WORLD MALARIA REPORT

2019

World Health Organization

WORLD MALARIA REPORT

2019

World Health Organization

World malaria report 2019

ISBN 978-92-4-156572-1

© World Health Organization 2019

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; https://creativecommons.org/licenses/by-nc-sa/3.0/igo).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization.

Suggested citation. World malaria report 2019. Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO.

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

Sales, rights and licensing. To purchase WHO publications, see http://apps.who.int/bookorders. To submit requests for commercial use and queries on rights and licensing, see http://www.who.int/about/licensing.

Third-party materials. If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

General disclaimers. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

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

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

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

Layout: DesignIsGood.info

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

Printed in France

Contents

Foreword iv
Acknowledgements vii
Abbreviations xi
This year's report at a glance xii
1. Introduction 1
2. Regional and global trends in burden of malaria cases and deaths 4
2.1 Estimated number of malaria cases by WHO region, 2000–2018 4
2.2 Malaria case incidence rate 7
2.3 Estimated number of malaria deaths and mortality rate by WHO region, 2010–2018 9
2.4 Progress towards the GTS milestones for malaria morbidity and mortality 11
3. Maternal, infant and child health consequences of malaria 14
3.1 Prevalence of exposure to malaria infection during pregnancy, correlation with maternal anaemia and contribution to low birthweight 15
3.2 Prevalence and burden of malaria-related anaemia in children aged under 5 years 19
3.3 Protecting the mother and child 21
4. High burden to high impact approach 24
4.1 HBHI initiation activities 24
4.2 Burden of malaria cases and deaths 26
4.3 Malaria prevention 28
4.4 Malaria diagnosis and treatment 30
4.5 Malaria funding 31
5. Malaria elimination and prevention of re-establishment 32
5.1 E-2020 initiative 32
5.2 Greater Mekong subregion 34
6. Investments in malaria programmes and research 36
6.1 Funding for malaria control and elimination 36
6.2 Investments in malaria R&D 40
6.3 Procurement and distributions of ITNs 42
6.4 Deliveries of RDTs 44
6.5 Deliveries of ACTs 45
7. Preventing malaria 46
7.1 Population at risk covered with ITNs 46
7.2 Population at risk protected by IRS 48
7.3 Pregnant women receiving three or more doses of IPTp 50
7.4 Seasonal malaria chemoprevention 51
8. Diagnostic testing and treatment 52
8.1 Prevalence of fever in children aged under 5 years 52
8.2 Numbers of children with fever brought for care 53
8.3 Parasitological testing of febrile children 54
8.4 Treatment of febrile children with antimalarial drugs 58
8.5 Use of ACT for the treatment of febrile children 59
8.6 Integrated community case management 60
9. Malaria surveillance 62
9.1 Strengthening national surveillance systems 62
9.2 Malaria modules 62
9.3 Assessment of national surveillance systems 65
10. Responding to biological threats to the fight against malaria 68
10.1 *Pf-hrp2/3* gene deletions 68
10.2 Parasite resistance – status of antimalarial drug efficacy (2010–2018) 69
10.3 Vector resistance to insecticides 72
11. Conclusion 76
References 78
Annexes 83

Foreword

Dr Tedros Adhanom Ghebreyesus
Director-General
World Health Organization

Leaving no one behind in the march to a malaria-free world

The scourge of malaria continues to strike hardest against pregnant women and children in Africa. The *World malaria report 2019* includes a special section focused on the burden and consequences of the disease among these two most at-risk groups. It delivers a clear message: we must all do more to protect the most vulnerable in the fight against a disease that continues to claim more than 400 000 lives every year.

Malaria in pregnancy compromises the mother's health and puts her at greater risk of death. It impacts the health of the fetus, leading to prematurity and low birthweight, major contributors to neonatal and infant mortality. Last year, some 11 million pregnant women in sub-Saharan Africa were infected with malaria and, consequently, nearly 900 000 children were born with a low birthweight.

To protect pregnant women in Africa, WHO recommends the use of insecticide-treated mosquito nets (ITNs) and preventive antimalarial medicines. This report shows progress on both fronts. Still, nearly 40% of pregnant woman did not sleep under an ITN in 2018 and two thirds did not receive the recommended three or more doses of preventive therapy.

Among children, efforts to expand access to preventive antimalarial medicines are bearing fruit. In Africa's Sahel sub-region, WHO recommends seasonal malaria chemoprevention during the peak transmission season. More than 60% of children living in areas eligible for this preventive therapy received it in 2018.

Sierra Leone is to be commended for becoming the first country in Africa to roll out intermittent preventive treatment in infants, another WHO-recommended approach for protecting young children in malaria-affected areas.

Still, access to care for children showing signs of a fever remains too low. Country surveys show that nearly 40% of febrile children in sub-Saharan Africa are not taken for care with a trained medical provider.

At least 10 countries that are part of the WHO "E-2020 initiative" are on track to reach the 2020 elimination milestone of our global malaria strategy. In 2015, all of these countries were malaria endemic; now they have either achieved zero indigenous malaria cases or are nearing the finish line.

However, in recent years, global progress in reducing new malaria cases has levelled off. Most worrying of all, malaria is on the rise across some high-burden countries in Africa.

Critical milestones of our global malaria strategy are likely to be missed.

In 2018, WHO and the RBM Partnership to End Malaria launched "High burden to high impact", a new approach to prevent disease and save lives in the countries hardest hit by malaria. Replacing a "one size fits all" strategy, the approach calls for using the most effective tools in a more targeted way. I am very pleased to note that two countries – India and Uganda – have reported substantial reductions in malaria cases in 2018 over the previous year.

In September, I issued a "Malaria Challenge", calling for greater investment in the research and development of transformative new tools, technologies and approaches to accelerate progress in beating back this disease.

Through a WHO-coordinated pilot progamme, Ghana, Kenya and Malawi recently introduced the world's first malaria vaccine in selected areas. Evidence and experience from the programme will inform policy decisions on the vaccine's potential wider use in Africa. With support from the Global Fund to Fight AIDS, Tuberculosis and Malaria and from Unitaid, other promising tools are being tested, such as new types of ITNs and tools that target outdoor-biting mosquitoes.

Achieving our common vision of a malaria-free world will also require enhanced action in other critical areas. We need affordable, people-centred health services. We need reliable and accurate surveillance and response systems. We need strategies that are tailored to local malaria-transmission settings.

Stepped-up financing for the malaria response is essential. In 2018, total funding for malaria control and elimination reached an estimated US$ 2.7 billion, falling far short of the US$ 5 billion funding target of our global strategy.

Through resolute, robust financing, political leadership and universal health coverage, we can defeat this disease once and for all.

Acknowledgements

We are very grateful to the numerous people who contributed to the production of the *World malaria report 2019*. The following people collected and reviewed data from both malaria endemic and malaria free countries and areas:

Ahmad Mureed Muradi, Naimullah Safi and Mohammad Shoaib Tamim (Afghanistan); Lammali Karima and Houria Khelifi (Algeria); Fernanda Francisco Guimaraes and Fernanda Isabel Martins Da Graça Do Espirito Santo Alves (Angola); Malena Basilio and Yael Provecho (Argentina); Raja Alsaloom and Hasan Shuaib (Bahrain); Mya Ngon, Anjan Kumar Saha and Sabera Sultana (Bangladesh); Kim Bautista (Belize); Telesphore Houansou and Théophile Migan (Benin); Tobgyel Drukpa, Rinzin Namgay, Phurpa Tenzin and Sonam Wangdi (Bhutan); Raúl Marcelo Manjón Tellería (Bolivia [Plurinational State of]); Kentse Moakofhi and Mpho Mogopa (Botswana); Cássio Roberto Leonel Peterka, Edília Sâmela Freitas Santos and Anderson Coutinho da Silva (Brazil); Laurent Moyenga and Yacouba Savadogo (Burkina Faso); Dismas Baza and Félicien Ndayizeye (Burundi); Carolina Cardoso da Silva Leite Gomes and António Lima Moreira (Cabo Verde); Tol Bunkea, Say Chy and Jean-Olivier Guintran (Cambodia); Abomabo Moïse Hugue René and Alexis Tougordi (Cameroon); Aristide Désiré Komangoya-Nzonzo and Christophe Ndoua (Central African Republic); Mahamat Idriss Djaskano and Daoudongar Honoré Djimrassengar (Chad); Wei Ding, Yao Ruan and Li Zhang (China); Eduin Pachón Abril (Colombia); Mohamed Issa Ibrahim and Ahamada Nassuri (Comoros); Hermann Judicaël Ongouo and Jean-Mermoz Youndouka (Congo); Teresita Solano Chinchilla (Costa Rica); Ehui Anicet Parfait Katche 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, Eric Mukomena and Bacary Sambou (Democratic Republic of the Congo); Mohamed Elhakim, Hawa Hassan Guessod and Angela Anna de Tommasi (Djibouti); Dianelba Valdez (Dominican Republic); Jaen Carlos Cagua and Mauricio Vallejo (Ecuador); Jaime Enrique Alemán Escobar (El Salvador); Angela Katherine Lao Seoane and Mathilde Riloha Rivas (Equatorial Guinea); Selam Mihreteab and Assefash Zehaie (Eritrea); 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 Diakité (Guinea); Inacio Alveranga and Paulo Djatá (Guinea-Bissau); Horace Cox (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); Nancy Dian Anggraeni and Herdiana Basri (Indonesia); Leila Faraji and Ahmad Raeisi (Iran [Islamic Republic of]); Nizar Maswadi (Jordan); James Kiarie and Josephine Njoroge (Kenya); Phonephet Butphomvihane, Chitsavang Chanthavisouk and Viengxay Vanisaveth (Lao People's Democratic Republic); Najib Achi (Lebanon); Levi Hinneh and Moses Jeuronlon (Liberia); Solo Harimalala Rajaobary and Henintsoa Rabarijaona Ratovo (Madagascar); Wilfred Dodoli and Austin Albert Gumbo (Malawi); Jenarun Jelip (Malaysia); Sidibe Boubacar and Idrissa Cissé (Mali); Sidina Mohamed Ghoulam and Saidou Niang (Mauritania); Frédéric Pagès (Mayotte); José Cruz Rodríguez Martínez and Gustavo Sánchez Tejeda (Mexico); Eva de Carvalho and Guidion Mathe (Mozambique); Badri Thapa, Aung Thi and Tet Toe Tun (Myanmar); Clothilde Narib and Wilma Soroses (Namibia); Subhash Lakhe and Bibek Kumar Lal (Nepal); Cristhian Toledo (Nicaragua); Fatima Aboubakar and Hadiza Jackou (Niger); Audu Bala-Mohammed and Lynda Ozor (Nigeria); Muhammad Suleman Memon (Pakistan); Lizbeth Cerezo (Panama); John Deli (Papua New Guinea); Cynthia Viveros (Paraguay); Karim Pardo Ruiz (Peru); Gawrie Galappaththy and Maria Santa Portillo (Philippines); Byoung-Hak Jeon (Republic of Korea); Michee Kabera and Daniel Ngamije (Rwanda); Claudina Augusto da Cruz and Anastácio Pires (Sao Tome and Principe); Mohammed Hassan Al-Zahrani (Saudi Arabia); Ndella Diakhate and Medoune Ndiop (Senegal);

Louise Ganda and Samuel Juana Smith (Sierra Leone); John Leaburi (Solomon Islands); Fahmi Isse Yusuf (Somalia); Mary Anne Groepe and Bridget Shandukani (South Africa); Moses Mutebi Nganda and Harriet Akello Pasquale (South Sudan); Manjula Danansuriya, H.D.B. Herath and Navaratnasingam Janakan (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 and Damian Rutazaana (Uganda); Anna Mahendeka, Irene Mwoga and Ritha Njau (United Republic of Tanzania [mainland]); Mohamed Haji Ali, Irene Mwoga and Ritha Njau (United Republic of Tanzania [Zanzibar]); Johnny Nausien (Vanuatu); Licenciada América Rivero (Venezuela [Bolivarian Republic of]); Dai Tran Cong and Nguyen Quy Anh (Viet Nam); Adel Aljasari and Moamer Mohammed Badi (Yemen); Japhet Chiwaula and Fred Masaninga (Zambia); and Jasper Pasipamire and Ottias Tapfumanei (Zimbabwe).

We are grateful to Patrick Walker and Oliver Watson (Imperial College) for their contribution to the analysis of exposure to malaria infection during pregnancy and attributable low birthweight. Paul Milligan (London School of Hygiene and Tropical Medicine) for his contribution to updating the section on seasonal malaria chemoprevention with the most up-to-date information on implementation and coverage. Manjiri Bhawalkar (Global Fund to Fight AIDS, Tuberculosis and Malaria [Global Fund]) supplied information on financial disbursements from the Global Fund. Adam Aspden (United Kingdom of Great Britain and Northern Ireland [United Kingdom] Department for International Development) and Adam Wexler (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. Dr Samir Bhatt (Imperial College) and the Malaria Atlas Project (MAP,[1] University of Oxford, led by Professor Peter Gething), with the support of the Bill & Melinda Gates Foundation, produced estimates of insecticide-treated mosquito net (ITN) coverage for African countries using data from household surveys, ITN deliveries by manufacturers, ITNs distributed by national malaria programmes (NMPs) and ITN coverage indicators. They also produced estimates of *Plasmodium falciparum* parasite prevalence in sub-Saharan Africa. MAP's work was managed and coordinated by Dr Dan Weiss. 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) provided information on the status of national insecticide resistance monitoring and management plans. Christen Fornadel (US President's Malaria Initiative) provided insecticide resistance data and Gildas Yahouedo assisted with data compilation from publications. Colin Mathers (World Health Organization [WHO] Department of Health Statistics and Information Systems) prepared estimates of malaria mortality in children aged under 5 years, on behalf of the Child Health Epidemiology Reference Group. John Painter, Anna Bowen and Julie Gutman (US Centers for Disease Control and Prevention) provided data analysis and interpretation for the section on intermittent preventive treatment in pregnancy.

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:

- Birkinesh Amenshewa, Ebenezer Sheshi Baba, Magaran Bagayoko, Steve Banza Kubenga 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);

[1] https://map.ox.ac.uk/

- Abderrahmane Kharchi Tfeil (AFRO/IST West Africa);
- Maria Paz Ade, Janina Chavez, Rainier Escalada, Valerie Mize, Roberto Montoya, Eric Ndofor and Prabhjot Singh (WHO Regional Office for the Americas);
- Samira Al-Eryani and Ghasem Zamani (WHO Regional Office for the Eastern Mediterranean);
- Elkhan Gasimov and Elena Chulkova (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 ROAD-MAPII team (led by Mike Thorn); map production was led and coordinated by Jen Rozier, with help from Lisa Chestnutt and Joe Harris. ROAD-MAPII is supported by the Bill & Melinda Gates Foundation.

We are also grateful to Kevin Marsh (University of Oxford), Arantxa Roca-Feltrer (Malaria Consortium), Larry Slutsker (PATH) and Robert Snow (KEMRI Wellcome Trust), who graciously reviewed all sections and provided substantial comments for improvement; Ana Balcazar Moreno, Egle Granziera and Claudia Nannini (WHO) for legal review; Martha Quiñones (WHO consultant), Amélie Latour (WHO consultant) and Laurent Bergeron (WHO) for the translation into Spanish and French, respectively, of the foreword and key points; Claude Cardot and the DesignIsGood team for the design and layout of the report; Lushomo (Cape Town, South Africa) for the report cover; 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 2019* was coordinated by Abdisalan Noor. Significant contributions were made by Laura Anderson, John Aponte, Maru Aregawi, Amy Barrette, Nelly Biondi, Lucia Fernandez Montoya, Beatriz Galatas, Peter Olumese, Edith Patouillard, Salim Sadruddin and Ryan Williams, in close collaboration with Yuen Ching Chan and Tamara Ehler (WHO consultants). 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 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, Saira Stewart and Amanda Tiffany. 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; Luxembourg's Ministry of Foreign and European Affairs – Directorate for Development Cooperation and Humanitarian Affairs; the Spanish Agency for International Development Cooperation; Unitaid; and the United States Agency for International Development.

Abbreviations

ACT	artemisinin-based combination therapy
AIDS	acquired immunodeficiency syndrome
AL	artemether-lumefantrine
ANC	antenatal care
AQ	amodiaquine
AS	artesunate
AS-SP	artesunate-sulfadoxine-pyrimethamine
AS-AQ	artesunate-amodiaquine
AS-MQ	artesunate-mefloquine
AS-PY	artesunate-pyronaridine
CHW	community health worker
CI	confidence interval
CQ	chloroquine
DHA	dihydroartemisinin
DHIS2	District Health Information Software2
DHS	demographic and health survey
E-2020	eliminating countries for 2020
Global Forum	Global Forum of Malaria-Eliminating Countries
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GMP	Global Malaria Programme
GMS	Greater Mekong subregion
GPW13	WHO's 13th General Programme of Work
GTS	*Global technical strategy for malaria 2016–2030*
Hb	haemoglobin
HBHI	high burden to high impact
HIV	human immunodeficiency virus
HMIS	health management information system
HRP2	histidine-rich protein 2
iCCM	integrated community case management
iDES	integrated drug efficacy surveillance
IPTi	intermittent preventive treatment in infants
IPTp	intermittent preventive treatment in pregnancy
IQR	interquartile range
IRS	indoor residual spraying
ITN	insecticide-treated mosquito net
LBW	low birthweight
LLIN	long-lasting insecticidal net
MEOC	Malaria Elimination Oversight Committee
MIS	malaria indicator survey
MPAC	Malaria Policy Advisory Committee
NMP	national malaria programme
OECD	Organisation for Economic Co-operation and Development
P.	*Plasmodium*
PBO	piperonyl butoxide
PPQ	piperaquine
PQ	primaquine
RAcE	Rapid Access Expansion Programme
R&D	research and development
RBM	Roll Back Malaria
RDT	rapid diagnostic test
SDG	Sustainable Development Goal
SMC	seasonal malaria chemoprevention
SP	sulfadoxine-pyrimethamine
TES	therapeutic efficacy study
UNICEF	United Nations Children's Fund
United Kingdom	United Kingdom of Great Britain and Northern Ireland
USA	United States of America
WHO	World Health Organization

This year's report at a glance

REGIONAL AND GLOBAL TRENDS IN BURDEN OF MALARIA CASES AND DEATHS

Malaria cases

- In 2018, an estimated 228 million cases of malaria occurred worldwide (95% confidence interval [CI]: 206–258 million), compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million).
- Most malaria cases in 2018 were in the World Health Organization (WHO) African Region (213 million or 93%), followed by the WHO South-East Asia Region with 3.4% of the cases and the WHO Eastern Mediterranean Region with 2.1%.
- Nineteen countries in sub-Saharan Africa[1] and India carried almost 85% of the global malaria burden. Six countries accounted for more than half of all malaria cases worldwide: Nigeria (25%), the Democratic Republic of the Congo (12%), Uganda (5%), and Côte d'Ivoire, Mozambique and Niger (4% each).
- The incidence rate of malaria declined globally between 2010 and 2018, from 71 to 57 cases per 1000 population at risk. However, from 2014 to 2018, the rate of change slowed dramatically, reducing to 57 in 2014 and remaining at similar levels through to 2018.
- The WHO South-East Asia Region continued to see its incidence rate fall – from 17 cases of the disease per 1000 population at risk in 2010 to five cases in 2018 (a 70% decrease). In the WHO African Region, case incidence levels also declined from 294 in 2010 to 229 in 2018, representing a 22% reduction. All other WHO regions recorded either little progress or an increase in incidence rate. The WHO Region of the Americas recorded a rise, largely due to increases in malaria transmission in the Bolivarian Republic of Venezuela.
- Between 2015 and 2018, only 31 countries, where malaria is still endemic, reduced case incidence significantly and were on track to reduce incidence by 40% or more by 2020. Without accelerated change, the *Global technical strategy for malaria 2016–2030* (GTS) milestones for morbidity in 2025 and 2030 will not be achieved.
- *Plasmodium falciparum* is the most prevalent malaria parasite in the WHO African Region, accounting for 99.7% of estimated malaria cases in 2018, as well as in the WHO South-East Asia Region (50%), the WHO Eastern Mediterranean Region (71%) and the WHO Western Pacific Region (65%).
- Globally, 53% of the *P. vivax* burden is in the WHO South-East Asia Region, with the majority being in India (47%). *P. vivax* is the predominant parasite in the WHO Region of the Americas, representing 75% of malaria cases.

Malaria deaths

- In 2018, there were an estimated 405 000 deaths from malaria globally, compared with 416 000 estimated deaths in 2017, and 585 000 in 2010.
- Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide.

[1] The full list of sub-Saharan countries is available at https://unstats.un.org/unsd/methodology/m49; for all analyses conducted in this report and pertaining to malaria endemic sub-Saharan countries, Sudan is also included.

- The WHO African Region accounted for 94% of all malaria deaths in 2018. Although this region was home to the highest number of malaria deaths in 2018, it also accounted for 85% of the 180 000 fewer global malaria deaths reported in 2018 compared with 2010.
- Nearly 85% of global malaria deaths in 2018 were concentrated in 20 countries in the WHO African Region and India; Nigeria accounted for almost 24% of all global malaria deaths, followed by the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), and Angola, Mozambique and Niger (4% each).
- In 2018, only the WHO African Region and the WHO South-East Asia Region showed reductions in malaria deaths compared with 2010. The WHO African Region had the largest absolute reduction in malaria deaths, from 533 000 in 2010 to 380 000 in 2018. Despite these gains, the malaria mortality reduction rate has also slowed since 2016.

MATERNAL, INFANT AND CHILD HEALTH CONSEQUENCES OF MALARIA

- In 2018, about 11 million pregnancies in moderate and high transmission sub-Saharan African countries would have been exposed to malaria infection.
- In 2018, prevalence of exposure to malaria infection in pregnancy was highest in the West African subregion and Central Africa (each with 35%), followed by East and Southern Africa (20%). About 39% of these were in the Democratic Republic of the Congo and Nigeria.
- The 11 million pregnant women exposed to malaria infections in 2018 delivered about 872 000 children with low birthweight (16% of all children with low birthweight in these countries), with West Africa having the highest prevalence of low birthweight children due to malaria in pregnancy.
- Between 2015 and 2018 in 21 moderate to high malaria burden countries in the WHO African Region, the prevalence of anaemia in children under 5 years with a positive rapid diagnostic test (RDT) was double that of children with a negative RDT. In the children who were positive for malaria, 9% had severe anaemia and 54% had moderate anaemia; in contrast, in the children without malaria, only 1% had severe anaemia and 31% had moderate anaemia.
- The countries with the highest percentage of severe anaemia among children aged under 5 years who were positive for malaria were Senegal (26%), Mali (16%), Guinea (14%) and Mozambique (12%). For most other countries, severe anaemia ranged from 5% to 10%.
- Overall, about 24 million children were estimated to be infected with *P. falciparum* in 2018 in sub-Saharan Africa, and an estimated 1.8 million of them were likely to have severe anaemia.

HIGH BURDEN TO HIGH IMPACT APPROACH

- There were about 155 million malaria cases in the 11 high burden to high impact (HBHI) countries in 2018, compared with 177 million in 2010. The Democratic Republic of the Congo and Nigeria accounted for 84 million (54%) of total cases.
- Of the 10 highest burden countries in Africa, Ghana and Nigeria reported the highest absolute increases in cases of malaria in 2018 compared with 2017. The burden in 2018 was similar to that of 2017 in all other countries, apart from in Uganda and India, where there were reported reductions of 1.5 and 2.6 million malaria cases, respectively, in 2018 compared with 2017.
- Malaria deaths reduced from about 400 000 in 2010 to about 260 000 in 2018, the largest reduction being in Nigeria, from almost 153 000 deaths in 2010 to about 95 000 deaths in 2018.

- By 2018, in all of the 11 HBHI countries, at least 40% of the population at risk were sleeping under long-lasting insecticidal nets (LLINs), the highest percentage being in Uganda (80%) and the lowest in Nigeria (40%).
- Only Burkina Faso and the United Republic of Tanzania were estimated as having more than half of pregnant women receiving three doses of intermittent preventive treatment in pregnancy (IPTp3) in 2018. In Cameroon, Nigeria and Uganda, the estimated coverage was about 30% or less.
- Six countries in Africa's Sahel subregion implemented seasonal malaria chemoprevention (SMC) in 2018; a mean total of 17 million children, out of the 26 million targeted, were treated per SMC cycle.
- The percentage of children aged under 5 years with fever seeking treatment varied from 58% in Mali to 82% in Uganda. In the Democratic Republic of the Congo and Mali, more than 40% of children were not brought for care at all. Testing was also worryingly low in children who were brought for care, with 30% or less being tested in Cameroon, the Democratic Republic of the Congo and Nigeria.
- Except for India, direct domestic investment remains very low relative to international funding in the HBHI countries.

MALARIA ELIMINATION AND PREVENTION OF RE-ESTABLISHMENT

- Globally, the elimination net is widening, with more countries moving towards zero indigenous cases: in 2018, 49 countries reported fewer than 10 000 such cases, up from 46 countries in 2017 and 40 countries in 2010. The number of countries with fewer than 100 indigenous cases – a strong indicator that elimination is within reach – increased from 17 countries in 2010, to 25 countries in 2017 and 27 countries in 2018.
- Paraguay and Uzbekistan were awarded WHO certification of elimination in 2018, with Algeria and Argentina achieving certification in early 2019. In 2018, China, El Salvador, Iran, Malaysia and Timor-Leste reported zero indigenous cases.
- One of the key GTS milestones for 2020 is elimination of malaria in at least 10 countries that were malaria endemic in 2015. At the current rate of progress, it is likely that this milestone will be reached.
- In 2016, WHO identified 21 countries with the potential to eliminate malaria by the year 2020. WHO is working with the governments in these countries – known as "E-2020 countries" – to support their elimination acceleration goals.
- Although 10 E-2020 countries remain on track to achieve their elimination goals, Comoros and Costa Rica reported increases in indigenous malaria cases in 2018 compared with 2017.
- In the six countries of the Greater Mekong subregion (GMS) – Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – the reported number of malaria cases fell by 76% between 2010 and 2018, and malaria deaths fell by 95% over the same period. In 2018, Cambodia reported no malaria related deaths for the first time in the country's history.

INVESTMENTS IN MALARIA PROGRAMMES AND RESEARCH

- In 2018, an estimated US$ 2.7 billion was invested in malaria control and elimination efforts globally by governments of malaria endemic countries and international partners – a reduction from the US$ 3.2 billion that was invested in 2017. The amount invested in 2018 fell short of the US$ 5.0 billion estimated to be required globally to stay on track towards the GTS milestones.
- Nearly three quarters of investments in 2018 were spent in the WHO African Region, followed by the WHO Region of the Americas (7%), the WHO South-East Asia Region (6%), and the WHO Eastern Mediterranean Region and the WHO Western Pacific Region (5% each).
- In 2018, 47% of total funding for malaria was invested in low-income countries, 43% in lower-middle-income countries and 11% in upper-middle-income countries. International funding represented the major source of funding in low-income and lower-middle-income countries, at 85% and 61%, respectively. Domestic funding has remained stable since 2010.
- Of the US$ 2.7 billion invested in 2018, US$ 1.8 billion came from international funders. Governments of malaria endemic countries contributed 30% of total funding (US$ 900 million) in 2018, a figure unchanged from 2017. Two thirds of domestically sourced funds were invested in malaria control activities carried out by national malaria programmes (NMPs), with the remaining share estimated as the cost of patient care.
- As in previous years, the United States of America (USA) was the largest international source of malaria financing, providing US$ 1.0 billion (37%) in 2018. Country members of the Development Assistance Committee together accounted for US$ 300 million (11%). The United Kingdom of Great Britain and Northern Ireland contributed around US$ 200 million (7%).
- Of the US$ 2.7 billion invested in 2018, US$ 1.0 billion was channelled through the Global Fund to Fight AIDS, Tuberculosis and Malaria.
- Although funding for malaria has remained relatively stable since 2010, the level of investment in 2018 is far from what is required to reach the first two milestones of the GTS; that is, a reduction of at least 40% in malaria case incidence and mortality rates globally by 2020, compared with 2015 levels.
- US$ 663 million was invested in basic research and product development for malaria in 2018, an increase of US$ 18 million compared with 2017.
- Funding for drug research and development (R&D) increased to the highest level ever recorded, from US$ 228 million in 2017 to US$ 252 million in 2018. This increase was a result of private sector industry investment in several Phase II trials of new chemical entities with the potential for single-exposure radical cure.

Deliveries of malaria commodities

Insecticide-treated mosquito nets

- Between 2016 and 2018, a total of 578 million insecticide-treated mosquito nets (ITNs), mainly LLINs, were reported by manufacturers as having been delivered globally, with 50% going to Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Ghana, India, Nigeria, Uganda and the United Republic of Tanzania.
- In 2018 about 197 million ITNs were delivered by manufacturers, of which more than 87% were delivered to countries in sub-Saharan Africa.
- Globally, 80% of ITNs were distributed through mass distribution campaigns, 10% in antenatal care facilities and 6% as part of immunization programmes.

Rapid diagnostic tests

- An estimated 412 million RDTs were sold globally in 2018.
- In 2018, 259 million RDTs were distributed by NMPs. Most RDTs (64%) were tests that detected *P. falciparum* only and were supplied to sub-Saharan Africa.

Artemisinin-based combination therapy

- An estimated 3 billion treatment courses of artemisinin-based combination therapy (ACT) were procured by countries over the period 2010–2018. An estimated 63% of these procurements were reported to have been made for the public sector.
- In 2018, 214 million ACT treatment courses were delivered by NMPs, of which 98% were in the WHO African Region.

PREVENTING MALARIA

Vector control

- Half of people at risk of malaria in sub-Saharan Africa are sleeping under an ITN; in 2018, 50% of the population were protected by this intervention, an increase from 29% in 2010. Furthermore, the percentage of the population with access to an ITN increased from 33% in 2010 to 57% in 2018. However, coverage has improved only marginally since 2015 and has been at a standstill since 2016.
- Households with at least one ITN for every two people increased to 72% in 2018, from 47% in 2010. However, this figure represents only a modest increase over the past 3 years, and remains far from the target of universal coverage.
- Fewer people at risk of malaria are being protected by indoor residual spraying (IRS), a prevention method that involves spraying the inside walls of dwellings with insecticides. Globally, IRS protection declined from a peak of 5% in 2010 to 2% in 2018, with declining trends seen across all WHO regions apart from the WHO Eastern Mediterranean Region.
- Although IRS coverage dropped from 180 million people at risk protected globally in 2010 to 93 million in 2018, the 2018 figure was a decrease of 13 million compared with 2017.
- The declines in IRS coverage may be due to the switch from pyrethroids to more expensive insecticides in response to increasing pyrethroid resistance, or changes in operational strategies (e.g. at-risk populations decreasing in countries aiming for elimination of malaria).

Preventive therapies

- To protect women in areas of moderate and high malaria transmission in Africa, WHO recommends IPTp with the antimalarial drug sulfadoxine-pyrimethamine (SP). Among 36 African countries that reported on IPTp coverage levels in 2018, an estimated 31% of eligible pregnant women received the recommended three or more doses of IPTp, compared with 22% in 2017 and 2% in 2010, indicating considerable improvements in country uptake.
- About 18% of women who use antenatal care services at least once do not receive any IPTp, representing a missed opportunity that, if harnessed, could considerably and rapidly improve IPTp coverage.
- In 2018, 19 million children in 12 countries in Africa's Sahel subregion were protected through SMC programmes. All targeted children received treatment in Cameroon, Guinea, Guinea-Bissau and Mali. However, about 12 million children who could have benefited from this intervention were not covered, mainly due to a lack of funding.

DIAGNOSTIC TESTING AND TREATMENT

Accessing care

- Prompt diagnosis and treatment is the most effective way to prevent a mild case of malaria from developing into severe disease and death. Based on national household surveys completed in 20 countries in sub-Saharan Africa between 2015 and 2018, a median of 42% (interquartile range [IQR]: 34–49%) of children with a fever (febrile) were taken to a trained medical provider for care in the public sector compared with 10% (IQR: 8–22%) in the formal private sector and 3% (IQR: 2–7%) in the informal private sector.
- A high proportion of febrile children did not receive any medical attention (median: 36%, IQR: 28–45%). Poor access to health care providers or lack of awareness of malaria symptoms among caregivers are among the contributing factors.

Diagnosing malaria

- The percentage of patients suspected of having malaria who are seen in public health facilities and tested with either an RDT or microscopy, rose from 38% in 2010 to 85% in 2018.
- In 71% of moderate to high transmission countries in sub-Saharan Africa, the percentage of suspected cases tested with any parasitological test was greater than 80% in 2018.
- According to 19 nationally representative household surveys conducted between 2015 and 2018 in sub-Saharan Africa, the median percentage of febrile children brought for care who received a finger or heel stick (suggesting that a malaria diagnostic test may have been performed) was greater in the public sector (median: 66%, IQR: 49–75%) than in the formal private sector (median: 40%, IQR: 16–46%) or the informal private sector (median: 9%, IQR: 5–22%).
- According to 61 surveys conducted in 29 sub-Saharan African countries between 2010 and 2018, the percentage of children with a fever that received a diagnostic test before antimalarial treatment in the public health sector increased from a median of 48% (IQR: 30–62%) in 2010–2013 to a median of 76% (IQR: 60–86%) in 2015–2018.

Treating malaria

- Based on 20 household surveys conducted in sub-Saharan Africa in 2015–2018, the median percentage of febrile children who were treated with any antimalarial drug was higher in the public sector (median: 48%, IQR: 30–69%) than in the formal private sector (median: 40%, IQR: 21–51%) or the informal private sector (median: 18%, IQR: 10–29%).
- Data from 20 national surveys conducted in sub-Saharan Africa show that for the period 2015–2018, an estimated 47% (IQR: 29–69%) of febrile children brought for treatment for malaria in the public health sector received antimalarial drugs, compared with 59% (IQR: 53–84%) among those visiting a community health worker and 49% (IQR: 19–55%) in the formal medical private sector.
- Based on 19 surveys, antimalarial treatments among febrile children who received antimalarial medicine were slightly more likely to be ACTs if treatment was sought in the public sector (median: 80%, IQR: 45–94%) than in the formal private sector (median: 77%, IQR: 43–87%) or the informal private sector (median: 60%, IQR: 40–84%).
- To bridge the treatment gap among children, WHO recommends the uptake of integrated community case management (iCCM). This approach promotes integrated management of common life-threatening conditions in children – malaria, pneumonia and diarrhoea – at health facility and community levels. In 2018, 30 countries were implementing iCCM at different levels, with only a few implementing nationally.

MALARIA SURVEILLANCE SYSTEMS

- Pillar 3 of the GTS is to transform malaria surveillance into a core intervention. To understand whether malaria surveillance systems are fit for purpose, WHO recommends the regular monitoring and evaluation of surveillance systems.
- The Global Malaria Programme (GMP), in collaboration with the University of Oslo, has developed standardized malaria modules in District Health Information Software2 (DHIS2) for aggregate and case-based collection of routine data with associated data elements, dashboards of key epidemiological and data quality indicators, reports and a curriculum for facility-level data analysis to facilitate data analysis and interpretation.
- As of October 2019, 23 countries have installed the WHO aggregate malaria module and another six installations are planned over the next year. Five countries have already developed and integrated their own malaria module into DHIS2.
- WHO has been working in coordination with national health management information systems (HMIS) departments of ministries of health, in particular the HBHI countries, to establish structured dynamic databases known as data repositories. The GMP has developed an easily adaptable repository structure in DHIS2, with guidance on relevant data elements and indicators, their definitions and computation to cover key thematic areas. So far, work to develop these databases has started in Gambia, Ghana, Mozambique, Nigeria, Uganda and the United Republic of Tanzania.
- WHO also encourages countries to implement surveillance system assessments. An example of such an assessment and its role in improving surveillance systems is illustrated through a case study of Mozambique.

RESPONDING TO BIOLOGICAL THREATS TO THE FIGHT AGAINST MALARIA

Pfhrp2/3 gene deletions

- Deletions in the *pfhrp2* and *pfhrp3* (*pfhrp2/3*) genes of the parasite renders parasites undetectable by RDTs based on histidine-rich protein 2 (HRP2). The prevalence of dual *pfhrp2* and *pfhrp3* among symptomatic patients reached as high as 80% in Eritrea and Peru.
- 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).
- WHO is tracking published reports of *pfhrp2/3* deletions using the Malaria Threat Map mapping tool. To date, 28 countries have reported *pfhrp2* deletions.

Drug resistance

- *PfKelch13* mutations have been identified as molecular markers of partial artemisinin resistance. *PfKelch13* mutations associated with artemisinin resistance are widespread in the GMS, and have also been detected at a significant prevalence (over 5%) in Guyana, Papua New Guinea and Rwanda. In the case of Rwanda, the presence of *PfKelch13* mutations does not affect efficacy of first-line treatment.
- In the WHO Western Pacific Region, artemisinin resistance has been confirmed in Cambodia, Lao People's Democratic Republic and Viet Nam through several studies conducted between 2001

and 2018. Treatment efficacy for *P. vivax* remains high across all countries where treatment failure rates are below 10%.

- In the WHO African Region the efficacy rates of artemether-lumefantrine (AL), artesunate-amodiaquine (AS-AQ) and dihydroartemisinin-piperaquine (DHA-PPQ) for *P. falciparum* were more than 98%, and efficacy has remained high over time.
- Treatment efficacy with first-line treatment remains high for *P. falciparum* and *P. vivax* in the WHO Region of the Americas.
- In the WHO South-East Asia Region, the presence of molecular markers of artemisinin resistance has been reported in Bangladesh, India, Myanmar and Thailand. With the exception of Myanmar, failure rates of *P. falciparum* to first-line ACTs were found to be above 10% and were as high as 93% in Thailand. For *P. vivax* most countries continue to demonstrate high efficacy of chloroquine (CQ), except for Myanmar and Timor-Leste.
- In the WHO Eastern Mediterranean Region, high failure rates of treatment with artesunate-sulfadoxine-pyrimethamine (AS-SP) for *P. falciparum* in Somalia and Sudan led to a change in first-line treatment policy to AL. For *P. vivax* there is high treatment efficacy with AL and CQ in all countries where a therapeutic efficacy study (TES) has been conducted.

Insecticide resistance

- From 2010 through 2018, some 81 countries reported data on insecticide resistance monitoring to WHO.
- Of the 81 malaria endemic countries that provided data for 2010–2018, resistance to at least one of the four insecticide classes in one malaria vector from one collection site was detected in 73 countries, an increase of five countries compared with the previous reporting period 2010–2017. In 26 countries, resistance was reported to all main insecticide classes.
- Resistance to pyrethroids – the only insecticide class currently used in ITNs – is widespread and was detected in at least one malaria vector in more than two thirds of the sites tested, and was highest in the WHO African Region and in the WHO Eastern Mediterranean Region.
- Resistance to organochlorines was detected for at least one malaria vector in almost two thirds of the sites. Resistance to carbamates and organophosphates was less prevalent and was detected in 31% and 26% of the tested sites, respectively. Prevalence was highest for carbamates in the WHO South-East Asia Region and for organophosphates in the WHO South-East Asia Region and in the WHO Western Pacific Region.
- All the standard insecticide resistance data reported to WHO are included in the WHO Global Insecticide Resistance database, and are available for exploration via the Malaria Threats Map. This online tool was extended in 2019 to cover invasive mosquito species, and currently shows the geographical extent of reports on the detection of *Anopheles stephensi*.
- 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 vector*. In 2018, a total of 45 countries reported having completed plans for resistance monitoring and management and 36 were currently in the process of developing them.
- NMPs and their partners should consider the deployment of pyrethroid-piperonyl butoxide nets in geographical areas where the main malaria vectors meet the criteria recommended by WHO in 2017, rather than being based on whether the whole country meets the criteria.

Avant-propos

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

N'oublier personne sur la voie d'un monde sans paludisme

Le fléau du paludisme continue de toucher plus lourdement les femmes enceintes et les enfants en Afrique. Le *Rapport sur le paludisme dans le monde 2019* comporte donc une section spéciale sur le poids de cette maladie et ses conséquences sur ces deux groupes les plus à risque. Le message qu'il délivre est très clair : nous devons tous faire davantage pour protéger les plus vulnérables contre une maladie responsable de plus de 400 000 décès chaque année.

Le paludisme pendant la grossesse nuit à la santé de la mère et l'expose à un risque accru de décès. Il a un impact sur la santé du fœtus, entraînant prématurité et insuffisance pondérale à la naissance qui sont les principales causes de mortalité néonatale et infantile. L'an passé, environ 11 millions de femmes enceintes en Afrique subsaharienne ont présenté une infection palustre et, par conséquent, près de 900 000 enfants un faible poids à la naissance.

Pour protéger les femmes enceintes en Afrique, l'OMS recommande l'utilisation de moustiquaires imprégnées d'insecticide (MII) et de médicaments antipaludiques préventifs. Ce rapport fait état de progrès sur les deux fronts. Pourtant, près de 40 % des femmes enceintes n'ont pas dormi sous MII en 2018 et les deux tiers n'ont pas reçu le minimum de trois doses de traitement préventif comme il est recommandé.

En ce qui concerne les enfants, les efforts déployés pour améliorer l'accès aux médicaments antipaludiques préventifs portent leurs fruits. En Afrique, dans la sous-région du Sahel, l'OMS recommande la chimioprévention du paludisme saisonnier durant la période de pic de transmission. Plus de 60 % des enfants vivant dans des zones éligibles à ce traitement préventif en ont bénéficié en 2018.

La Sierra Leone peut être citée en exemple ; en effet, elle est devenue le premier pays d'Afrique à déployer le traitement préventif intermittent chez les nourrissons, une autre approche recommandée par l'OMS pour protéger les enfants en bas âge dans les zones touchées par le paludisme.

Chez les enfants présentant des signes de fièvre, l'accès aux soins reste néanmoins trop faible. En Afrique subsaharienne, les enquêtes nationales indiquent que près de 40 % des enfants ayant eu de la fièvre n'ont pas été orientés vers un prestataire médical formé.

Au moins 10 pays participant à l'« Initiative E-2020 » de l'OMS sont en passe d'atteindre l'objectif d'élimination du paludisme d'ici à 2020 défini dans notre stratégie mondiale de lutte contre le paludisme. En 2015, la maladie était endémique dans tous ces pays ; aujourd'hui, soit ils n'enregistrent aucun cas de paludisme indigène, soit ils sont tout proches de l'objectif.

Toutefois, les progrès réalisés au niveau mondial en termes de baisse de l'incidence du paludisme ont ralenti ces dernières années. Plus préoccupant encore, le paludisme progresse dans quelques pays d'Afrique où il pèse déjà lourdement.

Il est probable que des objectifs essentiels de notre stratégie mondiale de lutte contre le paludisme ne seront pas atteints.

En 2018, l'OMS et le Partenariat RBM pour en finir avec le paludisme ont lancé « *High burden to high impact* » (« D'une charge élevée à un fort impact »), une nouvelle approche visant à prévenir la maladie et à sauver des vies dans les pays les plus durement touchés par le paludisme. Se substituant à une stratégie « universelle », cette approche encourage l'utilisation des outils les plus efficaces de façon plus ciblée. Je suis ravi de constater que deux pays, l'Inde et l'Ouganda, ont rapporté une baisse substantielle du nombre de cas de paludisme en 2018 par rapport à l'année précédente.

En septembre, j'ai publié un « Malaria Challenge », préconisant d'investir davantage dans la recherche et le développement d'outils, de technologies et d'approches de transformation innovants afin d'accélérer les progrès réalisés pour vaincre cette maladie.

Grâce à un programme pilote coordonné par l'OMS, le Ghana, le Kenya et le Malawi ont récemment introduit dans certaines régions le premier vaccin antipaludique au monde. Les données et les expériences tirées de ce programme éclaireront les décisions politiques sur une utilisation éventuellement plus large du vaccin en Afrique. Grâce au soutien du Fonds mondial de lutte contre le sida, la tuberculose et le paludisme et d'Unitaid, d'autres outils prometteurs sont en phase de test, notamment de nouveaux types de moustiquaires imprégnées d'insecticide, ainsi que des outils ciblant les moustiques exophages.

Pour concrétiser notre vision commune d'un monde sans paludisme, nous allons également devoir renforcer notre action dans d'autres domaines essentiels. Nous avons besoin de services de santé abordables et axés sur les populations. Nous avons également besoin de systèmes de surveillance et de riposte qui soient fiables et précis. Enfin, nous devons définir des stratégies parfaitement adaptées aux conditions locales de transmission du paludisme.

Augmenter le financement de la lutte contre le paludisme est également indispensable. En 2018, le financement total du contrôle et de l'élimination du paludisme a atteint US$ 2,7 milliards, bien en deçà de l'objectif de US$ 5 milliards défini dans le cadre de notre stratégie mondiale.

Grâce à un financement solide et résolu, à un véritable leadership politique et à une couverture de santé universelle, nous pourrons venir à bout de cette maladie une fois pour toutes.

Le rapport de cette année en un clin d'œil

POIDS DU PALUDISME AU NIVEAU MONDIAL ET RÉGIONAL : ÉVOLUTION DU NOMBRE DE CAS ET DE DÉCÈS

Cas de paludisme

- Au niveau mondial, le nombre de cas de paludisme est estimé à 228 millions en 2018 (intervalle de confiance [IC] de 95 % : 206-258 millions), contre 251 millions en 2010 (IC de 95 % : 231-278 millions) et 231 millions en 2017 (IC de 95 % : 211-259 millions).
- La plupart des cas (213 millions ou 93 %) ont été enregistrés en 2018 dans la région Afrique de l'OMS, loin devant la région Asie du Sud-Est (3,4 %) et la région Méditerranée orientale (2,1 %).
- Dix-neuf pays d'Afrique subsaharienne[1] et l'Inde ont concentré quasiment 85 % du nombre total de cas de paludisme dans le monde. Six pays, à eux seuls, ont enregistré plus de la moitié des cas : le Nigéria (25 %), la République démocratique du Congo (12 %), l'Ouganda (5 %), ainsi que la Côte d'Ivoire, le Mozambique et le Niger (4 % chacun).
- Au niveau mondial, l'incidence du paludisme a reculé entre 2010 et 2018, passant de 71 cas pour 1 000 habitants exposés au risque de paludisme à 57 pour 1 000. Néanmoins, cette baisse a considérablement ralenti entre 2014 et 2018, l'incidence ayant diminué à 57 pour 1 000 en 2014 pour rester à un niveau similaire jusqu'en 2018.
- Dans la région Asie du Sud-Est de l'OMS, l'incidence du paludisme continue à baisser, de 17 cas pour 1 000 habitants exposés au risque de paludisme en 2010 à 5 pour 1 000 en 2018 (soit une baisse de 70 %). De même, l'incidence du paludisme a diminué dans la région Afrique de l'OMS, avec 294 cas pour 1 000 en 2010 contre 229 en 2018 (-22 %). Toutes les autres régions de l'OMS ont enregistré des progrès très modestes, voire une hausse de l'incidence. Dans la région Amériques de l'OMS, l'incidence du paludisme a augmenté, principalement à cause d'une transmission accrue au Venezuela (République bolivarienne du).
- Seuls 31 pays dans lesquels le paludisme est encore endémique ont réduit l'incidence du paludisme de manière significative entre 2015 et 2018 et étaient donc en passe d'atteindre une baisse de l'incidence égale à au moins 40 % d'ici 2020. À moins d'un changement rapide, les objectifs de morbidité définis pour 2025 et 2030 dans la *Stratégie technique de lutte contre le paludisme 2016-2030* ([le] GTS) ne seront pas atteints.
- *P. falciparum* est le parasite du paludisme le plus prévalent dans la région Afrique de l'OMS ; il est en effet à l'origine de 99,7 % des cas de paludisme estimés en 2018, tout comme dans les régions Asie du Sud-Est (50 %), Méditerranée orientale (71 %) et Pacifique occidental (65 %).
- Au niveau mondial, 53 % des cas de paludisme à *P. vivax* sont enregistrés dans la région Asie du Sud-Est de l'OMS, avec une majorité des cas en Inde (47 %). *P. vivax* prédomine dans la région Amériques de l'OMS, représentant 75 % des cas de paludisme.

Mortalité associée

- Au niveau mondial, le nombre de décès dus au paludisme a été estimé à 405 000 en 2018, contre 416 000 en 2017 et 585 000 en 2010.
- Les enfants de moins de 5 ans sont les plus vulnérables face au paludisme. En 2018, ils ont représenté 67 % (272 000) des décès associés au paludisme dans le monde.
- À elle seule, la région Afrique de l'OMS a enregistré 94 % des décès liés au paludisme dans le monde en 2018. Pourtant, elle a aussi représenté 85 % des 180 000 décès en moins dus à la maladie par rapport à 2010.

[1] La liste des pays d'Afrique subsaharienne est disponible à l'adresse https://unstats.un.org/unsd/methodology/m49 ; pour toutes les analyses présentées dans ce rapport et liées aux pays d'endémie du paludisme en Afrique subsaharienne, le Soudan est également inclus.

- Près de 85 % des décès dus au paludisme dans le monde en 2018 ont été concentrés dans 20 pays de la région Afrique de l'OMS et en Inde. Le Nigéria a représenté à lui seul près de 24 % de ces décès, suivi par la République démocratique du Congo (11 %), la République-Unie de Tanzanie (5 %), ainsi que l'Angola, le Mozambique et le Niger (4 % chacun).
- Par rapport à 2010, la mortalité liée au paludisme n'a diminué en 2018 que dans les régions Afrique et Asie du Sud-Est de l'OMS. La baisse la plus prononcée du nombre de décès dus au paludisme, en valeur absolue, a été observée dans la région Afrique de l'OMS, qui est passée de 533 000 décès en 2010 à 380 000 en 2018. Malgré ces progrès, la baisse de la mortalité liée au paludisme a ralenti depuis 2016.

CONSÉQUENCES DU PALUDISME SUR LA SANTÉ MATERNELLE ET INFANTILE

- En 2018, près de 11 millions de femmes enceintes vivant dans des zones de transmission modérée à élevée en Afrique subsaharienne auraient été exposées à une infection palustre.
- Cette même année, la prévalence de l'exposition à l'infection palustre durant la grossesse a été plus forte dans les sous-régions Afrique de l'Ouest et Afrique centrale (chacune avec 35 %), suivies par la sous-région Afrique de l'Est et Afrique australe (20 %). Près de 39 % de cette prévalence a été concentrée en République démocratique du Congo et au Nigéria.
- Les 11 millions de femmes enceintes exposées à une infection palustre en 2018 ont donné naissance à quelque 872 000 enfants présentant un faible poids à la naissance (soit 16 % de tous les enfants avec un faible poids à la naissance dans ces pays). L'Afrique de l'Ouest a enregistré la plus forte prévalence d'insuffisance pondérale (liée au paludisme pendant la grossesse) chez le nouveau-né.
- Entre 2015 et 2018, dans 21 pays de la région Afrique de l'OMS où la transmission du paludisme est modérée à élevée, la prévalence de l'anémie chez les enfants de moins de 5 ans avec un résultat positif à un test de diagnostic rapide (TDR) était deux fois plus élevée que chez les enfants avec un résultat de TDR négatif. Parmi les enfants avec un résultat de test positif, 9 % souffraient d'anémie grave et 54 % d'anémie modérée. À titre de comparaison, 1 % seulement des enfants non infectés par le paludisme souffraient d'anémie grave et 31 % d'anémie modérée.
- Les pays où l'anémie grave chez les enfants de moins de 5 ans présentant un résultat positif à un test de dépistage du paludisme était la plus prévalente étaient les suivants : le Sénégal (26 %), le Mali (16 %), la Guinée (14 %) et le Mozambique (12 %). Dans la plupart des autres pays, l'anémie grave atteignait entre 5 % et 10 %.
- Selon les estimations, près de 24 millions d'enfants d'Afrique subsaharienne ont souffert d'infections palustres à *P. falciparum* en 2018, avec un risque d'anémie grave pour 1,8 million d'entre eux.

APPROCHE « HIGH BURDEN TO HIGH IMPACT » (D'UNE CHARGE ÉLEVÉE À UN FORT IMPACT)

- Les 11 pays où le paludisme sévit le plus (pays de l'approche HBHI) ont enregistré près de 155 millions de cas en 2018, contre 177 millions en 2010. La République démocratique du Congo et le Nigéria ont cumulé 84 millions de ces cas (54 %).
- Parmi les 10 pays africains de l'approche HBHI, le Ghana et le Nigéria ont rapporté les plus fortes augmentations, en valeur absolue, du nombre de cas en 2018 par rapport à 2017. En 2018, le poids du paludisme dans les autres pays est resté à un niveau similaire à celui de 2017, à l'exception de l'Ouganda et de l'Inde, qui ont rapporté respectivement 1,5 million et 2,6 millions de cas en moins.
- Les décès dus au paludisme ont diminué, passant de près de 400 000 en 2010 à environ 260 000 en 2018. La plus forte baisse a été enregistrée au Nigéria, avec 153 000 décès en 2010 et 95 000 décès en 2018.
- En 2018, dans les 11 pays de l'approche HBHI, au moins 40 % de la population à risque avait dormi sous moustiquaire imprégnée d'insecticide longue durée (MILD). Le pourcentage le plus élevé a été enregistré en Ouganda (80 %), et le plus faible au Nigéria (40 %).

- Selon les estimations, c'est uniquement au Burkina Faso et en République-Unie de Tanzanie que plus de 50 % des femmes enceintes ont reçu trois doses de traitement préventif intermittent pendant la grossesse (TPIp3) en 2018. Au Cameroun, au Nigéria et en Ouganda, le taux de couverture a atteint environ 30 %, voire moins.
- Six pays de la sous-région sahélienne ont mis en œuvre la chimioprévention du paludisme saisonnier (CPS) en 2018. En moyenne, 17 millions d'enfants sur les 26 millions ciblés ont été traités par cycle de CPS.
- Le pourcentage des enfants de moins de 5 ans ayant de la fièvre et sollicitant des soins a varié entre 58 % au Mali et 82 % en Ouganda. En République démocratique du Congo et au Mali, plus de 40 % des enfants n'ont sollicité aucun soin. Tout aussi préoccupant, le taux de dépistage du paludisme a été très faible chez les enfants sollicitant des soins, avec 30 % ou moins d'enfants testés au Cameroun, en République démocratique du Congo et au Nigéria.
- Dans tous les pays de l'approche HBHI à l'exception de l'Inde, les investissements nationaux directs restent très peu élevés par rapport au financement international.

ÉLIMINATION DU PALUDISME ET PRÉVENTION DE SA RÉAPPARITION

- Au niveau mondial, l'élimination du paludisme progresse. En effet, de plus en plus de pays tendent vers un nombre de cas de paludisme indigène égal à zéro. En 2018, 49 pays ont rapporté moins de 10 000 cas de paludisme indigène, alors qu'ils n'étaient que 46 en 2017 et 40 en 2010. Le nombre de pays comptant moins de 100 cas de paludisme indigène, un bon indicateur que l'élimination de la maladie est proche, est passé de 17 en 2010 à 25 en 2017, puis à 27 en 2018.
- Le Paraguay et l'Ouzbékistan ont été certifiés exempts de paludisme par l'OMS en 2018, alors que l'Algérie et l'Argentine ont obtenu cette certification début 2019. En 2018, la Chine, El Salvador, l'Iran, la Malaisie et le Timor-Leste ont rapporté zéro cas de paludisme indigène.
- Éliminer le paludisme dans au moins 10 pays où il était encore endémique en 2010 est l'un des principaux objectifs intermédiaires du GTS pour 2020. Compte tenu du rythme de progression actuel, il est probable que cet objectif sera atteint.
- En 2016, l'OMS a identifié 21 pays ayant le potentiel pour éliminer le paludisme d'ici 2020. L'OMS travaille avec les gouvernements de ces pays appelés « E-2020 » pour les aider à atteindre leurs objectifs d'élimination.
- Même si 10 de ces pays restent en bonne voie pour atteindre leurs objectifs, les Comores et le Costa Rica ont rapporté une augmentation des cas de paludisme indigène en 2018 par rapport à 2017.
- En revanche, 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 rapportés a diminué de 76 % entre 2010 et 2018, alors que le nombre de décès dus au paludisme a chuté de 95 % sur la même période. En 2018, le Cambodge n'a rapporté aucun décès dû au paludisme pour la première fois de son histoire.

INVESTISSEMENTS DANS LES PROGRAMMES ET LA RECHERCHE ANTIPALUDIQUES

- En 2018, US$ 2,7 milliards ont été investis au total par les gouvernements des pays d'endémie et les partenaires internationaux pour le contrôle et l'élimination du paludisme, soit une baisse par rapport aux US$ 3,2 milliards investis en 2017. Les investissements de 2018 sont bien inférieurs aux

US$ 5 milliards estimés nécessaires à l'échelle mondiale pour rester sur la voie des objectifs du GTS.

- Près des trois quarts des investissements réalisés en 2018 ont été dirigés vers la région Afrique de l'OMS, suivie par les régions Amériques (7 %), Asie du Sud-Est (6 %), Méditerranée orientale et Pacifique occidental (5 % chacune).
- En 2018, 47 % du financement total a été investi dans des pays à faible revenu, 43 % dans des pays à revenu intermédiaire de la tranche inférieure et 11 % dans des pays à revenu intermédiaire de la tranche supérieure. Les fonds internationaux ont représenté la principale source de financement dans les pays à faible revenu et à revenu intermédiaire de la tranche inférieure (respectivement 85 % et 61 %). Les financements nationaux stagnent depuis 2010.
- Sur les US$ 2,7 milliards investis en 2018, US$ 1,8 milliard provenaient de bailleurs de fonds internationaux. En 2018, les gouvernements des pays d'endémie ont contribué à hauteur de 30 % du financement total (US$ 900 millions), un chiffre inchangé par rapport à 2017. Deux tiers des financements nationaux ont été investis dans des activités de contrôle menées par les programmes nationaux de lutte contre le paludisme (PNLP), le tiers restant étant estimé correspondre aux coûts des soins dispensés aux patients.
- Comme les années précédentes, les États-Unis ont été le premier bailleur de fonds international pour les programmes de lutte contre le paludisme, avec US$ 1 milliard en 2018 (37 % du total). Les pays membres du Comité d'aide au développement ont investi au total US$ 300 millions (11 %). Le Royaume-Uni de Grande-Bretagne et d'Irlande du Nord a contribué à hauteur d'environ US$ 200 millions (7 %).
- Sur les US$ 2,7 milliards investis en 2018, US$ 1 milliard ont transité par le Fonds mondial de lutte contre le sida, la tuberculose et le paludisme.
- Même si le financement de la lutte contre le paludisme est relativement stable depuis 2010, les investissements consentis en 2018 sont loin d'atteindre le niveau requis pour réaliser les deux premiers objectifs intermédiaires du GTS, à savoir réduire d'au moins 40 % l'incidence du paludisme et la mortalité associée au plan mondial par rapport à 2015.
- Au total, US$ 663 millions ont été investis en 2018 dans la recherche fondamentale et le développement de produits contre le paludisme, soit une hausse de US$ 18 millions par rapport à 2017.
- Les fonds dédiés à la recherche et au développement (R&D) de médicaments ont atteint un niveau record, passant de US$ 228 millions en 2017 à US$ 252 millions en 2018. Cette augmentation est due aux investissements du secteur industriel privé dans plusieurs essais de phase II sur de nouveaux composants chimiques offrant le potentiel d'une guérison radicale en une prise unique.

