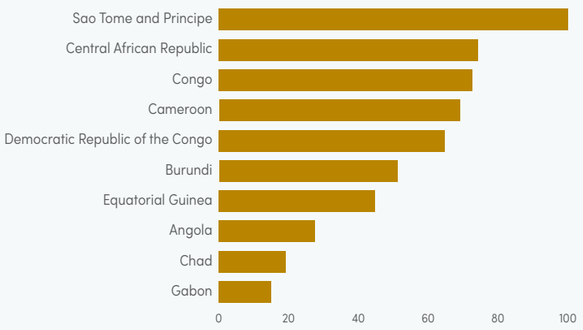
[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2019



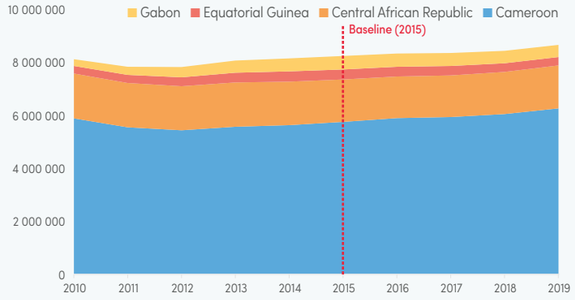
E. Percentage of population with access to either LLINs or IRS, 2019

Source: ITN coverage model from MAP

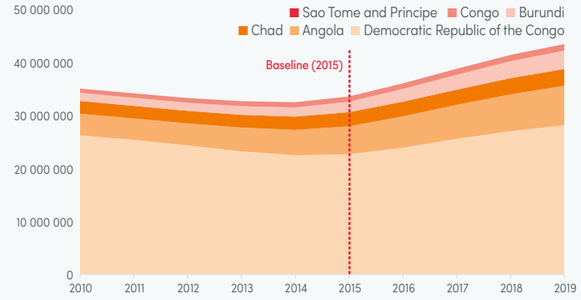


IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.

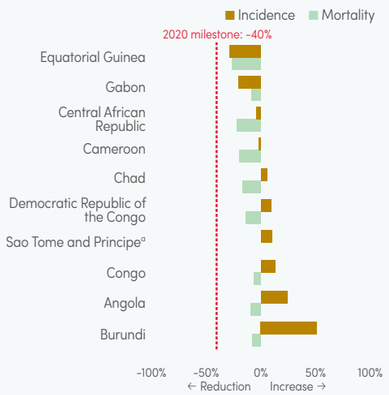
F. Estimated number of cases in countries likely to reduce case incidence by <40% by 2020



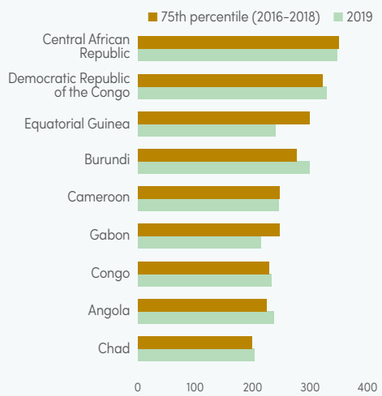
G. Estimated number of cases in countries with an increase in case incidence, 2015–2019



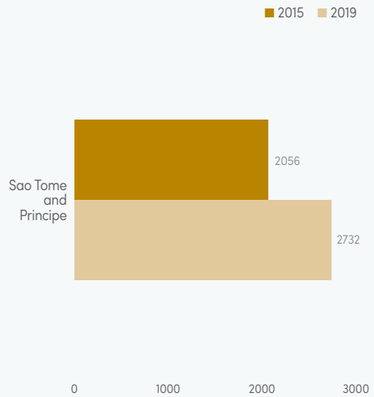
H. Change in estimated malaria incidence and mortality rates, 2015–2019



I. Incidence in 2019 compared to baseline (2016–2018)



J. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



[a] Sao Tome and Principe already achieved the 40% reduction in mortality rate in 2015; since then, there has been no change.

KEY MESSAGES

- About 186 million people living in the 10 countries of Central Africa are at high risk of malaria. Malaria transmission, almost exclusively due to *P. falciparum*, occurs throughout the year except in the north of Cameroon, northern Chad and the southern part of the Democratic Republic of the Congo. The HBHI initiative has been initiated in Cameroon and the Democratic Republic of the Congo.
- In 2019, the subregion had over 51 million estimated cases and almost 90 000 estimated deaths – a 12% increase and a 24% decrease compared with 2010, respectively. Five countries in the region accounted for 80% of the estimated cases: the Democratic Republic of the Congo accounted for 55.5% of estimated cases, followed by Angola (14.9%), Cameroon (12.8%), Burundi (5.8%) and Chad (5.2%). A similar distribution was seen for estimated malaria deaths, which were mainly observed in the Democratic Republic of the Congo (49%), Angola (15%), Cameroon (13%) and Chad (10%). More than 46 million cases were reported in the public and private sector, and in the community; of these, 49.2% were in children aged under 5 years and 44.6 million (96.1%) were confirmed. The proportion of total cases that were confirmed has improved substantially over time, being only 30.1% in 2010.
- Progress has been made towards achieving the GTS target of a 40% reduction in incidence by 2020 in Cameroon, Central African Republic, Chad, Equatorial Guinea and Gabon, but greater efforts are needed to ensure these countries meet the target. Five countries saw an increase in estimated malaria incidence between 2015 and 2019; Burundi had the largest increase (54%), followed by Angola (18%), Sao Tome and Principe (10%), the Democratic Republic of the Congo (5%) and the Congo (4%). Sao Tome and Principe also saw a slight increase in reported cases, although there have been zero deaths reported since 2018. Coverage of preventive vector control measures remains low in the region, except for Sao Tome and Principe with more than 80% coverage. In 2019, Angola, Burundi, Cameroon, the Congo and the Democratic Republic of the Congo conducted LLIN mass campaigns. Additionally, Cameroon and Chad are implementing SMC in targeted areas of the country.
- Vector resistance to pyrethroids was confirmed in 86% of the sites, to organochlorines in 94%, to carbamates in 20% and to organophosphates in 5%. Vector resistance to organochlorines was confirmed in all countries, and to pyrethroids in all countries except Sao Tome and Principe. Four countries have developed their insecticide resistance monitoring and management plans.
- The performance of the surveillance system varies across countries in the region, as can be seen through the completeness of public sector data reported for 2019. All countries except Sao Tome and Principe reported a public sector completeness rate below 100%. Additional challenges include insufficient domestic and international funding, and frequent malaria outbreaks.

Annex 2 - A. WHO African Region, c. Countries with high transmission in East and Southern Africa

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 360 million
Parasites: *P. falciparum* (almost 100%), *P. vivax* (<1%) and other (<1%)
Vectors: *An. arabiensis, An. funestus s.l., An. gambiae s.l., An. gambiae s.s., An. leesoni, An. nili, An. pharoensis, An. rivulorum, An. stephensi s.l.*[a] and *An. vaneedeni.*

[a] A potential vector identified.

FUNDING (US$), 2010–2019

758.6 million (2010), 733.7 million (2015), 698.1 million (2019); decrease 2010–2019: 8%
Proportion of domestic source[a] in 2019: 9%

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2019

Countries with ≥80% coverage with either LLIN or IRS in 2019: none
Countries with ≥50% coverage with either LLIN or IRS in 2019: Kenya, Madagascar, Malawi, Mozambique, Uganda and United Republic of Tanzania

Countries that implemented IPTp in 2019: Kenya, Madagascar, Malawi, Mozambique, South Sudan, Uganda, United Republic of Tanzania (mainland), Zambia and Zimbabwe
Countries with >30% IPTp3+ in 2019: Madagascar, Malawi, Mozambique, Uganda, United Republic of Tanzania and Zambia

Percentage of suspected cases tested (reported):[a] 38% (2010), 80% (2015), 90% (2019)
Number of ACT courses distributed:[b] 84.5 million (2010), 108.2 million (2015), 79.7 million (2019)
Number of any antimalarial treatment courses (incl. ACT) distributed: 84.7 million (2010), 109.9 million (2015), 87.6 million (2019)

[a] Uganda did not report any suspected cases in 2019.
[b] Malawi, South Sudan and Zimbabwe did not report on treatment courses distributed in 2019.

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 53.5 million (2010), 59.0 million (2015), 59.0 million (2019)
Confirmed cases: 8.8 million (2010), 36.2 million (2015), 54.7 million (2019)
Percentage of total cases confirmed: 16.4% (2010), 61.5% (2015), 92.8% (2019)
Deaths: 70 700 (2010), 38 300 (2015), 17 700 (2019)

Children aged under 5 years, presumed and confirmed cases: 21.6 million (2010), 17.6 million (2015), 21.3 million (2019)
Children aged under 5 years, percentage of total cases: 40.3% (2010), 29.9% (2015), 36.1% (2019)
Children aged under 5 years, deaths: 25 300 (2010), 10 400 (2015), 7000 (2019)

ESTIMATED CASES AND DEATHS, 2010–2019

Cases:[a] 55.8 million (2010), 51.4 million (2015), 50.0 million (2019); decrease 2010–2019: 10%
Deaths: 117 000 (2010), 100 800 (2015), 98 500 (2019); decrease 2010–2019: 16%

[a] Estimated cases are derived from the *Pf*Pr-to-incidence model, which means that estimated cases are lower than reported by the country.

ACCELERATION TO ELIMINATION

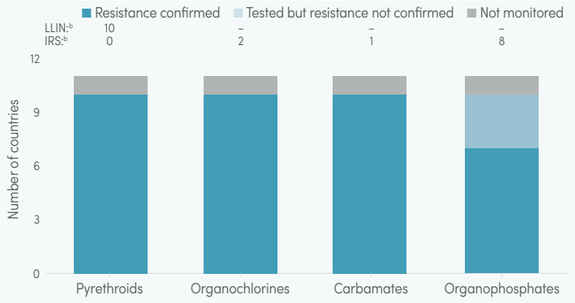
Countries with subnational/territorial elimination programme: United Republic of Tanzania (Zanzibar)

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2019	131	0.0	1.4	19.5	0.0	3.7
AS-AQ	2011–2018	30	0.0	0.0	2.0	0.0	1.0
DHA-PPQ	2010–2019	24	0.0	0.7	6.0	0.0	1.4

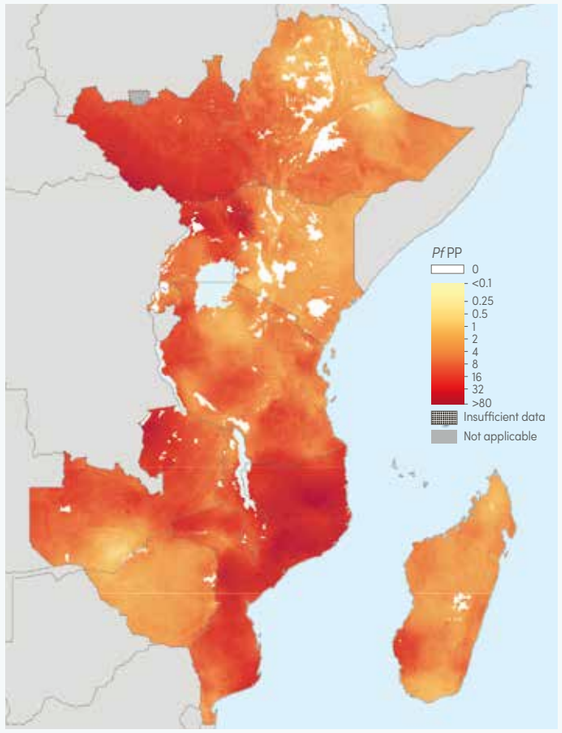
AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

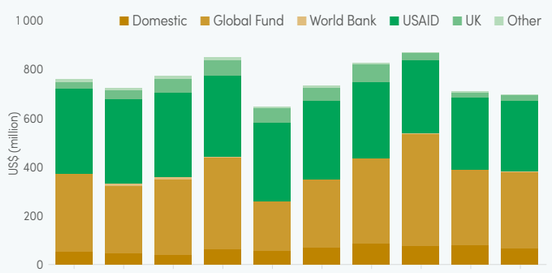


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2019

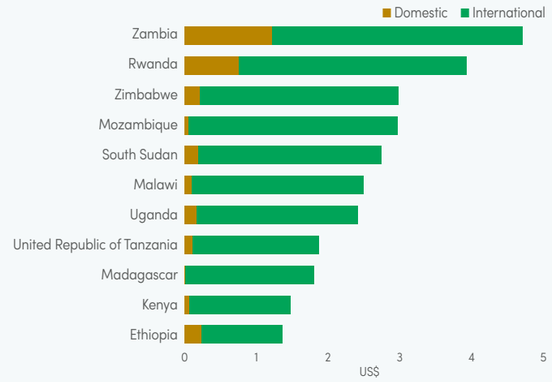


B. Malaria funding[a] by source, 2010–2019



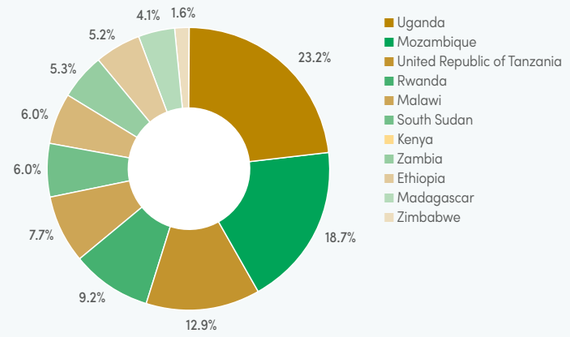
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019

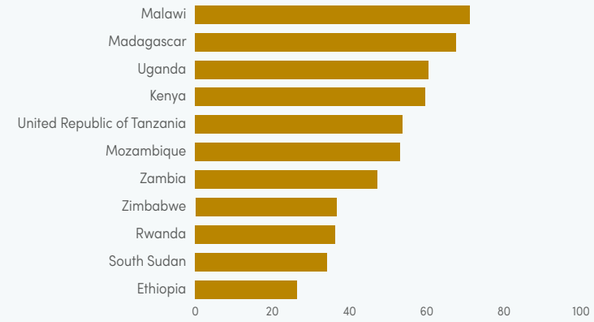


[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2019

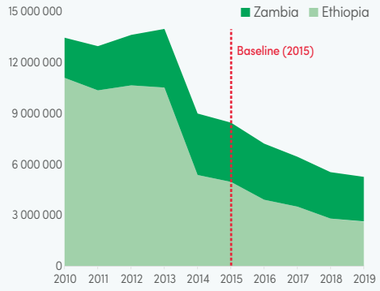


E. Percentage of population with access to either LLINs or IRS, 2019
Source: ITN coverage model from MAP

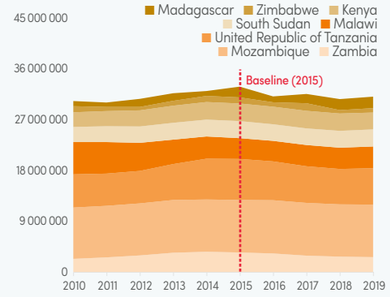


IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.

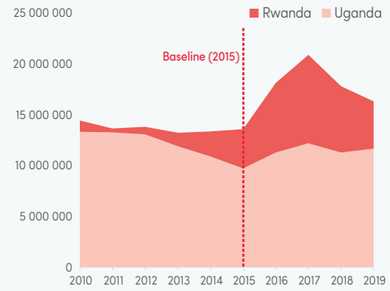
F. Estimated number of cases in countries on track to reduce case incidence by ≥40% by 2020



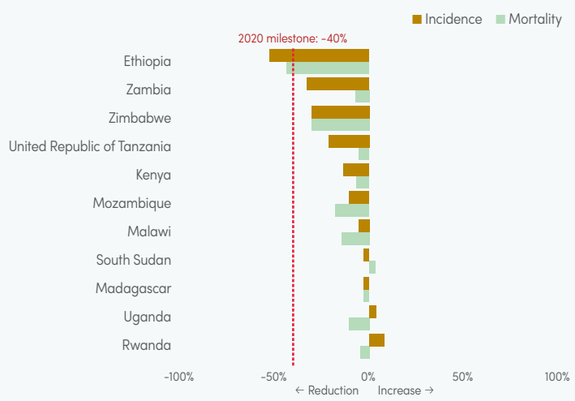
G. Estimated number of cases in countries likely to reduce case incidence by <40% by 2020



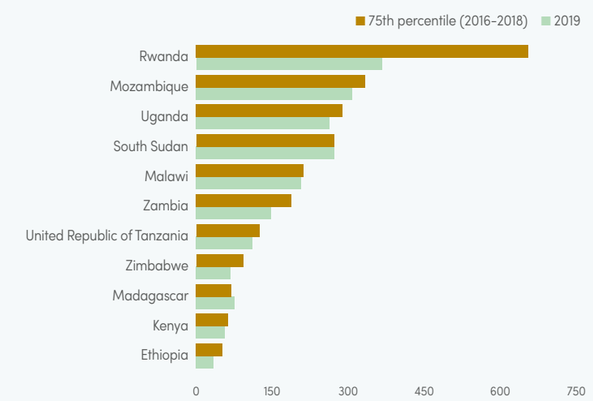
H. Estimated number of cases in countries with an increase in case incidence, 2015–2019



I. Change in estimated malaria incidence and mortality rates, 2015–2019



J. Incidence in 2019 compared to baseline (2016–2018)



KEY MESSAGES

- About 360 million people in the 11 countries with high transmission in East and Southern Africa are at high risk of malaria. Malaria transmission is almost exclusively due to *P. falciparum* (except in Ethiopia), and is highly seasonal in Ethiopia, Madagascar and Zimbabwe, and in coastal and highland areas of Kenya. Malaria transmission is stable in most of Malawi, Mozambique, South Sudan, Uganda, the United Republic of Tanzania and Zambia. The HBHI initiative has been initiated in Mozambique and Uganda.
- The subregion had 50 million estimated cases and about 98 500 estimated deaths, representing a 10% and 16% decrease compared with 2010, respectively. Three countries accounted for over 50% of the estimated cases: Uganda (23.2%), Mozambique (18.7%) and the United Republic of Tanzania (12.9%). In the public and private sector and the community, 59 million cases were reported, of which 36.1% were in children aged under 5 years and 55 million (93%) were confirmed. The proportion of total cases that were confirmed improved substantially over time, from only 16.4% in 2010. A significantly lower number of deaths were reported in 2019 (17 700) compared with 2010 (70 700) and 2015 (38 300).
- In 2019, Ethiopia had already achieved the GTS target of a 40% reduction in incidence by 2020. Zambia and Zimbabwe were closely approaching the target with a reduction in incidence of 33% and 30%, respectively, between 2015 and 2019, whereas all other countries in the region reported either small reductions in incidence, or increases (countries that reported increases were Madagascar, Rwanda, Uganda and, to a lesser extent, the United Republic of Tanzania). In more than half of the countries, 50% or more of the population had access to LLINs or IRS in 2019.
- Reported cases in Rwanda increased from 2.5 million in 2015 to 3.6 million in 2019, an increase of 44.2%. Malawi and Mozambique also had an increase of more than 40%. Causes of such increases can include inadequate vector control, climatic factors and improved reporting. Zanzibar (United Republic of Tanzania) reported 6963 cases in 2019, more than twice as many cases as were reported in 2018 (3332).
- Vector resistance to pyrethroids was confirmed in 74% of the sites, to organochlorines in 42%, to carbamates in 26% and to organophosphates in 14%. Vector resistance to pyrethroids, organochlorines and carbamates was confirmed in all countries except South Sudan, which did not report resistance monitoring. Eleven countries have developed their insecticide resistance monitoring and management plans.
- Challenges include frequent epidemics, emergencies, inadequate response (South Sudan), inadequate funding, delays in critical commodities and weak surveillance systems in several countries.

Annex 2 – A. WHO African Region, d. Countries with low transmission in East and Southern Africa

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 14 million
Parasites: *P. falciparum* (96%), *P. vivax* (4%) and other (<1%)
Vectors: *An. arabiensis, An. funestus s.l., An. funestus s.s., An. gambiae s.l.* and *An. gambiae s.s.*

FUNDING (US$), 2010–2019

68.8 million (2010), 25.9 million (2015), 47.0 million (2019); decrease 2010–2019: 32%
Proportion of domestic source[a] in 2019: 73%
Regional funding mechanisms: Southern Africa Malaria Elimination Eight Initiative

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2019

Countries with ≥80% coverage of at-risk population with either LLIN or IRS in 2019: None
Countries with ≥80% coverage of high risk population with either LLIN or IRS in 2019: Botswana

Countries with >30% IPTp3+ in 2019: none

Percentage of suspected cases tested (reported):[a] 79% (2010), 99% (2015), 98% (2019)
Number of ACT courses distributed:[b] 575 000 (2010), 366 000 (2015), 224 000 (2019)
Number of any antimalarial treatment courses (incl. ACT) distributed: 575 000 (2010), 366 000 (2015), 224 000 (2019)

[a] Comoros and South Africa did not report any suspected cases in 2019.
[b] Comoros and Eswatini did not report on treatment courses distributed in 2019.

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 205 300 (2010), 52 900 (2015), 129 700 (2019)
Confirmed cases: 82 400 (2010), 47 700 (2015), 129 700 (2019)
Percentage of total cases confirmed: 40.2% (2010), 90.2% (2015), 100% (2019)
Deaths:[a] 242 (2010), 178 (2015), 99 (2019)

Children aged under 5 years, presumed and confirmed cases: 56 400 (2010), 7300 (2015), 43 900 (2019)
Children aged under 5 years, percentage of total cases: 27.5% (2010), 13.7% (2015), 33.9% (2019)
Children aged under 5 years, deaths: 37 (2010), 16 (2015), 1 (2019)

[a] No report for Comoros in 2019.

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 133 200 (2010), 90 500 (2015), 224 900 (2019); increase 2010–2019: 69%
Deaths: 344 (2010), 293 (2015), 569 (2019); increase 2010–2019: 65%

ACCELERATION TO ELIMINATION

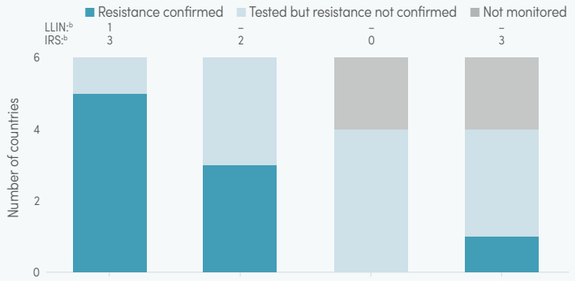
Countries with nationwide elimination programme: Botswana, Comoros, Eswatini, Namibia and South Africa

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2011–2017	18	0.0	0.0	2.5	0.0	0.0
AS-AQ	2010–2016	18	0.0	2.4	7.9	0.0	5.2

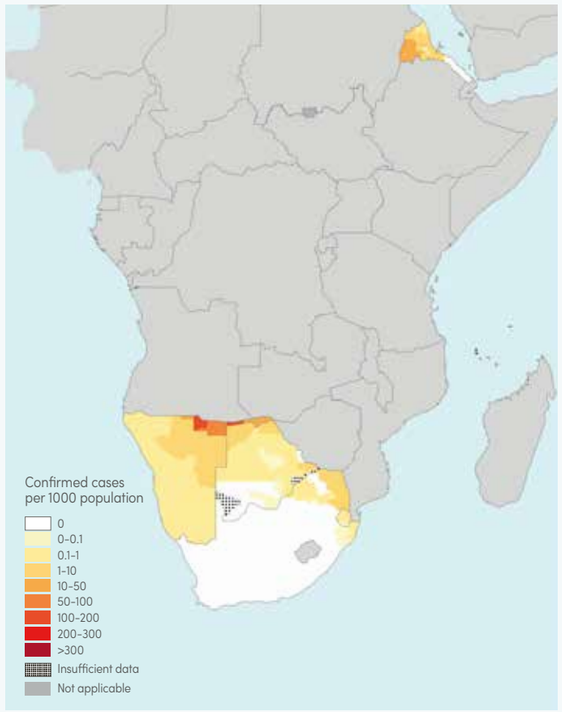
AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

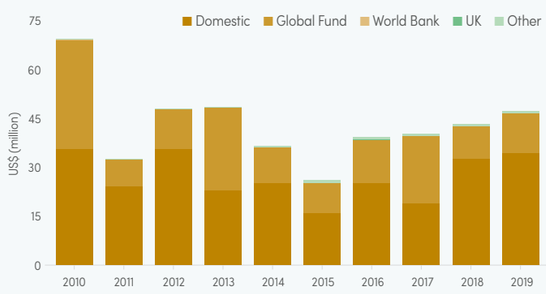


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. Confirmed malaria cases per 1000 population, 2019

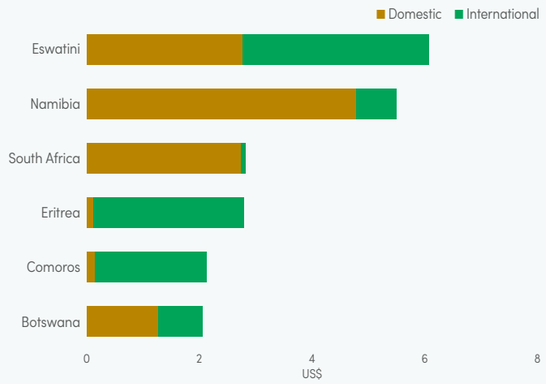


B. Malaria funding[a] by source, 2010–2019



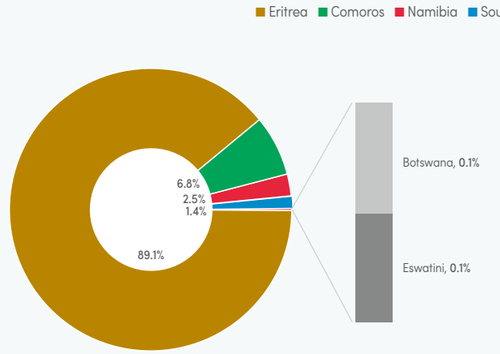
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019

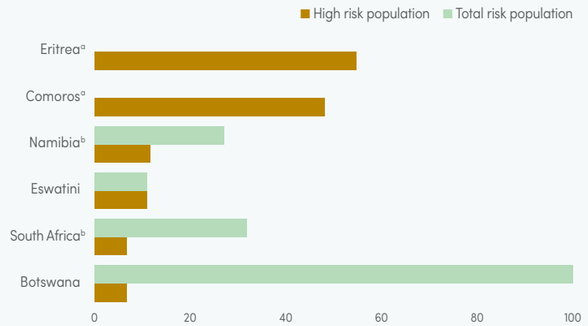


[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2019

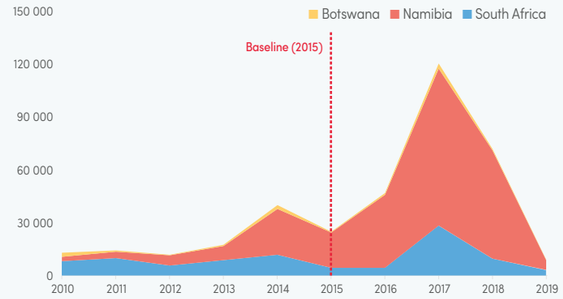


E. Percentage of population with access to either LLINs or IRS, 2019
Source: ITN coverage model from MAP

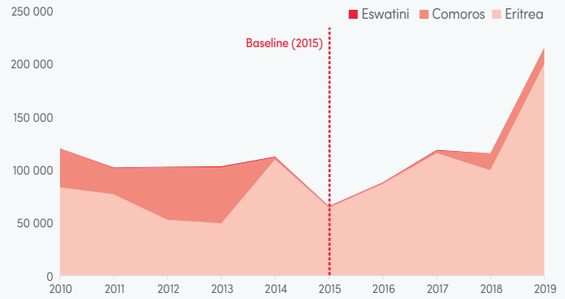


IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.
[a] Comoros and Eritrea have ITN coverage estimated by a model from MAP.
[b] LLIN and IRS coverage is combined in Namibia and South Africa because there is no overlap in the areas where they are used.

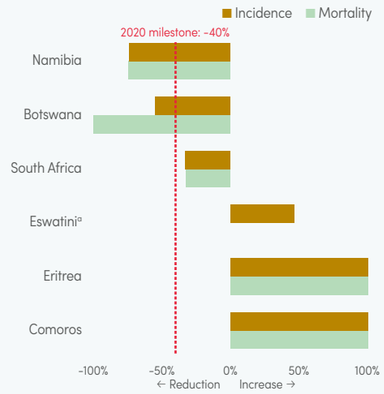
F. Estimated number of cases in countries on track to reduce case incidence by ≥40% by 2020



G. Estimated number of cases in countries with an increase in case incidence, 2015–2019

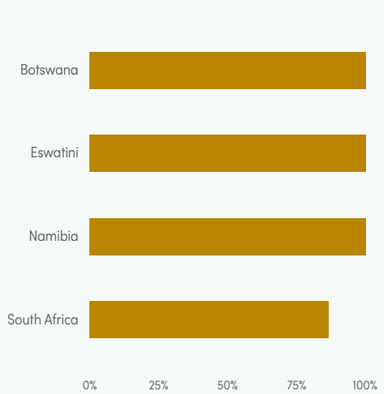


H. Change in estimated malaria incidence and mortality rates, 2015–2019

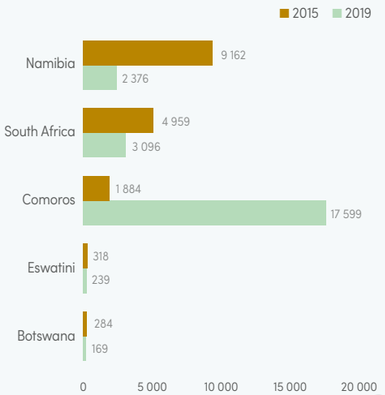


[a] Eswatini already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

I. Percentage of total confirmed cases investigated, 2019



J. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



KEY MESSAGES

- About 14 million people in the six countries with low transmission in East and Southern Africa are at high risk of malaria. Around 130 000 cases were reported, of which 33.9% were in children aged under 5 years and 100% were confirmed. The proportion of total cases that were confirmed improved substantially over time, from only 40.2% in 2010.
- Progress has been made towards achieving the GTS target of a 40% reduction in incidence by 2020 in Botswana, Namibia and South Africa. Estimated cases in Namibia increased significantly, from 2590 in 2010 to 61 564 in 2018, then declined greatly, falling to 5618 in 2019. Estimated indigenous cases in Botswana declined from 2229 in 2010 to 257 in 2019.
- Between 2015 and 2019, Comoros, Eswatini and South Africa recorded an increase in reported indigenous, imported and unclassified cases: Comoros (839%, from 1884 to 17 697), Eswatini (21%, from 475 to 577) and South Africa (179%, from 4959 to 13 833). The number of indigenous cases in Botswana declined over the same period, from 284 to 169 cases. Between 2018 and 2019, increases in cases were reported in Comoros (13%), Eritrea (102%) and South Africa (28%), whereas decreases were reported in Botswana (54%), Eswatini (40%) and Namibia (91%).
- Vector resistance to pyrethroids was confirmed in 29% of the sites, to organochlorines in 18%, to carbamates in 0% and to organophosphates in 7%. There remain significant gaps in standard resistance monitoring for carbamates and organophosphates. Five countries have developed their insecticide resistance monitoring and management plans.
- Challenges include inadequate coverage of vector control, bottlenecks in procurement and supply management, importation of cases from neighbouring countries and resurgence during the past 3 years.

Annex 2 – B. WHO Region of the Americas

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 139 million
Parasites: *P. vivax* (76%), *P. falciparum* and mixed (24%), and other (<1%)
Vectors: *An. albimanus, An. albitarsis, An. aquasalis, An. argyritarsis, An. braziliensis, An. cruzii, An. darlingi, An. neivai, An. nuneztovari, An. pseudopunctipennis* and *An. punctimacula.*

FUNDING (US$), 2010–2019

220.5 million (2010), 197.4 million (2015), 139.2 million (2019); decrease 2010–2019: 37%
Proportion of domestic source[a] in 2019: 86%
Regional funding mechanisms: Regional Malaria Elimination Initiative

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2010–2019

Number of people protected by IRS: 2.78 million (2010), 2.81 million (2015), 1.35 million (2019)
Total LLINs distributed:[a] 363 000 (2010), 875 000 (2015), 1 122 000 (2019)
Number of RDTs distributed: 83 700 (2010), 533 900 (2015), 1 232 700 (2019)
Number of ACT courses distributed: 148 400 (2010), 209 400 (2015), 136 100 (2019)
Number of any first-line antimalarial treatment courses (incl. ACT) distributed: 1.25 million (2010), 669 000 (2015), 1 110 000 (2019)

[a] Number of piperonyl butoxide (PBO) nets distributed is reported in 2019.

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 677 500 (2010), 455 800 (2015), 815 500 (2019)
Confirmed cases: 677 500 (2010), 455 800 (2015), 815 500 (2019)
Percentage of total cases confirmed: 100% (2010), 100% (2015), 100% (2019)
Deaths: 190 (2010), 98 (2015), 197 (2019)

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 821 000 (2010), 561 000 (2015), 889 000 (2019); increase 2010–2019: 8%
Deaths: 510 (2010), 400 (2015), 550 (2019): increase 2010–2019: 9%

ACCELERATION TO ELIMINATION

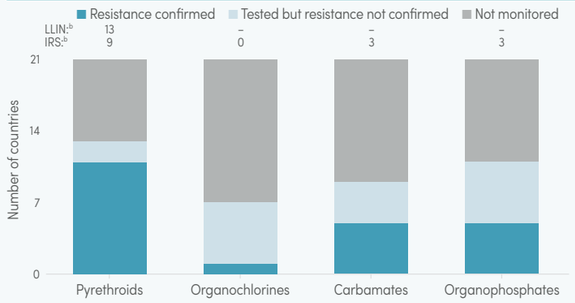
Countries part of the E-2020 initiative: Belize, Costa Rica, Ecuador, El Salvador, Mexico, Paraguay and Suriname
Zero indigenous cases for 3 consecutive years (2017, 2018 and 2019): El Salvador
Zero indigenous cases in 2019: Belize and El Salvador
Certified as malaria free since 2010: Argentina (2019) and Paraguay (2018)

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2011–2019	7	0.0	0.0	0.0	0.0	0.0
AS-MQ	2010–2017	6	0.0	0.0	0.0	0.0	0.0

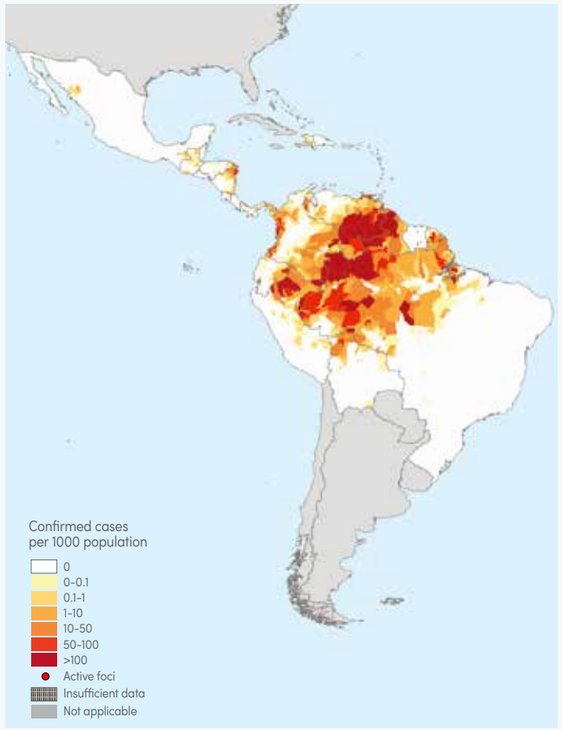
AL: artemether-lumefantrine; AS-MQ: artesunate-mefloquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

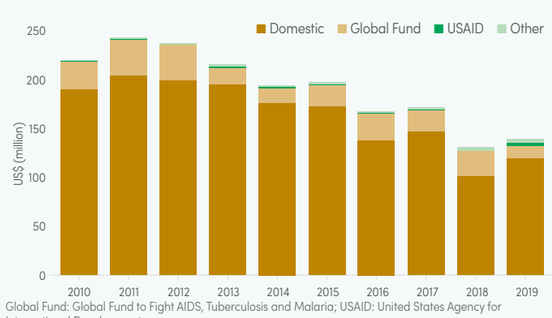


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. Confirmed malaria cases per 1000 population, 2019

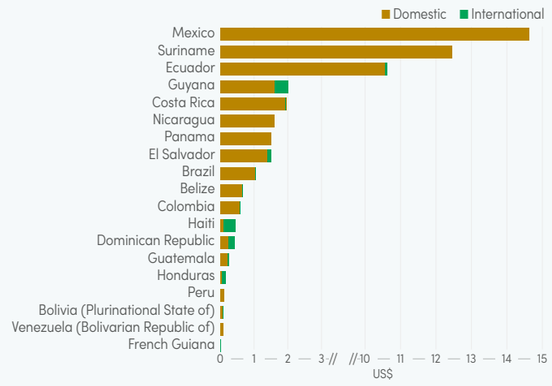


B. Malaria funding[a] by source, 2010–2019



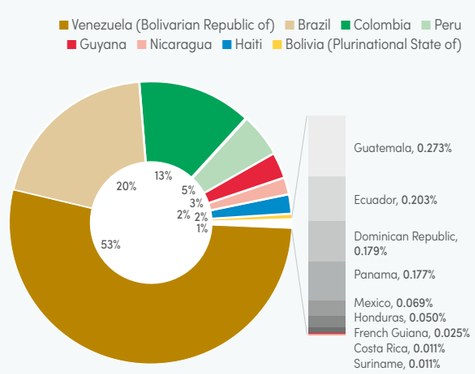
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; USAID: United States Agency for International Development.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019

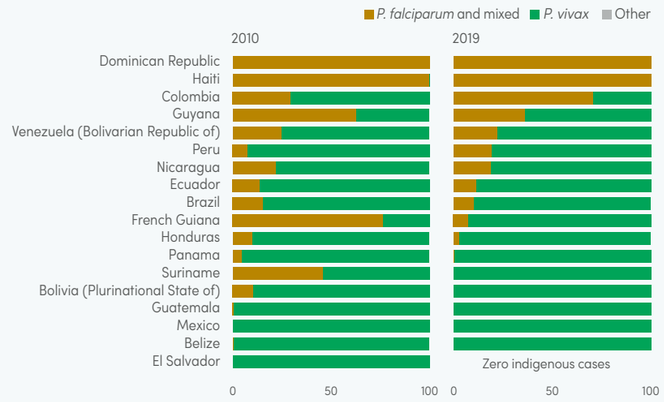


[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

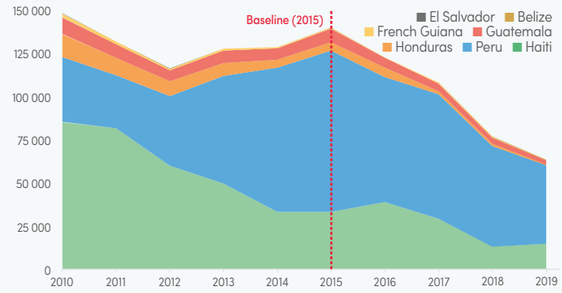
D. Share of estimated malaria cases, 2019



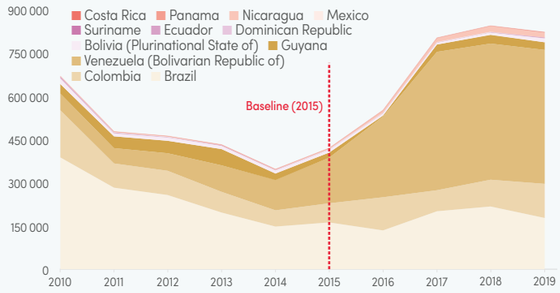
E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2019



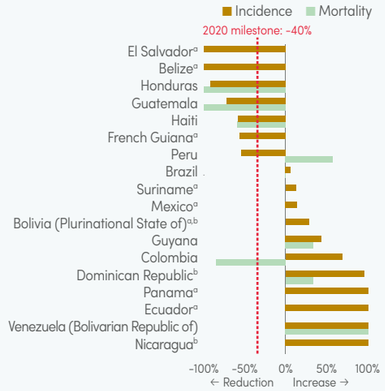
F. Estimated number of cases in countries and areas on track to reduce case incidence by ≥40% by 2020



G. Estimated number of cases in countries with an increase in case incidence, 2015–2019

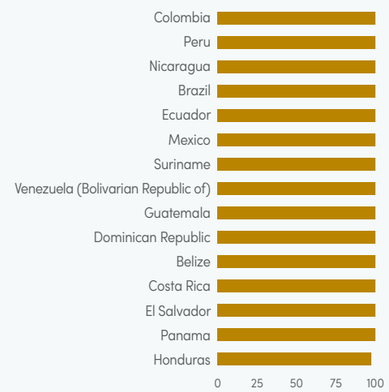


H. Change in estimated malaria incidence and mortality rates, 2015–2019



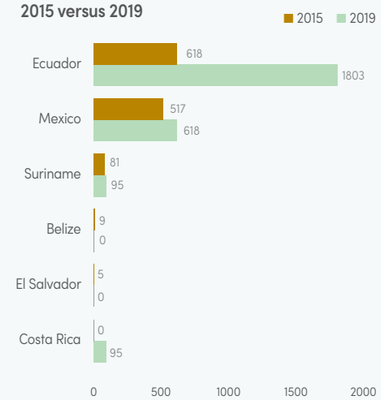
[a] These countries and areas (plus Costa Rica) already achieved the 40% reduction in mortality rate in 2015 and since then, there has been no change.
[b] These countries used reported deaths for mortality.

I. Percentage of total confirmed cases investigated, 2019



Note: Countries and areas with no reported case investigation: Bolivia (Plurinational State of), French Guiana, Guyana and Haiti.

J. Number of reported indigenous cases in countries with national elimination activities, 2015 versus 2019



KEY MESSAGES

- About 139 million people in 18 countries in the WHO Region of the Americas are at risk of malaria, most of which (almost 75%) is caused by *P. vivax*. In 2019, the region reported 815 543 malaria cases – a 20% increase from 2010 – and 197 deaths – a 4% increase from 2010. Three countries accounted for almost 90% of all reported cases: Venezuela (Bolivarian Republic of) (55%), Brazil (22%) and Colombia (11%). Malaria prevention in most of the countries relies on IRS, or mass or routine distribution of bed nets. Bolivia (Plurinational State of) was the only country that introduced the distribution of piperonyl butoxide (PBO) nets in 2019.
- Seven of the endemic countries in the region are on target to reduce estimated case incidence by more than 40% by 2020. Twelve countries – Bolivia (Plurinational State of), Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Guyana, Mexico, Nicaragua, Panama, Suriname and Venezuela (Bolivarian Republic of) – saw increases in incidence in 2019 compared with 2015. Additionally, Colombia, Guatemala, Haiti, Honduras and Peru experienced a reduction in the number of estimated deaths larger than 40%, while another nine countries reported zero malaria deaths.
- Eight countries experienced a reduction in the number of reported cases between 2015 and 2019: Belize (85% reduction), El Salvador (67% reduction), French Guiana (51% reduction), Guatemala (63% reduction), Haiti (39% reduction), Honduras (89% reduction), Peru (63% reduction) and Suriname (43%). All other countries experienced varying levels of increases in reported cases. Nevertheless, transmission in countries was focal – in particular, in Choco in Colombia, Loreto in Peru and Bolivar in Venezuela (Bolivarian Republic of) – with more than one third of all cases in the region in 2018 being from eight municipalities. Increases in other countries in 2019 are attributed to improved surveillance and focal outbreaks.
- All the local cases reported by Guatemala, Mexico and Suriname were due to *P. vivax*. Additionally, between 60% and 99% of the local cases were due to *P. vivax* in Bolivia (Plurinational State of), Brazil, Ecuador, French Guiana, Guyana, Honduras, Nicaragua, Panama, Peru and Venezuela (Bolivarian Republic of). Conversely, all local cases reported by the Dominican Republic and Haiti were due to *P. falciparum*, and 71% of the local cases reported in Colombia in 2019 were due to *P. falciparum*.
- Seven countries in this region are part of the E-2020 initiative: Belize, Costa Rica, Ecuador, El Salvador, Mexico, Paraguay and Suriname. Paraguay and Argentina were certified malaria free by WHO in 2018 and 2019, respectively. In 2019, imported cases accounted for 100% of the cases in Belize (2/2) and El Salvador (3/3), 52% of the cases in Suriname (111/215), 31% of the cases in Costa Rica (45/145), 6% of the cases in Ecuador (106/1909) and 3% of the cases in Mexico (22/641). Additionally, nine countries in Central America and Hispaniola are taking part in the subregional initiative to eliminate malaria by 2020.
- Vector resistance to pyrethroids was confirmed in 26% of the sites, to organochlorines in 4%, to carbamates in 17% and to organophosphates in 19%. Significant gaps remain in standard resistance monitoring for all of the five insecticide classes commonly used for vector control. Nine countries have developed insecticide resistance monitoring and management plans.

Annex 2 - C. WHO Eastern Mediterranean Region

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 324 million

Parasites: *P. falciparum* and mixed (73%), *P. vivax* (27%) and other (<1%)

Vectors: *An. annularis, An. arabiensis, An. culicifacies s.l., An. d'thali, An. fluviatilis s.l., An. funestus s.l., An. gambiae s.s., An. maculipennis s.l., An. merus, An. pulcherrimus, An. sacharovi, An. sergentii, An. stephensi* and *An. superpictus s.l.*

FUNDING (US$), 2010–2019

130.1 million (2010), 160.2 million (2015), 128.9 million (2019); decrease 2010–2019: 1%

Proportion of domestic source[a,b] in 2019: 29%

Regional funding mechanisms: none

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

[b] No domestic funding data reported for Afghanistan, Sudan and Yemen in 2019.

INTERVENTIONS, 2010–2019

Number of people protected by IRS:[a] 10.5 million (2010), 27.8 million (2015), 7.9 million (2019)

Total LLINs distributed:[a] 2.8 million (2010), 5.7 million (2015), 13.5 million (2019)

Number of RDTs distributed: 2.0 million (2010), 6.1 million (2015), 14.2 million (2019)

Number of ACT courses distributed: 2.6 million (2010), 3.2 million (2015), 4.7 million (2019)

Number of any first-line antimalarial treatment courses (incl. ACT) distributed: 2.6 million (2010), 4.0 million (2015), 5.4 million (2019)

[a] No data reported for Pakistan in 2010.

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases:[a] 6.4 million (2010), 5.4 million (2015), 4.5 million (2019)

Confirmed cases: 1.2 million (2010), 1.0 million (2015), 2.6 million (2019)

Percentage of total cases confirmed: 18.3% (2010), 18.8% (2015), 57.8% (2019)

Deaths:[b] 1140 (2010), 1020 (2015), 1690 (2019)

[a] Figures include imported cases. In 2019, 0 and 38 indigenous cases were reported in Iran (Islamic Republic of) and Saudi Arabia, respectively.

[b] In 2019, there was no report on malaria deaths in Pakistan.

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 5.0 million (2010), 4.1 million (2015), 5.2 million (2019): increase 2010–2019: 15%

Deaths: 8720 (2010), 7880 (2015), 10 130 (2019); increase 2010–2019: 16%

ACCELERATION TO ELIMINATION

Countries with nationwide elimination programme: Iran (Islamic Republic of) and Saudi Arabia

Zero indigenous cases in 2019: Iran (Islamic Republic of)

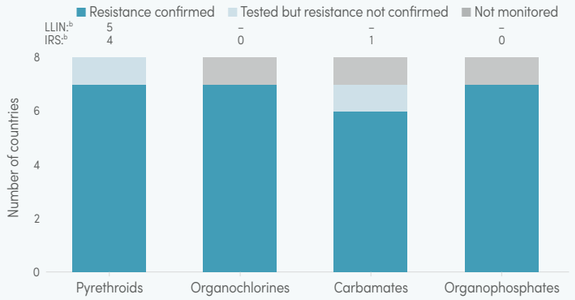
Certified as malaria free since 2010: Morocco (2010)

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2018	32	0.0	0.0	7.9	0.0	2.0
AS+SP	2010–2017	42	0.0	1.0	22.2	0.0	4.4
DHA-PPQ	2015–2017	8	0.0	0.0	2.5	0.0	1.4

AL: artemether-lumefantrine; AS+SP: artesunate+sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine.

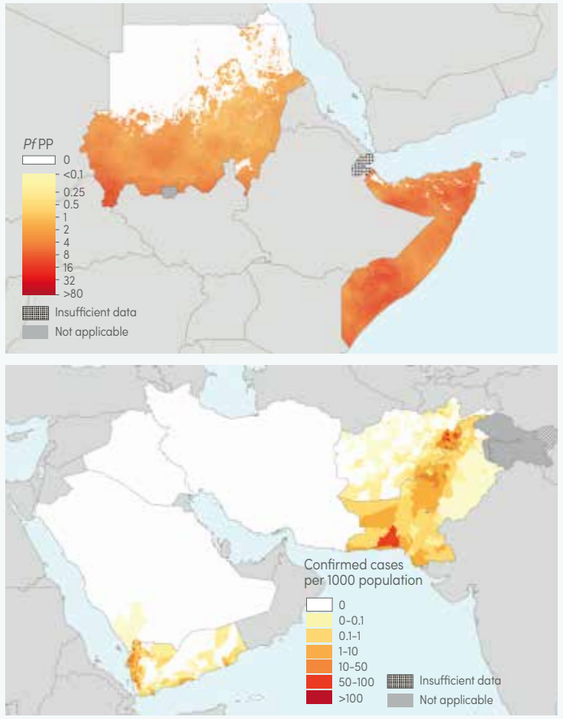
STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)



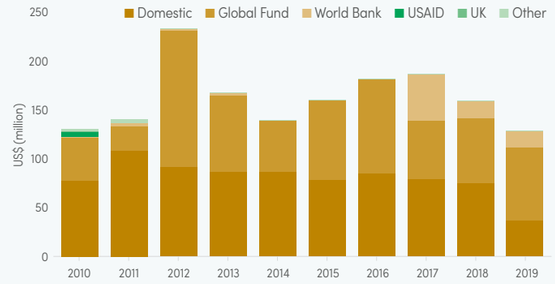
[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.

[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. *P. falciparum* parasite prevalence (*Pf* PP)/confirmed malaria cases per 1000 population, 2019



B. Malaria funding[a,b] by source, 2010–2019

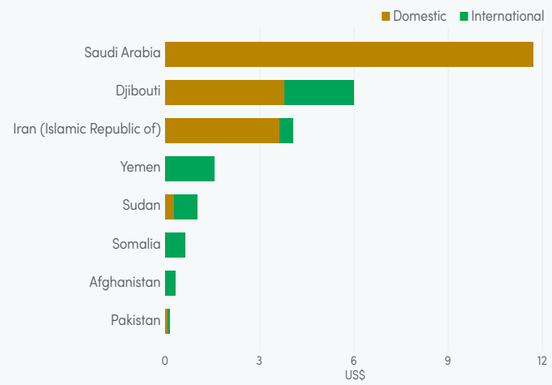


Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.

[a] Excludes patient service delivery costs and out-of-pocket expenditure.

[b] No domestic funding data reported for Afghanistan, Sudan and Yemen in 2019.

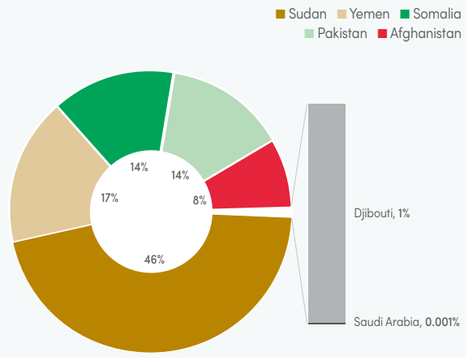
C. Malaria funding[a,b] per person at risk, average 2017–2017



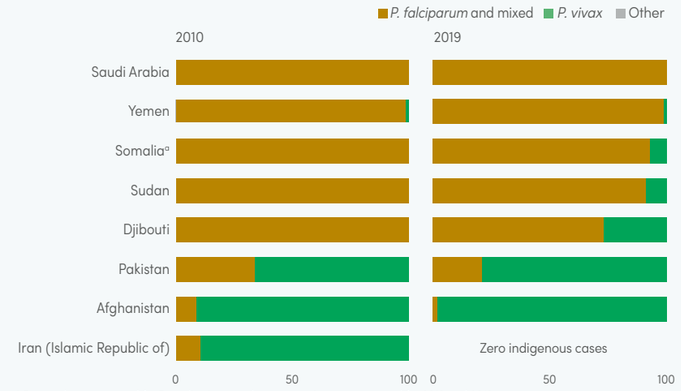
[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

[b] No domestic funding data reported for Afghanistan, Sudan and Yemen in 2019.

D. Share of estimated malaria cases, 2019

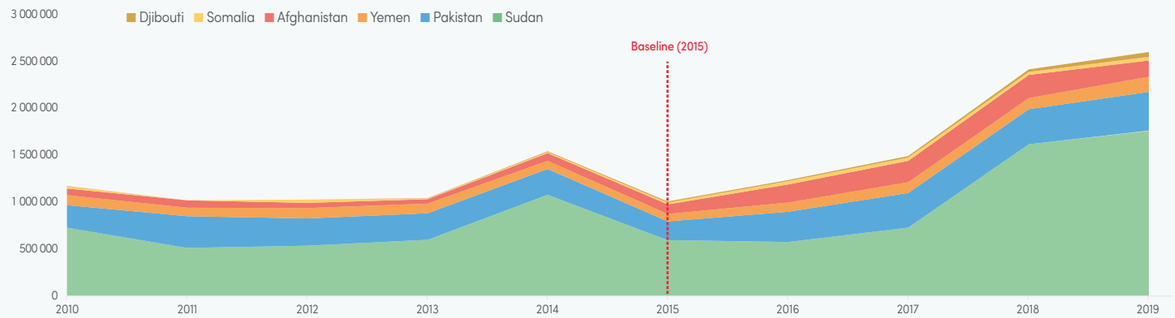


E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2019

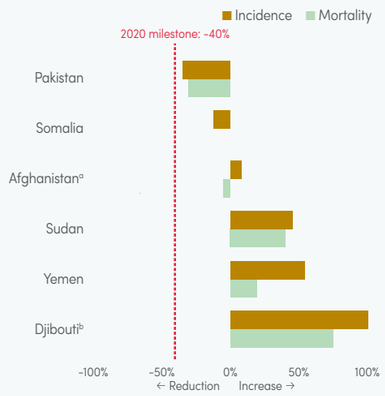


[a] Survey data were used for Somalia since no data on species were reported for 2018 and 2019.

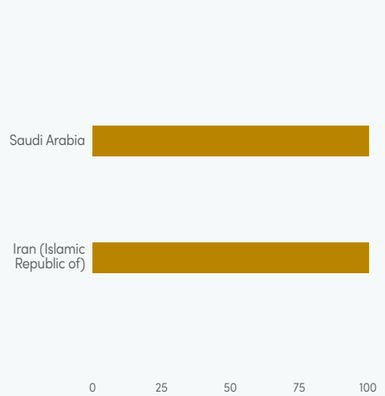
F. Countries with an increase in reported cases, 2015–2019



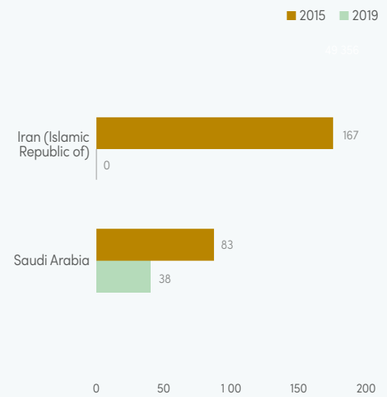
G. Change in estimated malaria incidence and mortality rates, 2015–2019



H. Percentage of total confirmed cases investigated, 2019



I. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



[a] Afghanistan experienced an increase in estimated incidence and mortality rate between 2015 and 2018, followed by a substantial reduction in 2019 (below the 2015 mortality rate, but still marginally above the estimated incidence rate in 2015).

[b] Reported incidence rate is used for Djibouti (as opposed to estimated incidence).

KEY MESSAGES

- Fourteen countries in the WHO Eastern Mediterranean Region are free of indigenous malaria and are at the stage of prevention of re-establishment. There are eight malaria endemic countries in the region, and *P. falciparum* is responsible for 73% of all detected infections. Estimated malaria incidence in the region declined between 2010 and 2015 but increased over the past 4 years, translating into a 15% increase between 2010 and 2019. The number of estimated malaria deaths also increased, in this case by 16% between 2010 and 2019.
- Sudan and Yemen accounted for about two thirds of the cases estimated for the region. In 2019, the region reported that about 2.6 million of the 4.5 million cases reported were confirmed (57.8%), which represented an increase from the 46% confirmation rate reported in 2018 and the 18% in 2010. The reported number of deaths increased from 1143 in 2010 to 1690 in 2019.
- The Islamic Republic of Iran and Saudi Arabia are both targeting elimination by 2020. The Islamic Republic of Iran reported zero indigenous cases for the past 2 years (and until October 2020). In Saudi Arabia, the number of indigenous malaria cases declined from 272 in 2016 to 38 in 2019. These countries undertake continued vigilance for malaria in the general health services, and provide diagnosis and treatment free of charge to all imported cases.
- Vector resistance to pyrethroids, organochlorines and organophosphates was confirmed in 76%, 66% and 46% of the sites tested, respectively, in all countries except for Saudi Arabia. Also, 25% of the sites in the region confirmed resistance to carbamates in all countries except for Saudi Arabia and Somalia. Seven countries have developed their insecticide resistance monitoring and management plans.
- Challenges include low coverage of essential interventions (below universal target) in most malaria endemic countries, inadequate funding and dependence on external resources, humanitarian emergencies, difficult operational environments and population displacements, a shortage of skilled technical staff (particularly at subnational level), and weak surveillance and health information systems. Frequent floods – particularly in Somalia, Sudan and Yemen – and the increasing presence of invasive *An. stephensi* in Djibouti, Somalia and Sudan have increased the risk of malaria, particularly in urban and suburban areas. The confirmed presence of HRP2/3 gene deletions in Djibouti and the high probability of the presence of this mutation in Somalia is another threat for the region. These challenges may have led to an overall increase in cases during the period 2015–2019 in some countries of the region.

Annex 2 - D. WHO South-East Asia Region

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 1.64 billion
Parasites: *P. falciparum* and mixed (53%), *P. vivax* (46%) and other (<1%)
Vectors: *An. albimanus, An. annularis, An. balabacensis, An. barbirostris, An. culicifacies s.l., An. dirus s.l., An. farauti s.l., An. fluviatilis, An. leteri, An. maculatus s.l., An. minimus s.l., An. peditaeniatus, An. philippinensis, An. pseudowillmori, An. punctulatus s.l., An. sinensis s.l., An. stephensi s.l., An. subpictus s.l., An. sundaicus s.l., An. tessellatus, An. vagus, An. varuna* and *An. yatsushiroensis.*

FUNDING (US$), 2010–2019

250.9 million (2010), 201.8 million (2015), 259.9 million (2019); increase 2010–2019: 4%
Proportion of domestic source[a] in 2019: 61%
Regional funding mechanisms: Mekong Malaria Elimination (MME) initiative in the Greater Mekong subregion: Myanmar and Thailand

[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2010–2019

Number of people protected by IRS: 76.4 million (2010), 57.2 million (2015), 31.6 million (2019)
Total LLINs distributed: 7.4 million (2010), 7.3 million (2015), 34.8 million (2019)
Number of RDTs distributed:[a] 11.4 million (2010), 23.5 million (2015), 6.6 million (2019)
Number of ACT courses distributed:[b] 3.5 million (2010), 2.8 million (2015), 1.0 million (2019)
Number of any first-line antimalarial treatment courses (incl. ACT) distributed:[b] 4.1 million (2010), 2.9 million (2015), 1.1 million (2019)

[a] Data for India were not available for 2019.
[b] Distribution numbers were not reported in India in 2019. Numbers for India were assigned based on the total number of cases treated in the country.

REPORTED CASES AND DEATHS,[a] 2010–2019

Total (presumed and confirmed) cases: 3.1 million (2010), 1.7 million (2015), 672 000 (2019)
Confirmed cases: 2.6 million (2010), 1.6 million (2015), 671 000 (2019)
Percentage of total cases confirmed: 85.8% (2010), 98.9% (2015), 99.9% (2019)
Deaths: 2421 (2010), 620 (2015), 162 (2019)

[a] Bangladesh, Bhutan, Indonesia, Nepal, Thailand and Timor-Leste included imported cases in 2019.