Livraison de produits antipaludiques

Moustiquaires imprégnées d'insecticide

- Les fabricants de moustiquaires imprégnées d'insecticide (MII) ont indiqué en avoir livré 578 millions dans le monde entre 2016 et 2018, principalement des MILD, dont 50 % en Côte d'Ivoire, en République démocratique du Congo, en Éthiopie, au Ghana, en Inde, au Nigéria, en Ouganda et en République-Unie de Tanzanie.
- En 2018, ces fabricants ont livré environ 197 millions de MII, dont plus de 87 % en Afrique subsaharienne.
- Au niveau mondial, 80 % des MII ont été distribuées gratuitement par le biais de campagnes de distribution de masse, 10 % via des établissements de soins prénataux et 6 % dans le cadre de programmes de vaccination.

Tests de diagnostic rapide

- En 2018, 412 millions de TDR ont été vendus dans le monde.
- En 2018, 259 millions de TDR ont été distribués par les PNLP. La plupart de ces TDR (64 %) étaient des tests livrés en Afrique subsaharienne et pouvant uniquement détecter le parasite *P. falciparum*.

Combinaisons thérapeutiques à base d'artémisinine

- Entre 2010 et 2018, les pays ont acheté 3 milliards de traitements par combinaison thérapeutique à base d'artémisinine (ACT). Au total, 63 % de ces achats auraient été effectués pour le secteur public de la santé.
- En 2018, 214 millions de traitements par ACT ont été distribués par les PNLP, dont 98 % dans la région Afrique de l'OMS.

PRÉVENTION DU PALUDISME

Lutte antivectorielle

- En Afrique subsaharienne, la moitié de la population à risque dort sous MII : en 2018, 50 % de la population a donc été protégée par cette intervention, contre 29 % en 2010. Par ailleurs, la part de la population ayant accès à une MII est passée de 33 % en 2010 à 57 % en 2018. Le taux de couverture n'a cependant que très peu augmenté depuis 2015 et il s'est même stabilisé depuis 2016.
- Le pourcentage des ménages disposant d'au moins une MII pour deux membres du foyer est passé de 47 % en 2010 à 72 % en 2018. Ce pourcentage ne représente néanmoins qu'une augmentation très modeste au cours des trois dernières années et reste bien loin de l'objectif de couverture universelle.
- La part de la population à risque protégée par pulvérisation intradomiciliaire d'insecticides à effet rémanent (PID), une mesure préventive qui consiste à pulvériser d'insecticides les murs intérieurs des habitations, a diminué. Au niveau mondial, le taux de couverture de cette intervention a diminué, passant d'un pic de 5 % en 2010 à 2 % en 2018, avec des tendances à la baisse dans toutes les régions de l'OMS, hormis la région Méditerranée orientale.
- Même si la population à risque couverte par cette intervention a chuté de 180 millions en 2010 à 93 millions en 2018, elle est pour 2018 inférieure de 13 millions au niveau de 2017.
- Ce recul de la couverture en PID est sans doute lié au passage des pyréthoïdes à des insecticides plus onéreux en réponse à la résistance aux pyréthoïdes ou à des changements de stratégies opérationnelles (baisse de la population à risque dans les pays en voie d'élimination du paludisme).

Traitements préventifs

- En Afrique, pour protéger les femmes vivant dans des zones de transmission modérée à élevée, l'OMS recommande le traitement préventif intermittent pendant la grossesse (TPIp) par sulfadoxine-pyriméthamine (SP). Sur 36 pays africains ayant communiqué des données de couverture en TPIp en 2018, 31 % des femmes enceintes éligibles ont reçu au moins trois doses de TPIp (comme recommandé par l'OMS), contre 22 % en 2017 et 2 % en 2010, ce qui traduit des progrès considérables en termes de mise en œuvre au niveau national.
- Toutefois, environ 18 % des femmes s'étant présentées au moins une fois dans un établissement de soins prénataux n'ont reçu aucune dose de TPIp. Si elles avaient été exploitées, ces opportunités de traitement auraient permis d'améliorer considérablement et rapidement la couverture en TPIp.
- En 2018, 19 millions d'enfants vivant dans 12 pays d'Afrique sahélienne ont été protégés par des programmes de CPS. Tous les enfants ciblés ont reçu un traitement au Cameroun, en Guinée, en Guinée-Bissau et au Mali. Cependant, quelque 12 millions d'enfants qui auraient pu bénéficier de cette intervention n'ont pas été couverts, principalement à cause d'un manque de financements.

DIAGNOSTIC ET TRAITEMENT

Accès aux soins

- Un diagnostic précoce et un traitement rapide sont les moyens les plus efficaces de prévenir l'aggravation des cas de paludisme et les décès associés. D'après les enquêtes nationales réalisées dans 20 pays d'Afrique subsaharienne entre 2015 et 2018, une médiane de 42 % (écart interquartile [ÉI] : 34 %-49 %) des enfants ayant eu de la fièvre ont sollicité des soins auprès d'un prestataire formé dans un établissement public, contre une médiane de 10 % (ÉI : 8 %-22 %) dans un établissement privé formel et de 3 % (ÉI : 2 %-7 %) dans le secteur privé informel.
- Une part importante des enfants n'ont pas reçu de soins médicaux (médiane de 36 %, ÉI : 28 %-45 %), ce qui s'explique en partie par un accès limité aux prestataires de santé ou un manque de connaissances de la part du personnel soignant.

Diagnostic

- Le pourcentage de patients suspectés de paludisme et soumis à un test de diagnostic par TDR ou microscopie dans un établissement public est passé de 38 % en 2010 à 85 % en 2018.
- Dans 71 % des pays d'Afrique subsaharienne où la transmission est modérée à élevée, le pourcentage des cas suspectés de paludisme ayant été soumis à un test parasitologique a dépassé 80 % en 2018.
- Sur les 19 enquêtes nationales réalisées auprès des ménages en Afrique subsaharienne entre 2015 et 2018, le pourcentage médian d'enfants fiévreux ayant subi un prélèvement sanguin au doigt ou au talon (laissant penser qu'un test de dépistage du paludisme a été réalisé) a été plus élevé dans le secteur public (médiane de 66 %, ÉI : 49 %-75 %) que dans les établissements privés formels (médiane de 40 %, ÉI : 16 %-46 %) ou dans le secteur privé informel (médiane de 9 %, ÉI : 5 %-22 %).
- Sur 61 enquêtes menées dans 29 pays d'Afrique subsaharienne entre 2010 et 2018, le pourcentage des enfants fiévreux soumis à un test de diagnostic préalablement à tout traitement antipaludique dans un établissement public a augmenté, passant d'une médiane de 48 % (ÉI : 30 %-62 %) sur la période 2010-2013 à une médiane de 76 % (ÉI : 60 %-86 %) sur la période 2015-2018.

Traitement

- Sur 20 enquêtes nationales réalisées auprès des ménages en Afrique subsaharienne entre 2015 et 2018, le pourcentage médian des enfants fiévreux et ayant reçu un médicament antipaludique a été plus important dans le secteur public (médiane de 48 %, ÉI : 30 %-69 %) que dans le secteur privé formel (médiane de 40 %, ÉI : 21 %-51 %) ou le secteur privé informel (médiane de 18 %, ÉI : 10 %-29 %).
- Entre 2015 et 2018, les données collectées à partir de 20 enquêtes nationales menées en Afrique subsaharienne montrent que 47 % (ÉI : 29 %-69 %) des enfants fiévreux ayant sollicité des soins dans le secteur public ont reçu un traitement antipaludique, contre 59 % (ÉI : 53 %-84 %) auprès d'un agent de santé communautaire et 49 % (ÉI : 19 %-55 %) dans un établissement privé formel.
- D'après 19 enquêtes, la probabilité que les traitements antipaludiques donnés aux enfants fiévreux soient des ACT est légèrement plus élevée si le traitement est sollicité dans le secteur public (médiane de 80 %, ÉI : 45 %-94 %) que s'il l'est dans le secteur privé formel (médiane de 77 %, ÉI : 43 %-87 %) ou le secteur privé informel (médiane de 60 %, ÉI : 40 %-84 %).
- Pour combler les écarts de traitement parmi les enfants, l'OMS recommande la prise en charge intégrée des cas dans la communauté (PEC-C). Cette approche favorise la gestion intégrée des causes de mortalité infantile, à savoir paludisme, pneumonie et diarrhée, au niveau des établissements de santé et de la communauté. En 2018, 30 pays avaient des politiques de PEC-C en place à différents niveaux, mais la mise en œuvre n'était effective au niveau national que dans quelques-uns.

SYSTÈMES DE SURVEILLANCE DU PALUDISME

- Faire de la surveillance du paludisme une intervention de base est le pilier 3 du GTS. Pour savoir si les systèmes de surveillance du paludisme en place sont adaptés, l'OMS recommande un suivi et une évaluation à intervalles réguliers de ces systèmes.
- En collaboration avec l'Université d'Oslo, le Programme mondial de lutte antipaludique a développé des modules sur le paludisme uniformisés et intégrés à District Health Information Software2 (DHIS2). Ils permettent une collecte basée sur les cas et agrégée des données de routine, ainsi que la mise à disposition d'éléments associés, de tableaux de bord des principaux indicateurs épidémiologiques, d'indicateurs de qualité des données, de rapports et d'un programme d'analyse des données au niveau des établissements en vue de faciliter l'analyse et l'interprétation des données.
- En date du mois d'octobre 2019, 23 pays avaient installé le module agrégé de l'OMS sur le paludisme, et six autres installations étaient planifiées pour 2020. Cinq pays ont déjà développé leur propre module sur le paludisme et l'ont intégré à DHIS2.
- L'OMS travaille conjointement avec les départements chargés des systèmes de gestion de l'information sanitaire de différents ministères de la Santé, en particulier dans les pays de l'approche HBHI, pour établir des bases de données dynamiques structurées, appelées référentiels de données. Le Programme mondial de lutte antipaludique a ainsi développé une structure de référentiel facile à adapter dans DHIS2, ainsi que des directives sur des éléments de données et des indicateurs pertinents, leurs définitions et les calculs en vue de couvrir les domaines thématiques essentiels. À ce jour, le travail de développement de ces bases de données a commencé en Gambie, au Ghana, au Mozambique, au Nigéria, en Ouganda et en République-Unie de Tanzanie.
- L'OMS encourage également les pays à mettre en œuvre des évaluations de leur système de surveillance. L'étude de cas du Mozambique est un parfait exemple de ce genre d'évaluation et de son rôle pour améliorer les systèmes de surveillance.

RÉPONSES AUX MENACES BIOLOGIQUES EN MATIÈRE DE LUTTE CONTRE LE PALUDISME

Suppression du gène *pfhrp2/3*

- 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). La prévalence des deux gènes *pfhrp2* et *pfhrp3* chez les patients symptomatiques a atteint jusqu'à 80 % en Érythrée et au Pérou.
- 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).
- 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. À ce jour, 28 pays ont rapporté des suppressions du gène *pfhrp2*.

Résistance aux antipaludiques

- Des mutations du gène *PfKelch13* ont été identifiées en tant que marqueurs moléculaires de résistance partielle à l'artémisinine. Ces mutations *PfKelch13* associées à la résistance à l'artémisinine sont répandues dans la sous-région du Grand Mékong et ont également été détectées avec une forte prévalence (plus de 5 %) au Guyana, en Papouasie-Nouvelle-Guinée et au Rwanda. Dans le cas du Rwanda, la présence de mutations *PfKelch13* n'affecte pas l'efficacité des traitements de première intention.

- Dans la région Pacifique occidental de l'OMS, diverses études menées entre 2001 et 2018 ont confirmé une résistance à l'artémisinine au Cambodge, en République démocratique populaire lao et au Viet Nam. L'efficacité du traitement contre les infections à *P. vivax* reste élevée dans tous les pays où le taux d'échec au traitement est inférieur à 10 %.
- Dans la région Afrique de l'OMS, les taux d'efficacité des traitements à base d'artéméther-luméfantrine (AL), d'artésunate-amodiaquine (AS-AQ) et de dihydroartémisinine-pipéraquine (DHA-PPQ) contre les infections à *P. falciparum* ont été supérieurs à 98 %, et l'efficacité n'a jamais faibli au fil du temps.
- L'efficacité des traitements de première intention reste élevée contre les infections à *P. falciparum* et à *P. vivax* dans la région Amériques de l'OMS.
- Dans la région Asie du Sud-Est de l'OMS, la présence de marqueurs moléculaires de résistance à l'artémisinine a été rapportée au Bangladesh, en Inde, au Myanmar et en Thaïlande. À l'exception du Myanmar, les taux d'échec des ACT de première intention contre les infections à *P. falciparum* se sont avérés supérieurs à 10 % et ont même atteint 93 % en Thaïlande. Concernant les infections à *P. vivax*, la plupart des pays continuent d'enregistrer une grande efficacité de la chloroquine (CQ), sauf au Myanmar et au Timor-Leste.
- Dans la région Méditerranée orientale de l'OMS, les taux d'échec importants des traitements à base d'AS-SP contre les infections à *P. falciparum* en Somalie et au Soudan ont induit un changement dans la politique du traitement de première intention en faveur de l'AL. Concernant les infections à *P. vivax*, l'efficacité des traitements à base d'AL et de CQ est élevée dans tous les pays où une étude sur leur efficacité thérapeutique a été menée.

Résistance aux insecticides

- De 2010 à 2018, quelque 81 pays ont transmis à l'OMS des données de surveillance sur la résistance aux insecticides.
- Sur les 81 pays d'endémie palustre ayant fourni des données pour la période 2010-2018, la résistance à au moins une des quatre classes d'insecticides chez l'un des vecteurs du paludisme sur un site de collecte a été détectée dans 73 pays. Il s'agit là d'une augmentation de cinq pays par rapport à la période précédente de 2010-2017. Dans 26 pays, la résistance a été rapportée à toutes les principales classes d'insecticides.
- La résistance aux pyréthoïdes, la seule classe d'insecticides actuellement utilisés dans les MII, est répandue. Elle a été détectée chez au moins un des vecteurs du paludisme sur plus des deux tiers des sites testés et s'est avérée la plus élevée dans les régions Afrique et Méditerranée orientale de l'OMS.
- La résistance aux organochlorés a été détectée chez au moins un des vecteurs du paludisme sur près des deux tiers des sites. La résistance aux carbamates et aux organophosphorés a été moins prévalente, mais a été détectée, respectivement, sur 31 % et 26 % des sites testés. La résistance la plus prévalente aux carbamates a été détectée dans la région Asie du Sud-Est de l'OMS, et aux organophosphorés dans les régions Asie du Sud-Est et Pacifique occidental de l'OMS.
- Toutes 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, et leur accès à des fins d'exploration est possible via la Carte des menaces du paludisme. Cet outil en ligne a été enrichi en 2019 pour couvrir les espèces de moustiques envahissantes et présente à l'heure actuelle la dimension géographique des rapports sur la détection des espèces *Anopheles stephensi*.
- 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 2018, 45 pays ont indiqué avoir établi un plan de suivi et de gestion de la résistance, et 36 en étaient encore à la phase de développement.
- Les PNLP et leurs partenaires devraient envisager de déployer des moustiquaires imprégnées de butoxyde de pipéronyle (PBO) dans les zones géographiques où les principaux vecteurs du paludisme répondent aux critères recommandés par l'OMS en 2017, plutôt qu'en partant du principe que tout le pays doit répondre à ces critères.

Prefacio

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

No dejar a nadie atrás en la marcha hacia un mundo libre de malaria

El flagelo de la malaria continúa golpeando con más fuerza a las mujeres embarazadas y a los niños en África. El *Informe mundial sobre la malaria 2019* incluye una sección especial centrada en la carga y las consecuencias de la enfermedad entre estos dos grupos de mayor riesgo. Transmite un mensaje claro: todos debemos hacer más para proteger a los más vulnerables en la lucha contra una enfermedad que sigue cobrando más de 400 000 vidas cada año.

La malaria en el embarazo compromete la salud de la madre y la pone en mayor riesgo de muerte. Afecta la salud del feto, lo que lleva a la prematuridad y al bajo peso al nacer, los principales contribuyentes de la mortalidad neonatal e infantil. El año pasado, unos 11 millones de mujeres embarazadas en África subsahariana se infectaron con malaria y, en consecuencia, casi 900 000 niños nacieron con bajo peso al nacer.

Para proteger a las mujeres embarazadas en África, la OMS recomienda el uso de mosquiteros tratados con insecticidas (MTI) y medicamentos antimaláricos preventivos. Este informe muestra el progreso en ambos frentes. Aún así, casi el 40% de las mujeres embarazadas no durmieron bajo un MTI en 2018 y dos tercios no recibieron las tres o más dosis recomendadas de terapia preventiva.

En los niños, los esfuerzos para ampliar el acceso a los medicamentos antipalúdicos preventivos están dando frutos. En la subregión del Sahel de África, la OMS recomienda la quimio-prevención de la malaria estacional durante la temporada alta de transmisión. Más del 60% de los niños que viven en áreas elegibles para esta terapia preventiva la recibieron en 2018.

Se debe elogiar a Sierra Leona por convertirse en el primer país de África en implementar un tratamiento preventivo intermitente en infantes, otro enfoque recomendado por la OMS para proteger a los niños pequeños en las áreas afectadas por la malaria.

Aún así, el acceso a la atención de los niños que muestran signos de fiebre sigue siendo demasiado bajo. Las encuestas de países muestran que casi 40% de los niños febriles en África subsahariana no son atendidos por un proveedor de atención médica capacitado.

Al menos 10 países que forman parte de la "Iniciativa E-2020" de la OMS están en camino de alcanzar la eliminación en 2020, hito de nuestra estrategia mundial contra la malaria. En 2015, todos estos países eran endémicos de malaria; ahora han logrado cero casos autóctonos de malaria o se están acercando a ésta meta.

Sin embargo, en los últimos años, el progreso global de la reducción de nuevos casos de malaria se ha estabilizado. Lo más preocupante de todo es que la malaria está en aumento en algunos países de alta carga en África.

Es probable que se pierdan los hitos críticos de nuestra estrategia global contra la malaria.

En 2018, la OMS y la Alianza para Hacer Retroceder la Malaria lanzaron el nuevo enfoque de "Alta carga a alto impacto", para prevenir la enfermedad y salvar vidas en los países más afectados por la malaria. Reemplazando una estrategia de "talla única", el enfoque requiere el uso de las herramientas más efectivas de una manera más específica. Me complace observar que dos países, India y Uganda, han reportado reducciones sustanciales en los casos de malaria en 2018 comparado con el año anterior.

En septiembre, emití el "Reto de la malaria", que pedía una mayor inversión en investigación y el desarrollo de nuevas herramientas, tecnologías y enfoques transformadores para acelerar el progreso en la lucha contra esta enfermedad.

A través de un programa piloto coordinado por la OMS, Ghana, Kenia y Malawi introdujeron recientemente, en áreas seleccionadas, la primera vacuna contra la malaria del mundo. La evidencia y la experiencia del programa informarán las decisiones de política sobre el posible uso más amplio de la vacuna en África. Con el apoyo del Fondo Mundial para la lucha contra el VIH/SIDA, la tuberculosis y la malaria y del Unitaid, se están probando otras herramientas prometedoras, como nuevos tipos de mosquiteros tratados con insecticidas e intervenciones dirigidas a los mosquitos que pican fuera de las viviendas.

Lograr nuestra visión común de un mundo libre de malaria también requerirá mejorar acciones en otras áreas críticas. Necesitamos servicios de salud asequibles y centrados en las personas. Necesitamos sistemas de vigilancia y respuesta confiables y precisos. Necesitamos estrategias que se adapten a los entornos locales de transmisión de la malaria.

Acelerar el financiamiento para responder a la malaria es esencial. En 2018, el financiamiento total para el control y la eliminación de la malaria alcanzó un estimado de US $ 2.7 mil millones, muy por debajo del objetivo de financiamiento de US $ 5 mil millones de nuestra estrategia global.

A través de una financiación sólida y decidida, liderazgo político y cobertura de salud universal, podemos vencer esta enfermedad de una vez por todas.

El informe de este año de un vistazo

TENDENCIAS REGIONALES Y MUNDIALES SOBRE LA CARGA DE CASOS Y MUERTES POR MALARIA

Casos de malaria

- En 2018, se estima que hubo 228 millones de casos de malaria en todo el mundo (intervalo de confianza [IC] del 95%: 206–258 millones), en comparación con 251 millones de casos en 2010 (IC del 95%: 231–278 millones) y 231 millones de casos en 2017 (IC 95%: 211–259 millones).
- La mayoría de los casos de malaria en 2018 se produjeron en la Región de África de la Organización Mundial de la Salud (OMS) (213 millones o 93%), seguida de la Región de Asia Sudoriental con el 3,4% de los casos y la Región del Mediterráneo Oriental con el 2.1%.
- Diecinueve países en África subsahariana[1] e India sumaron casi el 85% de la carga mundial de malaria. Mas de la mitad de todos los casos de malaria en todo el mundo se concentró en seis países: Nigeria (25%), la República Democrática del Congo (12%), Uganda (5%) y Costa de Marfil, Mozambique y Níger (4% cada uno).
- La tasa de incidencia de la malaria disminuyó a nivel mundial entre 2010 y 2018, de 71 a 57 casos por 1000 habitantes en riesgo. Sin embargo, de 2014 a 2018, la tasa de cambio disminuyó drásticamente, reduciendo a 57 en 2014 y permaneciendo en niveles similares hasta 2018.
- En la Región de Asia Sudoriental de la OMS la tasa de incidencia continúo disminuyendo: de 17 casos por cada 1000 habitantes en riesgo en 2010 a cinco casos en 2018 (una disminución del 70%). En la Región de África, los niveles de incidencia de casos también disminuyeron de 294 en 2010 a 229 en 2018, lo que representa una reducción del 22%. Todas las demás regiones de la OMS registraron poco progreso o un aumento en la tasa de incidencia. La Región de las Américas de la OMS registró un aumento, en gran parte debido a los aumentos en la transmisión de la malaria en la República Bolivariana de Venezuela.
- Entre 2015 y 2018, solo 31 países endémicos redujeron significativamente la incidencia de casos y estaban en camino de reducir la incidencia en un 40% o más en el año 2020. Sin un cambio acelerado, los hitos de la Estrategia Técnica Mundial contra la malaria 2016–2030 (ETM) relacionados con la morbilidad en 2025 y 2030 no se van a lograr.
- *Plasmodium falciparum* es el parásito de la malaria más frecuente en la Región de África de la OMS, representando el 99.7% de los casos estimados de malaria en 2018, así como en la Región de Asia Sudoriental de la OMS (50%), Región del Mediterráneo Oriental (71%) y Región del Pacífico occidental (65%).
- A nivel mundial, el 53% de la carga de *P. vivax* se concentra en la Región de Asia Sudoriental de la OMS, con la mayoría en India (47%). *P. vivax* es el parásito predominante en la Región de las Américas, representando el 75% de los casos de malaria.

Muertes por malaria

- En 2018, se estimaron 405 000 muertes por malaria en todo el mundo, comparado con 416 000 muertes estimadas en 2017 y 585 000 en 2010.
- Los niños menores de 5 años son el grupo más vulnerable afectado por la malaria. En 2018, este grupo represento el 67% (272 000) de todas las muertes por malaria en todo el mundo.

[1] La lista completa de países del África subsahariana puede consultarse en https://unstats.un.org/unsd/methodology/m49; Sudan ha sido incluido como país subsahariano en todos los análisis llevados a cabo para este informe para esta región.

- El 94% de todas las muertes por malaria en 2018 se produjo en la Región de África de la OMS. A pesar de ser la región que albergó la mayor cantidad de muertes por malaria en 2018, también es la región donde se produjo 85% de la reducción de muertes conseguida globalmente en 2018, 180 000 muertes de menos en comparación con 2010.
- Casi el 85% de las muertes por malaria en el mundo en 2018 se concentraron en 20 países de la Región de África de la OMS y la India. Nigeria representó casi el 50% de todas las muertes por malaria en el mundo, seguida de la República Democrática del Congo (11%), la República Unida de Tanzania (5%) y Angola, Mozambique y Níger (4% cada uno).
- En 2018, solo la Región de África de la OMS y la Región de Asia Sudoriental mostraron reducciones en las muertes por malaria en comparación con 2010. La Región de África tuvo la mayor reducción absoluta en las muertes por malaria, de 533 000 en 2010 a 380 000 en 2018. Sin embargo, a pesar de estas ganancias, la tasa de reducción de la mortalidad por malaria en esta región también se ha desacelerado desde 2016.

CONSECUENCIAS DE LA MALARIA PARA LA SALUD MATERNA, DE LOS INFANTES Y LOS NIÑOS

- En 2018, alrededor de 11 millones de embarazos en países con transmisión de malaria moderada y alta en el África subsahariana, habrían estado expuestas a una infección por malaria.
- En 2018, la prevalencia de exposición a infección por malaria durante el embarazo fue más alta en la subregión de África occidental y África central (cada una con un 35%), seguida de África oriental y Suráfrica (20%). Alrededor del 39% de esta exposición se concentró en la República Democrática del Congo y Nigeria.
- Los 11 millones de mujeres embarazadas expuestas a infecciones por malaria en 2018 dieron a luz a unos 872 000 niños con bajo peso al nacer (16% de todos los niños con bajo peso al nacer en estos países), con África Occidental teniendo la mayor prevalencia de niños con bajo peso al nacer atribuido a malaria durante el embarazo.
- Entre 2015 y 2018 en 21 países con carga de malaria de moderada a alta en la Región de África de la OMS, la prevalencia de anemia en niños menores de 5 años con una prueba de diagnóstico rápido (PDR) positivo fue el doble que la de los niños con una PDR negativa. En los niños con malaria confirmada, el 9% tenía anemia severa y el 54% tenía anemia moderada; en contraste, en los niños sin malaria, solo el 1% tenía anemia severa y el 31% tenía anemia moderada.
- Los países con el mayor porcentaje de anemia severa entre los niños menores de 5 años con malaria confirmada fueron Senegal (26%), Malí (16%), Guinea (14%) y Mozambique (12%). Para la mayoría de los otros países, la anemia severa varió del 5% al 10%.
- En general, se estimó que alrededor de 24 millones de niños estaban infectados con *P. falciparum* en 2018 en África subsahariana, y se estima que 1.8 millones de ellos tenían anemia severa.

ENFOQUE DE ALTA CARGA A ALTO IMPACTO

- En 2018, hubo alrededor de 155 millones de casos de malaria en los 11 países incluidos en el enfoque alta carga a alto impacto (ACAI), en comparación con 177 millones en 2010. La República Democrática del Congo y Nigeria tuvieron 84 millones (54% del total de casos).
- De los 10 países con mayor carga de malaria en África, Ghana y Nigeria reportaron, en 2018, los aumentos absolutos de casos más altos en comparación con 2017. La carga en 2018 fue similar a la de 2017 en los otros países, exceptuando Uganda e India, donde, en 2018, se reportó una reducción de 1.5 y 2.6 millones de casos, respectivamente en comparación con 2017.

- Las muertes por malaria se redujeron de aproximadamente de 400 000 en 2010 a aproximadamente 260 000 en 2018. La mayor reducción se produjo en Nigeria, donde las casi 153 000 muertes en 2010 pasaron a aproximadamente 95 000 en 2018.
- Para el año 2018, en todos los 11 países del enfoque ACAI, al menos el 40% de la población en riesgo durmió bajo mosquiteros tratados con insecticida de larga duración (MILD), el porcentaje más alto lo tuvo Uganda (80%) y el más bajo Nigeria (40%).
- En Burkina Faso y la República Unida de Tanzania, se estimó que más de la mitad de las mujeres embarazadas recibieron tres dosis de tratamiento preventivo intermitente durante el embarazo (TPI) en 2018. En Camerún, Nigeria y Uganda, la cobertura estimada fue de alrededor del 30% o menos.
- Seis países de la subregión africana del Sahel implementaron la quimio-prevención estacional de malaria (QPE) en 2018; de los 26 millones de niños objetivo, un total de 17 millones de niños, fueron tratados con QPE.
- El porcentaje de niños menores de 5 años con fiebre que buscaron tratamiento varió del 58% en Malí al 82% en Uganda. En la República Democrática del Congo y Malí, más del 40% de los niños no fueron llevados a recibir tratamiento. El porcentaje de niños que fueron diagnosticados también fue preocupantemente bajo entre los niños que fueron sometidos a tratamiento, con un 30% o menos de niños que fueron diagnosticados en Camerún, la República Democrática del Congo y Nigeria.
- A excepción de la India, en los países ACAI la inversión interna directa sigue siendo muy baja en relación con la financiación internacional.

ELIMINACIÓN DE LA MALARIA Y PREVENCIÓN DEL RESTABLECIMIENTO

- A nivel mundial, la red de eliminación se está ampliando, con más países avanzando hacia el objetivo de cero casos autóctonos: en 2018, 49 países reportaron menos de 10 000 de estos casos, frente a 46 países en 2017 y 40 países en 2010. El número de países con menos de 100 casos autóctonos, -un fuerte indicador de que la eliminación está cerca-, aumentó de 17 países en 2010 a 25 países en 2017 y 27 países en 2018.
- Paraguay y Uzbekistán obtuvieron la certificación de eliminación de la OMS en 2018, y Argelia y Argentina lograron la certificación a principios de 2019. En 2018, China, El Salvador, Irán, Malasia y Timor-Leste reportaron cero casos autóctonos.
- Uno de los hitos clave de la ETM para 2020 es la eliminación de la malaria en al menos 10 países de los que eran endémicos de malaria en 2015. Al ritmo actual de progreso, es probable que se alcance este hito.
- En 2016, la OMS identificó 21 países con el potencial de eliminar la malaria para el año 2020. La OMS está trabajando con los gobiernos de estos países, conocidos como "países E-2020", para apoyar sus objetivos de aceleración de la eliminación.
- Aunque hay 10 países del E-2020 que están en el buen camino para lograr sus objetivos de eliminación, en 2018 Comoros y Costa Rica informaron de aumentos en los casos de malaria autóctonos en comparación con 2017.
- En los seis países de la subregión del Gran Mekong (GM) - Camboya, China (provincia de Yunnan), República Democrática Popular Laos, Myanmar, Tailandia y Vietnam - el número de casos de malaria disminuyó en un 76% entre 2010 y 2018, y las muertes por malaria disminuyeron en un 95% durante el mismo período. En 2018, Camboya, por primera vez en la historia, reportó de que no hubo muertes relacionadas con la malaria denle el país.

INVERSIONES EN LOS PROGRAMAS DE MALARIA E INVESTIGACIÓN

- En 2018, los gobiernos de los países endémicos de malaria y sus colaboradores internacionales invirtieron aproximadamente $ 2.700 millones en esfuerzos de control y eliminación de la malaria a nivel mundial, menos que los $ 3.200 millones que se invirtieron en 2017. La cantidad invertida en 2018 es insuficiente dado que se estima que se requieren $ 5.0 mil millones para continuar avanzando hacia el complimiento de los objetivos de la ETM.
- Casi tres cuartas partes de las inversiones en 2018 se gastaron en la Región de África de la OMS, seguidas por la Región de las Américas (7%), la Región de Asia Sudoriental (6%), la Región del Mediterráneo Oriental y la Región del Pacífico Occidental (5% cada uno).
- En 2018, el 47% de la financiación total para la malaria se invirtió en países de bajos ingresos, el 43% en países de ingresos bajo a medio y el 11% en países de ingresos medio a alto. La financiación internacional representó la principal fuente de financiación en los países de bajos y de bajo a medios ingresos, con 85% y 61% respectivamente. La financiación interna se ha mantenido estable desde 2010.
- De los $ 2.700 millones de dólares invertidos en 2018, $ 1.800 millones provienen de financiadores internacionales. Los gobiernos de los países endémicos contribuyeron con el 30% de la financiación total ($ 900 millones de dólares) en 2018, una cifra sin cambios desde 2017. Dos tercios de los fondos de origen nacional se invirtieron en actividades de control de la malaria llevadas a cabo por los programas nacionales de malaria (PNM), siendo el resto estimado como el costo de atención a los pacientes.
- Como en años anteriores, los Estados Unidos de América (EE. UU.) Fue la mayor fuente internacional de financiación de la malaria, proporcionando $ 1 mil millones de dólares (37%) en 2018. Los países miembros del Comité de Asistencia para el Desarrollo representaron $ 300 millones (11%). El Reino Unido de Gran Bretaña e Irlanda del Norte contribuyeron con alrededor de $ 200 millones (7%).
- De los $ 2.700 millones de dólares invertidos en 2018, $ 1.000 millones se canalizaron a través del Fondo Mundial de Lucha contra el SIDA, la Tuberculosis y la Malaria.
- Aunque la financiación para la malaria se ha mantenido relativamente estable desde 2010, el nivel de inversión en 2018 está lejos de lo que se requiere para alcanzar los dos primeros hitos de la ETM; es decir, conseguir, para el 2020, una reducción de al menos el 40% en la incidencia de casos de malaria y en las tasas de mortalidad a nivel mundial en comparación con los niveles de 2015.
- Se invirtieron $ 663 millones de dólares en investigación básica y desarrollo de productos para la malaria en 2018, un aumento de $ 18 millones en comparación con 2017.
- La financiación para investigación y desarrollo de medicamentos antimaláricos llego al nivel más alto jamás registrado, de $ 228 millones en 2017 a $ 252 millones de dólares en 2018. Este aumento fue el resultado de la inversión del sector privado en varios ensayos de Fase II de nuevos productos con potencial de curación radical con una dosis única.

Distribución de productos básicos contra la malaria

Mosquiteros tratados con insecticida

- Entre 2016 y 2018, de acuerdo con los fabricantes, se entregaron 578 millones de mosquiteros tratados con insecticida (MTI), principalmente MILD, con un 50% destinado a Costa de Marfil, República Democrática del Congo, Etiopía, Ghana, India, Nigeria, Uganda y la República Unida de Tanzania.
- En 2018, los fabricantes entregaron alrededor de 197 millones de MILD, de los cuales más del 87% fueron entregados a países del África subsahariana.
- A nivel mundial, el 85% de los MTI se distribuyeron a través de campañas gratuitas de distribución masiva, el 10% en centros de atención prenatal y el 6% como parte de los programas de inmunización.

Pruebas de diagnóstico rápido (PDR).

- Se estima que 412 millones de PDR se vendieron a nivel mundial en 2018.
- En 2018, los PNM distribuyeron 259 millones de PDR. La mayoría de las PDR (64%) fueron pruebas para detectar *P. falciparum* y se suministraron al África subsahariana.

Terapia combinada basada en artemisinina

- Se estima que 3,000 millones de tratamientos de terapia combinada basada en artemisinina (TCA) fueron adquiridos por los países durante el período 2010-2018 y que el 63% fue adquirido por el sector público.
- En 2018, los PNM distribuyeron 214 millones de tratamientos con TCA, el 98% fueron en la Región de África de la OMS.

PREVENCIÓN DE LA MALARIA

Control de vectores

- La mitad de las personas en riesgo de malaria en África están durmiendo bajo un MTI; en 2018, el 50% de la población estaba protegida por esta intervención, un aumento del 29% comparado con 2010. Además, el porcentaje de la población con acceso a un MTI aumentó del 33% en 2010 al 57% en 2018. Sin embargo, la cobertura mejoró solo marginalmente desde 2015 y se ha estancado desde 2016.
- El porcentaje de hogares con al menos un MTI por cada dos personas aumentaron a 72% en 2018, de 47% en 2010. Sin embargo, esta cifra representa solo un aumento modesto en los últimos 3 años, y sigue estando lejos del objetivo de cobertura universal.
- El número de personas en riesgo de contraer malaria protegidas por el rociado residual intradomiciliar (RRI), un método de prevención que implica el rociado de insecticidas en las paredes interiores de las viviendas, está disminuyendo. A nivel mundial, la protección del RRI disminuyó de un pico del 5% en 2010 al 2% en 2018, año en el que se observaron disminuciones en todas las regiones de la OMS, salvo en la Región del Mediterráneo Oriental.
- Aunque la cobertura del RRI en la Región de África de la OMS cayo de 180 millones de personas en riesgo protegidas en 2010 a 93 millones en 2018, la cobertura disminuyó de 13 millones de personas entre 2017 y 2018.
- La disminución de la cobertura del RRI puede deberse los cambios en los insecticidas usados, la transición de piretroides a insecticidas más caros en respuesta al aumento de la resistencia a los piretroides; o a cambios en las estrategias operativas (por ejemplo, la disminución de las poblaciones en riesgo en los países en vías de eliminación de la malaria).

Terapias preventivas

- Para proteger a las mujeres en áreas de transmisión de malaria moderada y alta en África, la OMS recomienda TPI con el antimalárico sulfadoxina-pirimetamina (SP). Entre los 36 países africanos que informaron sobre los niveles de cobertura de TPI en 2018, se estima que el 31% de las mujeres embarazadas elegibles recibieron las tres o más dosis recomendadas de TPI, en comparación con el 22% en 2017 y el 0% en 2010, lo que indica mejoras considerables en la implementación de esta intervención en los países.
- Alrededor del 18% de las mujeres que utilizaron los servicios de atención prenatal al menos una vez, no recibieron ninguna dosis de TPI, lo que representa una oportunidad perdida que, si se aprovecha, podría mejorar considerablemente y rápidamente la cobertura de TPI.
- En 2018, 19 millones de niños en 12 países de la subregión del Sahel de África fueron protegidos a través de programas de quimio-prevención estacional (QPE). Todos los niños seleccionados recibieron tratamiento en Camerún, Guinea, Guinea-Bissau y Malí. Sin embargo, unos 12 millones de niños que podrían haberse beneficiado de esta intervención no lo hicieron. Esto es debido principalmente a la falta de fondos.

PRUEBAS DE DIAGNÓSTICO Y TRATAMIENTO

Acceso a la atención médica

- El diagnóstico y el tratamiento oportunos son la forma más efectiva de evitar que un caso leve de malaria se convierta en enfermedad grave y que cause la muerte. Según las encuestas nacionales de hogares realizadas en 20 países del África subsahariana entre 2015 y 2018, una mediana del 42% (rango inter-cuartil [RI]: 34-49%) de los niños con fiebre (febriles) fueron trasladados a un proveedor de atención médica capacitado en el sector público, comparado con el 10% (RI: 8–22%) en el sector privado formal y el 3% (RI: 2–7%) en el sector privado informal.
- Una alta proporción de niños febriles no recibió atención médica (mediana: 36%, RI: 28–45%). El pobre acceso a los proveedores de atención médica o la falta de conocimiento de los síntomas de la malaria entre los cuidadores son algunos de los factores que contribuyen a esta falta de atención médica.

Diagnóstico de la malaria

- El porcentaje de pacientes con sospecha de malaria, que son atendidos en centros de salud pública y examinados con una PDR o microscopía, aumentó del 38% en 2010 al 85% en 2018.
- En 2018, en el 71% de los países con transmisión moderada a alta en el África subsahariana, el porcentaje de casos con sospecha de malaria a quienes se les realizó una prueba parasitológica fue superior al 80%.
- Según 19 encuestas de hogares a nivel nacional, realizadas entre 2015 y 2018 en África subsahariana, el porcentaje promedio de niños febriles que fueron atendidos y recibieron un pinchazo en el dedo o el talón (lo que sugiere que pudo haberse realizado una prueba de diagnóstico de malaria) fue mayor en el sector público (mediana: 66%, RI: 49–75%) que en el sector privado formal (mediana: 40%, RI: 16–46%) o el sector privado informal (mediana: 9%, RI: 5– 22%).
- Según 61 encuestas de hogares realizadas en 29 países del África subsahariana entre 2010 y 2018, el porcentaje de niños con fiebre que recibieron una prueba de diagnóstico antes de recibir tratamiento antimalárico en el sector de la salud pública aumentó de una mediana del 48% (RI: 30 –62%) en 2010–2013, a una mediana del 76% (RI: 60–86%) en 2015–2018.

Tratamiento de la malaria

- Según 20 encuestas de hogares realizadas en África subsahariana en 2015–2018, el porcentaje medio de niños febriles que fueron tratados con algún medicamento antimalárico fue mayor en el sector público (mediana: 48%, RI: 30–69%) que en el sector privado formal (mediana: 40%, RI: 21–51%) o el sector privado informal (mediana: 18%, RI: 10–29%).
- Los datos de 20 encuestas nacionales realizados en África subsahariana muestran que, para el período 2015–2018, el 47% (RI: 29–69%) de los niños febriles que recibieron tratamiento para la malaria en el sector de la salud pública recibieron tratamiento antimalárico, en comparación con 59% (RI: 53–84%) entre quienes visitan a un trabajador de salud comunitario y 49% (RI: 19–55%) en el sector privado formal.
- Con base en 19 encuestas de hogares, los tratamientos antimaláricos dados a los niños febriles fueron más frecuentemente un TCA cuando se buscó tratamiento en el sector público (mediana: 80%, RI: 45-94%) que en el sector privado formal (mediana: 77%, RI: 43–87%) o el sector privado informal (mediana: 60%, RI: 40–84%).
- Para cerrar la brecha de tratamiento a los niños, la OMS recomienda la adopción del manejo integrado de casos por la comunidad (MICC). Este enfoque promueve el manejo integrado de condiciones de salud que comúnmente amenazan la vida de los niños (malaria, neumonía y diarrea) a nivel de centros de salud y comunitarios. En 2018, 30 países implementaron el MICC en diferentes niveles, con solo unos pocos implementando ésta a nivel nacional.

SISTEMAS DE VIGILANCIA DE LA MALARIA

- El pilar 3 de la Estrategia Mundial de malaria (ETM) es transformar la vigilancia de malaria en una intervención principal. Para comprender si los sistemas de vigilancia de la malaria son adecuados para su propósito, la OMS recomienda el monitoreo y la evaluación regulares de los sistemas de vigilancia.
- El Programa Global contra la Malaria (PGM), en colaboración con la Universidad de Oslo, ha desarrollado módulos estandarizados de vigilancia de malaria basados en el Software de Información de Salud del Distrito-2 (DHIS2) para la recogida de datos epidemiológicos de rutina, datos de casos individuales y datos de vigilancia entomológica y monitoria de intervenciones de control vectorial. Estos modules incluyen elementos de datos, indicadores de monitoria y de calidad de los datos, tableros estandarizados de interpretación de los datos e informes.
- Hasta octubre de 2019, 23 países han instalado el módulo agregado de malaria de la OMS, otras ocho instalaciones están planificadas para el próximo año y otros cinco países ya han desarrollado e integrado su propio módulo para la vigilancia de malaria en DHIS2.
- La OMS ha estado trabajando en coordinación con los departamentos de Sistemas de Información de Gestión de Salud (SIGS) de los ministerios de salud, en particular de los países ACAI, para establecer bases de datos dinámicas estructuradas conocidas como repositorios de datos. El PGM ha desarrollado una estructura de repositorio standard basada en DHIS2 y fácilmente adaptable, que contiene los elementos de datos e indicadores más relevantes, sus definiciones y computación para cubrir las áreas temáticas clave. Hasta ahora, el trabajo para desarrollar estas bases de datos ha comenzado en Gambia, Ghana, Mozambique, Nigeria, Uganda y la República Unida de Tanzania.
- La OMS también alienta a los países a implementar evaluaciones del sistema de vigilancia. Un ejemplo de estudio de caso de Mozambique ilustra tal evaluación y su papel en la mejora de los sistemas de vigilancia.

RESPONDIENDO A LOS DESAFÍOS BIOLÓGICAS EN LA LUCHA CONTRA LA MALARIA

Supresión del gen *Pfhrp2 / 3*

- La supresión de los genes *pfhrp2* y *pfhrp3* (*pfhrp2 / 3*) del parásito hacen que los parásitos sean indetectables por las PDR que se basan en la detección del HRP2. La supresión doble *pfhrp2* y *pfhrp3* entre pacientes sintomáticos ha alcanzado una prevalencia de hasta el 80% en Eritrea y Perú.
- La OMS ha recomendado a los países con evidencia de supresiones de *pfhrp2 / 3*, o los países vecinos, que realicen encuestas representativas entre los casos sospechosos de malaria para determinar si la prevalencia de supresión de *pfhrp2 / 3*, que causan falsos negativos en las PDR, ha alcanzado un umbral que indique la necesidad de cambio de PDR (> 5 % de deleciones en *pfhrp2* causan resultados de falsos negativos en PDR).
- La OMS está rastreando los informes publicados de supresiones *pfhrp2 / 3* utilizando la herramienta de mapeo del Mapa de los Desafíos de la Malaria. Hasta la fecha, 28 países han reportado supresiones de *pfhrp2*.

Resistencia a los medicamentos antimaláricos

- Las mutaciones de *PfKelch13* se han identificado como marcadores moleculares de resistencia parcial a la artemisinina. Las mutaciones de *PfKelch13* asociadas con la resistencia a la artemisinina están muy extendidas en la subregión del Gran Mekong (GM) y también se han detectado con una prevalencia significativa (más del 5%) en Guyana, Papua Nueva Guinea y Ruanda. En el caso de Ruanda, se ha visto que la presencia de mutaciones *PfKelch13* no afecta la eficacia del tratamiento de primera línea.

- En la Región del Pacífico Occidental de la OMS, la resistencia a la artemisinina se ha confirmado en Camboya, República Democrática Popular Lao y Vietnam a través de varios estudios realizados entre 2001 y 2018. La eficacia del tratamiento para *P. vivax* sigue siendo alta en todos los países, las tasas de fallo del tratamiento son inferiores al 10 %.
- En la Región de África, las tasas de eficacia de arteméter-lumefantrina (AL), artesunato-amodiaquina (AS-AQ) y dihidroartemisinina-piperaquina (DHA-PPQ) para *P. falciparum* fueron más del 98%, y la eficacia se ha mantenido alta a lo largo del tiempo.
- En la Región de las Américas, la eficacia del tratamiento para *P. falciparum*, contratamientos de primera línea, sigue siendo alta.
- En la Región de Asia Sudoriental, se han encontrado marcadores moleculares de resistencia a la artemisinina en Bangladesh, India, Myanmar y Tailandia. Con excepción de Myanmar, las tasas de fallo de los TCA de primera línea para *P. falciparum* fueron mayores que 10% y llegaron hasta el 93% en Tailandia. Con base a los estudios de eficacia terapéutica reportados, la cloroquina (CQ) sigue siendo altamente eficaz contra *P. vivax* en la mayoría de los países, excepto en Myanmar y Timor-Leste.
- En la Región del Mediterráneo Oriental, las altas tasas de fallo del tratamiento con AS-SP contra P. falciparum detectadas en Somalia y Sudán llevaron a un cambio en la política de tratamiento de primera línea que ahora es AL. Los estudios de eficacia terapéutica (EET) realizados con AL y CQ contra *P. vivax* indican una alta eficacia de estos tratamientos.

Resistencia a los insecticidas

- Desde 2010 hasta 2018, unos 81 países informaron datos a la OMS sobre el monitoreo de la resistencia a los insecticidas.
- De los 81 países endémicos de malaria que proporcionaron datos para 2010–2018, 73 confirmaron la resistencia a al menos una de las cuatro clases de insecticidas en al menos un vector de malaria y un sitio de recolección, un aumento de cinco países en comparación con el período del informe anterior 2010-2017. 26 países, confirmaron la resistencia a las cuatro clases principales de insecticidas.
- La resistencia a los piretroides, la única clase de insecticidas actualmente utilizada en los MTI, es generalizada y se detectó en al menos un vector de malaria en más de dos tercios de los sitios analizados, y fue más alta en la Región de África de la OMS y en la Región del Mediterráneo Oriental.
- La resistencia a los organoclorados fue confirmada en casi un tercio de los sitios de recolección en al menos un vector de malaria. La resistencia a los carbamatos y los organofosforados fue menos prevalente, siendo confirmada en el 31% y 26% de los sitios de recolección testados, respectivamente. La resistencia a los carbamatos fue más prevalente en la región de Asia sudoriental, mientras que la resistencia a los organofosforados fue más prevalente en la región de Asia sudoriental y el Pacifico Oriental.
- Todos los datos estándar de resistencia a los insecticidas proporcionados a la OMS están incluidos en la Base de datos Mundial de Resistencia a los Insecticidas en los Vectores de Malaria de la OMS y están disponibles para su consulta a través del Mapa de los Desafíos de la Malaria. Esta herramienta en línea se extendió en 2019 para cubrir los movimientos de las especies de mosquitos invasoras, y actualmente muestra el alcance geográfico de los informes sobre la detección de *Anopheles stephensi*.
- 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 documento *Estructura general de un plan nacional de monitoreo y manejo de la resistencia a insecticidas en vectores del paludismo* de la OMS. En 2018, un total de 45 países informaron haber completado el plan para el monitoreo y manejo de la resistencia y 36 estaban en proceso de desarrollarlo.
- Los PNM y sus socios deberían considerar la distribución de mosquiteros con piretroide y butóxido de piperonilo (PBO) en áreas geográficas concretas donde los principales vectores de la malaria cumplen con los criterios recomendados por la OMS en 2017, en lugar de basarse en si todo el país cumple los criterios.

FIG. 1.1.

Countries with indigenous cases in 2000 and their status by 2018 Countries with zero indigenous cases over at least the past 3 consecutive years are considered as having eliminated malaria. In 2018, China and El Salvador reported zero indigenous cases for the second consecutive year, and Iran (Islamic Republic of), Malaysia and Timor-Leste reported zero indigenous cases for the first time. *Source: WHO database.*

WHO: World Health Organization.

1 Introduction

The World Health Organization's (WHO's) *World malaria report 2019* summarizes global progress in the fight against malaria up to the end of 2018. This is the fourth world malaria report since the launch of the *WHO Global technical strategy for malaria 2016–2030* (GTS) (*1*). Key indicators are tracked across several countries (**Fig. 1.1**) and WHO regions against the milestones outlined in the GTS (**Table 1.1**).

TABLE 1.1.

GTS: global targets for 2030 and milestones for 2020 and 2025 *Source: GTS* (*1*).

Vision – A world free of malaria

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

Goals	Milestones		Targets
	2020	2025	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.*

FIG. 1.2.

Malaria and the SDGs 2016–2030 Reducing the burden of malaria will contribute to or benefit from progress towards the SDG goals. *Sources: United Nations* (*3*) and *Swiss Malaria Group* (*5*).

17

Goal 17: Partnership for the Goals. The many **multisectoral partnerships** in place to reduce and eliminate malaria have a positive collateral effect, and also bring progress to other **domains of development**.

1

Goal 1: No Poverty. Sustained investment in health and malaria unlocks the potential of human capital to **generate growth**. A 10% reduction in malaria has been associated with a 0.3% rise in annual GDP. At household level, **reducing malaria protects household income** from lost earnings and the costs of seeking care.

2

Goal 2: Zero Hunger. Sustainable agricultural practices help reduce malaria. People who suffer less from malaria work their fields more consistently, resulting in better harvests and **improved food security**. Well-nourished people, especially children, are better able to fight malaria.

3

Goal 3: Good Health and Well-being. The scale-up of malaria interventions **averted at least 670 million bouts of malaria illness and 4.3 million malaria deaths** between 2001 and 2013. Preventing malaria in pregnancy **reduces maternal mortality and gives newborns a far healthier start in life.** Lowering the burden of malaria makes a substantial contribution to **improvements in child health**, and thus often to a decline in fertility rates, and an associated increase in the investment that parents can make in their children.

10 16

Goals 10, 16: Reduce Inequality. Promote Peace and Justice. A targeted response to malaria actively improves the health of the poorest, enabling vulnerable families to **break the vicious cycle of disease and poverty**, and helping to make sure that no one is left behind. Investing in malaria reduction contributes to the creation of more **cohesive, inclusive societies**. Stable countries are more likely to attract international investment and overseas development aid.

4

Goal 4: Quality Education. Reducing malaria enables children to **attend school regularly and learn more effectively.** This significantly improves their school performance, and later wage-earning capacity. As a mother's or caregiver's level of education increases, so do the chances that their children will access malaria prevention and treatment services and survive childhood.

13

Goal 13: Climate Action. Given that climate change is predicted to increase the range and intensity of malaria transmission, plans to **mitigate the effects of climate change** are likely to include an increased commitment to controlling and eliminating malaria, and vice versa.

5

Goal 5: Gender Equality. Freeing women and school-age girls from the burden of caring for family members when they fall sick with malaria increases their likelihood of completing school, entering and remaining in the workforce, and participating in public decision-making.

9 11 15

Goals 9, 11, 15: Infrastructure, Sustainable Cities and Life on Land. By ensuring that major construction and development projects do not introduce or increase malaria transmission, the benefits of progress can be reaped, while also **protecting human health and ecosystems. Well-planned infrastructure and improved housing** help reduce exposure to mosquitoes, and facilitate greater access to health and malaria services.

6

Goal 6: Clean Water and Sanitation. Drainage of standing water leads to decreased mosquito breeding and a reduction in the rate of malaria transmission. It also improves water quality, generating further health benefits.

7

Goal 7: Affordable and Clean Energy. In resource-constrained malaria endemic regions, **access to sustainable energy will stimulate prosperity** and increase the adoption of more sophisticated personal protection measures. It will also mean greater access to electric lighting and cooling, enabling people to increase time spent indoors, where vectors are more easily controlled through insecticides, bet nets and temperature. These developments are likely to result in a reduced burden of malaria.

8 12

Goal 8, 12: Decent Work, Economic Growth and Responsible Production. Reducing malaria creates **healthier, more productive workforces** which can help to attract trade and commerce. When combined with pro-poor policies, these factors **drive job creation, inclusive growth and shared prosperity.** Enterprises that invest in their workers reduce the costs of doing business, increase their **competitiveness** and enhance their reputation.

GDP: gross domestic product; SDG: Sustainable Development Goal.

The report also tracks a set of indicators outlined in the Roll Back Malaria (RBM) advocacy plan, *Action and investment to defeat malaria 2016–2030* (AIM) (*2*) and the Sustainable Development Goals (SDGs) (*3*) – a set of interconnected global goals seen as a plan of action for people, the planet and prosperity (**Fig. 1.2**). The report highlights the various ways investment in the fight against malaria contributes to the SDGs and the aligned WHO "triple billion" targets of the 13th General programme of work (GPW13) (*4*) (**Fig. 1.3**).

The main results, presented in **Sections 2–10**, cover the period 2010–2018. **Section 2** describes the global trends in malaria morbidity and mortality burden. Estimates of the burden of anaemia and its association with malaria – and for the first time in the world malaria report, burden and consequences of malaria during pregnancy – are presented in **Section 3**. The "high burden to high impact" (HBHI) approach and related control activities and funding are described in **Section 4**, while progress towards elimination is presented in **Section 5**. **Section 6** dwells on total funding for malaria control and elimination, for malaria research and for the supply of key commodities to endemic countries. The population-level coverage achieved through these investments is presented in **Section 7** and **Section 8**. **Section 9** focuses on surveillance as an intervention, and **Section 10** describes the threats posed by *Plasmodium falciparum* parasite histidine-rich protein 2 (HRP2) deletions, and by drug and insecticide resistance. The main text is followed by annexes that contain data sources and methods, regional profiles and data tables. Country profiles are presented online (*6*).

FIG. 1.3.

The WHO triple billion targets and the contribution of the fight against malaria These interconnected targets articulated in the GPW13 aim for one billion more people benefiting from universal health coverage; one billion more people better protected from health emergencies; and one billion more people enjoying better health and well-being. *Source: WHO (2018)* (*4*).

WHO: World Health Organization.

2 Regional and global trends in burden of malaria cases and deaths

Assessing progress in reducing the burden of malaria, to track the targets and milestones of the GTS (*1*), is a key mandate of the WHO Global Malaria Programme (GMP). This section of the report reviews the total number of cases and deaths estimated to have occurred between 2010 and 2018. There are several methods for estimating the burden of malaria cases and deaths; the method used depends on the quality of the national surveillance systems and the availability of data over time (**Section 9.1** and **Annex 1**).

2.1 ESTIMATED NUMBER OF MALARIA CASES BY WHO REGION, 2000–2018

An estimated 228 million cases of malaria occurred worldwide in 2018 (95% confidence interval [CI]: 206–258 million) compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million) (**Table 2.1**).

The WHO African Region still bears the largest burden of malaria morbidity, with 213 million cases (93%) in 2018, followed by the WHO South-East Asia Region (3.4%) and the WHO Eastern Mediterranean Region (2.1%) (**Table 2.1**). Globally, 3.3% of all estimated cases were caused by *P. vivax*, with 53% of the vivax burden being in the WHO South-East Asia Region (**Table 2.2**). *P. vivax* is the predominant parasite in the WHO Region of the Americas (75%), and is responsible for 50% of cases in the WHO South-East Asia Region and 29% in the WHO Eastern Mediterranean Region (**Table 2.2**).

TABLE 2.1.

Estimated malaria cases by WHO region, 2010–2018 Estimated cases are shown with 95% upper and lower CIs. *Source: WHO estimates.*

	Number of cases (000)								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
African									
Lower 95% CI	199 000	194 000	190 000	185 000	181 000	184 000	189 000	192 000	191 000
Estimated total	**218 000**	**213 000**	**209 000**	**204 000**	**197 000**	**199 000**	**206 000**	**212 000**	**213 000**
Upper 95% CI	245 000	237 000	233 000	229 000	218 000	219 000	229 000	240 000	244 000
Americas									
Lower 95% CI	744	566	541	520	445	525	640	880	867
Estimated total	**814**	**611**	**580**	**562**	**477**	**566**	**691**	**944**	**929**
Upper 95% CI	894	666	627	613	512	611	749	1 026	1 007
Eastern Mediterranean									
Lower 95% CI	3 300	3 400	3 200	3 000	3 100	3 000	3 800	3 800	3 700
Estimated total	**4 300**	**4 500**	**4 200**	**3 900**	**4 000**	**3 800**	**4 800**	**5 000**	**4 900**
Upper 95% CI	6 300	6 500	6 000	5 300	5 500	5 200	6 400	6 800	6 800
South-East Asia									
Lower 95% CI	19 800	17 700	14 700	10 900	10 400	10 700	10 500	8 800	5 800
Estimated total	**25 000**	**21 100**	**18 400**	**13 700**	**13 000**	**13 600**	**14 000**	**11 300**	**7 900**
Upper 95% CI	33 900	23 300	24 400	18 000	17 400	18 200	19 700	15 400	10 700
Western Pacific									
Lower 95% CI	1 045	922	914	1 305	1 588	1 115	1 318	1 392	1 495
Estimated total	**1 839**	**1 576**	**1 761**	**2 027**	**2 345**	**1 445**	**1 733**	**1 854**	**1 980**
Upper 95% CI	2 779	2 340	3 009	2 925	3 339	1 852	2 228	2 420	2 588
World									
Lower 95% CI	231 000	222 000	214 000	205 000	202 000	203 000	210 000	211 000	206 000
Estimated total	**251 000**	**241 000**	**234 000**	**224 000**	**217 000**	**219 000**	**227 000**	**231 000**	**228 000**
Upper 95% CI	278 000	267 000	260 000	250 000	238 000	240 000	251 000	260 000	258 000
Estimated *P. vivax*									
Lower 95% CI	11 700	10 600	9 400	7 200	6 300	5 900	6 400	6 200	5 900
Estimated total	**16 300**	**15 700**	**14 200**	**10 900**	**8 700**	**8 000**	**8 300**	**7 700**	**7 500**
Upper 95% CI	23 700	24 100	22 300	17 200	12 300	10 900	10 900	9 800	9 300

CI: confidence interval; *P. vivax*: *Plasmodium vivax*; WHO: World Health Organization.

TABLE 2.2.

Estimated *P. vivax* malaria cases by WHO region, 2018 Estimated cases are shown with 95% upper and lower CI. *Source: WHO estimates.*

	Number of cases (000)					
	African	Americas	Eastern Mediterranean	South-East Asia	Western Pacific	World
Estimated *P. vivax*						
Lower 95% CI	91	657	1 171	2 860	556	5 900
Estimated total	**704**	**700**	**1 414**	**3 947**	**690**	**7 500**
Upper 95% CI	1 813	758	1 738	5 390	858	9 300
Percentage of *P. vivax* cases	0.3	75.4	28.9	50.0	34.8	3.3

CI: confidence interval; *P. vivax*: *Plasmodium vivax*; WHO: World Health Organization.

2 Regional and global trends in burden of malaria cases and deaths

Almost 85% of all malaria cases globally were in 19 countries: India and 18 African countries (**Fig. 2.1a**). Over 50% of all cases globally were accounted for by Nigeria (25%), followed by the Democratic Republic of the Congo (12%), Uganda (5%), and Côte d'Ivoire, Mozambique and Niger (4% each). Of these 19 countries, India reported the largest absolute reductions in cases, with 2.6 million fewer cases in 2018 than in 2017, followed by Uganda (1.5 million fewer cases) and Zimbabwe (0.6 million fewer cases). Notable increases were seen in Ghana (8% increase, 0.5 million more cases) and Nigeria (6% increase, 3.2 million more cases). Changes in the remaining 14 countries were generally small, suggesting a similar burden of cases in 2017 and 2018.

More than 85% of estimated vivax malaria cases in 2018 occurred in just six countries, with India accounting for 47% of all vivax cases globally (**Fig. 2.1b**).

FIG. 2.1.

Estimated country share of (a) total malaria cases and (b) *P. vivax* malaria cases, 2018 *Source: WHO estimates.*

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

2.2 MALARIA CASE INCIDENCE RATE

The global incidence rate (i.e. the number of cases per 1000 population) of malaria reduced between 2010 and 2018; it fell from 71 in 2010 to 57 in 2018 (**Fig. 2.2a**). However, from 2014 to 2018, the rate of change slowed dramatically, reducing from 60 in 2013 to 57 in 2014 and remaining at similar levels through to 2018. In the WHO African Region, case incidence levels declined from 294 in 2010 to 229 in 2018, representing a 22% reduction in incidence, although the rate of change also appeared to slow from 2014.

The WHO Eastern Mediterranean Region and WHO Western Pacific Region saw a slight increase in case incidence between 2010 and 2018, while the WHO Region of the Americas saw a moderate increase, largely due to an increase in cases in Venezuela (Bolivarian Republic of). The highest reductions in incidence, however, were seen in the WHO South-East Asia Region, mainly owing to reductions in India, Indonesia and countries in the Greater Mekong subregion (GMS) (**Fig. 2.2b**). The geographic distribution of malaria case incidence by country is shown in **Fig. 2.3**.

FIG. 2.2.

Trends in malaria case incidence rate (cases per 1000 population at risk) globally and by WHO region, 2010–2018 The WHO European Region has reported zero indigenous cases since 2015. *Source: WHO estimates.*

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.

FIG. 2.3.

Map of malaria case incidence rate (cases per 1000 population at risk) by country, 2018 *Source: WHO estimates.*

WHO: World Health Organization.

2.3 ESTIMATED NUMBER OF MALARIA DEATHS AND MORTALITY RATE BY WHO REGION, 2010–2018

Between 2010 and 2018, estimated deaths due to malaria globally declined from 585 000 to 405 000 cases (**Table 2.3**). Declines were recorded in all regions apart from the WHO Region of the Americas due to increases in malaria in Venezuela (Bolivarian Republic of) and the WHO Eastern Mediterranean Region due to increases in Somalia, Sudan and Yemen. Estimates of the malaria mortality rate (i.e. deaths per 100 000 population at risk) show that, compared with 2010, only the WHO African Region and the WHO South-East Asia Region had recorded notable reductions by 2018 (**Fig. 2.4** and **Fig. 2.5**). The highest absolute reduction in malaria deaths occurred in the WHO African Region, from 533 000 deaths in 2010 to 380 000 deaths in 2018. The rate of reduction of malaria mortality was slower in the period 2016–2018 than in the period 2010–2015.

FIG. 2.4.

Trends in malaria mortality rate (deaths per 100 000 population at risk), globally and in the WHO African Region, 2010–2018 *Source: WHO estimates.*

AFR: WHO African Region; WHO: World Health Organization.

FIG. 2.5.

Trends in malaria mortality rate (deaths per 100 000 population at risk) in WHO regions, 2010–2018 *Source: WHO estimates.*

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.

Globally, 272 000 (67%) malaria deaths were estimated to be in children aged under 5 years (**Table 2.3**).

Almost 85% of all deaths in 2018 occurred in 20 countries in the WHO African Region and India, and almost 50% of all malaria deaths globally were accounted for by Nigeria (24%) followed by the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), and Niger, Mozambique and Angola (4% each) (**Fig. 2.6**).

TABLE 2.3.

Estimated number of malaria deaths by WHO region, 2010–2018 *Source: WHO estimates.*

	Number of deaths								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
African	533 000	493 000	469 000	444 000	428 000	411 000	389 000	383 000	380 000
Americas	459	444	392	391	289	324	474	620	577
Eastern Mediterranean	8 300	7 500	7 600	6 900	6 900	7 100	8 600	9 200	9 300
European	0	0	0	0	0	0	0	0	0
South-East Asia	39 000	32 000	28 000	21 000	24 000	25 000	25 000	20 000	12 000
Western Pacific	3 800	3 300	3 600	4 600	4 400	2 800	3 500	3 600	3 600
World (total)	**585 000**	**536 000**	**508 000**	**477 000**	**463 000**	**446 000**	**427 000**	**416 000**	**405 000**
World (children aged under 5 years)	**450 000**	**406 000**	**377 000**	**348 000**	**334 000**	**311 000**	**290 000**	**278 000**	**272 000**

WHO: World Health Organization.

FIG. 2.6.

Percentage of estimated malaria deaths attributable to the 21 countries with nearly 85% of malaria deaths globally in 2018 *Source: WHO estimates.*

WHO: World Health Organization.

2.4 PROGRESS TOWARDS THE GTS MILESTONES FOR MALARIA MORBIDITY AND MORTALITY

The GTS aims for a reduction of 40% of malaria morbidity incidence and mortality rate by 2020 from a 2015 baseline (*1*). To illustrate the level of progress made so far, our analysis shows that if malaria case incidence and mortality rate remained the same as those in 2000, globally there would be 321 million cases and nearly 1 million malaria deaths in 2018 (**Fig. 2.7** and **Fig. 2.8**). Instead, there were an estimated 228 million malaria cases (**Table 2.1**) and 405 000 malaria deaths (**Table 2.3**) in 2018. These represent about 29% fewer cases and 60% fewer deaths in 2018 than would have been the case had levels of malaria incidence and malaria death remained similar to those in 2000.

FIG. 2.7.

Comparison of current estimated malaria cases with expected cases had malaria incidence remained at 2000 levels globally *Source: WHO estimates.*

WHO: World Health Organization.

FIG. 2.8.

Comparison of current estimated malaria deaths with expected deaths had malaria incidence remained at 2000 levels globally *Source: WHO estimates.*

WHO: World Health Organization.

While the gains to date are impressive, the global malaria challenge remains enormous and the level of progress is slowing down. For example, on the current trajectory, globally, the 2020 GTS milestones for morbidity will not be achieved, and without accelerated change, the 2025 and 2030 milestones will not be achieved. A global malaria case incidence of 45 per 1000 population at risk in 2018 would have been required to get the world on target for the 2020 milestones, but current estimated incidence is at 57 cases per 1000 population at risk. If the current trend in incidence is maintained, estimated malaria case incidence (per 1000 population at risk) would be 54 in 2020, 48 in 2025 and 42 in 2030, instead of the 34, 14 and 6 required to achieve the GTS milestones (**Fig. 2.9**).

FIG. 2.9.

Comparison of progress in malaria case incidence considering three scenarios: current trajectory maintained (blue), GTS targets achieved (green) and worst case scenario, that is a return to mean peak past incidence in the period 2000–2007 (red) *Source: WHO estimates.*

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

3 Maternal, infant and child health consequences of malaria

Malaria infection during pregnancy is a significant public health problem, with substantial risks for the pregnant woman, her fetus and the newborn child. The symptoms and complications of malaria in pregnancy vary according to malaria transmission intensity in the given geographical area, and the individual's level of acquired immunity (*7*). Malaria-associated maternal illness and anaemia, preterm birth and low birthweight newborns are mostly the result of *P. falciparum* infection and occurs predominantly in Africa. Maternal anaemia, of which malaria remains an important contributor, puts the mother at increased risk of death before and after childbirth. This also leads to preterm births and children of low weight at birth, causing problems with child growth and cognitive development, as well as being major risk factors for perinatal, neonatal and infant mortality (*8, 9*).

In moderate and high transmission settings, where levels of acquired immunity tend to be high, *P. falciparum* infection is usually asymptomatic in pregnancy. Nevertheless, parasites may be present in the placenta and contribute to maternal anaemia even in the absence of documented peripheral parasitaemia. Both maternal anaemia and placental parasitaemia can lead to low birthweight, which is an important contributor to infant mortality (*7, 10, 11*). In these settings, the adverse effects of *P. falciparum* infection in pregnancy are most pronounced for women in their first pregnancy. Infection with *P. vivax* leads to chronic anaemia, reducing the birthweight and increasing the risk of neonatal death. For women in their first pregnancy, the reduction in birthweight due to infection with *P. vivax* is about two thirds of the reduction associated with *P. falciparum* (*12*, *13*).

In addition to a higher risk of low birthweight, infants once again become susceptible to *P. falciparum* malaria when immunity acquired from the mother starts to wane. Infants are at increased risk of rapid disease progression, severe malaria (especially of the severe anaemia form) and death.

To avert the consequences of malaria infections to pregnant women, fetuses, infants and children, WHO recommends – in combination with vector control, and prompt diagnosis and effective treatment of malaria – the use of intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP) as part of antenatal care (ANC) (**Section 7.3**); and intermittent preventive treatment in infants (IPTi) with SP in areas of moderate to high transmission in sub-Saharan Africa. In addition, seasonal malaria chemoprevention (SMC) with amodiaquine plus SP in children aged under 5 years is recommended in Africa's Sahel subregion.

In this section, exposure to malaria infection during pregnancy is estimated, then that estimation is used to compute the risk and prevalence of low birthweight. The correlation between malaria in pregnancy and malaria anaemia is presented, as is the prevalence of anaemia in children aged under 5 years, with or without malaria infection, as measured during household surveys. The analysis is restricted to moderate to high transmission countries in sub-Saharan Africa (**Annex 1**), where burden of malaria in pregnancy, infants and children is greatest.

3.1 PREVALENCE OF EXPOSURE TO MALARIA INFECTION DURING PREGNANCY, CORRELATION WITH MATERNAL ANAEMIA AND CONTRIBUTION TO LOW BIRTHWEIGHT

Anaemia is characterized by a decrease in the number of red blood cells in the blood (or a decrease in haemoglobin [Hb] concentration) to a level that impairs the normal physiological capacity of the blood to transport oxygen to cells around the body. WHO defines mild anaemia as a Hb concentration of between 10 g/dL and 10.9 g/dL, moderate anaemia as between 7 g/dL and 9.9 g/dL, and severe anaemia as below 7 g/dL. Deficiency in iron is thought to be the most common cause of anaemia.[1] Maternal anaemia has multiple causes, mainly related to nutrition, infection and genetics (*14*). In malaria endemic countries, malaria is a major cause of anaemia in pregnant women, many of whom also have other conditions, such as HIV and helminths infections and iron deficiency.

Malaria infections cause anaemia through multiple mechanisms; for example, direct destruction of red blood cells, clearance of infected and uninfected red cells by the spleen, and impaired red cell production by bone marrow. Individuals who are anaemic are at a greater risk of mortality, including from malaria. Single or repeated episodes of malaria may result in life-threatening anaemia, metabolic acidosis (*15*) and death. Exposure to malaria infection during pregnancy leads to maternal anaemia, which is associated with higher risk of obstetric haemorrhage and death. WHO estimates of maternal anaemia (Hb concentration of <10.9 g/dL at sea level) by country were obtained for 38 moderate to high malaria transmission countries in sub-Saharan Africa.[2]

Exposure to malaria infection in pregnancy (measured as cumulative prevalence over 40 weeks) was estimated from mathematic models (*16*) that relate estimates of the geographical distribution of *P. falciparum* exposure by age across Africa in 2018 to patterns of infections in placental histology by age and parity (*17*) (**Annex 1**). Fertility rates specific to country, age and gravidity, 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.[3] Countries where surveys were not available were allocated fertility patterns based on survey data from a different country, matched on the basis of total fertility rate (*18*) and geography. The exposure prevalence and the expected number of pregnant women who would have been exposed to infection were computed by country and subregion.

[1] Additional important causes of anaemia include infections, other nutritional deficiencies (e.g. in folate, and vitamins B12, A and C), genetic conditions and haemoglobinopathies (e.g. sickle cell disease and thalassaemia), and chronic kidney disease (*10*). Anaemia is highly prevalent globally and is particularly prevalent in sub-Saharan Africa. According to the WHO guidelines for treatment of malaria (*36*), a Hb concentration of less than 5 g/dL in an individual infected with malaria defines severe malaria.

[2] https://apps.who.int/gho/data/node.main.1?lang=en; Maternal anaemia prevalence estimates are presented to 2016 and were kept the same for the 2018 estimates in this report.

[3] https://dhsprogram.com/

Analysis by subregion showed that the prevalence of exposure to malaria infection in pregnancy was highest in West Africa and Central Africa, each with 35%, followed by East and Southern Africa (20%) (**Fig. 3.1**, **Table 3.1**). Overall prevalence of exposure to malaria infection in pregnancy in moderate to high transmission sub-Saharan Africa was 29%. In total, about 11 million pregnancies would have been exposed to malaria infection in these countries in 2018. About 39% (4.4 million) of these pregnancies were in the Democratic Republic of the Congo and Nigeria.

The analysis shows a positive correlation of maternal anaemia and prevalence of exposure to malaria infection during pregnancy (**Fig. 3.2**). In 20 countries (Benin, Burkina Faso, Burundi, Cameroon, Central

FIG. 3.1.

Estimated prevalence of exposure to malaria infection during pregnancy overall and by subregion in 2018 in moderate to high transmission sub-Saharan Africa *Source: Imperial College, WHO estimates.*

WHO: World Health Organization.

African Republic, Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Ghana, Guinea, Liberia, Malawi, Mozambique, Nigeria, Sierra Leone, South Sudan, Togo and Uganda), prevalence of exposure to malaria infection during pregnancy was 30% or more while maternal anaemia exceeded 40%. Although these countries have some of the highest malaria burden, the results should be interpreted recognizing that in sub-Saharan Africa, iron deficiency, an important cause of maternal anaemia, and malaria infection often coexist, but the relationship between them is complex. Measuring iron status in someone with current or recent past *P. falciparum* malaria infection is complicated by the inflammatory response to malaria infection (*19*).

TABLE 3.1.

Estimates of pregnancies, livebirths, low birthweights, exposure to malaria infection in pregnancy and malaria-attributable low birthweights in 2018 in moderate to high transmission sub-Saharan Africa *Source: Imperial College, WHO estimates.*

Subregion	Number of pregnancies	Number of children born alive	Number of pregnancies infected during a 40-week gestation period	Number of children born with low birthweight (<2500 g)	Number of children born with low birthweight (<2500 g) due to malaria
Central Africa	7 654 000	7 187 000	2 647 000	934 000	186 000
West Africa	15 180 000	14 253 000	5 295 000	2 321 000	418 000
East and Southern Africa (+ Sudan and Somalia)	16 137 000	15 174 000	3 224 000	2 280 000	268 000
Sub-Saharan Africa: total	**38 971 000**	**36 614 000**	**11 166 000**	**5 535 000**	**872 000**

WHO: World Health Organization.

FIG. 3.2.

Estimated maternal anaemia (*20*)[a] versus exposure to malaria infection in pregnancy in 2018 in moderate to high transmission countries in sub-Saharan Africa *Source: Imperial College, UNICEF-WHO estimates.*

UNICEF: United Nations Children's Fund; WHO: World Health Organization.
[a] Prevalence of all cause low birthweight used in this analysis were those estimated for 2015 as shown in this source.

Low birthweight is defined as weight at birth of less than 2500 g, regardless of gestational age (*20*). Premature birth (<37 weeks) and growth faltering in the womb are the main reasons for low birthweight. Several factors contribute to these: maternal malnutrition and anaemia; maternal characteristics such as low or high age, parity and poor birth spacing; health problems such as high blood pressure, diabetes and infections; and other risk factors including smoking and alcohol consumption (*20*). Children with low weight at birth not only have a high risk of stunting and poor cognitive development but also are at higher risk of death.

In moderate to high transmission malaria endemic countries, malaria infection during pregnancy and the consequent placental infection are important contributors to low birthweight (*7, 10, 11*). The incremental risk of low birthweight posed by the different categories of placental infection, and the relation between parity-specific and histology-specific placental infection categories and the risk of low birthweight in the absence of other competing "non-malaria" risk factors were computed with data from different transmission settings (*16*).

In 38 moderate to high transmission countries in sub-Saharan Africa, the estimated 11 million (**Table 3.1**) pregnancies exposed to malaria infection in 2018 resulted in about 872 000 children born with low birthweight (**Fig. 3.3**), representing 16% of all children with low birthweight in these countries (**Fig. 3.3**). By subregion, the percentage of low birthweight children due to malaria was, in line with exposure to malaria infection during pregnancy, highest in West Africa (18% of low birthweight children), followed by Central Africa (20%) and East and Southern Africa (12%) (**Fig. 3.3**).

FIG. 3.3.

Estimated low birthweights due to exposure to malaria infection during pregnancy overall and by subregion in 2018 in moderate to high transmission sub-Saharan Africa *Source: Imperial College, WHO estimates.*

WHO: World Health Organization.

3.2 PREVALENCE AND BURDEN OF MALARIA-RELATED ANAEMIA IN CHILDREN AGED UNDER 5 YEARS

Data from household surveys implemented in 21 moderate to high malaria burden countries between 2015 and 2018 showed that, among children aged under 5 years, the prevalence of any anaemia was 61%, mild anaemia 25%, moderate anaemia 33% and severe anaemia 3%.

When children were categorized by malaria rapid diagnostic test (RDT) results, overall anaemia was higher in children who were positive for malaria than in those who were negative (**Fig. 3.4**). When anaemia prevalence was further classified, of the children who were positive for malaria, 9% had severe anaemia, 54% had moderate anaemia, 21% had mild anaemia and only 17% had no anaemia. In contrast, among those children who had no malaria, 1% had severe anaemia, 31% had moderate anaemia, 28% had mild anaemia and 40% had no anaemia (**Fig. 3.4**).

FIG. 3.4.

Prevalence of severe anaemia (<7 g/dL), moderate anaemia (7-9.9 g/dL) and mild anaemia (10–10.9 g/dL) in children aged under 5 years in sub-Saharan Africa, 2015–2018, by age and malaria infection status
Source: Household surveys.

RDT: rapid diagnostic test.

Analysis by country presents a mixed picture, although in general, higher anaemia prevalence was observed among children infected with malaria than among those who were not (**Fig. 3.5**). For most countries, the percentage of severe anaemia among children aged under 5 years who were positive for malaria ranged from 5% to 10%, except in Mozambique (12%), Guinea (14%), Mali (16%) and Senegal (26%).

The number of children who were likely to be infected with *P. falciparum* in moderate to high transmission countries in sub-Saharan Africa was estimated using spatiotemporal methods applied to community parasite prevalence data obtained from household surveys.[1] The anaemia by infection status derived from household surveys (**Fig. 3.4**, **Fig. 3.5**) were then applied to the estimated number of infections among children aged 1–59 months (**Table 3.2**). Overall, about 24 million children were infected with *P. falciparum* in 2018 in sub-Saharan Africa. Of these, 7.2 million were in Central Africa, 6.1 million in East and Southern Africa, and 10.6 million in West Africa. An estimated 1.8 million were likely to have severe anaemia (Hb <7 g/dL), 12 million had moderate anaemia (7–9.9 g/dL), 5.2 million had mild anaemia (10–10.9 g/dL), and only about 4.8 million had no anaemia.

[1] https://apps.who.int/malaria/maps/threats/

FIG. 3.5.

Prevalence of severe anaemia (<7 g/dL), moderate anaemia (7–9.9 g/dL) and mild anaemia (10–10.9 g/dL) in children aged under 5 years in sub-Saharan Africa, 2015–2018, by country *Source: Household surveys.*

RDT: rapid diagnostic test.

3.3 PROTECTING THE MOTHER AND CHILD

The sub-Saharan African countries most affected by malaria-related consequences in pregnancy and early childhood also have some of the highest concentration of other risk factors for unhealthy pregnancies, new-borns and children. Often in these communities, malaria occurs in mothers and children who are already weakened by parasitic, viral and bacterial infections; nutritional deficiencies; and genetic conditions (*21*). Broader determinants, such as socioeconomic status, mother's age, parity and health system factors further threaten the wellbeing of the mother and child, leading to some of the highest levels of maternal, infant and child mortality rates globally (*22*). Addressing these determinants requires a multisectoral approach underpinned by a health system that delivers effective primary health care, both in terms of quality and coverage.

To ensure that mothers and new-borns are protected, long-lasting insecticidal nets (LLINs) are routinely delivered through ANC and expanded programmes for immunization, respectively. About 28 million nets were distributed through these channels in sub-Saharan Africa in 2018. In the same year, about 61% of pregnant women and children slept under a treated mosquito net (**Section 7**). IPTp is now part of the WHO recommended

TABLE 3.2.

Estimated number of children aged 1–59 months infected with *P. falciparum* parasites in 2018 by subregion and overall in sub-Saharan Africa, *Source: WHO estimates.*

	Total number of children aged 1–59 months infected in 2018	Number by anaemia level among children aged 1–59 months who were infected in 2018			
		Severe (<7 g/dL)	Moderate (7–9.9 g/dL)	Mild (10–10.9 g/dL)	Not anaemic
Central Africa	7 130 000	630 000	3 800 000	1 5000 000	1 200 000
East and Southern Africa (+ Sudan and Somalia)	6 080 000	480 000	3 200 000	1 300 000	1 100 000
West Africa	10 610 000	14 253 000	5 000 000	2 400 000	2 500 000
Sub-Saharan Africa: total	**23 810 000**	**1 800 000**	**12 000 000**	**5 200 000**	**4 800 000**

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

ANC package, with an estimated 31% of pregnant women receiving at least three doses of IPTp (**Section 7**). IPTi has been scaled up nationally only in Sierra Leone, despite a WHO recommendation since 2010, following evidence of a significant impact on clinical incidence and severe anaemia in infants. It is recommended for delivery on a schedule that corresponds to that of diphteria, pertussis and tetanus (DPT) and measles vaccines. Management of fever remains inadequate, with nearly 40% of febrile children in sub-Saharan Africa not accessing treatment (**Section 8**). Although integrated community case management (iCCM) is considered an effective strategy in bridging the gap in clinical care for common childhood illnesses, its roll-out in most sub-Saharan African countries remains poor, mainly due to health-financing bottlenecks.

To highlight some of the potential health system quality and coverage issues related to malaria interventions, an analysis of the prevalence of exposure to malaria infection during pregnancy, coverage of four or more ANC visits (ANC4) (*22*) and use of three or more doses of IPTp during pregnancy (IPTp3) were implemented (**Fig. 3.6**). Countries appear to fall into several categories: those where access to ANC services is a major impediment to increasing coverage of IPTp3 (e.g. Central African Republic, Chad, Niger, Somalia and South Sudan); those where ANC4 coverage is relatively high but quality of care is an issue and few women receive IPTp during ANC visits (e.g. Angola, Cameroon, Congo, Equatorial Guinea, Gabon, Guinea-Bissau, Liberia, Mauritania and Zimbabwe); and those where coverage of both ANC4 and IPTp3 are moderate and the main opportunities are in increasing access (Burkina Faso, Burundi, the Democratic Republic of the Congo, Gambia, Ghana, Mali, Mozambique, Sierra Leone, the United Republic of Tanzania and Zambia).

FIG. 3.6.

Country comparison of coverage of ANC4 and IPTp3 in moderate and high transmission sub-Saharan Africa, 2018 Countries in red typeface are those where prevalence of exposure to malaria infection during pregnancy was >20% in 2018. *Source: WHO estimates.*

Coverage of 4 or more ANC visits	<20%		IPTp3 coverage	>60%
<20%	Somalia South Sudan			
		Central African Republic Chad Niger		
	Eritrea Rwanda Sudan Uganda	Benin Côte d'Ivoire Kenya Madagascar Malawi Nigeria Senegal Togo	Burkina Faso Burundi Democratic Republic of the Congo Mali Mozambique United Republic of Tanzania Zambia	
>60%	Angola Congo Equatorial Guinea Liberia Mauritania Zimbabwe	Cameroon Gabon Guinea-Bissau	Gambia Ghana Sierra Leone	

ANC4: 4 or more antenatal care visits; IPTp3: third dose of intermittent preventive treatment in pregnancy; WHO: World Health Organization.

4 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 (*23*) as a mechanism to bring the 11 highest burden countries back on track to achieve the 2025 GTS milestones (*1*). This followed the results of the world malaria reports of 2017 (*24*) and 2018 (*25*), which showed that, globally, progress has stalled in high-burden countries and that the GTS 2020 milestones are, therefore, unlikely to be achieved. 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.

Many factors contribute to the rising malaria burden in these, and other, high-burden countries, including the underlying intensity of malaria transmission, sociodemographic and epidemiologic risk factors, poor access to care and suboptimal malaria intervention coverage, and funding constraints. Consequently, the approach includes the four key response elements shown in **Fig. 4.1**, which have the aim of supporting countries to address their core country challenges so that they can get back on track towards the GTS milestones.

4.1 HBHI INITIATION ACTIVITIES

By November 2019, the HBHI approach had been initiated in Burkina Faso, Cameroon, Democratic Republic of Congo, Ghana, India, Mozambique, Niger, Nigeria and Uganda. The process involved national consultation meetings with in-country stakeholders, key international malaria partners and WHO. Countries implemented self-assessments on various aspects of the four response elements, which formed the basis of HBHI country discussions. Following the HBHI initiation meetings, countries developed detailed activity plans to address challenges revealed during assessments. Mali and the United Republic of Tanzania are expected to have held their national consultation meeting by the end of the first quarter of 2020. The key HBHI response highlights in most countries in 2019 include launch or strengthening of social mobilization and advocacy movements through the launching of the campaign "Zero Malaria Starts With Me" (*26*) with support from the RBM Partnership; initiation of the process of developing national malaria data repositories and stratification for intervention mix analysis with support from WHO, in-country and international partners; and increased political accountability through work with parliamentarians and high level, multisectoral bodies.

In addition, to ensure greater flexibility in adoption and adaptation of WHO recommendations by countries, the GMP convened an informal consultation in

September 2019 to reconsider the formulation of malaria policy guidance. The outcome of this consultation was submitted to the Malaria Policy Advisory Committee (MPAC) during its meeting in October 2019 (*27*). The MPAC agreed with the conclusion of the informal consultation that intervention prioritization should not be driven solely by sequentially optimizing single interventions for maximal coverage; instead, intervention prioritization should be based on local evidence and aligned to the specific needs of different epidemiological strata or settings, as defined in the country's national strategic plan. The MPAC appreciated the concept of "universal coverage" in striving to save lives, reduce disease and ultimately eradicate malaria. The MPAC encouraged work towards universal coverage of the right mix of interventions, recognizing that the coverage of individual interventions will vary by setting.

This section summarizes the progress made in malaria burden, prevention, diagnosis and treatment for all HBHI countries. It ends with a discussion of trends in external and domestic direct funding (excluding estimated costs of patient care) in the HBHI countries.

FIG. 4.1.

HBHI: a targeted malaria response to get countries back on target for the 2025 GTS milestones *Source: WHO GMP and RBM Partnership.*

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

4.2 BURDEN OF MALARIA CASES AND DEATHS

There were about 155 million estimated malaria cases in the 11 HBHI countries in 2018, compared with 177 million in 2010. The Democratic Republic of the Congo and Nigeria accounted for 84 million (54%) of total cases (**Fig. 4.2a**). Malaria deaths reduced from about 400 000 in 2010 to about 260 000 in 2018 (**Fig. 4.2a**).

FIG. 4.2a.

Estimated malaria cases and deaths, 2010–2018 Countries are presented from highest to lowest number of estimated malaria cases in 2018. The estimated number of deaths for each country is shown in the right-hand column. *Source: WHO estimates.*

WHO: World Health Organization.

In India, only seven out of 36 states accounted for 90% of the estimated cases in 2018. In these seven states, there were large reductions in malaria cases in 2018 compared with 2010, from a total of 14.3 million cases to 5.7 million cases (**Fig. 4.2b**). For most other countries, however, the rates of reductions were generally slower in the past 3 years than in preceding years.

WHO: World Health Organization.

FIG. 4.2b.

Estimated malaria cases in India, showing seven states that contributed a combined 90% of cases, 2010 versus 2018 *Source: WHO estimates.*

WHO: World Health Organization.

4.3 MALARIA PREVENTION

In the period 2016–2018, about 295 million long-lasting insecticidal nets (LLINs) were distributed in 11 HBHI countries, of which 116 million (39%) were distributed to communities in the Democratic Republic of the Congo and Nigeria (**Fig. 4.3a**). By 2018, access to LLINs was between 40% and 60% in Burkina Faso, Cameroon, Mozambique, Niger, Nigeria and the United Republic of Tanzania; between 60% and 70% in Mali; and between 70% and 80% in the Democratic Republic of the Congo, Ghana and Uganda (**Fig. 4.3b**). The percentage of the population sleeping under LLINs was highest in Uganda and lowest in Nigeria (**Fig. 4.3c**). The percentage of children sleeping under LLINs was about 50% in Burkina Faso and Nigeria, but above 70% in the

FIG. 4.3.

Distribution and coverage of preventive interventions *Source: NMP reports and WHO estimates.*

LLIN: long-lasting insecticidal net; NMP: national malaria programme; WHO: World Health Organization

Democratic Republic of Congo, Ghana and Uganda (**Fig. 4.4d**). LLIN use by pregnant women was almost exactly the same as that of children aged under 5 years. Coverage of the recommended three doses of SP for IPTp (IPTp3) was low to moderate, with only Burkina Faso and the United Republic of Tanzania estimated as having more than half of pregnant women receiving IPTp3 in 2018. In Cameroon, Nigeria and Uganda, the estimated coverage was about 30% or less (**Fig. 4.3e**). Of the 10 HBHI countries in Africa, six countries within the sub-Sahelian ecological zone implemented SMC; by 2018, a mean total of 17 million children, out of the 26 million targeted, were treated per SMC cycle. The gap in treatment was greatest in Ghana and Nigeria (**Fig. 4.3f**).

d) Percentage of children sleeping under an LLIN, 2018

e) Percentage of pregnant women who received IPTp3, 2018

f) SMC targeted children and mean treatments per cycle, 2018

HBHI: high burden to high impact; IPTp3: third dose of intermittent preventive treatment in pregnancy; LLIN: long-lasting insecticidal net; SMC: seasonal malaria chemoprevention.

Note: population level coverage of malaria interventions not shown for India due to lack of household surveys. Out of 11 HBHI countries, only Burkina Faso, Cameroon, Ghana, Mali, Niger and Nigeria have areas eligible for SMC.

4.4 MALARIA DIAGNOSIS AND TREATMENT

The percentage of children aged under 5 years with fever (in the 2 weeks preceding the survey) varied by country, from 16% in Cameroon to 41% in Nigeria (**Fig. 4.4a**). Among these children, the proportion seeking treatment ranged from 58% in Mali to 82% in Uganda. Only in Burkina Faso and Mozambique were more than 50% of these children treated in the public health sector; in other countries, 37% or less of these children were treated in this sector. The use of the private sector was highest in Nigeria and Uganda (48%), and lowest in Burkina Faso and Mozambique (<4%) (**Fig. 4.4a**). Worryingly, a considerable number of children were not brought for care, and in the Democratic Republic of the Congo and Mali, this figure was more than 40%. Among children who were brought for care, the percentage who were tested for malaria was about 30% or less in Cameroon, the Democratic Republic of the Congo, Mali, Niger and Nigeria; and about 50% or more in Burkina Faso, Ghana, Mozambique, Uganda and the United Republic of Tanzania (**Fig. 4.4b**).

FIG. 4.4.

Diagnosis and treatment of febrile children in HBHI African countries, (a) Treatment seeking for fevers in children aged under 5 years, and source of treatment by health sector, (b) Percentage of children aged under 5 years with fever who sought treatment and were diagnosed using a parasitological test *Source: Household surveys.*

Note: No data available from Niger.

DHS: demographic and health surveys; HBHI: high burden to high impact; MIS: malaria indicator surveys.
Note: Data not available for the Democratic Republic of the Congo and Niger.

4.5 MALARIA FUNDING

An estimated US$ 9.4 billion in funding was directed at the 11 HBHI countries in the period 2010–2018. Of this, US$ 7.7 billion (82%) came from international sources. This funding represents direct budgetary investment in malaria control, but excludes the cost of health workers' time spent on treating patients. Over the 2010–2018 period, the Democratic Republic of the Congo and Nigeria received the largest amount of international funding (**Fig. 4.5a** and **Fig. 4.5b**). In the past 3 years (2016–2018), about US$ 3.5 billion of direct malaria funding was reported in the 11 HBHI countries, with about 31% of this funding being in the Democratic Republic of the Congo and Nigeria (**Fig. 4.5b**). Except for India, direct domestic investment remains very low in the HBHI countries.

FIG. 4.5.

Total international and domestic direct funding for malaria in the 11 HBHI countries, (a) 2010–2018 and (b) 2016–2018 *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; WHO: World Health Organization.

5 Malaria elimination and prevention of re-establishment

An increasing number of countries are progressing towards elimination of malaria. Globally, the number of countries that were malaria endemic in 2000 and that reported fewer than 10 000 malaria cases increased from 40 in 2010 to 49 in 2018; in the same period, the number of countries with fewer than 100 indigenous cases increased from 17 to 27. Between 2017 and 2018, the number of countries with fewer than 10 indigenous cases increased from 19 to 24 (**Fig. 5.1**).

The GTS milestone for 2020 is to eliminate malaria from at least 10 countries that were malaria endemic in 2015 (*1*). Between 2000 and 2018, 19 countries attained zero indigenous cases for 3 years or more (**Table 5.1**); four countries that were malaria endemic in 2015 have since eliminated malaria. In 2018, no malaria endemic country reached zero indigenous malaria cases for the third consecutive year. However, several countries recorded zero indigenous cases for the first time in 2018, or for a second consecutive year (**Section 5.1**).

Certification of elimination by WHO is the official recognition of a country being free from indigenous malaria cases; this is based on an independent evaluation verifying the interruption of transmission and the country's ability to prevent re-establishment of transmission. Paraguay and Uzbekistan were awarded WHO certification of elimination in 2018, with Algeria and Argentina achieving certification in early 2019.

5.1 E-2020 INITIATIVE

In April 2016, WHO published an assessment of the likelihood of countries achieving malaria elimination by 2020. This assessment was based on the countries' trends in the number of indigenous malaria cases, their declared malaria elimination objectives and the informed opinions of WHO experts in the field (*28*). Twenty-one countries, across five WHO regions, were identified as being the most likely to reach zero indigenous cases by 2020. These countries were termed as the "eliminating countries for 2020" (E-2020), and they are the special focus of WHO efforts to accelerate national elimination efforts and monitor progress towards malaria free status (**Fig. 5.2**). An inaugural meeting of the national malaria programmes (NMPs) for the E-2020 countries, referred to as the Global Forum of Malaria-Eliminating Countries (Global Forum), was organized by WHO in March 2017 in Geneva, Switzerland; the Global Forum was held again in June 2018 in San José, Costa Rica, and in June 2019 in Wuxi, China.

In April 2018, WHO established the Malaria Elimination Oversight Committee (MEOC) to help countries to reach their elimination goals. The MEOC attended the 2018 and 2019 Global Forums and, in February 2019, met with a small group of countries on track to reach malaria elimination by 2020, to support those countries in their attempts to achieve malaria elimination. The MEOC has produced a series of recommendations to help countries accelerate towards this goal.

TABLE 5.1.

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 free from malaria are shown in green (with the year of certification in parentheses). *Source: 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				

WHO: World Health Organization.

FIG. 5.1.

Number of countries that were malaria endemic in 2000, with fewer than 10, 100, 1000 and 10 000 indigenous malaria cases between 2010 and 2018 *Sources: NMP reports and WHO estimates.*

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

In 2018, several countries reported significant progress towards elimination (**Fig. 5.2**). For the first time, Iran (Islamic Republic of), Malaysia and Timor-Leste reported zero indigenous cases, while China and El Salvador reported their second year of zero indigenous cases. Cabo Verde, Eswatini, Saudi Arabia and South Africa reported large reductions in the number of cases in 2018 compared with 2017. Comoros and Costa Rica, however, reported large increases in the number of cases.

5.2 GREATER MEKONG SUBREGION

The six countries of the Greater Mekong subregion (GMS) – Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – continue to make significant gains as

FIG. 5.2.

Trends in indigenous malaria cases in E-2020 countries, 2010–2018 Countries are presented from highest to lowest number of indigenous malaria cases at baseline year, 2010; the graphs show the number of indigenous malaria cases from 2010 to 2018. Years with zero indigenous malaria cases are represented by green dots. *Source: NMP reports.*

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

Note: Cases for Botswana, Nepal and Timor-Leste are derived from adjusting reported data for reporting and testing rates, and treatment seeking in different health sectors.

they aim for malaria elimination by 2030. Between 2010 and 2018, the reported number of malaria cases fell by 76% (**Fig. 5.3**); over the same period, malaria deaths fell by 95%. The GMS has reported a steep decline in *P. falciparum* cases: a decrease of 48% since 2010, and an 80% reduction in 2018 from the peak of 390 000 cases in 2012. This accelerated decrease in *P. falciparum* is especially critical because of drug resistance: in the GMS, *P. falciparum* parasites have developed partial resistance to artemisinin – the core compound of the best available antimalarial drugs.

In 2018, Cambodia reported no malaria-related deaths for the first time in the country's history. China also reported its second consecutive year of zero indigenous cases. Meanwhile, Thailand is nearing *P. falciparum* elimination, with a 38% decrease in *P. falciparum* cases between 2017 and 2018.

FIG. 5.3.

***P. falciparum* cases in the GMS, 2010–2018** *Source: NMP reports.*

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

FIG. 5.4.

Regional map of malaria incidence in the GMS by area, 2018 *Source: NMP reports.*

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

6 Investments in malaria programmes and research

For 2020, the GTS milestones are a global reduction of at least 40% in malaria case incidence and mortality rates compared with 2015, elimination in at least 10 countries and prevention of re-establishment in all malaria free countries (*1*). Estimates of the funding required to achieve these milestones have been set out in the GTS. 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 (*1*).

This section presents the most up-to-date funding trends for malaria control and elimination, by source and channel of funding for the period 2010–2018, both globally and for major country groupings. It then presents investments in malaria-related research and development (R&D) for the same period.

A large proportion of the investment in malaria is spent on scaling up malaria prevention, diagnosis and treatment. This section presents trends in the sales and in-country distribution of insecticide-treated mosquito nets (ITNs), artemisinin-based combination therapies (ACTs) and RDTs.

6.1 FUNDING FOR MALARIA CONTROL AND ELIMINATION

For the 91 countries analysed in this section, total funding for malaria control and elimination was estimated at US$ 2.7 billion in 2018, compared with US$ 3.2 billion in 2017. The amount invested in 2018 falls short of the US$ 5.0 billion estimated to be required globally to stay on track towards the GTS milestones (*1*). Moreover, the funding gap between the amount invested and the resources needed widened from US$ 1.3 billion in 2017 to US$ 2.3 billion in 2018.

Over the period 2010–2018, nearly 70% of the total funding for malaria control and elimination was provided by international sources (**Fig. 6.1**). However, the aggregated figures hide substantial variations in the relative share of funding from domestic and international sources across country groups, as noted later in this section.

Of the US$ 2.7 billion invested in 2018, US$ 1.8 billion came from international funders. The government of the United States of America (USA) contributed a total of US$ 1.0 billion through planned bilateral funding and contributions to multilateral funding agencies, followed by bilateral and multilateral disbursements from the United Kingdom of Great Britain and Northern Ireland (United Kingdom) of US$ 0.2 billion; France, Japan and Germany with contributions of about US$ 0.1 billion each; and other country members of the Development Assistance Committee and private sector contributors of about US$ 0.3 billion combined (**Fig. 6.2**).

Governments of malaria endemic countries continued to contribute about 30% of the total funding (**Fig. 6.1**), with investments reaching US$ 0.9 billion in 2018 (**Fig. 6.2**). Of this amount, US$ 0.6 billion was invested in malaria control activities, and US$ 0.3 billion was estimated to have been spent on malaria case management in the public sector.

FIG. 6.1.

Funding for malaria control and elimination over the period 2010–2018 (% of total funding), by source of funds (constant 2018 US$) *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD creditor reporting system database, the World Bank Data Bank and WHO estimates.*

EU: European Union; Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; WHO: World Health Organization.

FIG. 6.2.

Funding for malaria control and elimination 2010–2018, by source of funds (constant 2018 US$) *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD creditor reporting system database, the World Bank Data Bank and WHO estimates.*

EU: European Union; Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; NMP: national malaria programme; OECD: Organisation for Economic Co-operation and Development; WHO: World Health Organization.

Of the US$ 2.7 billion invested in 2018, nearly US$ 1.0 billion (35%) was channelled through the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) (**Fig. 6.3**). Compared with 2017, the Global Fund's disbursements to malaria endemic countries decreased by about US$ 0.4 billion in 2018. This difference in the disbursement amount in 2018 and 2017 reflects the cyclical distribution of ITNs supported by the Global Fund, and an increase in disbursements in 2017, corresponding to the end of most malaria grants in that year (**Fig. 6.3**).

Planned bilateral funding from the government of the USA amounted to US$ 0.8 billion in 2018, which was slightly lower than in 2017, although above the levels of all other annual planned contributions since 2010 (**Fig. 6.3**). The United Kingdom remains the second-largest bilateral funder, with about US$ 0.1 billion in 2018, followed by contributions from the World Bank and other Development Assistance Committee members (**Fig. 6.3**). With US$ 0.9 billion invested in 2018, the total contribution from governments of malaria endemic countries remained the same as in 2017.

FIG. 6.3.

Funding for malaria control and elimination 2010–2018, by channel (constant 2018 US$) *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD creditor reporting system database, the 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; USA: United States of America; WHO: World Health Organization.

Fig. 6.4 shows the substantial variation across country income groups in the share of funding from domestic and international sources. The 29 low-income countries accounted for 47% of total funding for malaria in 2018 (and >90% of global malaria cases and deaths, respectively) with 85% of their funding coming from international sources. International funding also dominated in the group of 36 lower-middle-income countries (43% of total funding in 2018), accounting for 61% of the amount invested in these countries. In contrast, in the group of 23 upper-middle-income countries (11% of the total funding in 2018), 5% of their malaria funding came from international sources, and 95% came from domestic public funding.

Of the US$ 2.7 billion invested in 2018, nearly three quarters benefited the WHO African Region, followed by the WHO Region of the Americas (7%), WHO South-East Asia Region (6%), and WHO Eastern Mediterranean Region and WHO Western Pacific Region (5% each) (**Fig. 6.5**). Funding flows for which no geographical information on recipients was available represented 5% of the total funding in 2018 (**Fig. 6.5**).

FIG. 6.4.

Funding for malaria control and elimination 2010–2018, by World Bank 2018 income group and source of funding (constant 2018 US$)[a] *Sources: ForeignAssistance.gov, United Kingdom Department for International Development, Global Fund, NMP reports, OECD creditor reporting system database, the 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; WHO: World Health Organization.

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

FIG. 6.5.

Funding for malaria control and elimination 2010–2018, by WHO region (constant 2018 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; 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 R&D

Globally, a total funding of US$ 663 million was invested in basic research and product development for malaria in 2018. This was a modest increase from the previous year (an increase of US$ 18 million, or 2.8%), but marked the third consecutive year of increased funding, and the largest annual investment in malaria R&D since its peak of US$ 676 million in 2009.

Funding for drug R&D increased to the highest level ever recorded (from US$ 228 million in 2017 to US$ 252 million in 2018) (**Fig. 6.6**), driven by increased private sector industry investment in several Phase II trials of new chemical entities with the potential for single-exposure radical cure. Funding for basic research also increased (from US$ 143 million in 2017 to US$ 163 million in 2018) (**Fig. 6.6**), as did funding for vector control product R&D (from US$ 35 million in 2017 to US$ 56 million in 2018) (**Fig. 6.6**), although this latter change was due largely to the cyclical funding patterns of the Bill & Melinda Gates Foundation.

Funding for vaccine R&D decreased (from US$ 181 million in 2017 to US$ 156 million in 2018)

FIG. 6.6.

Funding for malaria-related R&D 2010–2018, by product type (constant 2018 US$) *Sources: Policy Cures Research - G-FINDER 2019 report (in preparation).*

R&D: research and development.

(**Fig. 6.6**), owing to lower investment from private sector industry, which in turn reflects a pipeline that saw no new candidates advance from or enter into late-stage clinical trials, and pilot implementation studies for the vaccine RTS,S not commencing until 2019. Diagnostic R&D was the only other product area to receive lower funding in 2018, falling from US$ 31 million in 2017 to US$ 27 million in 2018 (**Fig. 6.6**).

Just over half (US$ 352 million, or 53%) of all malaria R&D funding in 2018 was for basic and early stage research; a further 27% (US$ 176 million) went to clinical development and post-registration studies. The remaining funding was not allocated to specific products or R&D stages, but mostly consisted of core funding to product development partnerships.

The public sector provided just over half (US$ 353 million, or 53%) of all malaria R&D funding in 2018 (**Fig. 6.7**), which was the same as in each of the previous 8 years. The remaining funding was split evenly between private sector industry (US$ 158 million, or 24%) and the philanthropic sector (US$ 152 million, or 23%) (**Fig. 6.7**). This was a record high investment by private sector industry, and marked the fourth consecutive year that its contribution equalled that of the philanthropic sector.

FIG. 6.7.

Malaria R&D funding in 2018, by sector (constant 2018 US$) *Sources: Policy Cures Research - G-FINDER 2019 report (in preparation).*

R&D: research and development.

6.3 PROCUREMENT AND DISTRIBUTIONS OF ITNs

The peak year for manufacturer deliveries of ITNs was 2017, when 251 million nets were reported as having been delivered globally. In 2018, about 197 million ITNs were delivered by manufacturers, of which more than 87% were delivered to countries in sub-Saharan Africa. This is fewer than in 2017, when 224 million nets were delivered worldwide (**Fig. 6.8**). Globally, the main channel of delivery was mass campaigns, while routine

FIG. 6.8.

Number of ITNs delivered by manufacturers[a] and distributed[b] by NMPs, 2010–2018 *Sources: Milliner Global Associates and NMP reports.*

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

[a] Deliveries by manufacturers in a given year are often not reflected in distributions by NMPs in that year; a lag of up to 1 year may occur.

[b] Distributions of ITNs reported by NMPs do not always reflect all the nets that have been distributed to communities, depending on completeness of recording.

Note: A lag between manufacturer deliveries to countries and NMP distributions of about 6–12 months is expected, which 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 the programmes.

distributions through immunization programmes in ANC facilities continue to play an important role.

During the 3-year period 2016–2018, 578 million ITNs – most of which were LLINs – were distributed globally by NMPs in malaria endemic countries. Of these, about 90% were delivered to 29 countries (**Fig. 6.9**), with 50% going to Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Ghana, India, Nigeria, Uganda and the United Republic of Tanzania.

FIG. 6.9.

Total LLINs distributed to communities by country in the period 2016–2018, in countries accounting for about 90% of global distributions by NMPs *Source: NMP reports.*

LLIN: long-lasting insecticidal net; NMP: national malaria programme.

6.4 DELIVERIES OF RDTs

Globally, 2.3 billion RDTs for malaria were sold by manufacturers in the period 2010–2018, with nearly 80% of these sales to countries in sub-Saharan Africa. These were sales by manufacturers that were eligible for procurement according to the Malaria RDT Product Testing Programme and WHO Prequalification and NMP distributions of RDTs. In the same time period NMPs distributed 1.6 billion RDTs.

In 2018, 412 million RDTs were sold by manufacturers, compared with 276 million in 2017 (**Fig. 6.10**). However, NMPs distributed 259 million RDTs in 2018, compared with 245 million in 2017, with 80% of distributions also occurring in sub-Saharan Africa. Usually, differences between sales and distributions of RDTs can be attributed to one or more of the following causes: manufacturer data include both public and private health sector sales, whereas NMP-distributed RDTs represent tests in the public sector only; an initial high distribution may be followed by a lower one, as countries use commodities procured in the previous year; misreporting may occur, where RDTs in ministry of health central stores are not included in NMP distributions; and reporting systems may be weak or manufacturer data may represent recent orders that are yet to arrive in the country. Most of the RDTs sold globally (266 million), particularly in sub-Saharan Africa, were tests that detected only *P. falciparum*.

FIG. 6.10.

Number of RDTs sold by manufacturers and distributed by NMPs for use in testing suspected malaria cases,[a] 2010–2018 *Sources: NMP reports and sales data from manufacturers eligible for WHO's 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.

6.5 DELIVERIES OF ACTs

More than 3 billion treatment courses of ACT were sold globally by manufacturers in the period 2010–2018 (**Fig. 6.11**). About 1.9 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 sold exclusively through the private retail sector. National data reported by NMPs show that, in the same period, 1.7 billion ACTs were delivered to health facilities to treat malaria patients in the public health sector. The discrepancy between global sales and national distributions is, in part, due to the lack of reports from the private sector for most countries. However, with declines in co-payments from the Global Fund, the number of ACTs procured for the private sector has decreased substantially since 2016. In 2018, some 249 million ACTs were sold by manufacturers to the public health sector, and in the same year 214 million ACTs were distributed to this sector by NMPs, of which 98% were in sub-Saharan Africa.

FIG. 6.11.

Number of ACT treatment courses delivered by manufacturers and distributed by NMPs to patients, 2010–2018[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.

7 Preventing malaria

For the prevention of malaria, WHO recommends vector control (i.e. reducing the chances of mosquitoes biting human beings) or chemoprevention (i.e. providing drugs that suppress infections) in specific population subgroups (i.e. pregnant women, children and other high-risk groups) or in specific contexts (e.g. complex emergencies and elimination). The core interventions recommended by WHO to prevent mosquito bites are sleeping under an ITN and indoor residual spraying (IRS). In a few specific settings and circumstances, ITNs and IRS can be supplemented by larval source management or other environmental modifications (*29*).

With regard to chemoprevention, WHO recommends a number of context-specific interventions. In sub-Saharan Africa, IPTp with SP has been shown to reduce maternal anaemia, low birthweight and perinatal mortality (*30*). IPTi with SP provides protection against clinical malaria and anaemia (*31*). SMC with amodiaquine (AQ) plus SP (AQ+SP) for children aged 3–59 months reduces the incidence of clinical attacks and severe malaria by about 75%, and could avert millions of cases and thousands of deaths among children living in areas of highly seasonal malaria transmission (*32*). Since March 2012, WHO has recommended SMC for children aged 3–59 months living in areas of highly seasonal malaria transmission in the Sahel subregion of Africa. Mass drug administration is defined as the time-limited administration of antimalarial treatment to all age groups of a defined population or to every person living in a defined geographical area (except those for whom the medicine is contraindicated) at about the same time and at specific repeated intervals. It is recommended for malaria elimination settings in combination with high coverage of core interventions and as a means of rapidly reducing the malaria burden in epidemics and complex emergencies, as part of the rapid initial response (*33*).

This section discusses the population-level coverage of ITNs, IRS, IPTp and SMC. Analysis of coverage indicators for ITNs is limited to sub-Saharan Africa, where there are sufficient household survey data to measure progress. IPTp and SMC are also reported only for sub-Saharan Africa, where these interventions are applicable. The coverage of IPTi is not reported because, as for 2018, no country has adopted it. In 2019, Sierra Leone began national scale-up of IPTi.

7.1 POPULATION AT RISK COVERED WITH ITNs

Indicators of population-level coverage of ITNs were estimated for countries in sub-Saharan Africa 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 (*34, 35*):

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

By 2018, 72% of households in sub-Saharan Africa had at least one ITN and about 57% of the population had access to an ITN, while 40% of the population lived in households with enough ITNs for all occupants. These indicators represented impressive progress from 2010, but no significant change since 2016 (**Fig. 7.1**).

Use of ITNs by household members, measured as the percentage of people who slept under an ITN the night before the survey, was 61% in 2018 compared with 36% in 2010 for both pregnant women and children aged under 5 years, and was 50% in 2018 compared with 29% in 2010 for the overall population (**Fig. 7.2**).

FIG. 7.1.

Percentage of population at risk with access to an ITN, and percentage of households with at least one ITN and enough ITNs for all occupants, sub-Saharan Africa, 2010–2018 *Source: ITN coverage model from MAP.*[a]

ITN: insecticide-treated mosquito net; MAP: Malaria Atlas Project.
[a] https://map.ox.ac.uk/

FIG. 7.2.

Percentage of population at risk, pregnant women and children aged under 5 years[a] sleeping under an ITN, sub-Saharan Africa, 2010–2018 *Source: ITN coverage model from MAP.*[b]

ITN: insecticide-treated mosquito net; MAP: Malaria Atlas Project.
[a] Estimates for children aged under 5 years and pregnant women highly overlap and show the same values in the trend since 2010.
[b] https://map.ox.ac.uk/

Results by country in sub-Saharan Africa on percentage of population with access to ITNs and proportion of households with enough ITNs for all occupants are shown in **Fig. 7.3**. These are countries where ITNs are the main vector control intervention. The analysis showed high levels of access (>70%) in 13 of 37 countries, moderate levels of access (50–70%) in an additional 13 countries, and access levels below 50% in 11 countries, including Burkina Faso and Nigeria, two very high burden countries. The percentage of households with at least one ITN for each two people was, as expected, highly correlated with, but consistently lower than, the percentage with access to ITN.

7.2 POPULATION AT RISK PROTECTED BY IRS

In most countries, IRS is targeted at a few focal areas, which may vary over time. Operational coverage of IRS is likely to be very high among the targeted populations. However, when interpreting the trends in IRS coverage presented here, the denominator of "population at risk" used is that of all populations

FIG. 7.3.

Percentage of population at risk with access to an ITN, and percentage of households with enough ITNs for all occupants, sub-Saharan Africa, 2010–2018 *Source: ITN coverage model from MAP.*[a]

ITN: insecticide-treated mosquito net; MAP: Malaria Atlas Project.
[a] https://map.ox.ac.uk/

living in areas where there is ongoing malaria transmission, to allow for consistency in trend.

Globally, the percentage of the populations at risk protected by IRS declined from 5% in 2010 to 2% in 2018, with increases seen in 2018 compared with 2017 in the regions for which data were analysed: the WHO Region of the Americas and WHO Eastern Mediterranean Region (**Fig. 7.4**). The number of people protected in 2010 was 180 million globally, but by 2018 this number had reduced to about 93 million, with a decrease of 13 million compared with 2017.

Reasons for the declining global IRS coverage may include the switch from pyrethroids to more expensive insecticides in response to increasing pyrethroid resistance, or changes in operational strategies (e.g. decreasing at-risk populations in countries aiming for elimination of malaria). **Fig. 7.5** shows the main chemical class used for IRS across countries that have reported the implementation of this intervention. Most countries still rely on pyrethroids, although in 2018 about half of countries reported using other insecticides, mainly organophosphates (**Section 10.3**).

FIG. 7.4.

Percentage of the population at risk protected by IRS, by WHO region, 2010–2018 *Source: NMP reports and IVCC data.*

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: WHO Western Pacific Region.

FIG. 7.5.

Main chemical classes used for IRS by national programmes globally, 2010–2018 *Source: NMP reports.*

IRS: indoor residual spraying; NMP: national malaria programme.

7.3 PREGNANT WOMEN RECEIVING THREE OR MORE DOSES OF IPTp

WHO recommends that IPTp be given to all pregnant women at each ANC visit, starting as early as possible in the second trimester (i.e. not during the first trimester). Each SP dose should be given at least 1 month apart, with women receiving at least three SP doses (IPTp3) during each pregnancy (*30*). To date, 36 African countries have adopted this policy. These countries reported routine health facility data from the public sector on the number of women receiving the first, second, third and fourth doses of IPTp (i.e. IPTp1, IPTp2, IPTp3 and IPTp4). Using annual expected pregnancies, discounted for fetal loss and stillbirths, as the denominator, the percentage IPTp use by dose was computed. As of 2018, coverage rates of IPTp1, IPTp2 and IPTp3 were 60%, 49% and 31%, respectively (**Fig. 7.6**). The 2018 estimate of IPTp3 coverage, relative to the 22% in 2017, represents the highest single annual increase in this indicator, indicating

FIG. 7.6.