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 24.6 million (2010), 13.3 million (2015), 6.3 million (2019); decrease 2010–2019: 74%
Deaths: 38 300 (2010), 24 100 (2015), 9000 (2019); decrease 2010–2019: 76%

ACCELERATION TO ELIMINATION

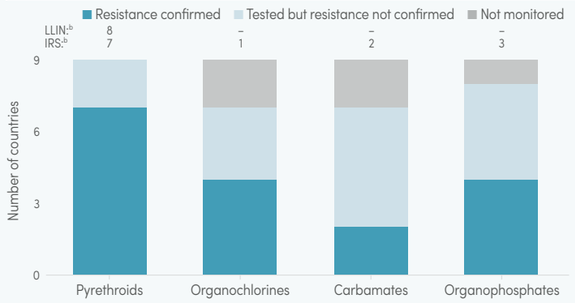
Countries with subnational/territorial elimination programme: Bangladesh, India, Indonesia, Myanmar and Thailand
Countries with nationwide elimination programme: Bhutan, Democratic People's Republic of Korea, Nepal and Timor-Leste
Zero indigenous cases in 2019: Timor-Leste
Certified as malaria free since 2010: Maldives (2015) and Sri Lanka (2016)

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2019	88	0.0	0.0	14.3	0.0	1.9
AS+SP	2010–2017	56	0.0	0.0	25.9	0.0	1.5
AS-MQ	2010–2016	23	0.0	2.1	49.1	0.0	15.6
DHA-PPQ	2010–2018	33	0.0	0.0	100.0	0.0	2.0

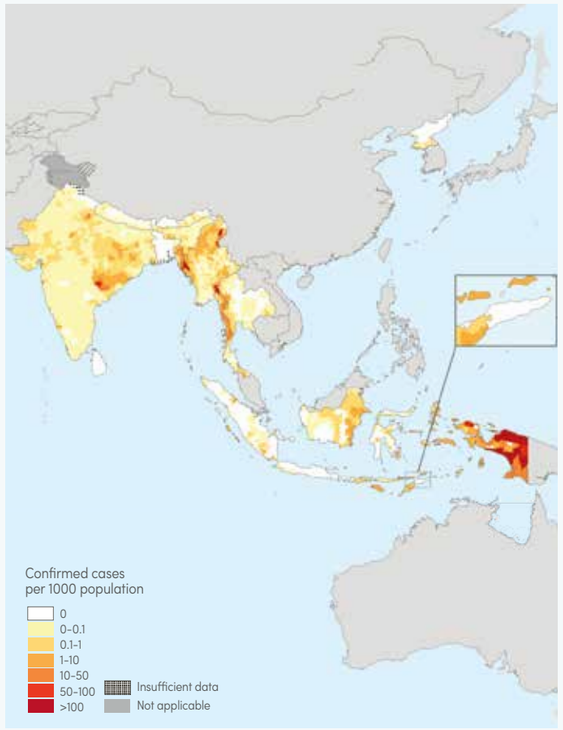
AL: artemether-lumefantrine; AS-MQ: artesunate-mefloquine; AS+SP: artesunate+sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

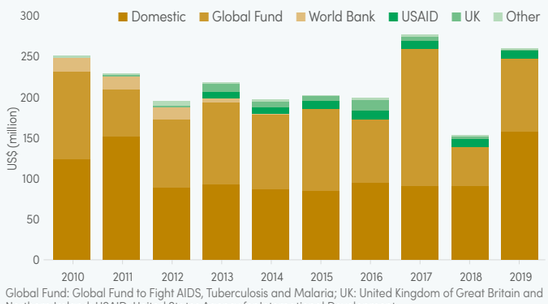


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. Confirmed malaria cases per 1000 population, 2019

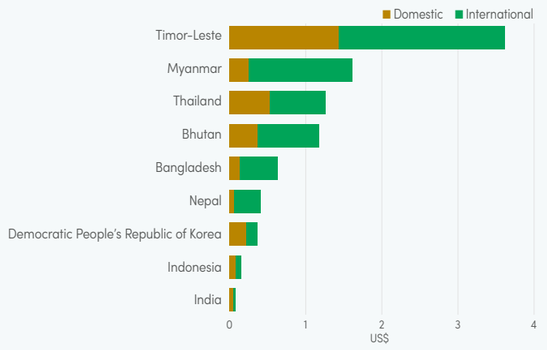


B. Malaria funding[a] by source, 2010–2019



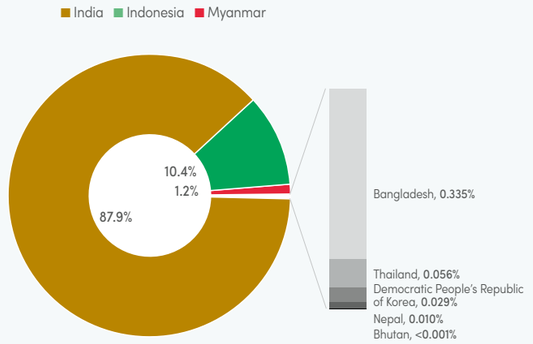
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a] per person at risk, average 2017–2019

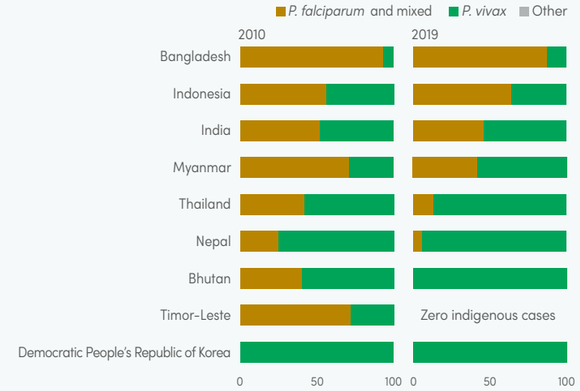


[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

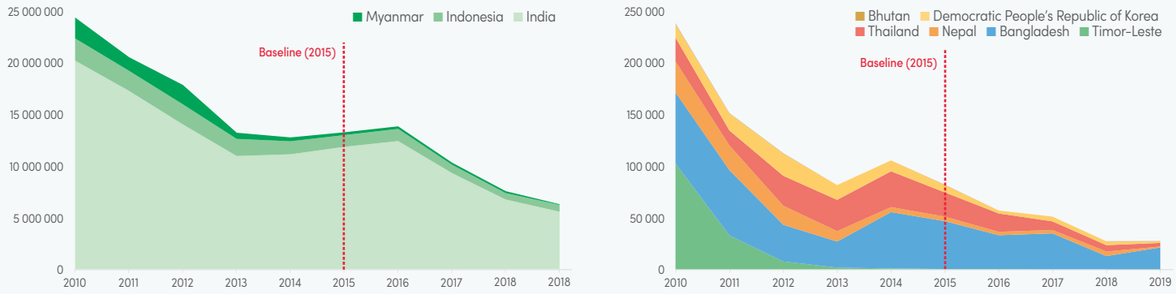
D. Share of estimated malaria cases, 2019



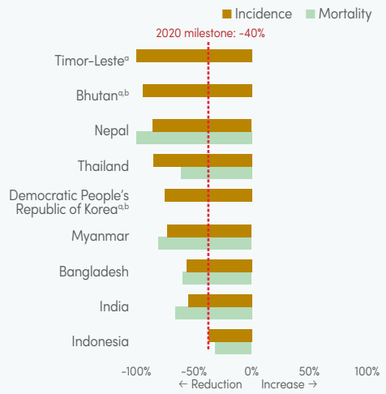
E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2019



F. Estimated number of cases in countries on track to reduce case incidence by ≥40% by 2020

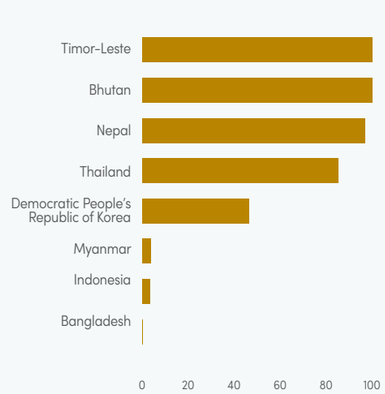


G. Change in estimated malaria incidence and mortality rates, 2015–2019



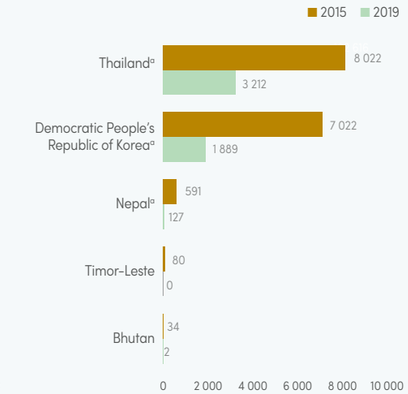
[a] These countries already achieved the 40% reduction in mortality rate in 2015; since then, there has been no change.
[b] Reported confirmed cases are used for these countries (as opposed to estimated cases).

H. Percentage of total confirmed cases investigated,[a] 2019



[a] Country with no reported case investigation: India.

I. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



[a] Not all confirmed cases underwent case investigation in these countries.

KEY MESSAGES

- An estimated 1.64 billion people in the WHO South-East Asia Region are at risk of malaria. The disease is endemic in nine of the region's 11 countries, accounting for nearly 50% of the burden of malaria outside the WHO African Region. In 2019, the region had 6.3 million estimated cases and 9000 estimated deaths – reductions of 73% and 74%, respectively, compared with 2000 – representing the largest decline among all regions. All countries are on target to achieve a more than 40% reduction in case incidence and mortality rate by 2020 compared with 2015, except Indonesia where the mortality rate reduced by 37%.
- Three countries accounted for 99.5% of the estimated cases in the region, India being the largest contributor (87.9%), followed by Indonesia (10.4%) and Myanmar (1.2%). Despite being the highest burden country of the region, in 2019, India recorded a 60% reduction in reported cases compared with 2017 and a 46% reduction compared with 2018. Two other countries in the region recorded substantial declines in total reported cases between 2018 and 2019: Democratic People's Republic of Korea (49% reduction) and Nepal (40% reduction).
- Continuing the declining trend, reported malaria deaths in the region dropped to 162 in 2019 – a 93% reduction compared with 2010. India, Indonesia and Myanmar accounted for 48%, 30% and 9% of the total reported deaths in the region, respectively. Bhutan, Democratic People's Republic of Korea, Nepal and Timor-Leste continue to record zero indigenous deaths.
- Three countries in this region aimed to eliminate malaria by 2020: Bhutan, Nepal and Timor-Leste. Timor-Leste continued to be free of indigenous malaria for the second successive year, while Bhutan reported just two indigenous cases in 2019. For both countries, these reductions in indigenous cases represent significant achievements compared with 2015 (100% and 94% reductions in reported cases, respectively). The majority of reported cases in these countries were imported: Bhutan at 71% (30/42), Nepal at 82% (579/710) and Timor-Leste at 100% (9/9). Maldives and Sri Lanka, which were certified as malaria free in 2015 and 2016, respectively, continue to maintain their malaria free status.
- Vector resistance to pyrethroids was confirmed in 50% of the sites, to organochlorines in 76%, to carbamates in 49% and to organophosphates in 57.5%. There remain significant gaps in standard resistance monitoring. Four countries have developed insecticide resistance monitoring and management plans.
- Challenges include decreased funding, multiple artemisinin-based combination therapy failures in the countries of the Greater Mekong subregion (GMS) and vector resistance to pyrethroids. Efforts are underway to strengthen surveillance and enhance reporting from private sector and nongovernmental organizations where relevant, and case-based surveillance and response to accelerate towards elimination. Imported malaria is an increasingly critical challenge for those countries that are on the verge of malaria elimination.

Annex 2 – E. WHO Western Pacific Region

EPIDEMIOLOGY

Population denominator used to compute incidence and mortality rate: 767 million
Parasites: *P. falciparum* and mixed (68%), *P. vivax* (32%) and other (<1%)
Vectors: *An. anthropophagus, An. balabacensis, An. barbirostris s.l., An. dirus s.l., An. donaldi, An. epirotivulus, An. farauti s.l., An. flavirostris, An. jeyporiensis, An. koliensis, An. litoralis, An. maculatus s.l., An. mangyanus, An. minimus s.l., An. punctulatus s.l., An. sinensis s.l.* and *An. sundaicus s.l.*

FUNDING (US$), 2010–2019

211.6 million (2010), 146.3 million (2015), 141.8 million (2019); decrease 2010–2019: 33%
Proportion of domestic source[a] in 2019: 53%
Regional funding mechanisms: Mekong Malaria Elimination (MME) initiative in the Greater Mekong subregion: Cambodia, China (Yunnan), Lao People's Democratic Republic and Viet Nam (supported by RAI2e Global Fund)
[a] Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2010–2019

Number of people protected by IRS: 27.9 million (2010), 3.3 million (2015), 1.8 million (2019)
Total LLINs distributed: 3.4 million (2010), 2.7 million (2015), 3.8 million (2019)
Number of RDTs distributed: 1.6 million (2010), 2.5 million (2015), 6.1 million (2019)
Number of ACT courses distributed: 591 000 (2010), 1.3 million (2015), 1.7 million (2019)
Number of any antimalarial treatment courses (incl. ACT) distributed: 963 000 (2010), 1.4 million (2015), 1.8 million (2019)

REPORTED CASES[a,b] AND DEATHS IN PUBLIC SECTOR, 2010–2019

Total (presumed and confirmed) cases: 1.8 million (2010), 829 000 (2015), 791 000 (2019)
Confirmed cases: 319 000 (2010), 517 000 (2015), 776 000 (2019)
Percentage of total cases confirmed: 17.7% (2010), 62.4% (2015), 98.2% (2019)
Deaths: 910 (2010), 235 (2015), 229 (2019)
[a] China, Malaysia, Philippines, Republic of Korea, Vanuatu and Viet Nam included imported cases for 2019. China has had no indigenous malaria since 2017.
[b] In Malaysia, figures for 2015 and 2019 included indigenous *P. knowlesi* cases. All indigenous malaria cases observed since 2018 have been *P. knowlesi*.

ESTIMATED CASES AND DEATHS, 2010–2019

Cases: 1.8 million (2010), 1.4 million (2015), 1.7 million (2019); decrease 2010–2019: 5%
Deaths: 3780 (2010), 2780 (2015), 3160 (2019); decrease 2010–2019: 16%

ACCELERATION TO ELIMINATION

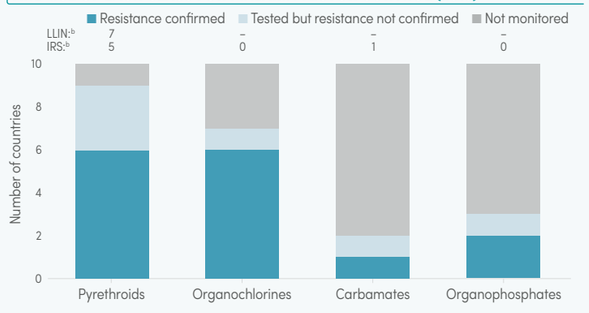
Countries with subnational/territorial elimination programme: Philippines
Countries with nationwide elimination programme: Cambodia, China, Lao People's Democratic Republic, Malaysia, Republic of Korea, Vanuatu and Viet Nam
Zero indigenous cases for 3 consecutive years (2017, 2018 and 2019): China
Zero indigenous cases in 2019: China and Malaysia

THERAPEUTIC EFFICACY STUDIES (CLINICAL AND PARASITOLOGICAL FAILURE AMONG PATIENTS WITH *P. FALCIPARUM* MALARIA, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2019	33	0.0	0.0	17.2	0.0	5.8
AS-MQ	2010–2019	32	0.0	0.0	12.5	0.0	0.0
AS-PY	2014–2019	15	0.0	1.6	18.0	0.0	5.1
DHA-PPQ	2010–2019	84	0.0	1.6	85.7	0.0	17.5

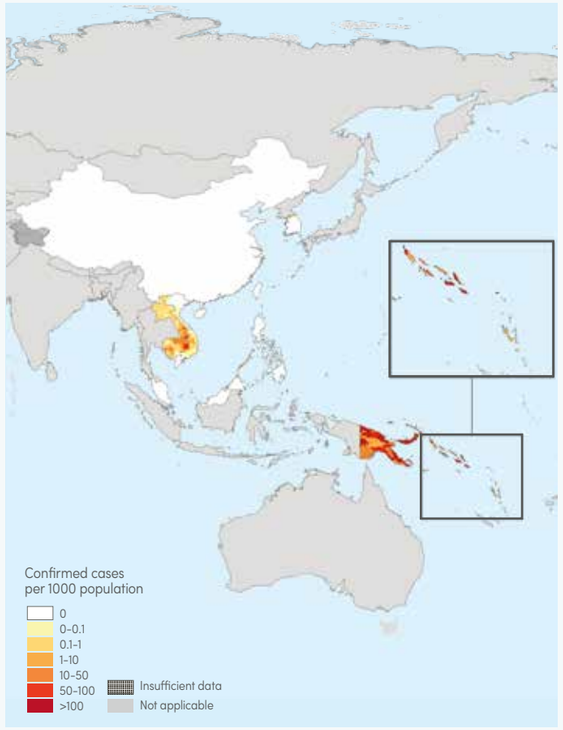
AL: artemether-lumefantrine; AS-MQ: artesunate-mefloquine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2019) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2019)

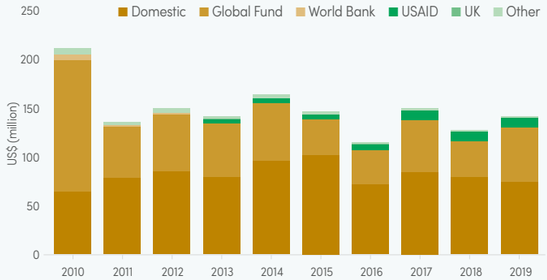


[a] Resistance is considered confirmed when it was detected to one insecticide in the class, in at least one malaria vector from one collection site.
[b] Number of countries that reported using the insecticide class for malaria vector control (2019).

A. Confirmed malaria cases per 1000 population, 2019

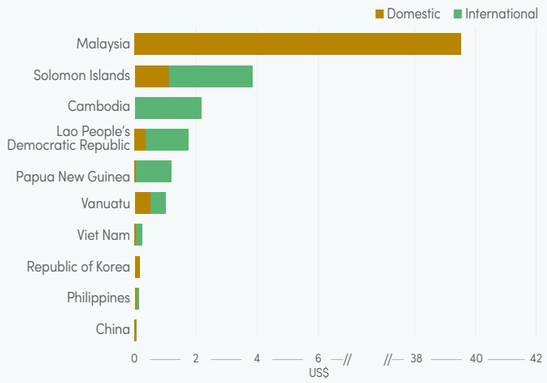


B. Malaria funding[a] by source, 2010–2019



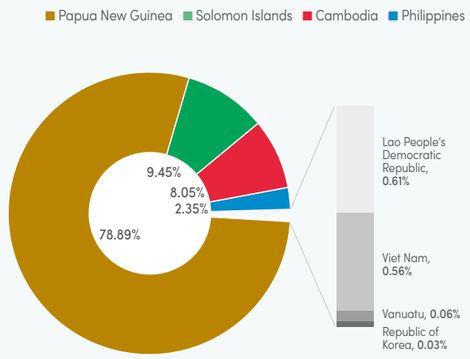
Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland; USAID: United States Agency for International Development.
[a] Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding[a,b] per person at risk, average 2017–2019



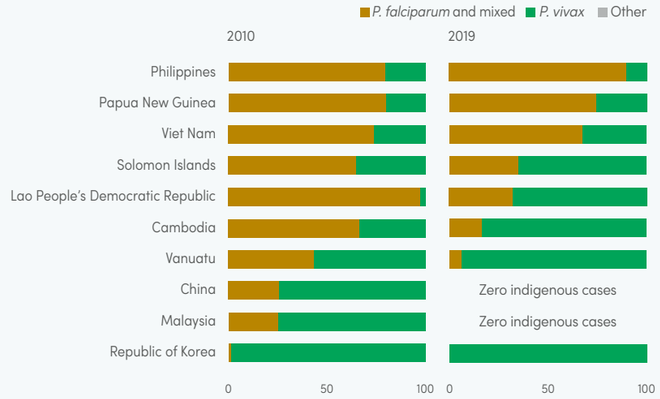
[a] Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.
[b] Only domestic funding in Malaysia and the Republic of Korea.

D. Share of estimated malaria cases, 2019

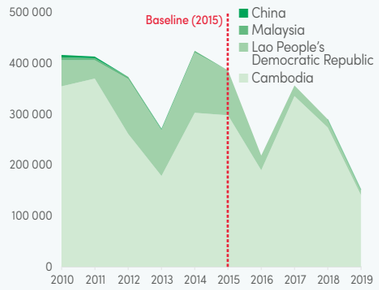


Note: Countries with zero cases: China and Malaysia.

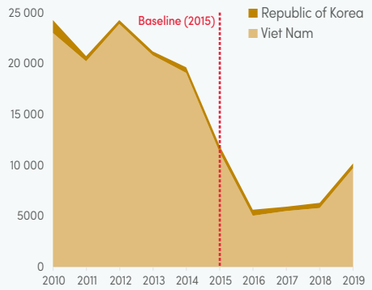
E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2019



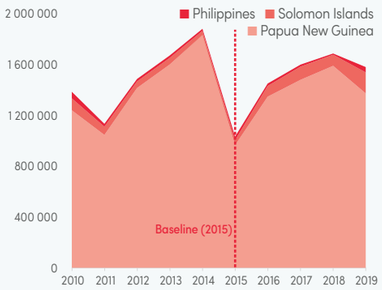
F. Estimated number of cases in countries on track to reduce case incidence by ≥40% by 2020



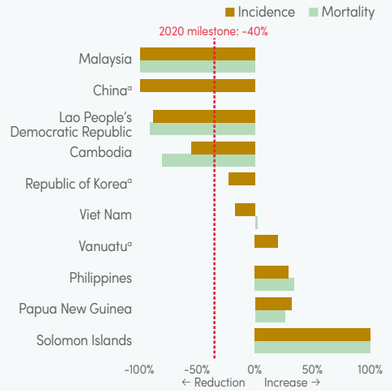
G. Estimated number of cases in countries likely to reduce case incidence by <40% by 2020



H. Estimated number of cases in countries with an increase in case incidence, 2015–2019

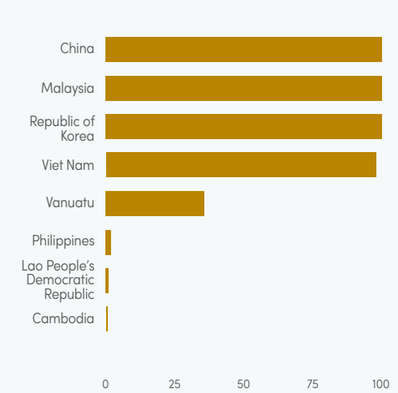


I. Change in estimated malaria incidence and mortality rates, 2015–2019



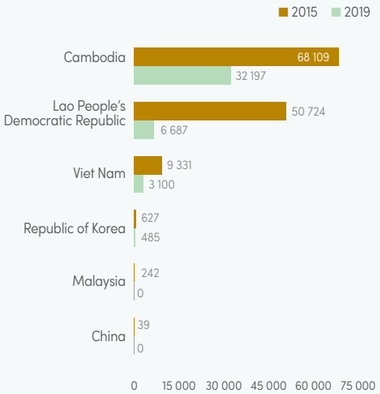
[a] There have been no estimated indigenous deaths between 2015 and 2019 in these countries.

J. Percentage of total confirmed cases investigated, 2019



Notes: Imported cases are included.
No case investigation in Papua New Guinea and Solomon Islands.

K. Reported indigenous cases in countries with national elimination activities, 2015 versus 2019



KEY MESSAGES

- About 767 million people in 10 countries in the WHO Western Pacific Region are at risk of malaria, which is predominantly caused by *P. falciparum* (66%), followed by *P. vivax* (32%). In 2019, the region had more than 1.7 million estimated malaria cases and about 3160 estimated deaths – a 5% increase and 16% reduction from 2010, respectively. Most cases occurred in Papua New Guinea (79%) which, together with Solomon Islands (9%) and Cambodia (8%), comprised 96% of the estimated cases in the region. About 776 000 cases were reported in the public and private sectors and in the community, of which almost 98% were confirmed. This was a significant improvement over 2018, when only 59% of cases were confirmed. There were 229 malaria deaths reported in the region in 2019.
- Of the 10 malaria endemic countries in the region, four are on target to achieve more than a 40% reduction in case incidence by 2020, including Cambodia, China, Lao People's Democratic Republic and Malaysia, whereas the Republic of Korea and Viet Nam are on track for a 20–40% reduction. Countries that have experienced an increase in estimated cases since 2015 are Papua New Guinea (32%), the Philippines (29%), Solomon Islands (270%) and Vanuatu (20%). All countries are on track to reduce the malaria mortality rate by at least 40% by 2020, except for Papua New Guinea, the Philippines and Solomon Islands.
- China and Malaysia are on track for elimination of malaria by 2020. China has reported zero indigenous cases for 3 consecutive years (since 2017) and Malaysia has reported zero indigenous human malaria cases since 2018. However, Malaysia is facing increasing cases of zoonotic malaria due to *P. knowlesi*, which increased from 1600 cases to over 4000 between 2016 and 2018. *P. knowlesi* cases have slightly declined (to 3213 cases), but resulted in 12 deaths in 2018–2019. The Republic of Korea continues to face the challenge of malaria transmission among military personnel along the northern border. The Philippines has continued its subnational elimination efforts, reporting zero indigenous cases in 78 out of 81 provinces.
- Three countries of the GMS (Cambodia, Lao People's Democratic Republic and Viet Nam) – supported through a regional artemisinin-resistance initiative financed by the Global Fund – aim to eliminate *P. falciparum* by 2020 and all species of malaria by 2030. The percentage of reported cases in Cambodia due to *P. falciparum* has fallen significantly, from 61% in 2015 to 17% in 2019, owing to intensified efforts in community outreach and active case detection. Although the goal of *P. falciparum* elimination will not be met by 2020, and targets will be delayed for a few years, much progress continues to be made.
- Vector resistance to pyrethroids was confirmed in 49% of the sites, to organochlorines in 67%, to carbamates in 36% and to organophosphates in 64%. Almost no standard resistance monitoring was reported for carbamates or organophosphates other than in China, the Philippines and Solomon Islands. Five countries have developed their insecticide resistance monitoring and management plans.
- Challenges include decreased funding, some vector resistance to pyrethroids, resurgence of malaria in Solomon Islands and sustained high levels of malaria in Papua New Guinea due to challenges in health system strengthening. Recent efforts are underway to improve access to services and case-based surveillance in the Pacific Island countries, and intensified community efforts to halt malaria transmission in the GMS countries, particularly in Cambodia. Although all countries have reported minor disruptions to implementing malaria interventions due to COVID-19, no major delays to service delivery have been reported.

ANNEX 3 – A. POLICY ADOPTION, 2019

WHO region Country/area	Insecticide-treated mosquito nets				Indoor residual spraying		Chemoprevention		Testing				Treatment				
	ITNs/LLINs are distributed free of charge	ITNs/LLINs are distributed through ANC	ITNs/LLINs distributed through EPI/well baby clinic	ITNs/LLINs distributed through mass campaigns	IRS is recommended by malaria control programme	DDT is used for IRS	IPTp is used to prevent malaria during pregnancy	SMC or IPTc is used	Patients of all ages should get a diagnostic test	Malaria diagnosis is free of charge in the public sector	RDTs are used at community level	G6PD test is recommended before treatment with primaquine	ACT for treatment of *P. falciparum*	Pre-referral treatment with quinine or artemether IM or artesunate suppositories	Single low dose of primaquine with ACT to reduce transmissibility of *P. falciparum*[1]	Primaquine is used for radical treatment of *P. vivax* cases	Directly observed treatment with primaquine is undertaken
AFRICAN																	
Angola	black	black	black	black	grey	red	black	red	grey	green	black	grey	black	black	red	grey	grey
Benin	black	black	black	grey	black	red	black	black	grey	light blue	black	red	black	grey	red	red	red
Botswana	black	black	black	grey	black	grey	NA	NA	grey	green	red	NA	black	black	black	black	black
Burkina Faso	black	black	black	grey	black	red	black	black	grey	light blue	black	NA	black	black	red	red	red
Burundi	black	black	black	black	black	red	black	red	grey	green	black	red	black	black	red	red	red
Cabo Verde	NA	NA	NA	NA	black	red	NA	NA	grey	light green	grey	red	black	red	grey	red	grey
Cameroon	black	black	red	black	grey	red	black	black	grey	red	black	red	black	grey	red	red	red
Central African Republic	black	black	black	grey	grey	red	black	grey	grey	light blue	black	red	black	black	red	red	red
Chad	black	black	black	grey	grey	red	black	black	grey	light green	black	red	black	grey	red	red	red
Comoros	grey	grey	grey	grey	grey	red	grey	NA	grey	light green	grey	red	grey	grey	grey	red	red
Congo	black	black	grey	black	grey	red	black	red	grey	red	red	red	black	black	NA	NA	NA
Côte d'Ivoire	black	black	black	grey	red	red	black	red	grey	light green	grey	red	black	grey	red	red	red
Democratic Republic of the Congo	black	black	black	black	grey	red	black	red	grey	light blue	black	red	black	black	red	red	red
Equatorial Guinea	black	black	red	grey	black	red	black	red	grey	light green	black	red	black	red	red	red	red
Eritrea	black	black	red	grey	black	orange	red	NA	grey	green	black	red	black	black	black	black	grey
Eswatini	grey	NA	NA	grey	black	grey	NA	NA	grey	green	grey	orange	black	black	black	black	black
Ethiopia	black	red	red	black	black	orange	red	NA	grey	green	grey	black	black	grey	black	black	red
Gabon	grey	grey	grey	red	red	red	black	red	grey	green	red	NA	black	black	NA	NA	red
Gambia	black	black	black	black	black	red	black	black	grey	green	black	NA	black	grey	NA	NA	NA
Ghana	black	black	black	grey	black	red	black	black	grey	red	black	red	black	grey	red	red	red
Guinea	black	black	black	black	grey	red	black	black	grey	green	black	red	black	black	grey	NA	red
Guinea-Bissau	black	black	black	grey	grey	red	black	black	grey	green	black	red	black	grey	red	red	red
Kenya	black	black	black	grey	black	red	black	red	grey	green	black	NA	black	grey	red	NA	NA
Liberia	black	black	red	grey	grey	red	black	red	grey	green	grey	red	black	grey	red	red	red
Madagascar	black	black	black	grey	black	red	black	NA	grey	green	grey	grey	black	grey	black	grey	black
Malawi	black	black	black	grey	black	red	black	red	grey	green	black	NA	black	grey	red	NA	red
Mali	black	black	black	black	black	red	black	black	grey	green	black	NA	black	black	NA	NA	NA
Mauritania	black	black	grey	grey	orange	red	black	red	grey	light blue	grey	grey	grey	grey	black	black	grey
Mayotte	–	–	–	–	–	red	NA	NA	grey	green	grey	grey	grey	grey	grey	red	grey
Mozambique	black	black	red	black	black	grey	black	red	grey	green	black	red	black	grey	red	red	red
Namibia	grey	NA	NA	grey	black	black	red	NA	grey	green	black	red	grey	grey	grey	grey	grey
Niger	black	black	black	grey	grey	red	black	black	grey	light blue	black	black	black	black	black	black	black
Nigeria	black	black	black	black	grey	red	black	black	grey	red	black	red	black	grey	red	red	red
Rwanda	black	black	black	grey	black	red	red	NA	grey	green	black	NA	black	grey	NA	NA	NA
Sao Tome and Principe	black	black	grey	grey	black	red	black	NA	grey	green	black	grey	black	grey	black	black	black
Senegal	black	black	red	black	black	red	black	black	grey	light blue	black	red	black	black	black	NA	grey
Sierra Leone	black	black	black	grey	grey	red	black	red	grey	green	black	red	black	grey	red	red	red
South Africa	NA	red	red	red	black	black	red	NA	grey	green	grey	red	black	red	black	black	black
South Sudan[2]	black	black	black	black	black	red	black	black	grey	light green	black	red	grey	grey	red	red	red
Togo	black	black	black	grey	grey	red	black	black	grey	light green	black	–	black	grey	red	red	red
Uganda	black	black	black	grey	black	red	black	red	grey	green	black	red	black	black	red	red	red
United Republic of Tanzania[3]																	
Mainland	black	black	black	grey	black	red	black	red	grey	red	red	red	black	grey	red	red	red
Zanzibar	black	black	black	red	black	red	grey	red	grey	light green	grey	NA	black	grey	grey	grey	grey
Zambia	black	black	black	grey	black	black	black	red	grey	green	black	NA	black	black	NA	NA	NA
Zimbabwe	black	black	black	black	black	black	black	NA	grey	green	black	red	black	black	black	grey	black
AMERICAS																	
Bolivia (Plurinational State of)	black	black	red	grey	black	red	NA	NA	grey	green	black	red	black	–	black	grey	red
Brazil	black	red	red	grey	black	orange	NA	NA	grey	green	red	red	black	red	black	black	red
Colombia	black	red	red	black	black	red	NA	NA	grey	green	black	red	black	black	black	black	black
Costa Rica	grey	red	red	red	black	red	NA	NA	grey	green	black	red	grey	red	black	grey	black
Dominican Republic	grey	red	red	grey	black	red	NA	NA	grey	green	black	red	NA	NA	grey	black	grey
Ecuador	black	red	red	black	black	red	NA	NA	grey	green	black	red	black	red	black	black	black

ANNEX 3 – A. POLICY ADOPTION, 2019

WHO region Country/area	Insecticide-treated mosquito nets				Indoor residual spraying		Chemoprevention		Testing				Treatment				
	ITNs/LLINs are distributed free of charge	ITNs/LLINs are distributed through ANC	ITNs/LLINs distributed through EPI/well baby clinic	ITNs/LLINs distributed through mass campaigns	IRS is recommended by malaria control programme	DDT is used for IRS	IPTp is used to prevent malaria during pregnancy	SMC or IPTc is used	Patients of all ages should get a diagnostic test	Malaria diagnosis is free of charge in the public sector	RDTs are used at community level	G6PD test is recommended before treatment with primaquine	ACT for treatment of *P. falciparum*	Pre-referral treatment with quinine or artemether IM or artesunate suppositories	Single low dose of primaquine with ACT to reduce transmissibility of *P. falciparum*[1]	Primaquine is used for radical treatment of *P. vivax* cases	Directly observed treatment with primaquine is undertaken
AMERICAS																	
El Salvador	⚪	⚪	⚪	⚪	⚫	🔴	NA	NA	⚪	🟢	🔴	🔴	⚪	🔴	⚪	⚪	⚪
French Guiana	⚪	⚪	🔴	⚪	⚪	🔴	NA	NA	⚪	🟢	🔴	⚪	–	🔴	🔴	⚪	🔴
Guatemala	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	🔴	⚫	🔴	⚪	⚫	⚫
Guyana	⚫	⚪	🔴	⚪	⚪	🔴	NA	NA	⚪	🟢	⚫	🔴	⚫	⚫	⚪	⚫	⚫
Haiti	⚫	⚪	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	🔴	NA	NA	⚫	⚫	⚪
Honduras	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🔵	⚫	🔴	⚫	🔴	⚫	⚫	⚫
Mexico	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🔵	🔴	🔴	⚫	🔴	⚪	⚪	⚪
Nicaragua	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🔵	⚫	🔴	🔴	🔴	⚪	⚫	⚫
Panama	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	🔴	⚫	⚫	⚫
Peru	⚫	🔴	🔴	🔴	⚫	🔴	NA	NA	⚪	🟢	⚫	🔴	⚫	⚪	⚪	⚪	⚪
Suriname	⚫	⚪	⚪	⚫	⚪	🔴	NA	NA	⚪	🟢	⚫	🔴	⚪	⚪	⚪	⚪	🔴
Venezuela (Bolivarian Republic of)	⚫	⚫	🔴	⚫	⚪	🔴	NA	NA	⚪	🟢	⚫	🔴	⚫	🔴	⚪	⚫	⚫
EASTERN MEDITERRANEAN																	
Afghanistan	⚫	⚫	⚫	⚫	⚪	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	🔴	⚫	⚫	🔴
Djibouti	⚫	⚪	⚪	⚫	⚫	🔴	NA	NA	⚪	🟢	🔴	⚪	⚫	🔴	⚪	⚪	⚪
Iran (Islamic Republic of)	⚫	⚪	⚪	⚪	⚫	🔴	NA	NA	⚫	🟩	⚫	⚪	⚫	🔴	⚪	⚪	⚪
Pakistan	⚫	⚫	🔴	⚫	⚫	🔴	NA	NA	⚫	🟢	🔴	⚪	⚫	🔴	⚫	⚫	🔴
Saudi Arabia	⚫	🔴	🔴	🔴	⚫	🟠	NA	NA	⚫	🟢	🔴	⚫	⚫	⚫	⚫	⚫	⚫
Somalia	⚫	⚫	🔴	⚫	⚫	🔴	⚫	🔴	⚪	🟢	⚫	⚪	⚫	⚫	⚫	⚫	⚪
Sudan	⚫	⚪	⚪	⚫	⚫	🟠	⚪	🔴	⚪	🟦	⚫	🔴	⚫	⚪	🔴	⚪	🔴
Yemen	⚪	⚪	⚪	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	⚪	⚫	⚫	NA
SOUTH-EAST ASIA																	
Bangladesh	⚫	🔴	🔴	⚫	⚫	🟠	NA	NA	⚪	🟢	⚫	🔴	⚫	⚫	⚫	⚫	🔴
Bhutan	⚪	🔴	🔴	⚪	⚫	🔴	NA	NA	⚪	🟩	🔴	🔴	⚫	🔴	⚪	⚪	🔴
Democratic People's Republic of Korea	⚫	🔴	NA	⚪	⚪	🟠	NA	NA	⚪	🟢	⚫	🔴	NA	NA	NA	⚫	⚫
India	⚫	⚪	🔴	⚪	⚫	⚫	NA	NA	⚪	🟩	⚫	🔴	⚫	🔴	🔴	⚪	⚪
Indonesia	⚫	⚫	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	🔴	⚫	⚪	⚫	⚫	🔴
Myanmar	⚫	⚪	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚪	NA	⚫	⚫	⚫	⚫	🔴
Nepal	⚫	⚫	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	⚪	⚫	⚫	🔴
Thailand	⚫	🔴	🔴	⚫	⚫	🔴	NA	NA	⚪	🟩	⚫	⚪	⚫	🔴	⚪	⚪	⚪
Timor-Leste	⚫	⚫	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	⚫	⚫	⚫	⚫
WESTERN PACIFIC																	
Cambodia	⚫	🔴	🔴	⚪	⚪	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	🔴	⚫	⚫	🔴
China	⚫	🔴	🔴	🟠	⚫	🔴	NA	NA	⚪	🔴	🔴	⚫	⚫	🔴	🔴	⚫	🟠
Lao People's Democratic Republic	⚫	⚫	🔴	⚫	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	🔴	⚫	⚫	🔴
Malaysia	⚫	🔴	🔴	⚫	⚫	🟠	NA	NA	⚪	🔵	NA	NA	⚫	⚫	⚫	⚫	⚫
Papua New Guinea	⚫	⚫	🔴	⚫	⚪	🔴	⚪	NA	⚪	🟦	⚪	🔴	⚫	⚪	⚫	⚫	🔴
Philippines	⚫	⚪	🔴	⚪	⚫	🔴	NA	NA	⚪	🟢	⚫	NA	⚫	⚫	⚫	⚫	⚫
Republic of Korea	⚫	NA	NA	⚪	⚪	🟠	NA	NA	⚪	🟢	🔴	⚪	NA	NA	NA	⚫	⚫
Solomon Islands	⚫	⚪	⚪	⚫	⚪	🔴	NA	NA	⚪	🟩	🔴	⚪	⚫	⚪	⚪	⚪	🔴
Vanuatu	⚫	⚪	🔴	⚫	⚪	🔴	NA	NA	⚪	🟦	⚫	⚫	⚫	⚪	⚪	⚫	⚪
Viet Nam	⚫	NA	NA	⚪	⚫	🔴	NA	NA	⚪	🟢	⚫	⚫	⚫	🔴	⚫	⚫	⚫

Data as of 17 February 2021

ACT: artemisinin-based combination therapy; ANC: antenatal care; DDT: dichlorodiphenyltrichloroethane; EPI: Expanded Programme on Immunization; G6PD: glucose-6-phosphate dehydrogenase; IM: intramuscular; IPTc: intermittent preventive treatment in children; IPTp: intermittent preventive treatment in pregnancy; IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; N: no; RDT: rapid diagnostic test; SMC: seasonal malaria chemoprevention; WHO: World Health Organization.

[1] Single dose of primaquine (0.75 mg base/kg) for countries in the WHO Region of the Americas.

[2] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

[3] Where national data for the United Republic of Tanzania are unavailable, refer to Mainland and Zanzibar.

⚫ = Policy adopted and implemented this year. Available data from the world malaria report data collection form provides evidence for implementation.
⚪ = Policy adopted but not implemented this year (2019) or no supportive available data reported to WHO.
🔴 = Policy not adopted.
🟠 = Policy discontinued.
🟢 = Both microscopy and RDT are free.
🟩 = Diagnosis is free but diagnostic test was not specified.
🔵 = Only microscopy is free.
🟦 = Only RDT is free.
NA = Policy not applicable.
– = Question not answered and there is no information from previous years.

ANNEX 3 – B. ANTIMALARIAL DRUG POLICY, 2019

WHO region Country/area	*P. falciparum*				*P. vivax*
	Uncomplicated unconfirmed	Uncomplicated confirmed	Severe	Prevention during pregnancy	Treatment
AFRICAN					
Angola	AL	AL	AS	SP(IPT)	AL
Benin	–	AL	AS	SP(IPT)	–
Botswana	–	AL+PQ	AS	SP(IPT)	AL
Burkina Faso	AL	AL	AS; QN	SP(IPT)	–
Burundi	AL	AL	AS	SP(IPT)	–
Cabo Verde	–	–	–	–	–
Cameroon	–	AL; DHA-PPQ; AS+AQ	AS	SP(IPT)	–
Central African Republic	AL	AL	AS	SP	–
Chad	–	AS+AQ; AL	AS	SP(IPT)	–
Comoros	–	–	–	–	–
Congo	AS+AQ	AS+AQ	AS	SP(IPT)	–
Democratic Republic of the Congo	AS+AQ	AS+AQ; AL	AS; QN	SP(IPT)	–
Equatorial Guinea	AS+AQ	–	AS	SP(IPT)	–
Eritrea	AS+AQ	AS+AQ	AS	–	AS+AQ
Eswatini	–	AL	AS	–	PQ
Ethiopia	AL	AL+PQ	AS	–	CQ+PQ
Gabon	AS+AQ; AL	AS+AQ; AL	AS	SP(IPT)	–
Gambia	AL	AL	AS	SP(IPT)	–
Ghana	–	–	–	–	–
Guinea	AS	AS	AS	SP	–
Guinea-Bissau	–	–	–	–	–
Kenya	AL	AL	AS	SP(IPT)	PQ
Liberia	–	–	–	–	–
Madagascar	AS+AQ	AS+AQ	AS	SP(IPT)	AS+AQ
Malawi	AL	AL	AS	SP(IPT)	–
Mali	AL	AL	AS	SP(IPT)	–
Mauritania	AS+AQ	AS+AQ	AS	SP(IPT)	AS+AQ+PQ
Mayotte	–	–	–	–	–
Mozambique	–	–	–	–	–
Namibia	–	–	–	–	–
Niger	AL	AL	AS; QN	SP(IPT)	–
Nigeria	–	–	–	–	–
Rwanda	AL	AL	AS; QN	–	–
Sao Tome and Principe	AS+AQ	AS+AQ	AS	SP(IPT)	PQ
Senegal	–	AS+AQ; AL	AS	SP(IPT)	–
Sierra Leone	AS+AQ	AL; AS+AQ	AS; AM; QN	SP(IPT)	–
South Africa	AL	AL	AS; QN	–	AL
South Sudan[1]	–	–	–	–	–
Togo	–	–	–	–	–
Uganda	AL	AL	AS	SP(IPT)	–
United Republic of Tanzania	–	–	–	–	–
Mainland	AL	AL	AS; AM; QN	SP(IPT)	–
Zanzibar	AS+AQ	AS+AQ	AS	–	PQ
Zambia	AL	AL	AS	SP(IPT)	–
Zimbabwe	–	AL	AS	SP(IPT)	–
AMERICAS					
Belize	–	CQ+PQ	AL, QN	–	CQ+PQ
Bolivia (Plurinational State of)	–	AL+PQ	AS	–	CQ+PQ
Brazil	–	AL+PQ; AS+MQ+PQ	AS	–	CQ+PQ
Colombia	–	AL	AS	–	CQ+PQ

ANNEX 3 – B. ANTIMALARIAL DRUG POLICY, 2019

WHO region Country/area	*P. falciparum*				*P. vivax*
	Uncomplicated unconfirmed	Uncomplicated confirmed	Severe	Prevention during pregnancy	Treatment
AMERICAS					
Costa Rica	–	CQ+PQ	AL	–	CQ+PQ
Dominican Republic	–	CQ+PQ	AS	–	CQ+PQ
Ecuador	–	AL+PQ	AS	–	CQ+PQ
El Salvador	–	AL+PQ	AL	QN	CQ+PQ
French Guiana	–	AL+PQ	AS	–	CQ+PQ
Guatemala	–	CQ+PQ	CQ+PQ	–	CQ+PQ
Guyana	–	AL+PQ	AS; AQ	CQ	CQ+PQ
Haiti	–	CQ+PQ	AS	–	CQ+PQ
Honduras	–	CQ+PQ	AS	–	CQ+PQ
Mexico	–	AL+PQ	AM+AL	–	CQ+PQ
Nicaragua	–	CQ+PQ	AS	–	CQ+PQ
Panama	–	AL+PQ	AS	–	CQ+PQ
Peru	–	AS+MQ+PQ	AS	–	CQ+PQ
Suriname	–	AL+PQ	AS	–	CQ+PQ
Venezuela (Bolivarian Republic of)	–	AL+PQ	AS	–	CQ+PQ
EASTERN MEDITERRANEAN					
Afghanistan	CQ	AL+PQ	AS; AM; QN	CQ	CQ+PQ
Djibouti	AL	AL+PQ	AS	–	AL+PQ
Iran (Islamic Republic of)	–	–	–	–	–
Pakistan	CQ+PQ	AL+PQ	AS	–	CQ+PQ
Saudi Arabia	–	AS+SP+PQ	AS+AM+QN	–	CQ+PQ
Somalia	AL	AL	AS	SP(IPT)	AL+PQ
Sudan	–	AL	AS; QN	–	AL+PQ
SOUTH-EAST ASIA					
Bangladesh	–	AL+PQ	AS+AL+PQ	–	CQ+PQ
Bhutan	–	AL	AM; QN	–	CQ+PQ
Democratic People's Republic of Korea	–	–	–	–	CQ+PQ
India	–	AS+SP+PQ; AL+PQ	AM; AS; QN	–	CQ+PQ
Indonesia	–	DHA-PPQ	AS	–	DHA+PPQ
Myanmar	–	AL+PQ	AS; AM; QN	–	CQ+PQ
Nepal	–	AL	AS	–	CQ+PQ
Thailand	–	DHA-PPQ; AS-PYR	AS	–	CQ+PQ
Timor-Leste	AL+PQ	AL+PQ	AS; QN	–	AL+PQ
WESTERN PACIFIC					
Cambodia	–	AS+MQ	AS	–	AS+MQ+PQ
China	–	ART-PPQ; AS+AQ; DHA-PPQ; PYR	AM; AS; PYR	–	CQ+PQ; PQ+PPQ; ACT+PQ; PYR
Lao People's Democratic Republic	–	AL	AS	–	AL
Malaysia	–	AL	AS	–	AL+ PQ
Papua New Guinea	–	AL	AS; AM	SP	AL+PQ
Philippines	–	AL+PQ	AS	–	AL+PQ
Republic of Korea	–	–	–	–	CQ+PQ
Solomon Islands	–	–	–	–	–
Vanuatu	–	AL	AS	CQ	PQ
Viet Nam	DHA-PPQ; PQ	DHA-PPQ; PQ	AS	–	CQ+PQ

Data as of 17 November 2020

ACT: artemisinin-based combination therapy; AL: artemether-lumefantrine; AM: artemether; AQ: amodiaquine; ART: artemisinin; AS: artesunate; AT: atovaquone; CL: clindamycline; CQ: chloroquine; D: doxycycline; DHA: dihydroartemisinin; IPT: intermittent preventive treatment; MQ: mefloquine; NQ: naphroquine; PG: proguanil; PPQ: piperaquine; PQ: primaquine; PYR: pyronaridine; QN: quinine; SP: sulfadoxine-pyrimethamine; T: tetracycline; WHO: World Health Organization.

[1] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, http://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
AFRICAN													
Angola	2017	15 722 726	22 888 423	0	0	40 766 534 [5]	12 023 625		18 000 000		139 995		
	2018	12 335 146	22 383 604	0	0	46 457 232 [5]	9 578 147		22 000 000		88 217		
	2019	5 028 041	22 000 000	0	0	1 754 960	2 864 156		20 000 000				
Benin	2017	26 147 674	16 646 126	0	0	4 395 380	33 122 938	0	9 642 332	3 140	158 723	5 400	
	2018	4 825 798	16 278 984	0	0	611 841	2 235 811	0	1 419 738	0	21 292	75 628	0
	2019	14 171 520	17 000 000	0	0	10 889 600	4 670 273	0	4 217 593	0	0	0	0
Botswana	2017	1 683 599	0	0	0	1 092 695	1 079 069	0	0	0		0	0
	2018	1 501 436	0	0	0	2 124 880	2 087 088	0	0	0		0	0
	2019	270 407	0	0	0	2 447 859	219 328	0	0	0		0	0
Burkina Faso	2017	9 849 157	26 009 571	11 219 204	1 432 054	15 573 795	9 474 402	5 608 893	13 053 101		164 363	163 431	5 570 878
	2018	33 120 195	25 435 913	9 192 622	1 008 709	7 647 998 [5]	14 880 669	5 321 114	16 646 476		431 795	228 084	2 900 368
	2019	33 269 764	25 000 000	9 035 082	0	11 925 354 [6]	66 864 802	6 473 917	20 960 657		107 706	546 944	
Burundi	2017	28 928 791	9 363 446	0	0	3 070 872	21 228 086		9 000 000		37 832	4 967 372	869 962
	2018	1 837 003	9 156 929	0	0	1 157 984	4 734 738		9 000 000		68 488	433 441	4 664 286
	2019	31 146 086	8 000 000	0	0	4 328 977	24 301 509		4 734 719		159 500	372 925	
Cabo Verde	2017	241 299	0	0	0	4 627 843	466 244				29 000		
	2018	-19 345	0	0	0	621 612	221 609				25 641		
	2019	0	0	0	0	519 158	116 809				82 598		
Cameroon	2017	23 622 914	20 807 657	0	0	2 288 193 [5]	28 008 486				882 650	1 105 377	9 477
	2018	17 374 572	22 892 322	0	0	10 607 209 [5]	47 200 683		29 913 228				
	2019	31 382 534	22 500 000	0	0	61 194 530 [5]	33 828 144	0	21 148 951	0	0	0	0
Central African Republic	2017	13 760 308	0	0	0	530 000	443 466				70 419		
	2018	17 466 536	0	0	0	675 455	8 399 445				50 000	306 968	
	2019	11 245 876	0	0	0	154 455 [5]	16 631 715				199 800	656 890	
Chad	2017	14 521 704	0	0	0	652 320 [6]	34 927 891				416	540 870	867 119
	2018	18 642 602	0	0	0	543 725 [6]							
	2019	38 076 559	0	0	0	0 [6]							
Comoros	2017	875 331	0	0	0	114 684	852 996	0	0	0	54 000		0
	2018	2 338 882	0	0	0	114 684		0	0	0	60 000		0
	2019	1 511 064	0	0	0	114 684 [6]	824 954						
Congo	2017	0	0	0	0	122 182	0	0	0	0	15 000	0	10 000
	2018	1 207 101	0	0	0	50 509	9 090 909	0	0	0	0	0	9 090
	2019	10 283 939	0	0	0	1 290 322	6 689 800	0	0	0	67 741	0	15 000
Côte d'Ivoire	2017	31 951 007	26 009 571	0	0	5 597 533 [6]	44 798 740	667 580	0	487 446	17 698	76 943	238 890
	2018	27 954 008	25 435 913	0	0	12 712 361 [6]	28 330 619	877 696	9 151 372	27 724 798	47 903	32 090	435 865
	2019	56 987 087	25 000 000	0	0	0	60 947 905		21 342 862		5 984	60 980	2 500 000
Democratic Republic of the Congo	2017	131 093 509	52 019 143	0	6 336 451	683 314	75 183 622	0	46 738 755	4 694 136	2 265 298	82 857	0
	2018	78 970 598	50 871 826	0	4 463 262	1 948 241	92 444 112	0	49 075 000	0	636 951	0	0
	2019	117 949 473	50 000 000	0	747 665	1 427 241	112 504 296	0	41 897 052		148 208	802 250	
Equatorial Guinea	2017	0	0	0	0	3 208 473 [6]							
	2018	0	0	0	0	3 208 473 [6]							
	2019	-218 638	0	0	0	3 153 487 [6]							
Eritrea	2017	13 533 044	0	0	0	408 557 [6]	9 150 700	0	0	0	80 450	0	
	2018	4 875 453	0	0	0	408 557 [6]	2 748 778	0	0	0	82 500	0	0
	2019	8 942 830	0	0	0	401 555 [6]	4 788 233	0	0	0	120 000	0	0
Eswatini	2017	1 715 924	0	0	0	799 994	20 910 608	0	0	0	620 000	0	0
	2018	589 889	0	0	0	989 110	1 376 660	0	0	0		0	0
	2019	836 280	0	0	0	838 430	2 652 105	0	0	0	10 613	0	0
Ethiopia	2017	74 957 424	38 494 165	0	0	7 861 539 [6]	31 604 918		7 150 000		0	30 000	13 500 000
	2018	37 121 554	36 627 715	0	0	20 758 465	44 800 000		26 358 971				14 000 000
	2019	26 668 897	36 000 000	0	0	22 907 737	26 083 562		18 000 000				122 344 828

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
AFRICAN													
Gabon	2017	0	0	0	0	142 296	0	0	0	0	12 616	0	0
	2018	0	0	0	0	148 042 [6]	0	0	0	0	128 016	0	49 674
	2019	0	0	0	0	145 505 [6]	0						
Gambia	2017	10 584 939	0	0	0	621 025 [6]	9 557 650				14 400	33 839	117 749
	2018	8 128 184	0	0	0	621 025 [6]	8 376 620				39 000	50 414	176 987
	2019	3 412 032	0	0	0	1 203 441 [5]	3 940 063				68 000	90 000	288 646
Ghana	2017	41 546 764	29 130 720	0	1 183 127	10 767 265 [5]	40 951 105	0	22 445 306		140 000	0	0
	2018	44 934 700	28 488 223	0	833 369	10 767 265 [6]	47 579 039	0	30 634 694	7 560 000	300 000	0	0
	2019	35 771 452	28 000 000	0	1 462 425	10 767 265 [6]	28 442 224	0	22 448 510	0	300 000	0	0
Guinea	2017	14 656 590	15 605 743	568 210	0	14 796 [5]	9 251 505	125 000	12 500 000		65 000		
	2018	12 752 728	15 261 548	1 174 368	0	6 438 381	12 000 000	156 000	14 000 000		45 000		
	2019	28 982 985	15 000 000	1 154 242	0	951 075	25 261 667		15 000 000		39 000		
Guinea-Bissau	2017	6 856 945	0	0	0	1 655 769	9 086 476	0	0	0		0	256 659
	2018	7 821 002	0	0	0	651 820	3 199 732	0	0	0		0	0
	2019	4 814 351	0	0	0	0 [6]	540 184 296						
Kenya	2017	61 554 420	36 413 400	0	1 031 373	1 677 914 [6]							
	2018	12 659 098	35 610 278	0	726 478	1 677 915 [6]							
	2019	33 425 267	35 000 000	0	0	6 568 505	14 497 642		34 000 000				
Liberia	2017	14 361 899	14 565 360	0	0	313 801 [6]	18 526 566		14 000 000				
	2018	20 506 609	14 244 111	0	0	313 801 [6]							
	2019	6 394 175	14 000 000	0	0	19 621 989	11 500 991	0	12 000 000	0	0	0	0
Madagascar	2017	14 559 438	27 049 954	0	0	37 214	43 205 989	0	26 000 000	0	220 000	0	0
	2018	41 069 905	26 453 350	0	0	13 007	33 200 289	0	26 000 000		46 000		
	2019	6 399 993	26 000 000	0	0	0 [6]	18 378 714		26 000 000		50 000		
Malawi	2017	12 134 701	22 888 423	0	0	291 194 [5]	16 282 087		22 000 000				
	2018	31 075 220	24 418 477	0	0	282 401	33 049 389		20 000 000				
	2019	14 464 267	24 000 000	0	0	317 711	12 768 682				150 000		
Mali	2017	23 608 912	26 009 571	5 920 105	0	4 382 069	19 288 748	3 226 759	25 500 000	0	140 713	854 199	
	2018	31 009 912	25 435 913	11 576 495	0	2 219 611	54 053 651	6 406 499	25 000 000			337 884	
	2019	21 096 259	25 000 000	11 378 101	0	1 273 817	19 414 667	1 085 642	25 000 000	0	24 083	2 420	7 224
Mauritania	2017	4 672 266	0	0	0	605 079 [5]	6 957 945				47 950		13 944
	2018	4 090 649	0	0	0	2 191 549	164 778						
	2019	73 220	0	0	0	124 788	175 296						
Mayotte	2017	0	0	0	0								
	2018	0	0	0	0								
	2019	0	0	0	0								
Mozambique	2017	64 693 665	30 171 103	2 118 290	7 986 026	710 705 [6]	58 222 077		29 000 000		240 000	3 848 028	10 995
	2018	36 396 779	29 505 659	0	5 625 187	2 136 147	45 915 417		29 000 000			1 590 000	4 361 414
	2019	50 895 946	29 000 000	0	0	1 848 592	62 708 218		29 000 000	39 548 431	414 944	1 102 707	17 667 110
Namibia	2017	2 754 765	0	0	0	5 166 667	1 096 657	0	0	0	100 000	0	789 566
	2018	755 622	0	0	0	11 216 160	908 515	0	0	0	100 000	100 000	1 148 515
	2019	618 414	0	0	0	11 123 042	3 377 753	0	0	0	100 000	0	150 000
Niger	2017	25 143 511	18 726 891	6 869 723	0	4 454 320	22 404 758	2 177 698	220 000	0	328 594	805 598	476 444
	2018	28 810 711	18 313 857	5 764 992	0	7 363 777	20 159 800	4 490 567	18 000 000	0	220 356	674 811	0
	2019	21 031 872	18 000 000	5 666 193	0	1 332 407 [5]	16 329 651	6 319 943	18 000 000	0	86 206	693 054	0
Nigeria	2017	123 616 145	78 028 714	0	0	17 296 365 [6]	198 176 039		75 000 000				
	2018	67 768 812	71 220 557	37 237 036	0	2 271 631 [6]	43 206 463		70 000 000				
	2019	115 283 739	70 000 000	36 598 879	2 522 480	9 783 998 [6]	131 373 863		70 000 000				
Rwanda	2017	17 364 322	18 726 891	0	0	13 704 611	11 440 292		18 000 000		270 000		
	2018	10 104 603	18 313 857	0	0	13 460 220	27 505 974		18 000 000				
	2019	34 528 150	18 000 000	0	0	0 [6]	20 091 346		18 000 000				

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
AFRICAN													
Sao Tome and Principe	2017	3 030 269	0	0	0	2 044 439	3 296 207	0	0	0	89 244	0	0
	2018	0	0	0	0	0 [6]							
	2019	-509 553	0	0	0	117 201	517 594	0	0	3 322 449	126 121	52 141	0
Senegal	2017	6 045 167	26 009 571	0	0	4 931 741	3 039 725	0	24 000 000	0	0	0	4 500 000
	2018	12 617 208	24 418 477	0	0	4 931 741	11 602 821	0	24 000 000	11 602 821	0	0	0
	2019	11 572 039	24 000 000	0	0	9 420 000	9 005 006	0	24 000 000	0	0	0	14 567 962
Sierra Leone	2017	1 548 151	15 605 743	0	1 316 498	821 674 [6]	19 300 000				72 812	3 464 362	
	2018	1 467 366	15 261 548	0	927 313	65 189 [5]	8 728 599		15 000 000		70 000	148 214	2 742
	2019	1 216 641	15 000 000	0	0	128 621	7 522 931		15 000 000		70 000	2 059	4 779
South Africa	2017	0	0	0	0	10 656 029	27 226 495	0	0	0	20 000	0	0
	2018	0	0	0	0	16 954 533	4 197 290	0	0	0	50 000	0	
	2019	0	0	0	0	19 251 230	6 591 498	0	0	0	45 000	0	1 132 611
South Sudan[8]	2017	23 629 994	0	0	13 904 529	2 603 242 [5]	16 478 112	0	6 000 000	6 654 000	200 000		5 249 000
	2018	11 313 364	0	0	9 794 056	2 704 995 [6]							
	2019	12 385 841	0	0	12 051 666	0 [6]	17 047 017	3 124 679	0	3 755 637	0		
Togo	2017	18 522 276	0	2 477 906	0	1 847 898	24 435 381	1 014 708	0	0	7 765	556 712	5 238 461
	2018	6 679 079	0	1 070 093	0	1 922 522 [6]	23 830 061	440 567	0	0	4 715	553 567	0
	2019	8 664 142	0	1 051 754	0	1 889 574 [6]							
Uganda	2017	55 050 846	34 332 634	0	7 595 938	7 280 412	150 649 446	0	34 000 000	8 974 881		743 791	4 335 860
	2018	65 879 046	33 575 405	0	5 350 418	7 243 128	47 530 743	0	33 000 000	14 073 138		743 791	0
	2019	39 302 893	33 000 000	0	11 811 455	7 283 521	58 333 000		33 000 000	14 389 262		1 254 438	705 940
United Republic of Tanzania[9]	2017	75 098 408	45 776 845	0	0	6 510 796 [6]							
	2018	29 252 693	44 767 207	0	0	6 682 225 [6]							
	2019	54 867 790	44 000 000	0	92 923	6 682 225 [6]							
Mainland	2017	69 674 305	0	0	0	70 274 555	70 274 555				42 000		
	2018	28 751 369	0	0	0	145 258 808	145 258 808		713 228				12 168
	2019	0	0	0	0	4 898 342	25 110 093	0	8 774 918	0	57 875	0	
Zanzibar	2017	2 509 129	0	0	0	8 894	2 960 586	0	978 962		10 000		
	2018	0	0	0	0	79 708	1 508 555	0	15 391 465	0	14 574	0	0
	2019	0	0	0	0	0 [6]	2 035 288	0	1 096 204	10 000	0	0	0
Zambia	2017	41 082 748	31 211 486	643 939	0	27 928 587	45 468 736		25 000 000		200 000		
	2018	22 492 101	30 523 096	870 986	0	18 159 340	24 605 077		3 000 000		200 000		3 692 991
	2019	23 722 752	30 000 000	856 060	188 909	15 340 495	17 019 922		30 000 000		300 000		5 330 000
Zimbabwe	2017	17 808 245	15 605 743	0	0	782 250	17 407 287		15 120 000				224 970
	2018	13 178 560	15 261 548	0	0	2 786 540	16 973 379	0	11 000 000	0	118 000	0	0
	2019	17 303 041	15 000 000	0	0	3 765 250	25 931 599		11 208 498		140 000		
AMERICAS													
Belize	2017	0	0	0	0	250 000	0	0	9 778	0	0	0	0
	2018	0	0	0	0	252 000	11 122	0	3 234	0	5 609	0	0
	2019	0	0	0	0	0 [6]	0	0	11 058	0	0	0	0
Bolivia (Plurinational State of)	2017	2 854 289	0	0	0	451 993		0	0	0		0	0
	2018	3 406 162	0	0	0	416 666							
	2019	822 768	0	0	0	292 852	1 191 940	0	0	0	27 891	0	0
Brazil	2017	0	0	0	0	54 904 745 [5]	0	0		0		0	
	2018	0	0	0	0	23 923 126 [5]	0	0	82 861	0		0	
	2019	0	0	0	0	53 733 857 [5]	0	0	154 641				
Colombia	2017	0	0	0	0	10 897 170	0	0	2 872	0	0	0	0
	2018	0	0	0	0	3 237 708	0	0	70 647				
	2019	0	0	0	0	5 049 012	0	0	269 661	0		0	

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
AMERICAS													
Costa Rica	2017	0	0	0	0	4 980 000 [5]	0	0	0	0	9 770	0	0
	2018	0	0	0	0	5 000 000 [5]	0	0	0	0	12 155	0	0
	2019	0	0	0	0	5 000 000 [5]	0	0	7 991	0	22 842	0	0
Dominican Republic	2017	0	0	0	0	1 149 368	125 543	0	0	0	824	0	27 987
	2018	0	0	0	0	367 647	9 949 957	0	0	0	143 176	0	48 938
	2019	0	0	0	0	2 560 753	0	0	313 661	0	322 922	0	98 488
Ecuador	2017	-608 606	0	0	0	5 835 716 [5]	0	0		0	69 039	0	0
	2018	0	0	0	0	6 898 763 [5]	0	0	0	0	85 733	0	
	2019	0	0	0	0	2 675 521 [5]	0	0	71 420	0	76 400	0	0
El Salvador	2017	0	0	0	0	2 662 869	538 732	0	0	0	73 758	0	0
	2018	647 719	0	0	0	2 709 300 [6]	707 436	0	0	0	15 156	0	0
	2019	217 471	0	0	0	0 [6]			34 787		3 773		
French Guiana	2017	0	0	0	0	0 [6]	0	0	0	0	0	0	0
	2018	0	0	0	0	0 [6]							
	2019	0	0	0	0								
Guatemala	2017	2 336 448	0	0	0	3 374 612	2 231 020		75 981				
	2018	2 228 927	0	0	0	3 492 749	1 724 076	0	138 643	0		0	580 000
	2019	619 705	0	0	0	1 277 993	520 837		76 014		110 535		
Guyana	2017	774 658	0	0	0	1 473 101	1 009 615	0	8 015	0	9 793	0	0
	2018	59 439	0	0	0	1 503 535	340 471	0	211 698	0	0	0	0
	2019	75 693	0	0	0	732 166	299 843	0	1 000 000	0	140 000	0	0
Haiti	2017	10 853 040	0	0	0	388 104 [6]	12 540 295	0	17 956	500 000	227 455		196 777
	2018	5 576 626	0	0	0	408 174 [5]	7 384 832	0	0	0	275 872		514 271
	2019	6 038 170	0	0	0	2 284 758 [5]	6 006 513	0	10 445	0	266 004		203 638
Honduras	2017	1 252 813	0	0	0	543 312	2 594 856	0	54 475	0	0	0	554 378
	2018	1 134 584	0	0	0	543 312	1 929 881	0	46 855	0	36 961	0	714 145
	2019	1 544 876	0	0	0	543 312	1 511 759		67 612	595 460	2 613		621 496
Mexico	2017	0	0	0	0	40 661 276	0	0	0	0		0	0
	2018	0	0	0	0	37 544 836	0	0	0	0		0	0
	2019	0	0	0	0	37 024 233			41 177		59 429		
Nicaragua	2017	2 534 883	0	0	0	3 984 944	1 826 934		23 971		98 131		
	2018	2 329 152	0	0	0	3 263 970	1 986 357		13 254		83 000		401 133
	2019	2 974 752	0	0	0	6 154 533	2 313 411		100	400 000	13 408		15 020
Panama	2017	0	0	0	0	3 671 002			49 705		100 000		181 109
	2018	0	0	0	0	8 000 000 [5]	0	0	85 165	0	18 823	0	147 827
	2019	0	0	0	0	6 383 374	475 156		32 085	668 596	62 342		
Peru	2017	0	0	0	0	1 704 408 [5]			39 886		128 851		
	2018	0	0	0	0	2 381 660 [5]			90 000				
	2019	0	0	0	0	3 711 574 [5]	0	0	193 079	0		0	0
Suriname	2017	1 189 182	0	0	0	806 069	1 041 205	0	52 213	0	12 920	0	0
	2018	834 200	0	0	0	1 034 627	922 115	0	22 037	0	8 861	0	49 344
	2019	655 335	0	0	0	1 286 407	695 291		46 808		5 000		30 000
Venezuela (Bolivarian Republic of)[10]	2017	0	0	0	0	3 617 328 [5]			0		85 193		
	2018	0	0	0	0	928 [5]			0		435 366		
	2019	0	0	0	0	0 [6]					147 419		

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
EASTERN MEDITERRANEAN													
Afghanistan	2017	7 166 347	0	0	0	937 596 [6]	1 053 356				85 814		
	2018	9 723 132	0	0	0	203 487 [6]	10 556 626				26 571		
	2019	10 199 127	0	0	0		7 759 216				80 885		
Djibouti	2017	2 662 775	0	244 338	0	3 222 506 [5]		0		0	51 000	0	
	2018	663 592	0	74 153	0	3 352 640 [6]	871 414			0	30 000	0	
	2019	1 055 614	0	72 882	0	1 457 180 [5]	171 627				406 776		
Iran (Islamic Republic of)	2017	1 132 770	0	0	0	2 700 000					48 000		
	2018	0	0	0	0	3 300 000	0	0	0		38 286		
	2019	-105 258	0	0	0	2 930 000	0	0	0	0	38 000	0	0
Pakistan	2017	16 898 605	0	0	0	18 664 597 [6]	22 635 097				130 000		
	2018	13 827 697	0	0	0	20 078 232 [6]	9 615 605				196 378		
	2019	14 883 169	0	0	0	2 443 594	14 600 000				296 000		
Saudi Arabia	2017	0	0	0	0	30 000 000	0	0	0	0	100 000	0	0
	2018	0	0	0	0	30 000 000	0	0	0	0	10 000	0	0
	2019	0	0	0	0	30 000 000	0	0	0	0	0	0	0
Somalia	2017	16 612 625	0	0	0	85 350	20 986 170	0	0	0	147 000		0
	2018	7 632 763	0	0	0	90 726	5 534 919	0	0	0	56 000		0
	2019	4 246 685	0	0	0	120 100	9 474 797	0	0	0	73 840	0	0
Sudan	2017	10 668 769	0	0	0	19 087 941	31 496 505	0	0	0	3 084	0	0
	2018	35 329 302	0	0	0	16 726 945	21 485 294	0	0	0	60 000	203 000	9 619
	2019	44 291 755	0	0	0								
Yemen	2017	3 728 150	0	47 407 385	0	0	7 933 620				2 080 000	473 627	
	2018	-7 374	0	17 395 815	0	0 [5]	1 890 037				1 427 948		
	2019	-56 405	0	17 097 691	0		6 123 238						
SOUTH-EAST ASIA													
Bangladesh	2017	13 182 596	0	0	0	1 493 690	8 821 888	0	0	0	210 000	0	0
	2018	7 061 234	0	0	0	2 496 429	6 835 307	0	0	0	250 000	0	0
	2019	5 406 054	0	0	0	2 634 763	7 082 673	0	0	0	100 000	0	0
Bhutan	2017	582 622	0	0	0	179 470	586 015	0	0	0	35 212	0	121 212
	2018	332 675	0	0	0	176 791	577 403	0	0	0	34 687	0	0
	2019	383 556	0	0	0	251 860	418 069	0	0	0	40 391	0	121 212
Democratic People's Republic of Korea	2017	1 549 812	0	0	0	2 151 000	3 426 508	0	0	0	35 000	0	0
	2018	2 354 899	0	0	0	2 181 000	3 219 957	0	0	0		0	
	2019	0	0	0	0	2 211 100	0	0	0	0	700 000	0	0
India	2017	68 981 923	0	0	0	51 980 993 [6]	94 474 099	0	0	0		0	
	2018	275 345	0	0	0	46 783 323	34 958 663	0	0	0		0	
	2019	22 045 007	0	0	0	107 930 657	31 242 857	0	0	0		0	
Indonesia	2017	23 964 363	0	0	0	17 686 075 [5]	30 336 061				147 033	1 505 774	
	2018	10 161 943	0	0	0	21 683 909 [5]	12 272 515				260 738	933 224	
	2019	17 489 764	0	0	0	24 594 057 [5]	25 652 636				100 000	782 076	
Myanmar	2017	41 491 550	10 403 829	0	4 075 391	6 780 092 [5]	53 056 520	0	10 000 000	6 532 464	25 000	0	3 462 068
	2018	17 304 512	10 174 365	0	2 870 619	6 780 092 [5]	29 581 578		9 000 000	6 607 886	25 000		
	2019	29 430 941	10 000 000	0	536 279	11 123 879 [5]	40 110 516		10 000 000	610 000	50 000		
Nepal	2017	5 255 284	0	0	0	263 262	102 424				24 509		
	2018	1 433 137	0	0	0	613 873	1 107 196	0	120 482	0	31 214	0	0
	2019	1 526 228	0	0	0	613 873	2 727 909	0	621 652	0	40 000	0	0
Thailand	2017	11 147 475	3 000 000	0	0	7 664 899	15 622 625	0			188 686		49 859
	2018	6 146 057	3 000 000	0	0	7 131 736	8 337 877	0	1 308 800	0	78 056	0	93 546
	2019	11 523 833	3 000 000	0	0	5 783 108	8 872 808		1 047 408		70 000		37 710

ANNEX 3 – C. FUNDING FOR MALARIA CONTROL, 2017–2019

WHO region Country/area	Year	Contributions reported by donors				Contributions reported by countries							
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]	Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
SOUTH-EAST ASIA													
Timor-Leste	2017	2 735 744	0	0	0	1 115 484	4 039 622	0	0	0	42 456	0	20 000
	2018	2 469 564	0	0	0	1 121 287	1 573 936	0	0	0	26 600	0	5 000
	2019	2 306 893	0	0	0	2 281 466 [6]	2 281 466				40 000		256 000
WESTERN PACIFIC													
Cambodia	2017	14 619 179	10 403 829	0	0	663 526	8 045 144	0	6 000 000	0	579 738	0	
	2018	10 561 499	10 174 365	0	0	83 636	3 181 783	0	10 000 000	0	628 297	0	
	2019	18 108 881	10 000 000	0	0	65 788	4 388 138	0	10 000 000	0		0	0
China	2017	0	0	0	0	19 448 382 [6]							
	2018	0	0	0	0	19 944 390 [6]							
	2019	0	0	0	0	19 602 589 [6]							
Lao People's Democratic Republic	2017	3 731 157	0	0	0	1 008 060	1 728 818	0	604 000	0	256 734	0	1 066 089
	2018	3 969 853	0	0	0	1 914 750	3 725 427	0	500 000	0	288 108	0	1 783 267
	2019	6 152 594	0	0	0	928 955	5 327 000	0	686 183	0	1 039 774	0	1 301 618
Malaysia	2017	0	0	0	0	48 365 863	0	0	0	0	0	0	0
	2018	0	0	0	0	49 561 180	0	0	0	0	0	0	0
	2019	0	0	0	0	48 817 455	0	0	0	0	0	0	0
Papua New Guinea	2017	10 747 518	0	0	0	753 771	10 330 449	0	0	0	95 000	0	911 770
	2018	7 403 211	0	0	0	108 100	7 407 034	0	0	0	86 500	0	1 083 168
	2019	10 203 124	0	0	0	48 600	8 831 155			1 474 700	95 000		
Philippines	2017	7 470 423	0	0	0	7 012 009	6 471 549	0	0	0	0	0	0
	2018	3 250 897	0	0	0	3 548 266	4 190 984	0	0	0	0	0	0
	2019	3 062 223	0	0	0	2 453 765	3 412 622	0	0	0	0	0	0
Republic of Korea	2017	0	0	0	0	475 173	0	0	0	0	0	0	0
	2018	0	0	0	0	433 726	0	0	0	0	0	0	0
	2019	0	0	0	0	719 992	0	0	0	0	0	0	0
Solomon Islands	2017	1 043 802	0	0	0	858 256	977 025	0	0	0	736 892	0	0
	2018	1 759 795	0	0	0	979 891	1 494 080				79 770		
	2019	1 959 252	0	0	0	299 919	717 728	0	0	455 000	37 607	0	0
Vanuatu	2017	0	0	0	0	139 254	285 333	0	0	206 575	21 918	0	0
	2018	0	0	0	0	128 194	131 786	0	0	92 363	9 367	0	0
	2019	0	0	0	0	181 350	182 877	0	0	0	178 245	0	0
Viet Nam	2017	16 078 339	0	0	0	3 022 523	9 324 657	0	0	0	200 000	0	500 000
	2018	9 458 697	0	0	0	1 813 863	7 901 624	0	0	0	105 045	0	315 396
	2019	16 462 619	0	0	0	1 620 317	10 221 830	0	0	0	333 000	0	385 000

Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NGO: nongovernmental organization; NMP: national malaria programme; PMI: United States President's Malaria Initiative; UK: United Kingdom of Great Britain and Northern Ireland government; UNICEF: United Nations Children's Fund; USAID: United States Agency for International Development; WHO: World Health Organization.

[1] Source: Global Fund to Fight AIDS, Tuberculosis and Malaria.

[2] Source: www.foreignassistance.gov.

[3] Source: Organisation for Economic Co-operation and Development (OECD) creditor reporting system (CRS) database.

[4] Source: Final UK aid spend.

[5] Budget not expenditure.

Data as of 17 February 2021

[6] WHO NMP funding estimates.

[7] Other contributions as reported by countries: NGOs, foundations, etc.

[8] South Sudan became an independent state on 9 July 2011 and a Member State of WHO on 27 September 2011. South Sudan and Sudan have distinct epidemiological profiles comprising high-transmission and low-transmission areas, respectively. For this reason, data up to June 2011 from the Sudanese high-transmission areas (10 southern states which correspond to contemporary South Sudan) and low-transmission areas (15 northern states which correspond to contemporary Sudan) are reported separately.

[9] Where national totals for the United Republic of Tanzania are unavailable, refer to the sum of Mainland and Zanzibar.

Note: Negative disbursements reflect recovery of funds on behalf of the financing organization.

Note: All contributions reported by donors are displayed in US 2019 constant dollars.

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
AFRICAN									
Algeria	2017	0	–	–	36	453	–	–	–
	2018	0	–	–	0	1 242	–	–	–
	2019	–	–	–	0	–	1 014	–	–
Angola	2017	2 924 769	50.8	–	397 882	3 090 761	–	3 090 761	–
	2018	3 863 521	52.4	–	2 000 350	1 950 000	–	1 950 000	–
	2019	1 545 055	27.5	–	–	–	–	–	5 575 259
Benin	2017	6 771 009	54	853 221	2 171 867	1 530 617	–	1 530 617	–
	2018	504 501	59.3	1 321 758	2 016 745	1 815 236	–	1 815 236	–
	2019	505 670	31.8	1 077 411	3 984 677	4 455 581	2 353 657	4 455 581	2 353 657
Botswana	2017	3 000	–	139 244	2 645	4 429	–	4 429	–
	2018	–	–	83 488	3 141	1 954	–	1 954	–
	2019	0	–	154 663	2 526	3 198	272	3 198	–
Burkina Faso	2017	986 164	67.3	–	12 853 861	10 457 752	–	10 457 752	–
	2018	1 946 047	49	766 374	13 026 870	11 968 368	–	11 968 368	–
	2019	–	66.5	587 248	–	–	–	–	11 223 002
Burundi	2017	6 717 994	59.4	848 441	10 046 047	7 978 264	–	7 613 646	–
	2018	986 025	71.2	1 754 679	7 012 203	5 149 436	–	5 032 209	–
	2019	7 528 556	51.2	725 449	–	9 338 611	–	9 271 032	–
Cabo Verde	2017	80	–	495 313	16 573	420	–	420	–
	2018	21	–	–	9 588	21	–	21	–
	2019	–	–	302 520	0	40	40	40	0
Cameroon	2017	362 629	71	–	1 589 218	879 039	–	785 765	–
	2018	573 843	62.9	–	1 739 286	1 064 668	–	918 505	–
	2019	8 860 653	69	–	2 082 527	–	1 834 114	–	1 157 011
Central African Republic	2017	857 198	62.1	–	806 218	947 205	–	947 205	–
	2018	753 889	75.5	–	1 189 881	1 773 072	–	1 773 072	–
	2019	103 848	74.3	–	2 764 293	5 753 501	2 654 215	5 640 687	2 602 171
Chad	2017	6 886 534	51.7	–	1 287 405	1 486 086	–	1 486 086	–
	2018	461 667	48.3	–	–	–	–	–	–
	2019	613 700	19.1	0	1 788 730	–	1 665 212	–	1 595 351
Comoros	2017	34 590	81.6	–	21 988	2 794	–	2 794	–
	2018	31 012	67.2	–	–	–	–	–	–
	2019	–	48.1	–	–	–	–	–	–
Congo	2017	2 223	32.1	–	0	0	–	0	–
	2018	4 641	30.2	–	0	0	–	0	–
	2019	2 648 456	72.5	–	0	200 000	427 959	200 000	233 389
Côte d'Ivoire	2017	13 216 468	73	–	6 986 825	5 373 545	–	5 373 545	–
	2018	16 703 932	74.3	–	6 069 250	6 799 565	–	6 799 565	–
	2019	1 410 391	60.5	–	6 456 625	4 657 570	5 200 350	4 657 570	5 200 350
Democratic Republic of the Congo	2017	8 412 959	66.2	232 181	18 994 861	17 250 728	–	17 250 728	–
	2018	16 919 441	58.8	111 735	18 549 327	16 917 207	–	16 917 207	–
	2019	20 710 146	64.8	–	26 963 687	18 853 209	18 853 210	18 853 209	18 853 209
Equatorial Guinea	2017	42 317	40.8	64 617	60 798	15 341	–	15 341	–
	2018	120 376	45.4	74 416	78 695	15 633	–	15 633	–
	2019	14 843	44.8	61 561	54 340	15 769	–	15 769	–
Eritrea	2017	1 724 972	54.1	375 696	481 600	296 399	–	296 399	–
	2018	60 083	61.7	376 143	400 900	301 525	–	301 525	–
	2019	124 225	54.8	437 194	388 395	207 150	–	207 150	–
Eswatini	2017	0	–	21 316	59 760	900	–	861	–
	2018	0	–	39 144	61 974	631	–	579	–
	2019	–	–	15 055	72 369	–	586	–	580
Ethiopia	2017	5 854 497	25.4	17 860 356	6 400 000	8 470 000	–	7 300 000	–
	2018	11 466 972	20.2	9 153 163	4 053 200	3 773 179	–	3 036 690	–
	2019	15 754 582	26.4	7 441 150	8 190 815	11 931 656	1 015 792	5 070 567	836 293

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
AFRICAN									
Gabon	2017	–	17.7	–	0	0	–	0	–
	2018	4 582	16.6	–	71 787	–	–	208 953	–
	2019	–	14.9	–	–	–	–	0	117 126
Gambia	2017	1 051 391	58.2	396 546	767 984	174 556	–	174 166	–
	2018	115 801	57	426 788	678 621	113 563	–	113 563	–
	2019	1 115 780	45.1	507 872	505 895	–	53 386	–	53 385
Ghana	2017	3 059 363	71.1	1 868 861	7 051 875	4 522 410	–	4 522 410	–
	2018	16 839 135	84.5	1 855 326	13 119 275	5 253 298	–	5 253 298	–
	2019	2 924 717	78.6	1 986 408	12 866 700	4 208 875	6 164 160	4 208 875	6 164 159
Guinea	2017	523 328	50.7	–	2 920 298	2 673 947	–	2 673 947	–
	2018	658 976	30.9	–	2 741 607	1 886 685	–	1 886 685	–
	2019	8 964 940	69.3	–	2 857 744	–	1 646 493	–	–
Guinea-Bissau	2017	1 222 428	64	–	303 651	136 507	–	110 508	–
	2018	93 859	62.5	–	320 217	162 773	–	147 927	–
	2019	102 586	37.5	–	325 690	155 848	155 848	140 478	140 478
Kenya	2017	15 621 773	69.8	906 388	11 337 850	10 696 827	–	10 696 827	–
	2018	2 673 730	70	1 833 860	–	–	–	–	–
	2019	1 797 075	59.8	2 011 860	4 179 875	8 285 622	5 259 988	7 247 430	5 004 487
Liberia	2017	157 954	26.1	–	–	–	–	–	–
	2018	2 500 796	59.4	–	–	994 008	–	994 008	–
	2019	197 736	54.7	–	536 915	–	1 004 895	2 108 721	732 322
Madagascar	2017	764 022	39.7	2 008 963	2 465 600	1 620 050	–	1 620 050	–
	2018	13 520 356	61.2	–	4 731 125	2 165 450	–	2 165 450	–
	2019	1 078 541	67.8	1 640 183	2 899 007	975 587	–	975 587	–
Malawi	2017	994 136	62	–	15 060 625	10 177 530	–	10 177 530	–
	2018	11 805 392	72.6	–	13 003 518	8 948 286	–	9 186 040	–
	2019	1 064 495	71.3	1 456 138	–	–	4 108 225	–	112 411
Mali	2017	4 148 911	64.5	823 201	4 164 041	3 746 616	–	3 746 616	–
	2018	4 993 868	67.3	665 581	6 105 500	3 558 964	–	3 558 964	–
	2019	4 005 010	73.7	690 793	3 656 317	2 846 438	2 846 438	2 826 112	2 826 112
Mauritania	2017	921 245	46.9	–	234 520	101 450	–	–	–
	2018	479 637	44.6	–	117 000	25 890	–	25 890	–
	2019	–	11.8	–	0	–	–	–	–
Mayotte	2017	–	–	–	–	–	–	–	–
	2018	–	–	–	–	44	–	44	–
	2019	–	–	–	–	–	–	–	–
Mozambique	2017	15 482 093	72.1	5 349 948	19 662 975	15 996 892	–	15 996 892	–
	2018	1 337 905	64.9	4 211 138	21 180 223	16 293 318	–	16 293 318	–
	2019	6 614 068	53.2	6 303 792	21 365 400	16 867 851	10 742 632	16 867 851	10 742 632
Namibia	2017	0	–	753 281	914 175	79 316	–	79 316	–
	2018	35 000	–	549 243	49 852	35 355	–	1 721	–
	2019	–	–	149 306	247 425	3 404	3 404	3 404	0
Niger	2017	981 423	69.7	0	3 909 600	2 697 115	–	2 161 440	–
	2018	4 024 529	74.4	–	5 149 981	3 536 000	–	3 536 000	–
	2019	–	76.1	–	5 831 287	3 211 243	3 015 081	3 211 243	–
Nigeria	2017	21 978 907	49.4	–	9 701 771	7 752 372	–	7 752 372	–
	2018	27 675 958	50.1	–	18 662 105	32 707 785	–	32 707 785	–
	2019	30 417 404	48.1	–	26 312 300	38 240 771	21 252 650	38 240 771	21 252 650
Rwanda	2017	2 816 586	75.4	1 753 230	4 960 020	6 300 445	–	6 265 890	–
	2018	974 847	53.5	1 621 955	5 364 990	5 233 680	–	5 214 330	–
	2019	536 637	36.4	4 532 103	4 904 370	4 231 880	3 566 544	4 215 120	3 545 251
Sao Tome and Principe	2017	15 151	–	138 000	96 826	2 410	–	2 410	–
	2018	142 894	–	–	–	–	–	–	–
	2019	16 260	–	53 401	221 450	2 457	2 457	2 457	2 457

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
AFRICAN									
Senegal	2017	448 305	73.6	619 578	2 391 311	958 473	–	958 473	–
	2018	617 470	47.7	0	2 646 144	1 606 813	–	1 490 147	–
	2019	9 373 577	72.1	51 652	2 552 381	–	354 432	–	339 598
Sierra Leone	2017	4 654 654	66.3	–	2 611 550	2 504 960	–	2 504 960	–
	2018	502 834	69	–	4 316 420	3 415 480	–	3 415 480	–
	2019	492 622	49.5	–	3 930 606	4 751 000	2 813 086	4 751 000	2 404 286
South Africa	2017	0	–	1 550 235	865 050	72 439	–	72 439	–
	2018	0	–	1 600 747	887 300	51 142	–	51 142	–
	2019	–	–	1 477 420	879 625	10 592	–	10 592	13 833
South Sudan[1]	2017	1 902 020	59.7	153 285	1 945 875	12 188 601	–	12 188 601	–
	2018	963 092	42.4	–	–	2 680 776	–	2 680 776	–
	2019	713 717	34.2	344 242	–	–	–	–	–
Togo	2017	4 706 417	77.9	–	1 613 393	1 355 640	–	1 196 518	–
	2018	224 265	79.5	–	2 485 086	1 988 845	–	2 055 831	–
	2019	407 911	66.7	–	2 957 298	2 284 746	2 284 746	1 499 012	2 266 412
Uganda	2017	23 797 483	83.1	3 223 800	24 620 100	27 396 300	–	27 396 300	–
	2018	11 220 492	79.9	4 436 156	28 200 125	25 606 514	–	25 606 514	–
	2019	1 855 163	60.6	4 478 754	20 979 775	17 706 390	–	17 706 390	–
United Republic of Tanzania[2]	2017	5 335 910	–	2 759 641	35 109 007	20 903 686	–	20 903 686	–
	2018	6 378 169	–	2 842 635	30 263 725	16 425 610	–	16 425 210	–
	2019	6 968 606	–	2 989 048	26 058 455	8 487 473	6 963	8 485 301	6 385 075
Mainland	2017	5 335 910	59.6	2 568 522	34 649 050	20 895 180	–	20 895 180	–
	2018	6 200 375	59.4	2 507 920	29 906 950	16 420 560	–	16 420 560	–
	2019	6 745 132	–	2 507 920	25 699 255	8 479 635	–	8 479 635	6 378 890
Zanzibar	2017	0	–	191 119	459 957	8 506	–	8 506	–
	2018	177 794	–	334 715	356 775	5 050	–	4 650	–
	2019	223 474	–	481 128	359 200	7 838	6 963	5 666	6 185
Zambia	2017	10 759 947	70.3	7 717 767	18 884 600	17 460 232	–	17 460 232	–
	2018	689 288	64.1	6 436 719	17 868 550	27 071 994	–	27 071 994	–
	2019	1 024 635	47.3	11 767 404	17 737 525	19 134 471	19 134 471	19 134 471	–
Zimbabwe	2017	513 300	46.4	3 673 311	875 713	549 083	–	553 953	–
	2018	1 015 246	36.3	3 020 032	1 484 134	607 379	–	615 359	–
	2019	2 160 175	36.6	3 164 344	1 445 007	–	304 309	–	304 309
AMERICAS									
Argentina	2017	0	–	4 208	0	39	–	9	–
	2018	0	–	155	0	213	–	92	–
	2019	–	–	–	–	–	–	–	–
Belize	2017	0	–	37 466	0	9	–	1	–
	2018	2 619	–	36 688	0	7	–	0	–
	2019	0	–	43 497	0	–	2	0	0
Bolivia (Plurinational State of)	2017	23 500	–	20 000	3 500	0	–	0	–
	2018	23 500	–	2 000	–	–	–	–	–
	2019	27 000	–	29 228	36 800	8 600	–	–	9 357
Brazil	2017	0	–	83 990	72 200	651 274	–	69 960	–
	2018	300 000	–	99 321	114 775	634 935	–	79 200	–
	2019	0	–	84 126	102 275	491 126	491 126	74 360	74 360
Colombia	2017	295 250	–	153 690	265 250	95 570	–	56 030	–
	2018	0	–	60 000	13 252	46 217	–	26 507	–
	2019	78 320	–	143 320	25 000	97 324	–	59 100	–
Costa Rica	2017	104	–	8 479	0	25	–	7	–
	2018	3 100	–	4 095	700	108	–	5	–
	2019	–	–	–	–	–	–	–	–

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
AMERICAN									
Dominican Republic	2017	0	–	30 361	48 850	398	–	–	–
	2018	5 052	–	36 891	42 425	484	–	9	–
	2019	–	–	33 226	55 000	–	1 314	–	7
Ecuador	2017	72 015	–	667 111	–	1 380	–	371	–
	2018	50 000	–	775 884	51 200	1 806	–	191	–
	2019	31 271	–	698 292	73 425	5 030	1 909	2 650	265
El Salvador	2017	2 925	–	19 167	0	4	–	0	–
	2018	4 817	–	32 691	0	2	–	1	–
	2019	1 813	–	23 512	–	–	–	–	–
French Guiana	2017	–	–	–	–	–	–	–	–
	2018	–	–	–	–	–	–	–	–
	2019	–	–	–	–	–	–	–	–
Guatemala	2017	83 258	–	6 245	170 325	9 995	–	0	–
	2018	310 218	–	15 358	75 300	3 246	–	–	–
	2019	128 982	–	4 091	61 275	–	–	–	2
Guyana	2017	5 534	–	–	–	13 936	–	5 141	–
	2018	43 181	–	–	–	11 767	–	3 073	–
	2019	1 759	–	–	37 800	16 913	–	6 622	–
Haiti	2017	709 720	–	–	261 600	18 772	–	–	–
	2018	1 919	–	42 130	207 800	8 083	–	–	–
	2019	19 063	–	–	293 200	22 172	10 687	–	–
Honduras	2017	24 092	–	225 027	29 710	–	–	–	–
	2018	53 944	–	338 730	15 000	14	–	45	–
	2019	32 091	–	–	17 580	14	–	–	2
Mexico	2017	5 695	–	87 772	0	765	–	14	–
	2018	17 891	–	85 812	0	803	–	10	–
	2019	19 001	–	83 581	0	641	–	–	12
Nicaragua	2017	103 676	–	182 602	46 500	49 085	–	50	–
	2018	47 301	–	183 098	117 350	86 195	–	–	–
	2019	228 589	–	139 795	63 500	35 649	13 226	–	–
Panama	2017	–	–	3 921	16 000	689	–	144	–
	2018	0	–	19 500	20 000	715	–	3	–
	2019	3 952	–	12 806	30 000	–	–	–	3
Paraguay	2017	0	–	631	5 000	2 498	–	408	–
	2018	–	–	–	–	–	–	–	–
	2019	–	–	–	–	–	–	–	–
Peru	2017	–	–	62 804	–	–	–	–	–
	2018	83 220	–	23 420	180 000	65 000	–	14 500	–
	2019	–	–	59 438	204 000	51 289	–	–	4 724
Suriname	2017	6 022	–	–	14 325	–	–	–	–
	2018	15 000	–	–	13 575	–	–	–	–
	2019	6 847	–	–	20 625	–	–	–	–
Venezuela (Bolivarian Republic of)	2017	5 000	–	3 900	–	–	–	–	–
	2018	81 402	–	–	48 117	404 924	–	97 293	–
	2019	256 311	–	–	250 000	398 285	–	–	90 153
EASTERN MEDITERRANEAN									
Afghanistan	2017	2 372 354	–	–	514 875	27 850	–	27 850	–
	2018	649 383	–	–	28 915	–	–	47 665	–
	2019	1 336 070	–	–	714 700	–	169 504	–	–
Djibouti	2017	134 701	20.7	–	63 488	14 212	–	–	–
	2018	109 500	31.5	–	91 416	46 380	–	98 380	–
	2019	218 650	20.9	37 663	335 625	148 890	47 691	148 890	47 691

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
EASTERN MEDITERRANEAN									
Iran (Islamic Republic of)	2017	4 218	–	126 111	–	–	–	–	–
	2018	4 500	–	117 174	128 650	–	–	–	–
	2019	–	–	64 365	7 737	4 984	159	8 139	159
Pakistan	2017	1 048 037	–	776 650	1 826 221	800 000	–	63 566	–
	2018	2 762 975	–	2 937 767	2 584 675	1 000 000	–	65 000	–
	2019	2 405 841	–	1 657 670	3 895 000	290 170	413 533	57 781	90 178
Saudi Arabia	2017	127 800	–	253 222	–	1 915	–	1 915	–
	2018	127 801	–	242 009	–	1 908	–	1 908	–
	2019	0	–	225 510	13 500 000	25 000	2 152	15 000	1 515
Somalia	2017	2 571 923	21.9	1 267 526	468 750	322 260	–	322 260	–
	2018	357 569	22	2 038 381	755 750	260 580	–	260 580	–
	2019	388 766	16.8	82 720	974 700	174 030	–	174 030	–
Sudan	2017	5 741 449	63	3 683 031	3 498 425	4 507 838	–	4 507 838	–
	2018	3 454 519	61.7	3 830 195	4 117 300	4 195 600	–	4 195 600	–
	2019	8 565 841	58	3 886 652	7 246 975	4 297 167	4 297 167	4 297 167	4 297 167
Yemen	2017	433 266	–	1 338 585	148 935	138 494	–	77 115	–
	2018	1 461 760	–	995 328	571 175	440 265	–	38 420	–
	2019	612 884	–	1 982 284	907 425	458 103	–	42 698	–
SOUTH-EAST ASIA									
Bangladesh	2017	2 242 527	–	–	373 138	29 916	–	24 790	–
	2018	1 559 423	–	72 000	500 440	10 762	–	8 609	–
	2019	727 253	–	98 786	756 573	17 225	17 225	15 099	15 099
Bhutan	2017	137 000	–	71 690	21 650	132	62	132	10
	2018	29 770	–	76 809	12 300	293	54	293	17
	2019	13 906	–	118 730	29 100	42	235	235	11
Democratic People's Republic of Korea	2017	0	–	1 147 548	176 612	17 038	–	0	–
	2018	500 815	–	169 841	657 050	3 698	–	0	–
	2019	30 928	–	0	458 743	4 000	1 869	0	0
India	2017	16 340 000	–	39 341 409	1 064 000	104 110	–	62 650	–
	2018	9 648 400	–	34 290 886	10 500 000	1 400 000	–	1 100 000	–
	2019	22 410 000	–	30 363 425	–	–	338 494	–	156 940
Indonesia	2017	4 376 636	–	3 320	1 783 498	607 965	–	607 965	–
	2018	340 074	–	305 493	255 300	670 603	–	670 603	–
	2019	–	–	164 192	1 980 775	–	234 381	–	234 381
Myanmar	2017	5 835 192	–	–	2 053 525	108 364	–	108 364	–
	2018	775 251	–	14 017	1 761 775	57 144	–	57 144	–
	2019	11 046 312	–	4 361	2 652 010	51 779	53 003	51 779	23 623
Nepal	2017	324 156	–	300 000	100 000	3 070	–	238	–
	2018	319 046	–	230 000	132 065	3 949	–	120	–
	2019	162 409	–	263 000	205 636	13 621	710	3 522	63
Sri Lanka	2017	18 019	–	10 317	27 500	57	–	27	–
	2018	21 759	–	15 707	11 150	48	–	15	–
	2019	29 941	–	3 467	20 035	53	–	24	–
Thailand	2017	358 400	–	207 250	173 425	21 540	–	7 540	–
	2018	131 425	–	165 580	30 550	25 292	–	9 892	–
	2019	80 000	–	489 105	303 613	31 276	3 904	11 976	536
Timor-Leste	2017	334 471	–	102 891	115 115	5 593	30	5 593	30
	2018	35 367	–	154 410	144 061	5 633	8	5 633	8
	2019	97 586	–	175 654	249 750	1 070	9	1 070	9

ANNEX 3 – D. COMMODITIES DISTRIBUTION AND COVERAGE, 2017–2019

WHO region Country/area	Year	No. of LLINs sold or delivered	Modelled percentage of population with access to an ITN	No. of people protected by IRS	No. of RDTs distributed	Any first-line treatment courses delivered (including ACT)	No. of malaria cases treated with any first-line treatment courses (including ACT)	ACT treatment courses delivered	No. of malaria cases treated with ACT
WESTERN PACIFIC									
Cambodia	2017	1 994 150	–	–	503 250	145 518	–	145 518	–
	2018	1 624 507	–	–	–	–	–	–	–
	2019	–	–	–	923 375	98 965	32 197	98 965	32 197
China	2017	11 349	–	352 731	–	–	–	–	–
	2018	5 987	–	161 224	–	–	–	–	–
	2019	1 807	–	206 599	–	–	2 487	–	2 125
Lao People's Democratic Republic	2017	242 405	–	–	333 675	42 972	–	39 272	–
	2018	50 403	–	2 052	34 387	8 931	–	34 765	–
	2019	1 085 527	–	3 333	1 371 367	21 071	6 551	21 071	6 550
Malaysia	2017	278 104	–	539 029	0	4 114	–	3 443	–
	2018	213 073	–	–	0	4 630	–	3 891	–
	2019	112 054	–	323 208	0	3 933	3 933	3 933	3 923
Papua New Guinea	2017	1 694 315	–	–	1 135 577	832 532	–	832 532	–
	2018	1 480 705	–	–	2 268 750	1 385 940	–	1 385 940	–
	2019	1 476 976	–	–	2 454 525	13 230 420	–	1 610 240	–
Philippines	2017	814 984	–	490 640	145 325	23 400	–	23 400	–
	2018	1 156 837	–	1 015 672	168 300	4 318	–	4 318	–
	2019	695 691	–	731 696	370 700	49 359	4 845	16 857	5 435
Republic of Korea	2017	0	–	–	0	515	–	–	–
	2018	0	–	–	0	576	–	–	–
	2019	–	–	0	20 000	–	196	–	0
Solomon Islands	2017	85 976	–	0	374 850	238 665	–	238 665	–
	2018	150 248	–	–	386 975	233 917	–	233 917	–
	2019	297 010	–	–	484 750	230 880	83 733	230 880	83 364
Vanuatu	2017	91 028	–	0	56 150	27 409	1 075	20 853	–
	2018	27 151	–	0	50 850	0	640	0	–
	2019	80 623	–	0	4 490	7 235	571	579	571
Viet Nam	2017	752 000	–	151 153	921 897	87 225	–	40 000	–
	2018	1 193 024	–	319 866	576 930	45 040	–	40 000	–
	2019	31 740	–	696 751	472 173	31 348	5 892	3 134	3 134

Data as of 17 November 2020

ACT: artemisinin-based combination therapy; IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; RDT: rapid diagnostic test; WHO: World Health Organization.

"–" refers to data not available.

[1] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, http://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

[2] Where national data for the United Republic of Tanzania are unavailable, refer to Mainland and Zanzibar.

ANNEX 3 – Ea. HOUSEHOLD SURVEY RESULTS, 2015–2019, COMPILED BY STATCOMPILER

WHO region Country/area	Source	% of households					% of population		% of ITNs	% of pregnant women		% of children <5 years				% of children <5 years with fever in the past 2 weeks			
		with at least one ITN	with at least one ITN for every two persons who stayed in the household the previous night	with IRS in the past 12 months	with at least one ITN and/or IRS in the past 12 months	with at least one ITN for every two persons and/or IRS in the past 12 months	with access to an ITN	who slept under an ITN last night	that were used last night	who slept under an ITN	who took 3+ doses of IPTp	who slept under an ITN	with moderate or severe anaemia	with a positive RDT	with a positive microscopy blood smear	for whom advice or treatment was sought	who had blood taken from a finger or heel for testing	who took antimalarial drugs	who took an ACT among those who received any antimalarial
AFRICAN																			
Angola	2015–16 DHS	30.9	11.3	1.6	31.8	12.5	19.7	17.6	71.0	23.0	20.0	21.7	34.0	13.5	–	51.8	34.3	18.1	76.7
Benin	2017–18 DHS	91.5	60.5	8.7	92.0	63.8	77.2	71.1	73.4	79.3	13.7	76.3	43.8	36.3	39.1	53.1	17.7	17.5	37.0
Burkina Faso	2017–18 MIS	75.3	32.8	–	–	–	54.5	44.1	76.0	58.2	57.7	54.4	50.1	20.2	16.9	73.5	48.8	51.1	79.4
Burundi	2016–17 DHS	46.2	17.1	1.0	46.8	17.9	32.3	34.7	86.9	43.9	12.9	39.9	36.3	37.9	26.8	69.6	66.4	47.0	11.3
Cameroon	2018 DHS	73.4	40.7	–	–	–	58.5	53.9	76.2	61.0	31.9	59.8	31.0	24.0		61.0	21.4	32.7	21.2
Ethiopia	2016 DHS	–	–	–	–	–	–	–	–	–	–	–	32.0	–	–	35.3		7.7	11.5
Ghana	2016 MIS	73.0	50.9	8.1	74.1	53.6	65.8	41.7	47.7	50.0	59.6	52.2	35.2	27.9	20.6	71.9	30.3	50.1	58.8
Ghana	2019 MIS	73.7	51.8	5.8	75.0	54.7	66.7	43.2	50.1	48.7	61.0	54.1	27.9	23.0	14.1	69.0	34.1	45.9	84.5
Guinea	2018 DHS	43.9	16.7	–	–	–	30.7	22.7	64.0	28.1	35.7	26.6	43.8	–	–	62.3	20.5	24.8	18.2
Kenya	2015 MIS	62.5	40.0	–	62.5	39.7	52.5	47.6	75.2	57.8	22.9	56.1	16.2	9.1	5.0	72.4	39.2	27.1	91.6
Liberia	2016 MIS	61.5	25.2	1.2	62.1	25.9	41.5	39.3	71.2	39.5	23.1	43.7	49.2	44.9	–	78.2	49.8	65.5	81.1
Madagascar	2016 MIS	79.5	44.4	6.9	80.9	47.9	62.1	68.2	78.7	68.5	10.6	73.4	20.5	5.1	6.9	59.0	15.5	10.1	17.0
Malawi	2015–16 DHS	56.9	23.5	4.9	58.6	27.0	38.8	33.9	73.3	43.9	30.4	42.7	36.1	–	–	67.0	52.0	37.6	91.8
Malawi	2017 MIS	82.1	41.7	–	–	–	63.1	55.4	76.8	62.5	41.1	67.5	37.1	36.0	24.3	54.4	37.6	29.4	96.4
Mali	2015 MIS	93.0	39.3	4.0	93.6	41.8	69.5	63.9	90.7	77.9	21.0	71.2	63.0	32.4	35.7	50.0	14.2	28.7	28.9
Mali	2018 DHS	89.8	54.8	–	–	–	75.2	72.9	88.7	83.7	28.3	79.1	56.7	18.9	–	52.8	16.4	18.7	31.0
Mozambique	2015 AIS	66.0	38.9	11.2	68.7	45.3	53.8	45.4	70.9	52.1	23.3	47.9	36.7	40.2	–	63.2	39.6	38.4	92.6
Mozambique	2018 MIS	82.2	51.2	–	–	–	68.5	68.4	85.4	76.4	40.6	72.7	55.2	38.9	–	68.6	47.9	32.7	98.6
Nigeria	2015 MIS	68.8	34.9	1.3	69.0	35.5	54.7	37.3	60.8	49.0	21.4	43.6	43.1	45.1	27.4	66.9	12.6	41.2	37.6
Nigeria	2018 DHS	60.6	29.8	–	–	–	47.5	43.2	80.6	58.0	16.6	52.2	41.1	36.2	22.6	72.8	13.8	43.5	52.0
Rwanda	2014–15 DHS	80.6	42.6	–	80.6	42.5	63.8	61.4	77.4	72.9	–	67.7	15.7	7.8	2.2	57.0	36.1	11.4	98.7
Rwanda	2017 MIS	84.1	55.1	19.6	89.2	66.9	71.9	63.9	71.0	68.5	–	68.0	–	11.8	7.2	55.6	38.1	19.6	98.7
Senegal	2015 DHS	76.8	40.5	4.8	77.1	43.0	66.0	51.0	70.0	51.8	11.2	55.4	38.0	0.6	0.3	49.6	9.5	3.4	12.5
Senegal	2016 DHS	82.4	56.4	5.3	82.9	58.0	75.7	63.1	68.2	69.0	22.1	66.6	36.7	0.9	0.9	49.9	13.0	1.7	85.0
Senegal	2017 DHS	84.2	50.4	4.2	84.5	52.3	72.8	56.9	68.6	61.8	22.0	60.7	41.8	0.9	0.4	51.4	16.1	4.7	65.5
Senegal	2018 DHS	76.6	39.0	2.1	76.8	40.1	62.2	51.6	74.5	55.7	22.4	56.4	–	–	–	52.8	13.8	5.1	24.0
Sierra Leone	2016 MIS	60.3	16.2	1.7	61.1	17.7	37.1	38.6	89.0	44.0	31.1	44.1	49.2	52.7	40.1	71.7	51.1	57.0	96.0
South Africa	2016 DHS	–	–	–	–	–	–	–	–	–	–	–	37.0	–	–	–	–	–	–
Togo	2017 MIS	85.2	71.4	–	–	–	82.3	62.5	52.3	69.0	41.7	69.7	47.8	43.9	28.3	55.9	29.3	31.1	76.3
Uganda	2016 DHS	78.4	51.1	–	–	–	64.6	55.0	74.0	64.1	17.2	62.0	29.2	30.4	–	81.2	49.0	71.5	87.8
Uganda	2018–19 MIS	83.0	53.9	10.1	84.2	58.7	71.5	59.2	74.3	65.4	41.0	60.3	25.0	18.2	9.8	87.0	50.7	62.5	87.7
United Republic of Tanzania	2015–16 DHS	65.6	38.8	5.5	66.2	41.0	55.9	49.0	69.4	53.9	8.0	54.4	31.2	14.4	5.6	81.2	35.9	51.1	84.9
United Republic of Tanzania	2017 MIS	77.9	45.4	–		–	62.5	52.2	66.7	51.4	25.8	54.6	30.5	7.3	–	75.4	43.1	36.2	89.4
Zambia	2018 DHS	78.3	40.9	35.3	83.3	60.4	59.9	46.4	64.2	48.9	58.7	51.6	29.5	–	–	77.2	63.0	34.9	96.9
Zimbabwe	2015 DHS	47.9	26.4	21.3	54.9	39.4	37.2	8.5	18.8	6.1	–	9.0	14.9	–	–	50.7	12.7	1.0	–

ANNEX 3 – Ea. HOUSEHOLD SURVEY RESULTS, 2015–2019, COMPILED BY STATCOMPILER

WHO region Country/area	Source	% of households					% of population	
		with at least one ITN	with at least one ITN for every two persons who stayed in the household the previous night	with IRS in the past 12 months	with at least one ITN and/or IRS in the past 12 months	with at least one ITN for every two persons and/or IRS in the past 12 months	with access to an ITN	who slept under an ITN last night
AMERICAS								
Guatemala	2014–15 DHS	–	–	–	–	–	–	–
Haiti	2016–17 DHS	30.7	12.3	2.6	32.2	14.5	19.9	13.0
EASTERN MEDITERRANEAN								
Afghanistan	2015 DHS	26.0	2.9	–	–	–	13.2	3.9
Pakistan	2017–18 DHS	3.6	0.6	5.1	8.4	5.7	2.0	0.2
SOUTH-EAST ASIA								
India	2015–16 DHS	7.6	3.3	–	–	–	5.3	4.2
Myanmar	2015–16 DHS	26.8	14.1	–	–	–	21.2	15.6
Nepal	2016 DHS	–	–	–	–	–	–	–
Timor-Leste	2016 DHS	64.0	32.8	–	–	–	48.3	47.6
WESTERN PACIFIC								
Papua New Guinea	2016–18 DHS	68.5	45.2	–	–	–	57.9	46.0

% of ITNs	% of pregnant women		% of children <5 years				% of children <5 years with fever in the past 2 weeks			
that were used last night	who slept under an ITN	who took 3+ doses of IPTp	who slept under an ITN	with moderate or severe anaemia	with a positive RDT	with a positive microscopy blood smear	for whom advice or treatment was sought	who had blood taken from a finger or heel for testing	who took antimalarial drugs	who took an ACT among those who received any antimalarial
–	–	–	–	12.1	–	–	–	–	–	–
62.3	16.0	–	18.2	37.5	–	–	46.8	15.8	1.1	–
21.4	4.1	–	4.6	–	–	–	63.5	7.9	11.8	4.4
11.6	0.4	–	0.4	–	–	–	81.4		9.2	3.3
68.9	4.7	–	5.0	30.8	–	–	81.1	10.8	20.1	8.5
58.3	18.4	–	18.6	26.7	–	–	66.7	3.0	0.8	–
–	–	–		26.5	–	–	–	–	–	–
79.9	60.1	–	55.7	12.6	–	–	57.6	24.5	10.0	11.1
67.9	49.0	23.5	51.5	–	–	–	49.5	24.6	21.3	3.3

Data as of 17 November 2020

ACT: artemisinin-based combination therapy; AIS: AIDS indicator survey; DHS: demographic and health survey; IPTp: intermittent preventive treatment in pregnancy; IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; MIS: malaria indicator survey; RDT: rapid diagnostic test; WHO: World Health Organization.

"–" refers to not applicable or data not available.

Sources: Nationally representative household survey data from DHS and MIS, compiled through STATcompiler – https://www.statcompiler.com/.

ANNEX 3 – Eb. HOUSEHOLD SURVEY RESULTS, 2015–2019, COMPILED THROUGH WHO CALCULATIONS

WHO region Country/area	Survey	Fever prevalence	Health sector where treatment was sought							Diagnostic testing coverage in each health sector		Diagnostic testing coverage in each health sector				Antimalarial treatment coverage in each health sector							ACT use among antimalarial treatment in each health sector		
		Overall	Public excluding community health workers	Community health workers	Formal medical private excluding pharmacies	Pharmacies or accredited drug stores	Informal private	No treatment seeking	Trained provider	Public excluding community health workers	Community health workers	Formal medical private excluding pharmacies	Pharmacies or accredited drug stores	Informal private	Trained provider	Public excluding community health workers	Community health workers	Formal medical private excluding pharmacies	Pharmacies or accredited drug stores	Self-treatment	No treatment seeking	Trained provider	Public	Private	Informal private
Angola	2015 DHS	15 (14, 16)	47 (44, 50)	0 (0, 0)	5 (4, 7)	1 (1, 2)	2 (2, 3)	45 (42, 48)	53 (50, 56)	59 (54, 63)	-	82 (74, 88)	27 (11, 52)	23 (13, 37)	60 (55, 64)	27 (23, 32)	-	40 (27, 54)	23 (11, 42)	10 (4, 21)	28 (24, 33)	7 (5, 10)	74 (67, 81)	84 (73, 91)	-
Benin	2017 DHS	20 (18, 21)	22 (20, 24)	0 (0, 0)	9 (8, 11)	9 (8, 11)	14 (12, 16)	46 (43, 49)	40 (37, 43)	52 (47, 57)	-	30 (23, 38)	9 (6, 14)	8 (5, 12)	37 (33, 40)	38 (34, 44)	-	34 (27, 41)	23 (17, 30)	12 (9, 17)	34 (30, 37)	7 (5, 9)	44 (36, 52)	31 (24, 39)	40 (26, 55)
Burkina Faso	2017 MIS	20 (19, 22)	71 (67, 75)	1 (0, 1)	1 (1, 4)	0 (0, 1)	2 (1, 3)	26 (22, 30)	73 (69, 76)	66 (61, 70)	-	-	-	-	66 (61, 70)	69 (64, 73)	-	-	-	-	68 (64, 72)	10 (7, 14)	80 (76, 83)	-	-
Burundi	2016 DHS	40 (38, 41)	54 (51, 56)	3 (2, 4)	10 (8, 12)	5 (4, 5)	1 (0, 1)	30 (28, 32)	69 (67, 71)	87 (86, 89)	95 (89, 98)	86 (82, 89)	36 (30, 44)	54 (26, 79)	84 (82, 86)	69 (66, 71)	93 (87, 97)	55 (49, 62)	32 (26, 40)	-	66 (63, 68)	9 (8, 11)	12 (10, 14)	10 (6, 15)	-
Cameroon	2018 DHS	16 (14, 17)	20 (17, 23)	1 (0, 1)	12 (9, 15)	12 (9, 14)	21 (18, 24)	37 (33, 41)	43 (39, 47)	52 (44, 61)	-	54 (43, 65)	11 (7, 19)	8 (5, 15)	42 (36, 48)	58 (49, 66)	-	48 (38, 58)	33 (24, 43)	46 (38, 54)	48 (43, 54)	12 (9, 16)	25 (17, 35)	21 (15, 27)	15 (8, 27)
Ethiopia	2016 DHS	14 (13, 16)	26 (23, 30)	0 (0, 0)	9 (7, 12)	0 (0, 0)	2 (1, 3)	63 (60, 67)	35 (31, 38)	-	-	-	-	-	-	16 (11, 23)	-	19 (10, 34)	-	-	17 (13, 23)	4 (2, 6)	14 (4, 38)	-	-
Ghana	2019 MIS	30 (27, 33)	34 (30, 38)	0 (0, 1)	20 (17, 24)	14 (10, 18)	3 (1, 5)	30 (26, 35)	67 (63, 71)	78 (72, 83)	-	30 (22, 39)	8 (4, 16)	-	50 (45, 55)	63 (56, 70)	-	55 (46, 63)	57 (44, 69)	-	59 (54, 65)	18 (14, 24)	88 (80, 93)	86 (77, 92)	-
Guinea	2018 DHS	17 (16, 19)	40 (36, 43)	0 (0, 1)	5 (3, 6)	0 (0, 0)	24 (21, 27)	32 (29, 36)	45 (41, 48)	42 (37, 47)	-	37 (23, 53)	-	4 (2, 8)	42 (37, 47)	41 (35, 47)	-	52 (33, 70)	-	24 (17, 31)	42 (37, 48)	10 (7, 14)	22 (15, 31)	15 (8, 25)	7 (3, 18)
Kenya	2015 MIS	36 (34, 39)	51 (46, 55)	1 (0, 2)	15 (12, 19)	5 (3, 7)	3 (2, 4)	27 (24, 31)	70 (67, 74)	52 (46, 57)	-	57 (45, 67)	9 (2, 28)	25 (12, 45)	49 (44, 54)	31 (25, 37)	-	30 (21, 40)	44 (23, 66)	29 (16, 47)	31 (26, 37)	19 (14, 25)	93 (88, 96)	90 (77, 96)	-
Liberia	2016 MIS	39 (36, 43)	46 (41, 52)	0 (0, 0)	13 (10, 17)	14 (11, 18)	8 (6, 11)	22 (18, 26)	71 (67, 76)	77 (72, 82)	-	82 (71, 89)	35 (25, 47)	14 (5, 33)	70 (64, 75)	84 (80, 88)	-	75 (65, 83)	76 (63, 85)	62 (49, 73)	81 (77, 84)	21 (15, 29)	87 (82, 91)	72 (64, 78)	80 (56, 93)
Madagascar	2016 MIS	16 (15, 18)	36 (31, 41)	7 (5, 10)	10 (8, 14)	1 (1, 2)	7 (5, 10)	40 (36, 44)	53 (49, 58)	31 (25, 39)	37 (22, 54)	7 (3, 14)	-	3 (1, 13)	27 (22, 33)	13 (8, 19)	19 (10, 33)	13 (6, 25)	-	18 (9, 35)	14 (10, 19)	5 (3, 9)	9 (3, 26)	-	-
Malawi	2017 MIS	40 (38, 43)	38 (34, 43)	3 (2, 5)	6 (4, 8)	2 (1, 4)	7 (5, 10)	46 (41, 51)	48 (43, 52)	76 (70, 82)	-	76 (61, 86)	-	4 (1, 14)	73 (67, 78)	55 (48, 62)	-	55 (39, 69)	-	21 (9, 41)	54 (48, 61)	7 (5, 11)	98 (94, 99)	97 (81, 99)	-
Mali	2018 DHS	16 (15, 17)	24 (21, 27)	3 (2, 5)	2 (1, 3)	7 (5, 9)	23 (19, 27)	42 (38, 46)	36 (33, 39)	46 (39, 53)	37 (22, 56)	-	8 (3, 17)	5 (3, 9)	36 (30, 42)	61 (54, 68)	56 (38, 72)	-	17 (9, 30)	5 (2, 10)	50 (44, 57)	4 (3, 6)	35 (27, 43)	20 (9, 38)	-
Mozambique	2018 MIS	31 (28, 35)	64 (57, 70)	4 (2, 7)	0 (0, 1)	0 (0, 1)	1 (1, 3)	31 (26, 37)	68 (62, 73)	72 (67, 76)	41 (13, 76)	-	-	-	70 (65, 74)	47 (40, 53)	57 (44, 70)	-	-	-	47 (41, 53)	10 (6, 17)	98 (97, 99)	-	-
Nigeria	2018 DHS	24 (23, 25)	27 (25, 29)	1 (1, 1)	38 (36, 40)	5 (4, 6)	4 (3, 5)	26 (25, 28)	70 (68, 72)	35 (32, 38)	9 (4, 18)	8 (6, 9)	11 (7, 16)	3 (1, 5)	18 (17, 20)	64 (61, 66)	57 (39, 73)	51 (48, 53)	37 (32, 43)	23 (17, 31)	55 (53, 56)	19 (17, 21)	54 (50, 57)	50 (46, 53)	35 (22, 50)
Rwanda	2017 MIS	31 (28, 34)	33 (29, 37)	18 (15, 22)	3 (2, 4)	5 (3, 7)	1 (1, 2)	44 (40, 48)	55 (51, 59)	73 (65, 80)	74 (65, 82)	70 (51, 84)	14 (4, 37)	-	67 (61, 73)	30 (22, 40)	60 (51, 68)	13 (4, 39)	31 (15, 54)	-	37 (31, 44)	2 (1, 4)	99 (95, 100)	-	-
Senegal	2018 DHS	20 (18, 22)	40 (37, 44)	1 (0, 1)	2 (1, 4)	8 (5, 13)	2 (1, 3)	47 (41, 53)	51 (46, 57)	29 (24, 35)	-	-	4 (1, 9)	-	25 (20, 30)	12 (8, 19)	-	-	6 (1, 33)	-	12 (7, 19)	0 (0, 1)	22 (14, 32)	-	-
Sierra Leone	2016 MIS	27 (25, 29)	63 (60, 66)	0 (0, 0)	4 (3, 6)	4 (3, 5)	2 (1, 3)	28 (25, 31)	70 (67, 74)	74 (71, 77)	-	72 (56, 84)	13 (6, 26)	-	71 (67, 74)	77 (74, 81)	-	77 (61, 88)	41 (28, 55)	-	75 (71, 79)	19 (14, 24)	98 (96, 98)	93 (80, 97)	-
South Africa	2016 DHS	21 (19, 23)	41 (36, 45)	0 (0, 1)	12 (9, 16)	15 (12, 20)	2 (1, 3)	31 (27, 36)	67 (62, 72)	-	-	-	-	-	-	0 (0, 0)	-	1 (0, 5)	1 (0, 4)	-	0 (0, 1)	1 (0, 7)	-	-	-
Togo	2017 MIS	24 (22, 27)	26 (22, 31)	5 (4, 8)	7 (5, 9)	3 (2, 5)	16 (12, 21)	43 (37, 49)	42 (37, 47)	78 (71, 84)	76 (60, 87)	45 (31, 60)	-	4 (2, 11)	66 (60, 72)	70 (60, 79)	83 (69, 91)	54 (37, 70)	-	10 (5, 17)	66 (59, 73)	7 (4, 10)	82 (74, 88)	56 (38, 73)	-
Uganda	2018 MIS	27 (24, 30)	33 (29, 37)	7 (5, 9)	38 (34, 41)	12 (10, 15)	1 (1, 1)	13 (11, 15)	86 (84, 88)	84 (79, 88)	77 (68, 83)	48 (43, 53)	20 (15, 28)	-	58 (54, 62)	72 (66, 76)	90 (84, 93)	72 (67, 77)	54 (42, 66)	-	70 (66, 74)	30 (23, 37)	89 (84, 93)	87 (82, 91)	-
United Republic of Tanzania	2017 MIS	21 (19, 22)	46 (43, 50)	0 (0, 1)	13 (11, 16)	17 (15, 20)	1 (1, 2)	25 (22, 28)	75 (71, 78)	66 (60, 71)	-	76 (68, 83)	13 (8, 21)	-	55 (51, 60)	34 (28, 40)	-	49 (41, 57)	57 (48, 66)	-	42 (36, 47)	24 (19, 30)	96 (92, 98)	83 (73, 90)	-
Zambia	2018 DHS	16 (15, 17)	69 (66, 72)	3 (2, 5)	4 (3, 6)	0 (0, 1)	1 (0, 2)	23 (20, 26)	76 (73, 79)	78 (73, 82)	83 (64, 93)	79 (65, 89)	-	-	78 (73, 82)	42 (37, 47)	86 (72, 93)	54 (41, 67)	-	-	44 (40, 49)	10 (7, 13)	97 (95, 98)	94 (76, 99)	-
Zimbabwe	2015 DHS	14 (13, 16)	35 (30, 40)	1 (1, 3)	9 (7, 13)	0 (0, 0)	6 (4, 8)	49 (45, 54)	45 (40, 50)	26 (20, 32)	-	13 (6, 26)	-	9 (3, 25)	23 (18, 28)	2 (1, 5)	-	1 (0, 7)	-	0 (0, 0)	1 (1, 4)	1 (0, 3)	-	-	-

Notes:
The analysis is presented as: point estimate (95% confidence interval).
Figures with fewer than 30 children in the denominator were removed.
"–" refers to not applicable or data not available.

Data as of 17 November 2020

ACT: artemisinin-based combination therapy; DHS: demographic and health survey; MIS: malaria indicator survey; WHO: World Health Organization.

Sources: Nationally representative household survey data from DHS and MIS, compiled through WHO calculations.