Percentage of pregnant women attending ANC at least once and receiving IPTp, by dose, sub-Saharan Africa, 2010–2018 *Source: NMP reports, WHO and US Centers for Disease Control and Prevention estimates.*

ANC: antenatal care; 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.

considerable improvements in country uptake. The analysis suggests, however, that about 18% of women who use ANC services at least once do not receive any IPTp, representing a missed opportunity that, if harnessed, could considerably and rapidly improve IPTp coverage.

7.4 SEASONAL MALARIA CHEMOPREVENTION

In the 12 countries in the Sahel subregion that have scaled up SMC, 31 million children aged under 5 years were in SMC-eligible areas; of these, 19 million children (62%) were treated. The main gaps in treatment were in Nigeria (70%, 8.4 million), Chad (67%, 1.8 million), Ghana (66%, 0.7 million), Senegal (100%, 0.7 million) and Gambia (47%, 0.1 million). All targeted children received treatment in Cameroon, Guinea, Guinea-Bissau and Mali (**Fig. 7.7**).

FIG. 7.7.

Number of SMC treatments administered in scale-up countries in 2018 *Source: London School of Hygiene & Tropical Medicine.*

SMC: seasonal malaria chemoprevention.

8 Diagnostic testing and treatment

Diagnostic testing and treatment is a key component of malaria control and elimination strategies. In addition to the treatment of uncomplicated malaria illness, prompt and effective case management helps to prevent severe disease and probable death; it may also reduce the pool of individuals who contribute to malaria transmission. Diagnosing patients rather than treating them presumptively may help health service providers to further investigate other potential causes of febrile illnesses that have a negative parasitological result, reduce the unnecessary use of antimalarial drugs and associated side-effects, and contribute to reducing the spread of drug resistance (*36*).

The ability of health systems to provide quality malaria case management at high coverage is influenced by three indicators: the extent to which patients with suspected malaria seek treatment, receive a diagnostic test after seeking care, and (if that test is positive for malaria) receive appropriate treatment. These indicators are usually measured through household surveys, such as MIS and DHS. For reasons of data availability, the analysis in this section is largely confined to sub-Saharan Africa, the region that carries the highest share of the global malaria burden; it covers 4-year periods because most countries conduct household surveys once every 3–5 years. **Annex 1** discusses the countries included, the calculation methods, and the limitations of the use of DHS and MIS data.

The signs and symptoms of malaria are similar to those of many other febrile illnesses. In non-immune individuals, malaria typically presents with fever, sometimes accompanied by chills, sweats, headache or other symptoms that may resemble signs or symptoms of other febrile illnesses. Consequently, fever is the main basis for suspecting malaria and triggering diagnostic testing of the patient in most malaria endemic settings. A history of fever in children aged under 5 years and subsequent steps taken to seek treatment have been the basis of measuring access to malaria case management. However, some important limitations of these data are as follows: what constitutes a "fever" varies by cultural context, which means that making comparisons across cultural groups can be problematic; the percentage of fevers that are due to malaria varies according to the underlying transmission intensity and level of control; there is no conclusive evidence that the household-level and individual-level processes for making the decision to seek treatment for malaria fevers are the same as those for other fevers or across different ages; and a percentage of respondents may not recall the medication they received, resulting in misclassification of the drugs that were prescribed.

8.1 PREVALENCE OF FEVER IN CHILDREN AGED UNDER 5 YEARS

Based on 20 household surveys conducted in sub-Saharan Africa between 2015 and 2018, a median of 26% of children (interquartile range [IQR]: 19–35%) had a fever in the 2 weeks preceding the survey. Children aged 6 months to 3 years had a higher prevalence (around 30%) of fever than children aged under 6 months or over 3 years (**Fig. 8.1**). Prevalence of fever ranged from more than 40% in Malawi and Nigeria to less than 20% in Angola, Ethiopia, Madagascar, Mali and Zimbabwe (**Annex 3-Eb**). However, the data should be interpreted with caution because of potential bias in the season in which surveys are conducted.

8.2 NUMBERS OF CHILDREN WITH FEVER BROUGHT FOR CARE

Based on 20 nationally representative household surveys in sub-Saharan Africa conducted between 2015 and 2018, a median of 42% (IQR: 34–49%) of febrile children aged under 5 years were brought for care in the public sector compared with 10% (IQR: 8–22%) in the formal private sector and 3% (IQR: 2–7%) in the informal private sector (i.e. shops, markets, kiosks, itinerant drug sellers, traditional healers, friends and relatives, and other nonmedical health facilities). A considerable percentage of febrile children were not brought for care (median: 36%, IQR: 28–45%). When looking more closely at the subcategories of health sectors, visits to public health facilities and community health workers (CHWs) accounted for 37% (IQR: 31–48%) and 3% (IQR: 1–4%), respectively. Visits to the formal private sector were to the formal medical private sector, excluding pharmacies (median: 8%, IQR: 4–11%), and to pharmacies or accredited drug stores (median: 5%, IQR: 1–10%). Overall, a median of 58% (IQR: 47–70%) of febrile children brought for care were taken to a trained provider (i.e. to public sector health facilities, CHWs, formal private health facilities or pharmacies) (**Fig. 8.2**).

FIG. 8.1.

Median percentage of children who had a fever in the 2 weeks preceding the survey, overall and by age group, sub-Saharan Africa, 2015–2018 (latest survey) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

FIG. 8.2.

Median percentage of febrile children brought for care, by health sector, sub-Saharan Africa, 2015–2018 (latest survey) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

Variation in care-seeking behaviour was substantial across countries. In Burkina Faso, Mozambique and Sierra Leone, most febrile children (>60%) were brought for care in the public sector, whereas in Nigeria and Uganda they were mainly taken to the private sector. In Benin, Ghana, Mali and Togo, more than 10% of febrile children attended the informal private sector. Also, in Benin, Ethiopia, Malawi, Mali, Senegal, Togo and Zimbabwe, most febrile children were not brought for care (**Annex 3-Eb**).

8.3 PARASITOLOGICAL TESTING OF FEBRILE CHILDREN

Data from NMP country reports show that, because of the increasing scale-up of diagnostics, the percentage of patients suspected of having malaria who are seen in public health facilities and tested with either an RDT

FIG. 8.3.

Malaria patients examined using RDT and microscopy, and percentage of suspected cases tested in public health facilities, sub-Saharan Africa, 2010–2018 *Source: NMP reports.*

NMP: national malaria programme; RDT: rapid diagnostic test.

or microscopy, has risen from 38% in 2010 to 85% in 2018 (**Fig. 8.3**).

Data reported by NMPs from 38 moderate to high transmission countries in sub-Saharan Africa show a considerable increase between 2010 and 2018 in the number of suspected malaria cases tested with a parasitological test (**Fig. 8.4**). In 27 of these countries, the percentage of suspected cases tested was greater than 80% in 2018; however, in Congo, Gabon, Kenya and Mauritania, less than 50% of suspected cases in the public health sector were tested for malaria.

FIG. 8.4.

Percentage of suspected cases tested in public health facilities, sub-Saharan Africa, 2010–2018 *Source: NMP reports.*

NMP: national malaria programme.

At community level, based on 19 nationally representative household surveys conducted between 2015 and 2018 in sub-Saharan Africa, the median percentage of febrile children brought for care who received a finger or heel stick (suggesting that a malaria diagnostic test may have been performed) was greater in the public sector (median: 66%, IQR: 49–75%) than in the formal private sector (median: 40%, IQR: 16–46%) or the informal private sector (median: 9%, IQR: 5–22%). In the public sector, 66% of febrile children received a diagnostic test in public health facilities (IQR: 49–75%) and 58% when visiting a CHW (IQR: 39–75%). In the formal private sector, the percentage of those brought for care who had a blood test was 58% in the formal medical private sector, excluding pharmacies (IQR: 30–76%), compared with 13% in pharmacies (IQR: 9–22%). Overall, 57% of children brought to a trained provider for care received a diagnostic test (IQR: 36–68%) (**Fig. 8.5**). This percentage ranged from more than 70% in Burundi,

FIG. 8.5.

Median percentage of febrile children who received a blood test, by health sector, sub-Saharan Africa, 2015–2018 (latest survey) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

Malawi and Sierra Leone, to less than 20% in Nigeria (**Annex 3-Eb**).

Based on 61 surveys conducted in 29 sub-Saharan African countries between 2010 and 2018, the percentage of febrile children attending public health facilities who had a blood test before treatment increased from a median of 48% (IQR: 30–62%) in 2010–2013 to a median of 76% (IQR: 60–86%) in 2015–2018. In the formal private sector, this median percentage also increased, from 32% (IQR: 16–49%) in 2010–2013 to 45% (IQR: 34–62%) in 2015–2017 (**Fig. 8.6**). Although median percentages are relatively high, antimalarial treatment continues to be prescribed based on fever without laboratory confirmation. The availability of high-quality, inexpensive RDTs in the public sector has significantly improved and expanded, but RDTs are often unavailable in the formal private sector.

FIG. 8.6.

Trend in the median percentage of febrile children who received a blood test among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

8.4 TREATMENT OF FEBRILE CHILDREN WITH ANTIMALARIAL DRUGS

Based on 20 household surveys conducted in sub-Saharan Africa in 2015–2018, the median percentage of febrile children who were treated with any antimalarial drug was higher in the public sector (median: 48%, IQR: 30–69%) than in the formal private sector (median: 40%, IQR: 21–51%) or the informal private sector (median: 18%, IQR: 10–29%) (**Fig. 8.7**). This pattern was consistent across countries except in Angola, Ethiopia, Kenya, Nigeria and the United Republic of Tanzania, where febrile children mainly received antimalarial drugs through the formal private sector. In some countries (e.g. Ghana, Liberia and Uganda), antimalarial treatment coverage was high in the informal private sector, where there is a risk that non-recommended treatments and poor-quality products may be used (**Annex 3-Eb**). When analysed by subcategory of source of care, the median percentage of children receiving antimalarial drugs was 47% (IQR: 29–69%) among those attending public health facilities, and 59% (IQR: 53–84%) among those visiting a CHW. In the private sector, this percentage was 49% (IQR: 19–55%) among those attending the formal medical private sector (excluding pharmacies), and 41% among those visiting pharmacies (IQR: 23–56%). Overall, 48% (IQR: 31–66%) of febrile children received an antimalarial drug among those visiting a trained provider. Among febrile children not brought for care, 8% (IQR: 5–19%) received an antimalarial drug as part of self-treatment at home.

Although there is considerable variation among countries, the median percentage of febrile children

FIG. 8.7.

Median percentage of febrile children who were treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2015–2018 (latest survey) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

FIG. 8.8.

Trend in the median percentage of febrile children who were treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys) *Sources: Nationally representative household survey data from DHS and MIS.*

DHS: demographic and health surveys; MIS: malaria indicator surveys.

receiving antimalarial drugs has remained stable, both in the public sector (around 50%) and in the formal private sector (close to 40%) (**Fig. 8.8**). Interpretation of levels and trends in malaria treatment coverage among all febrile children is limited because fevers are not always the result of malaria infection. Even if a country achieves a reasonably high level of treatment of fevers with an antimalarial drug, this measure can be misleading because it includes inappropriate treatment of non-malarial fevers.

8.5 USE OF ACT FOR THE TREATMENT OF FEBRILE CHILDREN

Based on 19 surveys, ACT was the most commonly used drug-based therapy among febrile children who received antimalarial medicine (median: 80%, IQR: 45–94%). Antimalarial treatments were slightly more likely to be ACT if treatment was sought in the public sector (median: 80%, IQR: 45–94%) than in the formal private sector (median: 77%, IQR: 43–87%) or the informal private sector (median: 60%, IQR: 40–84%) (**Fig. 8.9**). However, those relatively high percentages do not guarantee that each ACT was a quality-assured ACT, especially in the private sector.

Based on 69 nationally representative household surveys conducted in 32 sub-Saharan African countries between 2010 and 2018, the percentage of febrile children receiving an ACT among those treated with antimalarial medicine in public health facilities increased from a median of 45% (IQR: 29–77%) in 2010–2013 to 82% (IQR: 44–95%) in 2015–2018 (**Fig. 8.10**).

FIG. 8.9.

Median percentage of febrile children who received an ACT among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2015–2018 (latest survey) *Sources: Nationally representative household survey data from DHS and MIS.*

ACT: artemisinin-based combination therapy; DHS: demographic and health surveys; MIS: malaria indicator surveys.

FIG. 8.10.

Trend in the median percentage of febrile children who received an ACT among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys) *Sources: Nationally representative household survey data from DHS and MIS.*

ACT: artemisinin-based combination therapy; DHS: demographic and health surveys; MIS: malaria indicator surveys.

8.6 INTEGRATED COMMUNITY CASE MANAGEMENT

Nearly 40% of children with fever do not access care (**Fig. 8.2**). Integrated community case management (iCCM) is a proven strategy to deliver effective and simple life-saving interventions for major killers of children (i.e. malaria, pneumonia and diarrhoea) to hard-to-reach and under-served communities. iCCM involves using trained CHWs who may or may not be paid, to deliver health services to these communities. Thirty countries now implement iCCM at different levels, with only a few implementing nationally.

The Global Fund financed a thematic review report on iCCM across 18 countries through desk reviews and field visits with support from WHO and the United Nations Children's Fund (UNICEF). Released in September 2018, this report found that from 2014 to 2017 major donors and development partners increased their funding and technical support for iCCM implementation in all 18 countries. The report also found that many factors that contributed to iCCM success included establishment of national iCCM policies, strong leadership and partnership, and the presence of an existing competent pool of CHWs partnership support.[1]

In 2012, the Government of Canada awarded a grant to the WHO's GMP to support the scale-up of iCCM of pneumonia, diarrhoea and malaria among children aged under 5 in sub-Saharan Africa under the Rapid Access Expansion Programme (RAcE). The two main objectives of the programme were to contribute to the reduction of child mortality, and to document best practices to catalyse scale-up of iCCM. In 2019, WHO and implementing partners published the results of the implementation research on the impact of the RAcE programme, as well the best practices to improving coverage of iCCM in routine health systems (*37*).

To build on the lessons from these studies and experiences from country programmes that are implementing iCCM, in July 2019 UNICEF and WHO co-hosted in Addis Ababa, Ethiopia, a meeting on institutionalizing iCCM to end preventable child deaths. The technical consultation brought together technical experts and country teams to refine guiding principles and develop recommendations for iCCM, and priorities for national strategic plans to strengthen country programming and to identify needs and gaps for resource mobilization. Several challenges and possible solutions for achieving and maintaining an acceptable level of quality of care and coverage were identified during this meeting (**Box 8.1**).

[1] Desk review in the following 18 countries: Burundi, Ethiopia, Kenya, Rwanda, South Sudan and Uganda (East Africa); Malawi and Zambia (Southern Africa); and Benin, Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, Mali, Niger, Nigeria, Senegal and Sierra Leone (West and Central Africa). Field visits were conducted in Burkina Faso, Cameroon, Malawi, Nigeria, South Sudan and Zambia.

BOX. 8.1.

Challenges to and proposed solutions for the scale-up of iCCM

Source: WHO-UNICEF

Challenges

- Weaknesses in sustainable financing and integration of iCCM into national health system
- In some countries it is not clear which institution is in charge of activities
- Only a few countries have institutionalized CHWs as part of the system. Most countries rely on unpaid or volunteer CHWs
- Poor supervision due to shortage of staff at health facilities, weak links between CHWs and health facilities
- Non-integrated supply chain, poor data on iCCM commodity consumption
- Inadequate funding for pneumonia and diarrhoea commodities in some countries limit scale-up of malaria interventions through iCCM
- Multiple parallel community information systems supported, lack of complete information on performance of CHWs

Proposed solutions

- Planning for iCCM should take place under the umbrella of primary health care and overall health sector development
- National community health policies and strategies should be in place, containing clear, official guidelines for recruitment, job description and motivation of CHWs, as well as clear criteria for implementing iCCM with a focus on hardest to reach populations
- Domestic and external funding should be targeted at system strengthening, with an inclusive focus on malaria, pneumonia and diarrhoea as well as community and facility based provision of care
- iCCM should be included in the national costing exercise and the annual health sector budgeting processes, with specific budget lines
- To promote institutionalization and sustainability, donors should coordinate iCCM funding with the ministry of health and support the ministry's iCCM implementation plan, instead of funding disease-specific or site-specific projects
- iCCM commodities should be an integral part of health facility and district level quantification
- Supportive supervision of CHWs as part of the primary health care system is core to quality iCCM, and needs to be budgeted and included in district implementation plans
- iCCM requires continuum of care from community to first level health facility to referral facility, having the capacity to fully manage referred children
- Community engagement is key to institutionalization of iCCM: local communities are central for effective planning, implementation and uptake of quality ICCM services
- The training of CHWs should not be considered complete until demonstration of defined competencies, with post training follow-up (time to be fixed as per area context) as part of training programme

9 Malaria surveillance

Pillar 3 of the GTS (*1*) is to transform malaria surveillance into a core intervention. This requires surveillance systems that can accurately and reliably track the burden of malaria, the interventions to reduce it, and the impact achieved geographically and temporally. To understand whether malaria surveillance systems are fit for purpose, WHO recommends the regular monitoring and evaluation of surveillance systems (*38*). This involves assessment of the structure, core and support functions, and the quality of the data, across both passive and active case-detection systems. Such information is critical to the continuous improvement of surveillance systems.

This section provides a summary of WHO initiatives to work with NMPs and partners in developing surveillance standards and tools to support the strengthening of national systems. It also presents an example of a country surveillance system assessment, to demonstrate the type of information such assessments provide and their potential role in improving surveillance systems (**Box 9.1**).

9.1 STRENGTHENING NATIONAL SURVEILLANCE SYSTEMS

Over the past 3 years, GMP has embarked on an intensified process of improving national surveillance systems and the use of data for programmatic decision-making. This includes the development of the following information products and tools:

- the *WHO Malaria surveillance, monitoring and evaluation: a reference manual* (*38*), released in March 2018, which outlines the global standards and core features of malaria surveillance across the transmission continuum;
- malaria surveillance modules that are based on the above WHO surveillance reference manual and are built into the District Health Information Software 2 (DHIS2),[1] for burden reduction (aggregate data) and elimination (case-based data) settings, entomological surveillance and vector-control interventions;
- national malaria data repositories that consolidate routine surveillance and non-routine data sources as part of the support provided to the HBHI countries; and
- surveillance system assessments to evaluate the ability of the surveillance system to collect complete, timely and accurate data that can be used to inform decisions, stratification of transmission and deployment of interventions.

9.2 MALARIA MODULES

The DHIS2 malaria modules were developed, in collaboration with partners, as part of the Health Data Collaborative, which is coordinated by the WHO Integrated Services Department and includes

[1] https://www.dhis2.org/inaction

surveillance support activities across WHO departments dealing with health information systems; immunization; maternal, newborn and child health; tuberculosis; and HIV/AIDS. The modules comprise a standard set of data elements and indicators, validation rules and dashboards for visualization of core epidemiological and data quality indicators, as charts, tables and maps. Routine reports and data exports can be easily generated for rapid dissemination of information to decision-makers. The modules, which are configurable and can be used either separately or in conjunction with one another, are accompanied by a guidance document and a curriculum for facility-level data analysis,[1] to help programmes to understand the content and how the data can be used in practice.

9.2.1 Aggregate malaria module

In settings in which transmission remains relatively high and where the main aim of NMPs is to reduce the burden of morbidity and mortality, data are aggregated to provide an overall picture of where and when malaria occurs and who is most affected.[2] Surveillance data in high-transmission settings is used to monitor trends in the number of cases and deaths, over time and by geography; the characteristics of people infected or dying from malaria; and the seasonality of transmission. In high-transmission settings, surveillance data can also be used to stratify geographical units by their malaria prevalence or annual parasite incidence, to better target interventions and optimize resource allocation.

As of October 2019, 23 countries have installed the WHO aggregate malaria module and another six installations are planned over the next year (**Fig. 9.1**). Five countries have already developed and integrated their own malaria module into DHIS2.

9.2.2 Case-based malaria module

The case-based malaria module, due to be released soon, will support case investigations in elimination settings by allowing the collection of line-listed data for

[1] https://www.who.int/healthinfo/tools_data_analysis_routine_facility/en/
[2] https://www.who.int/malaria/areas/surveillance/support-tools/en/

FIG. 9.1.

Status of malaria surveillance modules implemented in DHIS2, October 2019 *Source: NMPs and the African Leaders Malaria Alliance.*

DHIS2: District Health Information Software 2; HMIS: health management information system; NMP: national malaria programme; WHO: World Health Organization.

suspected cases (optional); diagnosis and treatment; treatment follow-up (optional); case investigation; and foci investigation, response and follow-up. Data will be aggregated and displayed on elimination dashboards for analysis and reporting. This work is being developed in partnership with the Clinton Health Access Initiative and the University of Oslo.

9.2.3 Entomology and vector control modules

These modules have been developed to facilitate the collection and use of entomology and vector-control data to inform decision-making at country level. The modules consist of electronic data collection forms, standard indicators and automatically generated dashboards that cover the following interventions areas: ITN mass campaign distribution, ITN bioefficacy monitoring, IRS campaigns, IRS residual efficacy monitoring, insecticide resistance monitoring, adult mosquito surveillance and identification, and monitoring of mosquito larval habitats. All modules have been designed based on WHO-recommended data collection protocols and standard indicators. As of November 2019, one country was already using the modules and implementation had started in another two countries. In the course of 2020, significant geographical scale-up across Africa is planned and a module for ITN durability monitoring will be developed.

9.2.4 National malaria data repositories

WHO has been working in coordination with national health management information systems (HMIS) departments of ministries of health, in particular the HBHI countries, to establish structured dynamic databases (**Fig. 9.2**) that support NMPs subnationally

FIG. 9.2.

Proposed structure and examples of thematic areas for national malaria data repositories *Source: WHO-GMP.*

CHW: community health worker; GMP: Global Malaria Programme; HMIS: health management information system; IPTi: intermittent preventive treatment in infants; IPTp: intermittent preventive treatment in pregnancy; LLIN: long-lasting insecticidal net; LMIS: logistics management and information system; SoP: standard operating procedure; WHO: World Health Organization.

to implement targeted malaria activities informed by clear stratification, to monitor disease trends, to effectively respond to epidemics, to evaluate programme performance and to develop national strategic plans.

These national data repositories are developed either as part of WHO-supported national health observatories or as a direct service provided by the HMIS to disease programmes. GMP has developed an easily adaptable repository structure in DHIS2 with guidance on relevant data elements and indicators, their definitions and computation to cover key thematic areas (**Fig. 9.2**). So far, work to develop these databases has started in Gambia, Ghana, Mozambique, Nigeria, Uganda and the United Republic of Tanzania.

9.3 ASSESSMENT OF NATIONAL SURVEILLANCE SYSTEMS

Surveillance systems need to be assessed regularly to enable understanding of the quality of the data generated by the system, the use of the data to inform decision-making and the bottlenecks that impede the efficiency and effectiveness of the system. WHO recommends surveillance system assessments that monitor the following: structure, core functions, support functions and quality of surveillance (*38*).

A Mozambique case study is presented (**Box 9.1**) to illustrate the process of a surveillance assessment, the core findings and their contribution to strengthening the surveillance system.

BOX. 9.1.

Assessing and strengthening malaria surveillance: an example from Mozambique

Background: In July 2017, Mozambique's national malaria programme (NMP) and partners developed a National Malaria Surveillance Roadmap that outlines the core component of a surveillance system required to support malaria elimination (**Fig. B.9.1**). To determine whether the current surveillance system was able to provide good-quality epidemiological and intervention data for timely stratification of transmission and subsequent deployment of targeted interventions, a comprehensive malaria surveillance system assessment was carried out in July 2018. The main objective of this assessment was to assess performance and to identify bottlenecks that may hinder the collection, transmission, analysis and use of data. The NMP implemented the assessment with Malaria Consortium as the lead partner. WHO provided technical support and the Bill & Melinda Gates Foundation provided funding.

Fig. B.9.1. Surveillance components for evaluation during field assessment

HIS performance	HIS processes	Technical factors	Organizational factors	Behavioural factors
Data quality completeness	Data collection	Complexity of forms	Staff training	Self efficacy
Data quality timeliness	Data transmission	Availability of forms	Discussion on use of information	Promotion of a culture of information
Data quality completeness	Data processing /analysis	Software complexity	Promotion and use of information	Personal motivation
Report production			Supervision	
Display of information			Organizational factors	

Methods: Adapted Performance Review Information System Management (PRISM) (*39*) tools were used to collect data from a sample of 80 health facilities and 58 CHW sites, in 15 randomly sampled districts across eight provinces (**Fig. B.9.2**). Technical, organizational and behavioural factors that influence key surveillance system processes and data quality were evaluated to assess the overall performance of MIS. The assessment focused on the public health sector.

Results: Reporting completeness was more than 90% across all administrative levels, and completeness of key data fields was more than 80% (**Fig. B.9.3**). There were challenges, however, with receiving timely reports from CHWs, and accuracy of data was poor at both health facility and CHW levels. Also, a significant number of patients who were tested with RDTs and confirmed cases treated with ACTs were not reported, which can result in stock-outs, poor commodity quantification and resource allocation. The main reason for inaccurate data was the lack of recording tools (e.g. registers and consultation books) (**Fig. B.9.4**).

Fig. B.9.2. Map showing location of health facilities and community health worker sites from which data were collected

With regard to data analysis and use, although the capacity to perform basic analysis and interpretation was greater than was self-perceived at both health facility (70% versus 56%) and district levels (89% versus 63%), there was a lack of regular production of analytical reports and bulletins, and the analysis carried out was limited, particularly at the health facility level. This was partly from lack of training and problems with computer and internet access. As a consequence, the district was found to be overburdened with data management responsibilities, resulting in low motivation.

Conclusions: Inaccurate and incomplete data have a direct impact on key epidemiological indicators that inform decision-making, strategic planning, and programmatic action at all levels. This assessment allowed the NMP of Mozambique to investigate and identify the reasons behind the suboptimal performance of MIS, and to define the activities and investments required to strengthen malaria surveillance. The key recommendations were to prioritize enforcement of data quality checks; nurture the use of information; and provide and enforce simple and clear technical guidelines for data management.

Following these recommendations, Mozambique's NMP and partners' support have initiated the following activities aimed at strengthening surveillance: capacity-building and training on quality of data to data management staff at all levels of government; initiation of integrated supportive supervision of CHWs, health facility and district malaria focal points; development of iMISS technical requirements; piloting of automated data visualization dashboards at different levels; development of standard operating procedures for routine data management activities and actions that should be undertaken in response to findings; and initiation of operational protocols for malaria case and foci investigations and responses in very low transmission settings. Lessons learned from these surveillance strengthening activities are being documented through an ongoing adaptive learning cycle, to inform improvements of surveillance system performance and guide further rollout of activities.

Fig. B.9.3. Reporting completeness

Fig. B.9.4. Proportion of health facilities with data verification carried out in the past 3 months

10 Responding to biological threats to the fight against malaria

The GTS (*1*) recognizes challenges in the fight against malaria, including the lack of robust, predictable and sustained international and domestic financing; the risks posed by conflict and other complex situations; the emergence of parasite resistance to antimalarial medicines and of mosquito resistance to insecticides; and the inadequate performance of health systems. One of WHO's major roles is to bring emerging challenges to the attention of the global community and to coordinate responses to address these challenges. This section of the report documents these challenges and proposed responses.

10.1 *PF-HRP2/3* GENE DELETIONS

HRP2 is the predominant target of the 412 million *P. falciparum*-detecting malaria RDTs sold annually. Parasites that no longer express HRP2 may not be detectable by HRP2-based RDTs, and those that no longer express HRP2 and HRP3 are completely invisible to these RDTs. Deletions in the *pfhrp2* and *pfhrp3* (*pfhrp2/3*) genes of clinical isolates were first identified in 2010 in the Peruvian Amazon basin by researchers characterizing blood samples that were negative by HRP2-RDTs but positive by microscopy. In recent years, *pfhrp2/3* deleted parasites have been documented outside of South America, including in East, Central, West and Southern Africa, in Asia and in the Middle East. Prevalence estimates vary widely both within and between countries. The examples of Eritrea and Peru, where the prevalence of dual *pfhrp2* and *pfhrp3* deletions 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 the continued use of HRP2-based RDTs.

WHO has published guidance on investigating suspected *pfhrp2/3* deletions (*40*), and recommends that countries that have reports of *pfhrp2/3* deletions or that border countries with reports 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 parasite's lactate dehydrogenase [pLDH]) are limited; in particular, there is a lack of 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 Threat Map mapping tool,[1] and is encouraging a harmonized approach to mapping and reporting *pfhrp2/3* deletions through publicly available survey protocols. To date, 28 countries have reported *pfhrp2* deletions, but owing

[1] https://apps.who.int/malaria/maps/threats/

to variable methods in sample selection and laboratory analysis, the scale and scope of clinically significant *pfhrp2/3* deletions have not been fully elucidated. The WHO Global Response Plan for *pfhrp2/3* deletions outlines several areas for action beyond scaling up surveillance; the plan includes discovery of new biomarkers and improving the performance of non-HRP2 RDTs, as well as market forecasting and strengthened laboratory networks to support the demands of molecular characterization to rule in or rule out the presence of these gene deletions.

10.2 PARASITE RESISTANCE – STATUS OF ANTIMALARIAL DRUG EFFICACY (2010–2018)

Plasmodium resistance to antimalarial medicines is one of the key recurring challenges in the fight against malaria. Monitoring antimalarial drug efficacy supports early detection of changes in how well the recommended treatments work; this enables rapid action to mitigate any impact of resistance and prevent its spread. Therapeutic efficacy studies (TESs) provide a measure of clinical and parasitological patient outcomes, and are the main source of data on which the NMPs base their decisions regarding which treatment to recommend (*41*). In areas implementing malaria elimination activities, the routine surveillance system can track treatment and follow-up of all malaria cases, and use the data generated for integrated drug efficacy surveillance (iDES) (*38*). Information from TESs and iDES is supplemented by information on the prevalence and spread of molecular markers – genetic changes in the parasite – that are found to be associated with resistance. *PfKelch13* mutations have been identified as molecular markers of partial artemisinin resistance. *PfKelch13* mutations associated with artemisinin resistance are widespread in the GMS in South-East Asia, and have also been detected at a significant prevalence (over 5%) in Guyana, Papua New Guinea and Rwanda.

The WHO global database on antimalarial drug efficacy and resistance contains data from TESs conducted on *P. falciparum*, *P. vivax*, *P. knowlesi*, *P. malaria* and *P. ovale*, as well as molecular marker studies of *P. falciparum* drug resistance (*PfKelch13*, *PfPlasmepsin 2-3*, *Pfmdr1* and *Pfcrt* in Mesoamerica). Summary reports are regularly updated and are available on the WHO website (*42*). In addition, the Malaria Threats Maps provide a geographical representation of drug efficacy and resistance data.[1]

This section outlines the status of antimalarial drug efficacy in the WHO regions for 2010–2018.

WHO African Region

The first-line treatments used in most African countries for *P. falciparum* are artemether-lumefantrine (AL) and artesunate-amodiaquine (AS-AQ), with some countries' treatment policies also allowing for the use of dihydroartemisinin-piperaquine (DHA-PPQ). Between 2010 and 2018, treatment efficacy data for AL were available from 28 countries, for AS-AQ from 26 and for DHA-PPQ from 14. The overall average efficacy rates of AL, AS-AQ and DHA-PPQ for *P. falciparum* were 98.0%, 98.5% and 99.3%, respectively. When the failure rates of all three treatments were analysed separately by year, it was found that their high efficacy has remained constant over time. Treatment failure rates above 10% detected in Gambia and Malawi in 2010 are likely to be statistical outliers; recent studies show that most treatment failure rates remain low. The high reported failure rate from two studies in Angola was probably due to methodological issues. For all other medicines, treatment failure rates remain below 10%.

In Africa, artemisinin partial resistance has not yet been confirmed. Surveys are detecting a number of different validated and unvalidated *PfKelch13* mutations at low prevalence, except in Rwanda, where clearance and efficacy of the first-line treatment AL does not seem to be affected. There have been unconvincing case reports of travellers returning from Africa with malaria and not responding as expected to treatment. These include a Vietnamese male returning in 2013 to Viet Nam from Angola, who developed malaria that did not respond to intravenous artesunate, clindamycin or DHA-PPQ (*43*). Another case was reported in a Chinese male, who developed malaria 8 weeks after returning from Equatorial Guinea in 2013. The patient responded to treatment with DHA-PPQ but had low-level parasitaemia on day 3 after the start of treatment, and the infection was identified as carrying the *PfKelch13* mutation M579I, previously only reported once in Myanmar (*44, 45*). Three recent surveys conducted in Equatorial Guinea did not identify M579 among a total of 721 samples.

Eleven cases of treatment failure were reported in European travellers returning from different locations in Africa and treated with DHA-PPQ or AL (*46-48*). The patients were infected with parasites not carrying *PfKelch13* mutations, and molecular markers or blood levels of the partner medicines could not confirm resistance. Combined, these cases do not provide convincing evidence for the presence of resistance to artemisinin or ACT partner drugs in Africa. Nevertheless, reporting on these cases is important because

[1] https://apps.who.int/malaria/maps/threats/

resistance or treatment failures in travellers could be an early warning signal, supplementing the information collected in the endemic countries.

The *P. vivax* species is only endemic in a few countries in the WHO African Region. TESs with chloroquine (CQ) were conducted in Ethiopia, Madagascar and Mauritania. Ethiopia confirmed high rates of treatment failure for both CQ and AL. The high failure rate of AL without primaquine (PQ) is probably caused by the short half-life of artemisinin, which fails to prevent the first relapse. Madagascar monitored the efficacy of AS-AQ in 2012 and 2013, and Mauritania monitored CQ in 2012. The efficacy in these studies was found to be 100%.

WHO Region of the Americas

The first-line treatments for *P. falciparum* in the Amazon region are AL and artesunate-mefloquine (AS-MQ). Treatment efficacy was high for both medicines. One treatment failure was detected in a TES of AL, conducted in Suriname, among 11 patients. In Guatemala, Haiti, Honduras and Nicaragua, where the first-line treatment is CQ, molecular marker studies of *Pfcrt* are conducted to supplement TESs. Between 2010 and 2018, a low prevalence of *Pfcrt* mutation was observed in Haiti, Honduras and Nicaragua. TESs almost always confirmed the high efficacy of CQ in these countries.

A retrospective study of Guyanese samples collected in 2010 identified the *PfKelch13* mutation C580Y in five out of 98 samples (5.1%). A larger survey done in 2016–2017 found C580Y in 14 out of 877 samples (1.6%). Genetic studies have confirmed that these parasites were not imported from South-East Asia; rather, the mutation emerged in parasites of South American origin.

The first-line treatment policy for *P. vivax* in all endemic countries in this region is CQ. Between 2010 and 2018, TESs of *P. vivax* were conducted in Bolivia (Plurinational State of), Brazil, Colombia, Peru and Venezuela (Bolivarian Republic of). All countries conducted studies for *P. vivax* with CQ alone or with CQ and PQ. One study conducted in the Plurinational State of Bolivia confirmed CQ resistance. Additionally, Brazil conducted studies of AS-AQ, AL+PQ and AS-MQ+PQ. None of these resulted in treatment failures above 10%.

WHO South-East Asia Region

In Bhutan, Nepal and Timor-Leste, the first-line treatment policy for *P. falciparum* is AL. TESs conducted in these countries between 2010 and 2013 found high treatment efficacy, with less than 10% treatment failure.

Indonesia monitored DHA-PPQ efficacy between 2010 and 2017. All studies resulted in less than 10% treatment failures.

In Bangladesh, the first-line treatment policy includes AL, AS-AQ, AS-MQ and DHA-PPQ. Bangladesh monitored AL treatment failure between 2010 and 2018, and found rates above 10% in two studies, each with a small number of patients.

India's first-line treatment policy includes AL and AS-SP. India has extensively monitored the efficacy of AS-SP and found treatment failure rates ranging from 0% to 21.4%. Failure rates above 10% in north-eastern parts of India led to the treatment policy in this region changing to AL. All studies conducted for AL in India between 2011 and 2017 found treatment failure rates to be less than 10%.

Thailand's first-line treatment policy was AS-MQ until treatment failure rates began to progressively increase. The first-line treatment was changed to DHA-PPQ in 2015. Treatment failure for DHA-PPQ was monitored between 2014 and 2017, and treatment failure rates as high as 92.9% (13/14) were detected in 2017 in the north-eastern part of the country, probably from importation of malaria from Cambodia. As a result, the first-line treatment has since been changed to artesunate-pyronaridine (AS-PY) in eastern Thailand.

Myanmar's first-line treatment policy includes AL, AS-MQ and DHA-PPQ. Treatment failure rates were less than 10% despite the high prevalence of artemisinin partial resistance. In addition, Myanmar monitored AS-PY efficacy in four studies in 2017 and 2018, and found the treatment to be 100% efficacious.

The presence of molecular markers of artemisinin resistance has been reported in Bangladesh, India, Myanmar and Thailand. In Myanmar, seven different validated mutations have been reported, and the most frequently identified since 2010 is F446I. In Thailand, eight different validated mutations have been reported. In western Thailand, it is still possible to identify a range of different K13 mutations, whereas C580Y is becoming dominant in eastern Thailand. In Bangladesh, one C580Y mutation has been identified in a sample collected in 2018. Recently, two articles reported the emergence of artemisinin resistance in West Bengal, India based on the results from a TES with AS-SP done in the period 2014–2016 (*49, 50*). Among the 226 patients in the study, 10.6% (24/226) were found to have parasite clearance half-lives of more than 5 hours, 5.8% (13/226) were found to carry the *PfKelch13* mutation G625R, and 0.9% (2/226) carried R539T. The treatment failure rate was 8% (18/226). These results should be interpreted with caution (*51*). The data contrast with other available data on drug efficacy from India, including from West Bengal. *PfKelch13* mutations are rare in India, and the G625R mutation has not yet been validated as an artemisinin resistance marker; further investigation is needed to examine the role of G625R in delayed parasite clearance. TESs are

now being conducted in West Bengal, with an evaluation of parasite clearance times and analysis of *PfKelch13* mutations. Until appropriate validation and external quality control is completed, it is premature to claim that artemisinin resistance has emerged in India.

For *P. vivax*, CQ is the first-line treatment in Bangladesh, Bhutan, the Democratic People's Republic of Korea, India, Myanmar, Nepal, Sri Lanka and Thailand. DHA-PPQ is the first-line treatment in Indonesia, and AL in Timor-Leste. Although most studies demonstrated high efficacy of CQ, high failure rates of treatment with CQ were confirmed in Myanmar and Timor-Leste.

WHO Eastern Mediterranean Region

Studies conducted in Somalia and Sudan between 2011 and 2015 detected high failure rates of treatment with AS-SP, ranging from 12.3% to 22.2%. The evidence prompted a decision to change the new first-line treatment policy to AL. Therefore, the first-line treatment for *P. falciparum* in Afghanistan, Djibouti, Pakistan, Somalia and Sudan is AL. The efficacy of AL has been monitored in each of these countries, except in Djibouti. All TESs show low rates of AL treatment failure (<5%).

For infection with *P. vivax*, the first-line treatment policy is AL in Somalia and Sudan, and CQ in Afghanistan, Djibouti, Iran (Islamic Republic of), Pakistan, Saudi Arabia and Yemen. TESs of AL were conducted in Afghanistan and Sudan, and TESs of CQ were conducted in Iran (Islamic Republic of) and Pakistan. All studies showed high treatment efficacy. A study conducted in Pakistan in 2013 for DHA-PPQ detected one treatment failure among 103 cases (1%).

WHO Western Pacific Region

For *P. falciparum*, AL is the first-line treatment policy in countries outside the GMS as well as in Lao People's Democratic Republic. All studies conducted outside of the GMS resulted in failure rates of less than 10% for treatment with AL. In Lao People's Democratic Republic, treatment failure rates above 10% were found in three of nine studies between 2011 and 2017. However, the recommended samples sizes were not achieved.

In Cambodia, AS-MQ is the current first-line treatment. AS-MQ replaced DHA-PPQ after high rates of treatment failure were observed. Of the 17 studies conducted with AS-MQ since 2014, the treatment failure rate has been less than 2%. One study of AL found a treatment failure rate of 5% (3/60). The most recent studies with AS-PY in 2017 and 2018 showed efficacy of more than 95%. Treatment failure rates for AS-AQ ranged between 13.8% and 22.6%.

In Viet Nam, the first-line treatment policy is DHA-PPQ. Of the 42 TESs of DHA-PPQ conducted between 2010 and 2017, five studies detected treatment failure rates between 14.3% and 46.3%, all from 2015 to 2017. These studies were concentrated in the south, in the neighbouring provinces of Dak Nong and Binh Phuoc. Most recently, high failure rates for treatment with DHA-PPQ were observed in a third province, Dak Lak. Viet Nam has also monitored the efficacy of AL and AS-PY, with overall efficacies of 100% and 95.5%, respectively. Papua New Guinea monitored the efficacy of DHA-PPQ, and Malaysia monitored that of AS-MQ; both countries found 100% treatment efficacy for these medicines.

Artemisinin resistance has been confirmed in Cambodia, Lao People's Democratic Republic and Viet Nam through several studies conducted between 2001 and 2018. Between 2010 and 2018, eight *PfKelch13* mutations were identified in Cambodia and Lao People's Democratic Republic. C580Y was the most frequent, with about 71.7% of the genotypes carrying this mutation. In Viet Nam, six *PfKelch13* mutations were identified, and C580Y was also the most predominant, appearing on an average of 33.3% of the genotypes. The *PfKelch13* mutation C580Y has been identified twice in Papua New Guinea: in a survey in 2017 where 2.3% (3/132) of the samples carried the mutation (the percentage was higher in 2018) and in one traveller. No validated molecular markers of artemisinin resistance were found in studies conducted in Malaysia, the Philippines, Solomon Islands or Vanuatu.

The first-line treatment for *P. vivax* in Lao People's Democratic Republic, Malaysia, Papua New Guinea, Solomon Islands and Vanuatu is AL. High failure rates of treatment with AL were observed in Papua New Guinea (35% in 2011), Solomon Islands (31.6% in 2011), and Vanuatu (12.1% in 2013). These high rates in areas where early relapses occur are possibly explained by the short half-life of lumefantrine. In China, the Republic of Korea and Viet Nam, the first-line treatment for *P. vivax* is CQ. China and Viet Nam conducted TESs of CQ; only Viet Nam detected a treatment failure rate above 10% in 2015. In the Philippines, the recommended first-line treatments for *P. vivax* are AL and CQ. The nine studies in the Philippines conducted on CQ between 2010 and 2016 all showed treatment failure rates below 10%. In Cambodia, the first-line treatment for *P. vivax* is AS-MQ. Three recent TESs conducted in Cambodia showed 100% efficacy for AS-MQ. The efficacy of AS-MQ was also monitored in Lao People's Democratic Republic and Malaysia between 2012 and 2018. Both studies showed 100% efficacy. The efficacy of DHA-PPQ was monitored in Cambodia, Papua New Guinea and Viet Nam between 2010 and 2015. All studies found treatment failure rates below 10%.

10.3 VECTOR RESISTANCE TO INSECTICIDES

Resistance of malaria vectors to insecticides commonly used for malaria vector control – namely, pyrethroids, organophosphates, carbamates and the occasionally used organochlorine dichlorodiphenyltrichloroethane (DDT) – threatens malaria control and elimination efforts.

From 2010 through 2018, some 81 countries reported data from a total of 3075 sites to WHO, 10% more sites than in the period 2010–2017. The extent and frequency of insecticide resistance monitoring continue to vary considerably between countries. Of these 81 countries, 63 reported insecticide resistance monitoring data at least once within the past 3 years and 18 did not. Only 59 out of the 81 countries reported on their insecticide resistance status consistently every year for the past 3 years. The number of sites per country for which resistance monitoring data were reported between 2010 and 2018 varied widely, from a single site to 271 sites.

A total of 73 countries confirmed resistance to at least one insecticide in one malaria vector species from one mosquito collection site within the period 2010–2018, an increase of five countries compared with the previous reporting period (2010–2017). The number of countries that reported insecticide resistance to all four main insecticide classes used to date in at least one malaria vector species increased from 22 to 26, and the number of countries that reported resistance to three of these four classes in at least one malaria vector species increased from 16 to 18. Of those countries that reported insecticide resistance monitoring data to WHO, the proportion of countries that confirmed resistance to each of these insecticide classes was 87.5% for pyrethroids, 81.5% for organochlorines, 68% for carbamates and 56% for organophosphates. Only eight of the countries that reported data did not confirm resistance to any insecticide class.

Resistance to the four insecticide classes mentioned above was detected in all WHO regions except for the WHO European Region. Globally, resistance to pyrethroids was detected in at least one malaria vector in 68% of the sites for which data were available, and resistance to organochlorines was detected in 63% of the sites. Resistance to carbamates and organophosphates was less prevalent, being detected in 31% and 26%, respectively, of the sites that reported monitoring data. However, the geographical extent of confirmed resistance to each insecticide class differed considerably across regions (**Fig. 10.1**).

Collection and reporting of data to guide deployment of recently prequalified vector control tools covered by WHO policy recommendations have significantly improved. Further enhancement will be needed to guide strategic deployment of tools currently undergoing WHO evaluation. Until 2018, a total of 17 countries had monitored the involvement of metabolic resistance mechanisms in pyrethroid resistance by means of piperonyl butoxide (PBO) pre-exposure bioassays. By 2018, the number of countries reporting data from these bioassays to WHO rose to 23, all of which detected partial or full involvement of metabolic resistance mechanisms in phenotypic resistance to pyrethroids in at least one monitoring site for at least one vector species and one pyrethroid insecticide. Of the 190 sites for which data were reported until 2018, 187 detected full or partial involvement of metabolic resistance mechanisms for at least one vector species and one pyrethroid insecticide.

Results of biochemical and molecular assays conducted to detect metabolic resistance mechanisms are available for 24 countries and 160 sites for the period 2010–2018. Mono-oxygenases were detected in 64% of the sites for which reports are available (84/160), glutathione-S-transferases were detected in 76% of the sites (83/160) and esterases in 77% of the sites (114/160). Results of assays conducted to detect target-site resistance mechanisms are now available for 43 countries and 628 sites. *Kdr L1014F* was detected in 76% of the sites (514/628) and *Kdr L1014S* in 42% of the sites (311/628).

Recently, WHO Member States and their implementing partners have started to explore procedures and dosages to monitor resistance to neonicotinoid and pyrrole insecticides. A formal WHO process to establish discriminating dosages and test procedures for these two insecticide classes is ongoing and will be completed in 2020. The data on mosquito mortality after exposure to neonicotinoid and pyrrole insecticides reported so far to WHO will be assessed against these discriminating dosages once they have been finalized. WHO test procedures for insecticide resistance monitoring will be updated in 2020 to incorporate the new discriminating dosages and potential changes to the test procedures.

All the standard insecticide resistance data reported to WHO are included in the WHO Global Insecticide Resistance Database and are available for exploration via the online mapping tool, Malaria Threats Map.[1] This tool was extended in 2019 to cover a fourth threat to malaria control and elimination: invasive mosquito vector species. At present, this new theme shows the geographical extent of reports on the detection of *Anopheles stephensi*; it may be further extended to other invasive vector species as reported to WHO.

[1] https://apps.who.int/malaria/maps/threats/

10.3.1 Mitigating and managing insecticide resistance

Among other considerations, the selection of effective vector-control interventions needs to be based on routine and representative data on the susceptibility of local vectors to insecticides recommended 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 partners are advised to conduct regular insecticide resistance monitoring following the WHO-recommended *Test procedures for insecticide resistance monitoring in malaria vector mosquitoes* (*52*), and to report and share results in a timely manner. To facilitate reporting, WHO has developed and supports the rollout of data-reporting templates and DHIS2 modules for use by its Member States and their implementing partners.

Ultimately, it is likely that insecticide resistance will reduce the efficacy of currently available interventions. Countries should therefore not delay the development and application of policies and practices for resistance prevention, mitigation and management. Two relatively

FIG. 10.1.

Reported insecticide resistance status as a proportion of sites for which monitoring was conducted, by WHO region, 2010–2018, (a) Pyrethroids, (b) Organochlorines, (c) Carbamates, (d) 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 for which data were reported (n). *Sources: reports from NMPs and national health institutes, their implementation partners, 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.

new vector control options that should be considered as part of a strategy to mitigate or manage insecticide resistance – pyrethroid-PBO nets and neonicotinoid insecticides for IRS – have been recommended by WHO in the past 2 years; a number of prequalified products are now available, as well as a high-level map to support in-country discussion on pyrethroid-PBO net deployment (**Fig. 10.2**). Additional vector-control interventions to provide options for insecticide resistance management or to address outdoor transmission are under development; a number of these are already under WHO evaluation, supported by the WHO Vector Control Advisory Group.

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* (*53*). Through 2018, some countries have made progress in developing such plans. By the end of 2018 a total of 45 countries had finalized plans for resistance monitoring and management, and 36 were developing them. Further effort and support will be required to ensure that every country has such a plan, updates it regularly and has the necessary resources to implement it.

FIG. 10.2.

Status of monitoring WHO-recommended criteria for pyrethroid-PBO net deployment, 2010–2018 NMPs and their partners should consider the deployment of pyrethroid-PBO nets in areas where the main malaria vectors meet the criteria recommended by WHO in 2017 (*54*). Deployment of pyrethroid-PBO nets should be guided by whether geographical areas of operational relevance (e.g. districts or provinces) – rather than the whole country – meet the criteria specified by WHO and should be considered in the context of resource availability and potential for deployment of alternative malaria control interventions. *Sources: reports from NMPs and national health institutes, their implementation partners, research institutions and scientific publications.*

NMP: national malaria programme; PBO: piperonyl butoxide; WHO: World Health Organization.

11 Conclusion

WHO's *World malaria report 2019* summarizes global progress in the fight against malaria up to the end of 2018. This is the fourth world malaria report since the launch of the GTS (*1*). From a baseline of 2015, the GTS aims to achieve, by 2020, a reduction of 40% of malaria morbidity incidence and mortality rate, elimination in at least 10 countries and prevention of reintroduction in all countries that achieved elimination (*1*). To this end, the analysis shows that in 2018 there were an estimated 228 million cases and 405 000 deaths globally, concentrated mainly in Africa and India. This represents about 3 million fewer cases and 11 000 fewer deaths compared with 2017.

On the one hand, the analysis shows that if malaria case incidence and mortality rate remained the same as those in 2000, globally there would be 320 million cases and nearly 1 million malaria deaths in 2018. Instead, there were an estimated 228 million malaria cases and 405 000 malaria deaths in 2018. These represent about 30% fewer cases and 60% fewer deaths in 2018 than would have been the case had levels of malaria incidence and malaria death remained similar to those in 2000. While the gains to date are impressive, the global malaria challenge remains enormous, and the rate of progress is slowing. For example, on the current trajectory, globally, the 2020 GTS milestones for morbidity will not be achieved, and unless there is accelerated change, the 2025 and 2030 milestones will not be achieved. A global malaria case incidence of 45 per 1000 population at risk in 2018 would have been required to get the world on target for the 2020 milestones, but current estimated incidence is 57 cases per 1000 population at risk. If the current trend in incidence is maintained, estimated malaria case incidence (per 1000 population at risk) would be 54 in 2020, 48 in 2025 and 42 in 2030, instead of the 35, 14 and 6 required to achieve the GTS milestones.

Progress towards the GTS elimination goals is on track. At least 10 countries that are part of the WHO E-2020 initiative are on track to reach the 2020 elimination milestone of our global malaria strategy. In 2015, all of these countries were malaria endemic; now they have either achieved zero malaria cases or are nearing the finish line. Across the six countries of the GMS – Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam – there was a 76% reduction in malaria cases and a 95% reduction in deaths in the period 2010–2018. Notably, the report shows a steep decline in cases of *P. falciparum* malaria, the primary target in view of the ongoing threat of antimalarial drug resistance. In 2018, Cambodia reported zero malaria-related deaths for the first time in the country's history, China reported its second consecutive year of zero indigenous malaria cases and Thailand reported a 38% drop in *P. falciparum* cases compared with the previous year.

By November 2019, the HBHI approach had been initiated in nine high-burden countries in Africa. Countries have developed detailed activity plans to address the challenges revealed during the assessments. Two HBHI countries achieved significant reductions in malaria cases in 2018 compared with previous year – India (2.6 million fewer cases) and Uganda (1.5 million fewer cases). Notable increases were estimated in Ghana and Nigeria; however, overall, malaria case incidence and mortality rates continued to decline, but at a slower rate in recent years.

In 2018, total funding for malaria control and elimination reached an estimated US$ 2.7 billion, falling far short of the US$ 5 billion funding target of the GTS. Moreover, the funding gap widened between 2017 and 2018, from US $1.3 billion to US $2.3 billion. Over the period 2010–2018, nearly 70% of total malaria funding in 2018 was provided by international sources. Governments of malaria endemic countries contributed about 30% of total funding, with investments reaching US $0.9 billion in 2018. Of the US $2.7 billion invested in 2018, the government of the USA contributed about $1 billion; the United Kingdom contributed about $200 million; and France, Japan and Germany each contributed about $100 million. About US $1 billion in malaria funding was channelled through the Global Fund. Approximately three quarters of total funding benefited the WHO African Region, followed by the WHO Region of the Americas (7%), the WHO South-East Asia Region (6%), and the WHO Eastern Mediterranean Region and the WHO Western Pacific Region (5% each).

The scourge of malaria continues to strike hardest against pregnant women and children in Africa. The *World malaria report 2019* includes a special section focused on the burden and consequences of the disease among these two most-at-risk groups. In 2018, an estimated 11 million pregnant women in sub-Saharan Africa were infected with malaria, and 872 000 children were born with a low birthweight. About 24 million children in the region were estimated to be infected with the *P. falciparum* parasite in 2018; of these, 12 million had moderate anaemia and 1.8 million had severe anaemia. An estimated 70% of all malaria deaths globally, most of which were in sub-Saharan Africa, were of children aged under 5 years.

In 2018, 31% of pregnant women in 36 African countries received the recommended three or more doses of IPTp, up from 22% in 2017 and 0% in 2010. Notably, Burkina Faso and the United Republic of Tanzania reached IPTp coverage of more than 50% in 2018. Nearly 40% of pregnant women and children aged under 5 years did not sleep under an ITN in 2018. In the same year, two thirds of pregnant women also did not receive the recommended three or more doses of preventive therapy. In Africa's Sahel subregion, WHO recommends SMC during the peak transmission season. More than 60% of children living in SMC-eligible areas benefited from this preventive therapy in 2018. A high proportion of febrile children in sub-Saharan Africa (36%) do not receive any medical attention. Although impressive gains have been made in preventing and treating malaria in pregnant women and children, important gaps in access to care remain. Effective and equitable delivery of primary health care interventions is required to rapidly reduce the burden of malaria among these vulnerable groups.

References

1. Global technical strategy for malaria 2016–2030. Geneva: World Health Organization; 2015 (https://www.who.int/malaria/areas/global_technical_strategy/en, accessed 20 October 2019).

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, accessed 20 October 2019).

3. Sustainable Development Goals: 17 goals to transform our world [website]. United Nations; 2015 (https://www.un.org/sustainabledevelopment/sustainable-development-goals, accessed 20 October 2019).

4. Thirteenth general programme of work 2019–2023 [website]. Geneva: World Health Organization; 2018 (https://www.who.int/about/what-we-do/gpw-thirteen-consultation/en/, accessed 20 October 2019).

5. Malaria and the UN Sustainable Development Goals (SDGs) 2030. Swiss Tropical and Public Health Institute (TPH) Swiss TPH for the Swiss Malaria Group; 2018 (https://www.swissmalariagroup.ch/fr/assets/uploads/files/New%20factsheet%20Malaria%20and%20the%20UN%20Sustainable%20Development%20Goals%20x.pdf, accessed 20 October 2019).

6. Country profiles [website]. Geneva: World Health Organization; (https:///www.who.int/malaria/publications/country-profiles/en/, accessed 20 October 2019).

7. Malaria in pregnant women. Geneva: World Health Organization; 2017 (https://www.who.int/malaria/areas/high_risk_groups/pregnancy/en/, accessed 20 October 2019).

8. Stevens GA, Finucame MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-representative data. Lancet Glob Health. 2013 Jul;1(1):e16-25 (https://www.ncbi.nlm.nih.gov/pubmed/25103581, accessed 14 November 2019).

9. Guyatt HL, Snow RW. The epidemiology and burden of *Plasmodium falciparum*-related anemia among pregnant women in sub-Saharan Africa. Am J Trop Med Hyg. 2001 Jan-Feb;64(1-2 Suppl):36-44 (https://www.ncbi.nlm.nih.gov/pubmed/11425176, accessed 14 November 2019).

10. 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/, accessed 20 October 2019).

11. 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, accessed 20 October 2019).

12. Menendez C. Malaria during pregnancy. Curr Mol Med. 2006 Mar;6(2):269-73.

13. Bardaji A, Martinez-Espinosa FE, Arevalo-Herrera M, Padilla N, Kochar S, Ome-Kaius M et al. Burden and impact of *Plasmodium vivax* in pregnancy: A multi-centre prospective observational study. PLoS Negl Trop Dis. 2017 Jun 12;11(6):e0005606.

14. WHA Global Nutrition Targets 2015: Anaeamia Policy Brief. Geneva: World Health Organization; 2014 (https://www.who.int/nutrition/topics/globaltargets_anaemia_policybrief.pdf, accessed 14 November 2019).

15. Crawley J. Reducing the burden of anemia in infants and young children in malaria-endemic countries of Africa: from evidence to action. Am J Trop Med Hyg. 2004;71(2_suppl):25–34 (https://www.ajtmh.org/content/journals/10.4269/ajtmh.2004.71.25, accessed 20 October 2019).

16. 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.

17. Walker PGT, Griffin JT, Cairns M, Rogerson SJ, van Eijk AM; Ter Kuile F, Ghani AC. A model of parity-dependent immunity to placental malaria. Nat Commun. 2013;4:1609.

18. World Population Prospects. The 2019 Revision [website]. United Nations Population Division; 2019 (http://data.un.org/Data.aspx?d=PopDiv&f=variableID%3A54, accessed 14 November 2019).

19. Antimalarial drug efficacy and drug resistance (updated 27 April 2018) [website]. Geneva: World Health Organization; 2018 (https://www.who.int/malaria/areas/treatment/drug_efficacy/en/, accessed 15 October 2018).

20. UNICEF-WHO. Low birthweight estimates: Levels and trends 2000–2015. Geneva: World Health Organization; 2019 (https://www.unicef.org/media/53711/file/UNICEF-WHO%20Low%20birthweight%20estimates%202019%20.pdf, accessed 14 November 2019).

21. World health statistics overview 2019: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/handle/10665/311696/WHO-DAD-2019.1-eng.pdf, accessed 14 November 2019).

22. UNICEF Data: Monitoring the situation of children and women [website]. UNICEF; 2019 (https://data.unicef.org/topic/maternal-health/antenatal-care/, accessed 14 November 2019).

23. 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/, accessed 22 October 2019).

24. World malaria report. Geneva: World Health Organization; 2017 (https://www.who.int/malaria/publications/world-malaria-report-2017/en/, accessed 20 October 2019).

25. World malaria report. Geneva: World Health Organization; 2018 (https://www.who.int/malaria/publications/world-malaria-report-2018/en/, accessed 20 October 2019).

26. Zero Malaria Starts with Me Toolkit. RBM Partnership to End Malaria African and the African Union Commission (https://endmalaria.org/sites/default/files/Zero%20Malaria%20Toolkit%20Final.pdf, accessed 15 November 2019).

27. WHO Malaria Policy Advisory Committee (MPAC): meeting report. Geneva: World Health Organization Global Malaria Programme; 2019 (https://www.who.int/publications-detail/malaria-policy-advisory-committee-meeting-report-october-2019, accessed 15 November 2019).

28. Malaria elimination: report from the inaugural global forum of countries with potential to eliminate malaria by 2020. Wkly Epidemiol Rec. 2017;92(39):578–86 (https://www.ncbi.nlm.nih.gov/pubmed/28960948, accessed 16 October 2018).

29. Guidelines for malaria vector control. Geneva: World Health Organization; 2019 (https://www.who.int/malaria/publications/atoz/9789241550499/en/, accessed 25 October 2019).

30. Intermittent preventive treatment in pregnancy (IPTp) (updated 21 June 2018) [website]. Geneva: World Health Organization; 2018 (https://www.who.int/malaria/areas/preventive_therapies/pregnancy/en/, accessed 15 October 2018).

31. Intermittent preventive treatment in infants (updated 1 May 2017) [website]. Geneva: World Health Organization; 2017 (https://www.who.int/malaria/areas/preventive_therapies/infants/en/, accessed 15 October 2018).

32. Seasonal malaria chemoprevention with sulfadoxine-pyrimethamine plus amodiaquine in children: a field guide. Geneva: World Health Organization; 2013 (https://apps.who.int/iris/bitstream/handle/10665/85726/9789241504737_eng.pdf?sequence=1, accessed 15 October 2018).

33. Mass drug administration for falciparum malaria: a practical field manual. Geneva: World Health Organization; 2017 (https://extranet.who.int/iris/restricted/handle/10665/259367, accessed 20 October 2019).

34. Acosta A, Obi E, Selby RA, Ugot I, Lynch M, Maire M et al. Design, implementation, and evaluation of a school insecticide-treated net distribution program in Cross River State, Nigeria. J Glob Health Sci. 2018;6(2):272–87.

35. 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.

36. Guidelines for the treatment of malaria, third edition. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/162441/9789241549127_eng.pdf;sequence=1, accessed 20 October 2010).

37. Sadruddin S, Pagnoni P, Baugh G. Lessons from the integrated community case management (iCCM) Rapid Access Expansion Program. JoGH 2019;9: 020101 (http://www.jogh.org/documents/issue201902/jogh-09-020101.pdf, accessed 15 November 2019).

38. Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/272284/9789241565578-eng.pdf?ua=1, accessed 15 October 2018).

39. Adapted Performance Review Information System Management (PRISM) [website]. Measure Evaluation; (https://www.measureevaluation.org/resources/tools/health-information-systems/prism, accessed 21 October 2019).

40. False-negative RDT results and implications of new reports of *P. falciparum* histidine-rich protein 2/3 gene deletions World Health Organization; 2017 (https://apps.who.int/iris/bitstream/10665/258972/1/WHO-HTM-GMP-2017.18-eng.pdf, accessed 27 October 2017).

41. Methods for surveillance of antimalarial drug efficacy. Geneva: World Health Organization; 2009 (https://www.who.int/malaria/publications/atoz/9789241597531/en/, accessed 20 October 2019).

42. Global database on antimalaria drug efficacy and resistance (updated 27 April 2018). Geneva: World Health Organization; 2018 (https://www.who.int/malaria/areas/drug_resistance/drug_efficacy_database/en/, accessed 15 November 2019).

43. Van Hong N, Amambua-Ngwa A, Quang Tuan N, Duy Cuong D, Thi Huong Giang N, Van Dung N et al. Severe malaria not responsive to artemisinin derivatives in man returning from Angola to Vietnam. Emerg Infect Dis. 2014. 20(7):1199-202 (https://wwwnc.cdc.gov/eid/article/20/7/14-0155_article, accessed 15 November 2019).

44. Lu F, Culleton R, Zhang M, Ramaprasad A, von Seidlein L, Zhou H et al. Emergence of indigenous artemisinin-resistant *Plasmodium falciparum* in Africa. N Engl J Med. 2017 Mar 9;376(10):991-993 (https://www.nejm.org/doi/10.1056/NEJMc1612765, accessed 15 November 2019).

45. Rasmussen C, Nyunt MM, Ringwald P. Artemisinin-resistant *Plasmodium falciparum* in Africa. N Engl J Med. 2017 Jul 20;377(3):305-306 (https://www.nejm.org/doi/10.1056/NEJMc1705789, accessed 15 November 2019).

46. Russo G, L'Episcopia M, Menegon M, Souza SS, Dongho BGD, Vullo V et al. Dihydroartemisinin-piperaquine treatment failure in uncomplicated *Plasmodium falciparum* malaria case imported from Ethiopia. Infection. 2018 Dec;46(6):867-870 (https://link.springer.com/article/10.1007%2Fs15010-018-1174-9, accessed 15 November 2019).

47. Sonden K, Wyss K, Jovel I, Vieira da Silva A, Pohanka A, Asghar M et al. High rate of treatment failures in nonimmune travelers treated with artemether-lumefantrine for uncomplicated *Plasmodium falciparum* malaria in Sweden: retrospective comparative analysis of effectiveness and case series. Clin Infect Dis. 2017 Jan 15;64(2):199-206 (https://academic.oup.com/cid/article/64/2/199/2698880, accessed 15 November 2019).

48. Sutherland CJ, Lansdell P, Sanders M, Muwanguzi J, van Schalkwyk DA, Kaur H et al. Pfk13-independent treatment failure in four imported cases of *Plasmodium falciparum* malaria treated with artemether-lumefantrine in the United Kingdom. Antimicrob Agents Chemother. 2017 Feb 23;61(3): e02382-16 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5328508/, accessed 15 November 2019).

49. Das S, Saha B, Hati AK, Roy S. Evidence of artemisinin-resistant *Plasmodium falciparum* malaria in Eastern India. N Engl J Med. 2018 Nov 15;379(20):1962-1964 (https://www.nejm.org/doi/10.1056/NEJMc1713777, accessed 15 November 2019).

50. Das S, Manna S, Saha B, Hati AK, Roy S. Novel pfkelch13 gene polymorphism associates with artemisinin resistance in Eastern India. Clin Infect Dis. 2019 Sep 13;69(7):1144-1152 (https://academic.oup.com/cid/article/69/7/1144/5236823, accessed 15 November 2019).

51. Rasmussen C, Valecha N, Ringwald P. Lack of convincing evidence of artemisinin resistance in India. Clin Infect Dis. 2019, 1461-1462 (https://academic.oup.com/cid/article-abstract/69/8/1461/5367393?redirectedFrom=fulltext, accessed 15 November 2019).

52. Test procedures for insecticide resistance monitoring in malaria vector mosquitoes (second edition). Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/250677/9789241511575-eng.pdf, accessed 15 November 2019).

53. 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, accessed 15 November 2019).

54. Conditions for deployment of mosquito nets treated with a pyrethroid and piperonyl butoxide. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/bitstream/handle/10665/258939/WHO-HTM-GMP-2017.17-eng.pdf, accessed 15 November 2019).

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, 2018
- B. Antimalarial drug policy, 2018
- C. Funding for malaria control, 2016–2018
- D. Commodities distribution and coverage, 2016–2018
- Ea. Household survey results, 2015–2018, compiled through STATcompiler
- Eb. Household survey results, 2015–2018, compiled through WHO calculations
- F. Population at risk and estimated malaria cases and deaths, 2010–2018
- G. Population at risk and reported malaria cases by place of care, 2018
- H. Reported malaria cases by method of confirmation, 2010–2018
- I. Reported malaria cases by species, 2010–2018
- J. Reported malaria deaths, 2010–2018

Annex 1 – Data sources and methods

Fig. 1.1. Countries with indigenous cases in 2000 and their status by 2018

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 1.1. 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. 1.2. Malaria and the SDGs 2016–2030

This figure was adapted from a fact sheet on malaria and the Sustainable Development Goals (SDGs) (*3*) produced by the Swiss Tropical and Public Health Institute (a WHO Collaborating Centre) for the Swiss Malaria Group.

Fig. 1.3. The WHO triple billion targets and the contribution of the fight against malaria

This figure is extracted from the document *Informal Member States Consultation GPW 13 WHO Impact Framework* (*4*).

Table 2.1. Estimated malaria cases by WHO region, 2010–2018

The number of malaria cases was estimated by one of the following two methods:

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* (*5*), combines data reported by NMPs (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 and the peak at 0.8. If the value was greater than 50%, then 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 (*6*). 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% round the mean value. The fraction of children brought for care in the public sector and in the private sector were 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 divided by 4. 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, 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 the R statistical software (*7*).

For India, the values were obtained at subnational level using the same methodology, but adjusting the private sector for an additional factor due to 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 some 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 net (ITNs), antimalarial drugs and indoor residual spraying (IRS). 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 2018.[1] Second, an ensemble model was developed to predict malaria incidence as a function of parasite prevalence. 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 2018.[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 (*8*).

Other methods

For most of the elimination countries and countries in prevention of reintroduction, the number of indigenous cases registered by the 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 always 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 Ethiopia, the values were taken from a mixed distribution between values from Method 1 and Method 2 (50% from each method); for Gambia, 2010 values were imputed from 2011 to 2013 values; for Haiti, 2010 values were imputed from 2006 to 2008 values; for Namibia, 2012 values were imputed from 2010 and 2013 values; and for Papua New Guinea, 2012 values were imputed from 2009 to 2011 values. Estimated rates from 2017 were extrapolated to 2018 for Angola, Burundi, Central African Republic and Sudan. For Djibouti, 2011 and 2012 values were extrapolated from cases reported in 2009 and 2013. For Kenya, Mali, Niger and Somalia, the estimated series up to 2017 in the *World malaria report 2018* was used and extrapolated to 2018. To follow the current trends in reported cases in the public sector, modelled cases were adjusted for a factor of 1.1 in Uganda in 2018.

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 estimated from the proportion of *P. falciparum* cases reported by NMPs.

To transform malaria cases into incidence, a population at risk estimate 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.

[1] For methods on the development of maps by the Malaria Atlas Project, see https://www.map.ox.ac.uk/making-maps/.

Table 2.2. Estimated *P. vivax* malaria cases by WHO region, 2018

See methods notes for **Table 2.1**.

Fig. 2.1. Estimated country share of (a) total malaria cases and (b) *P. vivax* malaria cases, 2018

See methods notes for **Table 2.1**.

Fig. 2.2. Trends in malaria case incidence rate (cases per 1000 population at risk) globally and by WHO region, 2010–2018

See methods notes for **Table 2.1**.

Fig. 2.3. Map of malaria case incidence rate (cases per 1000 population at risk) by country, 2018

See methods notes for **Table 2.1**.

Fig. 2.4. Trends in malaria mortality rate (deaths per 100 000 population at risk), globally and in the WHO African Region, 2010–2018

See methods notes for **Table 2.3**.

Fig. 2.5. Trends in malaria mortality rate (deaths per 100 000 population at risk) in WHO regions, 2010–2018

See methods notes for **Table 2.3**.

Table 2.3. Estimated number of malaria deaths by WHO region, 2010–2018

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

Category 1 method

A Category 1 method was used for low-transmission countries and areas outside Africa and for low-transmission countries and areas in Africa: Afghanistan, Bangladesh, Bolivia (Plurinational State of), Botswana, Cambodia, Comoros, Dominican Republic, Eritrea, Eswatini, Ethiopia, French Guiana, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Lao People's Democratic Republic, Madagascar, Myanmar, Namibia, Nepal, Nicaragua, Pakistan, Papua New Guinea, 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 (*9–11*) 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. (*12*), 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 the $\text{Mortality}_{\text{overall}}$ 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

A 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 (*13*). 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 2.1**) 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 (*14*), and assuming a nonlinear association between under-5-years mortality and over-5-years mortality, as follows:

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

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

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 the NMPs is reported without further adjustments. This category includes the following countries: Algeria, Argentina, Armenia, Azerbaijan, Belize, Bhutan, Brazil, Cabo Verde, China, Colombia, Costa Rica, Democratic People's Republic of Korea, Djibouti, Ecuador, Egypt, El Salvador, Georgia, Iran (Islamic Republic of), Iraq, Kazakhstan, Kyrgyzstan, Malaysia, Mexico, Morocco, Oman, Panama, Paraguay, Peru, 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.

Fig. 2.6. Percentage of estimated malaria deaths attributable to the 21 countries with nearly 85% of malaria deaths globally in 2018

See methods notes for **Table 2.3**.

Fig. 2.7. Comparison of current estimated malaria cases with expected cases had malaria incidence remained at 2000 levels globally

Number of malaria cases by year was estimated using methods described for **Table 2.1**. Expected malaria cases if case incidence remained the same as the year 2000 were estimated using the 2000 incidence per 1000 population to estimated population at risk each year.

Fig. 2.8. Comparison of current estimated malaria deaths with expected deaths had malaria incidence remained at 2000 levels globally

Number of malaria deaths by year was estimated using methods described for **Table 2.3**. Expected malaria deaths if mortality rate remained the same as the year 2000 were estimated using the 2000 rate per 100 000 population to estimated population at risk each year.

Fig. 2.9. Comparison of progress in malaria case incidence considering three scenarios: current trajectory maintained (blue), GTS targets achieved (green) and worst case scenario, that is a return to mean peak past incidence in the period 2000–2007 (red)

GTS target 90% reduction of malaria incidence and mortality rate by 2030 with milestones of 40% and 75% reductions in both indicator for the years 2020 and 2025 respective (*1*). A curve based on a quadratic fit is used for the malaria incidence milestones. For projection of malaria incidence under current estimated trend, the same year on year trend observed from latest years (2016–2018) is forecast up to 2030. For the regress scenario, the trend in mean peak incidence of the 'pre-intervention scale-up' years (2000–2007) is projected forward to 2030.

Fig. 3.1. Estimated prevalence of exposure to malaria infection during pregnancy overall and by subregion in 2018 in moderate to high transmission sub-Saharan Africa

Estimates of malaria-exposed pregnancies and preventable malaria-attributable low birthweight (LBW) deliveries in the absence of pregnancy-specific malaria prevention (i.e. 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 (*15*) to patterns of infection in placental histology (*16*) and attributable LBW risk by gravidity in the absence of IPTp or other effective chemoprevention (*17*). The model was run across a 0.2 degree (5 km^2) longitude/latitude grid for 100 realisations of the MAP joint posterior estimated slide prevalence in 2-10 year olds in 2018 (*8*). 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 (*18*). Countries where surveys were not available were allocated fertility patterns from a survey from a different country matched on the basis of total fertility rate (*19*) 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/rural attribution at a 1 km^2 was conducted based upon WorldPop 1 km^2 2018 population estimates (*20*) and an urban/rural threshold of 386/km^2 (*21*) which 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 [X data source] country-level estimates of pregnancies and [Y data source] estimates of LBW in 2018.

Table 3.1. Estimates of pregnancies, livebirths, low birthweights, exposure to malaria infection in pregnancy and malaria-attributable low birthweights in 2018 in moderate to high transmission sub-Saharan Africa

Methods for estimating malaria infection in pregnancy and malaria-attributable LBWs are described in Walker et al. (*17*). Number of pregnancies and infection rates were estimated from latest UN population estimates and total fertility rates, while the underlying *P. falciparum* parasite prevalence estimates were the updated MAP series, methods described in Bhatt et al. (2015) (*8*).

Fig. 3.2. Estimated maternal anaemia versus exposure to malaria infection in pregnancy in 2018 in moderate to high transmission countries in sub-Saharan Africa

Malaria-related maternal anaemia prevalence estimates were derived from WHO, Global Health Observatory Data Repository/World Health Statistics.[1] The estimates have not been updated since 2016 and, for the purpose of this analysis, these estimates were maintained. For the methods used to compute malaria infection during pregnancy, see methods for **Table 3.1**.

Fig. 3.3. Estimated low birthweights due to exposure to malaria infection during pregnancy overall and by subregion in 2018 in moderate to high transmission sub-Saharan Africa

Overall LBW prevalence was obtained from a United Nations Children's Fund (UNICEF)–WHO publication (*22*). These rates have not been updated since 2015 and, for the purpose of the analysis, were applied to the number of livebirths in 2018 based on UN estimates of pregnancies and livebirths. For methods on low birthweights attributable to malaria infection during pregnancy, see methods for **Table 3.2**.

Fig. 3.4. Prevalence of severe anaemia (<7 g/dL), moderate anaemia (7–9.9 g/dL) and mild anaemia (10–10.9 g/dL) in children aged under 5 years in sub-Saharan Africa, 2015–2018, by age and malaria infection status

Estimates were derived from 16 nationally representative household surveys – demographic health surveys (DHS) and malaria indicator surveys (MIS) – conducted between 2015 and 2017 in Angola, Burundi, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda and United Republic of Tanzania.

The numerator is the number of children in each category: not anaemic (Hb >11 g/dL), mild anaemia (Hb 10–10.9 g/dL), moderate anaemia (Hb 7–9.9 g/dL) and severe anaemia (Hb <7 g/dL). The denominator is the number of children aged under 5 years. Please refer to the methods for **Section 8** for more details about the limitations related to the use of DHS and MIS data.

Fig. 3.5. Prevalence of severe anaemia (<7 g/dL), moderate anaemia (7–9.9 g/dL) and mild anaemia (10–10.9 g/dL) in children aged under 5 years in sub-Saharan Africa, 2015–2018, by country

See methods notes for **Fig. 3.4**.

Table 3.2. Estimated number of children aged 1–59 months infected with *P. falciparum* parasites in 2018 by subregion and overall in sub-Saharan Africa

These were estimated from geospatial models of *P. falciparum* infection prevalence by age (*8*). These models use a combination of household parasite survey data, climatic and malaria intervention covariates, and information on age-specific patterns of parasite prevalence in diverse transmission settings (*23*). Prevalence estimates were applied to age-structured UN population estimates for 38 moderate to high malaria transmission countries in sub-Saharan Africa. Data were aggregated to the WHO African Region.

Fig. 3.6. Country comparison of coverage of ANC4 and IPTp3 in moderate and high transmission sub Saharan Africa, 2018

Estimates of at least four visits to ANC (ANC4) coverage were obtained from the UNICEF data on antenatal care coverage. This data are posted on https://data.unicef.org/topic/maternal-health/antenatal-care/ and contain a measure of ANC coverage by visit from household surveys. IPTp3 coverage was estimated using methods described for **Figure 7.6**.

Fig. 4.1. HBHI: a targeted malaria response to get countries back on target for the 2025 GTS milestones

This was taken from a recent WHO publication (*24*).

Fig. 4.2a. Estimated malaria cases and deaths, 2010–2018

See methods notes for **Table 2.1** and **Table 2.3**.

Fig. 4.2b. Estimated malaria cases in India, showing seven states that contributed a combined 90% of cases, 2010 versus 2018

See methods notes for **Table 2.1**.

[1] https://apps.who.int/gho/data/node.main.1?lang=en

Fig. 4.3. Distribution and coverage of preventive interventions: (a) Number of LLINs distributed, 2016–2018, (b) Percentage of population with access to LLINs, 2018, (c) Percentage of population sleeping under an LLIN, 2018, (d) Percentage of children sleeping under an LLIN, 2018; (e) Percentage of pregnant women who received IPTp3, 2018; (f) SMC targeted children and mean treatments per cycle, 2018

See methods notes for **Fig. 6.8**, **Fig. 7.1**, **Fig. 7.2**, **Fig. 7.6** and **Fig. 7.7**, respectively.

Fig. 4.4. Diagnosis and treatment of febrile children in HBHI African countries: (a) Treatment seeking for fevers in children aged under 5 years, and source of treatment by health sector, (b) Percentage of children aged under 5 years with fever who sought treatment and were diagnosed with a parasitological test

Data obtained from household surveys such as DHS, MIS and multiple indicator cluster surveys (MICS).

Fig. 4.5. Total international and domestic direct funding for malaria in the 11 HBHI countries, (a) 2010–2018 and (b) 2016–2018

See methods notes for **Fig. 6.3**.

Table 5.1. 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.

Fig. 5.1. Number of countries that were malaria endemic in 2000 with fewer than 10, 100, 1000 and 10 000 indigenous malaria cases between 2010 and 2018

For the 16 countries that attained zero indigenous cases for 3 consecutive years between 2000 and 2018, the number of NMP-reported indigenous cases was tabulated according to the number of years preceding the attainment of zero cases. Data from years before the peak number of cases were excluded. Thus, if a country had experienced zero cases and malaria returned, cases were only included from the year in which they peaked. This inclusion criterion generates a slope that is steeper than it would be if cases from all years were included (because some increases are excluded). In some earlier years where data on indigenous cases were not available, the total number of reported cases was used (i.e. for country–years with larger numbers of cases, in which the proportion of imported cases is expected to be low).

Fig. 5.2. Trends in indigenous malaria cases in E-2020 countries, 2010–2018

Data were derived from NMP reports.

Fig. 5.3. *P. falciparum* cases in the GMS, 2010–2018

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

Fig. 5.4. Regional map of malaria incidence in the GMS by area, 2018

Data were derived from NMP reports to the GMS MEDB.

Fig. 6.1. Funding for malaria control and elimination over the period 2010–2018 (% of total funding), by source of funds (constant 2018 US$)

Total funding for malaria control and elimination over the period 2010–2018 was estimated using data obtained from several sources.

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 2018, data reported from previous years were used after conversion in constant 2018 US$. The number of reported malaria cases attending public health facilities was sourced from NMP reports, adjusted for diagnosis and reporting completeness. Between 1% and 3% of uncomplicated reported malaria cases were assumed to have moved to the severe stage of disease, and 50–80% of these severe cases were assumed to have been hospitalized. Costs of outpatient visits and inpatient bed-stays were estimated from the perspective of the public health care provider, using unit cost estimates[1] from WHO-CHOosing Interventions that are Cost-Effective (WHO-CHOICE). For each country, WHO-CHOICE 2010 unit cost estimates expressed in national currency were estimated for the period 2011–2018 using the gross domestic product (GDP) annual price deflator published by the World Bank[2] on 28 August 2019 and converted in base year 2010. Country-specific unit cost estimates were then converted from national currency to constant 2018 US$ for each year during 2010–2018. 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

[1] https://www.who.int/choice/en/
[2] https://data.worldbank.org/indicator

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.

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,[1] with the technical assistance of the Kaiser Family Foundation. Country-level planned funding data were available for the United States Agency for International Development (USAID) for the period 2010–2018. 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 2010–2018. For the government of the United Kingdom of Great Britain and Northern Ireland (United Kingdom), funding data towards malaria control for 2017 and 2018 were sourced from the Statistics on International Development: Final UK Aid Spend 2018[2] (UK Aid Spend) with the technical assistance of the United Kingdom Department for International Development. UK Aid Spend data do not capture all spending from the United Kingdom that may impact on 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 research and development, which are not included in these data.

For the period 2010–2016, United Kingdom spending data were sourced from the Organisation for Economic Co-operation and Development (OECD) creditor reporting system (CRS) database on aid activity.[3] For all other donors, disbursement data were also obtained from the OECD CRS database on aid activity for the period 2010–2018. For each year and each funder, the country-level and regional-level project-type interventions and other technical assistance were extracted. All data were converted to constant 2018 US$.

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)[4] and annual disbursements by the Global Fund to malaria endemic countries between 2010 and 2018 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 members' total use of the multilateral system.[5] All funding flows were converted to constant 2018 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 the same year. Equal contributions were assumed every year by each donor over the 3-year periods for which data were available.

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 the 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 up to estimate the total amount each funder contributed to malaria control and elimination over the period 2010–2018, and the relative percentage of the total spending contributed by each funder calculated for the period 2010–2018.

Fig. 6.1 excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.2. Funding for malaria control and elimination 2010–2018, by source of funds (constant 2018 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 2010–2018, by channel (constant 2018 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. 6.3** excludes household spending on malaria prevention and treatment in malaria endemic countries.

[1] https://foreignassistance.gov/
[2] https://www.gov.uk/government/statistics/statistics-on-international-development-final-uk-aid-spend-2018 (purpose code 12262)
[3] https://stats.oecd.org/Index.aspx?DataSetCode=CRS1
[4] https://www.theglobalfund.org/en/financials/
[5] https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

Fig. 6.4. Funding for malaria control and elimination 2010–2018, by World Bank 2018 income group and source of funding (constant 2018 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 2018 were sourced from the World Bank.[1] **Fig. 6.4** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.5. Funding for malaria control and elimination 2010–2018, by WHO region (constant 2018 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. **Fig. 6.5** excludes household spending on malaria prevention and treatment in malaria endemic countries.

Fig. 6.6. Funding for malaria-related R&D 2010–2018, by product type (constant 2018 US$)

Data on funding for malaria-related research and development for 2010–2018 were sourced directly from Policy Cures Research as advance preview of the forthcoming 2019 G-FINDER report.[2]

Fig. 6.7. Malaria R&D funding in 2018, by sector (constant 2018 US$)

See methods notes for **Fig. 6.6**.

Fig. 6.8. Number of ITNs delivered by manufacturers and distributed by NMPs, 2010–2018

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. 6.9. Total LLINs distributed to communities by country in the period 2016–2018, in countries accounting for about 90% of global distributions by NMPs

Data on long-lasting insecticidal nets (LLINs) were derived from NMP reports.

Fig. 6.10. Number of RDTs sold by manufacturers and distributed by NMPs for use in testing suspected malaria cases, 2010–2018

The numbers of rapid diagnostic tests (RDTs) distributed by WHO region are the annual totals reported as having been distributed by NMPs. Numbers of RDT sales were reported by 41 manufacturers that participated in RDT product testing by WHO, the Foundation for Innovative New Diagnostics (FIND), the CDC, and the Special Programme for Research and Training in Tropical Diseases. The number of RDTs reported by manufacturers represents total sales to the public and private sectors worldwide.

Fig. 6.11. Number of ACT treatment courses delivered by manufacturers and distributed by NMPs to patients, 2010–2018

Data on artemisinin-based combination therapy (ACT) sales were provided by eight manufacturers eligible for procurement by WHO or UNICEF. ACT sales were categorized as being to either the public sector or the private sector. Data on ACTs distributed within countries through the public sector were taken from NMP reports.

Fig. 7.1. Percentage of population at risk with access to an ITN, and percentage of households with at least one ITN and enough ITNs for all occupants, sub-Saharan Africa, 2010–2018

Estimates of ITN coverage were derived from a model developed by MAP,[3] 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 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.

[1] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups, accessed 1 October 2019
[2] https://www.policycuresresearch.org/, forthcoming
[3] https://www.map.ox.ac.uk/

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. (*25*), 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 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. Rather than the loss function being fitted to a small external dataset, as was done by Flaxman et al. (*25*), 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 to 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 zero nets, one net, two nets and so on). In this way, the size of the net crop was linked to distribution patterns among households while accounting for household size, in order 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 number of both ITNs and people in each household was 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 ($\text{ITN use}_{\text{all ages}} = 0.8133 \times \text{ITN access}_{\text{all ages}} + 0.0026$, $R^2 = 0.773$). This relationship was applied to the MAP's country–year estimates of household access in order 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 ($\text{ITN use}_{\text{children under 5}} = 0.9327 \times \text{ITN access}_{\text{children under 5}} + 0.0282$, $R^2 = 0.754$).

Fig. 7.2. Percentage of population at risk, pregnant women and children aged under 5 years sleeping under an ITN, sub-Saharan Africa, 2010–2018

See methods notes for **Fig. 7.1**.

Fig. 7.3. Percentage of population at risk with access to an ITN, and percentage of households with enough ITNs for all occupants, sub-Saharan Africa, 2010–2018

See methods notes for **Fig. 7.1**.

Fig. 7.4. Percentage of the population at risk protected by IRS, by WHO region, 2010–2018

The number of persons 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* (*19*), and the proportion at risk of malaria was derived from NMP reports.

Fig. 7.5. Main chemical classes used for IRS by national programmes globally, 2010–2018

Data on the type of insecticide used for IRS were reported to WHO by NMPs. Insecticides were classified into pyrethroids or other classes (carbamates, organochlorines or organophosphates). If data were not reported for a particular year, data from the most recent year were used. For the period 2010–2018, this method of imputation was used for an average of 19 countries each year.

Fig. 7.6. Percentage of pregnant women attending ANC at least once and receiving IPTp, by dose, sub-Saharan Africa, 2010–2018

The total number of pregnant women eligible for intermittent preventive treatment in pregnancy (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. Spontaneous pregnancy loss has previously been calculated by Dellicour et al. (*26*). Country-specific estimates of IPTp coverage were calculated as the ratio of pregnant women receiving IPTp at antenatal care (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. Among 38 countries with IPTp policy, dose coverage could be calculated for 34.

Fig. 7.7. Number of SMC treatments administered in scale-up countries in 2018

Data were provided by the Seasonal Malaria Chemoprevention (SMC) Working Group.

Diagnostic testing and treatment

The first step was to select for inclusion all nationally representative household surveys (DHS and MIS) conducted between 2015 and 2018 (and released before 4 October 2019), for which data on malaria case management were available. Sub-Saharan Africa is the region that carries the highest share of the global malaria burden, and more surveys were available from there than from other regions; hence, only surveys conducted in that region were included in the analyses. Data were 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 ACT or other antimalarial medicine. In addition to self-reported data, DHS and MIS also include biomarker testing for malaria, using RDTs that detect *P. falciparum* histidine-rich protein 2 (HRP2). Percentages were calculated for each country each year. Median values and interquartile ranges (IQRs) were calculated using country percentages over a 4-year period. For cross-sectional analysis over the period 2015–2018, in cases where more than one dataset were available for a country, the most recent survey was used. For trend analysis from 2010–2013 to 2015–2018, data were calculated over 4-year overlapping intervals and all surveys in all countries for all years were included.

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 is, therefore, 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 for the region of sub-Saharan Africa or for any one 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. 8.1. Median percentage of children who had a fever in the 2 weeks preceding the survey, overall and by age group, sub-Saharan Africa, 2015–2018 (latest survey)

Estimates were derived from 20 nationally representative household surveys (DHS and MIS) conducted between 2015 and 2018 in Angola, Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania and Zimbabwe. For each age group, the numerator was the number of children who had a fever in the 2 weeks preceding the survey, and the denominator was the number of children.

Fig. 8.2. Median percentage of febrile children brought for care, by health sector, sub-Saharan Africa, 2015–2018 (latest survey)

Estimates were derived from 20 nationally representative household surveys (DHS and MIS) conducted between 2015 and 2018 in Angola, Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi,

Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania and Zimbabwe. The numerator was the number of febrile children brought for care in each health sector, and the denominator was the number of febrile children aged under 5 years. Note that respondents could choose more than one source of care for one episode of fever. Community health worker data were based on 12 countries: Burkina Faso, Burundi, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Togo, Uganda and Zimbabwe.

Fig. 8.3. Malaria patients examined using RDT and microscopy, and percentage of suspected cases tested in health facilities, sub-Saharan Africa, 2010–2018

Data reported by NMPs on the number of tests (RDTs and microscopy) from the public health sector were combined to calculate the number of patients examined in this sector. The number of suspected cases was computed as the number of tests plus number of presumed cases. Percentage of suspected cases who were tested was computed as percentage of number of cases examined divided by number of suspected cases.

Fig. 8.4. Percentage of suspected cases tested in health facilities, sub-Saharan Africa, 2010–2018

See methods notes for **Fig. 8.3**.

Fig. 8.5. Median percentage of febrile children who received a blood test, by health sector, sub-Saharan Africa, 2015–2018 (latest survey)

Estimates were derived from 19 nationally representative household surveys (DHS and MIS) conducted between 2015 and 2018 in Angola, Benin, Burkina Faso, Burundi, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania and Zimbabwe. For each health sector, the numerator was the number of febrile children who received a blood test and the denominator was the number of febrile children aged under 5 years. Community health worker data were based on seven countries: Burundi, Madagascar, Mali, Mozambique, Rwanda, Togo and Uganda.

Fig. 8.6. Trend in the median percentage of febrile children who received a blood test among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys)

Estimates were derived from 61 nationally representative household surveys (DHS and MIS) conducted between 2010 and 2018 in 29 countries: Angola, Benin, Burkina Faso, Burundi, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania and Zambia. For each health sector, the numerator was the number of febrile children who received a blood test, and the denominator was the number of febrile children aged under 5 years who were treated with an antimalarial drug.

Fig. 8.7. Median percentage of febrile children who were treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2015–2018 (latest survey)

Estimates were derived from 20 nationally representative household surveys (DHS and MIS) conducted between 2015 and 2017 in Angola, Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania and Zimbabwe. For each health sector, the numerator was the number of febrile children who received an antimalarial drug, and the denominator was the number of febrile children aged under 5 years. Community health worker data were based on eight countries: Burundi, Madagascar, Mali, Mozambique, Nigeria, Rwanda, Togo and Uganda.

Fig. 8.8. Trend in the median percentage of febrile children who were treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys)

Estimates were derived from 71 nationally representative household surveys (DHS and MIS) conducted between 2010 and 2018 in 32 countries: Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania, Zambia and Zimbabwe. For each health sector, the numerator was the number of febrile children who received an antimalarial drug, and the denominator was the number of febrile children aged under 5 years.

Fig. 8.9. Median percentage of febrile children who received an ACT among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2015–2018 (latest survey)

Estimates were derived from 19 nationally representative household surveys (DHS and MIS) conducted between 2015 and 2018 in Angola, Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi,

Mali, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda and United Republic of Tanzania. The numerator was the number of febrile children who received an ACT, and the denominator was the number of febrile children aged under 5 years who were treated with an antimalarial drug.

Fig. 8.10. Trend in the median percentage of febrile children who received an ACT among those treated with an antimalarial drug, by health sector, sub-Saharan Africa, 2010–2018 (all surveys)

Estimates were derived from 70 nationally representative household surveys (DHS and MIS) conducted between 2010 and 2018 in 32 countries: Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania, Zambia and Zimbabwe. The numerator was the number of febrile children who received an ACT, and the denominator was the number of febrile children aged under 5 years who were treated with an antimalarial drug.

Fig. 9.1. Status of malaria surveillance modules implemented in DHIS2, October 2019

Data on the implementation of District Health Information Software 2 (DHIS2) were obtained from communications with NMPs and WHO GMP project reports.

Fig. 9.2. Proposed structure and examples of thematic areas for national malaria data repositories

The aim of national malaria data repositories is to assemble, in a structured way with ability for dynamic update, existing malaria-related databases in a malaria endemic country. These databases will be installed centrally and sub nationally by HMIS to allow for effective intervention against malaria. This figure illustrates the structure and some of the proposed content of such a database.

Fig. 10.1. Reported insecticide resistance status as a proportion of sites for which monitoring was conducted, by WHO region, 2010–2018, (a) Pyrethroids, (b) Organochlorines, (c) Carbamates, and (d) Organophosphates

Insecticide resistance monitoring results were collated from data submissions to WHO by NMPs, the African Network for Vector Resistance, national public health institutes, universities and research centers, MAP and the US President's Malaria Initiative, and extracted from scientific publications. Only data from standard WHO tube tests or CDC bottle bioassays with discriminating concentrations of insecticides were considered. Where multiple insecticide classes or types, mosquito species or time points were tested at an individual site, the highest resistance status was considered.

Fig. 10.2. Status of monitoring of the WHO-recommended criteria for pyrethroid-PBO net deployment, 2010–2018

The status of each country was judged based on whether their monitoring sites fulfill the following criteria, namely 1) resistance to pyrethroids was confirmed in at least one key malaria vector, 2) resistance was of moderate intensity and 3) it was conferred (at least in part) by monooxygenase-based resistance mechanism. Monitoring data was reported to WHO by NMPs, the US President's Malaria Initiative and extracted from scientific publications.

References for Annex 1

1. Global technical strategy for malaria 2016–2030. Geneva: World Health Organization; 2015 (https://www.who.int/malaria/areas/global_technical_strategy/en, accessed 20 October 2019).

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, accessed 20 October 2019).

3. Malaria and the UN Sustainable Development Goals (SDGs) 2030. Swiss Tropical and Public Health Institute (TPH) Swiss TPH for the Swiss Malaria Group; 2018 (https://www.swissmalariagroup.ch/fr/assets/uploads/files/New%20factsheet%20Malaria%20and%20the%20UN%20Sustainable%20Development%20Goals%20x.pdf, accessed 20 October 2019).

4. Informal Member States Consultation GPW 13 WHO Impact Framework. Geneva: World Health Organization; 2019.

5. World malaria report 2008. Geneva: World Health Organization; 2008 (https://www.who.int/malaria/publications/atoz/9789241563697/en, accessed 15 October 2013).

6. 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.

7. The R Core Team. R: A language and environment for statistical computing: reference index. Vienna, Austria: R Foundation for Statistical Computing.

8. 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.

9. 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.

10. 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.

11. Meek SR. Epidemiology of malaria in displaced Khmers on the Thai-Kampuchean border. SE Asian J Trop Med. 1988;19(2):243–52.

12. 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 Medicine. 2014;12(1):217.

13. 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.

14. 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.

15. Griffin QJ, Ferguson NM, Ghani AC. Estimates of the changing age-burden of *Plasmodium falciparum* malaria disease in sub-Saharan Africa. Nat Commun. 2014;5:3136.

16. Walker PGT, Griffin JT, Cairns M, Rogerson SJ, van Eijk AM, Ter Kuile F, Ghani AC. A model of parity-dependent immunity to placental malaria. Nat Commun. 2013;4:1609.

17. Walker PGT, 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.

18. The DHS Program: Demographic and Health Surveys [website]. (httpp://dhsprogram.com/, accessed 22 October 2019).

19. World population prospects [website]. United Nations; 2017 (https://population.un.org/wpp/, accessed 24 October 2018).

20. WorldPop [website]. (https://www.worldpop.org/, accessed 22 October 2019).

21. Cairns M, Roca-Felter 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.

22. UNICEF-WHO. Low birthweight estimates: levels and trends 2000–2015. Geneva: World Health Organization; 2015 (https://www.who.int/nutrition/publications/UNICEF-WHO-lowbirthweight-estimates-2019/en/, accessed 22 October 2019).

23. 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.

24. 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/, accessed 22 October 2019).

25. 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.

26. 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.

Annex 2 – A. WHO African Region, a. West Africa

EPIDEMIOLOGY

Population at risk: 381 million

Parasites: *P. falciparum* (almost 100%)

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$), 2010–2018

547.6 million (2010), 558.9 million (2015), 675.6 million (2017); increase 2010–2018: 23%

Proportion of domestic source* in 2018: 9%

Regional funding mechanisms: Senegal River Basin Development Organization (OMVS): Guinea, Mali, Mauritania and Senegal

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Countries with ≥80% coverage with either LLIN or IRS in 2018: Côte d'Ivoire and Togo

Countries with ≥50% coverage with either LLIN or IRS in 2018: Benin, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal and Sierra Leone

Countries implemented IPTp in 2018: Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo

Countries with >30% IPTp3+ in 2018: Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Niger, Senegal, Sierra Leone and Togo

Percentage of suspected cases tested (reported): 44% (2010), 71% (2015), 81% (2018)

Number of ACT courses distributed: 32.2 million (2010), 47.4 million (2015), 75.8 million (2018)

Number of any antimalarial treatment courses (incl. ACT) distributed: 32.2 million (2010), 49.3 million (2015), 75.8 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2018

Total (presumed and confirmed) cases: 29.4 million (2010), 52.3 million (2015), 61.1 million (2018)

Confirmed cases: 7.1 million (2010), 33.3 million (2015), 46.5 million (2018)

Percentage of total cases confirmed: 24.3% (2010), 63.6% (2015), 76.2% (2018)

Deaths*: 39 000 (2010), 21 600 (2015), 19 600 (2018)

* No data reported for Nigeria

Children aged under 5 years, presumed and confirmed cases: 11.9 million (2010), 21.0 million (2015), 24.6 million (2018)

Children aged under 5 years, percentage of total cases: 40.6% (2010), 40.2% (2015), 40.2% (2018)

Children aged under 5 years, deaths: 214 100 (2010), 22 100 (2015), 27 700 (2018)

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 118.9 million (2010), 107.6 million (2015), 111.1 million (2018); decrease 2010–2018: 7%

Deaths: 304 000 (2010), 220 000 (2015), 194 000 (2018); decrease 2010–2018: 36%

ACCELERATION TO ELIMINATION

Countries with nationwide elimination programme: Cabo Verde

Zero indigenous cases for 3 consecutive years (2016, 2017 and 2018): Algeria

Certified as malaria free since 2010: Algeria (2019)

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2017	69	0.0	0.0	11.9	0.0	2.6
AS-AQ	2010–2017	59	0.0	0.0	6.6	0.0	1.7
AS-PY	2011–2014	6	0.0	0.5	0.6	0.0	0.6
DHA-PPQ	2010–2016	12	0.0	0.0	1.9	0.0	0.2

AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of population with access to either LLINs or IRS, 2018

Source: ITN coverage model from MAP

* Cabo Verde is an E-2020 country, vectol control targeted at foci.

IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.

F. Countries on track to reduce case incidence by ≥40% by 2020

G. Countries likely to reduce case incidence by <40% by 2020

H. Countries with an increase in case incidence, 2015–2018

I. Change in estimated malaria incidence and mortality rates, 2015–2018

* Cabo Verde already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

** Zero cases and deaths in Algeria since 2015.

J. Incidence in 2018 compared to baseline (2015–2017)

K. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

* Zero cases and deaths in Algeria since 2015.

KEY MESSAGES

- About 381 million people living in the 17 countries of West Africa are at high risk. Algeria was certified malaria free in May 2019, following 3 consecutive years with zero indigenous cases. In the rest of the countries in the subregion, malaria transmission is year-round and almost exclusively due to *P. falciparum* in most of the countries, with strong seasonality in the Sahelian countries.
- The subregion had more than 111 million estimated cases and about 194 000 estimated deaths, representing a 7% and 36% decrease compared with 2010, respectively. Six countries accounted for over 80% of the estimated cases: Nigeria (51%), Côte d'Ivoire (7%), Burkina Faso (7%), Mali and Niger (each 7%) and Ghana (6%). In the public health sector, about 61 million cases were reported, of which 40.2% were in children aged under 5 years and 46.5 million (76.2%) were confirmed. The proportion of total cases that were confirmed improved substantially over time, from only 24.3% in 2010. A total of 27 700 malaria deaths were reported in children aged under 5 years; this figure exceeded the total malaria deaths, indicating that there are challenges in the surveillance of malaria mortality in some countries.
- In 12 of the 15 countries in which routine distribution of LLINs or use of IRS is still applicable, at least 50% of the population had access to these interventions. Seven countries are on track to meet the GTS target by reducing case incidence by at least 40% by 2020 compared with 2015: Algeria (already certified malaria free), Cabo Verde, Gambia, Mali, Mauritania, Niger and Togo. Nine countries showed progress towards meeting the target but need efforts to be accelerated to achieve the 40% reduction: Benin, Burkina Faso, Ghana, Guinea, Mali, Niger, Nigeria, Senegal and Sierra Leone. Despite Senegal's progress in malaria reduction in recent years, the country saw an increase in 2017 and 2018. In Côte d'Ivoire, Guinea-Bissau and Liberia, incidence increased in 2018 compared with 2015. Following a large increase in indigenous cases in Cabo Verde between 2016 and 2017, the country reported only two indigenous cases in 2018, similar to 2015. In addition to Algeria and Cabo Verde, only Burkina Faso and Mali are on track to reduce malaria mortality rates by at least 40%.
- In line with the Nouakchott Declaration and the Sahel Malaria Elimination Initiative (SaME), eight ministers of the Sahelian countries (Burkina Faso, Cabo Verde, Chad, Gambia, Mali, Mauritania, Niger and Senegal) committed on 31 August 2018 to accelerate implementation, with the aim of eliminating malaria by 2030. In addition to Cabo Verde as an eliminating country, Gambia, Mauritania, Niger and Senegal are reorienting their programmes towards malaria subnational elimination.
- Vector resistance to pyrethroids was confirmed in most of the countries, and resistance to organochlorines and carbamates was confirmed in more than half of the countries. Guinea-Bissau has not reported standard resistance monitoring to any of the four insecticide classes.
- 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 at risk: 180 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$), 2010–2018

246.2 million (2010), 370.0 million (2015), 318.7 million (2018); increase 2010–2018: 29%

Proportion of domestic source* in 2018: 20%

Regional funding mechanisms: none

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Countries with ≥80% coverage with either LLIN or IRS in 2018: Burundi and Sao Tome and Principe

Countries with ≥50% coverage with either LLIN or IRS in 2018: Cameroon, Central African Republic, Chad and Democratic Republic of the Congo

Countries implemented IPTp in 2018: Angola, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea and Gabon

Countries with >30% IPTp3+ in 2018: Burundi, Cameroon, Central African Republic, Chad and Democratic Republic of the Congo

Percentage of suspected cases tested (reported): 41% (2010), 92% (2015), 92% (2018)

Number of ACT courses distributed: 18.2 million (2010), 22.4 million (2015), 26.8 million (2018)

Number of any antimalarial treatment courses (incl. ACT) distributed: 19.0 million (2010), 22.4 million (2015), 26.9 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2018

Total (presumed and confirmed) cases: 20.4 million (2010), 24.6 million (2015), 35.1 million (2018)

Confirmed cases: 6.6 million (2010), 22.2 million (2015), 30.9 million (2018)

Percentage of total cases confirmed: 32.6% (2010), 90.1% (2015), 88.2% (2018)

Deaths: 40 400 (2010), 58 200 (2015), 39 500 (2018)

Children aged under 5 years, presumed and confirmed cases: 9.1 million (2010), 11.3 million (2015), 16.3 million (2018)

Children aged under 5 years, percentage of total cases: 44.9% (2010), 46.1% (2015), 46.4% (2018)

Children aged under 5 years, deaths: 26 000 (2010), 37 100 (2015), 25 100 (2018)

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 46.0 million (2010), 42.8 million (2015), 49.2 million (2018); increase 2010–2018: 7%

Deaths: 118 400 (2010), 92 000 (2015), 89 900 (2018); decrease 2010–2018: 24%

ACCELERATION TO ELIMINATION

Countries with subnational/territorial elimination programme: Sao Tome and Principe

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2018	27	0.0	2.1	13.6	0.0	3.6
AS-AQ	2010–2018	28	0.0	1.4	7.7	0.0	3.9

AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of population with access to either LLINs or IRS, 2018

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. Countries likely to reduce case incidence by <40% by 2020

G. Countries with an increase in case incidence, 2015–2018

H. Change in estimated malaria incidence and mortality rates, 2015–2018

I. Incidence in 2018 compared to baseline (2015–2017)

J. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

* Sao Tome and Principe already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

KEY MESSAGES

- About 180 million people living in the 10 countries of Central Africa are at high risk. Malaria transmission, almost exclusively due to *P. falciparum*, occurs throughout the year, except in Burundi, the highlands of eastern Cameroon, northern Chad and Congo.
- In 2018, the subregion had about 49 million estimated cases and almost 90 000 estimated deaths, representing a 7% increase and a 24% decrease compared with 2010, respectively. The Democratic Republic of the Congo accounted for 55% of estimated cases, followed by Angola (14%), Cameroon (13%), Burundi (6%) and Chad (5%). In the public health sector, about 35 million cases were reported, of which 46% were in children aged under 5 years and 30.9 million (87.7%) were confirmed. The proportion of total cases that were confirmed improved substantially over time from only 32.6% in 2010. There were 39 500 reported malaria deaths, of which 63% were in children aged under 5 years.
- 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 that these countries meet the target. Five countries saw an increase in cases between 2015 and 2018, with Burundi having the largest increase (51%). Although Sao Tome and Principe also saw a slight increase in reported cases, zero deaths were reported in 2018. In Cameroon, Central African Republic, Chad and the Democratic Republic of the Congo, 50% of the population had access to LLINs or IRS. Burundi and Sao Tome and Principe had more than 80% coverage, which is indicative of a rapid and efficient response to the increasing cases in the countries. In 2018, Angola, Central African Republic, Equatorial Guinea and Sao Tome and Principe conducted LLIN mass campaigns.
- Vector resistance to organochlorines was confirmed in all countries, and to pyrethroids in all countries except Sao Tome and Principe. All countries had standardized monitoring of carbamates and organophosphates, for which resistance is still lower.
- Challenges include weak health systems, insufficient domestic and international funding, and frequent malaria outbreaks. Equatorial Guinea and Gabon are no longer eligible for support from the Global Fund but domestic investments have increased to bridge the funding gap.

Annex 2 - A. WHO African Region, c. Countries with high transmission in East and Southern Africa

EPIDEMIOLOGY

Population at risk: 351 million

Parasites: *P. falciparum* (76%) and *P. vivax* (24%)

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.** and *An. vaneedeni.*

* A potential vector identified.

FUNDING (US$), 2010–2018

745.6 million (2010), 721.1 million (2015), 698.1 million (2018); decrease 2010–2018: 6%

Proportion of domestic source* in 2018: 11%

Regional funding mechanisms: none

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Countries with ≥80% coverage with either LLIN or IRS in 2018: Uganda

Countries with ≥50% coverage with either LLIN or IRS in 2018: Kenya, Malawi, Mozambique, Rwanda, South Sudan, United Republic of Tanzania and Zambia

Countries implemented IPTp in 2018: Kenya, Madagascar, Malawi, Mozambique, South Sudan, Uganda, United Republic of Tanzania, Zambia and Zimbabwe

Countries with >30% IPTp3+ in 2018: Mozambique, United Republic of Tanzania, Zambia and Zimbabwe

Percentage of suspected cases tested (reported): 30% (2010), 80% (2015), 89% (2018)

Number of ACT courses distributed: 84.5 million (2010), 108.2 million (2015), 108.3 million (2018)

Number of any antimalarial treatment courses (incl. ACT) distributed: 84.7 million (2010), 109.9 million (2015), 108.8 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2018

Total (presumed and confirmed) cases: 53.2 million (2010), 54.3 million (2015), 56.7 million (2018)

Confirmed cases: 19.9 million (2010), 40.2 million (2015), 47.6 million (2018)

Percentage of total cases confirmed: 37.5% (2010), 74.1% (2015), 83.9% (2018)

Deaths: 70 700 (2010), 38 300 (2015), 14 000 (2018)

Children aged under 5 years, presumed and confirmed cases: 21.6 million (2010), 17.6 million (2015), 11.0 million (2018)

Percentage of total cases under 5: 40.5% (2010), 32.5% (2015), 19.4% (2018)

Children aged under 5 years, deaths: 25 300 (2010), 10 400 (2015), 6500 (2018)

ESTIMATED CASES AND DEATHS, 2010–2018

Cases*: 53.5 million (2010), 48.7 million (2015), 52.2 million (2018); decrease 2010–2018: 2%

Deaths: 12 400 (2010), 5350 (2015), 6500 (2018); decrease 2010–2018: 48%

* 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

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2016	68	0.0	1.8	19.5	0.0	3.6
AS-AQ	2011–2016	14	0.0	0.0	2.0	0.0	1.2

AL: artemether-lumefantrine; AS-AQ: artesunate-amodiaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. *P. falciparum* parasite prevalence (*Pf* PP), 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of population with access to either LLINs or IRS, 2018

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. Countries on track to reduce case incidence by ≥40% by 2020

G. Countries likely to reduce case incidence by <40% by 2020

H. Countries with an increase in case incidence, 2015–2018

I. Change in estimated malaria incidence and mortality rates, 2015–2018

J. Incidence in 2018 compared to 75th percentile of 2015–2017

KEY MESSAGES

- About 351 million people in the 11 countries of East and Southern Africa are at high risk. 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 subregion had 52 million estimated cases and about 6500 estimated deaths, representing a 2% and 48% decrease compared with 2010, respectively. Three countries accounted for over 60% of the estimated cases: Uganda (24%), Mozambique (17%) and the United Republic of Tanzania (13%). In the public health sector more than 55 million cases were reported, of which 19.4% were in children aged under 5 years and 47 million (83.9%) were confirmed. The proportion of total cases that were confirmed improved substantially over time, from only 37.5% in 2010. A significantly lower number of malaria deaths were reported in 2018 (14 000) compared with 2010 (70 700) and 2015 (38 300).
- Ethiopia, Rwanda, Zambia and Zimbabwe are all on track for a 40% reduction in incidence by 2020; all other countries either reported small reductions in incidence, or increases (Rwanda, Uganda and the United Republic of Tanzania). Only Ethiopia and Zambia are on track to reduce malaria mortality rates by at least 40%. In more than half of the countries, 50% or more of the population had access to LLINs or IRS in 2018, and Uganda had coverage of more than 80%.
- Reported cases in Rwanda increased from 2.5 million in 2015 to 4.2 million in 2018, an increase of 68%. Madagascar and Mozambique also reported increases of 30% and 20%, respectively, during the period 2015–2018. Causes of such increases can include inadequate vector control; climatic factors and improved reporting. Uganda saw a 51% decrease in 2018 compared with 2017, which may be as a result of a successful rapid public health response to the almost 25% increase in cases that was reported between 2016 and 2017. Zanzibar (United Republic of Tanzania) also reported a 54% decrease in cases (from 3349 to 1532) between 2017 and 2018.
- Vector resistance to pyrethroids, organochlorines and carbamates was confirmed in all countries except South Sudan, which did not report resistance monitoring. Resistance to organophosphates was confirmed in half of the countries.
- Challenges include frequent epidemics, emergencies and inadequate response (South Sudan), inadequate funding and weak surveillance systems in a number of the countries.

Annex 2 - A. WHO African Region, d. Countries with low transmission in East and Southern Africa

EPIDEMIOLOGY

Population at risk: 14 million

Parasites: *P. falciparum* (98%) and *P. vivax* (2%)

Vectors: *An. arabiensis, An. funestus s.l., An. funestus s.s., An. gambiae s.l.* and *An. gambiae s.s.*

FUNDING (US$), 2010–2018

67.7 million (2010), 25.5 million (2015), 42.3 million (2018); decrease 2010–2018: 37%

Proportion of domestic source in 2018: 75%

Regional funding mechanisms: Southern Africa Malaria Elimination Eight Initiative

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Countries with ≥80% coverage of at-risk population with either LLIN or IRS in 2018: None

Countries with ≥80% coverage of high risk population with either LLIN or IRS in 2018: Botswana

Countries with >30% IPTp3+ in 2018: Comoros

Percentage of suspected cases tested (reported): 79% (2010), 98% (2015), 99% (2018)

Number of ACT courses distributed: 575 000 (2010), 366 000 (2015), 357 000 (2018)

Number of any antimalarial treatment courses (incl. ACT) distributed: 575 000 (2010), 366 000 (2015), 391 000 (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2018

Total (presumed and confirmed) cases: 205 300 (2010), 47 800 (2015), 99 800 (2018)

Confirmed cases: 82 400 (2010), 33 900 (2015), 79 500 (2018)

Percentage of total cases confirmed: 40.2% (2010), 70.8% (2015), 79.7% (2018)

Deaths: 242 (2010), 178 (2015), 175 (2018)

Children aged under 5 years, presumed and confirmed cases: 56 400 (2010), 7300 (2015), 11 500 (2018)

Children aged under 5 years, percentage of total cases: 27.5% (2010), 15.2% (2015), 11.5% (2018)

Children aged under 5 years, deaths: 37 (2010), 16 (2015), 33 (2018)

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 133 200 (2010), 87 300 (2015), 177 900 (2018); increase 2010–2018: 34%

Deaths: 344 (2010), 293 (2015), 438 (2018); increase 2010–2018: 27%

ACCELERATION TO ELIMINATION

Countries with nationwide elimination programme: Botswana, Comoros, Eswatini, Namibia and South Africa

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

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 (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. Confirmed malaria cases per 1000 population, 2018

B. Malaria funding* by source, 2010–2018

Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; UK: United Kingdom of Great Britain and Northern Ireland.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of population with access to either LLINs or IRS, 2018

Source: ITN coverage model from MAP

IRS: indoor residual spraying; ITN: insecticide-treated mosquito net; LLIN: long-lasting insecticidal net; MAP: Malaria Atlas Project.

* Comoros and Eritrea have ITN coverage estimated by a model from MAP.

** Namibia and South Africa LLIN and IRS coverage is combined because there is no overlap in the areas where they are used.