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Algeria[1,2,3]	2000	1 823 421	–	34	–	–	2	–
	2001	1 847 461	–	6	–	–	1	–
	2002	1 871 169	–	10	–	–	0	–
	2003	1 895 196	–	5	–	–	0	–
	2004	1 920 337	–	2	–	–	0	–
	2005	1 947 214	–	1	–	–	0	–
	2006	1 976 072	–	1	–	–	0	–
	2007	2 006 967	–	26	–	–	0	–
	2008	2 040 075	–	3	–	–	0	–
	2009	2 075 512	–	0	–	–	0	–
	2010	2 113 315	–	1	–	–	1	–
	2011	2 153 492	–	1	–	–	0	–
	2012	2 195 930	–	55	–	–	0	–
	2013	2 240 351	–	8	–	–	0	–
	2014	2 286 377	–	0	–	–	0	–
	2015	2 333 623	–	0	–	–	0	–
	2016	2 381 988	–	0	–	–	0	–
	2017	2 431 199	–	0	–	–	0	–
	2018	2 480 496	–	0	–	–	0	–
	2019	2 528 936	–	0	–	–	0	–
Angola	2000	16 395 477	3 840 000	5 275 560	7 013 000	16 900	18 674	20 700
	2001	16 945 753	4 016 000	5 517 080	7 339 000	16 900	18 684	20 800
	2002	17 519 418	3 952 000	5 426 313	7 318 000	17 200	19 083	21 300
	2003	18 121 477	4 132 000	5 667 511	7 569 000	17 400	19 456	21 800
	2004	18 758 138	4 316 000	5 946 911	7 974 000	17 100	19 210	21 700
	2005	19 433 604	4 747 000	6 177 115	7 831 000	16 300	18 442	20 900
	2006	20 149 905	4 708 000	6 086 202	7 708 000	15 200	17 425	20 000
	2007	20 905 360	4 354 000	5 695 246	7 354 000	14 100	16 410	19 100
	2008	21 695 636	3 727 000	4 945 196	6 457 000	13 000	15 240	18 100
	2009	22 514 275	3 284 000	4 362 172	5 725 000	11 800	14 116	17 000
	2010	23 356 247	3 089 000	4 108 235	5 420 000	11 000	13 429	16 400
	2011	24 220 660	2 998 000	4 030 883	5 258 000	10 400	12 845	16 000
	2012	25 107 925	3 094 000	4 155 393	5 460 000	10 000	12 467	15 800
	2013	26 015 786	3 337 000	4 500 708	5 909 000	9 770	12 295	15 800
	2014	26 941 773	3 601 000	4 828 163	6 362 000	9 840	12 535	16 400
	2015	27 884 380	4 028 000	5 297 305	6 797 000	10 100	13 168	17 700
	2016	28 842 482	4 528 000	5 927 529	7 693 000	10 200	13 311	18 100
	2017	29 816 769	4 741 000	6 450 282	8 522 000	10 300	13 455	18 400
	2018	30 809 787	5 034 000	7 004 857	9 491 000	10 300	13 529	18 600
	2019	31 825 299	5 271 000	7 484 109	10 290 000	10 400	13 663	18 900
Benin	2000	6 865 946	2 288 000	2 886 173	3 569 000	6 780	7 157	7 560
	2001	7 076 728	2 457 000	3 103 010	3 844 000	6 320	6 678	7 050
	2002	7 295 400	2 579 000	3 246 723	4 027 000	6 760	7 153	7 550
	2003	7 520 556	2 787 000	3 494 942	4 344 000	7 250	7 684	8 140
	2004	7 750 003	2 993 000	3 768 637	4 689 000	8 080	8 572	9 100
	2005	7 982 223	3 164 000	3 957 364	4 921 000	8 960	9 525	10 100
	2006	8 216 893	3 238 000	4 094 227	5 107 000	9 800	10 439	11 100
	2007	8 454 790	3 257 000	4 147 295	5 216 000	9 860	10 526	11 200
	2008	8 696 915	3 174 000	4 061 531	5 114 000	9 310	9 957	10 600
	2009	8 944 713	2 947 000	3 815 268	4 866 000	8 420	9 024	9 670
	2010	9 199 254	2 819 000	3 646 140	4 636 000	7 500	8 050	8 630
	2011	9 460 829	2 760 000	3 552 893	4 499 000	6 800	7 308	7 840
	2012	9 729 254	2 893 000	3 650 241	4 570 000	6 240	6 724	7 230
	2013	10 004 594	3 096 000	3 900 258	4 880 000	5 890	6 365	6 860
	2014	10 286 839	3 278 000	4 125 163	5 120 000	5 920	6 407	6 930
	2015	10 575 962	3 570 000	4 447 719	5 464 000	6 110	6 654	7 230
	2016	10 872 072	3 934 000	4 832 955	5 900 000	6 310	6 915	7 550
	2017	11 175 192	3 908 000	4 843 380	5 917 000	6 440	7 134	7 830
	2018	11 485 035	3 748 000	4 763 360	5 957 000	6 360	7 088	7 880
	2019	11 801 151	3 670 000	4 799 544	6 166 000	6 230	7 065	7 960
Botswana	2000	1 089 496	13 000	19 480	35 000	1	49	120
	2001	1 110 275	4 600	7 810	14 000	0	19	48
	2002	1 130 140	2 000	3 710	7 600	0	9	26
	2003	1 149 863	740	1 876	4 500	0	4	15
	2004	1 170 513	250	1 219	3 800	0	3	12
	2005	1 192 752	830	1 485	2 800	0	3	9
	2006	1 217 172	3 200	4 879	8 200	0	12	28
	2007	1 243 391	490	1 285	3 200	0	3	10
	2008	1 270 028	1 200	2 457	4 900	0	6	17
	2009	1 295 128	1 300	2 718	5 200	0	6	18
	2010	1 317 411	1 300	2 229	4 000	0	5	13
	2011	1 336 173	520	682	940	0	1	3
	2012	1 352 181	230	304	410	0	0	1
	2013	1 367 430	570	729	980	0	1	3
	2014	1 384 712	1 600	2 074	2 800	0	5	10
	2015	1 405 992	400	522	710	0	1	2
	2016	1 431 987	890	1 157	1 600	0	2	5
	2017	1 461 921	2 300	3 005	4 100	0	7	15
	2018	1 494 401	680	881	1 200	0	2	4
	2019	1 527 309	200	257	360	0	0	1

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Burkina Faso	2000	11 607 951	5 456 000	6 840 864	8 459 000	33 600	35 897	38 200
	2001	11 944 589	5 541 000	7 028 819	8 786 000	35 800	38 224	40 800
	2002	12 293 097	5 649 000	7 137 058	8 927 000	34 600	36 984	39 600
	2003	12 654 624	5 688 000	7 165 885	8 919 000	34 200	36 697	39 300
	2004	13 030 576	5 612 000	6 997 556	8 698 000	34 000	36 510	39 200
	2005	13 421 935	5 389 000	6 801 959	8 473 000	33 000	35 568	38 300
	2006	13 829 173	5 346 000	6 828 527	8 541 000	32 400	35 021	37 700
	2007	14 252 029	5 701 000	7 180 196	8 965 000	32 500	35 200	38 000
	2008	14 689 725	6 257 000	7 835 309	9 658 000	32 600	35 450	38 400
	2009	15 141 098	6 698 000	8 358 319	10 320 000	26 300	28 757	31 300
	2010	15 605 211	6 884 000	8 602 187	10 590 000	29 700	32 684	35 900
	2011	16 081 915	6 968 000	8 677 204	10 710 000	27 300	30 361	33 600
	2012	16 571 252	7 043 000	8 742 005	10 760 000	20 500	23 104	25 900
	2013	17 072 791	6 694 000	8 323 401	10 230 000	19 600	22 398	25 500
	2014	17 586 029	6 151 000	7 668 618	9 439 000	17 700	20 637	24 100
	2015	18 110 616	5 741 000	7 245 827	9 025 000	15 400	18 275	21 800
	2016	18 646 350	5 249 000	7 490 818	10 340 000	13 500	16 214	19 800
	2017	19 193 236	5 406 000	7 676 215	10 590 000	12 200	15 067	18 800
	2018	19 751 466	5 551 000	7 875 575	10 960 000	11 700	14 832	19 000
	2019	20 321 383	5 520 000	7 859 000	10 850 000	11 300	14 661	19 300
Burundi	2000	6 378 871	2 363 000	3 214 385	4 321 000	11 400	12 275	13 300
	2001	6 525 546	2 311 000	3 203 420	4 283 000	10 500	11 323	12 300
	2002	6 704 118	2 181 000	2 984 556	4 000 000	9 600	10 401	11 300
	2003	6 909 161	2 047 000	2 797 949	3 755 000	8 660	9 397	10 200
	2004	7 131 688	1 822 000	2 498 637	3 349 000	7 510	8 122	8 840
	2005	7 364 857	1 637 000	2 255 531	3 015 000	6 370	6 873	7 440
	2006	7 607 850	1 451 000	2 031 235	2 759 000	5 710	6 152	6 640
	2007	7 862 226	1 261 000	1 785 715	2 471 000	5 170	5 552	5 980
	2008	8 126 104	1 112 000	1 612 991	2 250 000	4 800	5 152	5 540
	2009	8 397 661	1 044 000	1 520 335	2 158 000	4 560	4 891	5 250
	2010	8 675 606	1 021 000	1 503 258	2 127 000	4 400	4 730	5 080
	2011	8 958 406	1 041 000	1 499 570	2 090 000	4 300	4 644	5 020
	2012	9 245 992	1 096 000	1 536 650	2 114 000	4 400	4 786	5 240
	2013	9 540 302	1 160 000	1 648 882	2 271 000	4 340	4 765	5 280
	2014	9 844 301	1 247 000	1 759 151	2 426 000	4 370	4 866	5 480
	2015	10 160 034	1 437 000	1 990 538	2 715 000	4 380	4 933	5 650
	2016	10 488 002	1 755 000	2 407 557	3 205 000	4 420	5 038	5 870
	2017	10 827 010	2 074 000	2 805 588	3 716 000	4 430	5 138	6 070
	2018	11 175 379	2 435 000	3 241 635	4 236 000	4 410	5 145	6 170
	2019	11 530 577	2 538 000	3 412 492	4 496 000	4 420	5 184	6 290
Cabo Verde[1,2]	2000	111 326	–	144	–	–	0	–
	2001	113 282	–	107	–	–	0	–
	2002	115 168	–	76	–	–	2	–
	2003	116 980	–	68	–	–	4	–
	2004	118 720	–	45	–	–	4	–
	2005	120 388	–	68	–	–	2	–
	2006	121 984	–	80	–	–	8	–
	2007	123 517	–	18	–	–	2	–
	2008	125 019	–	35	–	–	2	–
	2009	126 533	–	65	–	–	2	–
	2010	128 087	–	47	–	–	1	–
	2011	129 703	–	7	–	–	1	–
	2012	131 362	–	1	–	–	0	–
	2013	133 052	–	22	–	–	0	–
	2014	134 751	–	26	–	–	1	–
	2015	136 432	–	7	–	–	0	–
	2016	138 096	–	48	–	–	1	–
	2017	139 749	–	423	–	–	2	–
	2018	141 378	–	2	–	–	0	–
	2019	142 983	–	0	–	–	0	–
Cameroon	2000	15 513 944	4 949 000	6 291 500	7 905 000	15 700	16 746	17 900
	2001	15 928 910	5 090 000	6 471 215	8 108 000	16 900	18 040	19 300
	2002	16 357 605	5 199 000	6 583 442	8 205 000	20 500	22 018	23 500
	2003	16 800 869	5 469 000	6 959 244	8 724 000	22 600	24 196	25 900
	2004	17 259 322	5 879 000	7 457 970	9 380 000	23 700	25 402	27 300
	2005	17 733 408	5 958 000	7 629 075	9 613 000	23 300	25 042	27 000
	2006	18 223 677	5 909 000	7 603 454	9 610 000	21 300	22 995	24 800
	2007	18 730 283	5 696 000	7 437 648	9 477 000	18 200	19 576	21 100
	2008	19 252 674	5 297 000	6 963 958	9 021 000	15 200	16 419	17 700
	2009	19 789 922	4 828 000	6 299 137	8 113 000	13 200	14 233	15 300
	2010	20 341 236	4 529 000	5 909 335	7 556 000	11 800	12 750	13 700
	2011	20 906 392	4 272 000	5 574 283	7 146 000	11 400	12 276	13 200
	2012	21 485 267	3 981 000	5 455 543	7 293 000	11 800	12 733	13 800
	2013	22 077 300	3 795 000	5 590 823	7 961 000	11 900	12 904	14 000
	2014	22 681 853	3 680 000	5 649 911	8 290 000	11 900	12 948	14 100
	2015	23 298 376	3 822 000	5 777 768	8 306 000	11 500	12 629	13 800
	2016	23 926 549	4 178 000	5 918 836	8 153 000	11 000	12 184	13 500
	2017	24 566 070	4 501 000	5 965 313	7 830 000	10 400	11 661	13 000
	2018	25 216 261	4 696 000	6 077 650	7 751 000	10 100	11 413	12 900
	2019	25 876 387	4 854 000	6 291 256	8 076 000	9 730	11 278	13 000

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Central African Republic	2000	3 640 421	1 189 000	1 579 130	2 055 000	5 070	5 631	6 240
	2001	3 722 016	1 217 000	1 606 811	2 067 000	5 440	6 058	6 740
	2002	3 802 129	1 242 000	1 633 454	2 100 000	6 010	6 723	7 530
	2003	3 881 185	1 291 000	1 693 492	2 191 000	6 570	7 393	8 350
	2004	3 959 883	1 331 000	1 763 481	2 287 000	6 880	7 803	8 910
	2005	4 038 380	1 388 000	1 800 676	2 302 000	7 250	8 335	9 640
	2006	4 118 075	1 403 000	1 819 614	2 320 000	7 760	9 035	10 600
	2007	4 198 004	1 420 000	1 825 263	2 305 000	7 600	8 968	10 800
	2008	4 273 368	1 395 000	1 800 343	2 289 000	7 040	8 421	10 300
	2009	4 337 623	1 327 000	1 756 714	2 275 000	6 580	8 032	10 000
	2010	4 386 765	1 244 000	1 711 195	2 300 000	5 800	7 267	9 290
	2011	4 418 639	1 193 000	1 685 137	2 293 000	4 920	6 290	8 260
	2012	4 436 411	1 200 000	1 683 507	2 275 000	4 380	5 754	7 750
	2013	4 447 945	1 200 000	1 689 380	2 315 000	3 700	4 980	6 860
	2014	4 464 171	1 163 000	1 662 001	2 316 000	3 370	4 650	6 600
	2015	4 493 171	1 113 000	1 609 659	2 264 000	3 000	4 229	6 160
	2016	4 537 683	1 107 000	1 581 723	2 183 000	2 680	3 881	5 800
	2017	4 596 023	1 102 000	1 583 659	2 217 000	2 490	3 682	5 650
	2018	4 666 375	1 089 000	1 600 845	2 286 000	2 390	3 592	5 650
	2019	4 745 179	1 097 000	1 636 894	2 348 000	2 260	3 500	5 670
Chad	2000	8 264 159	1 235 000	2 245 611	3 779 000	6 800	7 214	7 670
	2001	8 583 024	1 292 000	2 363 133	3 935 000	6 720	7 140	7 580
	2002	8 920 465	1 156 000	2 119 101	3 554 000	7 280	7 746	8 240
	2003	9 271 268	1 186 000	2 124 954	3 636 000	7 530	8 013	8 540
	2004	9 628 165	1 156 000	2 114 917	3 580 000	7 790	8 306	8 870
	2005	9 986 071	1 129 000	2 180 093	3 863 000	8 700	9 303	9 960
	2006	10 342 616	1 123 000	2 249 747	4 017 000	10 000	10 754	11 600
	2007	10 699 573	1 173 000	2 286 009	4 029 000	11 000	11 778	12 700
	2008	11 061 128	1 298 000	2 315 942	3 896 000	12 300	13 299	14 400
	2009	11 433 558	1 407 000	2 397 825	3 798 000	12 700	13 790	15 000
	2010	11 821 258	1 458 000	2 452 621	3 891 000	12 500	13 636	14 900
	2011	12 225 633	1 351 000	2 408 462	3 935 000	11 500	12 628	13 800
	2012	12 644 755	1 201 000	2 412 960	4 258 000	10 400	11 462	12 600
	2013	13 075 669	1 089 000	2 435 214	4 630 000	9 520	10 576	11 700
	2014	13 513 945	1 070 000	2 512 304	4 979 000	8 630	9 661	10 800
	2015	13 956 455	1 245 000	2 674 276	5 109 000	8 120	9 161	10 300
	2016	14 402 207	1 440 000	2 795 550	4 884 000	7 740	8 840	10 100
	2017	14 852 327	1 623 000	2 873 012	4 780 000	7 500	8 692	10 100
	2018	15 308 245	1 748 000	3 049 681	4 979 000	7 390	8 663	10 300
	2019	15 772 263	1 798 000	3 187 220	5 221 000	7 260	8 665	10 500
Comoros[1]	2000	542 358	24 000	35 309	47 000	2	87	190
	2001	555 895	24 000	35 335	47 000	2	87	190
	2002	569 480	24 000	35 347	48 000	2	87	190
	2003	583 213	24 000	35 347	48 000	2	87	190
	2004	597 230	24 000	35 342	48 000	2	87	190
	2005	611 625	24 000	35 336	47 000	2	87	190
	2006	626 427	24 000	35 332	47 000	2	87	190
	2007	641 624	24 000	35 328	47 000	2	87	190
	2008	657 227	24 000	35 325	47 000	2	87	190
	2009	673 251	24 000	35 322	47 000	2	87	190
	2010	689 696	–	36 538	–	3	89	140
	2011	706 578	–	24 856	–	2	61	95
	2012	723 865	–	49 840	–	4	125	200
	2013	741 511	–	53 156	–	5	134	210
	2014	759 390	–	2 203	–	0	5	8
	2015	777 435	–	1 300	–	0	3	5
	2016	795 597	–	1 066	–	0	2	4
	2017	813 890	–	2 274	–	0	5	9
	2018	832 322	–	15 613	–	1	39	62
	2019	850 891	–	17 599	–	1	39	61
Congo	2000	3 127 420	723 000	1 107 773	1 622 000	2 420	2 594	2 780
	2001	3 217 930	720 000	1 105 780	1 640 000	2 520	2 696	2 890
	2002	3 310 376	694 000	1 059 383	1 564 000	2 530	2 698	2 880
	2003	3 406 915	702 000	1 063 381	1 561 000	2 560	2 733	2 920
	2004	3 510 468	701 000	1 081 512	1 582 000	2 420	2 576	2 740
	2005	3 622 775	727 000	1 071 382	1 522 000	2 290	2 434	2 590
	2006	3 745 143	704 000	1 029 257	1 451 000	2 080	2 204	2 340
	2007	3 876 123	666 000	964 732	1 374 000	1 930	2 039	2 160
	2008	4 011 487	589 000	879 254	1 256 000	1 850	1 954	2 060
	2009	4 145 400	528 000	830 863	1 241 000	1 810	1 909	2 010
	2010	4 273 738	506 000	825 106	1 283 000	1 790	1 894	2 000
	2011	4 394 842	522 000	841 452	1 300 000	1 770	1 882	2 000
	2012	4 510 197	551 000	867 530	1 308 000	1 760	1 898	2 040
	2013	4 622 757	589 000	923 236	1 377 000	1 790	1 951	2 140
	2014	4 736 965	615 000	963 579	1 437 000	1 780	1 968	2 200
	2015	4 856 093	624 000	994 126	1 523 000	1 730	1 900	2 150
	2016	4 980 996	615 000	1 052 715	1 693 000	1 750	1 942	2 230
	2017	5 110 701	598 000	1 135 273	1 923 000	1 740	1 938	2 250
	2018	5 244 363	626 000	1 212 707	2 150 000	1 760	1 957	2 300
	2019	5 380 504	625 000	1 241 940	2 239 000	1 780	1 985	2 360

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Côte d'Ivoire	2000	16 454 660	6 879 000	8 457 103	10 280 000	27 600	29 356	31 300
	2001	16 853 027	7 058 000	8 743 638	10 640 000	29 200	31 128	33 200
	2002	17 231 539	7 285 000	8 942 765	10 940 000	29 300	31 284	33 400
	2003	17 599 613	7 419 000	9 141 777	11 140 000	27 600	29 520	31 500
	2004	17 970 493	7 566 000	9 309 037	11 360 000	24 000	25 608	27 300
	2005	18 354 513	7 600 000	9 351 060	11 470 000	20 300	21 709	23 100
	2006	18 754 914	7 624 000	9 471 321	11 620 000	17 700	18 870	20 100
	2007	19 171 250	7 893 000	9 748 393	11 920 000	16 700	17 822	19 000
	2008	19 605 568	8 104 000	10 002 060	12 160 000	16 200	17 349	18 600
	2009	20 059 147	8 211 000	9 981 034	12 160 000	16 300	17 537	18 800
	2010	20 532 944	8 083 000	9 823 413	11 780 000	15 300	16 482	17 700
	2011	21 028 652	7 870 000	9 486 145	11 400 000	13 500	14 526	15 600
	2012	21 547 188	6 731 000	8 350 452	10 250 000	11 300	12 249	13 200
	2013	22 087 506	4 866 000	6 489 514	8 410 000	9 870	10 648	11 500
	2014	22 647 672	3 717 000	5 185 013	6 968 000	8 880	9 585	10 400
	2015	23 226 148	3 406 000	6 049 768	9 306 000	8 860	9 615	10 500
	2016	23 822 726	3 324 000	6 635 810	11 010 000	8 660	9 429	10 300
	2017	24 437 475	3 231 000	7 003 630	11 740 000	8 620	9 484	10 400
	2018	25 069 226	3 474 000	7 007 118	11 790 000	8 570	9 488	10 600
	2019	25 716 554	3 824 000	7 729 373	12 690 000	8 500	9 516	10 700
Democratic Republic of the Congo	2000	47 105 832	18 010 000	22 313 058	27 260 000	81 800	89 268	98 000
	2001	48 428 536	18 450 000	22 839 862	27 770 000	82 300	89 862	98 700
	2002	49 871 666	18 930 000	23 359 599	28 440 000	71 200	77 969	85 600
	2003	51 425 584	19 730 000	24 383 486	29 900 000	80 100	87 995	96 800
	2004	53 068 868	20 700 000	25 547 298	31 190 000	97 100	107 056	118 000
	2005	54 785 898	21 500 000	26 521 057	32 370 000	81 400	90 083	99 700
	2006	56 578 046	22 140 000	27 166 306	33 120 000	90 900	101 220	113 000
	2007	58 453 680	22 430 000	27 641 605	33 580 000	84 300	94 889	107 000
	2008	60 411 194	22 670 000	27 592 828	33 420 000	71 700	81 878	92 800
	2009	62 448 574	22 080 000	26 995 532	32 750 000	67 500	78 211	89 900
	2010	64 563 854	21 340 000	26 322 107	32 070 000	53 500	63 199	73 400
	2011	66 755 154	20 650 000	25 509 951	31 260 000	40 600	48 620	57 100
	2012	69 020 748	19 410 000	24 437 640	30 340 000	38 400	46 818	55 800
	2013	71 358 804	18 210 000	23 295 337	29 490 000	35 300	43 858	53 400
	2014	73 767 448	17 300 000	22 548 387	28 850 000	36 400	46 327	57 600
	2015	76 244 540	17 260 000	22 771 286	29 460 000	34 500	44 929	57 300
	2016	78 789 144	18 000 000	24 006 863	31 210 000	30 700	40 456	53 000
	2017	81 398 776	19 290 000	25 698 931	33 330 000	33 000	45 014	60 500
	2018	84 068 096	20 370 000	27 103 676	35 510 000	31 900	44 458	62 000
	2019	86 790 564	21 240 000	28 280 007	36 870 000	30 900	44 178	63 200
Equatorial Guinea	2000	606 180	180 000	231 851	294 000	720	792	890
	2001	631 662	191 000	243 023	309 000	730	807	910
	2002	658 388	198 000	254 921	322 000	760	846	960
	2003	686 670	210 000	269 400	341 000	810	910	1 030
	2004	716 949	221 000	283 388	358 000	860	979	1 120
	2005	749 527	230 000	294 552	371 000	880	1 012	1 160
	2006	784 494	239 000	304 370	382 000	930	1 070	1 230
	2007	821 686	243 000	311 961	396 000	880	1 024	1 190
	2008	860 839	230 000	307 045	400 000	830	983	1 160
	2009	901 589	197 000	290 904	418 000	800	965	1 160
	2010	943 640	187 000	287 783	425 000	860	1 056	1 290
	2011	986 861	207 000	303 392	427 000	850	1 077	1 340
	2012	1 031 191	256 000	339 433	442 000	810	1 054	1 340
	2013	1 076 412	285 000	371 697	475 000	760	1 013	1 320
	2014	1 122 273	296 000	386 868	497 000	670	906	1 210
	2015	1 168 575	288 000	385 596	510 000	550	760	1 040
	2016	1 215 181	266 000	374 252	510 000	470	662	930
	2017	1 262 008	237 000	358 794	519 000	460	662	960
	2018	1 308 966	202 000	333 528	520 000	450	656	980
	2019	1 355 982	186 000	321 438	524 000	440	655	1 000
Eritrea	2000	2 292 413	14 000	42 048	87 000	2	97	270
	2001	2 374 721	19 000	54 461	108 000	2	130	350
	2002	2 481 059	12 000	32 823	63 000	1	74	200
	2003	2 600 972	22 000	49 490	87 000	3	112	270
	2004	2 719 809	7 500	15 093	26 000	0	32	78
	2005	2 826 653	16 000	27 680	42 000	2	59	130
	2006	2 918 209	10 000	16 438	23 000	1	36	77
	2007	2 996 540	24 000	37 568	53 000	4	60	120
	2008	3 062 782	13 000	20 767	29 000	2	37	76
	2009	3 119 920	18 000	27 652	39 000	3	41	81
	2010	3 170 437	53 000	83 471	118 000	8	161	320
	2011	3 213 969	49 000	76 678	107 000	8	141	280
	2012	3 250 104	33 000	52 483	76 000	6	85	170
	2013	3 281 453	31 000	49 309	70 000	5	88	180
	2014	3 311 444	70 000	109 689	153 000	11	227	460
	2015	3 342 818	41 000	64 176	90 000	6	128	260
	2016	3 376 558	47 000	86 561	138 000	7	198	440
	2017	3 412 894	74 000	115 928	162 000	12	221	450
	2018	3 452 797	64 000	99 716	139 000	10	196	390
	2019	3 497 117	128 000	200 382	278 000	19	437	890

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Eswatini[1]	2000	281 520	340	792	1 400	0	2	5
	2001	283 810	–	1 395	–	0	3	5
	2002	285 335	–	670	–	0	1	2
	2003	286 382	–	342	–	0	0	1
	2004	287 360	–	574	–	0	1	2
	2005	288 561	–	279	–	0	0	1
	2006	290 106	–	155	–	–	0	–
	2007	291 942	–	84	–	–	0	–
	2008	293 985	–	58	–	–	0	–
	2009	296 089	–	106	–	–	0	–
	2010	298 155	–	268	–	0	0	1
	2011	300 168	–	549	–	0	1	2
	2012	302 199	–	562	–	0	1	2
	2013	304 316	–	962	–	0	2	3
	2014	306 606	–	711	–	0	1	2
	2015	309 130	–	157	–	–	0	–
	2016	311 918	–	350	–	0	0	1
	2017	314 946	–	724	–	0	1	2
	2018	318 156	–	308	–	0	0	1
	2019	321 477	–	239	–	–	0	–
Ethiopia	2000	45 032 869	2 092 000	7 083 936	17 940 000	380	14 085	40 400
	2001	46 348 411	2 411 000	8 374 138	19 500 000	550	15 186	42 100
	2002	47 696 619	2 441 000	8 353 748	19 360 000	540	15 508	43 900
	2003	49 075 997	2 824 000	10 752 274	26 840 000	580	19 940	58 400
	2004	50 482 860	2 973 000	13 976 643	35 470 000	550	27 173	87 400
	2005	51 915 486	2 832 000	10 149 347	25 270 000	500	20 160	63 000
	2006	53 372 658	2 293 000	9 905 755	24 740 000	380	18 708	58 100
	2007	54 858 556	1 768 000	8 665 431	21 780 000	280	15 546	49 400
	2008	56 383 037	1 129 000	6 833 523	17 340 000	180	12 194	39 600
	2009	57 959 068	682 000	9 892 034	24 830 000	110	18 808	60 500
	2010	59 595 175	513 000	11 075 492	27 890 000	83	20 605	67 000
	2011	61 295 151	452 000	10 327 222	24 770 000	73	16 460	52 200
	2012	63 054 338	471 000	10 633 280	25 380 000	76	17 152	52 800
	2013	64 862 335	465 000	10 503 836	23 450 000	74	18 715	56 100
	2014	66 704 096	472 000	5 348 416	10 470 000	84	9 063	24 600
	2015	68 568 110	562 000	4 948 978	9 542 000	110	8 929	23 300
	2016	70 450 352	591 000	3 889 793	7 170 000	110	7 285	18 500
	2017	72 351 951	623 000	3 489 602	6 373 000	110	6 754	17 000
	2018	74 272 600	1 542 000	2 793 314	4 189 000	230	6 500	14 100
	2019	76 213 540	1 453 000	2 614 852	3 907 000	250	5 626	12 100
Gabon	2000	1 228 359	255 000	398 659	595 000	500	543	600
	2001	1 258 008	245 000	386 140	581 000	420	447	490
	2002	1 288 310	224 000	354 028	530 000	410	442	480
	2003	1 319 946	192 000	303 081	457 000	390	414	440
	2004	1 353 788	152 000	238 031	355 000	360	384	410
	2005	1 390 550	132 000	199 934	293 000	370	394	420
	2006	1 430 144	113 000	174 027	255 000	350	375	400
	2007	1 472 565	98 000	158 828	245 000	350	369	390
	2008	1 518 538	92 000	165 933	276 000	360	382	400
	2009	1 568 925	101 000	199 936	356 000	380	399	420
	2010	1 624 146	125 000	249 796	453 000	390	421	450
	2011	1 684 629	161 000	312 175	534 000	410	444	480
	2012	1 749 677	209 000	386 021	653 000	430	466	510
	2013	1 817 070	240 000	455 643	793 000	450	493	550
	2014	1 883 801	258 000	498 531	872 000	460	509	570
	2015	1 947 690	267 000	516 861	901 000	460	518	590
	2016	2 007 882	260 000	508 527	900 000	450	504	580
	2017	2 064 812	247 000	487 781	872 000	460	519	600
	2018	2 119 275	232 000	473 614	875 000	460	523	610
	2019	2 172 578	221 000	460 333	848 000	470	530	630
Gambia	2000	1 317 708	352 000	446 688	556 000	680	713	750
	2001	1 360 070	350 000	446 588	555 000	640	678	710
	2002	1 404 263	349 000	446 775	555 000	620	654	690
	2003	1 449 925	350 000	447 208	560 000	590	620	650
	2004	1 496 524	351 000	447 727	556 000	570	597	620
	2005	1 543 745	353 000	448 193	559 000	560	581	600
	2006	1 591 444	352 000	448 477	559 000	550	572	600
	2007	1 639 846	354 000	448 548	556 000	550	570	590
	2008	1 689 288	352 000	448 432	558 000	550	574	600
	2009	1 740 277	353 000	448 246	558 000	560	578	600
	2010	1 793 199	351 000	448 101	555 000	580	598	620
	2011	1 848 142	376 000	464 717	564 000	580	609	630
	2012	1 905 020	401 000	501 644	610 000	590	616	640
	2013	1 963 708	364 000	462 225	572 000	600	623	650
	2014	2 024 037	233 000	298 645	370 000	610	631	660
	2015	2 085 860	340 000	442 373	555 000	610	638	660
	2016	2 149 134	215 000	283 311	358 000	620	645	670
	2017	2 213 900	106 000	142 239	182 000	630	656	680
	2018	2 280 092	141 000	192 863	248 000	640	663	690
	2019	2 347 696	87 000	118 614	153 000	650	677	710

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Ghana	2000	19 278 850	6 644 000	8 390 825	10 420 000	16 500	17 162	17 800
	2001	19 756 929	6 638 000	8 296 535	10 280 000	16 300	16 979	17 600
	2002	20 246 376	6 302 000	7 919 784	9 810 000	15 800	16 383	17 000
	2003	20 750 308	6 143 000	7 696 197	9 525 000	15 500	16 048	16 700
	2004	21 272 328	5 977 000	7 493 504	9 316 000	14 700	15 204	15 800
	2005	21 814 648	5 815 000	7 338 128	9 117 000	14 000	14 537	15 100
	2006	22 379 057	5 811 000	7 340 195	9 138 000	13 800	14 328	14 800
	2007	22 963 946	6 044 000	7 545 707	9 296 000	13 900	14 348	14 900
	2008	23 563 832	6 538 000	8 063 544	9 824 000	13 900	14 437	15 000
	2009	24 170 943	7 059 000	8 695 038	10 500 000	14 200	14 782	15 300
	2010	24 779 614	7 531 000	9 211 717	11 200 000	14 200	14 799	15 400
	2011	25 387 713	7 770 000	9 551 273	11 500 000	14 000	14 576	15 100
	2012	25 996 454	7 756 000	9 516 545	11 530 000	13 500	14 062	14 600
	2013	26 607 641	7 355 000	9 086 246	11 130 000	12 900	13 449	14 000
	2014	27 224 480	6 713 000	8 460 913	10 550 000	12 100	12 556	13 000
	2015	27 849 203	5 945 000	7 681 390	9 749 000	11 300	11 759	12 200
	2016	28 481 947	5 071 000	6 763 906	8 777 000	10 800	11 287	11 800
	2017	29 121 464	4 241 000	5 850 313	7 778 000	10 600	11 061	11 500
	2018	29 767 108	3 608 000	5 111 179	6 980 000	10 600	11 100	11 700
	2019	30 417 858	3 383 000	4 911 921	6 910 000	10 600	11 206	11 800
Guinea	2000	8 240 735	2 505 000	3 706 104	5 303 000	10 200	10 831	11 500
	2001	8 417 082	2 486 000	3 725 455	5 405 000	10 100	10 760	11 400
	2002	8 586 077	2 401 000	3 610 282	5 217 000	11 100	11 846	12 600
	2003	8 753 097	2 328 000	3 476 303	5 030 000	11 100	11 877	12 700
	2004	8 925 729	2 179 000	3 237 758	4 679 000	11 600	12 431	13 300
	2005	9 109 585	1 988 000	3 079 391	4 560 000	11 300	12 092	12 900
	2006	9 307 421	1 970 000	3 067 387	4 502 000	11 100	11 948	12 800
	2007	9 518 159	2 131 000	3 180 792	4 565 000	11 500	12 357	13 300
	2008	9 738 796	2 499 000	3 454 652	4 646 000	11 500	12 437	13 400
	2009	9 964 470	2 897 000	3 817 726	4 931 000	12 100	13 041	14 100
	2010	10 192 168	3 248 000	4 144 004	5 200 000	12 500	13 487	14 600
	2011	10 420 459	3 575 000	4 436 129	5 439 000	12 000	13 067	14 200
	2012	10 652 032	3 812 000	4 621 297	5 557 000	11 100	12 137	13 300
	2013	10 892 821	3 721 000	4 571 389	5 570 000	10 100	11 038	12 100
	2014	11 150 970	3 483 000	4 436 172	5 580 000	9 160	10 073	11 100
	2015	11 432 096	3 255 000	4 266 827	5 485 000	8 350	9 262	10 300
	2016	11 738 434	2 971 000	3 990 259	5 248 000	7 640	8 554	9 620
	2017	12 067 516	2 771 000	3 877 193	5 269 000	7 280	8 254	9 350
	2018	12 414 292	2 659 000	3 885 709	5 444 000	7 190	8 220	9 460
	2019	12 771 246	2 542 000	3 792 217	5 520 000	7 090	8 213	9 560
Guinea-Bissau	2000	1 201 305	262 000	501 949	872 000	1 030	1 110	1 200
	2001	1 227 105	221 000	427 534	751 000	950	1 021	1 100
	2002	1 254 454	176 000	343 670	603 000	810	867	930
	2003	1 283 297	132 000	256 462	451 000	620	656	690
	2004	1 313 492	89 000	169 346	296 000	600	636	670
	2005	1 344 931	71 000	128 488	216 000	620	658	700
	2006	1 377 582	62 000	106 765	176 000	600	640	680
	2007	1 411 545	69 000	106 203	158 000	600	636	680
	2008	1 446 936	93 000	126 581	169 000	600	636	680
	2009	1 483 920	106 000	157 865	222 000	600	644	690
	2010	1 522 603	118 000	191 239	294 000	600	650	700
	2011	1 562 996	122 000	205 541	332 000	600	650	710
	2012	1 604 981	112 000	203 548	344 000	590	645	710
	2013	1 648 259	100 000	203 190	373 000	590	644	710
	2014	1 692 433	81 000	183 272	356 000	590	646	720
	2015	1 737 207	70 000	164 101	323 000	580	636	700
	2016	1 782 434	65 000	150 258	309 000	600	670	760
	2017	1 828 146	55 000	139 153	302 000	600	675	760
	2018	1 874 304	53 000	152 524	360 000	610	679	780
	2019	1 920 917	52 000	166 853	413 000	610	687	790
Kenya	2000	31 964 557	5 417 000	7 089 454	9 006 000	13 800	14 336	14 900
	2001	32 848 569	6 252 000	8 087 966	10 310 000	13 900	14 515	15 100
	2002	33 751 745	5 883 000	7 591 570	9 695 000	13 900	14 451	15 000
	2003	34 678 778	5 656 000	7 328 901	9 330 000	13 400	13 967	14 500
	2004	35 635 260	4 961 000	6 407 693	8 191 000	12 700	13 187	13 700
	2005	36 624 894	3 729 000	5 045 463	6 721 000	11 800	12 251	12 700
	2006	37 649 036	2 821 000	3 909 296	5 338 000	11 300	11 685	12 100
	2007	38 705 936	2 235 000	3 071 448	4 127 000	11 100	11 451	11 800
	2008	39 791 984	1 877 000	2 596 985	3 482 000	10 900	11 292	11 600
	2009	40 901 802	1 818 000	2 500 146	3 343 000	11 000	11 318	11 700
	2010	42 030 686	1 911 000	2 597 365	3 450 000	11 100	11 461	11 800
	2011	43 178 270	1 984 000	2 710 113	3 599 000	11 500	11 921	12 300
	2012	44 343 470	2 091 000	2 871 457	3 844 000	11 600	12 082	12 500
	2013	45 519 982	2 178 000	3 041 343	4 170 000	11 700	12 201	12 700
	2014	46 700 066	2 217 000	3 115 580	4 294 000	11 800	12 304	12 900
	2015	47 878 348	2 248 000	3 157 992	4 329 000	11 800	12 357	13 000
	2016	49 051 524	2 229 000	3 162 892	4 394 000	11 800	12 387	13 100
	2017	50 221 148	1 999 000	3 123 817	4 599 000	11 800	12 455	13 200
	2018	51 392 568	1 841 000	3 085 899	4 839 000	11 900	12 534	13 400
	2019	52 573 968	1 615 000	2 999 160	5 002 000	12 000	12 703	13 600

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Liberia	2000	2 848 447	888 000	1 309 577	1 851 000	2 800	2 964	3 140
	2001	2 953 928	913 000	1 349 093	1 919 000	2 890	3 063	3 250
	2002	3 024 727	915 000	1 342 340	1 889 000	3 150	3 347	3 550
	2003	3 077 055	906 000	1 320 354	1 869 000	3 110	3 295	3 490
	2004	3 135 654	882 000	1 292 022	1 836 000	3 020	3 201	3 390
	2005	3 218 114	941 000	1 299 008	1 757 000	2 980	3 162	3 350
	2006	3 329 211	971 000	1 311 082	1 734 000	2 900	3 078	3 260
	2007	3 461 911	1 011 000	1 333 748	1 726 000	2 870	3 051	3 240
	2008	3 607 863	1 052 000	1 355 591	1 720 000	2 880	3 069	3 270
	2009	3 754 129	1 025 000	1 320 070	1 675 000	2 790	2 977	3 170
	2010	3 891 357	991 000	1 282 730	1 645 000	2 490	2 656	2 820
	2011	4 017 446	997 000	1 283 532	1 629 000	2 370	2 528	2 690
	2012	4 135 662	1 001 000	1 306 375	1 665 000	2 260	2 420	2 580
	2013	4 248 337	1 083 000	1 416 557	1 812 000	2 130	2 283	2 440
	2014	4 359 508	1 193 000	1 540 662	1 958 000	2 120	2 288	2 470
	2015	4 472 229	1 262 000	1 585 572	1 965 000	1 920	2 074	2 240
	2016	4 586 788	1 363 000	1 687 964	2 066 000	2 000	2 177	2 380
	2017	4 702 224	1 406 000	1 788 012	2 235 000	2 000	2 208	2 440
	2018	4 818 976	1 327 000	1 787 679	2 346 000	1 990	2 220	2 500
	2019	4 937 374	1 300 000	1 809 994	2 448 000	1 980	2 241	2 560
Madagascar	2000	15 766 806	81 000	901 335	1 958 000	38	2 228	6 680
	2001	16 260 933	154 000	1 108 699	2 410 000	54	2 740	7 920
	2002	16 765 122	22 000	899 947	2 035 000	29	2 224	6 770
	2003	17 279 139	29 000	1 180 072	2 667 000	41	2 916	8 640
	2004	17 802 992	28 000	830 038	1 847 000	36	2 051	5 930
	2005	18 336 722	24 000	659 087	1 476 000	28	1 628	4 960
	2006	18 880 265	24 000	665 725	1 480 000	28	1 645	4 780
	2007	19 433 520	134 000	442 733	882 000	25	1 094	2 930
	2008	19 996 476	258 000	469 371	797 000	36	1 160	2 680
	2009	20 569 115	527 000	882 824	1 392 000	68	2 182	4 810
	2010	21 151 640	524 000	893 540	1 438 000	71	2 208	4 940
	2011	21 743 970	487 000	794 810	1 164 000	61	1 964	4 120
	2012	22 346 641	861 000	1 424 675	2 258 000	110	3 522	7 810
	2013	22 961 259	863 000	1 333 712	2 050 000	110	3 297	7 200
	2014	23 589 897	625 000	880 283	1 188 000	75	2 176	4 270
	2015	24 234 080	1 367 000	1 897 533	2 515 000	170	4 691	9 070
	2016	24 894 370	757 000	1 053 774	1 410 000	92	2 604	5 040
	2017	25 570 511	1 239 000	1 664 118	2 146 000	150	4 113	7 780
	2018	26 262 313	1 456 000	1 950 602	2 501 000	170	4 822	9 100
	2019	26 969 306	1 535 000	2 052 071	2 642 000	180	5 073	9 580
Malawi	2000	11 148 751	3 941 000	5 205 857	6 743 000	24 900	26 153	27 500
	2001	11 432 001	4 059 000	5 336 397	6 909 000	23 000	24 206	25 500
	2002	11 713 663	3 878 000	5 101 713	6 648 000	20 300	21 410	22 500
	2003	12 000 183	3 627 000	4 778 782	6 238 000	17 200	18 120	19 100
	2004	12 301 837	3 460 000	4 546 728	5 882 000	14 200	14 969	15 800
	2005	12 625 950	3 618 000	4 574 875	5 742 000	11 800	12 472	13 100
	2006	12 973 693	3 670 000	4 636 378	5 803 000	10 700	11 200	11 800
	2007	13 341 808	3 834 000	4 857 181	6 076 000	9 900	10 403	10 900
	2008	13 727 899	4 199 000	5 266 583	6 501 000	9 470	9 984	10 500
	2009	14 128 161	4 528 000	5 601 872	6 927 000	9 200	9 739	10 300
	2010	14 539 609	4 598 000	5 725 757	7 098 000	8 500	8 992	9 530
	2011	14 962 118	4 453 000	5 586 489	6 922 000	8 070	8 519	8 980
	2012	15 396 010	3 905 000	4 994 440	6 289 000	7 800	8 228	8 660
	2013	15 839 287	3 368 000	4 346 791	5 534 000	7 070	7 484	7 920
	2014	16 289 550	3 010 000	3 936 043	5 015 000	6 550	6 999	7 490
	2015	16 745 305	2 805 000	3 686 979	4 721 000	6 130	6 649	7 210
	2016	17 205 253	2 800 000	3 638 513	4 635 000	5 850	6 422	7 070
	2017	17 670 193	2 898 000	3 766 163	4 859 000	5 690	6 328	7 040
	2018	18 143 215	2 867 000	3 761 580	4 821 000	5 630	6 295	7 120
	2019	18 628 749	2 883 000	3 868 722	5 042 000	5 610	6 333	7 240
Mali	2000	10 946 448	3 014 000	4 446 769	6 409 000	16 300	17 285	18 300
	2001	11 271 603	3 116 000	4 592 575	6 621 000	16 300	17 260	18 300
	2002	11 616 890	3 232 000	4 837 950	7 029 000	18 100	19 145	20 300
	2003	11 982 692	3 375 000	5 078 371	7 262 000	18 100	19 138	20 300
	2004	12 369 078	3 626 000	5 310 943	7 535 000	18 200	19 284	20 500
	2005	12 775 509	3 843 000	5 509 314	7 925 000	18 000	19 125	20 300
	2006	13 203 378	3 737 000	5 356 747	7 601 000	17 100	18 210	19 400
	2007	13 651 455	3 703 000	5 307 761	7 484 000	16 600	17 656	18 900
	2008	14 113 578	3 696 000	5 349 875	7 469 000	15 600	16 652	17 800
	2009	14 581 427	3 787 000	5 461 653	7 550 000	15 100	16 198	17 400
	2010	15 049 352	4 132 000	5 772 983	7 951 000	15 600	16 783	18 100
	2011	15 514 593	4 471 000	6 279 267	8 582 000	17 200	18 616	20 200
	2012	15 979 492	4 942 000	6 961 475	9 455 000	17 600	19 202	20 900
	2013	16 449 854	5 334 000	7 448 756	10 240 000	17 300	19 049	21 000
	2014	16 934 213	5 365 000	7 468 113	10 370 000	15 700	17 450	19 400
	2015	17 438 772	4 827 000	6 833 022	9 671 000	13 700	15 442	17 300
	2016	17 965 448	4 860 000	6 902 717	9 818 000	11 900	13 598	15 500
	2017	18 512 429	5 057 000	7 160 192	10 190 000	10 400	12 068	13 900
	2018	19 077 755	5 200 000	7 378 847	10 480 000	10 100	11 856	13 900
	2019	19 658 023	4 629 000	6 560 000	9 323 000	9 780	11 725	14 100

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Mauritania	2000	2 630 217	210 000	413 461	742 000	900	944	990
	2001	2 702 405	222 000	434 549	781 000	900	946	1 000
	2002	2 778 097	140 000	348 597	641 000	950	1 002	1 060
	2003	2 857 150	141 000	340 570	648 000	970	1 030	1 100
	2004	2 939 246	90 000	279 447	526 000	970	1 042	1 130
	2005	3 024 198	77 000	258 395	486 000	1 020	1 108	1 210
	2006	3 111 908	61 000	232 594	444 000	1 020	1 115	1 230
	2007	3 202 512	64 000	229 185	473 000	1 020	1 125	1 260
	2008	3 296 237	50 000	201 954	407 000	1 030	1 140	1 290
	2009	3 393 408	3 600	106 414	242 000	1 040	1 154	1 320
	2010	3 494 200	21 000	135 058	292 000	1 030	1 152	1 330
	2011	3 598 646	41 000	171 207	358 000	1 050	1 195	1 400
	2012	3 706 555	24 000	105 342	234 000	1 080	1 234	1 480
	2013	3 817 497	38 000	126 803	263 000	1 090	1 253	1 520
	2014	3 930 894	70 000	193 411	382 000	1 130	1 308	1 610
	2015	4 046 304	99 000	249 288	475 000	1 150	1 341	1 680
	2016	4 163 532	130 000	297 695	553 000	1 160	1 359	1 720
	2017	4 282 582	92 000	237 631	451 000	1 170	1 379	1 750
	2018	4 403 312	81 000	173 555	299 000	1 180	1 393	1 780
	2019	4 525 698	54 000	196 538	379 000	1 200	1 414	1 810
Mozambique	2000	17 711 925	7 046 000	8 576 640	10 380 000	33 900	36 318	38 900
	2001	18 221 884	7 454 000	9 095 681	11 010 000	32 600	34 970	37 500
	2002	18 764 147	7 587 000	9 213 576	11 080 000	30 700	32 930	35 300
	2003	19 331 097	7 662 000	9 275 843	11 170 000	28 000	30 062	32 300
	2004	19 910 549	7 306 000	8 916 792	10 770 000	25 200	27 015	29 000
	2005	20 493 927	6 926 000	8 453 733	10 160 000	21 900	23 517	25 200
	2006	21 080 108	6 802 000	8 277 183	9 962 000	20 500	22 032	23 600
	2007	21 673 319	6 794 000	8 268 318	9 987 000	18 300	19 577	20 900
	2008	22 276 596	6 933 000	8 476 119	10 290 000	16 800	17 992	19 200
	2009	22 894 718	7 207 000	8 818 084	10 710 000	16 200	17 314	18 600
	2010	23 531 567	7 395 000	9 089 598	11 060 000	15 800	17 045	18 400
	2011	24 187 500	7 479 000	9 151 744	11 140 000	15 800	17 148	18 700
	2012	24 862 673	7 577 000	9 246 901	11 170 000	15 600	17 251	19 100
	2013	25 560 752	7 692 000	9 380 800	11 340 000	15 400	17 362	19 700
	2014	26 286 192	7 578 000	9 283 721	11 220 000	14 900	16 996	19 800
	2015	27 042 001	7 603 000	9 326 039	11 320 000	14 000	16 234	19 300
	2016	27 829 930	7 689 000	9 456 263	11 520 000	13 200	15 543	18 900
	2017	28 649 007	7 544 000	9 353 438	11 500 000	12 600	15 061	18 600
	2018	29 496 009	7 410 000	9 281 345	11 480 000	12 400	15 043	19 200
	2019	30 366 043	7 437 000	9 364 806	11 610 000	12 100	15 032	19 500
Namibia	2000	1 424 450	31 000	77 821	156 000	4	199	540
	2001	1 447 535	55 000	102 902	185 000	6	263	640
	2002	1 469 643	33 000	70 395	136 000	4	180	470
	2003	1 491 545	29 000	67 564	140 000	3	172	480
	2004	1 514 266	51 000	105 493	204 000	6	270	720
	2005	1 538 538	34 000	65 303	120 000	4	167	420
	2006	1 564 733	41 000	68 176	112 000	4	174	400
	2007	1 592 672	6 400	20 663	48 000	0	52	160
	2008	1 621 934	1 600	12 094	33 000	0	30	110
	2009	1 651 824	730	5 557	17 000	0	14	54
	2010	1 681 858	800	2 590	6 200	0	6	20
	2011	1 711 879	2 600	3 654	5 400	0	9	19
	2012	1 742 104	2 700	5 860	9 700	0	15	36
	2013	1 772 845	6 400	8 068	9 900	0	20	37
	2014	1 804 531	21 000	26 144	32 000	2	66	120
	2015	1 837 452	16 000	19 990	25 000	1	51	92
	2016	1 871 697	33 000	41 397	51 000	3	105	190
	2017	1 907 082	71 000	89 155	109 000	7	228	410
	2018	1 943 338	49 000	61 564	76 000	5	157	280
	2019	1 980 028	4 000	5 618	8 000	0	14	29
Niger	2000	11 331 561	1 586 000	3 595 465	6 318 000	15 700	16 839	18 000
	2001	11 751 364	1 671 000	3 730 842	6 565 000	15 000	16 095	17 200
	2002	12 189 988	1 831 000	4 002 009	6 736 000	16 300	17 516	18 800
	2003	12 647 983	2 138 000	4 386 636	7 278 000	15 800	16 949	18 200
	2004	13 125 914	2 503 000	4 762 231	7 955 000	15 400	16 506	17 700
	2005	13 624 474	2 677 000	4 839 989	8 258 000	17 100	18 434	19 800
	2006	14 143 969	2 822 000	5 243 632	8 810 000	16 700	18 134	19 600
	2007	14 685 404	3 197 000	5 678 542	9 433 000	17 300	18 905	20 600
	2008	15 250 913	3 683 000	6 239 080	10 120 000	17 200	18 959	20 800
	2009	15 843 131	3 788 000	6 639 919	10 290 000	18 000	20 162	22 500
	2010	16 464 025	3 841 000	7 007 707	10 720 000	18 800	21 548	24 500
	2011	17 114 770	4 112 000	7 323 097	11 180 000	18 700	21 974	25 500
	2012	17 795 209	4 442 000	7 660 985	11 850 000	18 000	21 693	25 700
	2013	18 504 287	4 425 000	7 780 901	12 250 000	16 900	20 933	25 500
	2014	19 240 182	4 185 000	7 700 900	12 430 000	15 600	19 829	24 900
	2015	20 001 663	3 920 000	7 397 212	12 220 000	14 200	18 391	23 800
	2016	20 788 789	3 908 000	7 457 829	12 450 000	13 700	18 190	24 300
	2017	21 602 388	4 050 000	7 702 777	12 850 000	12 600	17 221	23 700
	2018	22 442 831	4 215 000	8 002 454	13 360 000	12 300	17 107	24 300
	2019	23 310 719	4 209 000	8 000 000	13 300 000	11 900	17 091	25 000

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Nigeria	2000	122 283 860	40 060 000	51 092 986	64 370 000	166 000	175 386	185 000
	2001	125 394 040	40 160 000	51 232 965	64 150 000	172 000	181 767	192 000
	2002	128 596 072	39 600 000	50 571 638	63 220 000	185 000	196 335	208 000
	2003	131 900 628	40 080 000	51 393 638	64 600 000	167 000	177 605	188 000
	2004	135 320 412	41 550 000	53 013 712	66 440 000	185 000	196 331	208 000
	2005	138 865 016	42 960 000	54 994 818	69 320 000	172 000	182 674	194 000
	2006	142 538 312	44 380 000	56 948 598	72 700 000	188 000	200 630	213 000
	2007	146 339 952	45 870 000	59 085 546	74 600 000	180 000	191 528	204 000
	2008	150 269 616	48 900 000	61 477 608	76 050 000	163 000	174 447	186 000
	2009	154 324 960	49 610 000	61 912 084	76 050 000	153 000	163 856	176 000
	2010	158 503 176	48 440 000	60 236 996	73 860 000	143 000	154 563	166 000
	2011	162 805 064	46 080 000	57 801 746	71 650 000	133 000	145 016	157 000
	2012	167 228 800	43 580 000	54 662 221	68 090 000	126 000	137 828	151 000
	2013	171 765 808	41 590 000	52 405 683	65 250 000	113 000	125 036	138 000
	2014	176 404 944	41 300 000	51 868 071	64 270 000	110 000	122 938	138 000
	2015	181 137 464	41 500 000	52 542 674	65 410 000	99 300	112 874	129 000
	2016	185 960 248	43 280 000	54 489 099	67 910 000	91 600	105 422	123 000
	2017	190 873 256	44 610 000	56 649 426	70 650 000	82 600	96 901	115 000
	2018	195 874 688	46 150 000	58 543 031	73 180 000	81 000	96 172	117 000
	2019	200 963 608	47 820 000	60 959 012	76 840 000	78 500	95 802	120 000
Rwanda	2000	7 933 688	947 000	2 014 767	3 741 000	4 590	4 813	5 050
	2001	8 231 150	871 000	1 982 122	3 769 000	4 580	4 779	4 990
	2002	8 427 061	822 000	1 600 697	3 053 000	4 260	4 435	4 620
	2003	8 557 160	700 000	1 319 618	2 195 000	4 020	4 173	4 340
	2004	8 680 516	477 000	1 141 680	1 827 000	3 700	3 841	3 990
	2005	8 840 220	390 000	1 389 705	2 294 000	3 430	3 557	3 680
	2006	9 043 342	361 000	1 398 594	2 205 000	3 250	3 367	3 480
	2007	9 273 759	504 000	840 559	1 260 000	3 140	3 251	3 360
	2008	9 524 532	423 000	686 028	1 005 000	3 070	3 170	3 270
	2009	9 782 770	1 008 000	1 547 226	2 168 000	3 010	3 114	3 220
	2010	10 039 338	748 000	1 079 765	1 425 000	3 020	3 136	3 260
	2011	10 293 333	291 000	390 705	495 000	2 960	3 103	3 260
	2012	10 549 668	597 000	753 855	917 000	2 930	3 095	3 290
	2013	10 811 538	1 094 000	1 312 966	1 548 000	2 910	3 088	3 320
	2014	11 083 629	1 832 000	2 436 130	3 071 000	2 910	3 100	3 370
	2015	11 369 066	2 870 000	3 855 678	4 884 000	2 920	3 122	3 420
	2016	11 668 829	5 045 000	6 832 535	8 714 000	2 940	3 156	3 490
	2017	11 980 960	6 336 000	8 681 013	11 140 000	2 970	3 209	3 550
	2018	12 301 969	4 764 000	6 527 693	8 381 000	3 020	3 252	3 640
	2019	12 626 938	3 379 000	4 622 960	5 931 000	3 060	3 311	3 720
Sao Tome and Principe[1,2]	2000	142 264	–	31 975	–	–	254	–
	2001	144 760	–	42 086	–	–	248	–
	2002	147 450	–	50 586	–	–	321	–
	2003	150 405	–	42 656	–	–	193	–
	2004	153 736	–	46 486	–	–	169	–
	2005	157 472	–	18 139	–	–	85	–
	2006	161 676	–	5 146	–	–	26	–
	2007	166 297	–	2 421	–	–	3	–
	2008	171 122	–	6 258	–	–	16	–
	2009	175 877	–	6 182	–	–	23	–
	2010	180 372	–	2 740	–	–	14	–
	2011	184 521	–	8 442	–	–	19	–
	2012	188 394	–	10 701	–	–	7	–
	2013	192 076	–	9 243	–	–	11	–
	2014	195 727	–	1 754	–	–	0	–
	2015	199 439	–	2 058	–	–	0	–
	2016	203 221	–	2 238	–	–	1	–
	2017	207 086	–	2 239	–	–	1	–
	2018	211 032	–	2 937	–	–	0	–
	2019	215 048	–	2 447	–	–	0	–
Senegal	2000	9 797 731	1 742 000	2 995 553	4 248 000	5 140	5 324	5 520
	2001	10 036 102	564 000	2 793 986	4 455 000	4 770	4 924	5 090
	2002	10 283 694	408 000	2 297 902	3 975 000	4 230	4 359	4 480
	2003	10 541 470	800 000	2 208 453	3 501 000	4 480	4 618	4 760
	2004	10 810 086	352 000	1 491 364	2 764 000	4 410	4 535	4 670
	2005	11 090 123	517 000	1 501 391	2 488 000	4 250	4 373	4 490
	2006	11 382 272	539 000	1 554 229	2 798 000	4 170	4 291	4 410
	2007	11 687 078	493 000	1 176 159	2 044 000	4 140	4 255	4 370
	2008	12 004 700	560 000	966 238	1 479 000	4 110	4 226	4 340
	2009	12 335 092	347 000	617 839	956 000	4 070	4 185	4 290
	2010	12 678 143	515 000	734 383	976 000	4 070	4 178	4 280
	2011	13 033 814	434 000	617 168	821 000	4 070	4 179	4 280
	2012	13 401 990	480 000	698 800	947 000	4 060	4 169	4 270
	2013	13 782 429	606 000	852 440	1 138 000	4 060	4 172	4 270
	2014	14 174 740	402 000	546 707	714 000	4 180	4 305	4 430
	2015	14 578 450	687 000	1 011 058	1 369 000	4 220	4 365	4 510
	2016	14 993 514	469 000	684 137	927 000	4 250	4 414	4 590
	2017	15 419 354	558 000	805 710	1 066 000	4 280	4 481	4 670
	2018	15 854 324	863 000	1 310 853	1 863 000	4 320	4 535	4 780
	2019	16 296 362	547 000	822 678	1 153 000	4 370	4 614	4 880

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Sierra Leone	2000	4 584 570	1 391 000	2 170 252	3 237 000	9 120	9 729	10 400
	2001	4 754 069	1 459 000	2 265 075	3 414 000	9 720	10 364	11 000
	2002	4 965 770	1 486 000	2 311 459	3 428 000	10 400	11 096	11 800
	2003	5 201 074	1 490 000	2 324 731	3 472 000	11 100	11 806	12 600
	2004	5 433 995	1 464 000	2 286 663	3 410 000	12 900	13 700	14 600
	2005	5 645 629	1 427 000	2 249 940	3 407 000	13 400	14 277	15 200
	2006	5 829 240	1 340 000	2 222 320	3 437 000	13 800	14 782	15 800
	2007	5 989 641	1 468 000	2 317 256	3 426 000	14 300	15 356	16 400
	2008	6 133 599	1 837 000	2 555 193	3 476 000	14 500	15 515	16 600
	2009	6 272 735	2 079 000	2 757 047	3 564 000	14 000	15 020	16 100
	2010	6 415 636	2 194 000	2 843 736	3 611 000	12 900	13 919	15 000
	2011	6 563 238	2 241 000	2 890 003	3 655 000	11 800	12 704	13 700
	2012	6 712 586	2 293 000	2 909 350	3 609 000	10 100	10 921	11 800
	2013	6 863 975	2 279 000	2 898 201	3 615 000	8 560	9 346	10 200
	2014	7 017 153	2 245 000	2 874 298	3 614 000	7 700	8 480	9 310
	2015	7 171 909	2 252 000	2 852 687	3 570 000	7 420	8 250	9 160
	2016	7 328 846	2 287 000	2 827 455	3 438 000	6 570	7 393	8 300
	2017	7 488 427	2 074 000	2 707 562	3 482 000	6 360	7 263	8 240
	2018	7 650 149	1 900 000	2 684 191	3 646 000	6 090	7 032	8 110
	2019	7 813 207	1 720 000	2 615 850	3 795 000	5 830	6 852	8 020
South Africa[1,2]	2000	4 496 771	13 000	18 064	26 000	–	424	–
	2001	4 557 127	–	26 506	–	–	81	–
	2002	4 615 091	–	15 649	–	–	96	–
	2003	4 671 919	–	13 459	–	–	142	–
	2004	4 729 161	–	13 399	–	–	88	–
	2005	4 788 059	–	7 755	–	–	63	–
	2006	4 848 946	–	12 098	–	–	87	–
	2007	4 911 976	–	6 327	–	–	37	–
	2008	4 977 946	–	7 796	–	–	43	–
	2009	5 047 701	–	6 072	–	–	45	–
	2010	5 121 696	–	8 060	–	–	83	–
	2011	5 200 375	–	9 866	–	–	54	–
	2012	5 283 266	–	5 629	–	–	72	–
	2013	5 368 712	–	8 645	–	–	105	–
	2014	5 454 418	–	11 705	–	–	174	–
	2015	5 538 637	–	4 357	–	–	110	–
	2016	5 620 764	–	4 323	–	–	34	–
	2017	5 700 975	–	28 295	–	–	301	–
	2018	5 779 251	–	9 540	–	–	0	–
	2019	5 855 826	–	3 096	–	–	79	–
South Sudan[4]	2000	6 199 396	1 498 000	2 294 495	3 410 000	6 290	7 046	7 900
	2001	6 447 791	1 512 000	2 346 954	3 484 000	6 180	6 903	7 710
	2002	6 688 225	1 469 000	2 261 368	3 352 000	5 940	6 625	7 380
	2003	6 935 665	1 453 000	2 247 914	3 286 000	5 710	6 353	7 060
	2004	7 213 354	1 459 000	2 217 717	3 298 000	5 550	6 181	6 880
	2005	7 535 931	1 508 000	2 315 801	3 423 000	5 270	5 880	6 570
	2006	7 907 407	1 560 000	2 423 657	3 607 000	5 060	5 671	6 360
	2007	8 315 144	1 641 000	2 510 442	3 713 000	4 860	5 487	6 190
	2008	8 736 932	1 722 000	2 585 000	3 774 000	4 730	5 389	6 130
	2009	9 142 258	1 710 000	2 618 296	3 842 000	4 500	5 176	5 950
	2010	9 508 372	1 719 000	2 702 708	4 064 000	4 290	4 978	5 760
	2011	9 830 695	1 826 000	2 824 974	4 206 000	4 120	4 813	5 620
	2012	10 113 648	1 900 000	2 924 759	4 328 000	3 970	4 655	5 480
	2013	10 355 030	1 914 000	3 000 808	4 516 000	3 940	4 670	5 600
	2014	10 554 882	1 833 000	3 002 690	4 609 000	4 010	4 878	6 000
	2015	10 715 657	1 825 000	3 000 904	4 649 000	4 060	5 020	6 360
	2016	10 832 520	1 807 000	2 939 565	4 530 000	4 050	5 148	6 750
	2017	10 910 774	1 795 000	2 961 899	4 640 000	4 070	5 305	7 180
	2018	10 975 924	1 782 000	2 991 029	4 725 000	4 020	5 320	7 430
	2019	11 062 114	1 762 000	3 009 338	4 825 000	3 980	5 364	7 730
Togo	2000	4 924 406	1 788 000	2 210 346	2 701 000	5 370	5 710	6 060
	2001	5 062 571	1 838 000	2 261 268	2 768 000	5 460	5 800	6 160
	2002	5 197 040	1 883 000	2 323 714	2 839 000	5 820	6 191	6 580
	2003	5 330 629	1 980 000	2 442 022	2 985 000	5 870	6 246	6 650
	2004	5 467 770	2 090 000	2 588 667	3 151 000	5 970	6 367	6 780
	2005	5 611 643	2 155 000	2 651 401	3 241 000	6 070	6 484	6 920
	2006	5 762 881	2 118 000	2 637 155	3 242 000	5 970	6 386	6 820
	2007	5 920 360	2 038 000	2 546 933	3 153 000	5 680	6 092	6 520
	2008	6 083 417	1 819 000	2 297 829	2 859 000	5 280	5 671	6 080
	2009	6 250 840	1 611 000	2 052 756	2 597 000	4 910	5 290	5 680
	2010	6 421 674	1 561 000	2 000 304	2 520 000	4 550	4 917	5 290
	2011	6 595 939	1 623 000	2 073 729	2 613 000	4 320	4 692	5 070
	2012	6 773 807	1 848 000	2 338 679	2 910 000	4 160	4 537	4 930
	2013	6 954 721	2 138 000	2 629 386	3 205 000	4 120	4 516	4 930
	2014	7 137 997	2 202 000	2 705 649	3 305 000	4 340	4 799	5 290
	2015	7 323 162	2 183 000	2 700 200	3 301 000	4 580	5 116	5 700
	2016	7 509 952	2 045 000	2 554 074	3 155 000	4 650	5 234	5 890
	2017	7 698 476	1 714 000	2 205 398	2 805 000	4 560	5 213	5 910
	2018	7 889 095	1 464 000	1 932 344	2 525 000	4 450	5 143	5 930
	2019	8 082 359	1 325 000	1 818 688	2 453 000	4 340	5 096	5 980

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Uganda	2000	23 650 159	8 864 000	11 522 961	14 680 000	40 100	42 278	44 500
	2001	24 388 974	9 599 000	12 388 974	15 880 000	38 000	40 071	42 200
	2002	25 167 261	9 609 000	12 587 470	16 040 000	34 600	36 492	38 500
	2003	25 980 547	9 713 000	12 577 824	16 120 000	32 600	34 366	36 300
	2004	26 821 300	9 286 000	12 064 883	15 440 000	33 700	35 574	37 600
	2005	27 684 590	9 299 000	12 005 292	15 370 000	32 400	34 191	36 100
	2006	28 571 475	9 288 000	12 037 459	15 350 000	30 000	31 774	33 600
	2007	29 486 335	9 494 000	12 249 023	15 610 000	27 800	29 426	31 100
	2008	30 431 734	10 070 000	12 719 269	15 820 000	25 500	26 998	28 600
	2009	31 411 096	10 690 000	13 288 506	16 370 000	22 400	23 726	25 100
	2010	32 428 164	10 570 000	13 277 279	16 390 000	19 300	20 484	21 700
	2011	33 476 772	10 420 000	13 212 603	16 450 000	16 500	17 515	18 600
	2012	34 558 698	10 200 000	13 013 284	16 370 000	14 200	15 127	16 000
	2013	35 694 516	9 079 000	11 862 873	15 290 000	12 800	13 647	14 500
	2014	36 911 530	8 090 000	10 862 413	14 320 000	12 400	13 331	14 300
	2015	38 225 440	6 793 000	9 690 714	13 220 000	12 100	13 149	14 300
	2016	39 649 176	7 947 000	11 226 154	14 840 000	12 200	13 452	14 900
	2017	41 166 588	8 019 000	12 140 161	16 870 000	12 300	13 757	15 400
	2018	42 729 036	7 357 000	11 224 558	17 940 000	12 000	13 654	15 600
	2019	44 269 584	7 697 000	11 629 246	18 180 000	11 800	13 631	15 900
United Republic of Tanzania	2000	33 499 179	8 683 000	11 514 222	14 770 000	28 800	30 015	31 300
	2001	34 385 848	8 695 000	11 423 519	14 800 000	27 700	28 864	30 100
	2002	35 334 794	8 130 000	10 671 297	13 710 000	26 000	27 114	28 200
	2003	36 337 778	7 675 000	10 103 304	12 980 000	25 000	26 017	27 100
	2004	37 379 762	7 158 000	9 453 680	12 140 000	23 400	24 375	25 400
	2005	38 450 326	6 965 000	9 110 945	11 700 000	21 900	22 859	23 800
	2006	39 548 662	6 443 000	8 496 533	11 000 000	20 700	21 540	22 400
	2007	40 681 414	5 753 000	7 696 476	10 140 000	19 700	20 434	21 200
	2008	41 853 946	5 038 000	6 868 920	9 134 000	19 100	19 808	20 500
	2009	43 073 834	4 594 000	6 260 997	8 321 000	18 700	19 421	20 100
	2010	44 346 534	4 320 000	5 917 848	7 959 000	18 600	19 242	19 900
	2011	45 673 516	4 199 000	5 731 836	7 645 000	18 400	19 095	19 800
	2012	47 053 030	4 245 000	5 747 118	7 629 000	18 400	19 079	19 800
	2013	48 483 134	4 754 000	6 364 999	8 418 000	19 000	19 842	20 700
	2014	49 960 560	5 398 000	7 254 020	9 490 000	19 200	20 088	21 100
	2015	51 482 634	5 444 000	7 298 719	9 612 000	19 500	20 485	21 800
	2016	53 049 230	5 127 000	6 901 228	9 126 000	19 600	20 775	22 300
	2017	54 660 342	4 750 000	6 531 130	8 675 000	19 800	21 160	22 800
	2018	56 313 440	4 590 000	6 300 422	8 476 000	20 000	21 423	23 400
	2019	58 005 458	4 657 000	6 453 096	8 790 000	20 200	21 846	24 000
Zambia	2000	10 415 942	3 028 000	4 077 584	5 351 000	8 740	9 150	9 570
	2001	10 692 197	3 138 000	4 244 872	5 614 000	8 900	9 307	9 720
	2002	10 971 704	3 022 000	4 052 286	5 346 000	8 580	8 965	9 340
	2003	11 256 740	2 860 000	3 874 121	5 116 000	8 360	8 723	9 110
	2004	11 550 641	2 604 000	3 508 861	4 611 000	7 840	8 171	8 530
	2005	11 856 244	2 344 000	3 083 423	3 991 000	7 180	7 481	7 790
	2006	12 173 518	2 070 000	2 709 301	3 476 000	6 640	6 905	7 170
	2007	12 502 958	1 870 000	2 429 271	3 119 000	6 280	6 518	6 740
	2008	12 848 531	1 734 000	2 256 010	2 864 000	6 120	6 339	6 540
	2009	13 215 142	1 748 000	2 240 349	2 815 000	6 080	6 298	6 500
	2010	13 605 986	1 873 000	2 360 288	2 953 000	6 050	6 270	6 470
	2011	14 023 199	2 056 000	2 605 359	3 251 000	6 260	6 484	6 710
	2012	14 465 148	2 314 000	2 965 555	3 710 000	6 520	6 776	7 020
	2013	14 926 551	2 682 000	3 442 318	4 328 000	6 740	7 014	7 290
	2014	15 399 793	2 811 000	3 613 660	4 579 000	7 120	7 439	7 780
	2015	15 879 370	2 679 000	3 493 518	4 499 000	7 210	7 576	7 960
	2016	16 363 449	2 438 000	3 302 790	4 392 000	7 230	7 636	8 080
	2017	16 853 608	2 034 000	2 927 778	4 127 000	7 190	7 687	8 190
	2018	17 351 714	1 773 000	2 732 856	4 014 000	7 240	7 793	8 440
	2019	17 861 034	1 671 000	2 637 628	3 990 000	7 260	7 914	8 660
Zimbabwe	2000	9 355 799	291 000	1 058 634	2 497 000	49	2 710	8 340
	2001	9 389 205	282 000	1 062 414	2 497 000	51	2 719	8 370
	2002	9 413 133	279 000	1 065 122	2 472 000	52	2 726	8 460
	2003	9 435 122	279 000	1 067 610	2 532 000	50	2 733	8 490
	2004	9 464 802	264 000	1 070 968	2 492 000	50	2 741	8 240
	2005	9 509 517	273 000	1 076 028	2 519 000	53	2 754	8 340
	2006	9 571 565	281 000	1 083 049	2 580 000	51	2 772	8 610
	2007	9 650 642	712 000	1 690 025	2 933 000	100	4 326	10 400
	2008	9 747 994	162 000	728 426	1 425 000	35	1 864	4 920
	2009	9 864 069	417 000	892 706	1 503 000	58	2 285	5 320
	2010	9 998 533	607 000	1 094 108	1 737 000	75	2 800	6 230
	2011	10 153 338	470 000	717 620	992 000	53	1 837	3 720
	2012	10 327 222	403 000	590 910	791 000	44	1 512	2 980
	2013	10 512 448	614 000	861 512	1 129 000	67	2 205	4 290
	2014	10 698 542	804 000	1 090 113	1 393 000	87	2 790	5 280
	2015	10 878 022	719 000	1 062 200	1 443 000	80	2 719	5 410
	2016	11 047 866	494 000	755 066	1 044 000	55	1 932	3 940
	2017	11 210 282	822 000	1 319 214	1 900 000	96	3 377	7 010
	2018	11 369 510	394 000	636 393	902 000	45	1 629	3 380
	2019	11 532 240	469 000	782 740	1 123 000	53	2 003	4 220

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Argentina[1,2,3]	2000	184 353	–	440	–	–	0	–
	2001	186 378	–	215	–	–	0	–
	2002	188 408	–	125	–	–	0	–
	2003	190 439	–	122	–	–	1	–
	2004	192 459	–	115	–	–	0	–
	2005	194 464	–	252	–	–	0	–
	2006	196 449	–	212	–	–	0	–
	2007	198 421	–	387	–	–	0	–
	2008	200 400	–	130	–	–	0	–
	2009	202 413	–	86	–	–	0	–
	2010	204 478	–	14	–	–	0	–
	2011	206 602	–	0	–	–	0	–
	2012	208 775	–	0	–	–	0	–
	2013	210 980	–	0	–	–	0	–
	2014	213 187	–	0	–	–	0	–
	2015	215 377	–	0	–	–	0	–
	2016	217 542	–	0	–	–	0	–
	2017	219 685	–	0	–	–	0	–
	2018	221 805	–	0	–	–	0	–
	2019	223 903	–	0	–	–	0	–
Belize[1,2]	2000	170 643	–	1 486	–	–	0	–
	2001	175 996	–	1 162	–	–	0	–
	2002	181 047	–	1 134	–	–	0	–
	2003	185 905	–	1 084	–	–	0	–
	2004	190 796	–	1 068	–	–	1	–
	2005	195 820	–	1 549	–	–	0	–
	2006	201 023	–	844	–	–	1	–
	2007	206 331	–	845	–	–	0	–
	2008	211 707	–	540	–	–	0	–
	2009	217 111	–	256	–	–	0	–
	2010	222 500	–	150	–	–	0	–
	2011	227 862	–	72	–	–	0	–
	2012	233 220	–	33	–	–	0	–
	2013	238 537	–	20	–	–	0	–
	2014	243 822	–	19	–	–	0	–
	2015	249 038	–	9	–	–	0	–
	2016	254 195	–	4	–	–	0	–
	2017	259 284	–	7	–	–	0	–
	2018	264 318	–	3	–	–	0	–
	2019	269 342	–	0	–	–	0	–
Bolivia (Plurinational State of)	2000	3 819 116	34 000	45 647	58 000	7	24	43
	2001	3 892 599	17 000	22 330	28 000	3	9	18
	2002	3 966 356	15 000	19 768	25 000	3	9	16
	2003	4 040 303	22 000	27 568	34 000	4	11	21
	2004	4 114 353	16 000	20 206	25 000	3	9	16
	2005	4 188 417	29 000	37 189	46 000	6	17	30
	2006	4 262 433	27 000	34 862	43 000	5	19	33
	2007	4 336 376	15 000	19 799	24 000	3	11	20
	2008	4 410 333	10 000	13 210	16 000	2	7	12
	2009	4 484 432	10 000	13 379	16 000	2	6	11
	2010	4 558 747	15 000	18 659	23 000	2	10	18
	2011	4 633 309	7 600	9 680	12 000	1	4	8
	2012	4 708 040	8 600	10 972	14 000	1	4	8
	2013	4 782 759	8 400	10 804	13 000	1	6	12
	2014	4 857 225	8 600	10 952	13 000	1	4	8
	2015	4 931 271	7 300	9 315	11 000	1	3	6
	2016	5 004 806	5 900	7 510	9 200	0	2	5
	2017	5 077 861	4 800	6 195	7 600	0	2	4
	2018	5 150 579	5 700	7 239	8 900	0	2	4
	2019	5 223 148	9 900	12 654	16 000	1	4	8
Brazil[2]	2000	35 482 438	643 000	760 760	886 000	–	245	–
	2001	35 970 799	407 000	467 114	533 000	–	142	–
	2002	36 446 116	363 000	407 200	457 000	–	95	–
	2003	36 907 274	425 000	465 651	513 000	–	104	–
	2004	37 353 321	481 000	516 739	561 000	–	102	–
	2005	37 783 803	624 000	658 276	706 000	–	123	–
	2006	38 197 972	561 000	584 183	623 000	–	110	–
	2007	38 596 477	478 000	534 516	578 000	–	93	–
	2008	38 982 161	322 000	335 694	358 000	–	68	–
	2009	39 358 958	316 000	328 858	351 000	–	85	–
	2010	39 729 868	348 000	389 809	422 000	–	76	–
	2011	40 095 452	273 000	284 024	303 000	–	70	–
	2012	40 455 322	248 000	258 095	276 000	–	60	–
	2013	40 810 285	176 000	196 793	213 000	–	40	–
	2014	41 161 038	142 000	148 071	158 000	–	36	–
	2015	41 507 764	154 000	162 341	173 000	–	35	–
	2016	41 851 100	129 000	134 862	144 000	–	35	–
	2017	42 190 269	193 000	201 475	215 000	–	34	–
	2018	42 522 271	207 000	217 900	232 000	–	44	–
	2019	42 843 057	169 000	177 967	190 000	–	36	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Colombia[2]	2000	8 773 678	154 000	210 720	270 000	–	124	–
	2001	8 912 266	246 000	333 024	424 000	–	168	–
	2002	9 049 394	218 000	291 432	368 000	–	162	–
	2003	9 184 115	192 000	254 224	319 000	–	118	–
	2004	9 315 195	151 000	197 464	245 000	–	126	–
	2005	9 441 780	129 000	166 899	206 000	–	87	–
	2006	9 564 247	127 000	165 418	205 000	–	77	–
	2007	9 683 047	136 000	177 615	221 000	–	68	–
	2008	9 797 609	86 000	111 811	139 000	–	54	–
	2009	9 907 215	84 000	110 555	138 000	–	28	–
	2010	10 011 853	125 000	164 479	206 000	–	42	–
	2011	10 109 278	64 000	84 072	105 000	–	23	–
	2012	10 200 703	64 000	84 176	105 000	–	24	–
	2013	10 293 636	55 000	72 310	90 000	–	10	–
	2014	10 398 179	43 000	57 024	71 000	–	17	–
	2015	10 520 599	51 000	66 603	83 000	–	18	–
	2016	10 665 474	88 000	115 550	144 000	–	36	–
	2017	10 828 150	56 000	73 861	92 000	–	19	–
	2018	10 994 461	71 000	93 468	117 000	–	9	–
	2019	11 144 649	91 000	119 302	149 000	–	3	–
Costa Rica[1,2]	2000	1 386 829	–	1 879	–	–	0	–
	2001	1 411 925	–	1 363	–	–	0	–
	2002	1 435 322	–	1 021	–	–	0	–
	2003	1 457 418	–	718	–	–	0	–
	2004	1 478 804	–	1 289	–	–	0	–
	2005	1 499 926	–	3 541	–	–	0	–
	2006	1 520 897	–	2 903	–	–	0	–
	2007	1 541 619	–	1 223	–	–	0	–
	2008	1 562 093	–	966	–	–	0	–
	2009	1 582 258	–	262	–	–	1	–
	2010	1 602 079	–	110	–	–	0	–
	2011	1 621 580	–	10	–	–	0	–
	2012	1 640 801	–	6	–	–	0	–
	2013	1 659 738	–	0	–	–	0	–
	2014	1 678 386	–	0	–	–	0	–
	2015	1 696 731	–	0	–	–	0	–
	2016	1 714 767	–	4	–	–	0	–
	2017	1 732 484	–	12	–	–	0	–
	2018	1 749 805	–	70	–	–	0	–
	2019	1 766 646	–	95	–	–	0	–
Dominican Republic[2]	2000	4 666 170	1 300	1 524	1 800	–	6	–
	2001	4 736 280	1 100	1 315	1 600	–	17	–
	2002	4 805 890	1 400	1 685	2 000	–	11	–
	2003	4 874 931	1 600	1 983	2 400	–	12	–
	2004	4 943 303	2 500	3 046	3 600	–	16	–
	2005	5 010 953	4 000	4 950	5 900	–	16	–
	2006	5 077 833	3 700	4 535	5 400	–	10	–
	2007	5 144 028	2 900	3 478	4 100	–	17	–
	2008	5 209 699	1 900	2 365	2 800	–	11	–
	2009	5 275 057	1 700	2 115	2 500	–	14	–
	2010	5 340 264	2 600	3 202	3 800	–	15	–
	2011	5 405 317	1 700	2 088	2 500	–	10	–
	2012	5 470 147	1 000	1 232	1 500	–	8	–
	2013	5 534 763	610	751	900	–	5	–
	2014	5 599 185	480	566	650	–	4	–
	2015	5 663 352	660	779	900	–	3	–
	2016	5 727 282	720	851	990	–	2	–
	2017	5 790 831	420	491	570	–	1	–
	2018	5 853 645	640	750	870	–	1	–
	2019	5 915 232	1 400	1 592	1 800	–	4	–
Ecuador[1,2]	2000	369 527	–	104 528	–	–	66	–
	2001	376 333	–	108 903	–	–	84	–
	2002	383 000	–	86 757	–	–	64	–
	2003	389 592	–	52 065	–	–	46	–
	2004	396 198	–	28 730	–	–	37	–
	2005	402 884	–	17 050	–	–	22	–
	2006	409 690	–	9 863	–	–	9	–
	2007	416 601	–	8 464	–	–	8	–
	2008	423 571	–	4 891	–	–	5	–
	2009	430 526	–	4 120	–	–	6	–
	2010	437 423	–	1 871	–	–	0	–
	2011	444 206	–	1 219	–	–	0	–
	2012	450 915	–	544	–	–	0	–
	2013	457 715	–	368	–	–	0	–
	2014	464 836	–	242	–	–	0	–
	2015	472 418	–	618	–	–	0	–
	2016	480 551	–	1 191	–	–	0	–
	2017	489 125	–	1 275	–	–	1	–
	2018	497 838	–	1 653	–	–	0	–
	2019	506 268	–	1 803	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
El Salvador[1,2]	2000	1 195 249	–	753	–	–	0	–
	2001	1 203 181	–	362	–	–	0	–
	2002	1 210 314	–	117	–	–	0	–
	2003	1 216 797	–	85	–	–	0	–
	2004	1 222 831	–	112	–	–	0	–
	2005	1 228 581	–	67	–	–	0	–
	2006	1 234 117	–	49	–	–	0	–
	2007	1 239 479	–	40	–	–	0	–
	2008	1 244 748	–	33	–	–	0	–
	2009	1 250 008	–	20	–	–	0	–
	2010	1 255 327	–	19	–	–	0	–
	2011	1 260 745	–	9	–	–	0	–
	2012	1 266 298	–	13	–	–	0	–
	2013	1 272 013	–	6	–	–	0	–
	2014	1 277 910	–	6	–	–	0	–
	2015	1 283 999	–	2	–	–	0	–
	2016	1 290 295	–	12	–	–	0	–
	2017	1 296 789	–	0	–	–	0	–
	2018	1 303 410	–	0	–	–	0	–
	2019	1 310 070	–	0	–	–	0	–
French Guiana	2000	90 184	3 900	4 428	5 300	0	8	15
	2001	94 057	4 000	4 554	5 400	0	9	16
	2002	99 037	3 800	4 348	5 200	0	7	13
	2003	103 463	4 000	4 540	5 300	0	9	16
	2004	107 889	3 200	3 580	4 200	0	7	12
	2005	112 315	3 600	4 015	4 700	0	5	9
	2006	116 188	4 300	4 796	5 600	0	5	10
	2007	119 508	5 000	5 647	6 600	0	5	9
	2008	122 828	3 500	3 884	4 500	0	4	6
	2009	126 147	3 600	4 051	4 700	0	3	7
	2010	128 914	1 800	2 260	2 900	0	4	8
	2011	131 680	1 300	1 413	1 600	0	2	4
	2012	135 000	940	1 054	1 200	0	2	3
	2013	137 766	960	1 126	1 300	0	2	3
	2014	141 086	480	543	620	0	0	1
	2015	144 406	410	462	530	–	0	–
	2016	148 279	240	268	310	–	0	–
	2017	152 152	610	685	790	–	0	–
	2018	156 578	570	640	740	–	0	–
	2019	161 004	190	226	260	–	0	–
Guatemala	2000	8 795 379	56 000	63 676	76 000	10	27	46
	2001	9 002 376	37 000	42 680	51 000	7	18	30
	2002	9 216 708	37 000	42 213	50 000	7	20	33
	2003	9 436 861	32 000	36 810	43 000	6	16	27
	2004	9 660 655	30 000	34 124	40 000	5	14	24
	2005	9 886 453	41 000	46 537	55 000	7	19	32
	2006	10 113 679	32 000	36 610	43 000	5	15	25
	2007	10 342 650	16 000	17 992	21 000	2	6	11
	2008	10 573 726	7 500	8 421	9 800	1	3	5
	2009	10 807 624	7 400	8 285	9 600	1	3	5
	2010	11 044 796	7 800	9 468	12 000	1	3	6
	2011	11 285 142	7 100	7 968	9 200	1	2	5
	2012	11 528 212	5 600	6 262	7 200	0	2	3
	2013	11 773 597	6 500	7 282	8 400	0	2	4
	2014	12 020 770	5 900	6 648	7 600	0	2	4
	2015	12 269 280	7 100	8 001	9 200	1	2	5
	2016	12 518 897	5 100	5 685	6 600	0	2	3
	2017	12 769 455	3 900	4 388	5 100	0	1	2
	2018	13 020 750	3 200	3 545	4 100	0	1	2
	2019	13 272 607	2 200	2 428	2 800	0	0	1
Guyana	2000	746 718	28 000	33 628	40 000	4	50	86
	2001	745 206	31 000	37 974	46 000	4	52	91
	2002	744 789	25 000	30 656	37 000	3	42	75
	2003	745 142	32 000	38 681	46 000	4	53	92
	2004	745 737	33 000	40 416	48 000	5	51	89
	2005	746 156	45 000	54 583	65 000	7	69	120
	2006	746 335	24 000	27 629	32 000	3	37	62
	2007	746 477	13 000	15 697	18 000	1	19	32
	2008	746 815	14 000	16 365	19 000	1	23	39
	2009	747 718	14 000	17 877	22 000	1	28	48
	2010	749 430	26 000	32 823	41 000	3	56	100
	2011	752 029	34 000	41 096	49 000	4	76	130
	2012	755 388	36 000	43 584	51 000	5	76	130
	2013	759 281	43 000	57 459	79 000	7	90	170
	2014	763 371	17 000	22 310	31 000	2	27	53
	2015	767 433	14 000	18 030	25 000	2	22	41
	2016	771 363	2 000	2 638	3 600	0	2	5
	2017	775 218	19 000	25 167	34 000	3	33	64
	2018	779 007	23 000	30 769	42 000	4	38	74
	2019	782 775	22 000	26 403	31 000	3	30	50

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Haiti	2000	7 561 729	41 000	72 509	117 000	5	185	420
	2001	7 691 283	42 000	73 751	119 000	5	188	430
	2002	7 821 130	43 000	74 996	122 000	5	191	440
	2003	7 951 534	44 000	76 247	123 000	5	195	440
	2004	8 082 844	45 000	77 506	125 000	5	198	450
	2005	8 215 255	46 000	78 775	128 000	5	201	460
	2006	8 348 816	47 000	81 199	129 000	5	207	460
	2007	8 483 323	43 000	73 292	114 000	5	187	410
	2008	8 618 438	53 000	89 554	140 000	6	229	510
	2009	8 753 770	48 000	83 939	135 000	5	214	490
	2010	8 888 919	49 000	85 235	137 000	6	218	500
	2011	9 023 827	50 000	81 483	126 000	5	208	460
	2012	9 158 378	37 000	59 798	93 000	4	153	340
	2013	9 292 168	30 000	49 387	77 000	3	126	280
	2014	9 424 693	22 000	32 932	45 000	2	84	170
	2015	9 555 609	22 000	32 829	44 000	2	84	170
	2016	9 684 651	26 000	38 506	52 000	2	98	200
	2017	9 811 866	19 000	28 964	39 000	2	74	150
	2018	9 937 674	8 500	12 822	17 000	0	32	65
	2019	10 062 660	9 600	14 412	19 000	1	36	73
Honduras	2000	5 955 191	38 000	51 498	66 000	8	23	41
	2001	6 115 881	26 000	35 405	45 000	5	15	28
	2002	6 276 530	18 000	25 251	32 000	3	11	19
	2003	6 436 907	15 000	20 618	26 000	3	9	16
	2004	6 596 898	18 000	25 120	32 000	4	11	21
	2005	6 756 345	17 000	23 374	30 000	3	11	20
	2006	6 915 144	13 000	17 253	22 000	2	8	15
	2007	7 072 957	11 000	14 960	19 000	2	7	13
	2008	7 229 149	8 900	11 741	15 000	2	6	10
	2009	7 382 976	9 900	12 889	16 000	1	8	15
	2010	7 533 961	10 000	13 306	16 000	2	7	13
	2011	7 681 790	8 000	10 124	12 000	1	5	8
	2012	7 826 738	6 800	8 677	11 000	1	4	7
	2013	7 969 703	5 700	7 317	9 000	1	5	10
	2014	8 111 963	3 600	4 553	5 600	0	3	5
	2015	8 254 468	3 800	4 819	5 900	0	4	7
	2016	8 397 485	4 300	5 521	6 800	0	5	10
	2017	8 540 802	1 400	1 733	2 100	0	0	1
	2018	8 684 378	1 000	1 298	1 600	–	0	–
	2019	8 828 030	350	444	540	–	0	–
Mexico[1,2]	2000	2 096 676	–	7 390	–	–	0	–
	2001	2 126 320	–	4 996	–	–	0	–
	2002	2 155 717	–	4 624	–	–	0	–
	2003	2 185 317	–	3 819	–	–	0	–
	2004	2 215 716	–	3 406	–	–	0	–
	2005	2 247 310	–	2 967	–	–	0	–
	2006	2 280 275	–	2 514	–	–	0	–
	2007	2 314 414	–	2 361	–	–	0	–
	2008	2 349 283	–	2 357	–	–	0	–
	2009	2 384 234	–	2 703	–	–	0	–
	2010	2 418 771	–	1 226	–	–	0	–
	2011	2 452 743	–	1 124	–	–	0	–
	2012	2 486 212	–	833	–	–	0	–
	2013	2 519 135	–	495	–	–	0	–
	2014	2 551 528	–	656	–	–	0	–
	2015	2 583 394	–	517	–	–	0	–
	2016	2 614 667	–	551	–	–	1	–
	2017	2 645 279	–	736	–	–	0	–
	2018	2 675 244	–	803	–	–	1	–
	2019	2 704 601	–	618	–	–	0	–
Nicaragua[2]	2000	2 212 753	25 000	29 953	35 000	–	4	–
	2001	2 245 952	11 000	13 275	16 000	–	2	–
	2002	2 278 234	8 100	9 745	12 000	–	8	–
	2003	2 310 008	7 100	8 507	10 000	–	7	–
	2004	2 341 791	7 300	8 735	10 000	–	1	–
	2005	2 373 989	7 000	8 412	9 900	–	6	–
	2006	2 406 754	3 300	3 943	4 700	–	1	–
	2007	2 440 063	1 400	1 717	2 000	–	0	–
	2008	2 473 835	800	965	1 100	–	0	–
	2009	2 507 927	640	772	910	–	0	–
	2010	2 542 201	730	876	1 000	–	1	–
	2011	2 576 674	970	1 171	1 400	–	1	–
	2012	2 611 374	1 300	1 564	1 800	–	2	–
	2013	2 646 264	1 200	1 471	1 700	–	0	–
	2014	2 681 303	1 200	1 446	1 700	–	0	–
	2015	2 716 441	2 400	2 886	3 400	–	1	–
	2016	2 751 682	6 600	7 943	9 400	–	2	–
	2017	2 786 983	12 000	13 866	16 000	–	1	–
	2018	2 822 191	17 000	20 158	24 000	–	0	–
	2019	2 857 112	14 000	16 717	20 000	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Panama[2]	2000	2 931 635	1 000	1 091	1 200	–	1	–
	2001	2 989 011	940	977	1 000	–	1	–
	2002	3 046 625	2 300	2 363	2 500	–	2	–
	2003	3 104 537	4 600	4 739	5 100	–	4	–
	2004	3 162 873	5 200	5 365	5 700	–	2	–
	2005	3 221 756	3 700	3 861	4 100	–	1	–
	2006	3 281 206	1 700	1 751	1 900	–	1	–
	2007	3 341 184	1 300	1 349	1 400	–	1	–
	2008	3 401 681	750	783	830	–	1	–
	2009	3 462 639	790	819	870	–	0	–
	2010	3 524 048	420	440	470	–	1	–
	2011	3 585 758	360	372	400	–	0	–
	2012	3 647 825	860	888	950	–	1	–
	2013	3 710 526	720	751	800	–	0	–
	2014	3 774 245	960	1 007	1 100	–	0	–
	2015	3 839 236	550	575	610	–	0	–
	2016	3 905 585	780	809	860	–	0	–
	2017	3 973 006	760	801	860	–	0	–
	2018	4 040 827	750	786	840	–	0	–
	2019	4 108 133	1 500	1 578	1 700	–	0	–
Paraguay[1,2,3]	2000	191 635	–	6 853	–	–	0	–
	2001	195 423	–	2 710	–	–	0	–
	2002	199 150	–	2 778	–	–	0	–
	2003	202 787	–	1 392	–	–	0	–
	2004	206 300	–	694	–	–	0	–
	2005	209 667	–	376	–	–	0	–
	2006	212 875	–	823	–	–	0	–
	2007	215 943	–	1 341	–	–	0	–
	2008	218 926	–	348	–	–	0	–
	2009	221 902	–	91	–	–	0	–
	2010	224 928	–	18	–	–	0	–
	2011	228 023	–	1	–	–	0	–
	2012	231 174	–	0	–	–	0	–
	2013	234 369	–	0	–	–	0	–
	2014	237 582	–	0	–	–	0	–
	2015	240 794	–	0	–	–	0	–
	2016	244 003	–	0	–	–	0	–
	2017	247 214	–	0	–	–	0	–
	2018	250 418	–	0	–	–	0	–
	2019	253 607	–	0	–	–	0	–
Peru	2000	10 392 407	72 000	94 271	117 000	14	96	170
	2001	10 525 688	83 000	105 067	128 000	16	89	160
	2002	10 644 174	105 000	128 960	154 000	20	108	180
	2003	10 750 711	93 000	111 816	132 000	17	95	160
	2004	10 849 691	98 000	115 387	133 000	18	98	160
	2005	10 944 705	92 000	108 134	125 000	17	80	130
	2006	11 037 363	68 000	80 054	93 000	13	52	85
	2007	11 128 088	53 000	62 633	73 000	10	43	71
	2008	11 218 137	47 000	54 608	63 000	8	34	56
	2009	11 308 606	45 000	52 035	60 000	8	31	51
	2010	11 400 911	33 000	37 847	43 000	6	20	32
	2011	11 493 851	26 000	30 924	36 000	4	19	31
	2012	11 589 086	33 000	40 437	48 000	6	24	41
	2013	11 694 030	51 000	62 669	75 000	10	45	76
	2014	11 818 294	69 000	83 936	100 000	14	60	100
	2015	11 967 687	77 000	93 936	113 000	15	76	130
	2016	12 146 509	60 000	72 836	86 000	10	69	120
	2017	12 350 062	59 000	72 518	86 000	10	64	110
	2018	12 564 103	48 000	58 455	70 000	9	48	80
	2019	12 768 809	33 000	45 729	64 000	6	35	66
Suriname[1,2]	2000	69 558	–	11 361	–	–	24	–
	2001	70 389	–	16 003	–	–	23	–
	2002	71 225	–	12 837	–	–	15	–
	2003	72 068	–	10 982	–	–	18	–
	2004	72 916	–	8 378	–	–	7	–
	2005	73 770	–	9 131	–	–	1	–
	2006	74 631	–	3 289	–	–	1	–
	2007	75 501	–	1 741	–	–	1	–
	2008	76 378	–	2 709	–	–	0	–
	2009	77 263	–	2 380	–	–	0	–
	2010	78 151	–	1 712	–	–	1	–
	2011	79 045	–	771	–	–	1	–
	2012	79 942	–	356	–	–	0	–
	2013	80 835	–	729	–	–	1	–
	2014	81 719	–	401	–	–	1	–
	2015	82 584	–	81	–	–	0	–
	2016	83 433	–	76	–	–	0	–
	2017	84 262	–	40	–	–	1	–
	2018	85 073	–	29	–	–	0	–
	2019	85 867	–	95	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Venezuela (Bolivarian Republic of)	2000	12 096 224	31 000	35 530	42 000	5	26	44
	2001	12 323 235	21 000	23 843	28 000	3	15	25
	2002	12 550 203	31 000	35 041	41 000	5	19	31
	2003	12 775 812	33 000	37 524	44 000	5	27	45
	2004	12 998 297	49 000	55 005	65 000	8	30	50
	2005	13 216 222	47 000	52 999	62 000	8	34	55
	2006	13 425 095	39 000	43 654	51 000	6	33	53
	2007	13 623 800	44 000	48 852	57 000	7	37	61
	2008	13 817 913	33 000	37 496	44 000	5	26	43
	2009	14 015 505	37 000	41 943	49 000	6	36	58
	2010	14 219 971	48 000	57 926	73 000	8	53	91
	2011	14 443 936	48 000	53 584	62 000	8	47	76
	2012	14 680 413	55 000	61 873	72 000	9	56	92
	2013	14 890 523	82 000	92 159	106 000	13	104	170
	2014	15 021 486	95 000	106 079	122 000	16	110	180
	2015	15 040 913	142 000	159 661	184 000	25	150	240
	2016	14 925 624	251 000	281 897	327 000	44	261	420
	2017	14 701 240	429 000	482 617	556 000	79	424	690
	2018	14 443 558	423 000	475 212	547 000	82	426	690
	2019	14 257 914	415 000	467 421	538 000	75	403	650
EASTERN MEDITERRANEAN								
Afghanistan	2000	16 017 398	846 000	1 319 942	2 044 000	220	971	2 030
	2001	16 654 885	852 000	1 319 942	2 015 000	220	971	2 010
	2002	17 420 902	913 000	1 391 183	2 098 000	220	1 141	2 220
	2003	18 253 452	819 000	1 248 701	1 910 000	210	801	1 560
	2004	19 059 579	481 000	717 358	1 076 000	120	351	680
	2005	19 774 570	313 000	535 476	866 000	89	259	520
	2006	20 374 865	225 000	418 218	717 000	64	222	460
	2007	20 889 368	237 000	452 625	785 000	69	236	500
	2008	21 368 611	199 000	381 132	668 000	57	187	400
	2009	21 887 000	149 000	274 469	455 000	44	139	290
	2010	22 496 483	165 000	290 333	460 000	49	164	320
	2011	23 214 801	198 000	362 321	571 000	57	192	380
	2012	24 019 501	122 000	220 650	354 000	29	92	190
	2013	24 873 724	109 000	181 194	283 000	28	84	170
	2014	25 722 550	174 000	254 108	360 000	42	121	220
	2015	26 526 347	231 000	354 933	512 000	59	167	310
	2016	27 273 591	451 000	641 459	883 000	110	306	550
	2017	27 977 406	437 000	574 672	737 000	100	271	470
	2018	28 652 489	495 000	646 248	824 000	110	297	520
	2019	29 322 964	328 000	424 653	539 000	66	175	310
Djibouti[1]	2000	538 125	1 400	1 832	2 300	0	0	1
	2001	549 705	1 400	1 872	2 300	0	0	1
	2002	560 150	1 500	1 907	2 300	0	0	1
	2003	569 668	1 500	1 940	2 400	0	0	1
	2004	578 637	1 500	1 970	2 400	0	0	1
	2005	587 373	1 500	2 000	2 500	0	0	1
	2006	595 851	1 600	2 029	2 500	0	0	1
	2007	604 027	1 600	2 057	2 500	0	0	1
	2008	612 205	1 600	2 084	2 600	0	0	1
	2009	620 798	–	2 686	–	0	1	1
	2010	630 077	–	1 010	–	0	2	4
	2011	640 184	1 700	2 180	2 700	0	0	1
	2012	651 032	1 700	2 217	2 700	0	0	1
	2013	662 401	–	1 684	–	0	0	1
	2014	673 958	–	9 439	–	1	3	5
	2015	685 425	–	9 473	–	0	24	37
	2016	696 763	–	13 804	–	1	30	48
	2017	707 999	–	14 671	–	1	24	38
	2018	719 115	–	25 319	–	2	44	69
	2019	730 089	–	49 402	–	5	97	150

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EASTERN MEDITERRANEAN								
Egypt[1,2]	2000	68 831 561	–	0	–	–	0	–
	2001	70 152 662	–	0	–	–	0	–
	2002	71 485 044	–	0	–	–	0	–
	2003	72 826 102	–	0	–	–	0	–
	2004	74 172 073	–	0	–	–	0	–
	2005	75 523 576	–	0	–	–	0	–
	2006	76 873 670	–	0	–	–	0	–
	2007	78 232 124	–	0	–	–	0	–
	2008	79 636 081	–	0	–	–	0	–
	2009	81 134 789	–	0	–	–	0	–
	2010	82 761 244	–	0	–	–	0	–
	2011	84 529 251	–	0	–	–	0	–
	2012	86 422 240	–	0	–	–	0	–
	2013	88 404 652	–	0	–	–	0	–
	2014	90 424 668	–	0	–	–	0	–
	2015	92 442 549	–	0	–	–	0	–
	2016	94 447 071	–	0	–	–	0	–
	2017	96 442 590	–	0	–	–	0	–
	2018	98 423 602	–	0	–	–	0	–
	2019	100 388 076	–	0	–	–	0	–
Iran (Islamic Republic of)[1,2]	2000	670 014	–	19 716	–	–	4	–
	2001	678 445	–	19 303	–	–	2	–
	2002	686 977	–	15 558	–	–	2	–
	2003	695 535	–	23 562	–	–	5	–
	2004	703 992	–	13 821	–	–	1	–
	2005	712 273	–	18 966	–	–	1	–
	2006	720 364	–	15 909	–	–	1	–
	2007	728 345	–	15 712	–	–	3	–
	2008	736 351	–	8 349	–	–	3	–
	2009	744 562	–	4 345	–	–	0	–
	2010	753 115	–	1 847	–	–	0	–
	2011	762 022	–	1 632	–	–	0	–
	2012	771 262	–	756	–	–	0	–
	2013	780 880	–	479	–	–	0	–
	2014	790 925	–	358	–	–	0	–
	2015	801 405	–	167	–	–	1	–
	2016	812 348	–	81	–	–	0	–
	2017	823 680	–	60	–	–	1	–
	2018	835 180	–	0	–	–	0	–
	2019	846 550	–	0	–	–	0	–
Iraq[1,2]	2000	3 054 686	–	1 860	–	–	0	–
	2001	3 147 063	–	1 265	–	–	0	–
	2002	3 241 149	–	952	–	–	0	–
	2003	3 333 785	–	288	–	–	0	–
	2004	3 420 798	–	148	–	–	0	–
	2005	3 499 896	–	44	–	–	0	–
	2006	3 568 256	–	23	–	–	0	–
	2007	3 628 461	–	2	–	–	0	–
	2008	3 690 146	–	2	–	–	0	–
	2009	3 766 510	–	0	–	–	0	–
	2010	3 866 457	–	0	–	–	0	–
	2011	3 994 289	–	0	–	–	0	–
	2012	4 145 701	–	0	–	–	0	–
	2013	4 310 417	–	0	–	–	0	–
	2014	4 473 553	–	0	–	–	0	–
	2015	4 624 394	–	0	–	–	0	–
	2016	4 759 382	–	0	–	–	0	–
	2017	4 881 862	–	0	–	–	0	–
	2018	4 996 368	–	0	–	–	0	–
	2019	5 110 272	–	0	–	–	0	–
Morocco[1,2,3]	2000	28 793 672	–	3	–	–	0	–
	2001	29 126 323	–	0	–	–	0	–
	2002	29 454 765	–	19	–	–	0	–
	2003	29 782 884	–	4	–	–	0	–
	2004	30 115 196	–	1	–	–	0	–
	2005	30 455 563	–	0	–	–	0	–
	2006	30 804 689	–	0	–	–	0	–
	2007	31 163 670	–	0	–	–	0	–
	2008	31 536 807	–	0	–	–	0	–
	2009	31 929 087	–	0	–	–	0	–
	2010	32 343 384	–	0	–	–	0	–
	2011	32 781 860	–	0	–	–	0	–
	2012	33 241 898	–	0	–	–	0	–
	2013	33 715 704	–	0	–	–	0	–
	2014	34 192 360	–	0	–	–	0	–
	2015	34 663 608	–	0	–	–	0	–
	2016	35 126 276	–	0	–	–	0	–
	2017	35 581 260	–	0	–	–	0	–
	2018	36 029 088	–	0	–	–	0	–
	2019	36 471 768	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EASTERN MEDITERRANEAN								
Oman[1,2]	2000	2 267 973	–	6	–	–	0	–
	2001	2 294 959	–	2	–	–	0	–
	2002	2 334 860	–	0	–	–	0	–
	2003	2 386 164	–	0	–	–	0	–
	2004	2 445 524	–	0	–	–	0	–
	2005	2 511 254	–	0	–	–	0	–
	2006	2 580 753	–	0	–	–	0	–
	2007	2 657 162	–	0	–	–	0	–
	2008	2 750 956	–	0	–	–	0	–
	2009	2 876 186	–	0	–	–	0	–
	2010	3 041 435	–	7	–	–	0	–
	2011	3 251 102	–	0	–	–	0	–
	2012	3 498 031	–	0	–	–	0	–
	2013	3 764 805	–	0	–	–	0	–
	2014	4 027 255	–	0	–	–	0	–
	2015	4 267 341	–	0	–	–	0	–
	2016	4 479 217	–	0	–	–	0	–
	2017	4 665 926	–	0	–	–	0	–
	2018	4 829 476	–	0	–	–	0	–
	2019	4 974 992	–	0	–	–	0	–
Pakistan	2000	139 939 408	357 000	929 292	2 197 000	120	995	2 930
	2001	143 512 840	426 000	1 037 774	2 400 000	130	1 144	3 290
	2002	147 023 801	352 000	966 325	2 409 000	110	1 001	3 040
	2003	150 507 621	392 000	924 733	2 215 000	120	991	2 940
	2004	154 018 597	384 000	683 580	1 330 000	100	643	1 570
	2005	157 596 481	378 000	845 170	1 932 000	110	923	2 630
	2006	161 252 281	355 000	851 104	2 027 000	110	882	2 610
	2007	164 973 809	350 000	835 398	2 063 000	100	879	2 620
	2008	168 749 848	282 000	763 800	1 952 000	94	679	2 130
	2009	172 560 988	443 000	1 015 691	2 324 000	130	1 000	2 780
	2010	176 394 157	641 000	1 445 704	3 044 000	190	1 616	4 270
	2011	180 243 576	921 000	1 905 938	3 705 000	270	1 814	4 430
	2012	184 116 966	785 000	1 652 576	3 349 000	240	1 703	4 300
	2013	188 030 412	749 000	1 419 225	2 774 000	220	1 047	2 420
	2014	192 006 322	723 000	1 373 305	2 684 000	220	897	2 130
	2015	196 058 630	523 000	992 598	2 031 000	150	780	1 980
	2016	200 192 018	822 000	1 221 807	2 012 000	200	1 005	2 070
	2017	204 394 687	739 000	1 007 334	1 477 000	170	789	1 500
	2018	208 643 736	750 000	957 848	1 307 000	170	693	1 230
	2019	212 907 531	561 000	707 396	949 000	120	587	1 030
Saudi Arabia[1,2]	2000	1 655 380	–	6 608	–	–	0	–
	2001	1 698 543	–	3 074	–	–	0	–
	2002	1 746 824	–	2 612	–	–	0	–
	2003	1 799 001	–	1 724	–	–	0	–
	2004	1 853 159	–	1 232	–	–	0	–
	2005	1 907 913	–	1 059	–	–	0	–
	2006	1 962 559	–	1 278	–	–	0	–
	2007	2 017 537	–	467	–	–	0	–
	2008	2 073 930	–	61	–	–	0	–
	2009	2 133 353	–	58	–	–	0	–
	2010	2 196 733	–	29	–	–	0	–
	2011	2 264 516	–	69	–	–	0	–
	2012	2 335 599	–	82	–	–	0	–
	2013	2 407 470	–	34	–	–	0	–
	2014	2 476 728	–	30	–	–	0	–
	2015	2 540 903	–	83	–	–	0	–
	2016	2 599 044	–	272	–	–	0	–
	2017	2 651 735	–	177	–	–	0	–
	2018	2 699 927	–	61	–	–	0	–
	2019	2 745 252	–	38	–	–	0	–
Somalia	2000	8 872 250	546 000	1 114 212	2 129 000	71	2 852	8 050
	2001	9 186 719	566 000	1 157 164	2 210 000	74	2 962	8 350
	2002	9 501 335	605 000	1 198 956	2 078 000	77	3 069	7 900
	2003	9 815 412	647 000	1 187 649	2 006 000	82	3 040	7 600
	2004	10 130 251	706 000	1 215 543	1 860 000	83	3 111	7 070
	2005	10 446 856	885 000	1 426 667	2 099 000	100	3 652	7 990
	2006	10 763 904	801 000	1 292 397	1 920 000	91	3 308	7 310
	2007	11 080 122	674 000	1 114 252	1 665 000	79	2 852	6 330
	2008	11 397 188	435 000	719 155	1 071 000	50	1 841	4 070
	2009	11 717 691	273 000	450 388	653 000	31	1 152	2 480
	2010	12 043 886	315 000	526 000	777 000	36	1 347	2 960
	2011	12 376 305	264 000	441 000	646 000	30	1 128	2 460
	2012	12 715 487	274 000	454 000	665 000	31	1 162	2 520
	2013	13 063 711	331 000	546 000	813 000	37	1 396	3 090
	2014	13 423 571	395 000	640 000	952 000	45	1 639	3 630
	2015	13 797 204	451 000	769 000	1 152 000	53	1 969	4 390
	2016	14 185 635	471 000	795 000	1 191 000	54	2 034	4 530
	2017	14 589 165	479 000	813 000	1 221 000	54	2 081	4 640
	2018	15 008 225	459 000	772 000	1 158 000	53	1 977	4 410
	2019	15 442 906	449 000	759 000	1 136 000	52	1 942	4 300

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EASTERN MEDITERRANEAN								
Sudan	2000	27 275 019	1 571 000	2 574 538	3 970 000	210	6 309	13 400
	2001	27 971 077	1 514 000	2 484 963	3 832 000	200	6 089	13 000
	2002	28 704 786	1 164 000	1 926 916	2 995 000	160	4 722	10 300
	2003	29 460 517	1 101 000	1 814 162	2 809 000	150	4 446	9 460
	2004	30 214 189	1 030 000	1 679 202	2 588 000	140	4 114	8 810
	2005	30 949 514	1 042 000	1 700 355	2 631 000	140	4 166	8 800
	2006	31 661 824	1 056 000	1 673 314	2 538 000	140	4 100	8 600
	2007	32 360 619	1 003 000	1 510 104	2 180 000	130	3 700	7 500
	2008	33 060 844	914 000	1 270 179	1 716 000	120	3 112	6 010
	2009	33 783 778	847 000	1 145 814	1 514 000	110	2 807	5 260
	2010	34 545 012	820 000	1 113 206	1 474 000	100	2 727	5 210
	2011	35 349 672	833 000	1 125 082	1 485 000	100	2 757	5 200
	2012	36 193 786	853 000	1 145 417	1 499 000	110	2 806	5 330
	2013	37 072 560	871 000	1 215 512	1 664 000	110	2 978	5 770
	2014	37 977 658	910 000	1 346 675	1 914 000	120	3 300	6 620
	2015	38 902 948	956 000	1 483 867	2 209 000	130	3 635	7 550
	2016	39 847 432	1 123 000	1 874 654	2 974 000	180	4 047	8 840
	2017	40 813 400	981 000	1 881 935	3 236 000	150	4 484	10 500
	2018	41 801 530	1 057 000	2 141 738	3 906 000	170	5 068	12 300
	2019	42 813 236	1 131 000	2 373 025	4 383 000	180	5 614	13 500
Syrian Arab Republic[1,2]	2000	16 410 847	–	6	–	–	0	–
	2001	16 766 555	–	63	–	–	0	–
	2002	17 084 628	–	15	–	–	0	–
	2003	17 415 214	–	2	–	–	0	–
	2004	17 827 827	–	1	–	–	0	–
	2005	18 361 178	–	0	–	–	0	–
	2006	19 059 257	–	0	–	–	0	–
	2007	19 878 257	–	0	–	–	0	–
	2008	20 664 037	–	0	–	–	0	–
	2009	21 205 873	–	0	–	–	0	–
	2010	21 362 541	–	0	–	–	0	–
	2011	21 081 814	–	0	–	–	0	–
	2012	20 438 861	–	0	–	–	0	–
	2013	19 578 466	–	0	–	–	0	–
	2014	18 710 711	–	0	–	–	0	–
	2015	17 997 411	–	0	–	–	0	–
	2016	17 465 567	–	0	–	–	0	–
	2017	17 095 669	–	0	–	–	0	–
	2018	16 945 062	–	0	–	–	0	–
	2019	17 070 132	–	0	–	–	0	–
United Arab Emirates[1,2,3]	2000	3 134 067	–	0	–	–	0	–
	2001	3 302 722	–	0	–	–	0	–
	2002	3 478 769	–	0	–	–	0	–
	2003	3 711 931	–	0	–	–	0	–
	2004	4 068 577	–	0	–	–	0	–
	2005	4 588 222	–	0	–	–	0	–
	2006	5 300 172	–	0	–	–	0	–
	2007	6 168 846	–	0	–	–	0	–
	2008	7 089 486	–	0	–	–	0	–
	2009	7 917 368	–	0	–	–	0	–
	2010	8 549 998	–	0	–	–	0	–
	2011	8 946 778	–	0	–	–	0	–
	2012	9 141 598	–	0	–	–	0	–
	2013	9 197 908	–	0	–	–	0	–
	2014	9 214 182	–	0	–	–	0	–
	2015	9 262 896	–	0	–	–	0	–
	2016	9 360 975	–	0	–	–	0	–
	2017	9 487 206	–	0	–	–	0	–
	2018	9 630 966	–	0	–	–	0	–
	2019	9 770 526	–	0	–	–	0	–
Yemen	2000	11 223 976	457 000	1 054 899	4 549 000	38	1 353	3 610
	2001	11 552 330	516 000	1 177 522	5 454 000	43	1 511	3 960
	2002	11 891 011	619 000	1 307 376	5 515 000	48	1 683	4 170
	2003	12 240 009	503 000	1 188 463	5 488 000	41	1 519	4 140
	2004	12 597 890	440 000	956 175	4 254 000	35	1 225	3 200
	2005	12 963 653	438 000	1 002 805	4 736 000	37	1 279	3 530
	2006	13 337 740	537 000	1 201 840	5 501 000	44	1 552	4 230
	2007	13 721 262	433 000	852 418	1 876 000	63	2 117	6 080
	2008	14 114 306	275 000	539 902	1 226 000	37	1 361	3 980
	2009	14 516 814	359 000	701 964	1 653 000	47	1 779	5 400
	2010	14 928 397	645 000	1 131 912	2 204 000	83	2 866	7 380
	2011	15 349 226	496 000	792 769	1 318 000	60	2 015	4 610
	2012	15 778 346	577 000	860 964	1 305 000	67	2 197	4 660
	2013	16 212 846	490 000	700 431	1 011 000	55	1 786	3 710
	2014	16 648 919	414 000	587 293	844 000	46	1 498	3 070
	2015	17 083 713	361 000	513 815	737 000	41	1 309	2 710
	2016	17 515 888	467 000	661 254	953 000	53	1 680	3 470
	2017	17 945 659	527 000	747 173	1 072 000	61	1 885	3 900
	2018	18 373 670	589 000	846 605	1 232 000	56	1 704	3 200
	2019	18 801 274	610 000	872 414	1 259 000	58	1 719	3 180