*** South Africa has no data for high risk population.

F. Countries with an increase in case incidence, 2015–2018

G. Change in estimated malaria incidence and mortality rates, 2015–2018

* Eswatini already achieved the 40% reduction in mortality rate in 2015; since then there has been no change

H. Percentage of total confirmed cases investigated, 2018

I. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

KEY MESSAGES

- About 14 million people in the six countries with low transmission in East and Southern Africa are at high risk of malaria. Malaria transmission is focal, highly seasonal and almost exclusively due to *P. falciparum* (except in Eritrea).
- The subregion had nearly 178 000 estimated malaria cases and about 440 estimated deaths, representing a 34% and 27% increase compared with 2010, respectively. The four frontline countries of the Elimination-8 (E8) initiative in Southern Africa (Botswana, Eswatini, Namibia and South Africa) accounted for almost 50% of cases and Eritrea accounted for almost 40%. In the public health sector almost 103 000 cases were reported, of which 11% were in children aged under 5 years and 79 500 (79.7%) were confirmed. The proportion of total cases that were confirmed improved substantially over time from only 40.2% in 2010.
- Despite previous decreases in case incidence between 2010 and 2015, all of the countries had an increase between 2015 and 2018, which means that currently none are on track to achieve the GTS target of at least a 40% reduction in incidence by 2020. Estimated cases in Namibia increased significantly, from only 2590 cases in 2010 to 89 155 in 2017, and only declined moderately (to 51 898) in 2018. South Africa is the only country on track for reducing the mortality rate by 40%. The proportion of cases investigated was high in all countries except Namibia, possibly because of a lack of resources as a result of the recent resurgence in cases.
- During 2016 and 2017 alone, the number of reported cases in South Africa increased more than fivefold (4323 to 22 061), but decreased to 9540 cases in 2018 (a reduction of 57%). Botswana and Eswatini also saw reductions in reported cases between 2017 and 2018, by 69% and 62%, respectively. Comoros, however, saw a huge increase of reported cases from 2274 in 2017 to 15 613 in 2018; an increase of 587%. There are multiple reasons for the increase in cases: improved diagnosis and reporting, inadequate vector control and climatic factors.
- Vector resistance to pyrethroids was confirmed in more than half of the countries. There are significant gaps in standard resistance monitoring for carbamates and organophosphates.
- Challenges include inadequate coverage of vector control, importation of cases from neighbouring countries and resurgence during the past 3 years.

Annex 2 - B. WHO Region of the Americas

EPIDEMIOLOGY

Population at risk: 138 million

Parasites: *P. vivax* (79.5%), *P. falciparum* and mixed (20.5%), 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$), 2010–2018

218.5 million (2010), 195.6 million (2015), 168.0 million (2018); decrease 2010–2018: 23%

Proportion of domestic source* in 2018: 84%

Regional funding mechanisms: Regional Malaria Elimination Initiative

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Number of people protected by IRS: 2.78 million (2010), 2.81 million (2015), 1.72 million (2018)

Total LLINs distributed: 363 000 (2010), 875 000 (2015), 957 000 (2018)

Number of RDTs distributed: 83 700 (2010), 534 000 (2015), 899 000 (2018)

Number of ACT courses distributed: 148 400 (2010), 209 400 (2015), 220 900 (2018)

Number of any first-line antimalarial treatment courses (incl. ACT) distributed: 1.25 million (2010), 669 000 (2015), 1.26 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR*, 2010–2018

Total (presumed and confirmed) cases: 677 100 (2010), 434 000 (2015), 753 700 (2018)

Confirmed cases: 677 100 (2010), 434 000 (2015), 753 700 (2018)

Percentage of total cases confirmed: 100% (2010), 100% (2015), 100% (2018)

Deaths: 190 (2010), 98 (2015), 338 (2018)

* In Belize, Brazil, Colombia, Costa Rica, Ecuador, Haiti, Suriname and Venezuela (Bolivarian Republic of), cases from the private sector and/or community are included in 2018.

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 814 000 (2010), 566 000 (2015), 929 000 (2018); increase 2010–2018: 14%

Deaths: 460 (2010), 320 (2015), 580 (2018); increase 2010–2018: 26%

ACCELERATION TO ELIMINATION

Countries with nationwide elimination programme: Argentina, Belize, Costa Rica, Ecuador, El Salvador, Mexico and Suriname

Zero indigenous cases for 3 consecutive years (2016, 2017 and 2018): Argentina

Zero indigenous cases in 2018: Argentina and El Salvador

Certified as malaria free since 2010: Argentina (2019) and Paraguay (2018)

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2011–2016	5	0.0	0.0	9.0	0.0	4.5
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 (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. Confirmed malaria cases per 1000 population, 2018

B. Malaria funding* by source, 2010–2018

Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; USAID: United States Agency for International Development.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

ND: No data.

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2018

F. Countries on track to reduce case incidence by ≥40% by 2020

G. Countries and areas likely to reduce case incidence by <40% by 2020

H. Countries with an increase in case incidence, 2015–2018

I. Change in estimated malaria incidence and mortality rates, 2015–2018

* Belize, Costa Rica, Ecuador, El Salvador, French Guiana, Mexico, Panama and Suriname already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

J. Percentage of total confirmed cases investigated, 2018

* Countries and areas with no reported case investigation: French Guiana, Guyana and Haiti.

K. Number of reported indigenous cases in countries with national elimination activities, 2015 versus 2018

KEY MESSAGES

- About 138 million people in 19 countries and areas are at risk of malaria, of which almost 80% is caused by *P. vivax*. In 2018, the region had almost 1 million estimated malaria cases and about 600 estimated deaths; increases of 14% and 26%, respectively, compared with 2010. Three countries – Brazil, Colombia and Venezuela (Bolivarian Republic of) – account for 80% of all estimated cases. In the public health sector, about 750 000 cases were reported, all of which were confirmed. Reported deaths due to malaria were few, at about 300 deaths.
- Eight out of the 19 malaria endemic countries and areas are on target to achieve a more than 40% reduction in case incidence by 2020, while Dominican Republic and French Guiana are on target to achieve a 20–40% reduction. Nine countries (Brazil, Colombia, Costa Rica, Ecuador, Guyana, Mexico, Nicaragua, Panama and Venezuela [Bolivarian Republic of]) saw increases in incidence in 2018 compared with 2015.
- The number of cases in French Guiana has fluctuated, largely because of variable detection efforts in the hinterland, whereas there have been large increases in Nicaragua (572%) and Venezuela (Bolivarian Republic of) (209%).
- Nevertheless, transmission in countries is focal, being particularly high in Choco in Colombia, Loreto in Peru and Bolivar in Venezuela (Bolivarian Republic of). More than one third of all cases in the region in 2018 were from five municipalities. Increases in other countries in 2018 are attributed to improved surveillance and focal outbreaks. El Salvador has reported zero indigenous cases for the past 2 years. Mexico and Bolivia have reported no local *P. falciparum* cases for more than 3 years, and Belize reported one case in 2018 and only two cases of *P. vivax*. The reported cases due to *P. falciparum* were below 10% in Brazil, Ecuador, Guatemala, Mexico, Nicaragua and Panama. LLIN distribution increased by 9% in 2018 compared with 2015, while the number of people protected by IRS decreased by 39%.
- Paraguay and Argentina were awarded malaria free certification by WHO in 2018 and 2019, respectively. Nine countries in Central America and Hispaniola are taking part in the subregional initiative to eliminate malaria by 2020. Despite Costa Rica reporting zero indigenous cases between 2013 and 2015, there has been a resurgence in cases in recent years, with eight cases being reported in 2016 and 70 cases in 2018, largely related to increased importation of cases from neighbouring countries and consequent re-establishment of transmission. Efforts are underway to enhance access to diagnosis and treatment, investigation of cases and adequate response.
- Vector resistance to pyrethroids was confirmed in more than half of the countries. There are significant gaps in standard resistance monitoring for all the five insecticide classes commonly used for vector control.

Annex 2 - C. WHO Eastern Mediterranean Region

EPIDEMIOLOGY

Population at risk: 317 million

Parasites: *P. falciparum* and mixed (75%), *P. vivax* (25%) and other (<1%)

Vectors: *An. annularis, An. arabiensis, An. culicifacies s.l., An. d'thali, An. fluviatilis, An. funestus s.l., An. gambiae s.s., An. maculipennis s.s., An. pulcherrimus, An. sacharovi, An. sergentii, An. stephensi* and *An. superpictus.*

FUNDING (US$), 2010–2018

127.9 million (2010), 158.2 million (2015), 140.0 million (2018); increase 2010–2018: 9%

Proportion of domestic source* in 2017: 52%

Regional funding mechanisms: none

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Number of people protected by IRS: 10.5 million (2010), 27.8 million (2015), 10.2 million (2018)

Total LLINs distributed: 2.8 million (2010), 5.7 million (2015), 10.4 million (2018)

Number of RDTs distributed: 2.0 million (2010), 6.1 million (2015), 8.3 million (2018)

Number of ACT courses distributed: 2.6 million (2010), 3.2 million (2015), 4.7 million (2018)

Number of any first-line antimalarial treatment courses (incl. ACT) distributed: 2.6 million (2010), 4.0 million (2015), 5.9 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR*, 2010–2018

Total (presumed and confirmed) cases: 6.4 million (2010), 5.4 million (2015), 5.2 million (2018)

Confirmed cases: 1.2 million (2010), 999 000 (2015), 2.4 million (2018)

Percentage of total cases confirmed: 18.3% (2010), 18.5% (2015), 46.4% (2018)

Deaths: 1140 (2010), 1020 (2015), 3320 (2018)

* In Djibouti, Pakistan and Sudan, cases from the private sector are included in 2018.

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 4.3 million (2010), 3.8 million (2015), 4.9 million (2018); increase 2010–2018: 12%

Deaths: 8300 (2010), 7120 (2015), 9330 (2018); increase 2010–2018: 13%

* In Iran (Islamic Republic of) and Saudi Arabia, reported malaria cases were used.

ACCELERATION TO ELIMINATION

Countries with nationwide elimination programme: Iran (Islamic Republic of) and Saudi Arabia

Zero indigenous cases in 2018: Iran (Islamic Republic of)

Certified as malaria free since 2010: Morocco (2010)

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2018	27	0.0	0.0	3.3	0.0	1.5
AS-SP	2010–2017	41	0.0	1.0	22.2	0.0	4.4
DHA-PPQ	2013–2016	6	0.0	0.5	2.5	0.0	2.2

AL: artemether-lumefantrine; AS-SP: artesunate-sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. *P. falciparum* parasite prevalence (*Pf* PP)/confirmed malaria cases per 1000 population, 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, average 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2018

F. Countries with an increase in reported cases, 2015–2018

G. Change in estimated malaria incidence and mortality rates, 2015–2018*

H. Percentage of total confirmed cases investigated, 2018

I. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

* Estimates of change in Afghanistan may be exaggerated due to uncertainties in adjustments; estimates for Pakistan were excluded due to high uncertainties.

** Reported confirmed cases are used for Djibouti (as opposed to estimated cases). No mortality data was reported for Djibouti for 2017 or 2018.

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 75% of all detected infections. Estimated malaria incidence in the region declined between 2010 and 2015, but increased over the past 3 years. Estimated malaria deaths also increased by 13% since 2010. Sudan accounted for 40% of reported cases. In 2018, the region reported 5.2 million cases (presumed and confirmed), of which only 2.4 million (46%) were confirmed. The proportion of confirmed cases was 18% in 2010 but has improved since then. The reported number of deaths increased from 1140 in 2010 to just over 3300 in 2018.
- 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 first time in 2018, and 20 introduced cases. In Saudi Arabia, the number of indigenous malaria cases declined from 272 in 2016 to 61 in 2018. Both the Islamic Republic of Iran and Saudi Arabia have reported zero indigenous deaths over the past 3 years. These countries undertake continued vigilance for malaria in the general health service, and provide free-of-charge diagnosis and treatment to all imported cases.
- Vector resistance to pyrethroids and organochlorines was confirmed in all countries except for Saudi Arabia. Resistance to organophosphates and carbamates was confirmed in most of the countries of the region.
- Challenges include low coverage of essential interventions (below universal target) in most malaria endemic countries, inadequate funding and dependence on external resources, difficult operational environments and population displacements, a shortage of skilled technical staff (particularly at subnational level), and weak surveillance and health information systems. These challenges may have led to an overall increase in cases during the period 2015–2018 in some countries of the region.

Annex 2 - D. WHO South-East Asia Region

EPIDEMIOLOGY

Population at risk: 1.61 billion

Parasites: *P. falciparum* and mixed (52%), *P. vivax* (48%) 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$), 2010–2018

246.6 million (2010), 198.4 million (2015), 151.0 million (2018); decrease 2010–2018: 39%

Proportion of domestic source* in 2018: 59%

Regional funding mechanisms: Malaria Elimination in the Greater Mekong Region (MME): Myanmar and Thailand

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Number of people protected by IRS: 76.4 million (2010), 57.2 million (2015), 35.4 million (2018)

Total LLINs distributed: 7.4 million (2010), 7.3 million (2015), 2.9 million (2018)

Number of RDTs distributed: 11.4 million (2010), 23.5 million (2015), 14.0 million (2018)

Number of ACT courses distributed: 3.5 million (2010), 2.8 million (2015), 1.8 million (2018)

Number of any first-line antimalarial treatment courses (incl. ACT) distributed: 2.9 million (2010), 2.9 million (2015), 2.2 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR*, 2010–2018

Total (presumed and confirmed) cases: 3.1 million (2010), 1.6 million (2015), 744 000 (2018)

Confirmed cases: 2.6 million (2010), 1.6 million (2015), 707 000 (2018)

Percentage of total cases confirmed: 84.8% (2010), 98.4% (2015), 95% (2018)

Deaths: 2421 (2010), 620 (2015), 165 (2018)

* In Bhutan, India, Indonesia, Myanmar, Thailand and Timor-Leste, cases from the private sector and/or community are included in 2018.

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 25.1 million (2010), 13.6 million (2015), 7.9 million (2018); decrease 2010–2018: 69%

Deaths: 39 100 (2010), 24 500 (2015), 11 600 (2018); decrease 2010–2018: 70%

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 2018: Timor-Leste

Certified as malaria free since 2010: Maldives (2015) and Sri Lanka (2016)

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2018	72	0.0	0.0	14.3	0.0	2.0
AS-SP	2010–2017	55	0.0	0.0	21.4	0.0	1.5
AS-MQ	2010–2016	22	0.0	1.8	49.1	0.0	17.3
DHA-PPQ	2010–2017	29	0.0	0.0	92.9	0.0	2.2

AL: artemether-lumefantrine; AS-MQ: artesunate-mefloquine; AS-SP: artesunate-sulfadoxine-pyrimethamine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. Confirmed malaria cases per 1000 population, 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, 2016–2018

* Excludes costs related to health staff, costs at sub-national level and out-of-pocket expenditure.

D. Share of estimated malaria cases, 2018

E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2018

F. Countries on track to reduce case incidence by ≥40% by 2020

G. Change in estimated malaria incidence and mortality rates, 2015–2018

*Bhutan, Democratic People's Republic of Korea and Timor-Leste already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

** Reported confirmed cases are used for Bhutan and Democratic People's Republic of Korea (as opposed to estimated cases).

H. Percentage of total confirmed cases investigated, 2018

* Countries with no reported case investigation: India.

I. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

KEY MESSAGES

- An estimated 1.61 billion people in the WHO South-East Asia Region are at risk of malaria. The disease is endemic in 9 out of 11 countries of the region, accounting for 50% of the burden outside the WHO African Region. In 2018, the region had almost 8 million estimated cases and about 11 600 estimated deaths – reductions of 69% and 70%, respectively, compared with 2010 – representing the largest decline among all regions. All countries are on target to achieve a more than 40% reduction in case incidence by 2020, and all have strategic plans that aim for malaria elimination by 2030 at the latest.
- Three countries accounted for 98% of the total reported cases in the region, the main contributor being India (58%), followed by Indonesia (30%) and Myanmar (10%). Despite being the highest burden country of the region, India showed a reduction in reported cases of 51% compared with 2017 and of 60% compared with 2016. Although cases continue to decrease in the public sector, estimates indicate that there are still gaps in reporting from the private sector and in treatment seeking in the three countries (estimated versus reported: India 6.7 million versus 400 000, Indonesia 1 million versus 200 000, Myanmar 100 000 versus 76 500). Two other countries in the region reported substantial decline in total reported cases between 2017 and 2018: by 62% in Bangladesh and by 21% in Thailand.
- Timor-Leste had no indigenous malaria cases in a year for the first time, while Bhutan had only six indigenous (and 14 introduced) cases. Maldives and Sri Lanka, certified as malaria free in 2015 and 2016, respectively, continue to maintain their malaria free status.
- Continuing the declining trend, reported malaria deaths in the region dropped to 165 in 2018, reductions of 93% and 45 compared with 2010 and 2017, respectively. India, Indonesia and Myanmar accounted for 58%, 21% and 12% of the total reported deaths in the region, respectively. Bhutan, Democratic People's Republic of Korea and Timor-Leste continue to record zero indigenous deaths.
- Vector resistance to pyrethroids was confirmed in one third of the countries. Resistance to organophosphates was confirmed in almost half of the countries, and resistance to organochlorines and carbamates was confirmed in less than one third of them. There are still significant gaps in standard resistance monitoring for these three classes of vector control agents.
- Challenges include decreased funding, multiple ACT treatment failures in the countries of the GMS and vector resistance to pyrethroids. Efforts are underway to strengthen surveillance and to enhance reporting from private sector and nongovernmental organizations (where relevant), and case-based surveillance and response to accelerate towards elimination.

Annex 2 – E. WHO Western Pacific Region

EPIDEMIOLOGY

Population at risk: 762 million

Parasites: *P. falciparum* and mixed (66%), *P. vivax* (33%) 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$), 2010–2018

213.7 million (2010), 145.4 million (2015), 129.4 million (2018); decrease 2010–2018: 39%

Proportion of domestic source* in 2018: 60%

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)

* Domestic source excludes patient service delivery costs and out-of-pocket expenditure.

INTERVENTIONS, 2018

Number of people protected by IRS: 27.9 million (2010), 3.3 million (2015), 1.5 million (2018)

Total LLINs distributed: 3.4 million (2010), 2.7 million (2015), 3.4 million (2018)

Number of RDTs distributed: 1.6 million (2010), 2.5 million (2015), 3.5 million (2018)

Number of ACT courses distributed: 591 000 (2010), 1.3 million (2015), 1.7 million (2018)

Number of any antimalarial treatment courses (incl. ACT) distributed: 963 000 (2010), 1.4 million (2015), 1.7 million (2018)

REPORTED CASES AND DEATHS IN PUBLIC SECTOR, 2010–2018

Total (presumed and confirmed) cases: 1.6 million (2010), 704 000 (2015), 1.1 million (2018)

Confirmed cases: 260 000 (2010), 411 000 (2015), 634 000 (2018)

Percentage of total cases confirmed: 15.8% (2010), 58.3% (2015), 58.9% (2018)

Deaths: 910 (2010), 234 (2015), 254 (2018)

ESTIMATED CASES AND DEATHS, 2010–2018

Cases: 1.8 million (2010), 1.4 million (2015), 2.0 million (2018); increase 2010–2018: 8%

Deaths: 3780 (2010), 2840 (2015), 3450 (2018); decrease 2010–2018: 9%

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 and Viet Nam

Zero indigenous cases in 2018: China and Malaysia

THERAPEUTIC EFFICACY TESTS (CLINICAL AND PARASITOLOGICAL FAILURE, %)

Medicine	Study years	No. of studies	Min.	Median	Max.	Percentile 25	Percentile 75
AL	2010–2018	30	0.0	0.0	17.2	0.0	5.2
AS-MQ	2010–2018	21	0.0	0.0	11.1	0.0	1.4
AS-PY	2014–2018	13	0.0	1.7	18.0	0.0	7.7
DHA-PPQ	2010–2017	75	0.0	0.8	62.5	0.0	12.3

AL: artemether-lumefantrine; AS-MQ: artesunate-mefloquine; AS-PY: artesunate-pyronaridine; DHA-PPQ: dihydroartemisinin-piperaquine.

STATUS OF INSECTICIDE RESISTANCE[a] PER INSECTICIDE CLASS (2010–2018) AND USE OF EACH CLASS FOR MALARIA VECTOR CONTROL (2018)

[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 (2018).

A. Confirmed malaria cases per 1000 population, 2018

B. Malaria funding* by source, 2010–2018

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.

* Excludes patient service delivery costs and out-of-pocket expenditure.

C. Malaria funding* per person at risk, 2016–2018

* Excludes costs related to health staff, costs at subnational level and out-of-pocket expenditure.

** Only domestic funding in China and the Republic of Korea.

D. Share of estimated malaria cases, 2018

* Countries with zero cases: China and Malaysia.

E. Percentage of *Plasmodium* species from indigenous cases, 2010 and 2018

F. Countries on track to reduce case incidence by ≥40% by 2020

G. Countries likely to reduce case incidence by <40% by 2020

H. Countries with an increase in case incidence, 2015–2018

I. Change in estimated malaria incidence and mortality rates, 2015–2018

* China, Republic of Korea and Vanuatu already achieved the 40% reduction in mortality rate in 2015; since then there has been no change.

J. Percentage of total confirmed cases investigated, 2018

* Imported cases are included.

K. Reported indigenous cases in countries with national elimination activities, 2015 versus 2018

KEY MESSAGES

- About 762 million people in 10 countries are at risk of malaria; infections are predominantly caused by *P. falciparum*, with about one third due to *P. vivax*. In 2018, the region had almost 2 million malaria cases and about 3500 estimated deaths – an 8% increase and a 9% decrease compared with 2010, respectively. Most of the cases were in Papua New Guinea (80%); when taken together with Cambodia and Solomon Islands, the three countries comprise 98% of the estimated cases. In the public health sector, just over 1 million cases were reported, of which 59% were confirmed. The proportion of total cases that were confirmed improved substantially between 2010 and 2015, from 15.8% to 58.3%, but since 2015 there has been little improvement. There were only about 250 reported deaths due to malaria.
- Five out of the 10 malaria endemic countries in the region are on target to achieve more than a 40% reduction in case incidence by 2020, and the Republic of Korea is on track for a 20–40% reduction. Cambodia, Papua New Guinea, Solomon Islands and Vanuatu have seen an increase in estimated cases since 2015: 18.8%, 40.2%, 99.6% and 37.3%, respectively. All countries are on track to reduce the malaria mortality rate by at least 40% by 2020, except Papua New Guinea and Solomon Islands.
- China and Malaysia are on course for elimination by 2020. China has reported zero indigenous cases for 2 consecutive years, and Malaysia reported zero indigenous human malaria cases for the first time in 2018. However, Malaysia is facing increasing cases of the zoonotic malaria *P. knowlesi*, which increased from 1600 to over 4000 between 2016 and 2018, and resulted in 12 deaths this year. The Republic of Korea is facing the challenge of malaria transmission in military personnel along the northern border. Philippines has initiated subnational elimination, reporting zero indigenous cases in 78 out of 81 provinces in 2018.
- Three countries of the GMS (Cambodia, Lao People's Democratic Republic and Viet Nam) aim to eliminate *P. falciparum* by 2020 and all species of malaria by 2030, through support from a Global Fund financed regional artemisinin-resistance initiative. The percentage of cases in Cambodia due to *P. falciparum* has fallen significantly, from 61% in 2015 to 27% in 2018, owing to intensified efforts in community outreach and active case detection to reduce *P. falciparum*. Although the goal of *P. falciparum* elimination will not be met by 2020, much progress has been made. Reducing *P. falciparum* cases in Lao People's Democratic Republic and Viet Nam has been more challenging, and from 2015 to 2018 they saw increases of 12% and 14%, respectively, due to sporadic outbreaks in 2017 and 2018.
- Vector resistance to pyrethroids was confirmed in half of the countries. Resistance to organochlorines was confirmed in more than half of the countries, although there are significant gaps in standard resistance monitoring for this class. Almost no standard resistance monitoring was reported for carbamates or organophosphates, other than in China, Philippines and Solomon Islands.
- Challenges include decreased funding, multiple ACT treatment failures, vector resistance to pyrethroids (in Cambodia, Lao People's Democratic Republic, Philippines and Viet Nam), resurgence of malaria in Cambodia and Solomon Islands, and sustained high levels of malaria in Papua New Guinea due to health system strengthening challenges. Recent efforts are underway to improve access to services and case-based surveillance to accelerate elimination in Cambodia, Lao People's Democratic Republic, Malaysia, Philippines, Republic of Korea, Vanuatu and Viet Nam.

Annex 3 – A. Policy adoption, 2018

WHO region Country/area	Insecticide-treated mosquito nets				Indoor residual spraying		Chemoprevention	
	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	Seasonal malaria chemo-prevention (SMC or IPTc) is used
AFRICAN								
Algeria	NA	NA	NA	NA	●	●	NA	NA
Angola	●	●	●	●	●	●	●	NA
Benin	●	●	●	●	●	●	●	●
Botswana	●	NA	NA	NA	●	●	●	NA
Burkina Faso	●	●	●	●	●	●	●	●
Burundi	●	●	●	●	●	●	●	NA
Cabo Verde	NA	NA	NA	NA	●	●	NA	NA
Cameroon	●	●	●	●	●	●	●	●
Central African Republic	●	●	●	●	●	●	●	NA
Chad	●	●	●	●	●	●	●	●
Comoros	●	●	●	●	●	●	●	NA
Congo	●	●	●	●	●	●	●	NA
Côte d'Ivoire	●	●	●	●	●	●	●	NA
Democratic Republic of the Congo	●	●	●	●	●	●	●	NA
Equatorial Guinea	●	●	●	●	●	●	●	NA
Eritrea	●	●	●	●	●	●	●	NA
Eswatini	●	NA	NA	●	●	●	NA	NA
Ethiopia	●	●	●	●	●	●	●	NA
Gabon	●	●	●	●	●	●	●	NA
Gambia	●	●	●	●	●	●	●	●
Ghana	●	●	●	●	●	●	●	●
Guinea	●	●	●	●	●	●	●	●
Guinea-Bissau	●	●	●	●	●	●	●	●
Kenya	●	●	●	●	●	●	●	NA
Liberia	●	●	●	●	●	●	●	NA
Madagascar	●	●	●	●	●	●	●	NA
Malawi	●	●	●	●	●	●	●	NA
Mali	●	●	●	●	●	●	●	●
Mauritania	●	●	●	●	●	●	●	●
Mayotte	●	–	–	–	–	●	NA	NA
Mozambique	●	●	●	●	●	●	●	NA
Namibia	●	NA	NA	●	●	●	●	NA
Niger	●	●	●	●	●	●	●	●
Nigeria	●	●	●	●	●	●	●	●
Rwanda	●	●	●	●	●	●	●	NA
Sao Tome and Principe	●	●	●	●	●	●	●	NA
Senegal	●	●	●	●	●	●	●	●
Sierra Leone	●	●	●	●	●	●	●	NA
South Africa	NA	●	●	●	●	●	●	NA
South Sudan[2]	●	●	●	●	●	●	●	NA
Togo	●	●	●	●	●	●	●	●
Uganda	●	●	●	●	●	●	●	NA
United Republic of Tanzania[3]								NA
Mainland	●	●	●	●	●	●	●	NA
Zanzibar	●	●	●	●	●	●	●	NA
Zambia	●	●	●	●	●	●	●	NA
Zimbabwe	●	●	●	●	●	●	●	NA
AMERICAS								
Argentina	NA	●	●	●	●	●	NA	NA
Belize	●	●	●	●	●	●	NA	NA
Bolivia (Plurinational State of)	●	●	●	●	●	●	NA	NA
Brazil	●	●	●	●	●	●	NA	NA
Colombia	●	●	●	●	●	●	NA	NA

Testing				Treatment				
Patients of all ages should get 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 is used for treatment of *P. vivax* cases	ACT for treatment of *P. falciparum*	Pre-referral treatment with quinine or artemether IM or artesunate suppositories	Single dose of primaquine is used as gametocidal medicine for *P. falciparum*[1]	Primaquine is used for radical treatment of *P. vivax* cases	Directly observed treatment with primaquine is undertaken
–	●	–	●	NA	–	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	–	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●*	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●

Annex 3 – A. Policy adoption, 2018

WHO region Country/area	Insecticide-treated mosquito nets				Indoor residual spraying		Chemoprevention	
	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	Seasonal malaria chemo-prevention (SMC or IPTc) is used
AMERICAS								
Costa Rica	●	●	●	○	●	●	NA	NA
Dominican Republic	●	●	●	●	●	●	NA	NA
Ecuador	●	●	●	●	●	●	NA	NA
El Salvador	●	●	●	●	●	●	NA	NA
French Guiana	●	○	●	○	○	●	NA	NA
Guatemala	●	●	●	●	●	●	NA	NA
Guyana	●	○	○	●	○	●	NA	NA
Haiti	●	●	●	○	●	●	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	●	●	○	●	●	●	○	NA
Sudan	●	●	●	●	●	●	●	NA
Yemen	●	○	○	●	●	●	NA	NA
SOUTH-EAST ASIA								
Bangladesh	●	●	●	●	●	●	NA	NA
Bhutan	○	●	●	○	●	●	NA	NA
Democratic People's Republic of Korea	●	●	●	●	●	●	NA	NA
India	○	○	●	○	●	○	NA	NA
Indonesia	●	●	●	●	●	●	NA	NA
Myanmar	○	●	●	○	●	●	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
Papua New Guinea	●	●	●	●	○	●	○	NA
Philippines	●	●	●	●	●	●	NA	NA
Republic of Korea	●	●	●	○	●	●	NA	NA
Solomon Islands	●	●	●	●	○	●	NA	NA
Vanuatu	●	○	●	●	○	●	NA	NA
Viet Nam	●	●	●	●	●	●	NA	NA

ACT: artemisinin-based combination therapy; ANC: antenatal care; DDT: dichloro-diphenyl-trichloroethane; 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; 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.

Testing				Treatment				
Patients of all ages should get 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 is used for treatment of *P. vivax* cases	ACT for treatment of *P. falciparum*	Pre-referral treatment with quinine or artemether IM or artesunate suppositories	Single dose of primaquine is used as gametocidal medicine for *P. falciparum*[1]	Primaquine is used for radical treatment of *P. vivax* cases	Directly observed treatment with primaquine is undertaken
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	–	●	●	●	●
●	●	●	●	–	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	–	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	NA	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●

Data as of 26 November 2019

● = 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 (2018) or no supportive available data reported to WHO.

● = Policy not adopted.

NA = Question not applicable.

– = Question not answered and there is no information from previous years.

* Free for children and/or pregnant women only.

Annex 3 – B. Antimalarial drug policy, 2018

WHO region Country/area	*P. falciparum*				*P. vivax*
	Uncomplicated unconfirmed	Uncomplicated confirmed	Severe	Prevention during pregnancy	Treatment
AFRICAN					
Algeria	-	-	-	-	PQ
Angola	AL	AL	AS; QN	SP(IPT)	-
Benin	AL	AL	AS; QN	SP(IPT)	-
Botswana	AL	AL	QN	-	-
Burkina Faso	AL; AS+AQ	AL; AS+AQ	AS; QN	SP(IPT)	-
Burundi	AS+AQ	AS+AQ	AS; QN	SP(IPT)	-
Cabo Verde	AL	AL	QN	-	-
Cameroon	AS+AQ	AS+AQ	AS; AM; QN	SP(IPT)	-
Central African Republic	AL	AL	AS; AM; QN	SP(IPT)	-
Chad	AL; AS+AQ	AL; AS+AQ	AS; QN	SP(IPT)	-
Comoros	AL	AL	QN	SP(IPT)	-
Congo	AS+AQ	AS+AQ	QN	SP(IPT)	-
Côte d'Ivoire	AS+AQ	AS+AQ	QN	SP(IPT)	-
Democratic Republic of the Congo	AS+AQ	AS+AQ	AS; QN	SP(IPT)	-
Equatorial Guinea	AS+AQ	AS+AQ	AS	SP(IPT)	-
Eritrea	AS+AQ	AS+AQ	QN	-	AS+AQ+PQ
Eswatini	-	AL	AS	-	-
Ethiopia	AL	AL	AS; AM; QN	-	CQ
Gabon	AS+AQ	AS+AQ	AS; AM; QN	SP(IPT)	-
Gambia	AL	AL	QN	SP(IPT)	-
Ghana	AS+AQ	AL; AS+AQ	AS; AM; QN	SP(IPT)	-
Guinea	AS+AQ	AS+AQ	AS	SP(IPT)	-
Guinea-Bissau	AL	AL	AS; QN	SP(IPT)	-
Kenya	AL	AL	AS; AM; QN	SP(IPT)	-
Liberia	AS+AQ	AS+AQ	AS; AM; QN	SP(IPT)	-
Madagascar	AS+AQ	AS+AQ	QN	SP(IPT)	-
Malawi	AL	AL	AS; QN	SP(IPT)	-
Mali	AS+AQ	AL; AS+AQ	QN	SP(IPT)	-
Mauritania	AS+AQ	AL; AS+AQ	QN	-	-
Mayotte	-	AL	QN; AS; QN+AS; AS+D; QN+D	-	CQ+PQ
Mozambique	AL	AL	AS; QN	SP(IPT)	-
Namibia	AL	AL	QN	-	AL
Niger	AL	AL	AS; QN	SP(IPT)	-
Nigeria	AL; AS+AQ	AL; AS+AQ	AS; AM; QN	SP(IPT)	-
Rwanda	AL	AL	AS; QN	-	-
Sao Tome and Principe	AS+AQ	AS+AQ	QN	-	-
Senegal	AL; AS+AQ; DHA-PPQ	AL; AS+AQ; DHA-PPQ	AS; QN	SP(IPT)	-
Sierra Leone	AS+AQ	AL; AS+AQ	AS; AM; QN	SP(IPT)	-
South Africa	-	AL; QN+CL; QN+D	QN	-	AL+PQ; CQ+PQ
South Sudan[1]	AS+AQ	AS+AQ	AM; AS; QN	-	AS+AQ+PQ
Togo	AL; AS+AQ	AL; AS+AQ	AS; AM; QN	SP(IPT)	-
Uganda	AL	AL	AS; QN	SP(IPT)	-
United Republic of Tanzania	AL; AS+AQ	AL; AS+AQ	AS; AM; QN	-	-
Mainland	AL	AL	AS; AM; QN	SP(IPT)	-
Zanzibar	AS+AQ	AS+AQ	AS; QN	SP(IPT)	-
Zambia	AL	AL	AS; AM; QN	SP(IPT)	-
Zimbabwe	AL	AL	QN	SP(IPT)	-
AMERICAS					
Argentina	-	AL	AS; AL	-	CQ + PQ
Belize	-	CQ+PQ	QN; AL	-	CQ+PQ
Bolivia (Plurinational State of)	-	AL	AS	-	CQ+PQ
Brazil	-	AL+PQ; AS+MQ+PQ	AS	-	CQ+PQ
Colombia	-	AL+PQ	AS	-	CQ+PQ
Costa Rica	-	CQ+PQ	AL	-	CQ+PQ

WHO region Country/area	*P. falciparum*				*P. vivax*
	Uncomplicated unconfirmed	Uncomplicated confirmed	Severe	Prevention during pregnancy	Treatment
AMERICAS					
Dominican Republic	-	CQ+PQ	AS	-	CQ+PQ
Ecuador	-	AL+PQ	AS	-	CQ+PQ
El Salvador	-	CQ+PQ	AS	-	CQ+PQ
French Guiana	-	AL	AS	-	CQ+PQ
Guatemala	-	CQ+PQ	AS	-	CQ + PQ
Guyana	-	AL+PQ	AM	-	CQ+PQ
Haiti	-	CQ+PQ	QN	-	CQ+PQ
Honduras	-	CQ+PQ	QN; AS	-	CQ+PQ
Mexico	-	AL+PQ	AM; AL	-	CQ+PQ
Nicaragua	-	CQ+PQ	QN	-	CQ+PQ
Panama	-	AL+PQ	-	-	CQ+PQ
Paraguay	-	AL+PQ	AS	-	CQ+PQ
Peru	-	AS+MQ+PQ	AS+MQ	-	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+PQ
Djibouti	AL	AL+PQ	AS	-	AL+PQ
Iran (Islamic Republic of)	-	AS+SP+PQ	AS; QN	-	CQ+PQ
Pakistan	CQ	AL+PQ	AS; QN	-	CQ+PQ
Saudi Arabia	-	AS+SP+PQ	AS; AM; QN	-	CQ+PQ
Somalia	AL	AL+PQ	AS; AM; QN	SP(IPT)	AL+PQ
Sudan	-	AL	AS; QN	-	AL+PQ
Yemen	AS+SP	AS+SP	AS, QN	-	CQ+PQ
SOUTH-EAST ASIA					
Bangladesh	-	AL	AS+AL; QN	-	CQ+PQ
Bhutan	-	AL	AM; QN	-	CQ+PQ
Democratic People's Republic of Korea	-	-	-	-	CQ+PQ
India	CQ	AS+SP+PQ; AL+PQ	AM; AS; QN	-	CQ+PQ
Indonesia	-	DHA-PPQ+PQ	AS; QN	-	DHA-PPQ+PQ
Myanmar	-	AL; AS+MQ; DHA-PPQ; PQ	AM; AS; QN	-	CQ+PQ
Nepal	-	AL+PQ	AS	-	CQ+PQ
Sri Lanka	-	AL+PQ	AS	-	CQ+PQ
Thailand	-	DHA-PPQ	AS	-	CQ+PQ
Timor-Leste	-	AL+PQ	AS; QN	-	AL+PQ
WESTERN PACIFIC					
Cambodia	-	AS+MQ	AM; AS; QN	-	AS+MQ+PQ
China	-	ART-PPQ; AS+AQ; DHA-PPQ; PYR	AM; AS; PYR	-	CQ+PQ; PQ+PPQ; ACTs+PQ; PYR
Lao People's Democratic Republic	AL+PQ	AL+PQ	AS+AL+PQ	-	AL+PQ; CQ+PQ
Malaysia	-	AS+MQ	AS+D; QN	-	ACT+PQ
Papua New Guinea	-	AL	AM; AS	SP(IPT)	AL+PQ
Philippines	AL	AL+PQ	QN+T; QN+D; QN+CL	SP(IPT)	CQ+PQ
Republic of Korea	CQ	-	QN	-	CQ+PQ
Solomon Islands	AL	AL	AS+AL; QN	CQ	AL+PQ
Vanuatu	-	AL	AS	CQ	AL+PQ
Viet Nam	DHA-PPQ	DHA-PPQ	AS; QN	-	CQ+PQ

Data as of 26 November 2019

ACT: artemisinin-based combination therapy; AL: artemether-lumefantrine; AM: artemether; AQ: amodiaquine; ART: artemisinin; AS: artesunate; AT: atovaquone; CL: clindamycine; 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, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
AFRICAN					
Algeria	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Angola	2016	2 725 165	28 133 718	0	0
	2017	15 453 275	22 496 168	0	0
	2018	12 123 750	22 000 000	0	0
Benin	2016	2 476 172	17 192 827	0	0
	2017	25 699 563	16 360 849	0	0
	2018	4 743 095	16 000 000	0	0
Botswana	2016	0	0	0	0
	2017	1 654 745	0	0	0
	2018	1 475 705	0	0	0
Burkina Faso	2016	29 722 841	14 587 854	5 420 843	58 501
	2017	9 680 365	25 563 827	10 570 944	1 375 065
	2018	32 552 591	25 000 000	10 570 944	991 422
Burundi	2016	7 877 578	9 898 901	0	0
	2017	28 433 018	9 202 978	0	0
	2018	1 805 521	9 000 000	0	0
Cabo Verde	2016	32 723	0	0	0
	2017	237 164	0	0	0
	2018	-19 013	0	0	0
Cameroon	2016	11 081 109	0	0	0
	2017	23 218 072	20 451 062	0	0
	2018	17 076 812	22 500 000	0	0
Central African Republic	2016	2 221 630	0	0	0
	2017	13 524 488	0	0	0
	2018	17 167 200	0	0	0
Chad	2016	34 361 246	0	0	0
	2017	14 272 836	0	0	0
	2018	18 323 111	0	0	0
Comoros	2016	3 017 257	0	0	0
	2017	860 330	0	0	0
	2018	2 298 799	0	0	0
Congo	2016	0	0	0	0
	2017	0	0	0	0
	2018	1 186 414	0	0	0
Côte d'Ivoire	2016	62 118 732	0	0	0
	2017	31 403 441	25 563 827	0	0
	2018	27 474 941	25 000 000	0	0
Democratic Republic of the Congo	2016	120 394 350	52 099 477	0	7 437 989
	2017	128 846 868	51 127 654	0	6 084 289
	2018	77 617 223	50 000 000	0	4 386 772
Equatorial Guinea	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Eritrea	2016	6 905 539	0	0	0
	2017	13 301 118	0	0	0
	2018	4 791 899	0	0	0
Eswatini	2016	897 122	0	0	0
	2017	1 686 517	0	0	0
	2018	579 780	0	0	0

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
1 743 483	0	0	0	0		0	0
1 748 498	0	0	0	0	43 809	0	0
1 812 462	0	0	0	0	9 214	0	0
50 874 556 [6]	16 852 909		27 000 000				
9 020 546	12 023 625		18 000 000		139 995		
46 457 232 [5]	9 578 147		22 000 000		88 217		
17 540 458 [5]	13 424 427	230 534	3 387 786		148 346	179 879	
4 395 380	33 122 938	0	9 642 332	3 140	158 723	5 400	
611 841	2 235 811	0	1 419 738	0	21 292	75 628	0
1 310 536	2 019 079	0	0	0		0	0
1 092 695	1 079 069	0	0	0		0	0
2 124 880	2 087 088	0	0	0		0	0
805 813	41 106 186	2 522 884	5 849 900		20 367	179 278	3 638 120
15 573 795	9 474 402	5 608 893	13 053 101		164 363	163 431	5 570 878
123 337	14 880 669	5 321 114	16 646 476		431 795	228 084	2 900 368
3 050 306	4 759 452		9 500 000		18 579	786 133	
3 070 872	21 228 086		9 000 000		37 832	4 967 372	869 962
1 157 984	4 734 738		9 000 000		68 488	433 441	4 664 286
1 229 033 [5]	315 038				59 219		
4 627 843	466 244				29 000		
621 612	221 609				25 641		
1 989 500	14 478 500				747 500		2 024 000
2 288 193 [5]	28 008 486				882 650	1 105 377	9 477
10 607 209 [5]	47 200 683		29 913 228				
530 000	4 724 918				150 000		
530 000	443 466				70 419		
675 455	8 399 445				50 000	306 968	
1 000 000 [5]	504 853			73 721	1 000	263 754	
641 141 [6]	34 927 891				416	540 870	867 119
534 407 [6]							
114 684	2 154 616				15 000		
114 684	852 996	0	0	0	54 000		0
114 684		0	0	0	60 000		0
118 498	0	0	0	0	24 727	2 863	0
122 182	0	0	0	0	15 000	0	10 000
50 509	9 090 909	0	0	0	0	0	9 090
4 688 040	60 352 423	0	0	0	13 627	35 933	0
5 380 263	95 971 000	0	0	0	18 218	76 943	10 319
7 493 797 991	6 619 727 462	0	25 000 000	0	0	874 070 529	0
7 327 062	143 685 771	0	49 325 000	8 063 499	3 677 567	4 771 747	0
683 314	75 183 622	0	46 738 755	4 694 136	2 265 298	82 857	0
1 948 241	92 444 112	0	49 075 000	0	636 951	0	0
3 122 871 [6]							
3 153 487 [6]							
3 153 487 [6]							
397 657 [6]	16 685 629	0	0	0	200 000	0	0
401 555 [6]	9 150 700	0	0	0	80 450	0	
401 555 [6]	2 748 778	0	0	0	82 500	0	0
1 112 523	1 719 139	0	0	0		0	
10 019 754	20 910 608	0	0	0	620 000	0	0
989 110	1 376 660	0	0	0		0	0

Annex 3 – C. Funding for malaria control, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
AFRICAN					
Ethiopia	2016	26 310 036	41 679 582	0	0
	2017	73 672 826	37 834 464	0	0
	2018	36 485 376	36 000 000	0	0
Gabon	2016	-574	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Gambia	2016	3 171 117	0	0	336 595
	2017	10 403 537	0	0	0
	2018	7 988 886	0	0	0
Ghana	2016	39 257 572	29 175 707	0	5 224 120
	2017	40 834 747	28 631 486	0	1 136 043
	2018	44 164 622	28 000 000	0	819 087
Guinea	2016	29 160 172	15 629 843	255 449	0
	2017	14 405 410	15 338 296	535 378	0
	2018	12 534 176	15 000 000	535 378	0
Guinea-Bissau	2016	9 113 073	0	0	0
	2017	6 739 432	0	0	0
	2018	7 686 968	0	0	0
Kenya	2016	11 362 945	36 469 634	0	6 776 489
	2017	60 499 518	35 789 358	0	990 329
	2018	12 442 150	35 000 000	0	714 027
Liberia	2016	6 373 170	14 587 854	0	0
	2017	14 115 769	14 315 743	0	0
	2018	20 155 173	14 000 000	0	0
Madagascar	2016	12 460 235	27 091 728	0	0
	2017	14 309 923	26 586 380	0	0
	2018	40 366 061	26 000 000	0	0
Malawi	2016	16 538 845	22 923 770	0	3 783 827
	2017	11 926 740	22 496 168	0	0
	2018	30 542 662	24 000 000	0	0
Mali	2016	9 714 772	26 049 738	4 888 374	125 410
	2017	23 204 310	25 563 827	5 578 034	0
	2018	30 478 473	25 000 000	5 578 034	0
Mauritania	2016	1 861 629	0	0	0
	2017	4 592 194	0	0	0
	2018	4 020 544	0	0	0
Mozambique	2016	61 708 435	30 217 697	1 431 916	0
	2017	63 584 965	29 654 039	1 995 892	7 668 217
	2018	35 773 022	29 000 000	1 995 892	5 528 785
Namibia	2016	2 212 537	0	0	0
	2017	2 707 554	0	0	0
	2018	742 672	0	0	0
Niger	2016	9 226 298	0	3 837 140	0
	2017	24 712 609	18 405 955	6 472 782	0
	2018	28 316 962	18 000 000	6 472 782	0
Nigeria	2016	106 477 832	78 149 215	13 526 155	2 946 514
	2017	121 497 648	76 691 481	0	0
	2018	66 607 410	70 000 000	0	0
Rwanda	2016	22 669 934	18 755 812	0	0
	2017	17 066 738	18 405 955	0	0
	2018	9 931 433	18 000 000	0	0

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
18 947 911	49 500 000		10 600 000		0	30 000	13 500 000
19 401 447	31 604 918		7 150 000		0	30 000	13 500 000
20 758 465	44 800 000		26 358 971				14 000 000
1 410 426 [6]	0	0	0	0		0	
142 296	0	0	0	0	12 616	0	0
0	0	0	0	0	128 016	0	49 674
604 456 [6]	9 352 149				0	0	1 031 868
610 382 [6]	9 557 650				14 400	33 839	117 749
1 327 049	8 376 620				39 000	50 414	176 987
9 856 505	36 596 848	0	28 000 000	9 883 185	300 000	0	0
683 179	40 951 105	0	22 445 306		140 000	0	0
140 392 544	47 579 039	0	30 634 694	7 560 000	300 000	0	0
4 229 893	36 810 868		15 000 000	2 235 000	91 500	5 001	636 998
14 796 [5]	9 251 505	125 000	12 500 000		65 000		
6 438 381	12 000 000	156 000	14 000 000		45 000		
241 163	8 972 945	0	0	0		0	269 981
1 655 769	9 086 476	0	0	0		0	256 659
651 820	3 199 732	0	0	0		0	0
1 633 148 [6]							
1 649 159 [6]							
1 649 159 [6]							
305 428 [6]							
308 423 [6]	18 526 566		14 000 000				
308 423 [6]							
32 100	6 395 563	0	26 000 000	0	486 635		
37 214	43 205 989	0	26 000 000	0	220 000	0	0
13 007	33 200 289	0	26 000 000		46 000		
347 710 [5]			22 000 000				
291 194 [5]	16 282 087		22 000 000				
282 401	33 049 389		20 000 000				
3 263 366	16 374 449		25 500 000		4 983	2 203 890	
4 382 069	19 288 748	3 226 759	25 500 000	0	140 713	854 199	
14 329 420	54 053 651	6 406 499	25 000 000			337 884	
2 450 845		3 500 400			220	384 900	
605 079 [5]	6 957 945				47 950		13 944
2 191 549	164 778						
1 237 214	190 374 239		29 000 000		325 000	1 250 640	
76 074	58 222 077		29 000 000		240 000	3 848 028	10 995
2 136 147	45 915 417		29 000 000			1 590 000	4 361 414
5 218 841	4 227 559	0	0	0	100 000	0	878 882
5 166 667	1 096 657	0	0	0	100 000	0	789 566
11 216 160	908 515	0	0	0	100 000	100 000	1 148 515
2 672 787	14 911 144	641 402	106 000	0	75 586	39 712	39 712
4 454 320	22 404 758	2 177 698	220 000	0	328 594	805 598	476 444
7 363 777	20 159 800	4 490 567	18 000 000	0	220 356	674 811	0
476 077 607	372 939 170		75 000 000	2 967 421			
107 005 355	198 176 039		75 000 000				
2 232 700 [6]	43 206 463		70 000 000				
16 853 782	30 497 401		18 000 000		72 000		
13 704 611	11 440 292		18 000 000		270 000		
13 460 220	27 505 974		18 000 000				

Annex 3 – C. Funding for malaria control, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
AFRICAN					
Sao Tome and Principe	2016	2 945 763	0	0	0
	2017	2 978 337	0	0	0
	2018	0	0	0	0
Senegal	2016	10 227 184	25 007 749	0	0
	2017	5 941 567	25 563 827	0	0
	2018	12 400 978	24 000 000	0	0
Sierra Leone	2016	5 776 307	0	0	7 657 486
	2017	1 521 619	15 338 296	0	1 264 107
	2018	1 442 219	15 000 000	0	911 421
South Africa	2016	0	0	0	48 271
	2017	0	0	0	0
	2018	0	0	0	0
South Sudan[8]	2016	6 625 486	6 251 937	0	21 105 454
	2017	23 225 030	0	0	13 351 190
	2018	11 119 479	0	0	9 626 208
Togo	2016	4 909 746	0	1 868 045	0
	2017	18 204 847	0	2 334 730	0
	2018	6 564 615	0	2 334 730	0
Uganda	2016	76 258 031	35 427 644	0	30 424 581
	2017	54 107 401	33 744 252	0	7 293 653
	2018	64 750 030	33 000 000	0	5 258 724
United Republic of Tanzania[9]	2016	62 681 243	0	0	0
	2017	72 183 435	0	0	0
	2018	0	0	0	0
Mainland	2016	61 652 875	0	0	0
	2017	69 674 305	0	0	0
	2018	0	0	0	0
Zanzibar	2016	1 028 368	0	0	0
	2017	2 509 129	0	0	0
	2018	0	0	0	0
Zambia	2016	27 622 155	26 049 738	286 668	28 080
	2017	40 378 684	30 676 592	606 731	0
	2018	22 106 638	30 000 000	606 731	0
Zimbabwe	2016	17 000 019	15 629 843	0	0
	2017	17 503 053	15 338 296	0	0
	2018	12 952 709	15 000 000	0	0
AMERICAS					
Belize	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Bolivia (Plurinational State of)	2016	4 324 861	0	0	0
	2017	2 805 373	0	0	0
	2018	3 347 788	0	0	0
Brazil	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Colombia	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
1 745 437	2 261 202	0	0	1 000 000	52 985	2 826	4 584
2 044 439	3 296 207	0	0	0	89 244	0	0
0 [6]							
4 816 000	1 865 570	0	24 000 000	0	7 828	28 795	24 167
4 931 741	3 039 725	0	24 000 000	0	0	0	4 500 000
4 931 741	11 602 821	0	24 000 000	11 602 821	0	0	0
346 772 [5]	5 389 748				36 569	55 295	
807 592 [6]	19 300 000				72 812	3 464 362	
65 189 [5]	8 728 599		15 000 000		70 000	148 214	2 742
15 428 406	0	0	0	0	0	0	75 061
10 656 029	27 226 495	0	0	0	20 000	0	0
16 954 533	4 197 290	0	0	0	50 000	0	
8 919 615 [5]	20 288 506	7 000 000	6 000 000	6 000 808	4 779 900	12 812 860	6 758 505
2 603 242 [5]	16 478 112	0	6 000 000	6 654 000	200 000		5 249 000
2 658 638 [6]							
68 213	2 973 548	943 022	0	0	7 158	169 496	10 650
1 847 898	24 435 381	1 014 708	0	0	7 765	556 712	5 238 461
64 103	23 830 061	440 567	0	0	4 715	553 567	0
7 585 730	31 501 450	0	33 000 000	29 246 018		743 791	3 772 657
7 280 412	150 649 446	0	34 000 000	8 974 881		743 791	4 335 860
7 243 128	47 530 743	0	33 000 000	14 073 138		743 791	0
5 873 258 [6]	104 603 541	37 578 250	2 888 539	5 466 569	0	0	0
70 283 449 [6]	73 235 141	0	978 962		52 000		
145 338 516 [6]	146 767 363	0	16 104 693	0	14 574	0	12 168
5 858 187	103 964 466	37 578 250	2 025 000	4 982 394	0	0	0
70 274 555	70 274 555				42 000		
145 258 808	145 258 808		713 228				12 168
15 071	639 075	0	863 539	484 175	0	0	0
8 894	2 960 586	0	978 962		10 000		
79 708	1 508 555	0	15 391 465	0	14 574	0	0
25 500 000	20 134 623		24 000 000		200 000		
27 928 587	45 468 736		25 000 000		200 000		
18 159 340	24 605 077		3 000 000		200 000		3 692 991
675 000	21 823 373		12 000 000		46 698		
782 250	17 407 287		15 120 000				224 970
2 786 540	16 973 379	0	11 000 000	0	118 000	0	0
248 000	0	0	1 419	0	0	0	0
250 000	0	0	9 778	0	0	0	0
252 000	11 122	0	3 234	0	5 609	0	0
425 405	2 846 786	0	0	0		0	
451 993		0	0	0		0	0
416 666							
44 240 812 [5]	0	0		0		0	
54 904 744 [5]	0	0		0		0	
61 816 864 [5]	0	0	82 861	0		0	
10 159 785	0	0	147 210	0	14 660	0	0
10 897 170	0	0	2 872	0	0	0	0
3 237 708	0	0	70 647				

Annex 3 – C. Funding for malaria control, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
AMERICAS					
Costa Rica	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Dominican Republic	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Ecuador	2016	0	0	0	0
	2017	-598 176	0	0	0
	2018	0	0	0	0
El Salvador	2016	0	0	0	0
	2017	0	0	0	0
	2018	636 619	0	0	0
French Guiana	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Guatemala	2016	1 859 389	0	0	0
	2017	2 296 407	0	0	0
	2018	2 190 728	0	0	0
Guyana	2016	-61 194	0	0	0
	2017	761 382	0	0	0
	2018	58 421	0	0	0
Haiti	2016	6 410 459	0	0	0
	2017	10 667 044	0	0	0
	2018	5 481 055	0	0	0
Honduras	2016	1 227 533	0	0	0
	2017	1 231 343	0	0	0
	2018	1 115 139	0	0	0
Mexico	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Nicaragua	2016	5 281 217	0	0	0
	2017	2 491 441	0	0	0
	2018	2 289 236	0	0	0
Panama	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Paraguay	2016	1 547 843	0	0	0
	2017	334 089	0	0	0
	2018	0	0	0	0
Peru	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Suriname	2016	170 752	0	0	0
	2017	1 168 802	0	0	0
	2018	819 904	0	0	0
Venezuela (Bolivarian Republic of)[10]	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
5 090 000 [5]	14 000	0	1 624	0	3 000	0	0
4 980 000 [5]	0	0	0	0	9 770	0	0
5 000 000 [5]	0	0	0	0	12 155	0	0
3 525 868	0	0	0	0	0	0	334 363
1 149 368	125 543	0	0	0	824	0	27 987
367 647	9 949 957	0	0	0	143 176	0	48 938
20 000 000 [5]	0	0		0	69 279	0	0
5 835 716 [5]	0	0		0	69 039	0	0
6 898 763 [5]	0	0	0	0	85 733	0	
2 662 869	166 311	0	1 089	0	4 733	0	65 789
2 662 869	538 732	0	0	0	73 758	0	0
3 950 441	707 436	0	0	0	15 156	0	0
0 [6]	0	0	0	0	0	0	0
0 [6]	0	0	0	0	0	0	0
0 [6]							
2 639 249	10 669 242	0		0		0	
3 374 612	2 231 020		75 981				
3 492 749	1 724 076	0	138 643	0		0	580 000
521 018	338 772	0	98 000	0	50 000	0	0
1 473 101	1 009 615	0	8 015	0	9 793	0	0
1 503 535	340 471	0	211 698	0	0	0	0
362 174 [5]	4 926 108	0	0	500 000	227 455		330 566
381 452 [6]	12 540 295	0	17 956	500 000	227 455		196 777
408 174 [5]	7 384 832	0	0	0	275 872		514 271
543 312	3 413 845		7 840	0	0	0	
543 312	2 594 856	0	54 475	0	0	0	554 378
543 312	1 929 881	0	46 855	0	36 961	0	714 145
43 376 321	0	0	0	0		0	0
40 661 276	0	0	0	0		0	0
37 544 836	0	0	0	0		0	0
3 544 313	3 727 737	0		0	8 250	0	
3 984 944	1 826 934		23 971		98 131		
3 263 970	1 986 357		13 254		83 000		401 133
3 822 596		0	23 247	0	9 665	0	
3 671 002			49 705		7 087		
8 000 000 [5]	0	0	59 277	0	18 823	0	
2 264 399	1 517 493	0	0	0	0	0	0
2 883 082	593 059	0	0	0	0	0	0
–							
180 563	0	0	183 809	0		0	0
2 074 113 [6]			39 886		168 737		
1 774 350			90 000				
106 372 [6]	945 713	0	16 151	0	60 176	0	0
61 800	1 041 205	0	52 213	0	12 920	0	0
63 194 [6]		0	22 037	0		0	
2 200 925	945 713	0	0	0	21 411	0	0
29 452 393 982 [5]			0		85 193		
573 136 589			0		435 366		

Annex 3 – C. Funding for malaria control, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
EASTERN MEDITERRANEAN					
Afghanistan	2016	5 945 750	0	0	0
	2017	7 043 533	0	0	0
	2018	9 556 500	0	0	0
Djibouti	2016	4 738 086	0	138 717	0
	2017	2 617 141	0	230 220	0
	2018	652 220	0	230 220	0
Iran (Islamic Republic of)	2016	1 798 772	0	0	0
	2017	1 113 357	0	0	0
	2018	0	0	0	0
Pakistan	2016	11 332 383	0	0	0
	2017	16 609 001	0	0	0
	2018	13 590 722	0	0	0
Saudi Arabia	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Somalia	2016	9 829 626	0	0	0
	2017	16 327 923	0	0	0
	2018	7 501 955	0	0	0
Sudan	2016	55 654 840	0	0	0
	2017	10 485 931	0	0	0
	2018	34 723 839	0	0	0
Yemen	2016	4 706 687	0	0	0
	2017	3 664 258	0	1 553 074	0
	2018	-7 248	0	0	0
SOUTH-EAST ASIA					
Bangladesh	2016	6 658 153	0	0	0
	2017	12 956 676	0	0	0
	2018	6 940 221	0	0	0
Bhutan	2016	455 891	0	0	0
	2017	572 637	0	0	0
	2018	326 974	0	0	0
Democratic People's Republic of Korea	2016	3 781 468	0	0	0
	2017	1 523 252	0	0	0
	2018	2 314 541	0	0	0
India	2016	4 248 221	0	0	0
	2017	67 799 731	0	0	0
	2018	270 626	0	0	0
Indonesia	2016	11 275 924	0	0	49 453
	2017	23 553 669	0	0	0
	2018	9 987 790	0	0	0
Myanmar	2016	35 058 903	10 419 895	0	12 914 507
	2017	40 780 480	10 225 531	0	3 913 209
	2018	17 007 953	10 000 000	0	2 821 423
Nepal	2016	3 101 226	0	0	0
	2017	5 165 221	0	0	0
	2018	1 408 576	0	0	0
Thailand	2016	9 107 668	0	0	0
	2017	10 956 433	0	0	0
	2018	6 040 728	0	0	0
Timor-Leste	2016	3 233 190	0	0	0
	2017	2 688 860	0	0	0
	2018	2 427 241	0	0	0

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
944 566 [6]	9 762 977				12 905		
921 528 [6]	1 053 356				85 814		
200 000 [6]	10 556 626				26 571		
4 547 153 [5]	4 547 153	0		1 000 000	25 000	25 000	
3 222 506 [5]		0		0	51 000	0	
3 295 183 [6]	871 414			0	30 000	0	
2 500 000	1 364 857						
2 700 000					48 000		
3 300 000	0	0	0		38 286		
16 400 000	11 536 047				300 000		
18 344 729 [6]	22 635 097				130 000		
3 774 306	9 615 605				196 378		
30 000 000	0	0	0	0	7 500	0	0
30 000 000	0	0	0	0	100 000	0	0
30 000 000	0	0	0	0	10 000	0	0
81 200	9 946 059	0	0	0	135 000		0
85 350	20 986 170	0	0	0	147 000		0
90 726	5 534 919	0	0	0	56 000		0
24 209 740	61 304 230	0	0	0	93 302	1 200 574	0
19 087 941	31 496 505	0	0	0	3 084	0	0
16 726 945	21 485 294	0	0	0	60 000	203 000	9 619
0	1 140 758	0	0	0	105 000	0	
0	7 933 620				2 080 000	473 627	
0 [5]	1 890 037				1 427 948		
1 162 970	9 734 466	0	0	0	188 000	0	0
1 493 690	8 821 888	0	0	0	210 000	0	0
2 496 429	6 835 307	0	0	0	250 000	0	0
163 046	550 197	0	0	0	40 273	0	72 424
179 470	586 015	0	0	0	35 212	0	121 212
176 791	577 403	0	0	0	34 687	0	0
2 080 000	3 775 232	0	0	0	35 000	0	
2 151 000	3 426 508	0	0	0	35 000	0	0
2 181 000	3 219 957	0	0	0		0	
48 364 518	15 892 221	0	0	0		0	
145 564 257	94 474 099	0	0	0		0	
46 783 323	34 958 663	0	0	0		0	
20 307 710 [5]	10 821 533	0	0	0	228 000	1 938 220	0
17 686 075 [5]	30 336 061				147 033	1 385 855	
21 683 909 [5]	12 272 515				260 738	115 242	
6 437 430 [5]	55 302 769		9 000 000	6 607 886	25 000		
6 780 092 [6]	53 056 520	0	10 000 000	6 532 464	25 000	0	3 462 068
6 780 092 [6]	29 581 578		9 000 000	6 607 886	25 000		
966 200 [5]	10 228 041	0	69 334	0	23 000		
263 262	102 424				24 509		
613 873	1 107 196	0	120 482	0	31 214	0	0
8 502 036	13 984 633	0	0	0	103 514	0	61 463
7 664 899	15 622 625	0			188 686		49 859
7 131 736	8 337 877	0	1 308 800	0	78 056	0	93 546
1 523 993	3 261 859	0	0	0	45 868	0	20 000
1 115 484	4 039 622	0	0	0	42 456	0	20 000
1 121 287	1 573 936	0	0	0	26 600	0	5 000

Annex 3 – C. Funding for malaria control, 2016–2018

WHO region Country/area	Year	Contributions reported by donors			
		Global Fund[1]	PMI/USAID[2]	World Bank[3]	UK[4]
WESTERN PACIFIC					
Cambodia	2016	8 383 140	6 251 937	0	0
	2017	14 368 640	10 225 531	0	0
	2018	10 380 499	10 000 000	0	0
China	2016	-317 097	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Lao People's Democratic Republic	2016	5 920 486	0	0	0
	2017	3 667 214	0	0	0
	2018	3 901 819	0	0	0
Malaysia	2016	0	0	0	779 447
	2017	0	0	0	0
	2018	0	0	0	0
Papua New Guinea	2016	7 880 106	0	0	135 199
	2017	10 563 330	0	0	0
	2018	7 276 337	0	0	0
Philippines	2016	3 531 540	0	0	0
	2017	7 342 397	0	0	0
	2018	3 195 184	0	0	0
Republic of Korea	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Solomon Islands	2016	2 540 226	0	0	0
	2017	1 025 914	0	0	0
	2018	1 729 636	0	0	0
Vanuatu	2016	0	0	0	0
	2017	0	0	0	0
	2018	0	0	0	0
Viet Nam	2016	6 091 536	0	0	0
	2017	15 802 793	0	0	0
	2018	9 296 596	0	0	0

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.

"–" refers to data not available.

[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: OECD CRS database.

[5] Budget not expediture.

Contributions reported by countries							
Government (NMP)	Global Fund	World Bank	PMI/USAID	Other bilaterals	WHO	UNICEF	Other contributions[7]
22 297	2 002 435	0	6 000 000	0	304 651	0	
663 526	8 045 144	0	6 000 000	0	579 738	0	
83 636	3 181 783	0	10 000 000	0	628 297	0	
18 929 499 [6]							
19 115 082 [6]							
19 602 589 [6]							
260 975	5 050 407	0	340 021	184 632	75 000	0	45 199
1 008 060	1 728 818	0	604 000	0	256 734	0	1 066 089
1 914 750	3 725 427	0	500 000	0	288 108	0	1 783 267
39 703 616	0	0	0	0	0	0	0
48 365 863	0	0	0	0	0	0	0
49 561 180	0	0	0	0	0	0	0
181 200	5 900 000	0	0	0	56 000	0	0
753 771	10 330 449	0	0	0	95 000	0	911 770
108 100	7 407 034	0	0	0	86 500	0	1 083 168
6 720 000 [5]	3 944 923	0	0	0	0	0	0
7 012 009	6 471 549	0	0	0	0	0	0
3 548 266	4 190 984	0	0	0	0	0	0
526 499	0	0	0	0	0	0	0
475 173	0	0	0	0	0	0	0
433 726	0	0	0	0	0	0	0
327 032	1 309 126	0	0	448 718	358 000	0	0
858 256	977 025	0	0	0	736 892	0	0
979 891	1 494 080				79 770		
196 760	927 486	0	0	249 071	148 217	0	0
139 254	285 333	0	0	206 575	21 918	0	0
128 194	131 786	0	0	92 363	9 367	0	0
801 554	11 088 506				200 764		200 000
3 022 523	9 324 657	0	0	0	200 000	0	500 000
1 813 863	7 901 624	0	0	0	105 045	0	315 396

Data as of 26 November 2019

[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 high-transmission areas of Sudan (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.

[10] Government contributions for 2016, 2017 and 2018 are indicated in local currency during that period.

Note: Negative disbursements reflect recovery of funds on behalf of the financing organization.

Annex 3 – D. Commodities distribution and coverage, 2016–2018

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)	ACT treatment courses delivered
AFRICAN							
Algeria	2016	0	–	–	0	432	–
	2017	0	–	–	36	453	–
	2018	0	–	–	0	1 242	–
Angola	2016	3 507 740	21	–	3 000 000	4 000 000	4 000 000
	2017	2 924 769	32	–	397 882	3 090 761	3 090 761
	2018	3 863 521	38	–	2 000 350	1 950 000	1 950 000
Benin	2016	720 706	36	853 221	1 500 047	1 199 055	1 199 055
	2017	6 771 009	44	853 221	2 171 867	1 530 617	1 530 617
	2018	0	59	1 321 758	2 016 745	1 815 236	1 815 236
Botswana	2016	116 048	–	115 973	2 196	1 634	1 634
	2017	3 000	–	139 244	2 645	4 429	4 429
	2018	–	–	83 488	3 141	1 954	1 954
Burkina Faso	2016	10 924 031	62	–	11 974 810	9 519 568	9 519 568
	2017	986 164	68	–	12 853 861	10 457 752	10 457 752
	2018	1 946 047	48	766 374	13 026 870	11 968 368	11 968 368
Burundi	2016	755 182	49	–	8 077 703	8 277 026	8 031 773
	2017	6 717 994	58	848 441	10 046 047	7 978 264	7 613 646
	2018	986 025	81	1 754 679	7 012 203	5 149 436	5 032 209
Cabo Verde	2016	0	–	349 126	8 906	71	71
	2017	80	–	495 313	16 573	420	420
	2018	21	–	–	9 588	21	21
Cameroon	2016	9 588 733	56	–	1 380 725	1 093 036	1 093 036
	2017	362 629	67	–	1 589 218	879 039	785 765
	2018	573 843	55	–	1 739 286	1 064 668	918 505
Central African Republic	2016	57 110	59	–	1 651 645	1 714 647	1 714 647
	2017	857 198	59	–	806 218	947 205	947 205
	2018	753 889	63	–	1 189 881	1 773 072	1 773 072
Chad	2016	384 606	15	–	882 617	–	–
	2017	6 886 534	45	–	1 287 405	1 486 086	1 486 086
	2018	–	65	–	–	–	–
Comoros	2016	451 358	73	–	61 600	1 373	1 373
	2017	34 590	89	–	21 988	2 794	2 794
	2018	31 012	77	–	–	–	–
Congo	2016	1 291	39	–	45 000	0	0
	2017	2 223	27	–	0	0	0
	2018	4 641	29	–	0	0	0
Côte d'Ivoire	2016	1 177 906	69	–	5 351 325	4 964 065	4 964 065
	2017	13 216 468	70	–	6 986 825	5 373 545	5 373 545
	2018	15 875 381	80	–	6 069 250	6 799 565	6 799 565
Democratic Republic of the Congo	2016	31 439 920	70	916 524	18 630 636	17 258 290	17 258 290
	2017	8 412 959	75	232 181	18 994 861	17 250 728	17 250 728
	2018	16 919 441	71	111 735	18 549 327	16 917 207	16 917 207
Equatorial Guinea	2016	66 232	34	82 749	62 133	18 072	18 072
	2017	42 317	34	64 617	60 798	15 341	15 341
	2018	120 376	34	74 416	78 695	15 633	15 633
Eritrea	2016	156 553	46	364 007	0	177 525	177 525
	2017	1 724 972	50	375 696	481 600	296 399	296 399
	2018	60 083	58	376 143	400 900	301 525	301 525
Eswatini	2016	4 758	–	24 179	56 780	600	600
	2017	0	–	21 316	59 760	900	861
	2018	0	–	39 144	61 974	631	579
Ethiopia	2016	13 266 926	62	15 050 413	9 742 450	6 530 973	5 239 080
	2017	2 755 700	55	17 628 133	6 400 000	8 470 000	7 300 000
	2018	11 100 000	39	10 486 854	4 053 200	3 773 179	3 036 690

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)	ACT treatment courses delivered
AFRICAN							
Gabon	2016	9 660	9	0	0	0	0
	2017	–	8	–	0	0	0
	2018	4 582	7	–	71 787	–	208 953
Gambia	2016	113 385	55	399 176	1 017 889	272 895	272 895
	2017	1 051 391	64	396 546	767 984	174 556	174 166
	2018	115 801	77	426 788	678 621	113 563	113 563
Ghana	2016	5 962 179	68	1 409 967	4 823 250	2 289 145	2 289 145
	2017	3 059 363	66	1 868 861	7 051 875	4 522 410	4 522 410
	2018	16 839 135	75	1 855 326	13 119 275	5 253 298	5 253 298
Guinea	2016	8 236 154	65	–	2 138 494	3 362 668	3 362 668
	2017	523 328	68	–	2 920 298	2 673 947	2 673 947
	2018	645 980	59	–	2 741 607	1 886 685	1 886 685
Guinea-Bissau	2016	71 500	77	–	238 412	133 647	115 361
	2017	1 222 428	73	–	303 651	136 507	110 508
	2018	93 859	72	–	320 217	162 773	147 927
Kenya	2016	2 005 477	68	0	8 352 950	11 327 340	11 327 340
	2017	15 621 773	70	906 388	11 337 850	10 696 827	10 696 827
	2018	2 673 730	74	1 833 860	–	–	–
Liberia	2016	–	59	–	–	–	–
	2017	157 954	30	–	–	–	–
	2018	2 500 796	34	–	–	994 008	994 008
Madagascar	2016	464 407	63	2 856 873	1 352 225	757 613	757 613
	2017	764 022	41	2 008 963	2 465 600	1 620 050	1 620 050
	2018	184 859	31	–	4 731 125	2 165 450	2 165 450
Malawi	2016	9 093 657	61	–	8 746 750	6 799 354	6 440 490
	2017	994 136	60	–	15 060 625	10 177 530	10 177 530
	2018	11 805 392	60	–	13 003 518	8 948 286	9 186 040
Mali	2016	2 189 027	69	788 711	3 250 000	3 511 970	3 511 970
	2017	4 148 911	66	823 201	4 164 041	3 746 616	3 746 616
	2018	4 993 868	68	665 581	6 105 500	3 558 964	3 558 964
Mauritania	2016	51 000	11	–	208 650	174 420	84 000
	2017	921 245	37	–	234 520	101 450	–
	2018	478 230	65	–	117 000	25 890	25 890
Mayotte	2016	–	–	–	–	–	–
	2017	–	–	–	–	–	–
	2018	–	–	–	–	44	44
Mozambique	2016	4 527 936	53	4 375 512	19 822 825	14 136 250	14 136 250
	2017	15 482 093	62	5 349 948	19 662 975	15 996 892	15 996 892
	2018	1 337 905	60	4 211 138	21 180 223	16 293 318	16 293 318
Namibia	2016	0	–	485 730	379 625	21 519	21 519
	2017	0	–	753 281	914 175	79 316	79 316
	2018	15 000	–	549 243	49 852	35 355	1 721
Niger	2016	746 469	64	0	4 622 433	3 257 506	3 257 506
	2017	981 423	56	0	3 909 600	2 697 115	2 161 440
	2018	4 015 529	58	–	5 149 981	3 536 000	3 536 000
Nigeria	2016	9 896 250	56	130 061	11 178 434	9 177 309	9 177 309
	2017	21 978 907	53	–	9 701 771	7 752 372	7 752 372
	2018	27 004 605	49	–	18 662 105	32 707 785	32 707 785
Rwanda	2016	2 882 445	66	2 484 672	6 013 020	7 639 177	7 603 560
	2017	2 816 586	73	1 753 230	4 960 020	6 300 445	6 265 890
	2018	974 847	70	1 621 955	5 364 990	5 233 680	5 214 330
Sao Tome and Principe	2016	11 922	–	149 930	117 676	2 121	2 121
	2017	15 151	–	138 000	96 826	2 410	2 410
	2018	142 894	–	–	–	–	–

Annex 3 - D. Commodities distribution and coverage, 2016–2018

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)	ACT treatment courses delivered
AFRICAN							
Senegal	2016	8 960 663	66	496 728	1 823 405	709 394	709 394
	2017	448 305	71	619 578	2 391 311	958 473	958 473
	2018	617 470	50	0	2 646 144	1 606 813	1 490 147
Sierra Leone	2016	452 608	42	-	3 093 725	4 714 900	4 714 900
	2017	4 611 638	53	-	2 611 550	2 504 960	2 504 960
	2018	502 834	73	-	4 316 420	3 415 480	3 415 480
South Africa	2016	0	-	1 165 955	227 325	12 677	12 677
	2017	0	-	1 550 235	865 050	72 439	72 439
	2018	0	-	1 600 747	887 300	51 142	51 142
South Sudan[1]	2016	2 759 527	65	281 998	5 147 954	13 617 422	13 617 422
	2017	1 902 020	75	153 285	1 945 875	12 188 601	12 188 601
	2018	-	73	-	-	2 680 776	2 680 776
Togo	2016	155 660	64	-	1 428 696	1 064 876	1 049 903
	2017	4 706 417	68	-	1 613 393	1 355 640	1 196 518
	2018	224 265	80	-	2 485 086	1 988 845	2 055 831
Uganda	2016	899 823	65	3 811 484	27 230 375	29 667 150	29 667 150
	2017	23 797 483	76	3 223 800	24 620 100	27 396 300	27 396 300
	2018	11 220 492	88	4 436 156	28 200 125	25 606 514	25 606 514
United Republic of Tanzania[2]	2016	-	59	-	-	-	-
	2017	5 335 910	60	2 568 522	-	-	-
	2018	-	59	-	-	-	-
Mainland	2016	11 731 272	59	2 377 403	23 223 400	13 786 620	13 786 620
	2017	5 335 910	60	2 377 403	34 649 050	20 895 180	20 895 180
	2018	6 200 375	59	2 507 920	29 906 950	16 420 560	16 420 560
Zanzibar	2016	756 445	-	27 664	24 026	11 100	10 020
	2017	0	-	191 119	459 957	8 506	8 506
	2018	177 794	-	334 715	356 775	5 050	4 650
Zambia	2016	1 292 400	58	6 737 918	15 286 570	19 084 818	19 084 818
	2017	10 759 947	64	7 717 767	18 884 600	17 460 232	17 460 232
	2018	-	79	6 436 719	17 868 550	27 071 994	27 071 994
Zimbabwe	2016	1 752 855	43	3 674 932	3 154 200	934 580	934 580
	2017	513 300	44	3 673 311	875 713	549 083	553 953
	2018	171 038	32	3 020 032	1 484 134	607 379	615 359
AMERICAS							
Argentina	2016	0	-	0	0	30	0
	2017	0	-	4 208	0	39	9
	2018	0	-	155	0	213	92
Belize	2016	4 000	-	35 264	0	5	0
	2017	0	-	37 466	0	9	1
	2018	2 619	-	36 688	0	7	0
Bolivia (Plurinational State of)	2016	84 000	-	12 689	-	5 553	5 553
	2017	23 500	-	20 000	3 500	0	0
	2018	23 500	-	2 000	-	-	-
Brazil	2016	0	-	98 593	68 650	567 842	103 428
	2017	0	-	83 990	72 200	651 274	69 960
	2018	300 000	-	99 321	114 775	634 935	79 200
Colombia	2016	306 498	-	1 180 400	21 575	202 175	94 494
	2017	295 250	-	153 690	265 250	95 570	56 030
	2018	0	-	60 000	13 252	46 217	26 507
Costa Rica	2016	206	-	430	0	13	3
	2017	104	-	8 479	0	25	7
	2018	3 100	-	4 095	700	108	5

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)	ACT treatment courses delivered
AMERICAS							
Dominican Republic	2016	1 483	–	40 510	89 800	755	40
	2017	0	–	30 361	48 850	398	–
	2018	5 052	–	36 891	42 425	484	9
Ecuador	2016	51 795	–	–	–	1 191	403
	2017	72 015	–	667 111	–	1 380	371
	2018	50 000	–	775 884	51 200	1 806	191
El Salvador	2016	2 578	–	27 338	0	14	0
	2017	2 925	–	19 167	0	4	0
	2018	4 817	–	32 691	0	2	1
French Guiana	2016	4 455	–	–	–	–	–
	2017	–	–	–	–	–	–
	2018	–	–	–	–	–	–
Guatemala	2016	485 010	–	–	92 100	0	0
	2017	83 258	–	6 245	170 325	9 995	0
	2018	310 218	–	15 358	75 300	3 246	–
Guyana	2016	8 320	–	0	8 268	10 979	3 759
	2017	5 534	–	–	–	13 936	5 141
	2018	43 181	–	–	–	11 767	3 073
Haiti	2016	10 000	–	–	274 404	19 702	–
	2017	709 720	–	–	261 600	18 772	–
	2018	1 919	–	42 130	207 800	8 083	–
Honduras	2016	81 470	–	360 553	27 300	43 097	45
	2017	24 092	–	225 027	29 710	–	–
	2018	53 944	–	338 730	15 000	–	45
Mexico	2016	61 000	–	112 184	0	596	13
	2017	5 695	–	–	0	765	14
	2018	17 891	–	48 608	0	803	10
Nicaragua	2016	191 178	–	147 801	20 840	6 284	–
	2017	103 676	–	182 602	46 500	49 085	50
	2018	47 301	–	183 098	117 350	86 195	–
Panama	2016	0	–	9 675	0	811	0
	2017	–	–	3 921	16 000	689	144
	2018	0	–	19 500	20 000	715	3
Paraguay	2016	0	–	217	0	10	7
	2017	0	–	631	5 000	2 498	408
	2018	–	–	–	–	–	–
Peru	2016	430	–	30 499	150 000	74 554	6 500
	2017	–	–	62 804	–	–	–
	2018	83 220	–	23 420	180 000	65 000	14 500
Suriname	2016	37 000	–	–	13 825	–	–
	2017	6 022	–	–	14 325	–	–
	2018	15 000	–	–	13 575	–	–
Venezuela (Bolivarian Republic of)	2016	30 000	–	29 232	80 000	240 613	61 034
	2017	5 000	–	3 900	–	–	–
	2018	81 402	–	–	48 117	404 924	97 293
EASTERN MEDITERRANEAN							
Afghanistan	2016	992 319	–	–	758 675	93 335	89 500
	2017	2 372 354	–	–	514 875	27 850	27 850
	2018	649 383	–	–	28 915	–	47 665
Djibouti	2016	33 851	10	–	–	–	–
	2017	134 701	27	–	63 488	14 212	–
	2018	109 500	53	–	91 416	46 380	98 380

Annex 3 - D. Commodities distribution and coverage, 2016–2018

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)	ACT treatment courses delivered
EASTERN MEDITERRANEAN							
Iran (Islamic Republic of)	2016	6 393	-	172 666	120 000	-	-
	2017	4 218	-	126 111	-	-	-
	2018	4 500	-	117 174	128 650	-	-
Pakistan	2016	1 304 305	-	552 500	13 446 268	850 000	62 000
	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
Saudi Arabia	2016	0	-	307 927	-	3 922	3 922
	2017	127 800	-	253 222	-	1 915	1 915
	2018	127 801	-	242 009	-	1 908	1 908
Somalia	2016	655 798	13	11 015	593 310	351 755	351 755
	2017	2 571 923	19	1 267 526	468 750	322 260	322 260
	2018	357 569	21	2 038 381	755 750	260 580	260 580
Sudan	2016	5 370 774	52	3 678 400	2 375 275	3 847 768	3 847 768
	2017	5 741 449	56	3 683 031	3 498 425	4 507 838	4 507 838
	2018	3 454 519	51	3 830 195	4 117 300	4 195 600	4 195 600
Yemen	2016	1 482 982	-	548 436	442 570	283 408	283 408
	2017	433 266	-	1 338 585	148 935	138 494	77 115
	2018	1 461 760	-	995 328	571 175	440 265	38 420
SOUTH-EAST ASIA							
Bangladesh	2016	41 255	-	-	420 049	28 407	24 431
	2017	2 242 527	-	-	373 138	29 916	24 790
	2018	1 559 423	-	72 000	500 440	10 762	8 609
Bhutan	2016	22 322	-	66 675	12 600	216	216
	2017	137 000	-	71 690	21 650	132	132
	2018	29 770	-	76 809	12 300	293	293
Democratic People's Republic of Korea	2016	0	-	1 152 402	182 980	23 231	0
	2017	0	-	1 147 548	176 612	17 038	0
	2018	500 815	-	169 841	657 050	3 698	0
India	2016	5 000 000	-	43 477 154	21 082 000	2 123 760	300 000
	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
Indonesia	2016	2 977 539	-	6 240	1 382 208	438 178	438 178
	2017	4 376 636	-	3 320	1 783 498	607 965	607 965
	2018	340 074	-	305 493	255 300	670 603	670 603
Myanmar	2016	3 965 187	-	44 484	1 596 525	126 585	126 585
	2017	5 835 192	-	-	2 053 525	108 364	108 364
	2018	775 251	-	14 017	1 761 775	57 144	57 144
Nepal	2016	290 647	-	286 865	61 000	4 500	274
	2017	324 156	-	300 000	100 000	3 070	238
	2018	319 046	-	230 000	132 065	3 949	120
Sri Lanka	2016	16 465	-	57 111	31 950	41	19
	2017	18 019	-	10 317	27 500	57	27
	2018	21 759	-	15 707	11 150	48	15
Thailand	2016	465 600	-	237 398	68 500	40 801	14 321
	2017	358 400	-	207 250	173 425	21 540	7 540
	2018	131 425	-	165 580	30 550	25 292	9 892
Timor-Leste	2016	309 067	-	166 426	114 263	84	84
	2017	334 471	-	102 891	115 115	30	30
	2018	35 367	-	154 410	144 061	8	8

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)	ACT treatment courses delivered
WESTERN PACIFIC							
Cambodia	2016	4 089 321	–	–	400 350	98 990	88 990
	2017	1 994 150	–	–	503 250	145 518	145 518
	2018	1 624 507	–	–	–	–	–
China	2016	26 562	–	272 108	–	6 290	4 130
	2017	11 349	–	352 731	–	–	–
	2018	5 987	–	161 224	–	–	–
Lao People's Democratic Republic	2016	1 213 755	–	–	270 950	63 889	62 994
	2017	242 405	–	–	333 675	42 972	39 272
	2018	50 403	–	2 052	34 387	8 931	34 765
Malaysia	2016	284 031	–	513 076	0	2 302	2 197
	2017	278 104	–	539 029	0	4 114	3 443
	2018	213 073	–	–	0	4 630	3 891
Papua New Guinea	2016	944 847	–	–	1 733 500	540 400	540 400
	2017	1 694 315	–	–	1 135 577	832 532	832 532
	2018	1 480 705	–	–	2 268 750	1 385 940	1 385 940
Philippines	2016	806 603	–	1 025 096	256 875	6 810	6 810
	2017	814 984	–	490 640	145 325	23 400	23 400
	2018	1 156 837	–	1 015 672	168 300	4 318	4 318
Republic of Korea	2016	0	–	–	4 625	673	–
	2017	0	–	–	0	515	–
	2018	0	–	–	0	576	–
Solomon Islands	2016	291 339	–	16 179	542 975	237 492	237 492
	2017	85 976	–	0	374 850	238 665	238 665
	2018	150 248	–	–	386 975	233 917	233 917
Vanuatu	2016	110 215	–	–	39 525	11 729	11 729
	2017	91 028	–	–	56 150	27 409	20 853
	2018	27 151	–	–	50 850	0	0
Viet Nam	2016	200 000	–	417 142	408 055	71 853	2 358
	2017	752 000	–	151 153	921 897	87 225	40 000
	2018	1 193 024	–	319 866	576 930	45 040	40 000

Data as of 19 December 2019

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, 2015–2018, compiled through 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 last 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
AFRICAN								
Angola	2015–16 DHS	30.9	11.3	1.6	31.8	12.5	19.7	17.6
Benin	2017–18 DHS	91.5	60.5	8.7	92.0	63.8	77.2	71.1
Burkina Faso	2017–18 MIS	75.3	32.8	–	–	–	54.5	44.1
Burundi	2016–17 DHS	46.2	17.1	1.0	46.8	17.9	32.3	34.7
Chad	2014–15 DHS	77.3	42.4	0.6	77.3	42.4	61.2	33.3
Ethiopia	2016 DHS	–	–	–	–	–	–	–
Ghana	2016 MIS	73.0	50.9	8.1	74.1	53.6	65.8	41.7
Kenya	2015 MIS	62.5	40.0	–	62.5	39.7	52.5	47.6
Liberia	2016 MIS	61.5	25.2	1.2	62.1	25.9	41.5	39.3
Madagascar	2016 MIS	79.5	44.4	6.9	80.9	47.9	62.1	68.2
Malawi	2015–16 DHS	56.9	23.5	4.9	58.6	27.0	38.8	33.9
Malawi	2017 MIS	82.1	41.7	–	–	–	63.1	55.4
Mali	2015 MIS	93.0	39.3	4.0	93.6	41.8	69.5	63.9
Mali	2018 DHS	89.8	54.8	–	–	–	75.2	72.9
Mozambique	2015 AIS	66.0	38.9	11.2	68.7	45.3	53.8	45.4
Mozambique	2018 MIS	82.2	51.2	–	–	–	68.5	68.4
Nigeria	2015 MIS	68.8	34.9	1.3	69.0	35.5	54.7	37.3
Rwanda	2014–15 DHS	80.6	42.6	–	80.6	42.5	63.8	61.4
Rwanda	2017 MIS	84.1	55.1	19.6	89.2	66.9	71.9	63.9
Senegal	2015 DHS	76.8	40.5	4.8	77.1	43.0	66.0	51.0
Senegal	2016 DHS	82.4	56.4	5.3	82.9	58.0	75.7	63.1
Senegal	2017 DHS	84.2	50.4	4.2	84.5	52.3	72.8	56.9
Sierra Leone	2016 MIS	60.3	16.2	1.7	61.1	17.7	37.1	38.6
Togo	2017 MIS	85.2	71.4	–	–	–	82.3	62.5
Uganda	2014–15 MIS	90.2	62.3	4.9	90.5	64.0	78.8	68.6
Uganda	2016 DHS	78.4	51.1	–	–	–	64.6	55.0
United Republic of Tanzania	2015–16 DHS	65.6	38.8	5.5	66.2	41.0	55.9	49.0
United Republic of Tanzania	2017 MIS	77.9	45.4	–	–	–	62.5	52.2
Zimbabwe	2015 DHS	47.9	26.4	21.3	54.9	39.4	37.2	8.5
AMERICAS								
Haiti	2016–17 DHS	30.7	12.3	2.2	32.0	14.1	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	0.9	0.4	–	–	–	0.6	4.1
Myanmar	2015–16 DHS	26.8	14.1	–	–	–	21.2	15.6
Timor-Leste	2016 DHS	63.6	32.7	–	–	–	48.1	47.3

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.

"–" 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/.

% of ITNs	% of pregnant women		% of children <5 years				% of children <5 years with fever in last 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
71.0	23.0	20.0	21.7	34.0	13.5	–	50.8	34.3	18.1	76.7
73.4	79.3	13.7	76.3	43.8	36.3	39.1	53.1	17.7	17.5	37.0
76.0	58.2	57.7	54.4	50.1	20.2	16.9	73.5	48.8	51.1	79.4
86.9	43.9	12.9	39.9	36.3	37.9	26.8	69.6	66.4	47.0	11.3
48.6	34.7	8.5	36.4	–	–	–	36.9	12.9	26.9	10.0
–	–	–	–	32.0	–	–	35.3		7.7	11.5
47.7	50.0	59.6	52.2	35.2	27.9	20.6	71.8	30.3	50.1	58.8
75.2	57.8	22.9	56.1	16.2	9.1	5.0	71.9	39.2	27.1	91.6
71.2	39.5	23.1	43.7	49.2	44.9	–	78.2	49.8	65.5	81.1
78.7	68.5	10.6	73.4	20.5	5.1	6.9	55.5	15.5	10.1	17.0
73.3	43.9	30.4	42.7	36.1	–	–	67.0	52.0	37.6	91.8
76.8	62.5	41.1	67.5	37.1	36.0	24.3	54.4	37.6	29.4	96.4
90.7	77.9	21.0	71.2	63.0	32.4	35.7	49.2	14.2	28.7	28.9
88.7	83.7	28.3	79.1	56.7	18.9	–	52.8	16.4	18.7	31.0
70.9	52.1	23.3	47.9	36.7	40.2	–	62.7	39.6	38.4	92.6
85.4	76.4	40.6	72.7	55.2	38.9	–	68.6	47.9	32.7	98.6
60.8	49.0	21.4	43.6	43.1	45.1	27.4	66.1	12.6	41.2	37.6
77.4	72.9	–	67.7	15.7	7.8	2.2	56.7	36.1	11.4	98.7
71.0	68.5	–	68.0	–	11.8	7.2	55.6	38.1	19.6	98.7
70.0	51.8	11.2	55.4	38.0	0.6	0.3	49.3	9.5	3.4	12.5
68.2	69.0	22.1	66.6	36.7	0.9	0.9	49.5	13.0	1.7	85.0
68.6	61.8	22	60.7	41.8	0.9	0.4	51.4	16.1	4.7	65.5
89.0	44.0	31.1	44.1	49.2	52.7	40.1	71.4	51.1	57.0	96.0
52.3	69.0	41.7	69.7	47.8	43.9	28.3	55.9	29.3	31.1	76.3
74.4	75.4	27.5	74.3	28.8	31.7	20.0	82.0	35.8	76.9	86.7
74.0	64.1	17.2	62.0	29.2	30.4	–	81.2	49.0	71.5	87.8
69.4	53.9	8.0	54.4	31.2	14.4	5.6	80.1	35.9	51.1	84.9
66.7	51.4	25.8	54.6	30.5	7.3	–	75.4	43.1	36.2	89.4
18.8	6.1	–	9.0	14.9	–	–	50.5	12.7	1.0	–
62.3	16.0	–	18.2	37.5	–	–	40.3	15.8	1.1	–
21.4	4.1	–	4.6	–	–	–	63.7	7.9	11.8	4.4
11.6	0.4	–	0.4	–	–	–	81.4	–	9.2	3.3
68.9	4.3	–	4.6	30.8	–	–	73.2	10.8	20.1	8.5
58.3	18.4	–	18.6	26.7	–	–	65.0	3.0	0.8	–
79.8	60.1	–	55.4	12.6	–	–	57.6	24.5	10.0	11.1

Data as of 23 October 2019

Annex 3 - Eb. Household survey results, 2015–2018, compiled through WHO calculations

WHO region Country/area	Survey	Fever prevalence	Health sector where treatment was sought							Diagnostic testing coverage 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
AFRICAN											
Angola	2015–16 DHS	15%	47%	–	5%	1%	2%	45%	53%	59%	–
Benin	2017–18 DHS	20%	22%	–	9%	9%	14%	46%	40%	52%	–
Burkina Faso	2017–18 MIS	20%	71%	1%	1%	0%	2%	26%	73%	66%	–
Burundi	2016–17 DHS	40%	54%	3%	10%	5%	1%	30%	69%	87%	95%
Ethiopia	2016 DHS	14%	26%	–	8%	0%	2%	63%	34%	–	–
Ghana	2016 MIS	31%	34%	–	15%	10%	12%	28%	60%	59%	–
Kenya	2015 MIS	36%	51%	–	15%	5%	3%	27%	70%	52%	–
Liberia	2016 MIS	39%	46%	–	13%	14%	8%	22%	71%	77%	–
Madagascar	2016 MIS	16%	36%	7%	10%	1%	7%	40%	53%	31%	37%
Malawi	2017 MIS	40%	38%	3%	6%	2%	7%	46%	48%	76%	–
Mali	2018 DHS	16%	24%	3%	2%	7%	23%	42%	36%	46%	37%
Mozambique	2018 MIS	31%	64%	4%	0%	0%	1%	31%	68%	72%	41%
Nigeria	2015 MIS	41%	20%	1%	6%	39%	3%	32%	65%	32%	–
Rwanda	2017 MIS	31%	33%	18%	3%	5%	1%	44%	55%	73%	74%
Senegal	2017 DHS	21%	39%	1%	4%	6%	3%	48%	49%	32%	–
Sierra Leone	2016 MIS	27%	63%	–	4%	4%	2%	28%	70%	74%	–
Togo	2017 MIS	24%	26%	5%	7%	3%	16%	43%	42%	78%	76%
Uganda	2016 DHS	34%	34%	3%	34%	12%	1%	18%	80%	77%	58%
United Republic of Tanzania	2017 MIS	21%	46%	–	13%	17%	1%	25%	75%	66%	–
Zimbabwe	2015 DHS	14%	35%	1%	9%	0%	6%	49%	45%	26%	–

ACT: artemisinin-based combination therapy; DHS: demographic and health survey; MIS: malaria indicator survey; WHO: World Health Organization.
"–" refers to not applicable or data not available.
Note: Figures with fewer than 30 children in the denominator were removed.
Sources: Nationally representative household survey data from DHS and MIS, compiled through WHO calculations.

Diagnostic testing coverage in each health sector				Antimalarial treatment coverage in each health sector							ACT use among antimalarial treatment in each health sector		
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
82%	27%	23%	60%	27%	–	40%	23%	10%	7%	28%	74%	88%	–
30%	9%	8%	37%	38%	–	34%	23%	12%	7%	34%	44%	28%	40%
–	–	–	66%	69%	–	–	–	–	10%	68%	80%	–	–
86%	36%	54%	84%	69%	93%	55%	32%	–	9%	66%	12%	10%	–
–	–	–	–	16%	–	19%	–	–	4%	17%	14%	–	–
60%	11%	0%	50%	64%	–	49%	56%	61%	29%	59%	57%	63%	40%
57%	9%	25%	49%	31%	–	30%	44%	29%	19%	31%	93%	91%	–
82%	35%	14%	70%	84%	–	75%	76%	62%	21%	81%	87%	71%	80%
7%	–	3%	27%	13%	19%	13%	–	18%	5%	14%	9%	–	–
76%	–	4%	73%	55%	–	55%	–	21%	7%	54%	98%	–	–
–	8%	5%	36%	61%	56%	–	17%	5%	4%	50%	35%	–	–
–	–	–	70%	47%	57%	–	–	–	10%	47%	98%	–	–
29%	6%	7%	16%	48%	47%	56%	48%	20%	28%	48%	46%	37%	–
70%	14%	–	67%	30%	60%	13%	31%	–	2%	37%	99%	–	–
23%	6%	20%	28%	9%	–	11%	3%	8%	1%	8%	68%	–	–
72%	13%	–	71%	77%	–	77%	41%	–	19%	75%	98%	92%	–
45%	–	4%	66%	70%	83%	54%	–	10%	7%	66%	82%	–	–
49%	22%	36%	57%	82%	87%	79%	78%	67%	43%	80%	91%	84%	96%
76%	13%	–	55%	34%	–	49%	57%	–	24%	42%	96%	83%	–
13%	–	9%	23%	2%	–	1%	–	0%	1%	1%	–	–	–

Data as of 23 October 2019

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Algeria[1,2,3]	2010	2 113 135	–	1	–	–	1	–
	2011	2 153 309	–	1	–	–	0	–
	2012	2 195 743	–	55	–	–	0	–
	2013	2 240 160	–	8	–	–	0	–
	2014	2 286 182	–	0	–	–	0	–
	2015	2 333 425	–	0	–	–	0	–
	2016	2 381 786	–	0	–	–	0	–
	2017	2 431 200	–	0	–	–	0	–
	2018	2 480 497	–	0	–	–	0	–
Angola	2010	23 356 247	3 209 000	4 332 945	5 712 000	11 000	13 387	16 500
	2011	24 220 660	3 171 000	4 262 568	5 614 000	10 400	12 803	16 100
	2012	25 107 925	3 241 000	4 379 690	5 807 000	9 930	12 408	15 900
	2013	26 015 786	3 464 000	4 706 326	6 229 000	9 700	12 229	15 900
	2014	26 941 773	3 762 000	5 063 524	6 625 000	9 780	12 484	16 600
	2015	27 884 380	4 238 000	5 576 653	7 193 000	10 100	13 118	17 800
	2016	28 842 482	4 852 000	6 345 114	8 177 000	10 100	13 252	18 200
	2017	29 816 769	5 109 000	6 825 325	8 998 000	10 100	13 345	18 500
	2018	30 809 787	5 261 000	7 052 636	9 225 000	10 200	13 425	18 800
Benin	2010	9 199 254	2 734 000	3 567 057	4 589 000	7 530	8 048	8 610
	2011	9 460 829	2 707 000	3 501 513	4 472 000	6 830	7 303	7 830
	2012	9 729 254	2 894 000	3 677 978	4 636 000	6 270	6 720	7 210
	2013	10 004 594	3 123 000	3 951 788	4 930 000	5 930	6 362	6 840
	2014	10 286 839	3 233 000	4 106 892	5 127 000	5 950	6 404	6 910
	2015	10 575 962	3 467 000	4 355 431	5 386 000	6 140	6 655	7 220
	2016	10 872 072	3 692 000	4 583 409	5 611 000	6 340	6 915	7 530
	2017	11 175 192	3 571 000	4 465 137	5 509 000	6 480	7 115	7 810
	2018	11 485 035	3 489 000	4 435 318	5 556 000	6 370	7 081	7 870
Botswana	2010	1 317 417	1 300	2 229	3 900	0	5	13
	2011	1 336 179	520	682	1 000	0	1	3
	2012	1 352 187	230	304	410	0	0	1
	2013	1 367 436	570	729	980	0	1	3
	2014	1 384 718	1 600	2 075	2 800	0	5	10
	2015	1 405 998	400	521	700	0	1	2
	2016	1 431 993	890	1 154	1 500	0	2	5
	2017	1 461 921	2 300	2 999	4 000	0	7	14
	2018	1 494 401	680	879	1 200	0	2	4
Burkina Faso	2010	15 605 211	6 884 000	8 602 187	10 590 000	28 000	30 750	33 800
	2011	16 081 915	6 968 000	8 677 204	10 710 000	25 200	27 994	31 200
	2012	16 571 252	7 043 000	8 742 005	10 760 000	18 500	20 916	23 700
	2013	17 072 791	6 694 000	8 323 401	10 230 000	17 200	19 930	23 100
	2014	17 586 029	6 151 000	7 668 618	9 439 000	15 300	18 144	21 500
	2015	18 110 616	5 741 000	7 245 827	9 025 000	13 100	15 940	19 300
	2016	18 646 350	5 249 000	7 490 818	10 340 000	11 400	14 072	17 500
	2017	19 193 236	5 406 000	7 676 215	10 590 000	10 300	12 955	16 600
	2018	19 751 466	5 551 000	7 875 575	10 960 000	9 860	12 725	16 700
Burundi	2010	8 675 606	1 321 000	1 823 594	2 488 000	4 390	4 720	5 090
	2011	8 958 406	1 193 000	1 649 646	2 226 000	4 300	4 636	5 020
	2012	9 245 992	1 037 000	1 423 214	1 903 000	4 390	4 776	5 230
	2013	9 540 302	936 000	1 341 256	1 858 000	4 330	4 754	5 260
	2014	9 844 301	967 000	1 393 043	1 969 000	4 370	4 850	5 480
	2015	10 160 034	1 167 000	1 681 495	2 322 000	4 380	4 917	5 640
	2016	10 488 002	1 739 000	2 367 597	3 150 000	4 410	5 020	5 870
	2017	10 827 010	2 009 000	2 709 703	3 557 000	4 420	5 097	6 060
	2018	11 175 379	2 079 000	2 796 890	3 682 000	4 410	5 118	6 170
Cabo Verde[1,2]	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	–	–	1	–
	2018	141 378	–	2	–	–	0	–
Cameroon	2010	20 341 236	4 436 000	6 011 372	7 914 000	11 400	12 409	13 600
	2011	20 906 392	4 204 000	5 542 323	7 153 000	10 900	11 903	13 100
	2012	21 485 267	3 993 000	5 266 733	6 827 000	11 200	12 317	13 600
	2013	22 077 300	3 839 000	5 365 639	7 162 000	11 300	12 481	13 800
	2014	22 681 853	3 808 000	5 536 236	7 750 000	11 300	12 547	14 000
	2015	23 298 376	4 059 000	5 929 407	8 411 000	10 900	12 276	13 900
	2016	23 926 549	4 011 000	6 324 089	9 433 000	10 300	11 886	13 700
	2017	24 566 070	3 807 000	6 441 846	10 160 000	9 700	11 371	13 400
	2018	25 216 261	3 644 000	6 228 154	9 831 000	9 360	11 192	13 500

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Central African Republic	2010	4 386 765	1 393 000	1 906 095	2 567 000	5 890	7 378	9 320
	2011	4 418 639	1 304 000	1 852 888	2 559 000	5 020	6 389	8 270
	2012	4 436 411	1 289 000	1 832 621	2 527 000	4 490	5 845	7 750
	2013	4 447 945	1 265 000	1 809 535	2 499 000	3 770	5 053	6 880
	2014	4 464 171	1 218 000	1 754 603	2 434 000	3 420	4 721	6 620
	2015	4 493 171	1 183 000	1 707 013	2 394 000	3 060	4 302	6 200
	2016	4 537 683	1 094 000	1 642 736	2 373 000	2 730	3 949	5 860
	2017	4 596 023	1 050 000	1 596 323	2 318 000	2 530	3 739	5 700
	2018	4 666 375	1 078 000	1 620 758	2 361 000	2 410	3 654	5 730
Chad	2010	11 821 305	1 610 000	2 670 920	4 135 000	12 600	13 692	14 900
	2011	12 225 682	1 584 000	2 573 306	3 958 000	11 600	12 672	13 800
	2012	12 644 806	1 514 000	2 469 991	3 805 000	10 400	11 499	12 600
	2013	13 075 722	1 297 000	2 345 147	3 920 000	9 580	10 607	11 700
	2014	13 514 000	1 242 000	2 301 093	3 969 000	8 680	9 685	10 800
	2015	13 956 512	1 268 000	2 334 698	3 924 000	8 160	9 190	10 300
	2016	14 402 266	1 288 000	2 447 429	4 300 000	7 780	8 862	10 100
	2017	14 852 327	1 248 000	2 559 078	4 687 000	7 510	8 693	10 000
	2018	15 308 245	1 253 000	2 523 288	4 594 000	7 370	8 693	10 300
Comoros[1]	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	–	1 143	–	0	2	4
	2017	813 890	–	3 230	–	0	8	12
	2018	832 322	–	15 613	–	1	39	62
Congo	2010	4 273 738	593 000	944 174	1 442 000	1 800	1 894	2 000
	2011	4 394 842	628 000	986 118	1 500 000	1 770	1 883	2 000
	2012	4 510 197	650 000	1 013 105	1 499 000	1 770	1 899	2 040
	2013	4 622 757	694 000	1 068 018	1 580 000	1 790	1 955	2 150
	2014	4 736 965	724 000	1 098 243	1 597 000	1 790	1 972	2 220
	2015	4 856 093	703 000	1 100 944	1 635 000	1 730	1 907	2 160
	2016	4 980 996	679 000	1 162 467	1 855 000	1 760	1 948	2 250
	2017	5 110 701	697 000	1 229 822	2 053 000	1 750	1 938	2 260
	2018	5 244 363	703 000	1 232 815	2 017 000	1 760	1 961	2 310
Côte d'Ivoire	2010	20 532 944	7 829 000	9 635 484	11 700 000	15 400	16 488	17 700
	2011	21 028 652	7 612 000	9 296 942	11 240 000	13 500	14 492	15 600
	2012	21 547 188	6 845 000	8 538 623	10 460 000	11 300	12 157	13 100
	2013	22 087 506	5 714 000	7 484 764	9 688 000	9 830	10 548	11 400
	2014	22 647 672	5 354 000	7 135 696	9 284 000	8 840	9 486	10 200
	2015	23 226 148	5 561 000	7 433 189	9 805 000	8 800	9 501	10 300
	2016	23 822 726	6 048 000	8 448 875	11 500 000	8 530	9 275	10 100
	2017	24 437 475	6 128 000	8 855 281	12 340 000	8 460	9 263	10 200
	2018	25 069 226	5 381 000	8 287 840	12 270 000	8 410	9 297	10 300
Democratic Republic of the Congo	2010	64 563 853	22 370 000	27 653 200	33 780 000	54 100	63 385	74 000
	2011	66 755 151	21 440 000	26 674 386	32 590 000	40 900	48 721	57 500
	2012	69 020 749	19 980 000	25 054 526	30 890 000	38 500	46 851	56 100
	2013	71 358 804	18 320 000	23 378 784	29 300 000	35 500	43 955	53 500
	2014	73 767 445	17 600 000	22 748 873	28 730 000	36 600	46 394	57 900
	2015	76 244 532	17 940 000	23 546 242	30 470 000	34 700	44 994	57 300
	2016	78 789 130	18 860 000	25 430 848	33 900 000	30 800	40 491	53 100
	2017	81 398 765	19 410 000	26 790 666	35 990 000	33 100	44 991	60 700
	2018	84 068 092	19 600 000	26 888 424	35 910 000	32 200	44 615	62 000
Equatorial Guinea	2010	943 640	207 000	320 824	481 000	860	1 058	1 290
	2011	986 861	224 000	337 903	489 000	860	1 078	1 340
	2012	1 031 191	276 000	368 909	488 000	810	1 054	1 340
	2013	1 076 412	306 000	393 693	495 000	760	1 012	1 320
	2014	1 122 273	313 000	405 084	514 000	660	906	1 210
	2015	1 168 575	288 000	396 704	537 000	540	760	1 040
	2016	1 215 181	216 000	373 026	604 000	470	662	930
	2017	1 262 008	180 000	360 585	652 000	460	662	950
	2018	1 308 966	183 000	352 124	623 000	440	659	970
Eritrea	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	137 000	6	198	440
	2017	3 412 894	74 000	115 928	161 000	12	221	450
	2018	3 452 797	64 000	99 716	139 000	10	196	390

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Eswatini[1]	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	–	268	–	0	0	1
Ethiopia	2010	59 595 174	470 000	7 652 137	26 680 000	63	14 424	62 900
	2011	61 295 151	415 000	7 118 302	24 110 000	55	11 571	47 600
	2012	63 054 347	431 000	7 326 062	24 490 000	58	12 042	49 800
	2013	64 862 339	431 000	7 238 627	22 650 000	56	13 081	52 700
	2014	66 704 099	432 000	3 809 119	10 240 000	57	6 665	23 600
	2015	68 568 108	513 000	3 618 580	9 267 000	80	6 769	22 600
	2016	70 450 353	515 000	2 917 544	7 035 000	80	5 687	17 900
	2017	72 351 949	537 000	2 658 314	6 225 000	78	5 352	16 400
	2018	74 272 598	474 000	2 362 979	5 553 000	74	4 757	14 700
Gabon	2010	1 624 146	122 000	288 810	597 000	400	424	450
	2011	1 684 629	167 000	358 358	686 000	420	448	490
	2012	1 749 677	231 000	429 606	730 000	430	469	520
	2013	1 817 070	285 000	495 758	799 000	450	497	550
	2014	1 883 801	317 000	538 273	864 000	460	514	580
	2015	1 947 690	316 000	553 999	902 000	470	523	600
	2016	2 007 882	284 000	543 480	933 000	460	510	590
	2017	2 064 812	264 000	524 958	937 000	460	521	610
	2018	2 119 275	276 000	526 060	922 000	470	528	620
Gambia	2010	1 793 199	402 000	518 727	651 000	560	618	690
	2011	1 848 142	384 000	475 455	575 000	570	629	710
	2012	1 905 020	420 000	523 533	637 000	580	637	720
	2013	1 963 708	366 000	465 386	575 000	580	645	740
	2014	2 024 037	228 000	287 463	354 000	590	654	760
	2015	2 085 860	321 000	406 835	499 000	590	661	770
	2016	2 149 134	199 000	250 439	308 000	600	668	780
	2017	2 213 900	93 000	117 383	144 000	600	677	800
	2018	2 280 092	119 000	150 480	184 000	610	688	820
Ghana	2010	24 779 614	7 354 000	9 023 507	10 910 000	14 300	14 866	15 500
	2011	25 387 713	7 904 000	9 635 269	11 650 000	14 100	14 626	15 200
	2012	25 996 454	8 005 000	9 730 304	11 800 000	13 500	14 092	14 700
	2013	26 607 641	7 532 000	9 293 452	11 290 000	12 900	13 469	14 000
	2014	27 224 480	6 872 000	8 596 537	10 630 000	12 100	12 558	13 100
	2015	27 849 203	6 040 000	7 719 431	9 709 000	11 300	11 757	12 300
	2016	28 481 947	5 190 000	6 721 686	8 620 000	10 800	11 277	11 800
	2017	29 121 464	4 570 000	6 190 041	8 182 000	10 600	11 003	11 500
	2018	29 767 108	4 187 000	6 678 000	10 100 000	10 600	11 070	11 700
Guinea	2010	10 192 168	3 284 000	4 226 309	5 365 000	12 300	13 400	14 700
	2011	10 420 459	3 599 000	4 448 442	5 435 000	11 800	13 003	14 300
	2012	10 652 032	3 751 000	4 556 901	5 474 000	10 900	12 084	13 500
	2013	10 892 821	3 534 000	4 445 128	5 537 000	9 800	11 017	12 400
	2014	11 150 970	3 216 000	4 249 538	5 529 000	8 840	10 017	11 500
	2015	11 432 096	2 945 000	4 077 155	5 512 000	8 050	9 223	10 700
	2016	11 738 434	2 614 000	3 890 993	5 570 000	7 400	8 573	10 200
	2017	12 067 516	2 312 000	3 759 396	5 708 000	7 020	8 234	9 900
	2018	12 414 292	2 055 000	3 524 261	5 625 000	6 880	8 203	10 100
Guinea-Bissau	2010	1 522 603	133 000	204 588	303 000	610	651	710
	2011	1 562 996	135 000	219 683	337 000	600	651	710
	2012	1 604 981	114 000	206 635	343 000	600	646	710
	2013	1 648 259	86 000	186 899	355 000	590	646	710
	2014	1 692 433	64 000	158 919	331 000	590	647	720
	2015	1 737 207	57 000	138 573	290 000	580	637	710
	2016	1 782 434	44 000	127 177	292 000	600	671	760
	2017	1 828 146	41 000	143 200	377 000	610	674	770
	2018	1 874 304	66 000	231 124	593 000	610	680	780
Kenya	2010	42 030 684	1 658 000	2 845 913	4 638 000	11 100	11 456	11 800
	2011	43 178 270	1 696 000	2 930 265	4 795 000	11 500	11 874	12 300
	2012	44 343 469	1 866 000	3 252 855	5 394 000	11 600	12 007	12 400
	2013	45 519 986	2 112 000	3 754 660	6 340 000	11 700	12 106	12 600
	2014	46 700 063	2 201 000	3 916 556	6 580 000	11 700	12 195	12 700
	2015	47 878 339	1 922 000	3 455 175	5 783 000	11 800	12 241	12 900
	2016	49 051 531	1 921 000	3 452 117	5 758 000	11 800	12 280	13 000
	2017	50 221 146	1 964 000	3 520 384	5 866 000	11 800	12 307	13 100
	2018	51 392 570	2 017 000	3 602 498	5 997 000	11 800	12 416	13 200

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Liberia	2010	3 891 357	1 025 000	1 345 523	1 736 000	2 410	2 583	2 780
	2011	4 017 446	1 009 000	1 327 415	1 718 000	2 260	2 437	2 640
	2012	4 135 662	918 000	1 273 383	1 726 000	2 120	2 310	2 530
	2013	4 248 337	916 000	1 347 912	1 924 000	1 970	2 157	2 390
	2014	4 359 508	1 011 000	1 471 653	2 094 000	1 900	2 110	2 380
	2015	4 472 229	1 140 000	1 551 740	2 039 000	1 730	1 928	2 190
	2016	4 586 788	1 422 000	1 771 898	2 180 000	1 770	2 001	2 330
	2017	4 702 224	1 465 000	1 886 107	2 378 000	1 750	2 004	2 380
	2018	4 818 976	1 182 000	1 742 079	2 447 000	1 730	2 006	2 420
Madagascar	2010	21 151 640	523 000	893 540	1 425 000	68	2 208	5 000
	2011	21 743 970	486 000	794 810	1 161 000	61	1 964	4 140
	2012	22 346 641	967 000	1 594 592	2 516 000	130	3 941	8 730
	2013	22 961 259	966 000	1 497 292	2 298 000	120	3 701	8 010
	2014	23 589 897	768 000	1 079 845	1 448 000	93	2 669	5 200
	2015	24 234 080	1 705 000	2 358 382	3 106 000	200	5 830	11 200
	2016	24 894 370	1 034 000	1 408 502	1 857 000	120	3 482	6 650
	2017	25 570 511	1 442 000	1 934 794	2 488 000	170	4 783	9 020
	2018	26 262 313	1 618 000	2 163 930	2 775 000	190	5 350	10 100
Malawi	2010	14 539 609	4 482 000	5 612 558	6 919 000	8 650	9 139	9 680
	2011	14 962 118	4 282 000	5 427 890	6 785 000	8 220	8 674	9 170
	2012	15 396 010	3 741 000	4 834 579	6 111 000	7 960	8 420	8 940
	2013	15 839 287	3 273 000	4 242 633	5 435 000	7 240	7 682	8 210
	2014	16 289 550	2 937 000	3 860 686	4 953 000	6 700	7 192	7 770
	2015	16 745 305	2 752 000	3 634 338	4 682 000	6 310	6 846	7 520
	2016	17 205 253	2 694 000	3 624 533	4 730 000	6 020	6 614	7 370
	2017	17 670 193	2 880 000	3 821 420	4 982 000	5 850	6 495	7 340
	2018	18 143 215	2 678 000	3 876 121	5 471 000	5 780	6 478	7 460
Mali	2010	15 049 352	4 132 000	5 772 983	7 951 000	15 700	16 884	18 200
	2011	15 514 593	4 471 000	6 279 267	8 582 000	17 300	18 737	20 300
	2012	15 979 492	4 942 000	6 961 475	9 455 000	17 700	19 306	21 000
	2013	16 449 854	5 334 000	7 448 756	10 240 000	17 400	19 142	21 000
	2014	16 934 213	5 365 000	7 468 113	10 370 000	15 800	17 513	19 400
	2015	17 438 772	4 827 000	6 833 022	9 671 000	13 800	15 478	17 400
	2016	17 965 448	4 860 000	6 902 717	9 818 000	12 000	13 602	15 500
	2017	18 512 429	5 057 000	7 160 192	10 190 000	10 400	12 017	13 800
	2018	19 077 755	5 200 000	7 378 847	10 480 000	10 100	11 848	13 800
Mauritania	2010	3 494 200	21 000	135 686	297 000	1 030	1 155	1 350
	2011	3 598 646	40 000	171 207	359 000	1 060	1 199	1 420
	2012	3 706 555	24 000	105 342	233 000	1 080	1 241	1 490
	2013	3 817 497	39 000	126 803	264 000	1 100	1 260	1 530
	2014	3 930 894	67 000	193 411	380 000	1 130	1 315	1 630
	2015	4 046 304	98 000	249 288	468 000	1 160	1 350	1 700
	2016	4 163 532	132 000	297 695	546 000	1 170	1 365	1 740
	2017	4 282 582	94 000	237 631	453 000	1 180	1 380	1 770
	2018	4 403 312	81 000	173 555	298 000	1 190	1 397	1 800
Mozambique	2010	23 531 567	7 707 000	9 375 217	11 280 000	15 500	16 896	18 500
	2011	24 187 500	7 749 000	9 431 228	11 370 000	15 400	16 935	18 800
	2012	24 862 673	7 716 000	9 492 059	11 490 000	15 200	16 940	19 100
	2013	25 560 752	7 710 000	9 635 885	11 850 000	14 900	16 919	19 600
	2014	26 286 192	7 778 000	9 590 106	11 670 000	14 300	16 451	19 400
	2015	27 042 001	7 905 000	9 623 584	11 580 000	13 400	15 644	18 800
	2016	27 829 930	7 844 000	9 596 334	11 620 000	12 700	14 951	18 300
	2017	28 649 007	7 505 000	9 350 958	11 590 000	12 100	14 412	18 000
	2018	29 496 009	7 159 000	9 006 864	11 160 000	11 900	14 426	18 400
Namibia	2010	1 681 850	800	2 590	6 200	0	6	20
	2011	1 711 870	2 600	3 654	5 400	0	9	19
	2012	1 742 095	2 700	5 861	9 700	0	15	36
	2013	1 772 836	6 400	8 068	9 800	0	20	37
	2014	1 804 522	21 000	26 144	32 000	2	66	120
	2015	1 837 443	16 000	19 990	24 000	1	51	93
	2016	1 871 687	33 000	41 397	51 000	3	105	190
	2017	1 907 082	71 000	89 155	109 000	7	228	420
	2018	1 943 338	41 000	51 898	64 000	4	132	240
Niger	2010	16 464 025	3 841 000	7 007 707	10 720 000	18 900	21 543	24 600
	2011	17 114 770	4 112 000	7 323 097	11 180 000	18 800	21 975	25 600
	2012	17 795 209	4 442 000	7 660 985	11 850 000	18 100	21 678	25 900
	2013	18 504 287	4 425 000	7 780 901	12 250 000	17 000	20 907	25 700
	2014	19 240 182	4 185 000	7 700 900	12 430 000	15 700	19 775	25 000
	2015	20 001 663	3 920 000	7 397 212	12 220 000	14 200	18 392	24 000
	2016	20 788 789	3 908 000	7 457 829	12 450 000	13 700	18 164	24 400
	2017	21 602 388	4 050 000	7 702 777	12 850 000	12 700	17 120	23 700
	2018	22 442 831	4 215 000	8 002 454	13 360 000	12 300	17 084	24 200