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EUROPEAN								
Armenia[1,2,3]	2000	3 069 597	–	141	–	–	0	–
	2001	3 050 686	–	79	–	–	0	–
	2002	3 033 976	–	52	–	–	0	–
	2003	3 017 938	–	29	–	–	0	–
	2004	3 000 715	–	47	–	–	0	–
	2005	2 981 262	–	7	–	–	0	–
	2006	2 958 301	–	0	–	–	0	–
	2007	2 932 615	–	0	–	–	0	–
	2008	2 907 615	–	0	–	–	0	–
	2009	2 888 094	–	0	–	–	0	–
	2010	2 877 314	–	0	–	–	0	–
	2011	2 876 536	–	0	–	–	0	–
	2012	2 884 239	–	0	–	–	0	–
	2013	2 897 593	–	0	–	–	0	–
	2014	2 912 403	–	0	–	–	0	–
	2015	2 925 559	–	0	–	–	0	–
	2016	2 936 147	–	0	–	–	0	–
	2017	2 944 789	–	0	–	–	0	–
	2018	2 951 741	–	0	–	–	0	–
	2019	2 957 728	–	0	–	–	0	–
Azerbaijan[1,2]	2000	186 823	–	1 526	–	–	0	–
	2001	188 537	–	1 058	–	–	0	–
	2002	190 372	–	506	–	–	0	–
	2003	192 312	–	482	–	–	0	–
	2004	194 325	–	386	–	–	0	–
	2005	196 388	–	242	–	–	0	–
	2006	198 493	–	143	–	–	0	–
	2007	200 657	–	108	–	–	0	–
	2008	202 902	–	72	–	–	0	–
	2009	205 260	–	78	–	–	0	–
	2010	207 746	–	50	–	–	0	–
	2011	210 364	–	4	–	–	0	–
	2012	213 087	–	3	–	–	0	–
	2013	215 865	–	0	–	–	0	–
	2014	218 629	–	0	–	–	0	–
	2015	221 323	–	0	–	–	0	–
	2016	223 928	–	0	–	–	0	–
	2017	226 442	–	0	–	–	0	–
	2018	228 839	–	0	–	–	0	–
	2019	231 097	–	0	–	–	0	–
Georgia[1,2]	2000	43 621	–	245	–	–	0	–
	2001	42 969	–	438	–	–	0	–
	2002	42 585	–	474	–	–	0	–
	2003	42 389	–	316	–	–	0	–
	2004	42 258	–	257	–	–	0	–
	2005	42 101	–	155	–	–	0	–
	2006	41 897	–	59	–	–	0	–
	2007	41 668	–	24	–	–	0	–
	2008	41 426	–	6	–	–	0	–
	2009	41 194	–	1	–	–	0	–
	2010	40 990	–	0	–	–	0	–
	2011	40 810	–	0	–	–	0	–
	2012	40 640	–	0	–	–	0	–
	2013	40 487	–	0	–	–	0	–
	2014	40 353	–	0	–	–	0	–
	2015	40 241	–	0	–	–	0	–
	2016	40 154	–	0	–	–	0	–
	2017	40 087	–	0	–	–	0	–
	2018	40 029	–	0	–	–	0	–
	2019	39 967	–	0	–	–	0	–
Kazakhstan[1,2]	2000	14 922 724	–	0	–	–	0	–
	2001	14 910 207	–	0	–	–	0	–
	2002	14 976 184	–	0	–	–	0	–
	2003	15 100 045	–	0	–	–	0	–
	2004	15 250 016	–	0	–	–	0	–
	2005	15 402 803	–	0	–	–	0	–
	2006	15 551 263	–	0	–	–	0	–
	2007	15 702 112	–	0	–	–	0	–
	2008	15 862 126	–	0	–	–	0	–
	2009	16 043 015	–	0	–	–	0	–
	2010	16 252 273	–	0	–	–	0	–
	2011	16 490 669	–	0	–	–	0	–
	2012	16 751 523	–	0	–	–	0	–
	2013	17 026 118	–	0	–	–	0	–
	2014	17 302 619	–	0	–	–	0	–
	2015	17 572 010	–	0	–	–	0	–
	2016	17 830 902	–	0	–	–	0	–
	2017	18 080 023	–	0	–	–	0	–
	2018	18 319 616	–	0	–	–	0	–
	2019	18 551 428	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EUROPEAN								
Kyrgyzstan[1,2,3]	2000	3 838 155	–	12	–	–	0	–
	2001	3 871 014	–	28	–	–	0	–
	2002	3 893 352	–	2 743	–	–	0	–
	2003	3 910 559	–	468	–	–	0	–
	2004	3 930 416	–	93	–	–	0	–
	2005	3 958 765	–	226	–	–	0	–
	2006	3 997 015	–	317	–	–	0	–
	2007	4 043 819	–	96	–	–	0	–
	2008	4 098 875	–	18	–	–	0	–
	2009	4 161 072	–	4	–	–	0	–
	2010	4 229 392	–	3	–	–	0	–
	2011	4 303 983	–	0	–	–	0	–
	2012	4 384 834	–	0	–	–	0	–
	2013	4 470 423	–	0	–	–	0	–
	2014	4 558 726	–	0	–	–	0	–
	2015	4 648 118	–	0	–	–	0	–
	2016	4 737 975	–	0	–	–	0	–
	2017	4 827 987	–	0	–	–	0	–
	2018	4 917 139	–	0	–	–	0	–
	2019	5 004 363	–	0	–	–	0	–
Tajikistan[1,2]	2000	2 076 253	–	19 064	–	–	0	–
	2001	2 110 382	–	11 387	–	–	0	–
	2002	2 146 571	–	6 160	–	–	0	–
	2003	2 184 877	–	5 428	–	–	0	–
	2004	2 225 238	–	3 588	–	–	0	–
	2005	2 267 632	–	2 309	–	–	0	–
	2006	2 312 145	–	1 344	–	–	0	–
	2007	2 358 930	–	635	–	–	0	–
	2008	2 408 114	–	318	–	–	0	–
	2009	2 459 827	–	164	–	–	0	–
	2010	2 514 150	–	111	–	–	0	–
	2011	2 570 967	–	65	–	–	0	–
	2012	2 630 195	–	18	–	–	0	–
	2013	2 691 967	–	3	–	–	0	–
	2014	2 756 444	–	2	–	–	0	–
	2015	2 823 642	–	0	–	–	0	–
	2016	2 893 634	–	0	–	–	0	–
	2017	2 966 010	–	0	–	–	0	–
	2018	3 039 682	–	0	–	–	0	–
	2019	3 113 221	–	0	–	–	0	–
Turkey[1,2]	2000	4 110 612	–	11 432	–	–	0	–
	2001	4 172 495	–	10 812	–	–	0	–
	2002	4 234 448	–	10 224	–	–	0	–
	2003	4 295 811	–	9 222	–	–	0	–
	2004	4 355 710	–	5 302	–	–	0	–
	2005	4 413 725	–	2 084	–	–	0	–
	2006	4 469 192	–	796	–	–	0	–
	2007	4 522 820	–	313	–	–	0	–
	2008	4 577 210	–	166	–	–	0	–
	2009	4 635 891	–	38	–	–	0	–
	2010	4 701 254	–	0	–	–	0	–
	2011	4 773 811	–	0	–	–	0	–
	2012	4 852 318	–	0	–	–	0	–
	2013	4 935 154	–	0	–	–	0	–
	2014	5 019 902	–	0	–	–	0	–
	2015	5 104 412	–	0	–	–	0	–
	2016	5 188 811	–	0	–	–	0	–
	2017	5 272 570	–	0	–	–	0	–
	2018	5 352 105	–	0	–	–	0	–
	2019	5 422 923	–	0	–	–	0	–
Turkmenistan[1,2,3]	2000	293 548	–	24	–	–	0	–
	2001	296 665	–	8	–	–	0	–
	2002	299 651	–	18	–	–	0	–
	2003	302 623	–	7	–	–	0	–
	2004	305 720	–	3	–	–	0	–
	2005	309 052	–	1	–	–	0	–
	2006	312 657	–	1	–	–	0	–
	2007	316 559	–	0	–	–	0	–
	2008	320 824	–	0	–	–	0	–
	2009	325 516	–	0	–	–	0	–
	2010	330 668	–	0	–	–	0	–
	2011	336 314	–	0	–	–	0	–
	2012	342 413	–	0	–	–	0	–
	2013	348 814	–	0	–	–	0	–
	2014	355 311	–	0	–	–	0	–
	2015	361 743	–	0	–	–	0	–
	2016	368 054	–	0	–	–	0	–
	2017	374 248	–	0	–	–	0	–
	2018	380 308	–	0	–	–	0	–
	2019	386 236	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EUROPEAN								
Uzbekistan[1,2,3]	2000	24 769	–	126	–	–	0	–
	2001	25 108	–	77	–	–	0	–
	2002	25 431	–	74	–	–	0	–
	2003	25 749	–	74	–	–	0	–
	2004	26 077	–	66	–	–	0	–
	2005	26 427	–	102	–	–	0	–
	2006	26 804	–	73	–	–	0	–
	2007	27 204	–	30	–	–	0	–
	2008	27 626	–	7	–	–	0	–
	2009	28 065	–	0	–	–	0	–
	2010	28 515	–	3	–	–	0	–
	2011	28 977	–	0	–	–	0	–
	2012	29 449	–	0	–	–	0	–
	2013	29 932	–	0	–	–	0	–
	2014	30 426	–	0	–	–	0	–
	2015	30 929	–	0	–	–	0	–
	2016	31 441	–	0	–	–	0	–
	2017	31 959	–	0	–	–	0	–
	2018	32 476	–	0	–	–	0	–
	2019	32 981	–	0	–	–	0	–
SOUTH-EAST ASIA								
Bangladesh	2000	13 727 050	42 000	78 958	128 000	7	166	390
	2001	13 988 438	43 000	80 462	131 000	7	170	400
	2002	14 245 368	42 000	81 940	132 000	7	173	410
	2003	14 494 139	43 000	83 371	135 000	7	176	420
	2004	14 730 151	44 000	84 728	137 000	7	179	420
	2005	14 950 487	46 000	85 995	140 000	7	181	440
	2006	15 153 253	41 000	68 539	103 000	6	139	290
	2007	15 340 271	63 000	75 032	88 000	8	155	270
	2008	15 517 025	96 000	121 084	151 000	12	264	480
	2009	15 691 292	109 000	128 228	149 000	15	251	430
	2010	15 868 787	59 000	68 774	80 000	6	165	290
	2011	16 051 340	54 000	63 356	73 000	5	155	270
	2012	16 237 645	31 000	35 747	41 000	3	87	150
	2013	16 426 435	23 000	25 366	29 000	2	60	100
	2014	16 615 254	49 000	54 801	61 000	4	133	220
	2015	16 802 238	41 000	46 361	52 000	4	111	190
	2016	16 987 281	29 000	32 789	37 000	2	77	130
	2017	17 170 973	30 000	34 766	40 000	3	80	140
	2018	17 352 838	11 000	12 708	15 000	0	27	48
	2019	17 532 354	18 000	21 146	25 000	1	47	82
Bhutan[1,2]	2000	437 350	–	5 935	–	–	15	–
	2001	446 695	–	5 982	–	–	14	–
	2002	455 858	–	6 511	–	–	11	–
	2003	464 601	–	3 806	–	–	14	–
	2004	472 718	–	2 670	–	–	7	–
	2005	480 070	–	1 825	–	–	5	–
	2006	486 478	–	1 868	–	–	7	–
	2007	492 006	–	793	–	–	2	–
	2008	496 992	–	329	–	–	2	–
	2009	501 963	–	972	–	–	4	–
	2010	507 271	–	436	–	–	2	–
	2011	513 039	–	194	–	–	1	–
	2012	519 170	–	82	–	–	1	–
	2013	525 573	–	15	–	–	0	–
	2014	532 099	–	19	–	–	0	–
	2015	538 634	–	34	–	–	0	–
	2016	545 162	–	15	–	–	0	–
	2017	551 716	–	11	–	–	0	–
	2018	558 253	–	6	–	–	0	–
	2019	564 689	–	2	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
SOUTH-EAST ASIA								
Democratic People's Republic of Korea[1,2]	2000	8 953 346	–	90 582	–	–	0	–
	2001	9 032 966	–	115 615	–	–	0	–
	2002	9 113 589	–	98 852	–	–	0	–
	2003	9 192 849	–	16 538	–	–	0	–
	2004	9 267 160	–	15 827	–	–	0	–
	2005	9 334 099	–	6 728	–	–	0	–
	2006	9 392 944	–	6 913	–	–	0	–
	2007	9 445 059	–	4 795	–	–	0	–
	2008	9 492 624	–	16 611	–	–	0	–
	2009	9 538 778	–	14 632	–	–	0	–
	2010	9 585 831	–	13 520	–	–	0	–
	2011	9 634 466	–	16 760	–	–	0	–
	2012	9 684 153	–	21 850	–	–	0	–
	2013	9 734 471	–	14 407	–	–	0	–
	2014	9 784 567	–	10 535	–	–	0	–
	2015	9 833 782	–	7 409	–	–	0	–
	2016	9 882 137	–	2 719	–	–	0	–
	2017	9 929 834	–	4 575	–	–	0	–
	2018	9 976 610	–	3 698	–	–	0	–
	2019	10 022 121	–	1 869	–	–	0	–
India	2000	987 264 165	15 390 000	19 660 000	25 490 000	2 700	29 513	53 100
	2001	1 004 480 209	15 870 000	20 040 000	25 970 000	2 890	28 615	50 700
	2002	1 021 595 666	14 700 000	18 910 000	24 730 000	2 660	27 222	48 800
	2003	1 038 607 248	15 800 000	20 230 000	25 970 000	2 890	27 849	49 100
	2004	1 055 520 127	17 220 000	22 450 000	29 460 000	3 120	31 216	56 200
	2005	1 072 326 769	18 120 000	24 310 000	33 220 000	3 450	32 652	60 200
	2006	1 089 030 372	14 660 000	19 930 000	27 640 000	2 740	27 978	52 100
	2007	1 105 590 990	14 160 000	19 140 000	27 120 000	2 620	27 675	52 800
	2008	1 121 905 943	14 480 000	20 110 000	28 940 000	2 720	29 921	57 400
	2009	1 137 843 607	14 850 000	20 650 000	30 080 000	2 710	32 024	62 500
	2010	1 153 312 308	14 940 000	20 220 000	28 460 000	2 750	30 529	57 800
	2011	1 168 268 867	12 800 000	17 280 000	23 980 000	2 410	25 632	48 500
	2012	1 182 744 981	10 310 000	14 020 000	19 830 000	1 940	20 436	39 000
	2013	1 196 818 869	8 160 000	10 950 000	15 270 000	1 510	16 697	31 400
	2014	1 210 609 238	8 375 000	11 120 000	15 460 000	1 390	20 096	38 200
	2015	1 224 206 387	8 956 000	11 860 000	16 170 000	1 460	21 707	41 100
	2016	1 237 628 916	8 819 000	12 410 000	17 950 000	1 540	22 404	43 600
	2017	1 250 859 601	6 774 000	9 310 000	13 180 000	1 190	16 245	31 300
	2018	1 263 908 968	4 645 000	6 736 000	9 397 000	940	9 618	18 200
	2019	1 276 780 904	3 723 000	5 551 000	7 850 000	770	7 705	14 600
Indonesia	2000	211 513 816	1 014 000	1 393 982	1 819 000	200	1 898	3 580
	2001	214 427 416	1 036 000	1 413 184	1 839 000	200	1 924	3 610
	2002	217 357 816	1 049 000	1 432 497	1 862 000	200	1 950	3 690
	2003	220 309 464	1 063 000	1 451 950	1 889 000	200	1 977	3 720
	2004	223 285 648	1 061 000	1 180 838	1 318 000	180	1 484	2 390
	2005	226 289 464	1 608 000	1 788 058	2 000 000	260	2 481	4 030
	2006	229 318 248	1 356 000	1 505 353	1 685 000	220	2 126	3 450
	2007	232 374 240	1 122 000	1 531 463	1 999 000	210	2 085	3 940
	2008	235 469 752	1 135 000	1 551 864	2 019 000	220	2 113	3 990
	2009	238 620 544	1 150 000	1 572 629	2 047 000	220	2 141	4 030
	2010	241 834 240	1 944 000	2 163 008	2 419 000	300	3 457	5 610
	2011	245 116 000	1 770 000	1 967 619	2 203 000	260	3 100	5 020
	2012	248 451 712	1 754 000	1 951 821	2 181 000	270	3 071	5 010
	2013	251 805 312	1 494 000	1 661 300	1 854 000	230	2 643	4 300
	2014	255 128 088	1 135 000	1 263 267	1 415 000	170	2 037	3 320
	2015	258 383 224	1 017 000	1 128 972	1 264 000	150	1 776	2 890
	2016	261 556 400	1 058 000	1 175 037	1 312 000	150	2 041	3 340
	2017	264 650 968	729 000	798 959	878 000	100	1 398	2 260
	2018	267 670 528	557 000	609 581	671 000	80	1 051	1 710
	2019	270 625 584	602 000	658 380	724 000	86	1 170	1 910
Myanmar	2000	27 806 631	945 000	1 357 303	2 010 000	160	2 746	5 590
	2001	28 107 446	951 000	1 371 987	2 012 000	160	2 776	5 790
	2002	28 391 369	970 000	1 385 845	2 048 000	160	2 804	5 810
	2003	28 657 265	983 000	1 398 824	2 077 000	170	2 830	5 810
	2004	28 904 615	997 000	1 410 898	2 086 000	160	2 854	5 870
	2005	29 134 019	995 000	1 422 096	2 073 000	160	2 877	5 890
	2006	29 342 994	660 000	1 017 917	1 576 000	120	2 041	4 330
	2007	29 533 711	943 000	1 285 851	1 840 000	150	2 561	5 090
	2008	29 717 127	1 153 000	1 573 811	2 263 000	180	3 222	6 460
	2009	29 908 014	1 098 000	1 492 380	2 129 000	170	3 023	6 020
	2010	30 116 600	1 368 000	2 017 344	3 123 000	240	3 882	8 150
	2011	30 348 592	1 024 000	1 326 604	1 779 000	160	2 479	4 660
	2012	30 600 405	1 348 000	1 892 905	2 771 000	220	3 680	7 410
	2013	30 861 549	454 000	611 838	846 000	73	1 169	2 300
	2014	31 116 493	281 000	383 705	534 000	46	729	1 450
	2015	31 354 512	220 000	271 877	328 000	34	482	850
	2016	31 571 437	211 000	261 099	314 000	33	440	770
	2017	31 772 210	167 000	206 263	248 000	26	357	620
	2018	31 966 116	152 000	187 624	226 000	25	297	520
	2019	32 166 754	61 000	75 513	91 000	10	96	170

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
SOUTH-EAST ASIA								
Nepal	2000	6 949 622	28 000	49 894	81 000	7	26	53
	2001	7 067 479	22 000	57 996	124 000	7	29	76
	2002	7 177 354	44 000	88 606	161 000	13	65	150
	2003	7 280 477	31 000	75 753	158 000	10	48	120
	2004	7 378 725	15 000	36 155	81 000	4	25	69
	2005	7 473 113	16 000	37 463	89 000	4	27	77
	2006	7 566 637	15 000	36 982	86 000	4	34	96
	2007	7 658 337	18 000	43 820	92 000	5	41	110
	2008	7 740 775	13 000	32 238	75 000	3	25	76
	2009	7 803 751	12 000	25 643	58 000	3	21	59
	2010	7 841 393	15 000	30 320	63 000	3	27	70
	2011	7 849 525	14 000	23 897	46 000	2	8	21
	2012	7 834 413	12 000	18 423	33 000	2	6	16
	2013	7 813 407	6 900	10 164	17 000	1	6	14
	2014	7 810 268	3 000	4 886	9 800	0	3	8
	2015	7 841 923	2 500	4 422	9 400	0	2	7
	2016	7 914 028	2 300	3 373	5 800	0	2	4
	2017	8 021 214	2 500	3 091	4 000	0	1	2
	2018	8 155 623	3 300	4 448	6 400	0	1	3
	2019	8 304 537	540	677	890	–	0	–
Sri Lanka[1,2,3]	2000	4 318 849	–	210 039	–	–	77	–
	2001	4 349 697	–	66 522	–	–	52	–
	2002	4 384 369	–	41 411	–	–	30	–
	2003	4 421 528	–	10 510	–	–	4	–
	2004	4 459 045	–	3 720	–	–	1	–
	2005	4 495 347	–	1 640	–	–	0	–
	2006	4 530 074	–	591	–	–	1	–
	2007	4 563 670	–	198	–	–	1	–
	2008	4 596 316	–	670	–	–	0	–
	2009	4 628 406	–	531	–	–	0	–
	2010	4 660 199	–	684	–	–	0	–
	2011	4 691 654	–	124	–	–	0	–
	2012	4 722 497	–	23	–	–	0	–
	2013	4 752 502	–	0	–	–	0	–
	2014	4 781 357	–	0	–	–	0	–
	2015	4 808 845	–	0	–	–	0	–
	2016	4 834 870	–	0	–	–	0	–
	2017	4 859 446	–	0	–	–	0	–
	2018	4 882 614	–	0	–	–	0	–
	2019	4 904 458	–	0	–	–	0	–
Thailand[1,2]	2000	11 945 892	–	81 692	–	–	625	–
	2001	12 057 196	–	63 528	–	–	424	–
	2002	12 157 749	–	44 555	–	–	361	–
	2003	12 248 982	–	37 355	–	–	204	–
	2004	12 333 510	–	26 690	–	–	230	–
	2005	12 413 376	–	29 591	–	–	161	–
	2006	12 488 587	–	30 115	–	–	113	–
	2007	12 558 708	–	33 162	–	–	97	–
	2008	12 624 918	–	30 988	–	–	101	–
	2009	12 688 650	–	35 597	–	–	70	–
	2010	12 750 928	–	22 949	–	–	80	–
	2011	12 812 287	–	14 465	–	–	43	–
	2012	12 872 552	–	29 059	–	–	37	–
	2013	12 931 104	–	30 218	–	–	47	–
	2014	12 986 935	–	34 844	–	–	38	–
	2015	13 039 267	–	23 540	–	–	33	–
	2016	13 087 996	–	17 800	–	–	27	–
	2017	13 133 254	–	8 417	–	–	15	–
	2018	13 174 743	–	6 094	–	–	8	–
	2019	13 212 150	–	3 538	–	–	13	–
Timor-Leste	2000	831 754	37 000	88 848	211 000	6	168	530
	2001	847 600	38 000	90 541	214 000	6	173	550
	2002	867 807	47 000	73 579	104 000	8	140	280
	2003	890 765	39 000	46 228	54 000	5	86	150
	2004	914 070	90 000	165 686	250 000	18	318	660
	2005	935 929	72 000	113 031	159 000	12	223	440
	2006	955 968	69 000	121 188	180 000	12	239	490
	2007	974 732	80 000	112 278	148 000	12	221	420
	2008	992 640	89 000	134 166	185 000	14	271	530
	2009	1 010 376	74 000	103 246	137 000	11	198	370
	2010	1 028 463	72 000	102 580	138 000	11	198	380
	2011	1 046 931	26 000	32 765	41 000	3	69	130
	2012	1 065 599	6 200	7 311	8 600	0	9	16
	2013	1 084 678	1 200	1 418	1 700	0	1	3
	2014	1 104 471	400	480	560	0	0	1
	2015	1 125 125	93	110	130	–	0	–
	2016	1 146 752	110	130	150	–	0	–
	2017	1 169 297	19	23	27	–	0	–
	2018	1 192 542	–	0	–	–	0	–
	2019	1 216 191	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
WESTERN PACIFIC								
Cambodia	2000	8 596 064	413 000	669 109	985 000	61	1 582	3 280
	2001	8 772 982	285 000	388 681	523 000	39	904	1 730
	2002	8 937 268	256 000	349 008	462 000	35	803	1 520
	2003	9 091 755	365 000	464 899	592 000	48	1 062	1 950
	2004	9 240 480	328 000	403 094	498 000	44	894	1 580
	2005	9 386 783	330 000	388 706	462 000	49	705	1 200
	2006	9 531 298	341 000	437 975	577 000	50	897	1 670
	2007	9 674 325	140 000	191 165	273 000	21	394	780
	2008	9 818 509	163 000	214 883	290 000	21	496	960
	2009	9 966 856	333 000	426 267	549 000	50	853	1 560
	2010	10 121 448	291 000	353 293	428 000	45	644	1 130
	2011	10 283 547	320 000	368 041	424 000	47	641	1 070
	2012	10 452 589	226 000	260 016	300 000	36	383	640
	2013	10 626 470	154 000	177 403	207 000	25	243	400
	2014	10 801 977	260 000	301 502	353 000	40	500	840
	2015	10 976 603	256 000	296 318	346 000	38	507	860
	2016	11 149 762	163 000	188 731	221 000	24	310	520
	2017	11 321 696	289 000	334 147	392 000	43	554	930
	2018	11 491 692	235 000	272 272	318 000	44	265	430
	2019	11 659 117	121 000	140 077	164 000	23	102	170
China[1,2]	2000	542 675 955	–	8 025	–	–	31	–
	2001	546 292 480	–	21 237	–	–	27	–
	2002	549 751 407	–	25 520	–	–	42	–
	2003	553 091 065	–	28 491	–	–	52	–
	2004	556 358 427	–	27 197	–	–	31	–
	2005	559 590 377	–	21 936	–	–	48	–
	2006	562 800 567	–	35 383	–	–	37	–
	2007	565 993 199	–	29 304	–	–	18	–
	2008	569 183 474	–	16 650	–	–	23	–
	2009	572 384 457	–	9 287	–	–	10	–
	2010	575 602 489	–	4 990	–	–	19	–
	2011	578 839 498	–	3 367	–	–	33	–
	2012	582 085 796	–	244	–	–	0	–
	2013	585 319 566	–	86	–	–	0	–
	2014	588 510 377	–	56	–	–	0	–
	2015	591 629 054	–	39	–	–	0	–
	2016	594 669 360	–	1	–	–	0	–
	2017	597 615 770	–	0	–	–	0	–
	2018	600 417 964	–	0	–	–	0	–
	2019	603 014 836	–	0	–	–	0	–
Lao People's Democratic Republic	2000	2 770 134	86 000	173 739	284 000	12	427	970
	2001	2 814 822	54 000	83 174	122 000	6	204	420
	2002	2 858 356	42 000	63 475	93 000	4	157	320
	2003	2 901 748	37 000	58 140	89 000	4	144	310
	2004	2 946 268	31 000	48 705	73 000	3	120	260
	2005	2 992 826	25 000	38 773	58 000	2	95	200
	2006	3 041 946	45 000	70 761	106 000	5	179	390
	2007	3 093 395	45 000	68 726	100 000	5	173	370
	2008	3 146 303	45 000	67 647	96 000	4	170	350
	2009	3 199 373	33 000	48 097	67 000	3	119	240
	2010	3 251 692	36 000	51 184	69 000	3	127	250
	2011	3 302 891	26 000	35 886	48 000	2	85	160
	2012	3 353 345	78 000	107 497	142 000	10	235	450
	2013	3 403 701	65 000	89 436	118 000	10	164	310
	2014	3 454 934	86 000	117 828	156 000	15	179	340
	2015	3 507 695	64 000	87 857	117 000	12	114	210
	2016	3 562 168	21 000	28 666	38 000	3	34	64
	2017	3 617 940	15 000	20 348	27 000	2	29	55
	2018	3 674 379	12 000	16 435	22 000	1	24	47
	2019	3 730 554	7 700	10 549	14 000	1	10	20
Malaysia[1,2]	2000	927 770	–	12 705	–	–	35	–
	2001	948 364	–	12 780	–	–	46	–
	2002	968 335	–	11 019	–	–	38	–
	2003	987 952	–	6 338	–	–	21	–
	2004	1 007 625	–	6 154	–	–	35	–
	2005	1 027 624	–	5 569	–	–	33	–
	2006	1 048 078	–	5 294	–	–	21	–
	2007	1 068 814	–	4 048	–	–	15	–
	2008	1 089 440	–	6 071	–	–	20	–
	2009	1 109 401	–	5 955	–	–	23	–
	2010	1 128 321	–	5 194	–	–	13	–
	2011	1 146 038	–	3 954	–	–	12	–
	2012	1 162 727	–	3 662	–	–	12	–
	2013	1 178 756	–	2 921	–	–	10	–
	2014	1 194 664	–	3 147	–	–	4	–
	2015	1 210 838	–	242	–	–	4	–
	2016	1 227 386	–	266	–	–	2	–
	2017	1 244 186	–	85	–	–	0	–
	2018	1 261 121	–	0	–	–	0	–
	2019	1 277 991	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
WESTERN PACIFIC								
Papua New Guinea	2000	5 847 590	496 000	1 523 740	2 741 000	120	3 274	8 090
	2001	5 974 627	527 000	1 519 641	2 671 000	130	3 237	7 720
	2002	6 098 621	392 000	1 314 224	2 378 000	110	2 802	6 780
	2003	6 223 378	434 000	1 432 124	2 603 000	120	3 025	7 510
	2004	6 354 247	667 000	1 853 465	3 275 000	160	3 817	9 310
	2005	6 494 902	512 000	1 549 081	2 785 000	140	3 063	7 410
	2006	6 646 891	544 000	1 640 034	2 906 000	150	3 236	7 800
	2007	6 808 503	460 000	1 398 768	2 531 000	120	2 911	7 090
	2008	6 976 200	445 000	1 326 406	2 410 000	110	2 768	6 800
	2009	7 144 774	709 000	1 774 239	3 073 000	160	3 770	9 010
	2010	7 310 512	446 000	1 240 109	2 178 000	110	2 633	6 300
	2011	7 472 196	385 000	1 045 967	1 833 000	87	2 344	5 620
	2012	7 631 003	470 000	1 413 033	2 830 000	110	3 044	8 030
	2013	7 788 388	897 000	1 596 966	2 473 000	130	3 848	8 340
	2014	7 946 733	1 097 000	1 831 551	2 794 000	200	3 535	7 450
	2015	8 107 772	654 000	963 545	1 335 000	100	2 012	3 950
	2016	8 271 766	966 000	1 346 118	1 809 000	150	2 848	5 480
	2017	8 438 038	1 012 000	1 477 804	2 029 000	170	3 006	5 860
	2018	8 606 324	1 098 000	1 587 573	2 179 000	180	3 124	6 070
	2019	8 776 119	1 023 000	1 372 189	1 770 000	160	2 745	5 130
Philippines	2000	45 292 927	88 000	119 377	158 000	9	305	590
	2001	46 269 230	83 000	112 964	149 000	9	289	560
	2002	47 252 061	89 000	121 077	159 000	9	309	600
	2003	48 231 599	115 000	156 723	205 000	12	401	770
	2004	49 194 798	121 000	169 772	229 000	13	434	860
	2005	50 133 100	108 000	151 755	203 000	16	306	590
	2006	51 040 472	82 000	118 908	162 000	13	234	460
	2007	51 921 338	77 000	112 751	152 000	12	217	420
	2008	52 790 413	49 000	74 621	102 000	8	142	280
	2009	53 668 594	40 000	58 667	79 000	6	114	220
	2010	54 570 267	37 000	53 401	71 000	5	112	220
	2011	55 501 351	17 000	23 891	31 000	2	47	90
	2012	56 455 261	14 000	19 138	25 000	1	35	67
	2013	57 418 667	13 000	17 518	23 000	1	35	68
	2014	58 371 998	11 000	14 543	19 000	0	31	58
	2015	59 301 219	22 000	29 896	39 000	2	66	130
	2016	60 201 724	12 000	17 491	23 000	1	38	74
	2017	61 078 112	12 000	16 724	22 000	1	36	72
	2018	61 936 727	7 900	11 149	15 000	0	25	50
	2019	62 787 645	22 000	40 873	178 000	2	94	460
Republic of Korea[1,2]	2000	3 316 546	–	4 183	–	–	0	–
	2001	3 339 435	–	2 556	–	–	0	–
	2002	3 359 968	–	1 799	–	–	0	–
	2003	3 378 263	–	1 171	–	–	0	–
	2004	3 394 540	–	864	–	–	0	–
	2005	3 409 074	–	1 369	–	–	0	–
	2006	3 421 631	–	2 051	–	–	0	–
	2007	3 432 437	–	2 227	–	–	1	–
	2008	3 442 772	–	1 052	–	–	0	–
	2009	3 454 321	–	898	–	–	1	–
	2010	3 468 194	–	1 267	–	–	1	–
	2011	3 485 030	–	505	–	–	2	–
	2012	3 504 244	–	394	–	–	0	–
	2013	3 524 200	–	383	–	–	0	–
	2014	3 542 553	–	557	–	–	0	–
	2015	3 557 616	–	627	–	–	0	–
	2016	3 568 841	–	602	–	–	0	–
	2017	3 576 748	–	436	–	–	0	–
	2018	3 582 018	–	501	–	–	0	–
	2019	3 585 772	–	485	–	–	1	–
Solomon Islands	2000	408 538	132 000	254 582	421 000	27	476	1 070
	2001	419 709	155 000	285 929	461 000	32	521	1 150
	2002	431 079	152 000	280 109	456 000	30	513	1 140
	2003	442 545	166 000	238 969	347 000	28	456	920
	2004	453 963	187 000	337 528	542 000	36	652	1 430
	2005	465 218	151 000	285 544	464 000	31	546	1 220
	2006	476 275	150 000	281 608	464 000	29	549	1 240
	2007	487 211	111 000	155 491	222 000	18	310	630
	2008	498 332	67 000	92 630	132 000	10	180	360
	2009	510 030	54 000	75 305	108 000	8	142	290
	2010	522 582	66 000	91 425	131 000	10	163	320
	2011	536 106	44 000	62 676	92 000	7	108	220
	2012	550 505	39 000	52 221	73 000	6	89	180
	2013	565 615	40 000	53 689	75 000	6	83	160
	2014	581 208	25 000	30 591	39 000	3	48	88
	2015	597 101	33 000	39 916	49 000	5	57	99
	2016	613 243	72 000	84 451	101 000	12	103	170
	2017	629 669	80 000	103 482	139 000	14	134	250
	2018	646 327	75 000	86 348	102 000	12	109	180
	2019	663 122	122 000	164 358	230 000	25	186	360

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
WESTERN PACIFIC								
Vanuatu	2000	184 964	13 000	23 167	38 000	2	34	75
	2001	189 209	13 000	18 702	27 000	1	24	49
	2002	193 927	25 000	36 655	53 000	4	52	100
	2003	198 960	28 000	42 687	64 000	5	68	140
	2004	204 123	23 000	33 102	45 000	3	49	93
	2005	209 282	17 000	25 624	39 000	3	35	71
	2006	214 379	14 000	22 943	35 000	2	30	63
	2007	219 464	15 000	27 312	117 000	3	36	170
	2008	224 700	13 000	26 771	116 000	2	37	180
	2009	230 244	8 100	14 887	25 000	1	22	51
	2010	236 216	13 000	15 669	20 000	1	20	35
	2011	242 658	8 900	11 631	16 000	1	14	27
	2012	249 505	6 400	8 394	11 000	–	0	–
	2013	256 637	4 100	5 326	7 200	–	0	–
	2014	263 888	1 900	2 427	3 300	–	0	–
	2015	271 128	680	787	920	–	0	–
	2016	278 326	3 200	4 177	5 600	–	0	–
	2017	285 499	1 700	2 268	3 100	–	0	–
	2018	292 675	900	1 167	1 600	–	0	–
	2019	299 882	800	1 047	1 400	–	0	–
Viet Nam	2000	58 893 103	158 000	201 414	270 000	22	421	800
	2001	59 506 334	148 000	185 145	241 000	21	380	700
	2002	60 089 950	105 000	131 451	172 000	14	271	500
	2003	60 655 409	78 000	96 592	125 000	11	197	360
	2004	61 216 381	47 000	56 559	72 000	6	115	210
	2005	61 783 751	34 000	40 604	51 000	4	79	140
	2006	62 362 205	37 000	43 620	54 000	4	92	160
	2007	62 953 293	24 000	28 022	34 000	2	53	92
	2008	63 560 457	16 000	17 911	22 000	1	37	65
	2009	64 186 031	21 000	22 853	26 000	1	47	81
	2010	64 831 191	21 000	22 959	26 000	2	45	75
	2011	65 497 232	19 000	20 206	23 000	2	35	58
	2012	66 183 027	22 000	23 838	27 000	2	40	66
	2013	66 883 664	19 000	20 760	23 000	2	33	55
	2014	67 592 103	18 000	19 060	21 000	2	29	47
	2015	68 301 988	10 000	11 283	13 000	1	16	25
	2016	69 011 962	4 600	5 024	5 600	0	7	12
	2017	69 719 636	5 000	5 481	6 100	0	9	15
	2018	70 416 327	5 300	5 794	6 500	0	9	16
	2019	71 091 518	8 900	9 702	11 000	0	17	29

Data as of 1 March 2021

"–" refers to not applicable.

[1] The number of indigenous malaria cases registered by the NMPs is reported here without further adjustments.

[2] The number of indigenous malaria deaths registered by the NMPs is reported here without further adjustments.

[3] Certified malaria free countries are included in this listing for historical purposes.

[4] South Sudan became an independent state on 9 July 2011 and a Member State of WHO on 27 September 2011. South Sudan and Sudan have distinct epidemiological profiles comprising high-transmission and low-transmission areas respectively. For this reason, data up to June 2011 from the Sudanese high-transmission areas (10 southern states, which correspond to South Sudan) and low-transmission areas (15 northern states which correspond to contemporary Sudan) are reported separately.

Note: Population denominator for incidence and mortality rate is based on the United Nations population, times the proportion of the population at risk at baseline.

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
REGIONAL SUMMARY								
African	2000	561 491 220	189 000 000	204 000 000	223 000 000	657 000	680 000	713 000
	2001	576 919 091	194 000 000	210 000 000	230 000 000	662 000	686 000	720 000
	2002	592 809 433	191 000 000	207 000 000	227 000 000	661 000	686 000	721 000
	2003	609 224 535	194 000 000	211 000 000	234 000 000	644 000	672 000	717 000
	2004	626 241 488	194 000 000	214 000 000	242 000 000	671 000	706 000	771 000
	2005	643 915 606	193 000 000	211 000 000	234 000 000	624 000	653 000	703 000
	2006	662 275 145	193 000 000	211 000 000	235 000 000	637 000	667 000	713 000
	2007	681 309 516	193 000 000	211 000 000	234 000 000	610 000	638 000	678 000
	2008	700 984 911	193 000 000	211 000 000	232 000 000	567 000	591 000	625 000
	2009	721 246 235	196 000 000	215 000 000	239 000 000	538 000	569 000	618 000
	2010	742 051 594	195 000 000	215 000 000	239 000 000	509 000	542 000	597 000
	2011	763 387 435	192 000 000	211 000 000	234 000 000	474 000	502 000	544 000
	2012	785 261 042	190 000 000	209 000 000	231 000 000	449 000	478 000	522 000
	2013	807 674 868	186 000 000	205 000 000	227 000 000	424 000	454 000	500 000
	2014	830 636 714	182 000 000	197 000 000	215 000 000	414 000	436 000	469 000
	2015	854 148 154	183 000 000	199 000 000	218 000 000	397 000	418 000	453 000
	2016	878 208 893	189 000 000	205 000 000	225 000 000	376 000	395 000	430 000
	2017	902 801 345	196 000 000	212 000 000	234 000 000	369 000	390 000	428 000
	2018	927 906 329	195 000 000	212 000 000	234 000 000	367 000	386 000	429 000
	2019	953 437 537	197 000 000	215 000 000	237 000 000	365 000	386 000	433 000
Americas	2000	109 188 092	1 392 000	1 540 000	1 701 000	666	909	1 168
	2001	110 990 578	1 171 000	1 297 000	1 432 000	593	832	1 090
	2002	112 769 369	1 078 000	1 183 000	1 298 000	514	764	1 030
	2003	114 521 921	1 067 000	1 159 000	1 262 000	480	725	992
	2004	116 248 867	1 067 000	1 146 000	1 234 000	460	710	986
	2005	117 950 571	1 211 000	1 283 000	1 371 000	443	692	968
	2006	119 623 022	1 042 000	1 106 000	1 181 000	348	586	852
	2007	121 266 287	912 000	994 000	1 080 000	297	503	744
	2008	122 889 430	645 000	699 000	762 000	224	471	756
	2009	124 504 289	634 000	687 000	751 000	227	463	740
	2010	126 117 540	745 000	821 000	906 000	250	507	791
	2011	127 738 849	567 000	611 000	667 000	206	468	733
	2012	129 363 963	542 000	580 000	627 000	211	416	622
	2013	130 968 623	520 000	562 000	612 000	227	436	642
	2014	132 521 808	447 000	477 000	512 000	196	348	484
	2015	134 002 794	525 000	561 000	602 000	216	398	551
	2016	135 398 190	625 000	677 000	736 000	252	515	731
	2017	136 722 017	852 000	915 000	998 000	287	655	947
	2018	138 017 933	861 000	926 000	1 007 000	243	602	880
	2019	139 345 434	822 000	889 000	970 000	220	551	813
Eastern Mediterranean	2000	328 684 376	5 500 000	7 000 000	11 500 000	4 000	12 000	22 000
	2001	336 594 828	5 600 000	7 200 000	12 000 000	4 200	12 700	22 500
	2002	344 615 001	5 300 000	6 800 000	12 400 000	4 400	11 600	20 000
	2003	352 797 295	5 000 000	6 400 000	10 800 000	3 800	10 800	18 600
	2004	361 206 289	4 100 000	5 300 000	9 000 000	2 800	9 400	16 300
	2005	369 878 322	4 300 000	5 500 000	9 800 000	3 200	10 300	17 800
	2006	378 856 185	4 100 000	5 500 000	10 300 000	3 300	10 100	17 400
	2007	388 103 609	3 700 000	4 800 000	6 600 000	3 600	9 800	17 000
	2008	397 480 796	2 900 000	3 700 000	5 200 000	2 500	7 200	12 300
	2009	406 794 797	2 700 000	3 600 000	5 300 000	2 500	6 900	12 200
	2010	415 912 919	3 400 000	4 500 000	6 500 000	3 500	8 700	14 800
	2011	424 785 396	3 500 000	4 600 000	6 600 000	3 200	7 900	12 800
	2012	433 470 308	3 300 000	4 300 000	6 100 000	3 000	8 000	12 900
	2013	442 075 956	3 200 000	4 100 000	5 500 000	2 800	7 300	11 700
	2014	450 763 360	3 300 000	4 200 000	5 700 000	2 800	7 500	12 200
	2015	459 654 774	3 200 000	4 100 000	5 500 000	2 600	7 900	13 100
	2016	468 761 207	4 200 000	5 200 000	6 700 000	3 400	9 100	15 000
	2017	478 058 244	4 000 000	5 000 000	6 600 000	3 200	9 500	16 500
	2018	487 588 434	4 200 000	5 400 000	7 200 000	3 100	9 800	17 600
	2019	497 395 568	3 900 000	5 200 000	7 300 000	2 900	10 100	19 000
European	2000	28 566 102	–	32 570	–	–	0	–
	2001	28 668 063	–	23 887	–	–	0	–
	2002	28 842 570	–	20 251	–	–	0	–
	2003	29 072 303	–	16 026	–	–	0	–
	2004	29 330 475	–	9 742	–	–	0	–
	2005	29 598 155	–	5 126	–	–	0	–
	2006	29 867 767	–	2 733	–	–	0	–
	2007	30 146 384	–	1 206	–	–	0	–
	2008	30 446 718	–	587	–	–	0	–
	2009	30 787 934	–	285	–	–	0	–
	2010	31 182 302	–	167	–	–	0	–
	2011	31 632 431	–	69	–	–	0	–
	2012	32 128 698	–	21	–	–	0	–
	2013	32 656 353	–	3	–	–	0	–
	2014	33 194 813	–	2	–	–	0	–
	2015	33 727 977	–	0	–	–	0	–
	2016	34 251 046	–	0	–	–	0	–
	2017	34 764 115	–	0	–	–	0	–
	2018	35 261 935	–	0	–	–	0	–
	2019	35 739 944	–	0	–	–	0	–

ANNEX 3 – F. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND ESTIMATED MALARIA CASES AND DEATHS, 2000–2019

WHO region Country/area	Year	Population denominator for incidence and mortality rate	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
REGIONAL SUMMARY								
South-East Asia	2000	1 273 748 475	18 700 000	23 000 000	29 100 000	8 000	35 000	59 000
	2001	1 294 805 142	19 100 000	23 300 000	29 200 000	7 000	34 000	57 000
	2002	1 315 746 945	17 900 000	22 200 000	28 000 000	7 000	33 000	55 000
	2003	1 336 567 318	18 900 000	23 400 000	29 300 000	7 000	33 000	55 000
	2004	1 357 265 769	20 200 000	25 400 000	32 400 000	8 000	36 000	62 000
	2005	1 377 832 673	21 600 000	27 800 000	36 700 000	9 000	39 000	66 000
	2006	1 398 265 555	17 500 000	22 700 000	30 400 000	7 000	33 000	57 000
	2007	1 418 531 724	17 100 000	22 200 000	30 300 000	7 000	33 000	58 000
	2008	1 438 554 112	18 000 000	23 600 000	32 200 000	7 000	36 000	64 000
	2009	1 458 235 381	18 100 000	24 000 000	33 500 000	7 000	38 000	69 000
	2010	1 477 506 020	19 400 000	24 600 000	33 100 000	9 000	38 000	66 000
	2011	1 496 332 701	16 200 000	20 700 000	27 900 000	7 000	31 000	55 000
	2012	1 514 733 127	14 200 000	18 000 000	24 000 000	7 000	27 000	46 000
	2013	1 532 753 900	10 500 000	13 300 000	17 400 000	4 000	21 000	36 000
	2014	1 550 468 770	10 100 000	12 900 000	17 300 000	3 000	23 000	41 000
	2015	1 567 933 937	10 400 000	13 300 000	17 700 000	3 000	24 000	43 000
	2016	1 585 154 979	10 400 000	13 900 000	19 500 000	3 000	25 000	47 000
	2017	1 602 118 513	7 800 000	10 400 000	14 100 000	3 000	18 000	34 000
	2018	1 618 838 835	5 500 000	7 600 000	10 300 000	2 000	11 000	20 000
	2019	1 635 329 742	4 500 000	6 300 000	8 600 000	2 000	9 000	16 000
Western Pacific	2000	668 913 591	1 894 000	2 990 000	4 289 000	2 200	6 600	11 800
	2001	674 527 192	1 621 000	2 631 000	3 850 000	1 800	5 600	10 300
	2002	679 940 972	1 411 000	2 334 000	3 427 000	1 600	5 000	9 300
	2003	685 202 674	1 523 000	2 526 000	3 674 000	1 700	5 400	10 000
	2004	690 370 852	1 718 000	2 936 000	4 350 000	1 800	6 100	11 700
	2005	695 492 937	1 455 000	2 509 000	3 787 000	1 500	4 900	9 500
	2006	700 583 742	1 585 000	2 659 000	3 987 000	1 600	5 300	9 800
	2007	705 651 979	1 109 000	2 018 000	3 145 000	1 100	4 100	8 400
	2008	710 730 600	964 000	1 845 000	2 949 000	900	3 900	7 900
	2009	715 854 081	1 341 000	2 436 000	3 760 000	900	5 100	10 200
	2010	721 042 912	1 058 000	1 839 000	2 816 000	800	3 800	7 500
	2011	726 306 547	927 000	1 576 000	2 343 000	600	3 300	6 700
	2012	731 628 002	969 000	1 888 000	3 273 000	700	3 800	8 800
	2013	736 965 664	1 269 000	1 964 000	2 860 000	600	4 400	8 800
	2014	742 260 435	1 603 000	2 321 000	3 326 000	700	4 300	8 200
	2015	747 461 014	1 122 000	1 431 000	1 820 000	500	2 800	4 800
	2016	752 554 538	1 291 000	1 676 000	2 134 000	500	3 300	6 000
	2017	757 527 294	1 503 000	1 961 000	2 538 000	600	3 800	6 700
	2018	762 325 554	1 495 000	1 981 000	2 577 000	500	3 600	6 600
	2019	766 886 556	1 394 000	1 739 000	2 181 000	500	3 200	5 600
Total	2000	2 970 591 856	222 000 000	238 000 000	259 000 000	697 000	736 000	782 000
	2001	3 022 504 894	228 000 000	244 000 000	265 000 000	700 000	739 000	786 000
	2002	3 074 724 290	223 000 000	239 000 000	260 000 000	698 000	736 000	783 000
	2003	3 127 386 046	226 000 000	244 000 000	268 000 000	681 000	723 000	775 000
	2004	3 180 663 740	227 000 000	248 000 000	277 000 000	708 000	759 000	830 000
	2005	3 234 668 264	229 000 000	247 000 000	272 000 000	662 000	708 000	765 000
	2006	3 289 471 416	223 000 000	242 000 000	268 000 000	675 000	716 000	771 000
	2007	3 345 009 499	222 000 000	241 000 000	265 000 000	644 000	685 000	735 000
	2008	3 401 086 567	222 000 000	240 000 000	264 000 000	599 000	638 000	685 000
	2009	3 457 422 717	226 000 000	246 000 000	271 000 000	572 000	620 000	681 000
	2010	3 513 813 287	226 000 000	247 000 000	273 000 000	546 000	594 000	658 000
	2011	3 570 183 359	218 000 000	239 000 000	262 000 000	505 000	545 000	596 000
	2012	3 626 585 140	213 000 000	234 000 000	258 000 000	481 000	517 000	568 000
	2013	3 683 095 364	206 000 000	225 000 000	248 000 000	451 000	487 000	538 000
	2014	3 739 845 900	201 000 000	217 000 000	236 000 000	440 000	471 000	511 000
	2015	3 796 928 650	203 000 000	218 000 000	238 000 000	422 000	453 000	496 000
	2016	3 854 328 853	210 000 000	226 000 000	247 000 000	403 000	433 000	478 000
	2017	3 911 991 528	213 000 000	231 000 000	252 000 000	396 000	422 000	467 000
	2018	3 969 939 020	211 000 000	228 000 000	250 000 000	389 000	411 000	458 000
	2019	4 028 134 781	211 000 000	229 000 000	252 000 000	387 000	409 000	460 000

Data as of 1 March 2021

ANNEX 3 – G. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND REPORTED MALARIA CASES BY PLACE OF CARE, 2019

WHO region Country/area	Population				Public sector		Private sector		Community level	
	UN population	At risk (low + high)	At risk (high)	Number of people living in active foci	Presumed	Confirmed	Presumed	Confirmed	Presumed	Confirmed
AFRICAN										
Angola	31 825 299	31 825 299	31 825 299	–	475 810	6 575 539	–	–	0	479 439
Benin	11 801 151	11 801 151	11 801 151	–	73 703	2 129 817	114 944	362 795	0	403 266
Botswana	2 303 703	1 527 309	97 032	486 563	0	272 [5]	–	–	–	–
Burkina Faso	20 321 383	20 321 383	20 321 383	–	597 601	5 877 426 [5]	–	–	–	–
Burundi	11 530 577	11 530 577	11 530 577	–	19 299	8 188 304	5 011	542 598	0	1 228 631
Cabo Verde	549 936	142 983	0	4 521	0	40 [4]	–	–	–	–
Cameroon	25 876 387	25 876 387	18 372 235	–	110 739	1 505 465	80 591	1 123 247	0	191 091
Central African Republic	4 745 179	4 745 179	4 745 179	–	252 123	1 410 908	39 414	235 859	0	770 193
Chad	15 946 882	15 772 264	10 741 022	–	223 617	1 230 171	0	13 574	54 372	388 784
Comoros	850 891	850 891	404 854	873 724	–	17 697	–	–	–	–
Congo	5 380 504	5 380 504	5 380 504	–	427 959	117 837	–	–	–	–
Côte d'Ivoire	25 716 554	25 716 554	25 716 554	–	15 158	5 895 048	0	40 130	–	–
Democratic Republic of the Congo	86 790 564	86 790 564	84 186 847	–	–	18 809 460	–	–	0	1 670 850
Equatorial Guinea	1 355 982	1 355 982	1 355 982	–	17 993	25 904 [5]	–	–	–	–
Eritrea	3 497 117	3 497 117	2 482 953	–	–	68 375	–	–	–	25 503
Eswatini	1 148 133	321 477	0	–	0	577 [5]			–	–
Ethiopia	112 078 736	76 213 540	30 485 416	–	111 297	904 495	–	–	–	–
Gabon	2 172 578	2 172 578	2 172 578	–	89 735	53 182	–	–	–	–
Gambia	2 347 696	2 347 696	2 347 696	–	0	50 878	–	2 258	–	250
Ghana	30 417 858	30 417 858	30 417 858	–	347 037	3 274 299	175 948	1 107 581	65 435	1 733 387
Guinea	12 771 246	12 771 246	12 771 246	–	–	1 783 753	0	50 103	0	309 369
Guinea-Bissau	1 920 917	1 920 917	1 920 917	–	–	151 857	–	4 900	–	4 150
Kenya	52 573 968	52 573 968	36 904 297	–	–	4 656 702 [4]	–	–	–	362 687
Liberia	4 937 374	4 937 374	4 937 374	–	102 155	707 630	23 800	208 215	–	–
Madagascar	26 969 306	26 969 306	23 670 420	–	13 476	970 828	–	–	–	–
Malawi	18 628 749	18 628 749	18 628 749	–	21 813	4 317 906	–	–	0	866 201
Mali	19 658 023	19 658 023	17 918 681	–	360 269	2 832 997	–	90 633	25 433	297 905
Mauritania	4 525 698	4 525 698	2 917 627	–	120 251	14 869	–	–	–	–
Mayotte		–	–	–	–	–	–	–	–	–
Mozambique	30 366 043	30 366 043	30 366 043	–	39 436	10 864 677	–	–	7 154	870 249
Namibia*	2 494 524	1 980 028	1 151 497	–	0	3 428	–	–	0	12
Niger	23 310 719	23 310 719	23 310 719	–	–	3 431 534	0	91 890	0	248 027
Nigeria	200 963 608	200 963 608	153 491 985	–	2 923 017	17 322 638	646 861	2 032 897	–	451 380
Rwanda	12 626 938	12 626 938	12 626 938	–	0	1 093 753	0	471 206	0	2 047 863
Sao Tome and Principe	215 048	215 048	215 048	–	0	2 457	–	–	0	285
Senegal	16 296 362	16 296 362	16 202 332	–	4 538	274 467 [4]	–	–	1 689	80 241
Sierra Leone	7 813 207	7 813 207	7 813 207	–	2 442 191	2 407 505 [3]	–	–	–	–
South Africa	58 558 268	5 855 827	2 342 331	–	0	13 833	–	–	–	–
South Sudan[1]	11 062 114	11 062 114	11 062 114	–	2 160 920	1 903 742 [3]	–	–	–	–
Togo	8 082 359	8 082 359	8 082 359	–	0	1 611 364 [4]	–	–	0	794 727
Uganda	44 269 584	44 269 584	44 269 584	–	1 141 110	10 086 845	391 764	1 681 636	77 557	2 213 881
United Republic of Tanzania[2]	58 005 458	58 005 458	4 234 398	–	89 748	5 619 657	–	293 927	–	–
Mainland	56 364 236	56 364 236	41 145 892	–	89 748	5 612 694	–	293 927	–	–
Zanzibar	1 641 222	1 641 222	1 005 806	–	0	6 963 [4]	–	–	–	–
Zambia	17 861 034	17 861 034	17 861 034	–	212 670	5 147 350	–	–	–	–
Zimbabwe	14 645 473	11 532 241	4 190 949	–	–	177 289	–	8 761	–	122 123
AMERICAS										
Belize	390 351	269 342	0	18 968	0	2 [5]	–	–	–	–
Bolivia (Plurinational State of)	11 513 102	5 223 149	287 597	14 869	0	9 357 [5]	–	–	–	–
Brazil	211 049 544	42 843 057	4 854 140	–	0	157 454 [4]	–	–	–	–
Colombia	50 339 446	11 144 650	5 058 108	9 710 964	0	80 415 [5]	–	–	–	–
Costa Rica	5 047 561	1 766 646	50 476	172 541	0	145 [5]	–	–	–	–
Dominican Republic*	10 738 957	5 915 232	151 956	–	0	1 314 [5]	–	–	–	–
Ecuador	17 373 657	506 268	158 795	–	0	1 909 [5]	–	–	–	–
El Salvador	6 453 550	1 310 071	0	0	0	3 [4]	–	–	–	–
French Guiana	291 000	161 004	26 859	–	0	212 [5]	–	–	–	–
Guatemala*	17 581 476	13 272 608	2 398 641	–	0	2 072 [5]	–	–	–	–
Guyana	782 775	782 775	85 432	–	0	18 826 [4]	–	–	–	–
Haiti	11 263 079	10 062 660	2 730 058	–	–	6 717	–	1 968	–	2 002
Honduras*	9 746 115	8 828 031	2 484 090	–	0	391 [5]	–	–	–	–

ANNEX 3 – G. POPULATION DENOMINATOR FOR CASE INCIDENCE AND MORTALITY RATE, AND REPORTED MALARIA CASES BY PLACE OF CARE, 2019

WHO region Country/area	Population				Public sector		Private sector		Community level	
	UN population	At risk (low + high)	At risk (high)	Number of people living in active foci	Presumed	Confirmed	Presumed	Confirmed	Presumed	Confirmed
AMERICAS										
Mexico*	127 575 524	2 704 601	127 576	1 975 222	0	641 [4]	–	–	–	–
Nicaragua	6 545 503	2 857 112	561 801	–	0	13 226 [5]	–	–	–	–
Panama	4 246 440	4 108 133	178 945	46 429	0	1 597 [5]	–	–	–	–
Peru	32 510 462	12 768 809	1 627 474	–	0	24 324 [4]	–	–	–	–
Suriname	581 363	85 867	24 685	1 157	0	215 [5]	–	–	–	–
Venezuela (Bolivarian Republic of)	28 515 829	14 257 915	5 913 755	–	0	492 753 [5]	–	–	–	–
EASTERN MEDITERRANEAN										
Afghanistan	38 041 754	29 322 964	10 358 009	–	976	173 860 [4]	–	–	58	–
Djibouti	973 557	730 090	341 796	–	–	49 402	–	–	–	–
Iran (Islamic Republic of)*	82 913 888	846 551	0	72 749	–	1 190 [5]	–	–	–	
Pakistan	216 565 320	212 907 532	62 624 194	–	0	290 712	0	122 821	–	–
Saudi Arabia	34 268 533	2 745 252	0	143 632	0	2 152 [4]	–	–	–	–
Somalia*	15 442 906	15 442 906	7 859 976	–	25 688	39 687 [3]	–	–	–	–
Sudan	42 813 236	42 813 236	37 204 702	–	1 816 930	1 752 011 [4]	–	–	–	–
Yemen	29 161 922	18 801 274	11 219 175	–	31 800	115 194	19 064	43 161	–	7 544
SOUTH-EAST ASIA										
Bangladesh	163 046 168	17 532 354	2 059 273	–	0	3 455	0	46	0	13 724
Bhutan	763 094	564 690	99 202	16 742	0	42 [4]	–	–	–	–
Democratic People's Republic of Korea	25 666 158	10 022 121	1 441 668	1 671 952	0	1 869 [5]	–	–	–	–
India	1 366 417 920	1 276 780 904	165 760 158	–	0	338 494 [5]	–	–	–	–
Indonesia	270 625 584	270 625 584	17 303 800	–	0	205 352	0	37 153	0	8 139
Myanmar	54 045 422	32 166 754	8 545 122	–	0	56 640 [5]	–		–	
Nepal	28 608 715	8 304 538	1 495 378	276 247	548	564	180	135	0	11
Thailand	69 625 584	13 212 151	1 541 510	274 079	0	4 237	0	421	0	763
Timor-Leste*	1 293 120	1 216 192	437 948	0	0	8	0	1	–	–
WESTERN PACIFIC										
Cambodia	16 486 542	11 659 118	7 934 313	–	0	15 599	–	–	0	16 598
China	1 441 860 352	603 014 836	201 860	0	5	2 482 [4]	–	–	–	–
Lao People's Democratic Republic	7 169 456	3 730 555	3 730 555	–	0	4 283	0	606	0	1 798
Malaysia[6]	31 949 789	1 277 992	958 494	9 211	0	3 941 [4]	–	–	–	–
Papua New Guinea	8 776 119	8 776 119	8 249 552	–	0	646 648	–	–	–	–
Philippines	108 116 620	813 684	428 437	519 001	0	2 081	0	386	0	3 311
Republic of Korea*	51 225 322	3 585 773	0	–	0	559 [4]	–	–	–	–
Solomon Islands	669 821	663 123	663 123	–	12 923	71 531	426	1 236	–	–
Vanuatu	299 882	299 882	260 672	–	0	576 [3]	–	–	–	–
Viet Nam*	96 462 116	71 091 518	6 557 012	–	1 222	4 665	0	100	–	–
REGIONAL SUMMARY										
African	1 045 213 130	950 833 144	789 192 269	1 364 808	12 483 413	137 152 432	1 478 333	8 656 137	231 640	15 560 494
Americas	552 545 734	138 867 930	26 720 388	11 940 150	0	811 573	0	1 968	0	2 002
Eastern Mediterranean	460 181 116	323 609 805	129 607 852	216 381	1 875 394	2 424 208	19 064	165 982	58	7 544
South-East Asia	1 980 091 765	1 630 425 288	198 684 059	2 239 020	548	610 661	180	37 756	0	22 637
Western Pacific	1 763 016 019	704 912 600	28 984 018	528 212	14 150	752 365	426	2 328	0	21 707
Total	**5 801 047 764**	**3 748 648 767**	**1 173 188 586**	**16 288 571**	**14 334 266**	**137 079 387**	**1 777 052**	**7 750 744**	**243 814**	**16 149 163**

Data as of 17 February 2021

RDT: rapid diagnostic testing; UN: United Nations; WHO: World Health Organization.

"–" refers to data not available.

* Confirmed cases are corrected for double counting of microscopy and RDT.

[1] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

[2] Where national data for the United Republic of Tanzania are unavailable, refer to Mainland and Zanzibar.

[3] Figures reported for the public sector include cases detected at the community level.

[4] Figures reported for the public sector include cases detected in the private sector.

[5] Figures reported for the public sector include cases detected at the community level and in the private sector.

[6] Figures include all imported or non-human malaria cases, none of them being indigenous malaria cases.

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Algeria[1]	Suspected cases	12 224	11 974	15 790	12 762	8 690	8 000	6 628	6 469	10 081	8 620
	Presumed and confirmed	408	191	887	603	266	747	432	453	1 242	1 014
	Microscopy examined	12 224	11 974	15 790	12 762	8 690	8 000	6 628	6 469	10 081	8 620
	Microscopy positive	408	191	887	603	266	747	432	453	1 242	1 014
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	396	187	828	587	260	727	420	446	1 241	1 014
Angola	Suspected cases	4 591 529	4 469 357	4 849 418	5 273 305	6 134 471	6 839 963	7 649 902	11 050 353	10 870 446	14 341 390
	Presumed and confirmed	3 687 574	3 501 953	3 031 546	3 144 100		3 254 270	4 301 146	4 500 221	5 928 260	7 530 788
	Microscopy examined	1 947 349	1 765 933	2 245 223	3 025 258	3 398 029	3 345 693	4 183 727	7 493 969	5 066 780	5 643 654
	Microscopy positive	1 324 264	1 147 473	1 056 563	1 462 941	1 431 313	1 396 773	2 058 128	2 199 810	2 442 500	2 557 385
	RDT examined	639 476	833 753	1 069 483	1 103 815	1 855 400	3 009 305	2 959 282	2 931 055	5 025 981	8 221 926
	RDT positive	358 606	484 809	440 271	536 927	867 666	1 372 532	1 736 125	1 675 082	2 708 075	4 497 593
Benin	Suspected cases	–	1 928 016	2 431 902	2 091 263	2 930 569	2 733 611	2 184 524	2 705 456	2 880 743	3 966 504
	Presumed and confirmed	1 873 015	1 786 864	2 069 728	1 717 115	2 122 011	2 042 684	1 667 005	1 968 532	2 255 946	3 084 525
	Microscopy examined	–	88 134	243 008	291 479	155 205	296 264	267 405	267 492	349 191	432 001
	Microscopy positive	–	68 745	–	99 368	108 714	108 061	104 601	208 823	258 519	294 518
	RDT examined	–	475 986	825 005	1 173 271	1 962 591	2 116 289	1 860 904	2 403 344	2 251 418	3 338 134
	RDT positive	–	354 223	705 839	991 234	1 200 524	1 613 565	1 506 189	1 725 089	1 717 293	2 601 360
Botswana	Suspected cases	12 196	1 141	308	506	1 485	1 298	12 986	12 605	13 979	16 564
	Presumed and confirmed	12 196	1 141	308	506	1 485	346	725	1 911	585	272
	Microscopy examined	–	–	–	–	–	–	5 178	5 223	872	707
	Microscopy positive	1 046	432	–	–	–	–	–	–	–	–
	RDT examined	–	–	–	–	–	1 284	7 806	7 380	13 107	15 857
	RDT positive	–	–	193	456	1 346	332	723	1 909	585	272
	Imported cases	–	–	–	30	30	48	64	62	51	103
Burkina Faso	Suspected cases	6 037 806	5 446 870	7 852 299	7 857 296	9 272 755	9 783 385	12 006 793	14 811 872	14 931 136	18 116 942
	Presumed and confirmed	5 723 481	5 024 697	6 970 700	7 146 026	8 278 408	8 286 453	9 799 818	12 255 671	11 991 146	6 475 027
	Microscopy examined	177 879	400 005	223 372	183 971	198 947	222 190	191 208	133 101	157 824	270 289
	Microscopy positive	88 540	83 857	90 089	82 875	83 259	92 589	80 077	46 411	56 989	52 582
	RDT examined	940 985	450 281	4 516 273	4 296 350	6 224 055	8 290 188	11 795 178	12 980 360	13 061 136	15 997 219
	RDT positive	715 999	344 256	3 767 957	3 686 176	5 345 396	6 922 857	9 699 334	10 510 849	10 221 981	5 824 844
Burundi	Suspected cases	5 590 736	4 780 117	4 270 100	7 507 441	7 831 895	8 761 333	13 022 128	13 956 707	8 734 322	16 214 258
	Presumed and confirmed	4 255 301	3 307 158	2 600 286	4 567 428	4 987 388	5 512 414	8 902 503	9 259 694	5 149 436	9 983 843
	Microscopy examined	2 825 558	2 859 720	2 659 372	4 123 012	4 471 998	3 254 670	3 941 251	3 814 355	1 542 232	3 858 517
	Microscopy positive	1 599 908	1 485 332	1 484 676	2 366 134	2 718 391	1 964 862	2 520 622	2 269 831	1 148 316	1 759 011
	RDT examined	273 324	188 476	1 177 132	2 995 339	3 098 808	5 422 959	8 971 550	9 678 610	7 009 165	12 331 431
	RDT positive	163 539	89 905	682 014	1 812 204	2 007 908	3 463 848	6 272 554	6 526 121	3 818 195	8 200 522
Cabo Verde	Suspected cases	47	26 508	8 715	10 621	6 894	3 117	8 393	3 857	16 623	13 463[#]
	Presumed and confirmed	47	36	36	46	46	28	75	446	21	40
	Microscopy examined	–	–	8 715	10 621	6 894	3 117	8 393	3 857	16 623	5 596
	Microscopy positive	47	–	36	46	46	28	75	446	21	40
	RDT examined	–	26 508	–	–	–	–	–	–	–	7 867
	RDT positive	–	36	–	–	–	–	–	–	–	40
	Imported cases	–	29	35	24	20	21	27	23	18	39
Cameroon	Suspected cases	–	3 134 048	3 031 461	4 132 326	3 709 906	3 378 923	4 665 318	5 098 975	5 036 256	4 743 338
	Presumed and confirmed	1 845 691	1 899 928	1 728 723	2 285 412	1 369 518	2 381 592	2 615 750	3 607 898	3 550 183	3 011 133
	Microscopy examined	–	1 110 308	1 182 610	1 236 306	1 086 095	1 024 306	1 373 802	627 709	658 017	1 527 436
	Microscopy positive	–	–	–	–	–	592 351	810 367	390 130	428 888	1 097 615
	RDT examined	–	141 686	186 784	653 189	1 254 293	1 166 306	3 151 919	3 108 156	3 085 689	2 716 410
	RDT positive	–	17 874	66 656	42 581	–	600 930	1 665 786	1 854 658	1 828 745	1 722 188
Central African Republic	Suspected cases	–	–	–	546 095	625 301	1 218 246	2 095 095	1 533 258	1 367 986	3 393 641
	Presumed and confirmed	66 484	221 980	500 806	454 532	495 238	953 535	1 607 079	1 296 277	995 157	2 708 497
	Microscopy examined	–	–	–	63 695	55 943	139 241	189 481	112 007	163 370	265 673
	Microscopy positive	–	–	–	36 943	41 436	106 524	144 924	28 855	117 267	196 413
	RDT examined	–	–	105 521	191 569	369 208	724 303	1 537 852	536 887	1 181 578	2 781 622
	RDT positive	–	–	87 566	126 758	253 652	492 309	1 094 393	383 058	854 852	2 220 547
Chad	Suspected cases	743 471	528 454	730 364	1 272 841	1 737 195	1 641 285	2 032 301	2 943 595	1 941 489	2 779 742
	Presumed and confirmed	544 243	528 454	668 285	1 272 841	1 513 772	1 490 556	1 402 215	1 962 372	1 364 706	1 910 518
	Microscopy examined	89 749	–	69 789	–	–	–	1 063 293	1 584 525	190 006	211 816
	Microscopy positive	75 342	86 348	7 710	206 082	160 260	149 574	720 765	1 064 354	137 501	152 127
	RDT examined	309 927	114 122	–	621 469	1 137 455	937 775	861 561	1 359 070	1 751 483	2 260 256
	RDT positive	125 106	94 778	–	548 483	753 772	637 472	574 003	898 018	1 227 205	1 480 402

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Comoros	Suspected cases	159 976	135 248	168 043	185 779	103 545	117 762	116 692	229 445	119 592	–
	Presumed and confirmed	103 670	76 661	65 139	62 565	2 465	2 101	1 734	3 896	19 682	17 697
	Microscopy examined	87 595	63 217	125 030	154 824	93 444	89 634	71 902	130 134	90 956	–
	Microscopy positive	35 199	22 278	45 507	46 130	1 987	963	559	1 325	9 197	–
	RDT examined	5 249	20 226	27 714	21 546	9 839	27 911	44 523	99 311	24 567	–
	RDT positive	1 339	2 578	4 333	7 026	216	921	908	2 571	6 416	–
	Imported cases	–	–	–	–	–	–	–	–	–	98
Congo	Suspected cases	–	–	–	209 169	290 346	300 592	466 254	322 916	385 729	594 237[#]
	Presumed and confirmed	446 656	277 263	120 319	183 026	248 159	264 574	374 252	297 652	324 615	545 796
	Microscopy examined	–	–	–	69 375	88 764	87 547	202 922	153 203	178 017	166 278
	Microscopy positive	–	37 744	120 319	43 232	54 523	51 529	134 612	127 939	116 903	117 837
	RDT examined	–	–	–	–	19 746	–	60 927	–	–	–
	RDT positive	–	–	–	–	11 800	–	37 235	–	–	–
Côte d'Ivoire	Suspected cases	–	2 607 856	3 423 623	6 003 033[#]	6 418 571	5 216 344	5 560 136[#]	7 262 684[#]	6 706 148	8 280 575
	Presumed and confirmed	1 721 461	2 588 004	2 795 919	4 725 798	4 658 774	3 606 725	3 754 504	4 149 665	5 297 926	5 950 336
	Microscopy examined	–	49 828	195 546	395 914	568 562	811 426	975 507	1 221 845	1 132 659	1 447 694
	Microscopy positive	62 726	29 976	107 563	215 104	306 926	478 870	579 566	588 969	696 124	918 371
	RDT examined	–	–	1 572 785	3 405 647	4 904 066	4 174 097	4 584 629	5 923 555	5 042 040	6 152 962
	RDT positive	–	–	1 033 064	2 309 222	3 405 905	2 897 034	3 174 938	3 445 812	4 070 353	5 016 807
Democratic Republic of the Congo	Suspected cases	10 568 756	12 018 784	11 993 189	14 877 406	15 064 146	17 617 219	23 443 227	23 195 284	23 833 694	32 067 354
	Presumed and confirmed	9 252 959	9 442 144	9 128 398	11 368 481	10 288 519	12 538 805	16 888 006	16 888 842	18 208 440	20 480 310
	Microscopy examined	3 678 849	4 226 533	4 329 318	4 126 129	3 533 165	2 877 585	2 810 067	1 981 621	1 926 455	2 152 433
	Microscopy positive	2 374 930	2 700 818	2 656 864	2 611 478	2 126 554	1 902 640	1 847 143	1 291 717	995 577	1 128 371
	RDT examined	54 728	2 912 088	3 327 071	6 102 683	11 530 981	14 739 634	20 566 284	21 117 823	20 671 006	26 963 687
	RDT positive	42 850	1 861 163	2 134 734	4 108 409	8 161 965	10 636 165	14 973 987	15 501 285	15 976 630	20 480 310
Equatorial Guinea	Suspected cases	83 639	40 704	45 792	59 358	57 129	68 058	318 779	91 217	43 533	94 656
	Presumed and confirmed	78 095	37 267	20 890	28 438	20 417	15 142	147 714	15 725	10 926	43 897
	Microscopy examined	42 585	23 004	33 245	27 039	47 322	21 831	239 938	13 127	8 395	43 417
	Microscopy positive	39 636	20 601	13 196	11 235	17 685	8 564	125 623	6 800	4 135	14 787
	RDT examined	16 772	2 899	6 826	20 286	9 807	46 227	78 841	78 090	33 174	33 246
	RDT positive	14 177	1 865	1 973	5 170	2 732	6 578	22 091	8 925	4 827	11 117
Eritrea	Suspected cases	96 792	97 479	138 982	134 183	186 358	155 782	106 403	205 836	253 687	452 673
	Presumed and confirmed	53 750	39 567	42 178	34 678	55 491	32 974	80 450	55 588	48 326	93 878
	Microscopy examined	79 024	67 190	84 861	81 541	63 766	59 268	83 599	74 962	70 465	116 666
	Microscopy positive	13 894	15 308	11 557	10 890	10 993	8 332	24 251	14 519	10 325	18 117
	RDT examined	–	25 570	33 758	39 281	117 635	91 576	–	129 291	181 336	336 007
	RDT positive	22 088	19 540	10 258	10 427	39 541	19 704	–	39 486	36 115	75 761
Eswatini	Suspected cases	–	797	626	–	711	651	1 386	3 212	9 837	34 866
	Presumed and confirmed	1 722	797	626	962	711	475	317	1 127	957	577
	Microscopy examined	–	–	–	–	–	–	1 249	371	1 526	15 434
	Microscopy positive	87	130	345	488	711	43	141	68	957	212°
	RDT examined	–	–	–	–	–	–	–	2 841	8 311	19 432
	RDT positive	181	419	217	474	–	452	458	1 594	–	243°
	Imported cases	–	170	153	234	322	157	67	687	271	338
Ethiopia	Suspected cases	5 420 110	5 487 972	5 962 646	9 243 894	7 457 765	5 987 580	6 611 801	6 471 958	5 913 799	6 708 222
	Presumed and confirmed	4 107 396	3 549 613	3 876 745	3 316 013	2 513 863	2 174 707	1 962 996	1 755 748	1 206 891	1 015 792
	Microscopy examined	2 509 543	3 418 719	3 778 479	8 573 335	7 062 717	5 679 932	6 367 309	6 246 949	5 668 995	6 596 925
	Microscopy positive	1 196 829	1 480 360	1 692 578	2 645 454	2 118 815	1 867 059	1 718 504	1 530 739	962 087	904 495
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
Gabon	Suspected cases	233 770	–	238 483	256 531	256 183	285 489	202 989	212 092	1 022 022	214 286[#]
	Presumed and confirmed	185 105	178 822	188 089	185 196	185 996	217 287	161 508	157 639	797 278	142 917
	Microscopy examined	54 714	–	66 018	90 185	90 275	79 308	62 658	70 820	264 676	75 819
	Microscopy positive	12 816	–	18 694	26 432	27 687	20 390	22 419	28 297	88 112	31 184
	RDT examined	7 887	–	4 129	10 132	11 812	12 761	2 738	18 877	71 787	47 712
	RDT positive	1 120	–	1 059	2 550	4 213	3 477	1 496	6 947	23 607	21 998
Gambia	Suspected cases	492 062	–	862 442	889 494	603 424	908 082	874 690	656 212	706 868	602 947
	Presumed and confirmed	194 009	268 020	313 469	281 550	168 256	255 403	164 421	83 668	88 654	53 386
	Microscopy examined	290 842	172 241	156 580	236 329	286 111	272 604	165 793	77 491	171 668	150 585
	Microscopy positive	52 245	71 588	29 325	65 666	66 253	49 649	26 397	11 343	14 510	10 982
	RDT examined	123 564	–	705 862	614 128	317 313	626 423	707 215	573 093	533 994	452 362
	RDT positive	64 108	196 432	284 144	176 847	102 003	196 699	136 342	66 697	72 938	42 404

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Ghana	Suspected cases	5 107 626	5 121 411	12 656 535	8 507 245	10 748 502	15 946 366	15 742 112	19 069 870	15 542 218	11 977 117
	Presumed and confirmed	3 900 311	4 207 941	10 754 320	7 259 892	8 566 002	11 678 306	11 451 328	13 472 089	11 154 400	6 703 687
	Microscopy examined	2 031 674	1 172 838	4 219 097	1 394 249	1 987 959	2 023 581	2 594 918	2 495 536	2 659 067	3 004 989
	Microscopy positive	1 029 384	624 756	2 971 699	721 898	970 448	934 304	1 189 012	1 089 799	1 105 348	1 160 426
	RDT examined	247 278	781 892	1 438 284	1 496 746	3 610 453	7 901 575	7 124 845	10 105 400	6 660 205	8 383 708
	RDT positive	42 253	416 504	783 467	921 744	2 445 464	4 722 792	4 239 967	5 913 356	3 826 106	4 954 841
Guinea	Suspected cases	–	1 276 057	–	–	1 595 828	1 254 937	1 503 035	2 134 543	2 608 481	3 733 346
	Presumed and confirmed	1 117 182	1 189 016	1 261 951	775 341	1 595 828	895 016	992 146	1 335 323	1 246 598	2 143 225
	Microscopy examined	–	43 549	–	–	116 767	78 377	79 233	99 083	131 715	184 697
	Microscopy positive	20 936	5 450	191 421	63 353	82 818	52 211	53 805	64 211	77 119	112 966
	RDT examined	–	139 066	–	–	–	1 092 523	1 423 802	2 035 460	2 445 164	3 498 748
	RDT positive	–	90 124	148 837	147 904	577 389	758 768	938 341	1 271 112	1 137 877	2 030 259
Guinea-Bissau	Suspected cases	195 006	300 233	237 398	238 580	330 533	413 727	398 429	498 879	469 640	497 916[#]
	Presumed and confirmed	140 143	174 986	129 684	132 176	102 945	150 085	156 523	152 619	171 075	160 907
	Microscopy examined	48 799	57 698	61 048	58 909	106 882	123 810	146 708	157 970	149 423	151 262
	Microscopy positive	30 239	21 320	23 547	17 733	35 546	45 789	53 014	53 770	45 564	45 675
	RDT examined	56 455	139 531	97 047	102 079	218 130	289 917	251 669	340 909	320 217	341 365
	RDT positive	20 152	50 662	26 834	36 851	61 878	104 296	103 457	98 849	125 511	115 232
Kenya	Suspected cases	7 557 454	13 127 058	12 883 521	14 742 401	15 204 056	16 037 285	16 290 286	15 362 146	18 435 472	8 911 133[#]
	Presumed and confirmed	6 071 583	11 120 812	9 335 951	9 790 796	9 698 529	8 219 230	8 647 072	8 462 076	10 875 734	5 019 389
	Microscopy examined	2 384 402	3 009 051	4 836 617	6 606 885	7 444 865	7 772 329	6 167 609	5 952 353	4 282 912	-
	Microscopy positive	898 531	1 002 805	1 426 719	2 060 608	2 415 950	1 025 508	1 569 045	2 215 665	827 947	4 656 702
	RDT examined	–	–	164 424	719 849	912 217	2 087 003	4 540 401	4 554 743	5 594 916	514 579
	RDT positive	–	–	26 752	314 521	435 605	1 015 769	1 495 751	1 391 361	1 490 143	362 687
Liberia	Suspected cases	3 087 659	2 896 874	2 441 800	2 202 213	2 450 878	2 403 783	3 105 390	2 034 027	–	1 726 913[#]
	Presumed and confirmed	2 675 816	2 488 331	1 805 546	1 483 676	1 083 513	1 835 238	2 343 410	1 366 176	–	1 041 800
	Microscopy examined	335 973	728 443	772 362	818 352	1 318 801	509 062	649 096	715 643	–	640 901
	Microscopy positive	212 927	577 641	507 967	496 269	302 708	305 981	381 781	425 639	–	325 658
	RDT examined	998 043	1 601 259	1 276 521	1 144 405	929 788	1 001 194	1 304 021	1 045 323	–	960 057
	RDT positive	709 246	1 343 518	904 662	747 951	578 516	635 730	809 356	667 476	–	590 187
Madagascar	Suspected cases	719 967	805 701	1 066 564	1 156 468	1 357 857	2 386 641	2 567 451	2 610 069	2 034 027	2 866 191
	Presumed and confirmed	293 910	255 814	456 795	472 644	688 852	1 366 205	1 216 077	1 163 807	1 078 140	984 304
	Microscopy examined	24 393	34 813	38 453	42 573	37 362	39 604	33 085	34 265	43 759	40 619
	Microscopy positive	2 173	3 447	3 667	4 947	3 853	4 748	3 734	5 134	7 400	5 932
	RDT examined	604 114	739 572	974 216	1 074 701	1 102 567	1 920 489	2 004 313	2 397 849	2 290 797	2 685 182
	RDT positive	200 277	221 051	399 233	428 503	467 071	934 909	682 290	980 718	965 390	964 896
	Imported cases	–	–	–	–	712	1 167	–	–	–	–
Malawi	Suspected cases	–	5 734 906	6 528 505	5 787 441	7 703 651	8 518 905	9 239 462	10 530 601	11 513 684	10 994 966
	Presumed and confirmed	6 851 108	5 338 701	4 922 596	3 906 838	5 065 703	4 933 416	5 165 386	5 936 348	5 865 476	5 205 920
	Microscopy examined	–	119 996	406 907	132 475	198 534	216 643	240 212	127 752	129 575	103 754
	Microscopy positive	–	50 526	283 138	44 501	77 635	75 923	96 538	46 099	34 735	30 328
	RDT examined	–	580 708	2 763 986	3 029 020	5 344 724	7 030 084	8 661 237	9 413 944	11 384 109	10 861 320
	RDT positive	–	253 973	1 281 846	1 236 391	2 827 675	3 585 315	4 730 835	4 901 344	5 830 741	5 153 779
Mali	Suspected cases	3 324 238	2 628 593	–	2 849 453	–	4 410 839	3 778 535	3 624 885	3 725 896	5 232 430
	Presumed and confirmed	2 191 285	1 961 070	2 286 378	2 510 534	2 774 983	3 543 576	2 465 914	2 456 639	2 614 104	3 607 237
	Microscopy examined	–	–	–	–	–	–	–	397 723	437 903	594 303
	Microscopy positive	–	–	97 995°	190 337	219 637°	243 151	235 212	276 673	301 880	468 011
	RDT examined	1 399 921	974 558	87 730	2 072 435	233 837	3 603 344	3 623 719	3 047 741	3 019 364	4 252 425
	RDT positive	239 787	307 035	870 141°	1 316 603	2 001 319°	2 211 357	2 075 886	2 000 545	2 043 595	2 753 524
Mauritania	Suspected cases	239 795	191 726	209 955	190 446	203 991	233 362	192 980	214 087	221 121	155 658[#]
	Presumed and confirmed	234 041	182 909	206 685	182 947	172 326	195 740	171 348	182 677	175 841	135 120
	Microscopy examined	5 449	3 752	1 865	5 510	–	–	–	–	–	–
	Microscopy positive	909	1 130	255	957	–	–	–	–	–	–
	RDT examined	2 299	7 991	3 293	3 576	47 500	60 253	50 788	51 515	75 889	35 407
	RDT positive	1 085	1 796	1 633	630	15 835	22 631	29 156	20 105	30 609	14 869
Mayotte	Suspected cases	2 023	1 214	1 463	82	15	–	–	–	–	–
	Presumed and confirmed	396	92	72	82	15	11	28	19	47	–
	Microscopy examined	2 023	1 214	1 463	–	–	–	–	–	–	–
	Microscopy positive	396	92	72	82	15	11	28	19	47	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	236	51	47	71	14	10	10	10	44	–

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Mozambique	Suspected cases	6 097 263	7 059 112	6 265 567	8 565 263	12 612 456	15 057 398	17 490 954	17 463 976	18 791 446	21 180 727
	Presumed and confirmed	3 381 371	3 344 413	3 296 332	4 261 529	7 452 733	8 306 986	10 373 341	9 981 277	10 339 330	11 781 516
	Microscopy examined	1 950 933	2 504 720	2 546 213	2 058 998	2 295 823	2 313 129	1 886 154	1 699 589	1 909 051	1 669 097
	Microscopy positive	644 568	1 093 742	886 143	774 891	1 009 496	735 750	674 697	700 282	743 435	608 016
	RDT examined	2 287 536	2 966 853	2 276 298	5 526 908	10 271 075	12 660 097	14 922 332	15 675 711	16 847 537	19 465 040
	RDT positive	878 009	663 132	967 133	2 507 281	6 397 679	7 487 064	9 016 176	9 192 319	9 561 037	11 126 910
Namibia	Suspected cases	39 855	74 407	10 844	34 002	186 972	209 083	310 192	618 291	396 037	313 141
	Presumed and confirmed	25 889	14 071^	3 163	4 775^	15 692^	12 050^	24 869^	66 141^	36 451^	3 440^
	Microscopy examined	14 522	13 262	7 875	1 507	1 894	1 471	1 778	1 778	1 215	511
	Microscopy positive	556	335	194	136	222	118	329	364	289	301
	RDT examined	–	48 599	–	32 495	185 078	207 612	308 414	616 513	394 822	295 367
	RDT positive	–	1 525	–	4 775	15 692	12 050	24 869	66 141	36 451	3 428
	Imported cases	–	–	–	–	–	2 888	3 980	11 874	4 021	1 064
Niger	Suspected cases	11 231 308	5 315 185	7 818 305	5 584 223	7 100 212	4 671 411	7 347 200	4 013 178	4 810 919	5 582 958
	Presumed and confirmed	4 231 896	4 401 099	6 398 943	4 333 905	5 247 235	3 937 742	5 166 336	2 761 268	3 358 058	3 771 451
	Microscopy examined	165 514	130 658	1 781 505	1 799 299	2 872 710	295 229	3 198 194	203 583	213 795	303 115
	Microscopy positive	49 285	68 529	1 119 929	1 176 711	1 953 279	206 660	2 120 515	125 856	121 657	211 783
	RDT examined	7 476 672	1 622 013	1 967 117	1 824 610	2 944 035	2 830 548	3 240 780	3 809 595	4 285 516	5 279 843
	RDT positive	593 489	770 056	1 209 331	1 196 880	2 010 489	2 185 448	2 137 595	2 635 412	2 924 793	3 559 668
Nigeria	Suspected cases	3 873 463	5 221 656	11 789 970	21 659 831	20 558 467	20 243 915	29 113 322	25 106 551	25 381 459	29 489 245[#]
	Presumed and confirmed	3 873 463	4 306 945	6 938 519	12 830 911	17 257 495	16 702 261	23 956 669	20 219 268	20 482 380	23 376 793
	Microscopy examined	–	672 185	1 953 399	1 633 960	1 681 469	839 849	901 141	1 055 444	1 428 731	3 298 156
	Microscopy positive	523 513	–	–	–	1 233 654	556 871	618 363	749 118	1 023 273	2 476 514
	RDT examined	45 924	242 526	2 898 052	7 194 960	10 191 825	10 770 388	17 853 794	16 919 717	18 018 372	22 621 211
	RDT positive	27 674	–	–	–	7 338 668	7 511 712	12 979 919	12 338 760	13 524 751	17 330 401
Rwanda	Suspected cases	2 883 666	1 802 382	3 095 386	3 064 585	4 178 206	6 093 114	7 502 174	11 186 029	9 666 424	8 829 176
	Presumed and confirmed	669 322	273 293	483 470	962 618	1 623 176	2 505 794	3 380 568	5 940 533	4 231 883	3 612 822
	Microscopy examined	2 708 973	1 602 271	2 904 793	2 862 877	4 010 202	5 811 267	6 603 261	6 637 571	5 501 455	4 576 495
	Microscopy positive	638 669	208 858	422 224	879 316	1 541 189	2 354 400	2 916 902	2 927 780	1 657 793	1 144 762
	RDT examined	174 693	200 111	190 593	201 708	168 004	281 847	898 913	4 548 458	4 164 969	4 252 681
	RDT positive	30 653	64 435	61 246	83 302	81 987	151 394	463 666	3 012 753	2 574 090	2 468 060
Sao Tome and Principe	Suspected cases	58 355	117 279	126 897	108 634	91 445	84 348	121 409	96 612	169 883	202 207
	Presumed and confirmed	2 740	8 442	12 550	9 243	1 754	2 058	2 238	2 241	2 940	2 742
	Microscopy examined	48 366	83 355	103 773	73 866	33 355	11 941	3 682	2 146	13 186	4 071
	Microscopy positive	2 233	6 373	10 706	6 352	569	140	33	109	148	306
	RDT examined	9 989	33 924	23 124	34 768	58 090	72 407	117 727	94 466	156 697	198 136
	RDT positive	507	2 069	1 844	2 891	1 185	1 918	2 205	2 132	2 792	2 436
	Imported cases	–	–	–	–	–	2	0	2	3	10
Senegal	Suspected cases	721 687	633 380	666 101	867 157	727 918	1 421 221	1 559 054	2 035 693	2 096 124	2 270 914[#]
	Presumed and confirmed	390 515	328 276	390 618	476 147	294 229	502 084	356 272	398 377	536 745	360 935
	Microscopy examined	661 503	579 223	555 724	757 697	702 601	26 556	38 748	21 639	12 881	36 564
	Microscopy positive	330 331	274 119	280 241	366 687	268 912	17 846	9 918	10 463	3 997	9 352
	RDT examined	–	–	–	–	–	1 384 834	1 513 574	2 011 383	2 077 442	1 969 296
	RDT positive	–	–	–	–	–	474 407	339 622	385 243	526 947	345 356
	Imported cases	–	–	–	–	–	–	–	–	292	45
Sierra Leone	Suspected cases	2 327 928	1 150 747	2 579 296	2 576 550	2 647 375	2 337 297	2 996 959	4 496 407	2 895 596	6 573 450
	Presumed and confirmed	934 028	856 332	1 945 859	1 715 851	1 898 852	1 569 606	1 845 727	3 302 472	1 781 855	4 849 696
	Microscopy examined	718 473	46 280	194 787	185 403	66 277	75 025	120 917	10 910	20 155	140 768
	Microscopy positive	218 473	25 511	104 533	76 077	39 414	37 820	60 458	5 717	8 719	35 055
	RDT examined	1 609 455	886 994	1 975 972	2 377 254	2 056 722	2 176 042	2 805 621	2 834 261	2 827 417	3 990 491
	RDT positive	715 555	613 348	1 432 789	1 625 881	1 335 062	1 445 556	1 714 848	1 645 519	1 725 112	2 372 450
South Africa	Suspected cases	276 669	382 434	151 344	603 726	540 913	43 515	63 277	112 514	–	–
	Presumed and confirmed	8 060	9 866	6 621	8 645	11 705	4 959	4 323	29 615	10 789	13 833
	Microscopy examined	–	178 387	121 291	364 021	300 291	13 917	20 653	–	–	–
	Microscopy positive	3 787	5 986	1 632	2 572	4 101	785	1 219	9 592	2 666	477
	RDT examined	276 669	204 047	30 053	239 705	240 622	29 598	42 624	56 257	–	–
	RDT positive	4 273	3 880	4 989	6 073	7 604	4 174	3 104	20 023	8 123	13 356
	Imported cases	–	–	–	–	–	3 568	3 075	6 234	5 742	8 890
South Sudan[2]	Suspected cases	–	–	–	–	2 492 473	3 814 332	566 043	5 391 360	6 405 779	5 258 306[#]
	Presumed and confirmed	900 283	1 473 653	1 125 039	1 855 501	2 433 991	3 789 475	555 957	4 054 795	4 697 506	4 064 662
	Microscopy examined	–	–	–	–	27 321	22 721	6 954	800 067	1 204	4 689
	Microscopy positive	900 283	112 024	225 371	262 520	18 344	11 272	2 357	335 642	634	1 237
	RDT examined	–	–	–	–	102 538	26 507	10 751	2 024 503	1 805 912	3 092 697
	RDT positive	–	–	–	–	53 033	13 099	5 262	1 152 363	98 209	1 902 505

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Togo	Suspected cases	2 035 303	906 276	1 661 179#	1 550 804	2 255 010	2 356 048	2 577 029	2 747 984	3 009 800	3 531 375
	Presumed and confirmed	1 403 375	519 452	980 042	965 832	1 524 339	1 610 711	1 746 334	1 756 582	2 002 877	2 406 091
	Microscopy examined	478 354	502 977	579 507	560 538	621 119	643 815	501 516	482 664	446 404	492 629
	Microscopy positive	206 071	224 619	260 535	272 984	310 207	317 578	231 919	209 626	229 267	269 526
	RDT examined	1 134 779	390 611	1 010 759	990 266	1 633 891	1 712 233	2 075 513	2 265 320	2 563 396	3 038 746
	RDT positive	812 958	282 145	648 594	692 848	1 214 132	1 293 133	1 514 415	1 546 956	1 773 610	2 136 565
Uganda	Suspected cases	15 294 306	12 340 717	16 845 771	26 145 615	19 201 136	22 952 246	27 257 784	22 319 643	17 111 650	25 756 835
	Presumed and confirmed	13 217 617	11 991 843	13 591 932	16 541 563	13 724 345	13 696 889	14 008 604	11 667 831	8 522 824	15 592 793
	Microscopy examined	3 705 284	385 928	3 466 571	3 718 588	2 048 185	3 684 722	4 492 090	5 515 931	1 606 330	4 691 859
	Microscopy positive	1 628 595	134 726	1 413 149	1 502 362	578 289	1 248 576	1 542 091	1 694 441	458 909	1 622 576
	RDT examined	–	194 819	2 449 526	7 387 826	7 060 545	12 983 382	18 492 939	16 803 712	12 741 670	19 454 545
	RDT positive	–	97 147	1 249 109	–	3 053 650	6 164 171	8 193 758	9 973 390	5 300 265	12 359 786
United Republic of Tanzania	Suspected cases	15 452 268	15 442 493	14 659 506	15 177 829	25 197 621	20 829 480	20 276 522	22 784 288	22 785 648	20 997 372#
	Presumed and confirmed	12 893 899	10 165 442	8 478 109	8 587 676	7 403 797	8 406 179	6 623 965	5 988 136	6 219 125	6 003 332
	Microscopy examined	3 701 608	5 800 195	7 077 411	6 888 029	727 130	673 223	1 386 389	2 888 538	3 015 052	1 840 897
	Microscopy positive	1 277 388	1 813 654	1 772 736	1 481 759	572 289	412 702	1 262 679	916 742	831 903	366 673
	RDT examined	136123*	1 628 092	1 091 615	1 256 762	17 746 946	16 652 731	15 633 676	17 144 755	19 603 825	18 861 368
	RDT positive	1974*	337 582	214 893	72 879	107 963	4 489 951	4 499 694	4 828 165	5 221 811	5 546 911
	Imported cases	–	–	–	719*	1583*	2550*	–	–	1 754*	3 286*
Mainland	Suspected cases	15 116 242	14 986 775	14 122 756	14 649 872	24 880 179	20 451 119	17 526 829	19 930 496	22 440 865	20 570 343#
	Presumed and confirmed	12 819 556	10 160 953	8 474 952	8 585 128	7 399 316	8 400 537	6 617 261	5 982 270	6 215 115	5 996 369
	Microscopy examined	3 637 659	5 656 907	6 931 025	6 804 085	592 320	532 118	1 285 720	2 826 948	2 937 666	1 768 635
	Microscopy positive	1 277 024	1 813 179	1 772 062	1 481 275	571 598	411 741	1 261 650	915 887	830 668	364 890
	RDT examined	–	1 315 662	701 477	813 103	17 566 750	16 416 675	15 379 517	16 861 141	19 338 466	18 711 960
	RDT positive	–	333 568	212 636	71 169	106 609	4 486 470	4 494 019	4 823 976	5 219 714	5 541 731
Zanzibar	Suspected cases	272 077	455 718	536 750	527 957	317 442	378 361	354 828	346 026	343 423	427 029#
	Presumed and confirmed	74 343	4 489	3 157	2 548	4 481	5 642	6 704	5 866	4 010	6 963
	Microscopy examined	63 949	143 288	146 386	83 944	134 810	141 105	100 669	61 590	77 386	72 262
	Microscopy positive	364	475	674	484	691	961	1 029	855	1 235	1 783
	RDT examined	136 123	312 430	390 138	443 659	180 196	236 056	254 159	283 614	265 359	149 408
	RDT positive	1 974	4 014	2 257	1 710	1 354	3 481	5 675	4 189	2 097	5 180
	Imported cases	–	–	–	719	1 583	2 550	–	–	1 754	3 286
Zambia	Suspected cases	–	–	–	–	7 859 740	8 116 962	9 627 862	10 952 323	10 055 407	11 340 409#
	Presumed and confirmed	4 229 839	4 607 908	4 695 400	5 465 122	5 972 933	5 094 123	5 976 192	6 054 679	5 195 723	5 360 020
	Microscopy examined	–	–	–	–	–	–	–	–	180 697	275 323
	Microscopy positive	–	–	–	–	–	–	–	–	49 855	78 474
	RDT examined	–	–	–	–	5 964 354	7 207 500	8 502 989	10 403 283	9 718 666	10 852 416
	RDT positive	–	–	–	–	4 077 547	4 184 661	4 851 319	5 505 639	4 989 824	5 068 876
Zimbabwe	Suspected cases	912 618	480 011	727 174	1 115 005	1 478 357	1 638 438	1 400 095	1 831 823	1 293 392	1 324 299
	Presumed and confirmed	898 344	319 935	276 963	422 633	572 944	482 379	384 029	767 069	264 018	308 173
	Microscopy examined	–	10 004	–	–	–	–	–	–	2 771	–
	Microscopy positive	249 379	–	–	–	–	–	–	–	–	–
	RDT examined	513 032	470 007	727 174	1 115 005	1 453 689	1 638 438	1 330 069	1 533 030	1 290 621	1 297 197
	RDT positive	249 379	319 935	276 963	422 633	548 276	482 379	314 003	468 276	264 018	308 173
	Imported cases	–	–	–	–	–	180	358	768	672	–
AMERICAS											
Argentina[1]	Suspected cases	2 547	7 872	7 027	4 913	5 691	3 862	3 479	2 114	345	–
	Presumed and confirmed	109	28	16	11	15	11	7	18^	23	–
	Microscopy examined	2 547	7 872	7 027	4 913	5 691	3 862	3 479	2 114	345	–
	Microscopy positive	109	28	16	11	15	11	7	18	23	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	2	–	–
	Imported cases	46	28	16	11	15	11	7	18	23	–
Belize[3]	Suspected cases	27 366	22 996	20 789	25 351	24 122	26 367	20 936	26 995	17 642	19 731#
	Presumed and confirmed	150	79	37	26	19	13^	5	9^	7	2
	Microscopy examined	27 366	22 996	20 789	25 351	24 122	26 367	20 936	26 995	17 642	19 731
	Microscopy positive	150	79	37	26	19	13	5	9	7	2
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	5	–	3	–	–
	Imported cases	–	7	4	4	0	4	1	2	4	2

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS											
Bolivia (Plurinational State of)	Suspected cases	140 857	150 662	132 904	144 049	124 900	159 167	155 407	151 697	139 938	137 473
	Presumed and confirmed	13 769	7 143	7 415	7 342	7 401	6 907	5 553	4 587	5 354	9 357
	Microscopy examined	133 463	143 272	121 944	133 260	124 900	159 167	155 407	151 697	139 938	110 028
	Microscopy positive	12 252	6 108	6 293	6 272	7 401	6 907	5 553	4 334	5 261	8 118
	RDT examined	7 394	7 390	10 960	10 789	–	–	–	–	–	27 445
	RDT positive	1 517	1 035	1 122	1 070	–	–	–	253	93	1 239
	Imported cases	–	–	–	–	–	33	11	15	12	19
Brazil	Suspected cases	2 711 433	2 477 821	2 349 341	1 893 018	1 756 460	1 590 403	1 364 912	1 696 063	1 800 465	1 591 308
	Presumed and confirmed	334 667	267 146	242 758	178 546	142 744^	146 161	129 244	194 425	194 573	157 454
	Microscopy examined	2 711 432	2 476 335	2 325 775	1 873 518	1 744 640	1 573 538	1 341 639	1 656 685	1 754 244	1 539 938
	Microscopy positive	334 667	266 713	237 978	174 048°	142 744	139 844°	124 210	184 876	181 967	146 868
	RDT examined	–	1 486	23 566	19 500	11 820	16 865	23 273	39 378	46 221	51 370
	RDT positive	–	433	4 780	3 719°	1 384	3 318°	5 034	9 549	12 606	10 586
	Imported cases	–	–	–	8 905	4 847	4 915	5 068	4 867	6 816	4 158
Colombia	Suspected cases	521 342	418 032	416 767	327 055	403 532	328 434	296 091	254 380	208 538	295 406
	Presumed and confirmed	117 650	64 436	60 179	51 722	40 768	55 866	83 227	54 102	63 143	80 415
	Microscopy examined	521 342	396 861	346 599	284 332	325 713	316 451	242 973	244 732	195 286	283 471
	Microscopy positive	117 637	60 121°	50 938	44 293°	36 166	48 059°	57 515°	38 349°	42 810°	47 806°
	RDT examined	–	21 171	70 168	42 723	77 819	11 983	53 118	9 648	13 252	11 935
	RDT positive	13	4 188°	9 241	7 403°	4 602	3 535°	5 655°	5 056°	3 407°	3 703°
	Imported cases	–	–	–	–	–	7 785	618	1 297	1 948	2 306
Costa Rica	Suspected cases	15 599	10 690	7 485	16 774	4 420	7 376	5 162	9 683	9 700	10 631
	Presumed and confirmed	114	17	8	6	6	8^	13^	25^	152	145
	Microscopy examined	15 599	10 690	7 485	16 774	4 420	7 373	5 160	9 680	9 000	10 631
	Microscopy positive	114	17	8	6	6	8	13	25	108	145
	RDT examined	–	–	–	–	–	3	2	3	700	–
	RDT positive	–	–	–	–	–	3	2	3	44	–
	Imported cases	4	6	1	4	5	8	9	13	38	45
Dominican Republic	Suspected cases	495 637	477 555	506 583	502 683	416 729	324 916	73 779	314 385	118 270	198 366
	Presumed and confirmed	2482^	1 616	952	579	496	661^	755	398^	484^	1 314^
	Microscopy examined	469 052	421 405	415 808	431 683	362 304	317 257	51 329	226 988	33 420	143 366
	Microscopy positive	2 480	1 616	952	579	496	661	484°	398	322	1 314
	RDT examined	26 585	56 150	90 775	71 000	54 425	7 659	22 450	87 397	84 850	55 000
	RDT positive	932	–	–	–	–	129	80^	74	221	1 313
	Imported cases	–	–	–	105	37	30	65	57	50	23
Ecuador	Suspected cases	488 830	460 785	459 157	397 628	370 825	261 824	311 920	306 894	244 777	177 742
	Presumed and confirmed	1 888	1 232	558	378	242	686^	1 424	1 380^	1 806	1 909
	Microscopy examined	481 030	460 785	459 157	397 628	370 825	261 824	311 920	306 894	237 995	177 742
	Microscopy positive	1 888	1 232	558	378	242	686	1 191°	1 380	1 589	1 428
	RDT examined	7 800	–	–	–	–	–	–	–	6 782	–
	RDT positive	–	–	–	–	–	6	5°	6	217	481
	Imported cases	–	14	14	10	0	59	233	105	153	106
El Salvador[3]	Suspected cases	115 256	100 884	124 885	103 748	106 915	89 267	81 904	70 022	52 217	89 992#
	Presumed and confirmed	26	15^	20	7	8	9	14	4	2^	3
	Microscopy examined	115 256	100 883	124 885	103 748	106 915	89 267	81 904	70 022	52 216	89 992
	Microscopy positive	26	15	20	7	8	9	14	4	2	3
	RDT examined	–	1	–	–	–	–	–	–	1	–
	RDT positive	–	1	–	–	–	–	–	–	1	–
	Imported cases	9	8	7	1	2	4	1	3	2	3
French Guiana	Suspected cases	14 373	14 429	13 638	22 327	14 651	11 558	9 430	597	–	–
	Presumed and confirmed	1 632^	1 209^	900^	875	448	434	231	597	546	212
	Microscopy examined	14 373	14 429	13 638	22 327	14 651	11 558	9 430	–	–	–
	Microscopy positive	1 085	720	523	321°	242	297	173	468	546	212
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	944	704	499	551°	206	137	58	129	–	–
	Imported cases	–	–	–	–	–	60	41	43	–	–
Guatemala	Suspected cases	237 075	195 080	186 645	153 731	300 989	301 746	408 394	542 483	514 133	488 514#
	Presumed and confirmed	7 384	6 817	5 346	6 214	4 931	5 540^	5 001	4 124^	3 021^	2 072^
	Microscopy examined	235 075	195 080	186 645	153 731	250 964	295 246	333 535	372 158	438 833	427 239
	Microscopy positive	7 198°	6 817	5 346	6 214	4 931	5 538	4 854°	3 744	3 021	2 072
	RDT examined	2 000	–	–	–	50 025	6 500	74 859	170 325	75 300	61 275
	RDT positive	–	–	–	–	–	1 298	1°	2 078	1 748	1 309
	Imported cases	–	–	–	–	1	2	1	3	3	3

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS											
Guyana	Suspected cases	212 863	201 728	196 622	205 903	142 843	132 941	117 483	100 308	101 346	103 836#
	Presumed and confirmed	22 935	29 471	31 601^	31 479	12 354	9 984	11 108^	13 936^	17 038^	18 826
	Microscopy examined	212 863	201 693	196 622	205 903	142 843	132 941	110 891	100 105	95 986	85 736
	Microscopy positive	22 935	29 471	31 610	31 479	12 354	9 984	10 906	13 734	15 607	13 840
	RDT examined	–	35	–	–	–	–	6 592	203	5 360	18 100
	RDT positive	–	35	55	–	–	–	1 724	242	3 570	4 986
	Imported cases	–	–	–	–	–	–	411	–	–	–
Haiti	Suspected cases	270 427	184 934	167 772	171 409	261 403	330 603	459 959	364 351	312 804#	266 675
	Presumed and confirmed	84 153	34 350	27 866	26 543	17 696	17 583^	21 430^	19 135^	8 828^	10 687
	Microscopy examined	270 427	184 934	167 726	165 823	134 766	69 659	61 428	62 539	59 803	35 144
	Microscopy positive	84 153	34 350	27 866	26 543	10 893	5 224	4 342	2 119	1 586	765
	RDT examined	–	–	46	5 586	126 637	260 944	398 531	301 812	253 001	231 531
	RDT positive	–	–	–	–	6 803	12 702	23 325	18 309	8 232	9 922
Honduras	Suspected cases	156 961	156 451	159 165	144 673	152 847	155 782	188 581	174 030	174 336	161 624#
	Presumed and confirmed	9 745	7 618^	6 439^	5 364^	3 380^	3 555^	4 097^	1 287^	653^	391^
	Microscopy examined	152 961	152 451	155 165	144 436	151 420	150 854	167 836	148 160	142 780	142 870
	Microscopy positive	9 745	7 618	6 439	5 364	3 380	3 555	4 097	1 251	653	391
	RDT examined	4 000	4 000	4 000	237	1 427	4 928	20 745	25 870	31 556	18 754
	RDT positive	–	45	10	64	102	79	657	263	454	193
	Imported cases	–	–	–	–	2	0	3	10	21	61
Mexico	Suspected cases	1 192 081	1 035 424	1 025 659	1 017 508	900 580	867 860	798 574	644 180	548 247#	531 632#
	Presumed and confirmed	1 233	1 130	842	499	666	551^	596^	765^	826	641^
	Microscopy examined	1 192 081	1 035 424	1 025 659	1 017 508	900 578	867 853	798 568	644 174	548 247	531 471
	Microscopy positive	1 233	1 130	842	499	666	551	596	765	826	641
	RDT examined	–	–	–	–	–	7	6	6	–	161
	RDT positive	–	–	–	–	–	7	6	6	–	3
	Imported cases	7	6	9	4	10	34	45	29	23	22
Nicaragua	Suspected cases	554 414	536 105	552 722	539 022	605 357	604 418	554 415	663 132	875 982	1 029 288#
	Presumed and confirmed	692	925	1 235	1 196	1 163	2 308	6 284	10 952	15 934	13 226
	Microscopy examined	535 914	521 904	536 278	519 993	605 357	604 418	553 615	660 452	831 077	1 001 225
	Microscopy positive	692	925	1 235	1 196	1 163	2 308	6 284	10 952	15 934	12 337
	RDT examined	18 500	14 201	16 444	19 029	–	–	800	2 680	44 905	28 063
	RDT positive	–	–	–	–	–	–	–	–	–	889
	Imported cases	–	–	–	34	21	29	12	3	17	26
Panama	Suspected cases	141 038	116 588	107 711	93 624	80 701	64 511	50 772	39 099	24 524	22 171#
	Presumed and confirmed	418	354	844	705	874	562^	811^	689	715^	1 597
	Microscopy examined	141 038	116 588	107 711	93 624	80 701	64 511	50 772	38 270	23 383	18 217
	Microscopy positive	418	354	844	705	874	562	811	689	715	1 209
	RDT examined	–	–	–	–	–	–	–	829	1 141	3 954
	RDT positive	–	–	–	–	–	3	5	–	424	388
	Imported cases	–	–	–	9	10	16	42	40	31	17
Paraguay[1]	Suspected cases	62 178	48 611	31 499	24 806	24 832	6 697	3 193	9 281	–	–
	Presumed and confirmed	27	10	15	11	8	8^	10^	5	0	0
	Microscopy examined	62 178	48 611	31 499	24 806	24 832	6 687	3 192	8 014	–	–
	Microscopy positive	27	10	15	11	8	8	10	5	–	–
	RDT examined	–	–	–	–	–	10	1	1 267	–	–
	RDT positive	–	–	–	–	–	1	1	–	–	–
	Imported cases	9	9	15	11	8	8	10	5	0	0
Peru	Suspected cases	744 650	702 952	759 285	864 648	866 047	884 113	566 230	402 623	464 785	243 240
	Presumed and confirmed	31 545^	25 005^	31 436	48 719	65 252	66 609^	56 623	55 367^	45 619^	24 324
	Microscopy examined	744 627	702 894	758 723	863 790	864 413	865 980	566 230	388 699	304 785	243 240
	Microscopy positive	31 545	25 005	31 436	48 719	65 252	66 609	56 623	55 367	45 619	24 324
	RDT examined	23	58	562	858	1 634	18 133	–	13 924	160 000	–
	RDT positive	1	34	–	–	–	463	–	2 325	1 000	–
	Imported cases	–	–	–	–	–	–	–	–	176	159
Suriname	Suspected cases	17 902	16 160	22 134	19 736	33 097	15 236	23 444	22 302	19 836	20 743#
	Presumed and confirmed	1 771	795	569	729	401	376	327	551^	235	215
	Microscopy examined	16 533	15 135	17 464	13 693	17 608	15 083	14 946	12 536	11 799	13 702
	Microscopy positive	1 574°	751°	306°	530	98	345	315°	412	218	209
	RDT examined	1 369	1 025	4 670	6 043	15 489	153	8 498	9 766	8 037	7 041
	RDT positive	190°	20°	248°	199	303	31	11°	160	17	6
	Imported cases	–	–	–	–	–	274	251	414	198	111

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS											
Venezuela (Bolivarian Republic of)	Suspected cases	400 495	382 303	410 663	476 764	522 617	625 174	932 556	1 144 635	747 247	1 104 736
	Presumed and confirmed	45 155	45 824	52 803	80 320	91 918	137 996	301 466	525 897	522 059	492 753
	Microscopy examined	400 495	382 303	410 663	476 764	522 617	625 174	852 556	1 144 635	699 130	1 040 683
	Microscopy positive	45 155	45 824	52 803	80 320	91 918	137 996	301 466	525 897	404 924°	398 285°
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	48 117°	64 053°
	Imported cases	–	–	–	1 677	1 210	1 594	1 948	2 941	2 125	1 848
EASTERN MEDITERRANEAN											
Afghanistan	Suspected cases	865 181	936 252	847 933	817 606	881 515	939 964	1 055 368	1 143 511	1 240 523	1 008 487
	Presumed and confirmed	392 864	482 748	391 365	326 593	317 608	383 008	436 017	413 536	299 863	174 894
	Microscopy examined	524 523	531 053	511 408	507 145	514 466	538 789	598 556	611 904	665 200	561 160
	Microscopy positive	69 397	77 549	54 840	46 114	83 920	103 377	151 528	194 866	104 960	71 389
	RDT examined	17 592	–	–	36 833	155 919	138 026	262 028	431 157	524 149	446 293
	RDT positive	401	–	–	6 851	22 558	16 482	89 705	118 220	143 729	102 471
Djibouti	Suspected cases	–	354	1 410	7 189	39 284	10 586	19 492	75 594	104 800	214 101
	Presumed and confirmed	1 010	230	27	1 684	9 439	9 557	13 822	14 810	25 319	49 402
	Microscopy examined	–	124	1 410	7 189	39 284	10 502	19 492	24 504	–	–
	Microscopy positive	1 010	–	22	1 684	9 439	1 764	2 280	1 283	–	–
	RDT examined	–	–	–	–	–	–	–	51 090	104 800	214 101
	RDT positive	–	–	3	–	–	7 709	11 542	13 527	25 319	49 402
Iran (Islamic Republic of)	Suspected cases	614 817	530 470	479 655	385 172	468 513	630 886	418 125	383 397	541 975	556 125
	Presumed and confirmed	3 031	3 239	1 629	1 374	1 243	799	705	939	625^	1190^
	Microscopy examined	614 817	530 470	479 655	385 172	468 513	610 337	418 125	383 397	477 914	454 322
	Microscopy positive	3 031	3 239	1 629	1 374	1 243	799	705	939	625	1 190
	RDT examined	–	–	–	–	–	–	–	–	64 061	101 803
	RDT positive	–	–	–	–	–	–	–	–	436	1 089
	Imported cases	1 184	1 529	842	853	867	632	611	868	602	1 105
Pakistan	Suspected cases	8 601 835	8 418 570	8 902 947	7 752 797	8 514 341	8 885 456	8 141 124	8 200 899	7 226 725	8 157 351
	Presumed and confirmed	4 281 356	4 065 802	4 285 449	3 472 727	3 666 257	3 776 244	2 121 958	2 209 708	1 069 052	413 533
	Microscopy examined	4 281 346	4 168 648	4 497 330	3 933 321	4 343 418	4 619 980	5 046 870	4 539 869	4 324 570	4 855 044
	Microscopy positive	220 870	287 592	250 526	196 078	193 952	137 401	154 541	132 580	119 099	125 804
	RDT examined	279 724	518 709	410 949	628 504	779 815	691 245	1 296 762	1 821 139	2 207 613	3 302 307
	RDT positive	19 721	46 997	40 255	85 677	81 197	64 612	169 925	237 237	255 411	287 729
Saudi Arabia	Suspected cases	944 723	1 062 827	1 186 179	1 309 783	1 249 752	1 306 700	1 267 933	1 073 998	1 015 953	2 237 412
	Presumed and confirmed	1 941	2 788	3 406	2 513	2 305	2 620	5 382	3 151	2 711	2 152
	Microscopy examined	944 723	1 062 827	1 186 179	1 309 783	1 249 752	1 306 700	1 267 933	1 073 998	1 015 953	1 118 706
	Microscopy positive	1 941	2 788	3 406	2 513	2 305	2 620	5 382	3 151	2 711	2 152
	RDT examined	–	–	–	–	–	–	–	–	–	1 118 706
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	1 912	2 719	3 324	2 479	2 254	2 537	5 110	2 974	2 517	2 029
Somalia	Suspected cases	223 981	99 403	53 658	69 192	79 653	119 008	205 753	228 912	253 220	418 117
	Presumed and confirmed	24 833	41 167	23 202	9 135	26 174	39 169	58 021	37 156	31 030	65 375^
	Microscopy examined	20 593	26 351	–	–	–	–	–	–	–	59 494
	Microscopy positive	5 629	1 627	–	–	–	–	–	–	–	11 615
	RDT examined	203 388	35 236	37 273	67 464	64 480	100 792	183 360	226 894	253 211	332 935
	RDT positive	19 204	1 724	6 817	7 407	11 001	20 953	35 628	35 138	31 021	39 687
Sudan	Suspected cases	2 398 239	2 929 578	2 438 467	2 197 563	–	4 101 841	4 199 740	3 691 112	9 760 505	7 642 050
	Presumed and confirmed	1 465 496	1 214 004	964 698	989 946	1 207 771	1 102 186	897 194	1 642 058	3 585 736	3 568 941
	Microscopy examined	–	–	–	–	–	3 586 482	3 236 118	2 426 329	6 668 355	4 797 856
	Microscopy positive	625 365	506 806	526 931	592 383	579 038	586 827	378 308	588 100	1 251 544	1 408 242
	RDT examined	1 653 300	2 222 380	2 000 700	1 800 000	788 281	–	632 443	422 841	1 113 247	1 027 264
	RDT positive	95 192	–	–	–	489 468	–	187 707	212 016	386 473	343 769
Yemen	Suspected cases	835 018	804 401	888 952	927 821	821 618	711 680	1 217 602	1 659 798	779 312	1 283 681#
	Presumed and confirmed	198 963	142 152	165 687	149 451	122 812	104 831	145 627	143 333	233 143	216 763
	Microscopy examined	645 463	645 093	685 406	723 691	643 994	561 644	960 860	1 070 020	419 415	841 358
	Microscopy positive	78 269	60 751	71 300	63 484	51 768	42 052	45 886	28 936	64 233	104 350
	RDT examined	97 289	108 110	150 218	157 457	141 519	121 464	210 815	589 778	284 654	391 459
	RDT positive	28 428	30 203	41 059	39 294	34 939	34 207	53 814	114 397	93 667	61 549

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EUROPEAN											
Armenia[1]	Suspected cases	31 026	–	821 860	825 443	–	1 213	465	350	320	–
	Presumed and confirmed	1	–	4	–	1	2	2	2	6	–
	Microscopy examined	31 026	–	–	–	–	1 213	465	350	320	–
	Microscopy positive	1	–	–	–	–	2	2	2	6	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	1	0	4	0	1	2	2	2	6	–
Azerbaijan[3]	Suspected cases	456 652	449 168	497 040	432 810	399 925	405 416	465 860	373 562	358 009	358 912
	Presumed and confirmed	52	8	4	4	2	1	1	1	2	0
	Microscopy examined	456 652	449 168	497 040	432 810	399 925	405 416	465 860	373 562	358 009	–
	Microscopy positive	52	8	4	4	2	1	1	1	2	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	2	4	1	4	2	1	1	1	2	0
Georgia[3]	Suspected cases	2 368	2 032	1 046	192	440	294	318	416	386	335[#]
	Presumed and confirmed	0	5	4	7	5	5	7	8	9	8
	Microscopy examined	2 368	2 032	1 046	192	440	294	318	416	286	335
	Microscopy positive	0	5	4	7	5	5	7	8	9	8
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	0	5	4	7	5	5	7	8	9	8
Kyrgyzstan[3]	Suspected cases	30 190	27 850	18 268	54 249	35 600	–	–	–	–	–
	Presumed and confirmed	6	5	3	4	0	1	6	2	–	–
	Microscopy examined	30 190	27 850	18 268	54 249	35 600	75 688	62 537	8 459	–	–
	Microscopy positive	6	5	3	4	0	1	6	2	–	–
	RDT examined	–	–	–	–	–	0	0	0	–	–
	RDT positive	–	–	–	–	–	0	0	0	–	–
	Imported cases	3	5	3	4	0	1	6	2	–	–
Tajikistan[3]	Suspected cases	173 523	173 367	209 239	213 916	200 241	388 582	233 336	232 502∞	232 502∞	209 830
	Presumed and confirmed	116	100	39	14	7	4	1	3	1	3
	Microscopy examined	173 523	173 367	209 239	213 916	200 241	188 341	198 766	191 284∞	191 284∞	207 821
	Microscopy positive	116	100	39	14	7	4	1	3	1	3
	RDT examined	–	–	–	–	–	–	34 570	41 218∞	41 218∞	2 009
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	4	22	11	10	5	4	1	3	1	3
Turkey[3]	Suspected cases	507 841	421 295	337 830	255 125	189 854	211 740	144 499	115 557	–	–
	Presumed and confirmed	81	128	376	251	249	221	208	214	–	–
	Microscopy examined	507 841	421 295	337 830	255 125	189 854	211 740	144 499	115 557	–	–
	Microscopy positive	78°	128	376	251°	249	221	208	214	–	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	81	128	376	251	249	221	208	214	–	–
Turkmenistan[1]	Suspected cases	81 784	–	–	–	–	167 350	169 211	168 528	85 722	–
	Presumed and confirmed	–	–	–	–	–	–	–	–	–	–
	Microscopy examined	81 784	–	–	–	–	83 675	85 536	84 264	85 722	–
	Microscopy positive	–	–	–	–	–	–	–	–	–	–
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	–	–	–	–	–
Uzbekistan[1]	Suspected cases	921 364	886 243	805 761	908 301	812 347	800 912	797 472	1 310 224	699 495	669 373[#]
	Presumed and confirmed	5	1	1	3	1	–	–	–	–	1
	Microscopy examined	921 364	886 243	805 761	908 301	812 347	800 912	797 472	655 112	699 495	669 373
	Microscopy positive	5	1	1	3	1	–	–	–	–	1
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	2	1	1	3	1	0	0	0	0	1
SOUTH-EAST ASIA											
Bangladesh	Suspected cases	767 134	629 800	372 806	424 192[#]	640 560[#]	790 953[#]	1 848 205[#]	1 822 366	1 300 691	1 507 230
	Presumed and confirmed	55 873	51 773	49 135	32 328	67 859	39 719	27 737	53 582	10 523	17 225
	Microscopy examined	308 326	270 253	253 887	290 496	418 519	527 659	573 540	613 304	800 251	750 657
	Microscopy positive	20 519	20 232	9 901	7 303	13 628	6 621	3 217	3 325	1 135	1 311
	RDT examined	152 936	119 849	83 244	128 259	211 662	263 294	1 274 665	1 209 062	500 440	756 573
	RDT positive	35 354	31 541	19 617	19 588	43 852	33 098	24 520	50 257	9 388	15 914
	Imported cases	–	–	–	–	–	129	109	19	41	6

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SOUTH-EAST ASIA											
Bhutan	Suspected cases	54 760	44 494	42 512	31 632	33 586	74 087	118 841	42 135	133 498	119 975
	Presumed and confirmed	487	207	82	45	48	104	74	51	54	42^
	Microscopy examined	54 709	44 481	42 512	31 632	33 586	26 149	23 442	22 885	19 778	18 973
	Microscopy positive	436	194	82	45	48	84	59	51	49	38
	RDT examined	–	–	–	–	–	47 938	95 399	19 250	113 720	101 002
	RDT positive	–	–	–	–	–	20	15	–	5	37
	Imported cases	–	–	–	23	34	70	56	38	34	30
Democratic People's Republic of Korea	Suspected cases	27 019	27 857	40 925	72 719	38 878	91 007	205 807	189 357	685 704	461 998
	Presumed and confirmed	15 392	18 104	23 537	15 673	11 212	7 409	5 113	4 626	3 698	1 869
	Microscopy examined	25 147	26 513	39 238	71 453	38 201	29 272	22 747	16 835	28 654	3 255
	Microscopy positive	13 520	16 760	21 850	14 407	10 535	7 010	4 890	4 463	3 446	886
	RDT examined	–	–	–	–	–	61 348	182 980	172 499	657 050	458 743
	RDT positive	–	–	–	–	–	12	143	140	252	983
	Imported cases	–	–	–	–	–	–	–	–	–	1 869
India	Suspected cases	119 279 429	119 470 044	122 159 270	127 891 198	138 628 331	140 841 230	144 539 608	125 977 799	124 613 482	134 230 349
	Presumed and confirmed	1 599 986	1 310 656	1 067 824	881 730	1 102 205	1 169 261	1 087 285	844 558	429 928	338 494
	Microscopy examined	108 679 429	108 969 660	109 033 790	113 109 094	124 066 331	121 141 970	124 933 348	110 769 742	111 123 775	113 969 785
	Microscopy positive	1 599 986	1 310 656	1 067 824	881 730	1 102 205	1 169 261	1 087 285	306 768	230 432	132 790
	RDT examined	10 600 000	10 500 384	13 125 480	14 782 104	14 562 000	19 699 260	19 606 260	15 208 057	13 489 707	20 260 564
	RDT positive	–	–	–	–	–	–	–	537 790	199 496	205 704
Indonesia	Suspected cases	1 591 179	1 212 799	1 900 725	1 708 161	1 550 296	1 567 450	1 457 858	1 441 679	1 700 094	2 491 516
	Presumed and confirmed	465 764	422 447	417 819	343 527	252 027	217 025	218 449	261 617	222 136	250 644
	Microscopy examined	1 335 445	962 090	1 429 139	1 447 980	1 300 835	1 224 504	1 092 093	1 045 994	1 322 026	1 899 437
	Microscopy positive	465 764	422 447	417 819	343 527	252 027	217 025	218 449	261 617	190 573	212 995
	RDT examined	255 734	250 709	471 586	260 181	249 461	342 946	365 765	395 685	378 068	592 079
	RDT positive	–	–	–	–	–	–	–	–	31 563	37 649
	Imported cases	–	–	–	–	–	–	–	–	11	61
Myanmar	Suspected cases	1 277 568	1 210 465	1 423 966	1 300 556	1 567 095	2 657 555	3 185 245	3 368 697	3 717 875[#]	3 717 875
	Presumed and confirmed	693 124	567 452	481 204	333 871	205 658	182 616	110 146	85 019	76 518	56 640
	Microscopy examined	275 374	312 689	265 135	138 473	151 258	98 014	122 078	107 242	50 902	50 902
	Microscopy positive	103 285	91 752	75 220	26 509	12 010	6 453	6 717	4 648	2 577°	1 050
	RDT examined	729 878	795 618	1 158 831	1 162 083	1 415 837	2 559 541	3 063 167	3 261 455	3 666 973	3 666 973
	RDT positive	317 523	373 542	405 984	307 362	193 648	176 163	103 429	80 371	55 590°	55 590
Nepal	Suspected cases	213 353	188 702	276 752	168 687	200 631	131 654	146 705	263 510	256 020	224 726
	Presumed and confirmed	96 383	71 752	71 410	37 336	26 526	19 896	10 687	4 059	2 930	1 438
	Microscopy examined	102 977	95 011	152 780	100 336	127 130	63 946	84 595	163 323	160 904	92 367
	Microscopy positive	3 115	1 910	1 659	1 197	1 469	1 112	1 009	1 293	1 158	102
	RDT examined	17 887	25 353	55 792	32 989	48 444	49 649	52 432	97 870	93 378	131 631
	RDT positive	779	1 504	1 571	777	–	725	–	449	34	608
	Imported cases	–	1 079	1 026	–	637	521	502	670	539	579
Sri Lanka[1]	Suspected cases	1 001 107	985 060	957 155	1 249 846	1 078 884	1 157 366	1 090 743	1 104 333	1 149 897	1 185 659
	Presumed and confirmed	736	175	93	93	95	49	36	41	57	48	53
	Microscopy examined	1 001 107	985 060	948 250	1 236 580	1 069 817	1 142 466	1 072 396	1 089 290	1 129 070	1 164 914
	Microscopy positive	736	175	74	93	45	35	40	38	48	51
	RDT examined	–	–	8 905	13 266	9 067	14 900	18 347	15 043	20 827	20 745
	RDT positive	–	–	19	2	4	1	1	19	0	2
	Imported cases	52	51	70	95	49	36	41	57	48	53
Thailand	Suspected cases	1 777 977	1 450 885	1 272 324	1 927 585	1 833 061	1 537 430	1 619 174	1 268 976	976 482	937 053
	Presumed and confirmed	32 480	24 897	46 895	41 602	41 218	24 155	17 800	11 440	6 750	5 421
	Microscopy examined	1 695 980	1 354 215	1 130 757	1 830 090	1 756 528	1 358 953	1 302 834	1 117 648	908 540	856 893
	Microscopy positive	22 969	14 478	32 569	33 302	37 921	14 750	11 301	7 154	5 171	4 170
	RDT examined	81 997	96 670	141 567	97 495	76 533	178 477	316 340	151 328	67 942	80 160
	RDT positive	9 511	10 419	14 326	8 300	3 297	9 405	6 499	4 286	1 579	1 251
	Imported cases	–	–	–	–	–	9 890	5 724	4 020	1 618	1 342
Timor-Leste[3]	Suspected cases	266 386	225 858	193 695	208 064	135 053	121 054	150 333	129 175	154 816	181 676
	Presumed and confirmed	119 074	36 150	6 458	1 240	411	80	95	30	8	9^
	Microscopy examined	109 806	82 175	64 318	56 192	30 515	30 237	35 947	37 705	45 976	51 042
	Microscopy positive	40 250	19 739	5 208	1 025	347	80	94	30	8	9
	RDT examined	85 643	127 272	128 437	151 855	104 538	90 817	114 385	91 470	108 840	130 634
	RDT positive	7 887	–	310	198	64	–	–	–	–	7
	Imported cases	–	–	–	–	–	–	–	13	7	9

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
WESTERN PACIFIC											
Cambodia	Suspected cases	411 104	300 344	207 483	356 027	354 901	332 613	298 108	376 702	282 295	596 009
	Presumed and confirmed	181 857	106 905	74 628	46 890	70 304	68 109	43 380	76 804	62 582	32 197
	Microscopy examined	90 175	86 526	80 212	54 716	48 591	49 357	42 802	38 188	42 834	38 964
	Microscopy positive	14 277	13 792	10 124	4 598	5 288	7 423	3 695	5 908	8 318	2 635
	RDT examined	235 536	270 080	215 055	149 946	306 310	283 256	255 306	338 514	239 461	557 045
	RDT positive	82 187	93 113	59 427	39 471	63 890	60 686	39 685	70 896	54 264	29 562
China[3]	Suspected cases	7 118 649	9 190 401	6 918 770	5 555 001	4 403 633	4 052 616	3 194 929	2 409 280	1 904 295	1 680 801
	Presumed and confirmed	9 973	5 258	2 716	4 246	3 079	3 279	3 150	2 672	2 511	2 486
	Microscopy examined	7 115 784	9 189 270	6 918 657	5 554 960	4 403 633	4 052 588	3 194 915	2 409 280	1 904 290	1 680 796
	Microscopy positive	7 108	3 367°	2 603	4 205	3 079	3 251	3 150	2 663	2 511	2 482
	RDT examined	–	–	–	–	–	–	–	–	–	–
	RDT positive	–	–	–	–	–	–	–	–	–	–
	Imported cases	2 118	2 819	2 474	4 051	3 026	3 240	3 149	2 672	2 511	2 486
Lao People's Democratic Republic	Suspected cases	319 731	309 669	435 764	400 793	275 447	320 208	324 952	320 200	353 940	567 919
	Presumed and confirmed	28 970	21 080	62 552	54 795	68 028	50 724	17 071	12 362	10 141	6 687
	Microscopy examined	150 512	213 578	223 934	202 422	133 916	110 084	89 998	110 450	89 622	127 959
	Microscopy positive	4 524	6 226	13 232	10 036	8 018	4 167	1 597	1 549	1 091	898
	RDT examined	166 972	95 719	211 213	195 047	234 529	242 313	184 919	209 750	235 330	439 960
	RDT positive	22 199	14 482	48 703	41 435	60 010	46 557	14 944	10 805	9 050	5 789
Malaysia[3,4]	Suspected cases	1 619 074	1 600 439	1 566 872	1 576 012	1 443 958	1 066 518	1 153 155	1 046 223	1 070 356	1 072 252#
	Presumed and confirmed	6 650	5 306	4 725	3 850	3 923	2 359	2 349	4 174	4 630	3 941
	Microscopy examined	1 619 074	1 600 439	1 566 872	1 576 012	1 443 958	1 066 470	1 153 108	1 046 163	1 070 356	1 072 252
	Microscopy positive	6 650	5 306	4 725	3 850	3 923	2 311	2 302	4 114	4 630	3 941
	RDT examined	–	–	–	–	–	48	47	60	–	–
	RDT positive	–	–	–	–	–	48	47	60	–	–
	Imported cases	831	1 142	924	816	731	435	428	423	485	630
Papua New Guinea	Suspected cases	1 505 393	1 279 140	1 113 528	1 520 167	1 015 615	996 660	1 246 456	1 432 082	1 513 776	1 279 574#
	Presumed and confirmed	1 379 787	1 151 343	878 371	1 176 874	707 716	620 785	785 120	892 235	940 693	646 648
	Microscopy examined	198 742	184 466	156 495	139 972	83 257	112 864	146 242	139 910	121 766	72 636
	Microscopy positive	75 985	70 603	67 202	70 658	68 118	64 719	80 472	70 449	59 652	39 684
	RDT examined	20 820	27 391	228 857	519 446	538 678	609 442	849 913	888 815	967 566	1 206 938
	RDT positive	17 971	13 457	82 993	245 467	245 918	281 712	454 347	418 429	456 597	606 964
Philippines	Suspected cases	314 788	329 665	360 126	353 823	339 319	315 010	321 848	398 759	443 997	343 174
	Presumed and confirmed	19 648	9 648	9 107	8 926	6 099	11 445	6 690	6 791	4 641	5 778
	Microscopy examined	301 031	327 060	332 063	317 360	287 725	224 843	255 302	171 424	122 502	170 887
	Microscopy positive	18 560	9 552	7 133	5 826	3 618	5 694	2 860	874	569	1 370
	RDT examined	13 211	2 540	27 042	35 257	51 582	90 132	66 536	227 335	321 495	172 287
	RDT positive	542	31	953	1 894	2 469	5 716	3 820	5 917	4 072	4 408
	Imported cases	–	–	–	–	68	85	53	69	82	95
Republic of Korea	Suspected cases	1 772	838	555	443	635	692	662	515	576	559
	Presumed and confirmed	1 772	838	555	443	635	692^	662^	515^	576^	559^
	Microscopy examined	–	–	–	–	–	–	662	515	576	559
	Microscopy positive	1 772	838	555	443	635	692	662	515	576	559
	RDT examined	–	–	–	–	–	–	–	–	–	94
	RDT positive	–	–	–	–	–	452	454	372	429	94
	Imported cases	56	64	47	50	78	72	71	79	75	74
Solomon Islands	Suspected cases	284 931	254 506	249 520	245 014	233 803	192 044	274 881	238 814	244 523	271 748#
	Presumed and confirmed	95 006	80 859	57 296	53 270	51 649	50 916	84 514	68 712	72 430	86 116
	Microscopy examined	212 329	182 847	202 620	191 137	173 900	124 376	152 690	89 061	89 169	79 694
	Microscopy positive	35 373	23 202	21 904	21 540	13 865	14 793	26 187	15 978	17 825	18 239
	RDT examined	17 300	17 457	13 987	26 216	26 658	40 750	92 109	133 560	142 115	178 705
	RDT positive	4 331	3 455	2 479	4 069	4 539	9 205	28 245	36 541	41 366	54 528
Vanuatu	Suspected cases	55 161	38 150	39 047	32 716	40 333	16 044	24 232	34 152	26 931	23 531
	Presumed and confirmed	20 982	7 263	4 812	2 883	1 314	845	2 531	1 228	644	576
	Microscopy examined	29 180	19 183	16 981	15 219	18 135	4 870	6 704	9 187	5 935	4 596
	Microscopy positive	4 013	2 077	733	767	190	15	225	120	53	26
	RDT examined	14 816	17 883	21 786	17 497	22 198	10 900	17 249	24 965	20 996	11 318
	RDT positive	5 804	4 102	3 799	2 116	1 124	556	2 027	1 108	591	550
	Imported cases	–	–	–	–	–	–	–	1	12	9
Viet Nam	Suspected cases	2 803 918	3 312 266	3 436 534	3 115 804	2 786 135	2 673 662	2 497 326	2 614 663	2 169 224	2 420 032#
	Presumed and confirmed	54 297	45 588	43 717	35 406	27 868	19 252	10 446	8 411	6 870^	5 987^
	Microscopy examined	2 760 119	2 791 917	2 897 730	2 684 996	2 357 536	2 204 409	2 082 986	2 009 233	1 674 897	1 914 379
	Microscopy positive	17 515	16 612	19 638	17 128	15 752	9 331	4 161	4 548	4 813	4 765
	RDT examined	7 017	491 373	514 725	412 530	416 483	459 332	408 055	603 161	492 270	504 431
	RDT positive	–	–	–	–	–	–	–	1 594	1 848	3 243
	Imported cases	–	–	–	–	–	–	–	–	1 681	1 565

ANNEX 3 – H. REPORTED MALARIA CASES BY METHOD OF CONFIRMATION, 2010–2019

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
REGIONAL SUMMARY (presumed and confirmed malaria cases)										
African	114 136 561	109 674 966	120 095 708	131 873 575	139 971 828	146 536 084	161 747 293	164 462 509	160 091 538	170 908 841
Americas	677 545	495 220	471 839	441 271	390 790	455 828	628 226	888 253	881 018	815 543
Eastern Mediterranean	6 369 494	5 952 130	5 835 463	4 953 423	5 353 609	5 418 414	3 678 726	4 464 691	5 247 479	4 492 250
European	258	246	430	281	266	235	223	231	22	14
South-East Asia	3 079 299	2 503 613	2 164 457	1 687 447	1 707 213	1 660 301	1 477 427	1 265 039	752 593	671 835
Western Pacific	1 798 942	1 434 088	1 138 479	1 387 583	940 615	828 406	955 913	1 073 904	1 105 718	790 975
Total	**126 062 099**	**120 060 263**	**129 706 376**	**140 343 580**	**148 364 321**	**154 899 268**	**168 487 808**	**172 154 627**	**168 078 368**	**177 679 458**

Data as of 1 March 2021

RDT: rapid diagnostic test; WHO: World Health Organization.

"–" refers to not applicable or data not available.

* Data is available for Zanzibar only.

^ Confirmed cases are corrected for double counting of microscopy and RDT.

° Incomplete lab data. Confirmed cases reported by the country exceed microscopy positive + RDT positive.

Note: Suspected cases = presumed+microscopy examined+rdt examined, unless reported by the country.

Country reported suspected cases but due to data quality issues these were adjusted based on the formula suspected= presumed+microscopy examined+rdt examined.

Figures reported include all cases reported from the public, private and community sectors where available

∞ This data is unlikely to be correct.

[1] Certified malaria free countries are included in this listing for historical purposes.

[2] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

[3] There are no indigenous cases.

[4] Figures include all imported or non-human malaria cases, none of them being indigenous malaria cases.

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Algeria[1]	Indigenous cases	1*	1*	55*	8*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	396	187	828	587	260	727	420	446	1 241	1 014
Angola	Indigenous cases	1 682 870	1 632 282	1 496 834	1 999 868	2 298 979	2 769 305	3 794 253	3 874 892	5 150 575	7 054 978
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	7 054 978
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Benin	Indigenous cases	–	422 968	705 839	1 090 602	1 309 238	1 721 626	1 610 790	1 933 912	1 975 812	2 895 878
	Total *P. falciparum*	–	68 745	–	–	1 044 235	1 268 347	1 324 576	1 696 777	1 768 450	2 895 878
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Botswana	Indigenous cases	1 046	432	193	456**	1 346**	284**	659**	1 847**	534*	169*
	Total *P. falciparum*	1 046	432	193	456	1 346	326^	703^	1 891^	534	169
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	13^	9^	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	30	30	48	64	62	51	103
Burkina Faso	Indigenous cases	804 539	428 113	3 858 046	3 769 051	5 428 655	7 015 446	9 779 411	10 557 260	10 278 970	5 877 426
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	5 877 426
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Burundi	Indigenous cases	1 763 447	1 575 237	2 166 690	4 178 338	4 726 299	5 428 710	8 793 176	8 795 952	4 966 511	9 959 533
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Cabo Verde	Indigenous cases	47	7*	1*	22*	26*	7*	48*	423*	2*	0*
	Total *P. falciparum*	47	7	–	–	26	7	48	423	2	0
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	29	35	24	20	21	27	23	18	39
Cameroon	Indigenous cases	–	17 874	66 656	42 581	–	1 193 281	2 476 153	2 244 788	2 257 633	2 819 803
	Total *P. falciparum*	–	–	–	–	–	592 351	810 367	1 191 257	1 249 705	2 318 830
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Central African Republic	Indigenous cases	–	–	87 566	163 701	295 088	598 833	1 032 764	383 309	972 119	2 416 960
	Total *P. falciparum*	–	–	–	–	295 088	598 833	1 032 764	383 309	972 119	4 063 727
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Chad	Indigenous cases	200 448	181 126	7 710	754 565	914 032	787 046	1 294 768	1 962 372	1 364 706	1 632 529
	Total *P. falciparum*	–	–	–	–	–	–	–	–	1 364 706	1 632 529
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Comoros	Indigenous cases	36 538	24 856	49 840	53 156	2 203	1 884	1 467	3 896	15 613	17599**
	Total *P. falciparum*	33 791	21 387	43 681	45 669	2 203	1 300	1 066	2 274	15 613	17 599
	Total *P. vivax*	528	334	637	72	–	–	–	–	–	–
	Total mixed cases	–	–	–	363	–	–	–	–	–	–
	Total other species	880	557	1 189	363	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	–	–	–	–	98

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Congo	Indigenous cases	–	37 744	120 319	43 232	66 323	51 529	171 847	127 939	116 903	117 837
	Total *P. falciparum*	–	37 744	120 319	43 232	66 323	51 529	171 847	127 939	116 903	117 837
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Côte d'Ivoire	Indigenous cases	62 726	29 976	1 140 627	2 524 326	3 712 831	3 375 904	3 754 504	4 032 381	4 766 477	5 935 178
	Total *P. falciparum*	–	–	–	2 506 953	3 712 831	3 375 904	3 471 024	3 274 683	4 766 477	5 935 178
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Democratic Republic of the Congo	Indigenous cases	2 417 780	4 561 981	4 791 598	6 719 887	10 288 519	12 538 805	16 821 130	16 793 002	16 972 207	21 608 681
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	21 608 681
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Equatorial Guinea	Indigenous cases	53 813	22 466	15 169	16 405	20 417	15 142	147 714	15 725	8 962	25 904
	Total *P. falciparum*	53 813	22 466	15 169	13 129	17 452	–	–	–	–	239
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	15 790
	Total mixed cases	–	–	–	–	–	–	–	–	–	2 036
	Total other species	–	–	–	–	–	–	–	–	–	0
Eritrea	Indigenous cases	35 982	34 848	21 815	21 317	50 534	28 036	24 251	54 005	46 440	93 878
	Total *P. falciparum*	9 785	10 263	12 121	12 482	23 787	14 510	20 704	21 849	16 553	75 568
	Total *P. vivax*	3 989	4 932	9 204	7 361	6 780	4 780	2 999	9 185	6 108	15 790
	Total mixed cases	63	94	346	1 391	166	70	543	429	268	2 036
	Total other species	57	19	–	83	35	12	5	23	26	0
Eswatini	Indigenous cases	268	379**	409**	728**	389**	318*	250*	440*	686*	239*
	Total *P. falciparum*	87	189	192	253	389	318	250	440	686	239
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	1	–	–	–	–	–	–
	Imported cases	–	170	153	234	322	157	67	687	271	338
Ethiopia	Indigenous cases	1 196 829	1 480 360	1 692 578	2 645 454	2 118 815	1 867 059	1 718 504	1 530 739	962 087	904 495
	Total *P. falciparum*	732 776	814 547	946 595	1 687 163	1 250 110	1 188 627	1 142 235	1 059 847	859 675	738 155
	Total *P. vivax*	390 252	665 813	745 983	958 291	868 705	678 432	576 269	470 892	102 412	166 340
	Total mixed cases	73 801	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Gabon	Indigenous cases	13 936	–	19 753	28 982	31 900	23 867	23 915	35 244	111 719	53 182
	Total *P. falciparum*	2 157	–	–	26 432	26 117	–	23 915	35 244	111 719	52 811
	Total *P. vivax*	720	–	–	–	–	–	–	–	–	–
	Total mixed cases	55	–	–	–	–	–	–	–	–	–
	Total other species	2 015	–	–	–	1 570	–	–	–	–	–
Gambia	Indigenous cases	116 353	268 020	313 469	242 513	168 256	246 348	162 739	78 040	87 448	53 386
	Total *P. falciparum*	64 108	190 379	271 038	240 792	99 976	240 382	153 685	69 931	87 448	53 386
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Ghana	Indigenous cases	1 071 637	1 041 260	3 755 166	1 643 642	3 415 912	5 657 096	5 428 979	7 003 155	4 931 454	6 115 267
	Total *P. falciparum*	926 447	593 518	3 755 166	1 629 198	3 415 912	4 319 919	4 421 788	4 266 541	4 808 163	6 075 297
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	83 654	82 153	–	28 952
	Total other species	102 937	31 238	–	–	–	–	–	–	–	11 018
Guinea	Indigenous cases	20 936	95 574	340 258	211 257	660 207	810 979	992 146	1 335 323	1 214 996	2 143 225
	Total *P. falciparum*	20 936	5 450	191 421	63 353	660 207	810 979	992 146	1 335 323	1 214 996	2 143 225
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Guinea-Bissau	Indigenous cases	50 391	71 982	50 381	54 584	97 424	150 085	156 471	152 619	171 075	160 907
	Total *P. falciparum*	–	–	–	–	–	–	–	89 784	125 511	160 907
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Kenya	Indigenous cases	898 531	1 002 805	1 453 471	2 375 129	2 851 555	2 041 277	3 064 796	3 607 026	2 318 090	5 019 389
	Total *P. falciparum*	898 531	1 002 805	1 453 471	2 335 286	2 808 931	1 499 027	2 783 846	3 215 116	1 521 566	4 656 702
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Liberia	Indigenous cases	922 173	1 921 159	1 412 629	1 244 220	881 224	941 711	1 191 137	1 093 115	–	915 845
	Total *P. falciparum*	212 927	577 641	1 407 455	1 244 220	864 204	941 711	1 191 137	1 093 115	–	915 845
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Madagascar	Indigenous cases	202 450	224 498	402 900	433 450	470 212**	938 490**	686 024	985 852	972 790	970 828
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	712	1 167	–	–	–	–
Malawi	Indigenous cases	–	304 499	1 564 984	1 280 892	2 905 310	3 661 238	4 827 373	4 947 443	5 865 476	5 184 107
	Total *P. falciparum*	–	–	–	–	2 905 310	3 585 315	4 730 835	4 901 344	5 830 741	5 184 107
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Mali	Indigenous cases	239 787	307 035	968 136	1 506 940	2 220 956	2 454 508	2 311 098	2 277 218	2 345 475	3 221 535
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	3 221 535
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Mauritania	Indigenous cases	1 994	2 926	1 888	1 587	15 835	22 631	29 156	20 105	30 609	14 869
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Mayotte	Indigenous cases	201*	45*	27*	1*	1*	1*	18*	9*	3*	–
	Total *P. falciparum*	–	38	21	–	1	–	–	–	–	–
	Total *P. vivax*	–	2	2	–	–	–	–	–	–	–
	Total mixed cases	–	–	4	–	–	–	–	–	–	–
	Total other species	–	–	2	–	–	–	–	–	–	–
	Imported cases	236	51	47	71	14	10	10	10	44	–
Mozambique	Indigenous cases	1 522 577	1 756 874	1 853 276	3 282 172	7 407 175	8 222 814	9 690 873	9 892 601	10 304 472	11 734 926
	Total *P. falciparum*	878 009	663 132	927 841	2 998 874	7 117 648	7 718 782	8 520 376	8 921 081	9 292 928	11 734 926
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Namibia	Indigenous cases	556	1 525	194	4 775	15 692	9 162*	19 510*	54 268*	30 567*	2 376*
	Total *P. falciparum*	556	335	194	136	15 692	9 162	329	364	280	2 340
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	6
	Total mixed cases	–	–	–	–	–	–	–	–	–	0
	Total other species	–	–	–	–	–	–	–	–	–	16
	Imported cases***	–	–	–	–	–	2 888	3 980	11 874	4 021	1 064
Niger	Indigenous cases	642 774	838 585	2 329 260	2 373 591	3 963 768	2 392 108	4 258 110	2 761 268	3 046 450	3 771 451
	Total *P. falciparum*	601 455	757 449	817 072	1 426 696	3 828 486	2 267 867	3 961 178	2 638 580	3 046 450	3 748 155
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	17 123	21 370	22 399	46 068	78 102	–	–	–	–	–
	Total other species	–	–	25 270	5 102	39 066	4 133	186 989	–	–	23 296

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Nigeria	Indigenous cases	551 187	–	–	–	8 572 322	8 068 583	13 598 282	13 087 878	14 548 024	19 806 915
	Total *P. falciparum*	523 513	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Rwanda	Indigenous cases	669 322	273 293	483 470	962 618	1 623 176	2 505 794	3 380 568	5 940 533	4 231 883	3 612 822
	Total *P. falciparum*	638 669	208 858	483 470	962 618	1 623 176	–	–	2 927 780	1 657 793	1 306 846
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	2 305 976
	Total other species	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	Indigenous cases	2 740	8 442	12 550	9 243	1 754	2 056**	2 238	2 239**	2 937**	2 732**
	Total *P. falciparum*	2 219	6 363	10 700	9 242	1 754	2 055	2 234	2 239	2 937	2 447
	Total *P. vivax*	14	4	1	1	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	6	–	–	–	1	–	–	–	–
	Imported cases	–	–	–	–	–	2	0	2	3	10
Senegal	Indigenous cases	330 331	274 119	280 241	366 687	268 912	492 253	349 540	395 706	530 652**	354 663**
	Total *P. falciparum*	330 331	274 119	280 241	345 889	265 624	491 901	347 635	395 706	530 652	354 663
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	0	0	0	292	45
Sierra Leone	Indigenous cases	934 028	638 859	1 537 322	1 701 958	1 374 476	1 483 376	1 775 306	1 651 236	1 733 831	2 407 505
	Total *P. falciparum*	218 473	25 511	1 537 322	1 701 958	1 374 476	1 483 376	1 775 306	1 651 236	1 733 831	2 407 505
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
South Africa	Indigenous cases	8 060	9 866	6 621	8 645	11 705	555*	1 113*	21 442*	9 540*	3 096*
	Total *P. falciparum*	2 181	6 906	3 109	8 645	11 563	554	3 104^	22 061^	9 540	3 096
	Total *P. vivax*	–	14	5	–	–	–	–	–	–	–
	Total mixed cases	12	–	–	–	–	–	–	–	–	–
	Total other species	5	15	7	–	–	1	–	–	–	–
	Imported cases	–	–	–	–	–	3 568	3 075	6 234	5 742	8 890
South Sudan[2]	Indigenous cases	900 283	112 024	225 371	262 520	71 377	24 371	7 619	1 488 005	98 843	1 903 742
	Total *P. falciparum*	–	112 024	–	–	–	–	7 619	1 488 005	3 242	1 902 505
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Togo	Indigenous cases	1 019 029	506 764	909 129	965 832	1 524 339	1 610 711	1 746 334	1 756 582	2 002 877	2 406 091
	Total *P. falciparum*	1 018 801	506 741	909 120	965 824	1 524 322	1 610 568	1 746 101	1 756 331	2 002 712	2 402 967
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	8	–	–	–	–	–	–
	Total other species	7	23	9	8	17	17	9 149	77	224	1 005
Uganda	Indigenous cases	1 628 595	231 873	2 662 258	1 502 362	3 631 939	7 412 747	9 735 849	11 667 831	5 759 174	13 982 362
	Total *P. falciparum*	1 565 348	231 873	2 662 258	1 502 362	3 631 939	7 137 662	9 385 132	11 700 000	5 759 174	13 982 362
	Total *P. vivax*	15 812	–	–	–	–	–	–	–	–	–
	Total mixed cases	47 435	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
United Republic of Tanzania	Indigenous cases	1 279 362	2 151 236	1 987 629	1 554 117	680 442	4 900 085	5 762 373	5 744 907	6 051 844	5 908 168
	Total *P. falciparum*	2338Σ	4489Σ	2730Σ	1475Σ	227Σ	412 433	–	1 733Σ	486Σ	1 338Σ
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	212 837	69 511	106 764	175	–	1 606	1 020	–
	Total other species	–	–	–	–	106 609	–	–	10	26	–
	Imported cases	–	–	–	719	1 583	2 550	–	–	1 754	3 286
Mainland	Indigenous cases	1 277 024	2 146 747	1 984 698	1 552 444	678 207	4 898 211	5 755 669	5 739 863	6 050 382	5 906 621
	Total *P. falciparum*	–	–	–	–	–	411 741	–	–	–	–
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	212 636	69 459	106 609	–	–	–	–	–
	Total other species	–	–	–	–	106 609	–	–	–	–	–

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN											
Zanzibar	Indigenous cases	2 338	4 489	2 931	1'673*	2'235*	1'874*	6 704	5 044	1 462*	1 547*
	Total *P. falciparum*	2 338	4 489	2 730	1 475	227	692	-	1 733	486	1 338
	Total *P. vivax*	-	-	-	-	-	-	-	-	-	-
	Total mixed cases	-	-	201	52	155	175	-	1 606	1 020	-
	Total other species	-	-	-	-	-	-	-	10	26	-
	Imported cases	-	-	-	719	1 583	2 550	-	-	1 754	3 286
Zambia	Indigenous cases	-	-	-	-	4 077 547	4 184 661	4 851 319	5 505 639	5 039 679	5 147 350
	Total *P. falciparum*	-	-	-	-	4 077 547	4 184 661	4 851 319	5 505 639	5 039 679	5 147 350
	Total *P. vivax*	-	-	-	-	-	-	-	-	-	-
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
Zimbabwe	Indigenous cases	498 758	319 935	276 963	422 633	548 276	482 199**	313 645**	467 508**	271 976**	308 173
	Total *P. falciparum*	249 379	319 935	276 963	422 633	535 931	391 651	279 988	315 624	183 755	308 173
	Total *P. vivax*	-	-	-	-	-	-	-	-	-	-
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	-	-	-	-	180	358	768	672	-
AMERICAS											
Argentina[1]	Indigenous cases	14*	0*	0*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	-	-	-	-	-	-	-	-	-	-
	Total *P. vivax*	14	-	-	-	-	-	-	-	-	-
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	46	28	16	11	15	11	7	18	23	-
Belize	Indigenous cases	150	72*	33*	20*	19*	9*	4*	7*	3*	0*
	Total *P. falciparum*	-	-	-	-	-	-	-	-	1	0
	Total *P. vivax*	149	72	33	20	19	9	4	5	2	0
	Total mixed cases	1	-	-	-	-	-	-	2	-	0
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	7	4	4	0	4	1	2	4	2
Bolivia (Plurinational State of)	Indigenous cases	13 769	7 143	7 415	7 342	7 401	6 874*	5 542*	4 572**	5 342*	9 338**
	Total *P. falciparum*	1 165	370	337	959	325	77	4	-	-	26
	Total *P. vivax*	12 569	6 756	7 067	6 346	7 060	6 785	5 535	4 572	5 342	9 299
	Total mixed cases	35	17	11	37	16	12	3	-	-	5
	Total other species	-	-	-	-	-	-	-	-	-	8
	Imported cases	-	-	-	-	-	33	11	15	12	19
Brazil	Indigenous cases	334 667	267 146	242 758	169 641**	137 897**	141 246**	124 176**	189 558*	187 757*	153 296*
	Total *P. falciparum*	47 406	32 029	31 913	25 928	21 295^^	14 762	13 160^^	18 614	17 852	15 138
	Total *P. vivax*	283 435	231 368	203 018	137 887	115 809^^	122 746	110 340^^	169 886	168 499	136 949
	Total mixed cases	3 642	3 606	7 722	5 015	2 139^^	683	669^^	1 032	1 331	1 189
	Total other species	183	143	0	32	38^^	38	8^^	26	11	20
	Imported cases	-	-	-	8'905	4'847	4'915	5'068	4 867	6 816	4 158
Colombia	Indigenous cases	117 650	64 436	60 179	51 722	40 768	47 616*	82 609*	52 805*	61 195*	78 109*
	Total *P. falciparum*	32 900	14 650	17 612	17 650	20 067	27 875	47 232	29 558	29 953	40 074
	Total *P. vivax*	83 255	44 701	44 283	33 345	20 129	19 002	32 635	22 132	30 063	37 197
	Total mixed cases	1 434	754	672	690	567	739	2 742	1 115	1 179	838
	Total other species	48	16	9	11	5	-	-	-	-	-
	Imported cases	-	-	-	-	-	7 785	618	1 297	1 948	2 306
Costa Rica	Indigenous cases	110*	10*	6*	0*	0*	0*	4*	12*	70*	95*
	Total *P. falciparum*	-	-	-	-	-	-	-	-	9	8
	Total *P. vivax*	110	10	4^	-	-	-	4	12	61	87
	Total mixed cases	-	-	1^	-	-	-	-	-	-	-
	Total other species	-	-	2^	-	-	-	-	-	-	-
	Imported cases	4	6	1	4	5	8	9	13	38	45

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS											
Dominican Republic	Indigenous cases	2 482	1 616	952	473*	459*	631*	690*	341*	433*	1 291*
	Total *P. falciparum*	2 480	1 614	950	474	459	631	690	341	561	1 291
	Total *P. vivax*	2	2	2	-	-	-	-	-	29	0
	Total mixed cases	-	-	-	-	-	-	-	-	2	0
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	-	-	105	37	30	65	57	50	23
Ecuador	Indigenous cases	1 888	1 218**	544**	368**	242**	618*	1 191*	1 275*	1 653*	1 803*
	Total *P. falciparum*	258	290	78	160	40	184	403	309	149	211
	Total *P. vivax*	1 630	929	466	208	202	434	788	963	1 504	1 592
	Total mixed cases	-	-	-	-	-	-	-	3	-	0
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	14	14	10	0	59	233	105	153	106
El Salvador[1]	Indigenous cases	17**	7**	13**	6*	6*	5*	12*	0*	0*	0*
	Total *P. falciparum*	-	-	-	-	-	-	-	-	-	-
	Total *P. vivax*	17	7	-	6	6	2	12	-	-	-
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	9	8	7	1	2	4	1	3	2	3
French Guiana	Indigenous cases	1 632	1 209	900	875	448	374**	190**	554**	546	212
	Total *P. falciparum*	987	584	382	304	136	32	29	33	-	17
	Total *P. vivax*	476	339	257	220	129	203	99	409	-	193
	Total mixed cases	561	496	381	348	182	3	3	5	-	0
	Total other species	5	5	2	345	1	-	-	-	-	2
	Imported cases	-	-	-	-	-	60	41	43	-	-
Guatemala	Indigenous cases	7 384	6 817	5 346	6 214*	4 930**	5 538*	5 000**	4 121**	3 021**	2 069*
	Total *P. falciparum*	30	64	54	101	24	43	4	3	-	0
	Total *P. vivax*	7 163	6 707	5 278	6 062	4 839	5 487	4 849	3 739	3 021	2 069
	Total mixed cases	5	3	14	51	67	8	-	1	-	0
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	-	-	-	1	2	1	3	3	3
Guyana	Indigenous cases	22 935	29 471	31 601	31 479	12 354	9 984	10 697**	13 936	17 038	18 826
	Total *P. falciparum*	11 244	15 945	16 722	13 655	3 943	3 219	4 046^^	5 141	6 032	5 737
	Total *P. vivax*	8 402	9 066	11 244	13 953	7 173	6 002	6 923^^	7 645	9 853	11 940
	Total mixed cases	3 157	4 364	3 607	3 770	1 197	731	930^^	1 078	1 089	381
	Total other species	132	96	83	101	41	32	57^^	72	64	38
	Imported cases	-	-	-	-	-	-	411	-	-	-
Haiti	Indigenous cases	84 153	32 969	25 423	20 957	17 696	17 926	21 430	19 135	8 828	10 687
	Total *P. falciparum*	84 153	32 969	25 423	20 957	17 696	17 583	21 430	18 843	8 828	10 687
	Total *P. vivax*	-	-	-	-	-	-	-	-	-	-
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
Honduras	Indigenous cases	9 745	7 618	6 439	5 428	3 378**	3 575	4 094**	1 277**	632**	330**
	Total *P. falciparum*	866	585	560	1 113	562	904	1 309	128	60^	11
	Total *P. vivax*	8 759	7 044	5 865	4 269	2 881	2 642	2 745	1 149	591^	319
	Total mixed cases	120	34	24	46	37	29	40	-	1^	0
	Total other species	-	-	-	-	-	-	-	-	1^	-
	Imported cases	-	-	-	-	2	0	3	10	21	61
Mexico	Indigenous cases	1 226**	1 124**	833**	495*	656*	517*	551*	736*	803*	618*
	Total *P. falciparum*	-	-	-	-	-	-	-	-	-	-
	Total *P. vivax*	1 226	1 124	833	495	656	517	551	736	803	618
	Total mixed cases	-	-	-	-	-	-	-	-	-	-
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	7	6	9	4	10	34	45	29	23	22
Nicaragua	Indigenous cases	692	925	1 235	1 162*	1 142*	2 279*	6 272*	10 949*	15 917*	13 200*
	Total *P. falciparum*	154	150	236	208	155	338	1 285	1 836	1 319	2 398
	Total *P. vivax*	538	775	999	954	985	1 937	4 965	9 080	14 553	10 679
	Total mixed cases	-	-	-	-	2	4	22	33	45	123
	Total other species	-	-	-	-	-	-	-	-	-	-
	Imported cases	-	-	-	34	21	29	12	3	17	26

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS											
Panama	Indigenous cases	418	354	844	696**	864*	546*	769*	649*	684*	1 580**
	Total *P. falciparum*	20	1	1	–	–	–	21	1	–	25
	Total *P. vivax*	398	353	843	696	864	546	748	648	684	1 197
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	375
	Imported cases	–	–	–	9	10	16	42	40	31	17
Paraguay[1]	Indigenous cases	18*	1*	0*	0*	0*	0*	0*	0*	0	0
	Total *P. falciparum*	–	–	–	–	–	–	–	–	–	–
	Total *P. vivax*	18	1	–	–	–	–	–	–	–	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	1	–	–	–	–	–	–
	Imported cases	9	9	15	11	8	8	10	5	0	0
Peru	Indigenous cases	31 545	25 005	31 436	48 719	65 252*	61 865*	56 623*	55 367*	45 443*	24 324*
	Total *P. falciparum*	2 291	2 929	3 399^^	7 890^^	10 416	12 569	15 319	13 173	9 438	4 724
	Total *P. vivax*	29 169	21 984	28 030^^	40 829^^	54 819	49 287	41 287	42 044	36 004	19 600
	Total mixed cases	83	89	102^^	213^^	–	–	–	148	–	0
	Total other species	3	3	7^^	11^^	17	9	17	2	1	–
	Imported cases	–	–	–	–	–	–	–	–	176	159
Suriname	Indigenous cases	1 771	795	569	729	401	81*	76*	19*	29*	95*
	Total *P. falciparum*	638	310	115	322	165	17	6	1	5	0
	Total *P. vivax*	817	382	167	322	78	61	69	17	23	95
	Total mixed cases	83	21	11	85	158	3	1	1	1	0
	Total other species	36	17	2	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	274	251	414	198	111
Venezuela (Bolivarian Republic of)	Indigenous cases	45 155	45 824	52 803	78 643*	90 708*	136 402*	240 613*	411 586*	404 924*	398 285*
	Total *P. falciparum*	10 629	9 724	10 978	22 421	21 074	24 018	46 046	68 362	80 087	64 307
	Total *P. vivax*	32 710	34 651	39 478	49 691	62 850	100 880	178 187	314 406	342 692	308 132
	Total mixed cases	–	–	–	4 808	6 769	11 491	14 531	25 849	28 128	25 846
	Total other species	60	6	23	46	15	13	25	28	9	–
	Imported cases	–	–	–	1 677	1 210	1 594	1 948	2 941	2 125	1 848
EASTERN MEDITERRANEAN											
Afghanistan	Indigenous cases	69 798	77 549	54 840	52 965	106 478	119 859	241 233	313 086	248 689	173 860
	Total *P. falciparum*	6 142	5 581	1 231	1 877	3 000	4 004	6 369	6 907	6 437	2 701
	Total *P. vivax*	63 255	71 968	53 609	43 369	58 362	82 891	132 407	154 468	166 583	170 747
	Total mixed cases	–	–	–	–	1 566	–	311	403	473	232
	Total other species	–	–	–	–	–	–	–	–	–	–
Djibouti	Indigenous cases	1 010	–	25	1 684	9 439	9 473	13 822	14 810	25 319	49 402
	Total *P. falciparum*	1 010	–	20	–	–	–	11 781	9 290	16 130	36 025
	Total *P. vivax*	–	–	–	–	–	–	2 041	5 381	9 189	13 377
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Iran (Islamic Republic of)	Indigenous cases	1 847*	1 632*	756*	479*	358*	167*	81*	57*	0*	0*
	Total *P. falciparum*	166	152^	44^	72^	21^	8	0	2	–	–
	Total *P. vivax*	1 656	1 502^	711^	426^	351^	157	79	55	–	–
	Total mixed cases	25	56^	32^	22^	4^	1	2	–	–	–
	Total other species	–	–	–	1^	–	–	–	–	–	–
	Imported cases	1 184	1 529	842	853	867	632	611	868	602	1 105
Pakistan	Indigenous cases	240 591	334 589	290 781	281 755	275 149	202 013	324 466	369 817	374 510	413 533
	Total *P. falciparum*	73 857	73 925	95 095	46 067	33 391	30 075	42 011	54 467	55 832	87 169
	Total *P. vivax*	143 136	205 879	228 215	283 661	232 332	163 872	257 962	300 623	314 385	323 355
	Total mixed cases	–	–	2 901	10 506	556	8 066	24 493	14 787	4 489	2 510
	Total other species	–	–	–	–	–	–	–	–	–	–
Saudi Arabia	Indigenous cases	29*	69*	82*	34*	30*	83*	272*	177*	61*	38*
	Total *P. falciparum*	29	69	82	34^	51^	83	270	172	57	38
	Total *P. vivax*	–	–	–	–	–	–	2	5	4	–
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	6^	–	–	–	–	–	–
	Imported cases	1 912	2 719	3 324	2 479	2 254	2 537	5 110	2 974	2 517	2 029

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EASTERN MEDITERRANEAN											
Somalia	Indigenous cases	24 833	3 351	6 817	7 407	11 001	20 953	35 628	35 138	31 021	39 687
	Total *P. falciparum*	5 629	189	–	–	–	–	–	–	–	36 304
	Total *P. vivax*	–	–	–	–	–	–	–	–	–	3 383
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
Sudan	Indigenous cases	720 557	506 806	526 931	592 383	1 068 506	586 827	566 015	800 116	1 638 017	1 752 011
	Total *P. falciparum*	–	–	–	–	–	–	333 009	580 145	1 286 915	1 363 507
	Total *P. vivax*	–	–	–	–	–	–	82 175	58 335	143 314	194 904
	Total mixed cases	–	–	–	–	–	–	32 557	82 399	187 270	193 600
	Total other species	–	–	–	–	–	–	–	–	–	–
Yemen	Indigenous cases	106 697	90 954	112 359	102 778	86 707	76 259	99 700	143 333	157 900	165 899
	Total *P. falciparum*	77 271	59 689	109 504	102 369	86 428	75 898	45 469	109 849	112 823	163 941
	Total *P. vivax*	966	478	398	408	267	334	347	1 833	970	1 802
	Total mixed cases	30	7	2	–	12	27	70	2 322	63	114
	Total other species	2	33	4	–	–	–	–	–	69	42
EUROPEAN											
Armenia[1]	Indigenous cases	0*	0*	0*	0	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	1^	0	3^	0	1^	1^	1^	2^	3^	0
	Total *P. vivax*	0	0	0	0	0	0	0	0	1^	0
	Total mixed cases	0	0	0	0	0	0	0	0	0	0
	Total other species	0	0	1^	0	0	1^	1^	0	2^	0
	Imported cases	1	0	4	0	1	2	2	2	6	0
Azerbaijan	Indigenous cases	50*	4*	3*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	2^	2^	1^	4^	2^	1^	1^	1^	2^	0
	Total *P. vivax*	50^	6^	3^	0	0	0	0	0	0	0
	Total mixed cases	0	0	0	0	0	0	0	0	0	0
	Total other species	0	0	0	0	0	0	0	0	0	0
	Imported cases	2	4	1	4	2	1	1	1	2	0
Georgia	Indigenous cases	0*	0*	0*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	0	3^	3^	6^	5^	5^	^	6^	7^	6^
	Total *P. vivax*	0	2^	1^	1^	0	0	0	1^	2^	0
	Total mixed cases	0	0	0	0	0	0	0	0	0	0
	Total other species	0	0	0	0	0	0	0	1^	0	2^
	Imported cases	0	5	4	7	5	5	7	8	9	8
Kyrgyzstan[1]	Indigenous cases	3*	0*	0*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	0	0	0	0	0	0	0	0	0	0
	Total *P. vivax*	3	0	0	0	0	0	0	0	0	0
	Total mixed cases	0	0	0	0	0	0	–	0	0	0
	Total other species	0	0	0	0	0	0	0	0	0	0
	Imported cases	3	5	3	4	0	1	6	2	0	0
Tajikistan	Indigenous cases	112*	78*	28*	4*	2*	0*	0*	0*	0*	0*
	Total *P. falciparum*	1	5	2^	1^	0	0	0	1^	0	2^
	Total *P. vivax*	111	73	37^	13^	7^	4^	1^	2^	1^	1^
	Total mixed cases	0	0	0	0	0	0	0	0	0	0
	Total other species	0	0	0	0	0	0	0	0	0	0
	Imported cases	4	22	11	10	5	4	1	3	1	3
Turkey	Indigenous cases	0*	0*	0*	0*	0*	0*	0*	0*	–	–
	Total *P. falciparum*	49^	97^	131^	186^	196^	149^	121^	148^	–	–
	Total *P. vivax*	28^	30^	243^	60^	41^	49^	47^	36^	–	–
	Total mixed cases	0^	0^	1^	5^	8^	21^	32^	23^	–	–
	Total other species	4^	1^	1^	0^	4^	2^	8^	7^	–	–
	Imported cases	81	128	376	251	249	221	208	214	–	–
Turkmenistan[1]	Indigenous cases	0*	0*	0*	0*	0*	0*	0*	0*	0*	–
	Total *P. falciparum*	0	0	0	0	0	0	0	0	0	–
	Total *P. vivax*	0	0	0	0	0	0	0	0	0	–
	Total mixed cases	0	0	0	0	0	0	0	0	0	–
	Total other species	0	0	0	0	0	0	0	0	0	–
	Imported cases	0	0	0	0	0	0	0	0	0	–

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EUROPEAN											
Uzbekistan[1]	Indigenous cases	3*	0*	0*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	0	1^	1^	2^	1^	0	0	0	0	1^
	Total *P. vivax*	3	0	0	1^	0	0	0	0	0	0
	Total mixed cases	0	0	0	0	0	0	0	0	0	0
	Total other species	0	0	0	0	0	0	0	0	0	0
	Imported cases	2	1	1	3	1	0	0	0	0	1
SOUTH-EAST ASIA											
Bangladesh	Indigenous cases	55 873	51 773	29 518	26 891	57 480	39 590**	27 628**	53 563**	10 482**	17 219**
	Total *P. falciparum*	52 012	49 086	27 651	25 815	41 261	26 453	17 269	23 314	8 470	14 752
	Total *P. vivax*	3 824	2 579	1 699	983	3 348	4 000	3 297	4 442	1 672	2 126
	Total mixed cases	37	110	168	93	12 871	9 137	7 062	1 472	340	338
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	129	109	19	41	6
Bhutan	Indigenous cases	436	194	82*	15*	19*	34*	15*	11*	6*	2*
	Total *P. falciparum*	140	87	–	6	11	13	1	0	1	4
	Total *P. vivax*	261	92	–	9	8	21	13	11	5	2
	Total mixed cases	35	15	–	0	0	0	1	0	0	0
	Total other species	–	–	–	33	–	0	0	0	0	0
	Imported cases	–	–	0	23	34	70	56	38	34	30
Democratic People's Republic of Korea	Indigenous cases	13 520	16 760	21 850*	14 407*	10 535*	7 022	5 033	4 603	3 698	1 869
	Total *P. falciparum*	0	0	0	0	0	0	0	0	0	0
	Total *P. vivax*	13 520	16 760	21 850	14 407	10 535	7 022	5 033	4 603	3 698	1 869**
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	–	–	–	–	1 869
India	Indigenous cases	1 599 986	1 310 656	1 067 824	881 730	1 102 205	1 169 261	1 087 285	844 558	429 928	338 494
	Total *P. falciparum*	830 779	662 748	524 370	462 079	720 795	774 627	706 257	525 637	204 733	154 645
	Total *P. vivax*	765 622	645 652	534 129	417 884	379 659	390 440	375 783	315 028	222 730	181 554
	Total mixed cases	3 585	2 256	9 325	1 767	1 751	4 194	5 245	3 893	2 465	2 295
	Total other species	–	–	–	–	–	–	–	–	–	–
Indonesia	Indigenous cases	465 764	422 447	417 819	343 527	252 027	217 025	218 449	261 617	222 125**	250 583**
	Total *P. falciparum*	226 241	205 364	203 114	164 722	125 217	105 525	118 836	144 600	116 046	142 036
	Total *P. vivax*	205 877	186 730	184 684	156 266	108 268	96 284	82 063	96 142	84 862	86 742
	Total mixed cases	32 185	29 192	28 872	21 146	16 564	13 385	16 471	18 988	18 383	18 707
	Total other species	1 281	1 161	1 149	1 393	1 978	1 831	1 080	1 887	2 794	–
	Imported cases	–	–	–	–	–	–	–	–	11	61
Myanmar	Indigenous cases	420 808	465 294	481 204*	333 871	205 658	182 616	110 146*	85 019*	58 167*	56 410*
	Total *P. falciparum*	388 464	433 146	314 676	222 770	138 311	110 449	62 917	50 730	38 483	23 017
	Total *P. vivax*	29 944	28 966	135 385	98 860	61 830	65 536	43 748	32 070	36 502	32 788
	Total mixed cases	2 054	3 020	31 040	12 216	5 511	6 624	3 476	2 214	1 530	606
	Total other species	346	162	103	25	6	7	5	5	3	–
Nepal	Indigenous cases	3 894	3 414**	3 230**	1 974	832*	591*	507*	623*	493*	127*
	Total *P. falciparum*	550	–	20	273	81	67	61	25	5	9
	Total *P. vivax*	2 349	908	1 480	1 659	693	504	433	587	488	118
	Total mixed cases	216	30	–	22	58	20	13	11	0	0
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	–	1 079	1 026	–	637	521	502	670	539	579
Sri Lanka[1]	Indigenous cases	684*	124*	23*	0*	0*	0*	0*	0*	0*	0*
	Total *P. falciparum*	6	3	4	–	–	0	0	0	0	0
	Total *P. vivax*	669	119	19	–	–	0	0	0	0	0
	Total mixed cases	9	–	–	–	–	0	0	0	0	0
	Total other species	–	–	–	–	–	0	0	0	0	0
	Imported cases	52	51	70	95	49	36	41	57	48	53

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SOUTH-EAST ASIA											
Thailand	Indigenous cases	32 480	24 897	46 895	41 602	41 218	8 022*	7 428*	5 698*	4 099*	3 212*
	Total *P. falciparum*	9 401	5 710	11 553	14 449	13 743	3 291	1 609	846	447	391
	Total *P. vivax*	13 401	8 608	17 506	15 573	20 513	4 655	5 765	4 802	3 575	2 752
	Total mixed cases	147	147	298	196	588	57	40	36	34	25
	Total other species	20	13	3 172	3 084	3 077	19	14	10	21	44
	Imported cases	–	–	–	–	–	9 890	5 724	4 020	1 618	1 342
Timor-Leste	Indigenous cases	48 137	19 739	5 518	1 223	411	80	81*	16*	0*	0*
	Total *P. falciparum*	28 350	14 261	1 962	373	118	33	46	4	0	0
	Total *P. vivax*	11 432	3 758	2 288	512	139	24	7	3	0	0
	Total mixed cases	468	1 720	–	140	85	23	28	9	0	0
	Total other species	–	–	–	–	–	–	0	0	0	0
	Imported cases	–	–	–	–	–	–	–	13	7	9
WESTERN PACIFIC											
Cambodia	Indigenous cases	96 464	106 905	69 551	44 069	69 178	68 109	43 380	76 804	62 582	32 197
	Total *P. falciparum*	8 213	7 054	14 896	7 092	8 332	17 830	12 156	20 328	10 525	4 834
	Total *P. vivax*	4 794	5 155	19 575	11 267	10 356	13 146	9 816	15 207	30 680	26 871
	Total mixed cases	1 270	1 583	4 971	2 418	6 464	2 954	1 520	1 397	1 080	492
	Total other species	–	–	4 971	–	–	2 498	–	–	–	–
China	Indigenous cases	4 990*	1 308**	244*	83*	53*	39*	1*	0*	0*	0*
	Total *P. falciparum*	1 269	57	16	11	6	1	0	0	0	0
	Total *P. vivax*	3 675	677	179	67	45	24	1	0	0	0
	Total mixed cases	26	1	5	1	0	0	0	0	0	0
	Total other species	20	0	0	0	0	6	0	0	0	0
	Imported cases	2 118	2'819	2 474	4 051	3 026	3 240	3 149	2 672	2 511	2 486
Lao People's Democratic Republic	Indigenous cases	26 723	20 708	61 935	51 471	68 028	50 724	16 541	12 354	10 141	6 687
	Total *P. falciparum*	4 393	5 770	37 692	24 538	23 928	14 430	4 255	4 550	4 726	2 167
	Total *P. vivax*	122	442	7 634	12 537	22 625	20 804	6 795	4 590	4 077	4 441
	Total mixed cases	8	–	769	956	1 517	822	173	193	110	69
	Total other species	1	14	769	1	1	–	–	–	–	0
Malaysia	Indigenous cases	5 194*	3 954*	3 662*	2 921*	3 147*	242*	266*	85*	0*	0*
	Total *P. falciparum*	1 344^^	634^^	651^^	422^^	177^^	110	67	18	0	0
	Total *P. vivax*	3 387^^	1750^^	915^^	385^^	241^^	84	178	59	0	0
	Total mixed cases	145^^	120^^	48^^	42^^	33^^	22	9	1	0	0
	Total other species	943^^	1660^^	2 187^^	194^^	120^^	26	12	7	0	0
	Imported cases	831	1 142	924	816	731	435	428	423	485	630
Papua New Guinea	Indigenous cases	93 956	84 060	150 195	316 125	314 032	346 431	534 819	488 878	516 249	646 648
	Total *P. falciparum*	56 735	59 153	58 747	119 469	120 641	118 452	183 686	163 160	174 818	181 463
	Total *P. vivax*	13 171	9 654	7 108	7 579	78 846	62 228	95 328	113 561	138 006	163 237
	Total mixed cases	4 089	1 164	769	1 279	79 574	115 157	197 711	200 186	201 658	299 869
	Total other species	1 990	632	609	1 279	2 125	1 950	1 772	1 433	1 767	2 079
Philippines	Indigenous cases	19 102	9 583	8 086	7 720	6019**	11325**	6627**	6722**	4559**	5683**
	Total *P. falciparum*	11 824	6 877	4 774	4 968	3 760	834	366	3 258	1 310	5 016
	Total *P. vivax*	2 885	2 380	2 189	1 357	834	882	1 503	551	116	535
	Total mixed cases	214	166	113	83	235	–	–	81	22	72
	Total other species	175	127	57	67	74	826	534	60	47	50
	Imported cases	–	–	–	–	68	85	53	69	82	95
Republic of Korea	Indigenous cases	1 267*	505*	394*	383*	557*	627*	602*	436*	501*	485*
	Total *P. falciparum*	27^^	20^^	36^^	–	–	0	0	0	0	0
	Total *P. vivax*	1 691^^	754^^	473^^	383	557	627	602	436	501	485
	Total mixed cases	–	–	–	–	–	–	–	–	–	–
	Total other species	–	–	–	–	–	–	–	–	–	–
	Imported cases	56	64	47	50	78	72	71	79	75	74

ANNEX 3 – I. REPORTED MALARIA CASES BY SPECIES, 2010–2019

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
WESTERN PACIFIC											
Solomon Islands	Indigenous cases	39 704	26 657	24 383	25 609	18 404	23 998	54 432	52 519	59 191	72 767
	Total *P. falciparum*	22 892	14 454	14 748	13 194	9 835	10 478	16 607	15 400	15 771	15 595
	Total *P. vivax*	12 281	8 665	9 339	11 628	7 845	12 150	33 060	30 169	35 072	47 164
	Total mixed cases	200	83	232	446	724	1 370	4 718	6 881	8 341	9 584
	Total other species	200	–	–	–	–	–	46	13	4	27
Vanuatu	Indigenous cases	9 817	6 179	4 532	2 883	1 314	571	2 252	1 227**	632**	567**
	Total *P. falciparum*	1 545	770	1 257	1 039	279	150	186	273	42	36
	Total *P. vivax*	2 265	1 224	1 680	1 342	703	273	1 682	798	590	531
	Total mixed cases	193	81	470	–	–	–	–	–	–	–
	Total other species	10	2	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	–	–	1	12	9
Viet Nam	Indigenous cases	17 515	16 612	19 638	17 128	15 752	9 331	4 161	6 142	3 132*	3 100*
	Total *P. falciparum*	12 763	10 101	11 448	9 532	8 245	4 327	2 323	2 858	2 966^^	3 110^^
	Total *P. vivax*	4 466	5 602	7 220	6 901	7 220	4 756	1 750	1 608	1 751^^	1 514^^
	Total mixed cases	286	909	970	695	287	234	73	70	83^^	31^^
	Total other species	–	–	–	–	–	14	15	12	13^^	10^^
	Imported cases	–	–	–	–	–	–	–	–	1 681	1 565

P.: *Plasmodium*; WHO: World Health Organization.

Data as of 1 March 2021

"–" refers to not applicable or data not available.

* Reported indigenous cases.

** Indigenous cases = confirmed cases - imported cases.

^ Includes imported cases.

^^ Data discrepancies can arise due to differences in data sources, classification of mixed infections or failure to update data following further verification.

Σ Zanzibar only.

[1] Certified malaria free countries are included in this listing for historical purposes.

[2] In May 2013, Sudan was reassigned to the WHO African Region (WHA resolution 66.21, https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

ANNEX 3 – J. REPORTED MALARIA DEATHS, 2010–2019

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN										
Algeria[1]	1	0	0	0	0	0	0	0	0	
Angola	8 114	6 909	5 736	7 300	5 714	7 832	15 997	13 967	11 814	18 691
Benin	964	1 753	2 261	2 288	1 869	1 416	1 646	2 182	2 138	2 589
Botswana	8	8	3	7	22	5	3	17	9	14
Burkina Faso	9 024	7 001	7 963	6 294	5 632	5 379	3 974	4 144	4 294	1 060
Burundi	2 677	2 233	2 263	3 411	2 974	3 799	5 853	4 414	2 481	3 316
Cabo Verde	1	1	0	0	1	0	1	2	0	0
Cameroon	4 536	3 808	3 209	4 349	4 398	3 440	2 639	3 195	3 256	4 510
Central African Republic	526	858	1 442	1 026	635	1 763	2 668	3 689	1 292	2 017
Chad	886	1 220	1 359	1 881	1 720	1 572	1 686	2 088	1 948	3 374
Comoros	53	19	17	15	0	1	0	3	8	
Congo		892	623	2 870	271	435	733	229	131	107
Côte d'Ivoire	1 023	1 389	1 534	3 261	4 069	4 413	3 340	3 222	3 133	1 693
Democratic Republic of the Congo	23 476	23 748	21 601	30 918	25 502	39 054	33 997	27 458	18 030	13 072
Equatorial Guinea	30	52	77	66		28	109			15
Eritrea	27	12	30	6	15	12	21	8	5	3
Eswatini	8	1	3	4		5	3	20	2	3
Ethiopia	1 581	936	1 621	358	213	662	510	356	158	213
Gabon	182	74	134	273	159	309	101	218	591	314
Gambia	151	440	289	262	170	167	79	54	60	41
Ghana	3 859	3 259	2 855	2 506	2 200	2 137	1 264	599	428	336
Guinea	735	743	979	108	1 067	846	867	1 174	1 267	1 881
Guinea-Bissau	296	472	370	418	357	477	191	296	244	288
Kenya	26 017	713	785	360	472	15 061	603			858
Liberia	1 422		1 725	1 191	2 288	1 379	1 259	758		601
Madagascar	427	398	552	641	551	841	443	370	927	657
Malawi	8 206	6 674	5 516	3 723	4 490	3 799	4 000	3 613	2 967	2 341
Mali	3 006	2 128	1 894	1 680	2 309	1 544	1 344	1 050	1 001	1 454
Mauritania	60	66	106	46	19	39	315	67		
Mayotte	0	0	0	0	0	0	0			
Mozambique	3 354	3 086	2 818	2 941	3 245	2 467	1 685	1 114	968	734
Namibia	63	36	4	21	61	45	65	104	82	7
Niger	3 929	2 802	2 825	2 209	2 691	2 778	2 226	2 316	3 576	4 449
Nigeria	4 238	3 353	7 734	7 878	6 082					
Rwanda	670	380	459	409	496	516	715	376	341	224
Sao Tome and Principe	14	19	7	11	0	0	1	1	0	0
Senegal	553	472	649	815	500	526	325	284	555	260
Sierra Leone	8 188	3 573	3 611	4 326	2 848	1 107	1 345	1 298	1 949	2 771
South Africa	83	54	72	105	174	110	34	301	69	79
South Sudan[2]	1 053	406	1 321	1 311				3 483	1 191	4 873
Togo	1 507	1 314	1 197	1 361	1 205	1 127	847	995	905	1 275
Uganda	8 431	5 958	6 585	7 277	5 921	6 100	5 635	5 111	3 302	5 027
United Republic of Tanzania	15 915	11 806	7 828	8 528	5 373	6 315	5 046	3 685	2 753	1 171
Mainland	15 867	11 799	7 820	8 526	5 368	6 313	5 045	3 684	2 747	1 163
Zanzibar	48	7	8	2	5	2	1	1	6	8
Zambia	4 834	4 540	3 705	3 548	3 257	2 389	1 827	1 425	1 209	1 339
Zimbabwe	255	451	351	352	406	200	351	527	192	532

ANNEX 3 – J. REPORTED MALARIA DEATHS, 2010–2019

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AMERICAS										
Argentina[1]	0	0	0	0	0	0	0	0	0	0
Belize	0	0	0	0	0	0	0	0	0	0
Bolivia (Plurinational State of)	0	0	0	0	1	0	0	0	0	0
Brazil	76	70	60	40	36	35	35	34	56	36
Colombia	42	23	24	10	17	18	36	19	9	3
Costa Rica	0	0	0	0	0	0	0	0	0	0
Dominican Republic	15	10	8	5	4	3	2	1	1	4
Ecuador	0	0	0	0	0	0	0	1	0	0
El Salvador[3]	0	0	0	0	0	0	0	0	0	0
French Guiana	1	2	2	3	0	0	0	0	0	0
Guatemala	0	0	0	1	1	1	0	0	0	0
Guyana	24	36	35	14	11	12	13	11		15
Haiti	8	5	6	10	9	15	13	24	26	7
Honduras	3	2	1	1	2	0	0	1	1	0
Mexico	0	0	0	0	0	0	1	0	1	0
Nicaragua	1	1	2	0	0	1	2		3	1
Panama	1	0	1	0	0	0	0	0	0	0
Paraguay[1]	0	0	0	0	0	0	0	0	0	0
Peru	0	1	7	4	4	5	7	10	4	5
Suriname	1	1	0	1	1	0	0	1	0	0
Venezuela (Bolivarian Republic of)	18	16	10	6	5	8	105	333	257	126
EASTERN MEDITERRANEAN										
Afghanistan	22	40	36	24	32	49	47	10	1	0
Djibouti	0	0	0	17	28	23	5			
Iran (Islamic Republic of)[3]	0	0	0	0	0	1	0	1	0	0
Pakistan		4	260	244	56	34	33	113	102	0
Saudi Arabia	0	0	0	0	0	0	0	0	0	0
Somalia	6	5	10	23	14	27	13	20	31	20
Sudan	1 023	612	618	685	823	868	698	1 534	3 129	1 663
Yemen	92	75	72	55	23	14	65	37	57	5
EUROPEAN										
Armenia[1]	0	0	0	0	0	0	0	0	0	0
Azerbaijan[3]	0	0	0	0	0	0	0	0	0	0
Georgia[3]	0	0	0	0	0	0	0	0	0	0
Kyrgyzstan[1]									0	0
Tajikistan[3]	0	0	0	0	0	0	0	0	0	0
Turkey[3]	0	0	0	0	0	0	0	0	0	0
Turkmenistan[1]	0	0	0	0	0	0	0	0	0	0
Uzbekistan[1]	0	0	0	0	0	0	0	0	0	0

ANNEX 3 – J. REPORTED MALARIA DEATHS, 2010–2019

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SOUTH-EAST ASIA										
Bangladesh	37	36	11	15	45	9	17	13	7	9
Bhutan	2	1	1	0	0		0	0	0	0
Democratic People's Republic of Korea	0	0	0	0	0	0	0	0	0	0
India	1 018	754	519	440	562	384	331	194	96	77
Indonesia	432	388	252	385	217	157	161	47	34	49
Myanmar	788	581	403	236	92	37	21	30	19	14
Nepal	6	2	0	0	0	0	3	4	0	0
Sri Lanka[1]	0	0	0	0	0	0	0	0	0	
Thailand	80	43	37	47	38	33	27	15	15	13
Timor-Leste[3]	58	16	6	3	1	0	0	0	0	0
WESTERN PACIFIC										
Cambodia	151	94	45	12	18	10	3	1	0	0
China[3]	19	33	0	0	0	0	0	0	0	0
Lao People's Democratic Republic	24	17	44	28	4	2	1	2	6	0
Malaysia[4]	13	12	12	10	4	4	2	0	0	0
Papua New Guinea	616	523	381	307	203	163	306	273	216	180
Philippines	30	12	16	12	10	20	7	4	2	9
Republic of Korea	1	2	0	0	0	0	0	0	0	1
Solomon Islands	34	19	18	18	23	13	20	27	7	14
Vanuatu	1	1	0	0	0	0	0	0	0	0
Viet Nam	21	14	8	6	6	3	3	6	1	0
REGIONAL SUMMARY										
African	150 383	104 057	104 113	116 354	99 376	118 286	103 748	94 213	73 276	82 189
Americas	190	167	156	95	91	98	214	435	358	197
Eastern Mediterranean	1 143	736	996	1 048	976	1 016	861	1 715	3 320	1 688
European	0	0	0	0	0	0	0	0	0	0
South-East Asia	2 421	1 821	1 229	1 126	955	620	560	302	164	162
Western Pacific	910	727	524	393	268	215	342	325	232	204
Total	**155 047**	**107 508**	**107 018**	**119 016**	**101 666**	**120 235**	**105 725**	**96 990**	**77 350**	**84 440**

Data as of 17 November 2020

[1] Certified malaria free countries are included in this listing for historical purposes.

[2] In May 2013, South Sudan was reassigned to the WHO African Region (WHA resolution 66.21, https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R21-en.pdf).

[3] There are no indigenous malaria deaths.

[4] In Malaysia, there was no local transmission of human malaria in 2018. Malaria deaths were imported non-human malaria.

Note: Deaths can be probable and confirmed or only confirmed deaths depending on the country. Malaria deaths presented in this annex are considered to be due to local transmission.

Notes

Imperial College London

For further information please contact:

Global Malaria Programme
World Health Organization
20, avenue Appia
CH-1211 Geneva 27
Web: www.who.int/teams/global-malaria-programme
Email: infogmp@who.int

ISBN 978 92 4 001579 1