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Nigeria	2010	158 503 203	51 570 000	63 227 343	77 010 000	142 000	153 437	166 000
	2011	162 805 080	49 400 000	60 654 202	73 960 000	132 000	143 660	157 000
	2012	167 228 803	46 370 000	58 151 864	72 090 000	124 000	136 386	150 000
	2013	171 765 819	44 150 000	56 451 623	70 980 000	112 000	123 585	137 000
	2014	176 404 931	43 450 000	55 462 568	69 290 000	108 000	121 382	137 000
	2015	181 137 454	42 460 000	53 631 431	66 830 000	98 300	111 554	128 000
	2016	185 960 244	38 610 000	52 324 868	68 990 000	90 600	104 403	122 000
	2017	190 873 247	37 020 000	54 029 359	76 150 000	82 100	95 916	115 000
	2018	195 874 685	38 940 000	57 184 148	81 230 000	80 800	95 844	117 000
Rwanda	2010	10 039 338	852 000	1 268 118	1 751 000	3 020	3 132	3 260
	2011	10 293 333	301 000	404 386	514 000	2 970	3 098	3 260
	2012	10 549 668	595 000	753 855	916 000	2 940	3 092	3 290
	2013	10 811 538	1 095 000	1 313 059	1 550 000	2 920	3 088	3 320
	2014	11 083 629	1 827 000	2 436 249	3 069 000	2 920	3 100	3 370
	2015	11 369 066	2 892 000	3 887 798	4 907 000	2 920	3 123	3 420
	2016	11 668 829	5 035 000	6 832 535	8 707 000	2 950	3 153	3 480
	2017	11 980 960	4 706 000	6 449 821	8 267 000	2 980	3 194	3 550
	2018	12 301 969	4 369 000	5 984 752	7 678 000	3 020	3 244	3 630
Sao Tome and Principe[1,2]	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	–
Senegal	2010	12 678 143	526 000	751 511	1 001 000	4 090	4 194	4 310
	2011	13 033 814	455 000	650 480	867 000	4 080	4 187	4 310
	2012	13 401 990	522 000	762 806	1 032 000	4 060	4 166	4 290
	2013	13 782 429	659 000	935 859	1 238 000	4 050	4 159	4 290
	2014	14 174 740	410 000	560 097	732 000	4 140	4 279	4 450
	2015	14 578 450	692 000	1 017 535	1 381 000	4 170	4 331	4 530
	2016	14 993 514	468 000	684 544	920 000	4 190	4 373	4 600
	2017	15 419 354	561 000	807 277	1 072 000	4 220	4 418	4 680
	2018	15 854 324	618 000	883 919	1 163 000	4 260	4 480	4 780
Sierra Leone	2010	6 415 636	2 295 000	2 943 081	3 698 000	13 100	14 100	15 100
	2011	6 563 238	2 319 000	2 977 428	3 753 000	11 800	12 757	13 700
	2012	6 712 586	2 390 000	3 003 669	3 738 000	10 000	10 831	11 700
	2013	6 863 975	2 304 000	2 970 027	3 765 000	8 390	9 151	9 990
	2014	7 017 153	2 187 000	2 872 180	3 698 000	7 220	7 975	8 820
	2015	7 171 909	2 255 000	2 895 435	3 672 000	6 530	7 329	8 210
	2016	7 328 846	2 311 000	2 868 006	3 530 000	6 110	6 983	7 940
	2017	7 488 427	2 000 000	2 726 766	3 625 000	5 830	6 786	7 860
	2018	7 650 149	1 433 000	2 451 110	3 979 000	5 520	6 564	7 770
South Africa[1,2]	2010	5 121 696	–	8 060	–	–	83	–
	2011	5 200 375	–	9 866	–	–	54	–
	2012	5 283 265	–	6 621	–	–	72	–
	2013	5 368 712	–	8 645	–	–	105	–
	2014	5 454 418	–	11 705	–	–	174	–
	2015	5 538 636	–	1 157	–	–	110	–
	2016	5 620 764	–	4 323	–	–	34	–
	2017	5 700 975	–	22 517	–	–	301	–
	2018	5 779 252	–	9 540	–	–	69	–
South Sudan[4]	2010	9 508 372	1 464 000	2 319 793	3 495 000	4 360	5 010	5 810
	2011	9 830 695	1 428 000	2 318 780	3 552 000	4 180	4 841	5 660
	2012	10 113 648	1 449 000	2 353 290	3 599 000	4 020	4 678	5 520
	2013	10 355 030	1 485 000	2 427 031	3 747 000	3 980	4 695	5 620
	2014	10 554 882	1 531 000	2 492 468	3 867 000	4 080	4 910	6 080
	2015	10 715 657	1 576 000	2 575 568	3 926 000	4 100	5 056	6 440
	2016	10 832 520	1 598 000	2 649 109	4 068 000	4 120	5 188	6 800
	2017	10 910 774	1 627 000	2 681 845	4 161 000	4 130	5 328	7 230
	2018	10 975 924	1 578 000	2 589 443	4 048 000	4 080	5 356	7 490
Togo	2010	6 421 674	1 489 000	1 983 506	2 596 000	4 520	4 947	5 420
	2011	6 595 939	1 570 000	2 067 173	2 686 000	4 280	4 715	5 200
	2012	6 773 807	1 855 000	2 368 811	2 987 000	4 100	4 554	5 050
	2013	6 954 721	2 182 000	2 680 257	3 253 000	4 040	4 532	5 080
	2014	7 137 997	2 247 000	2 745 866	3 324 000	4 240	4 812	5 470
	2015	7 323 162	2 170 000	2 667 930	3 237 000	4 430	5 129	5 950
	2016	7 509 952	1 953 000	2 439 684	3 008 000	4 440	5 244	6 220
	2017	7 698 476	1 678 000	2 141 714	2 694 000	4 310	5 199	6 320
	2018	7 889 095	1 508 000	2 108 823	2 901 000	4 170	5 132	6 410

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AFRICAN								
Uganda	2010	32 428 164	10 870 000	13 533 746	16 620 000	19 300	20 412	21 700
	2011	33 476 772	10 210 000	12 912 102	16 120 000	16 400	17 358	18 500
	2012	34 558 700	8 748 000	11 465 552	14 640 000	14 000	14 920	15 900
	2013	35 694 519	6 542 000	9 074 826	12 200 000	12 600	13 402	14 300
	2014	36 911 530	5 749 000	8 143 369	11 020 000	12 100	13 029	14 000
	2015	38 225 447	6 554 000	9 025 492	12 200 000	11 800	12 800	14 000
	2016	39 649 173	9 342 000	12 069 689	15 300 000	11 800	13 036	14 500
	2017	41 166 588	10 840 000	13 863 230	17 470 000	11 800	13 272	15 000
	2018	42 729 032	7 623 000	12 356 577	18 970 000	11 700	13 203	15 200
United Republic of Tanzania	2010	44 346 532	4 688 000	6 450 494	8 725 000	18 600	19 241	20 000
	2011	45 673 520	4 389 000	6 050 835	8 096 000	18 500	19 107	19 800
	2012	47 053 033	3 992 000	5 469 691	7 351 000	18 400	19 127	19 900
	2013	48 483 132	3 944 000	5 419 407	7 268 000	19 100	19 946	20 900
	2014	49 960 563	4 368 000	5 942 515	7 966 000	19 300	20 253	21 300
	2015	51 482 638	4 569 000	6 267 687	8 287 000	19 600	20 624	21 900
	2016	53 049 231	4 818 000	6 555 045	8 675 000	19 800	20 922	22 400
	2017	54 660 345	5 025 000	6 775 567	8 955 000	19 900	21 163	22 900
	2018	56 313 444	4 677 000	6 997 809	10 090 000	20 100	21 550	23 500
Zambia	2010	13 605 986	1 885 000	2 408 568	3 042 000	6 080	6 286	6 520
	2011	14 023 199	2 067 000	2 618 128	3 274 000	6 250	6 479	6 740
	2012	14 465 148	2 270 000	2 937 598	3 724 000	6 480	6 739	7 030
	2013	14 926 551	2 599 000	3 369 958	4 296 000	6 640	6 935	7 270
	2014	15 399 793	2 632 000	3 433 829	4 420 000	6 930	7 303	7 720
	2015	15 879 370	2 410 000	3 216 354	4 211 000	6 960	7 389	7 890
	2016	16 363 449	2 042 000	2 968 175	4 180 000	6 930	7 417	8 030
	2017	16 853 608	1 730 000	2 697 352	3 997 000	6 860	7 419	8 140
	2018	17 351 714	1 709 000	2 719 036	4 096 000	6 890	7 519	8 390
Zimbabwe	2010	9 998 533	606 000	1 094 108	1 709 000	73	2 800	6 220
	2011	10 153 338	468 000	717 620	989 000	52	1 837	3 690
	2012	10 327 222	402 000	590 910	793 000	44	1 512	3 010
	2013	10 512 448	613 000	861 512	1 122 000	66	2 205	4 280
	2014	10 698 542	805 000	1 090 113	1 397 000	86	2 790	5 320
	2015	10 878 022	717 000	1 062 200	1 448 000	80	2 719	5 430
	2016	11 047 866	489 000	726 722	995 000	54	1 860	3 740
	2017	11 210 282	805 000	1 216 876	1 710 000	90	3 115	6 410
	2018	11 369 510	393 000	579 888	789 000	43	1 484	2 960
AMERICAS								
Argentina[1,2,3]	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	–
Belize[1,2]	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	–
Bolivia (Plurinational State of)	2010	4 558 757	15 000	18 659	23 000	2	10	18
	2011	4 633 319	7 600	9 680	12 000	1	4	8
	2012	4 708 051	8 600	10 972	13 000	1	4	8
	2013	4 782 769	8 500	10 804	13 000	1	6	11
	2014	4 857 236	8 500	10 952	13 000	1	4	8
	2015	4 931 282	7 300	9 315	11 000	1	3	6
	2016	5 004 817	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
Brazil[2]	2010	39 729 868	349 000	389 809	422 000	–	76	–
	2011	40 095 451	273 000	284 024	303 000	–	70	–
	2012	40 455 320	248 000	258 095	275 000	–	60	–
	2013	40 810 288	176 000	196 793	213 000	–	40	–
	2014	41 161 040	142 000	148 071	158 000	–	36	–
	2015	41 507 767	144 000	161 093	174 000	–	35	–
	2016	41 851 100	129 000	134 862	144 000	–	35	–
	2017	42 190 266	197 000	220 848	239 000	–	34	–
	2018	42 522 271	207 000	217 900	232 000	–	44	–

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Colombia[2]	2010	10 011 898	125 000	164 479	206 000	–	42	–
	2011	10 109 321	64 000	84 072	105 000	–	23	–
	2012	10 200 749	64 000	84 176	105 000	–	24	–
	2013	10 293 683	55 000	72 310	91 000	–	10	–
	2014	10 398 227	43 000	57 024	71 000	–	17	–
	2015	10 520 647	54 000	73 007	94 000	–	18	–
	2016	10 665 522	88 000	115 550	145 000	–	36	–
	2017	10 828 150	60 000	80 963	104 000	–	19	–
	2018	10 994 461	71 000	93 468	117 000	–	9	–
Costa Rica[1,2]	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	–
Dominican Republic	2010	5 340 225	2 600	3 202	3 800	0	8	14
	2011	5 405 278	1 700	2 088	2 500	0	5	9
	2012	5 470 107	1 000	1 232	1 500	0	3	5
	2013	5 534 723	610	751	900	0	1	3
	2014	5 599 144	480	566	660	0	1	2
	2015	5 663 311	660	779	910	0	1	3
	2016	5 727 240	760	933	1 100	0	2	4
	2017	5 790 831	300	349	400	0	0	1
	2018	5 853 645	600	704	820	0	1	3
Ecuador[1,2]	2010	437 453	–	1 871	–	–	0	–
	2011	444 237	–	1 219	–	–	0	–
	2012	450 946	–	544	–	–	0	–
	2013	457 747	–	368	–	–	0	–
	2014	464 868	–	242	–	–	0	–
	2015	472 450	–	618	–	–	0	–
	2016	480 584	–	1 191	–	–	0	–
	2017	489 125	–	1 275	–	–	0	–
	2018	497 838	–	1 653	–	–	0	–
El Salvador[1,2]	2010	1 255 327	–	19	–	–	0	–
	2011	1 260 745	–	10	–	–	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	–
French Guiana	2010	128 915	1 800	2 260	2 900	0	4	8
	2011	131 893	1 300	1 412	1 600	0	2	4
	2012	134 816	940	1 052	1 200	0	2	3
	2013	137 797	960	1 123	1 300	0	2	3
	2014	140 961	480	541	620	0	0	1
	2015	144 406	410	460	530	–	0	–
	2016	148 180	240	267	310	–	0	–
	2017	152 257	610	681	780	–	0	–
	2018	156 543	230	444	710	–	0	–
Guatemala	2010	11 044 796	7 900	9 657	12 000	1	3	6
	2011	11 285 142	7 100	7 961	9 200	1	2	5
	2012	11 528 212	5 600	6 251	7 200	0	2	3
	2013	11 773 597	6 500	7 263	8 400	0	2	4
	2014	12 020 770	5 900	6 625	7 600	0	2	4
	2015	12 269 280	7 100	7 967	9 200	1	2	5
	2016	12 518 897	5 100	5 656	6 500	0	2	3
	2017	12 769 455	3 900	4 380	5 000	0	1	2
	2018	13 020 750	3 100	3 521	4 000	0	1	2
Guyana	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	52 000	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	1	22	41
	2016	771 363	14 000	19 269	26 000	2	24	46
	2017	775 218	19 000	25 235	35 000	3	33	63
	2018	779 007	26 000	34 565	47 000	4	43	83

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Haiti	2010	8 888 919	44 000	77 638	125 000	5	198	450
	2011	9 023 827	50 000	81 483	127 000	5	208	460
	2012	9 158 378	36 000	59 798	92 000	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	24 000	36 765	50 000	2	94	190
	2017	9 811 866	23 000	34 878	47 000	2	89	180
	2018	9 937 674	11 000	16 000	22 000	1	40	81
Honduras	2010	7 533 978	10 000	13 306	16 000	2	7	13
	2011	7 681 807	8 000	10 124	12 000	1	5	8
	2012	7 826 756	6 800	8 677	11 000	1	4	7
	2013	7 969 720	5 700	7 317	8 900	1	5	10
	2014	8 111 981	3 600	4 553	5 600	0	3	5
	2015	8 254 486	3 800	4 849	5 900	0	4	7
	2016	8 397 503	4 800	6 230	7 800	0	6	11
	2017	8 540 802	1 500	1 876	2 300	0	0	1
	2018	8 684 378	900	1 154	1 400	–	0	–
Mexico[1,2]	2010	2 419 227	–	1 226	–	–	0	–
	2011	2 453 206	–	1 124	–	–	0	–
	2012	2 486 681	–	833	–	–	0	–
	2013	2 519 611	–	495	–	–	0	–
	2014	2 552 010	–	656	–	–	0	–
	2015	2 583 882	–	517	–	–	0	–
	2016	2 615 160	–	551	–	–	0	–
	2017	2 645 279	–	736	–	–	0	–
	2018	2 675 244	–	803	–	–	0	–
Nicaragua	2010	2 542 195	730	876	1 000	–	0	–
	2011	2 576 668	970	1 171	1 400	–	0	–
	2012	2 611 368	1 300	1 564	1 800	0	0	1
	2013	2 646 258	1 200	1 471	1 700	0	0	1
	2014	2 681 297	1 200	1 446	1 700	–	0	–
	2015	2 716 435	2 400	2 886	3 400	0	1	2
	2016	2 751 676	6 600	7 943	9 400	1	6	10
	2017	2 786 983	12 000	13 866	16 000	2	10	16
	2018	2 822 191	17 000	20 158	24 000	3	10	18
Panama[2]	2010	3 524 055	420	440	470	–	1	–
	2011	3 585 766	360	372	400	–	0	–
	2012	3 647 832	860	888	950	–	1	–
	2013	3 710 534	720	751	800	–	0	–
	2014	3 774 253	960	1 007	1 100	–	0	–
	2015	3 839 244	550	575	610	–	0	–
	2016	3 905 593	780	809	860	–	0	–
	2017	3 973 006	760	801	860	–	0	–
	2018	4 040 827	750	786	840	–	0	–
Paraguay[1,2,3]	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	–
Peru[2]	2010	11 400 969	33 000	37 849	43 000	–	0	–
	2011	11 493 910	26 000	30 924	36 000	–	1	–
	2012	11 589 145	33 000	40 437	48 000	–	7	–
	2013	11 694 090	51 000	62 669	75 000	–	4	–
	2014	11 818 354	69 000	83 936	100 000	–	4	–
	2015	11 967 748	76 000	93 936	113 000	–	5	–
	2016	12 146 571	60 000	72 836	87 000	–	7	–
	2017	12 350 062	59 000	72 518	86 000	–	10	–
	2018	12 564 103	48 000	58 455	70 000	–	4	–
Suriname[1,2]	2010	78 151	–	1 823	–	–	1	–
	2011	79 045	–	771	–	–	1	–
	2012	79 942	–	554	–	–	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	–

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
AMERICAS								
Venezuela (Bolivarian Republic of)	2010	14 219 971	48 000	57 926	74 000	8	53	91
	2011	14 443 936	48 000	53 539	62 000	8	47	77
	2012	14 680 413	55 000	61 768	71 000	9	56	92
	2013	14 890 523	82 000	91 924	106 000	13	104	170
	2014	15 021 486	94 000	105 721	122 000	15	110	180
	2015	15 040 913	142 000	158 987	182 000	25	149	240
	2016	14 925 624	251 000	280 468	321 000	44	260	420
	2017	14 701 240	428 000	479 761	549 000	78	421	680
	2018	14 443 558	422 000	471 995	541 000	75	423	680
EASTERN MEDITERRANEAN								
Afghanistan	2010	22 496 454	171 000	339 820	571 000	54	192	400
	2011	23 214 771	204 000	438 076	736 000	65	232	480
	2012	24 019 470	126 000	267 829	467 000	33	113	240
	2013	24 873 691	126 000	224 236	370 000	34	103	210
	2014	25 722 516	220 000	325 811	461 000	54	156	290
	2015	26 526 314	263 000	395 552	561 000	66	187	340
	2016	27 273 556	506 000	712 132	975 000	120	341	610
	2017	27 977 405	573 000	757 412	982 000	140	353	620
	2018	28 652 489	633 000	831 091	1 068 000	140	383	670
Djibouti[1,2]	2010	630 077	–	1 010	–	–	0	–
	2011	640 184	1 700	2 189	2 700	–	0	–
	2012	651 032	1 700	2 153	2 600	–	0	–
	2013	662 401	–	1 684	–	–	17	–
	2014	673 958	–	9 439	–	–	28	–
	2015	685 425	–	9 473	–	–	23	–
	2016	696 763	–	13 804	–	–	5	–
	2017	707 999	–	14 671	–	–	0	–
	2018	719 115	–	25 319	–	–	0	–
Egypt[1,2]	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	–
Iran (Islamic Republic of)[1,2]	2010	753 410	–	1 847	–	–	0	–
	2011	762 321	–	1 632	–	–	0	–
	2012	771 564	–	756	–	–	0	–
	2013	781 186	–	479	–	–	0	–
	2014	791 235	–	358	–	–	0	–
	2015	801 719	–	167	–	–	0	–
	2016	812 666	–	81	–	–	0	–
	2017	823 680	–	60	–	–	0	–
	2018	835 180	–	0	–	–	0	–
Morocco[1,2,3]	2010	32 343 384	–	0	–	–	0	–
	2011	32 781 860	–	0	–	–	0	–
	2012	33 241 898	–	0	–	–	0	–
	2013	33 715 705	–	0	–	–	0	–
	2014	34 192 358	–	0	–	–	0	–
	2015	34 663 608	–	0	–	–	0	–
	2016	35 126 274	–	0	–	–	0	–
	2017	35 581 257	–	0	–	–	0	–
	2018	36 029 089	–	0	–	–	0	–
Oman[1,2]	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	–
Pakistan	2010	176 393 981	640 000	1 445 704	3 037 000	190	1 616	4 280
	2011	180 243 369	918 000	1 905 938	3 739 000	280	1 814	4 360
	2012	184 116 776	774 000	1 652 576	3 284 000	220	1 703	4 270
	2013	188 030 212	750 000	1 419 225	2 716 000	220	1 047	2 420
	2014	192 006 115	724 000	1 373 305	2 723 000	220	897	2 100
	2015	196 058 432	526 000	992 598	2 028 000	160	716	1 780
	2016	200 191 818	800 000	1 202 476	1 996 000	200	1 012	2 110
	2017	204 394 674	707 000	970 992	1 468 000	160	756	1 430
	2018	208 643 752	545 000	705 532	987 000	120	495	880

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EASTERN MEDITERRANEAN								
Saudi Arabia[1,2]	2010	2 196 624	–	29	–	–	0	–
	2011	2 264 403	–	69	–	–	0	–
	2012	2 335 482	–	82	–	–	0	–
	2013	2 407 350	–	34	–	–	0	–
	2014	2 476 605	–	30	–	–	0	–
	2015	2 540 776	–	83	–	–	0	–
	2016	2 598 914	–	272	–	–	0	–
	2017	2 651 735	–	177	–	–	0	–
	2018	2 699 927	–	61	–	–	0	–
Somalia	2010	12 043 886	214 000	356 323	526 000	24	912	2 000
	2011	12 376 305	181 000	301 405	441 000	20	771	1 680
	2012	12 715 487	188 000	310 864	454 000	21	795	1 730
	2013	13 063 711	223 000	366 378	546 000	26	937	2 070
	2014	13 423 571	265 000	430 886	640 000	30	1 103	2 440
	2015	13 797 204	304 000	514 253	769 000	35	1 316	2 920
	2016	14 185 635	311 000	528 591	795 000	35	1 353	3 020
	2017	14 589 165	320 000	541 768	813 000	37	1 386	3 100
	2018	15 008 225	305 000	514 396	772 000	35	1 316	2 960
Sudan	2010	34 545 014	779 000	1 059 304	1 405 000	87	2 711	5 160
	2011	35 349 676	781 000	1 059 374	1 400 000	88	2 711	5 090
	2012	36 193 781	797 000	1 091 647	1 457 000	90	2 794	5 400
	2013	37 072 555	812 000	1 166 089	1 645 000	92	2 985	5 900
	2014	37 977 657	827 000	1 267 868	1 843 000	97	3 245	6 680
	2015	38 902 948	847 000	1 395 818	2 202 000	100	3 573	7 710
	2016	39 847 433	842 000	1 662 933	2 933 000	110	4 257	10 100
	2017	40 813 398	871 000	1 908 105	3 652 000	120	4 884	12 100
	2018	41 801 532	904 000	1 954 302	3 686 000	120	5 003	12 300
Syrian Arab Republic[1,2]	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	–
United Arab Emirates[1,2,3]	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	–
Yemen	2010	18 035 338	649 000	1 131 912	2 191 000	82	2 866	7 350
	2011	18 543 752	492 000	792 413	1 326 000	60	2 013	4 620
	2012	19 062 181	577 000	859 569	1 302 000	67	2 193	4 690
	2013	19 587 110	494 000	700 432	1 006 000	56	1 786	3 670
	2014	20 113 940	412 000	585 987	850 000	46	1 495	3 080
	2015	20 639 226	362 000	513 816	737 000	40	1 309	2 700
	2016	17 515 888	464 000	661 252	949 000	54	1 668	3 420
	2017	17 945 659	525 000	747 173	1 073 000	64	1 853	3 800
	2018	18 373 670	587 000	842 226	1 233 000	68	2 138	4 400
EUROPEAN								
Armenia[1,2,3]	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	–
Azerbaijan[1,2]	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	–

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
EUROPEAN								
Georgia[1,2]	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	–
Kazakhstan[1,2]	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	–
Kyrgyzstan[1,2,3]	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	–
Tajikistan[1,2]	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	–
Turkey[1,2]	2010	4 701 254	–	0	–	–	0	–
	2011	4 773 811	–	0	–	–	0	–
	2012	4 852 317	–	0	–	–	0	–
	2013	4 935 154	–	0	–	–	0	–
	2014	5 019 902	–	0	–	–	0	–
	2015	5 104 411	–	0	–	–	0	–
	2016	5 188 811	–	0	–	–	0	–
	2017	5 272 569	–	0	–	–	0	–
	2018	5 352 105	–	0	–	–	0	–
Turkmenistan[1,2,3]	2010	5 087 211	–	0	–	–	0	–
	2011	5 174 076	–	0	–	–	0	–
	2012	5 267 906	–	0	–	–	0	–
	2013	5 366 376	–	0	–	–	0	–
	2014	5 466 324	–	0	–	–	0	–
	2015	5 565 283	–	0	–	–	0	–
	2016	5 662 371	–	0	–	–	0	–
	2017	5 757 667	–	0	–	–	0	–
	2018	5 850 902	–	0	–	–	0	–
Uzbekistan[1,2,3]	2010	2 028 390	–	0	–	–	0	–
	2011	2 061 459	–	0	–	–	0	–
	2012	2 095 284	–	0	–	–	0	–
	2013	2 129 847	–	0	–	–	0	–
	2014	2 165 068	–	0	–	–	0	–
	2015	2 200 922	–	0	–	–	0	–
	2016	2 237 184	–	0	–	–	0	–
	2017	2 273 336	–	0	–	–	0	–
	2018	2273336	–	0	–	–	0	–
SOUTH-EAST ASIA								
Bangladesh	2010	15 868 196	59 000	68 774	80 000	6	165	290
	2011	16 050 743	54 000	63 356	73 000	5	155	270
	2012	16 237 042	31 000	35 747	41 000	3	87	150
	2013	16 425 823	23 000	25 366	29 000	2	60	100
	2014	16 614 636	49 000	54 801	61 000	4	133	220
	2015	16 801 613	41 000	45 658	51 000	4	109	180
	2016	16 986 651	29 000	31 662	35 000	2	74	120
	2017	17 170 973	30 000	33 444	37 000	2	77	130
	2018	17 352 837	11 000	12 021	13 000	0	26	44

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
SOUTH-EAST ASIA								
Bhutan[1,2]	2010	507 271	–	526	–	–	2	–
	2011	513 039	–	228	–	–	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	–
Democratic People's Republic of Korea[1,2]	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	–	3 598	–	–	0	–
India	2010	1 153 311 084	14 840 000	20 200 000	28 480 000	2 730	30 495	57 800
	2011	1 168 267 799	12 770 000	17 240 000	24 290 000	2 370	25 574	48 300
	2012	1 182 743 793	10 290 000	14 020 000	19 840 000	1 920	20 433	38 800
	2013	1 196 817 595	8 172 000	10 960 000	15 210 000	1 490	16 706	31 200
	2014	1 210 608 062	8 383 000	11 140 000	15 520 000	1 350	20 128	37 700
	2015	1 224 205 084	8 941 000	11 840 000	16 220 000	1 470	21 667	40 900
	2016	1 237 627 593	8 826 000	12 370 000	17 930 000	1 550	22 316	44 500
	2017	1 250 859 582	6 832 000	9 348 000	13 250 000	1 210	16 310	31 700
	2018	1 263 908 949	4 659 000	6 737 000	9 541 000	930	9 620	18 300
Indonesia	2010	241 834 226	2 120 000	2 665 491	3 501 000	370	4 260	8 000
	2011	245 115 988	1 930 000	2 424 712	3 190 000	330	3 820	7 160
	2012	248 451 714	1 913 000	2 405 245	3 147 000	320	3 785	7 120
	2013	251 805 314	1 632 000	2 047 233	2 686 000	270	3 256	6 100
	2014	255 128 076	1 241 000	1 556 734	2 041 000	210	2 510	4 700
	2015	258 383 257	1 108 000	1 391 240	1 830 000	190	2 190	4 080
	2016	261 556 386	1 154 000	1 448 007	1 896 000	190	2 516	4 740
	2017	264 650 969	1 428 000	1 792 690	2 338 000	230	3 138	5 890
	2018	267 670 549	933 000	1 034 866	1 154 000	140	1 785	2 930
Myanmar	2010	30 116 448	1 384 000	2 017 346	3 108 000	230	3 882	8 320
	2011	30 348 439	1 014 000	1 319 917	1 761 000	160	2 466	4 620
	2012	30 600 253	1 355 000	1 892 905	2 749 000	220	3 680	7 500
	2013	30 861 393	455 000	611 838	840 000	74	1 169	2 290
	2014	31 116 339	281 000	383 705	535 000	46	729	1 440
	2015	31 354 355	220 000	272 329	328 000	34	482	850
	2016	31 571 282	131 000	161 570	195 000	20	273	480
	2017	31 772 208	98 000	120 755	145 000	15	209	370
	2018	31 966 116	88 000	108 815	131 000	14	172	300
Nepal	2010	7 841 339	15 000	30 320	63 000	3	27	70
	2011	7 849 471	14 000	23 802	45 000	3	9	23
	2012	7 834 359	12 000	18 349	33 000	2	9	20
	2013	7 813 353	7 000	10 222	18 000	1	6	14
	2014	7 810 214	3 000	4 885	9 800	0	3	8
	2015	7 841 869	2 500	4 483	9 600	0	2	7
	2016	7 913 973	2 300	3 372	5 900	0	2	4
	2017	8 021 214	2 500	3 104	4 100	0	1	2
	2018	8 155 623	2 600	3 588	5 300	0	1	2
Sri Lanka[1,2,3]	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	–
Thailand[1,2]	2010	12 751 063	–	32 480	–	–	80	–
	2011	12 812 422	–	24 897	–	–	43	–
	2012	12 872 689	–	32 569	–	–	37	–
	2013	12 931 240	–	33 302	–	–	47	–
	2014	12 987 073	–	37 921	–	–	38	–
	2015	13 039 404	–	17 427	–	–	33	–
	2016	13 088 134	–	13 451	–	–	27	–
	2017	13 133 254	–	12 515	–	–	15	–
	2018	13 174 743	–	4 782	–	–	8	–

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
SOUTH-EAST ASIA								
Timor-Leste	2010	1 028 463	72 000	102 579	136 000	11	198	380
	2011	1 046 931	26 000	32 736	41 000	3	69	130
	2012	1 065 599	6 500	7 740	9 100	0	10	17
	2013	1 084 678	1 400	1 692	2 000	0	2	3
	2014	1 104 471	480	568	660	0	0	1
	2015	1 125 125	120	139	160	–	0	–
	2016	1 146 752	110	130	150	–	0	–
	2017	1 169 297	31	37	43	–	0	–
	2018	1 192 542	–	0	–	–	0	–
WESTERN PACIFIC								
Cambodia	2010	10 121 505	292 000	353 293	428 000	45	644	1 120
	2011	10 283 605	321 000	368 041	426 000	47	641	1 080
	2012	10 452 648	226 000	260 016	301 000	35	383	640
	2013	10 626 530	147 000	168 806	196 000	23	231	380
	2014	10 802 038	208 000	240 449	282 000	31	399	670
	2015	10 976 665	189 000	218 837	255 000	28	374	630
	2016	11 149 825	107 000	124 137	145 000	16	204	340
	2017	11 321 696	175 000	202 696	237 000	27	336	560
	2018	11 491 692	235 000	272 272	320 000	42	265	430
China[1,2]	2010	575 598 390	–	4 990	–	–	19	–
	2011	578 835 356	–	3 367	–	–	33	–
	2012	582 081 652	–	244	–	–	0	–
	2013	585 315 386	–	86	–	–	0	–
	2014	588 506 114	–	56	–	–	0	–
	2015	591 624 804	–	39	–	–	0	–
	2016	594 665 143	–	3	–	–	0	–
	2017	597 615 756	–	0	–	–	0	–
	2018	600 418 023	–	0	–	–	0	–
Lao People's Democratic Republic	2010	3 251 667	36 000	51 184	69 000	3	127	250
	2011	3 302 866	26 000	35 886	48 000	2	85	160
	2012	3 353 319	70 000	96 451	127 000	9	211	400
	2013	3 403 674	58 000	79 309	105 000	9	145	280
	2014	3 454 907	75 000	103 303	137 000	13	157	300
	2015	3 507 668	57 000	78 225	103 000	10	100	190
	2016	3 562 141	20 000	27 668	37 000	3	33	62
	2017	3 617 940	15 000	20 357	27 000	2	29	56
	2018	3 674 379	11 000	15 437	20 000	1	23	44
Malaysia[1,2]	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	–	–	10	–
	2018	1 261 121	–	0	–	–	12	–
Papua New Guinea	2010	7 310 512	463 000	1 240 109	2 159 000	110	2 633	6 270
	2011	7 472 196	389 000	1 045 967	1 826 000	87	2 344	5 580
	2012	7 631 003	420 000	1 296 356	2 600 000	100	2 793	7 230
	2013	7 788 388	952 000	1 677 722	2 572 000	140	4 043	8 660
	2014	7 946 733	1 177 000	1 931 287	2 943 000	220	3 728	7 750
	2015	8 107 772	739 000	1 066 533	1 461 000	120	2 227	4 310
	2016	8 271 766	1 056 000	1 469 150	1 965 000	160	3 108	5 970
	2017	8 438 038	1 036 000	1 500 657	2 077 000	170	3 053	5 970
	2018	8 606 324	1 096 000	1 587 573	2 180 000	180	3 124	6 060
Philippines	2010	54 570 270	37 000	53 401	71 000	5	112	220
	2011	55 501 350	17 000	23 891	31 000	2	47	90
	2012	56 455 267	14 000	19 138	25 000	1	35	67
	2013	57 418 668	13 000	17 518	23 000	1	35	68
	2014	58 371 999	11 000	14 543	19 000	0	31	59
	2015	59 301 223	20 000	28 020	37 000	2	62	120
	2016	60 201 722	12 000	17 491	23 000	1	38	74
	2017	61 078 122	13 000	18 685	25 000	1	41	81
	2018	61 936 730	7 700	10 947	15 000	0	24	48
Republic of Korea[1,2]	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	3 582 019	–	501	–	–	0	–

WHO region Country/area	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
WESTERN PACIFIC								
Solomon Islands	2010	522 582	65 000	91 425	130 000	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	170
	2013	565 615	40 000	53 689	74 000	6	83	160
	2014	581 208	25 000	30 591	38 000	3	48	87
	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	15	134	250
	2018	646 327	75 000	86 343	101 000	12	109	180
Vanuatu	2010	236 216	13 000	15 669	19 000	1	20	35
	2011	242 658	8 900	11 631	16 000	1	14	27
	2012	249 505	6 500	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	2 266	3 000	–	0	–
	2018	292 675	900	1 167	1 600	–	0	–
Viet Nam	2010	64 831 194	21 000	22 959	26 000	2	45	76
	2011	65 497 232	19 000	20 206	23 000	2	35	58
	2012	66 183 031	22 000	23 838	27 000	2	40	66
	2013	66 883 662	19 000	20 760	23 000	2	33	55
	2014	67 592 098	18 000	19 060	21 000	2	29	47
	2015	68 301 989	10 000	11 283	13 000	1	16	25
	2016	69 011 970	4 600	5 024	5 600	0	7	13
	2017	69 719 633	5 100	5 481	6 100	0	9	15
	2018	70 416 320	5 300	5 794	6 500	0	9	16

Data as of 19 November 2019

"–" 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.

Annex 3 – F. Population at risk and estimated malaria cases and deaths, 2010–2018

WHO region	Year	Population at risk	Cases			Deaths		
			Lower	Point	Upper	Lower	Point	Upper
REGIONAL SUMMARY								
African	2010	742 051 480	199 000 000	219 000 000	245 000 000	507 000	533 000	588 000
	2011	763 387 315	194 000 000	213 000 000	237 000 000	469 000	493 000	537 000
	2012	785 260 919	190 000 000	209 000 000	233 000 000	444 000	469 000	514 000
	2013	807 674 747	185 000 000	204 000 000	229 000 000	419 000	444 000	493 000
	2014	830 636 558	181 000 000	198 000 000	218 000 000	408 000	428 000	462 000
	2015	854 147 991	184 000 000	199 000 000	219 000 000	391 000	411 000	448 000
	2016	878 208 734	189 000 000	206 000 000	229 000 000	371 000	389 000	425 000
	2017	902 801 325	192 000 000	212 000 000	240 000 000	364 000	383 000	423 000
	2018	927 888 238	191 000 000	213 000 000	244 000 000	361 000	380 000	425 000
Americas	2010	126 118 119	744 000	814 000	894 000	220	459	730
	2011	127 739 647	566 000	611 000	666 000	180	444	710
	2012	129 364 372	541 000	580 000	627 000	180	392	600
	2013	130 969 261	520 000	562 000	613 000	180	391	590
	2014	132 522 297	445 000	477 000	512 000	140	289	420
	2015	134 003 416	525 000	566 000	611 000	150	324	460
	2016	135 398 716	640 000	691 000	749 000	210	474	680
	2017	136 722 119	880 000	944 000	1 026 000	250	620	910
	2018	138 017 898	867 000	929 000	1 007 000	220	577	850
Eastern Mediterranean	2010	419 019 843	3 300 000	4 300 000	6 300 000	3 000	8 300	14 400
	2011	427 979 875	3 400 000	4 500 000	6 500 000	3 000	7 500	12 300
	2012	436 754 102	3 200 000	4 200 000	6 000 000	2 900	7 600	12 400
	2013	445 450 169	3 000 000	3 900 000	5 300 000	2 500	6 900	11 100
	2014	454 228 324	3 100 000	4 000 000	5 500 000	2 400	6 900	11 300
	2015	463 210 243	3 000 000	3 800 000	5 200 000	2 300	7 100	12 200
	2016	468 761 159	3 800 000	4 800 000	6 400 000	2 900	8 600	15 300
	2017	478 058 225	3 800 000	4 900 000	6 800 000	3 000	9 200	17 300
	2018	487 588 453	3 700 000	4 900 000	6 800 000	2 600	9 300	17 700
European	2010	37 906 443	–	170	–	–	0	–
	2011	38 469 606	–	69	–	–	0	–
	2012	39 086 200	–	21	–	–	0	–
	2013	39 739 267	–	3	–	–	0	–
	2014	40 405 247	–	2	–	–	0	–
	2015	41 065 655	–	0	–	–	0	–
	2016	41 714 844	–	0	–	–	0	–
	2017	42 352 758	–	0	–	–	0	–
	2018	42 973 389	–	0	–	–	0	–
South-East Asia	2010	1 477 504 120	19 800 000	25 100 000	33 900 000	9 000	39 000	67 000
	2011	1 496 330 952	16 700 000	21 100 000	28 300 000	7 000	32 000	57 000
	2012	1 514 731 269	14 700 000	18 400 000	24 400 000	7 000	28 000	47 000
	2013	1 532 751 942	10 900 000	13 700 000	18 000 000	4 000	21 000	36 000
	2014	1 550 466 894	10 400 000	13 200 000	17 400 000	4 000	24 000	42 000
	2015	1 567 931 968	10 700 000	13 600 000	18 200 000	3 000	25 000	44 000
	2016	1 585 152 940	10 500 000	14 000 000	19 700 000	3 000	25 000	47 000
	2017	1 602 118 493	8 800 000	11 300 000	15 400 000	3 000	20 000	35 000
	2018	1 618 838 836	5 800 000	7 900 000	10 700 000	2 000	12 000	21 000
Western Pacific	2010	721 038 851	1 045 000	1 839 000	2 779 000	800	3 800	7 500
	2011	726 302 437	922 000	1 576 000	2 340 000	600	3 300	6 600
	2012	731 623 901	914 000	1 761 000	3 009 000	700	3 600	8 000
	2013	736 961 516	1 305 000	2 027 000	2 925 000	600	4 600	9 300
	2014	742 256 202	1 588 000	2 345 000	3 339 000	700	4 400	8 500
	2015	747 456 804	1 115 000	1 445 000	1 852 000	500	2 800	5 000
	2016	752 550 363	1 318 000	1 733 000	2 228 000	500	3 500	6 400
	2017	757 527 287	1 392 000	1 854 000	2 420 000	500	3 600	6 500
	2018	762 325 610	1 495 000	1 980 000	2 588 000	500	3 600	6 500
Total	2010	3 523 638 856	231 000 000	251 000 000	278 000 000	541 000	585 000	649 000
	2011	3 580 209 832	222 000 000	241 000 000	266 000 000	499 000	536 000	588 000
	2012	3 636 820 763	214 000 000	234 000 000	260 000 000	474 000	508 000	560 000
	2013	3 693 546 902	205 000 000	224 000 000	250 000 000	446 000	477 000	531 000
	2014	3 750 515 522	202 000 000	218 000 000	239 000 000	434 000	463 000	504 000
	2015	3 807 816 077	203 000 000	219 000 000	240 000 000	416 000	446 000	491 000
	2016	3 861 786 756	210 000 000	227 000 000	251 000 000	398 000	427 000	473 000
	2017	3 919 580 207	211 000 000	231 000 000	259 000 000	390 000	416 000	462 000
	2018	3 977 632 424	206 000 000	228 000 000	258 000 000	384 000	405 000	452 000

Data as of 19 November 2019

Annex 3 – G. Population at risk and reported malaria cases by place of care, 2018

WHO region Country/area	Population			
	UN population	At risk (low + high)	At risk (high)	Number of people living in active foci
AFRICAN				
Algeria	42 228 415	–	–	0
Angola	30 809 787	30 809 787	30 809 787	–
Benin	11 485 035	11 485 035	11 485 035	–
Botswana	2 254 067	1 494 401	94 941	–
Burkina Faso	19 751 466	19 751 466	19 751 466	–
Burundi	11 175 379	11 175 379	11 175 379	–
Cabo Verde	543 764	–	–	162 814
Cameroon	25 216 261	25 216 261	17 903 545	–
Central African Republic	4 666 375	4 666 375	4 666 375	–
Chad	15 477 727	15 308 245	10 425 023	–
Comoros	832 322	832 322	396 019	–
Congo	5 244 363	5 244 363	5 244 363	–
Côte d'Ivoire	25 069 226	25 069 226	25 069 226	–
Democratic Republic of the Congo	84 068 092	84 068 092	81 546 049	–
Equatorial Guinea	1 308 966	1 308 966	1 308 966	–
Eritrea	3 452 797	3 452 797	2 451 486	–
Eswatini	1 136 274	318 156	0	–
Ethiopia	109 224 410	74 272 598	29 709 040	–
Gabon	2 119 275	2 119 275	2 119 275	–
Gambia	2 280 092	2 280 092	2 280 092	–
Ghana	29 767 108	29 767 108	29 767 108	–
Guinea	12 414 292	12 414 292	12 414 292	–
Guinea-Bissau	1 874 304	1 874 304	1 874 304	–
Kenya	51 392 570	51 392 570	36 075 015	–
Liberia	4 818 976	4 818 976	4 818 976	–
Madagascar	26 262 313	26 262 313	23 049 907	–
Malawi	18 143 215	18 143 215	18 143 215	–
Mali	19 077 755	19 077 755	17 389 755	–
Mauritania	4 403 312	4 403 312	2 838 727	–
Mozambique	29 496 009	29 496 009	29 496 009	–
Namibia	2 448 300	1 943 338	1 130 160	–
Niger	22 442 831	22 442 831	22 442 831	–
Nigeria	195 874 685	195 874 685	149 605 167	–
Rwanda	12 301 969	12 301 969	12 301 969	–
Sao Tome and Principe	211 032	211 032	211 032	–
Senegal	15 854 324	15 854 324	15 762 845	–
Sierra Leone	7 650 149	7 650 149	7 650 149	–
South Africa	57 792 520	5 779 252	2 311 701	–
South Sudan[1]	10 975 924	10 975 924	10 975 924	–
Togo	7 889 095	7 889 095	7 889 095	–
Uganda	42 729 032	42 729 032	42 729 032	–
United Republic of Tanzania[2]	56 313 444	56 313 444	55 696 563	–
Mainland	54 720 096	54 720 096	54 720 096	–
Zanzibar	1 593 348	1 593 348	976 467	–
Zambia	17 351 714	17 351 714	17 351 714	–
Zimbabwe	14 438 812	11 369 510	4 131 810	–
AMERICAS				
Belize	383 071	–	–	17 225
Bolivia (Plurinational State of)	11 353 140	5 150 579	283 601	–
Brazil	209 469 320	42 522 271	4 817 794	–
Colombia	49 661 056	10 994 461	4 989 943	–
Costa Rica	4 999 443	–	–	137 832
Dominican Republic	10 627 147	5 853 645	150 374	–
Ecuador	17 084 359	–	–	246 833
El Salvador	6 420 740	–	–	12 700
French Guiana	282 938	156 543	26 115	–
Guatemala	17 247 855	13 020 750	2 353 125	–
Guyana	779 007	779 007	85 021	–

Public sector		Private sector		Community level	
Presumed	Confirmed	Presumed	Confirmed	Presumed	Confirmed
0	1 242 [5]	–	–	–	–
777 685	5 150 575 [3]	–	–	0	241 294
280 134	1 768 450 [4]	323 782	245 807	0	207 362
0	585 [5]	0	2	–	–
1 691 351	10 278 970 [4]	365 492	310 030	20 825	79 954
182 925	4 966 511 [5]	1 399	298 023	0	679 278
0	21 [5]	0	0	–	–
1 221 809	1 249 705	913 574	930 111	70 741	77 817
23 038	972 119	27 653	147 456	9 858	959
–	1 364 706 [3]	–	–	159 503	222 205
4 069	15 613 [5]	0	427	881	3 642
207 712	116 903 [4]	–	–	–	–
531 449	4 766 477 [5]	0	126 327	0	194 076
1 236 233	16 972 207 [3]	–	–	0	1 372 477
0	8 962	–	–	–	–
853	22 955 [4]	–	–	1 033	23 485
0	656 [5]	0	296	–	–
244 804	962 087 [5]	–	–	–	–
685 559	111 719	–	–	–	–
1 206	87 448 [4]	0	1 206	0	4 294
6 222 946	4 931 448 [5]	1 919 308	1 556 857	–	–
384 629	1 214 996 [5]	109 156	53 260	0	299 767
0	171 075	0	5 854	0	4 318
8 429 215	1 521 566	1 738 477	465 581	128 429	330 943
–	–	–	–	–	–
–	972 790 [4]	262 805	51 693	105 350	108 338
0	5 865 476 [3]	–	–	0	1 045 467
0	2 345 475 [5]	0	51 177	0	268 623
145 232	30 609	–	–	–	–
27 629	9 292 928	–	–	7 229	1 011 544
0	36451*	–	–	–	–
311 068	3 046 450 [5]	40 112	47 791	0	93 889
5 916 631	12 953 583	498 219	1 487 171	17 725	107 270
0	1 975 926	0	33 854	0	2 222 103
0	2 940 [5]	–	–	–	547
5 801	530 944 [5]	–	–	1 080	143 876
48 024	1 733 831 [3]	18 871	18 230	245 840	561 180
6 174	10 789 [3]	–	–	0	1 675
4 598 663	98 843	–	–	–	–
291 076	1 090 334 [4]	0	291 076	0	621 467
3 136 262	5 759 174 [5]	340 522	372 612	–	–
166 771	6 053 714 [2]	119 178	494 052	0	442
164 733	6 050 382 [4]	119 178	492 692	–	–
2 038	3 332 [4]	0	1 360	0	442
156 044	5 039 679 [3]	–	–	710 465	393 548
0	184 427 [4]	0	8 630	0	79 591
0	7 [5]	0	2	–	–
0	5 354 [3]	–	–	0	93
0	194 512 [4]	–	–	–	–
0	63 143 [5]	–	–	–	–
0	108* [4]	0	4	–	–
0	484*	0	84	22	137
0	1 806 [5]	0	10	–	–
0	2	0	1	0	0
–	–	–	–	–	–
–	4 769**	0	3	–	–
0	17 038	–	37	0	2 102

Annex 3 - G. Population at risk and reported malaria cases by place of care, 2018

WHO region Country/area	Population			
	UN population	At risk (low + high)	At risk (high)	Number of people living in active foci
AMERICAS				
Haiti	11 123 183	9 937 674	2 696 148	-
Honduras	9 587 523	8 684 378	2 443 668	-
Mexico	126 190 782	-	-	3 120 973
Nicaragua	6 465 502	2 822 191	554 934	-
Panama	4 176 868	4 040 827	176 013	-
Peru	31 989 265	12 564 103	1 601 383	-
Suriname	575 987	85 073	24 456	-
Venezuela (Bolivarian Republic of)	28 887 117	14 443 558	5 990 747	-
EASTERN MEDITERRANEAN				
Afghanistan	37 171 922	28 652 489	10 121 171	-
Djibouti	958 923	719 115	336 659	-
Iran (Islamic Republic of)	81 800 204	835 180	0	-
Pakistan	212 228 288	208 643 752	61 370 054	-
Saudi Arabia	33 702 757	-	-	176 408
Somalia	15 008 225	15 008 225	7 638 736	-
Sudan	41 801 532	41 801 532	36 325 531	-
Yemen	28 498 683	18 373 670	10 964 013	-
SOUTH-EAST ASIA				
Bangladesh	161 376 713	17 352 837	2 038 188	-
Bhutan	754 396	-	-	14 876
Democratic People's Republic of Korea	25 549 606	-	-	12 379 473
India	1 352 642 283	1 263 908 949	164 089 035	-
Indonesia	267 670 549	267 670 549	17 114 855	-
Myanmar	53 708 318	31 966 116	8 491 822	-
Nepal	28 095 712	8 155 623	1 468 563	-
Thailand	69 428 454	13 174 743	1 537 146	-
Timor-Leste	1 267 975	1 192 542	429 432	-
WESTERN PACIFIC				
Cambodia	16 249 795	11 491 692	7 820 376	-
China	1 435 651 150	600 418 023	200 991	-
Lao People's Democratic Republic	7 061 498	3 674 380	3 674 380	-
Malaysia	31 528 033	-	-	3 884
Papua New Guinea	8 606 324	8 606 324	8 089 945	-
Philippines	106 651 394	61 936 730	7 268 293	-
Republic of Korea	51 171 700	3 582 019	0	-
Solomon Islands	652 856	646 327	646 327	-
Vanuatu	292 675	292 675	254 407	-
Viet Nam	95 545 959	70 416 320	6 494 737	-
REGIONAL SUMMARY				
African	1 060 267 778	925 208 989	782 493 367	162 814
Americas	547 304 303	131 055 060	26 193 322	3 535 563
Eastern Mediterranean	451 170 534	314 033 963	126 756 164	176 408
South-East Asia	1 960 494 006	1 603 421 359	195 169 041	12 394 349
Western Pacific	1 753 411 384	761 064 490	34 449 456	3 884
Total	**5 772 648 005**	**3 734 783 861**	**1 165 061 350**	**16 273 018**

UN: United Nations; WHO: World Health Organization.

"–" refers to not applicable or data not available.

* Corrected for double counting of microscopy and RDT.

** Double counting of microscopy and RDT reported, but proportion is not indicated.

[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.

Note: Reported cases include all presumed and confirmed cases.

Public sector		Private sector		Community level	
Presumed	Confirmed	Presumed	Confirmed	Presumed	Confirmed
–	8828* [5]	0	2 049	0	793
0	653*	0	73	32	152
0	826 [5]	0	6	–	–
0	15 934	–	–	–	–
0	715	0	3	–	–
0	45619*	–	–	–	–
0	235 [5]	–	16	0	17
0	404924* [3]	–	–	–	–
126 370	173 493	0	5 365	21 278	69 831
0	25 319 [4]	–	474	–	–
0	625* [5]	–	–	–	–
694 738	374 510 [4]	0	103 693	–	–
0	2 711	–	–	–	–
9	31 021	–	–	–	–
1 974 469	1 606 833 [4]	–	–	4 434	31 184
78 970	113 925	10 253	36 521	0	3 727
0	1 919	0	56	0	8 548
0	54 [5]	0	5	–	–
0	3 598	–	–	–	–
0	429 928 [3]	–	–	–	199 496
0	223 468 [5]	0	28 759	0	2 804
0	74 392 [3]	0	2 126	0	59 832
1 772	1 158 [5]	544	34	–	–
428	5 389	0	656	0	705
0	8* [5]	–	–	0	0
0	42 285	0	0	0	20 297
0	2 513	–	–	–	–
0	8 913 [3]	0	1 228	0	1 804
0	4 630 [5,6]	0	52 [6]	–	–
424 397	516 249	–	–	0	0
0	1 574	0	295	295	2 772
0	576	0	429	–	–
13 239	59 191	–	–	–	–
0	644 [3]	–	–	0	150
0	6 661 [5]	0	39	–	–
36 934 992	113 681 359	6 678 548	6 997 523	1 478 959	10 401 431
0	764 957	0	2 288	54	3 294
2 874 556	2 328 437	10 253	146 053	25 712	104 742
2 200	739 914	544	31 636	0	271 385
437 636	643 236	0	2 043	295	25 023
40 249 384	**118 157 903**	**6 689 345**	**7 179 543**	**1 505 020**	**10 805 875**

Data as of 14 February 2020

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Algeria[1]	Presumed and confirmed	408	191	887	603	266	747	432	453	1 242 [5]
	Microscopy examined	12 224	11 974	15 790	12 762	8 690	8 000	6 628	6 469	10 081
	Confirmed with microscopy	408	191	887	603	266	747	432	453	1 242
	RDT examined	–	–	–	–	–	0	0	0	0
	Confirmed with RDT	–	–	–	–	–	0	0	0	0
	Imported cases	398	190	828	593	260	745	432	453	1 242 [3]
Angola	Presumed and confirmed	3 687 574	3 501 953	3 031 546	3 144 100	3 180 021	3 254 270	4 301 146	4 500 221	5 928 260
	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
	Confirmed with microscopy	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
	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
	Confirmed with RDT	358 606	484 809	440 271	536 927	867 666	1 372 532	1 736 125	1 675 082	2 708 075
	Imported cases	–	–	–	–	–	–	–	–	–
Benin	Presumed and confirmed	1 432 095	1 424 335	1 513 212	1 670 273	1 509 221	1 495 375	1 374 729	1 719 171	2 048 584 [4]
	Microscopy examined	–	88 134	243 008	291 479	155 205	296 264	267 405	267 492	349 191
	Confirmed with microscopy	–	68 745	–	99 368	108 714	108 061	104 601	208 823	258 519
	RDT examined	–	475 986	825 005	1 158 526	1 335 582	1 486 667	1 500 047	2 016 767	2 016 745
	Confirmed with RDT	–	354 223	705 839	979 466	935 521	1 160 286	1 219 975	1 487 954	1 509 931
	Imported cases	–	–	–	–	–	–	–	–	–
Botswana	Presumed and confirmed	12 196	1 141	308	506	1 485	340	718	1 902	585 [5]
	Microscopy examined	–	–	–	–	–	–	5 178	5 223	872
	Confirmed with microscopy	1 046	432	–	–	–	–	–	–	–
	RDT examined	–	–	–	–	–	1 284	7 806	7 380	13 107
	Confirmed with RDT	–	–	193	456	1 346	326	716	1 900	585
	Imported cases	–	–	–	30	30	48	64	62	51
Burkina Faso	Presumed and confirmed	5 723 481	5 024 697	6 970 700	7 146 026	8 278 408	8 286 453	9 785 822	11 915 816	11 970 321 [4]
	Microscopy examined	177 879	400 005	223 372	183 971	198 947	222 190	191 208	133 101	157 824
	Confirmed with microscopy	88 540	83 857	90 089	82 875	83 259	92 589	80 077	46 411	56 989
	RDT examined	940 985	450 281	4 516 273	4 296 350	6 224 055	8 290 188	11 794 810	12 561 490	13 061 136
	Confirmed with RDT	715 999	344 256	3 767 957	3 686 176	5 345 396	6 922 857	9 699 077	10 179 048	10 221 981
	Imported cases	–	–	–	–	–	–	–	–	–
Burundi	Presumed and confirmed	4 255 301	3 298 979	2 570 754	4 469 007	4 831 758	5 243 410	8 383 389	8 133 919	5 149 436 [5]
	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
	Confirmed with microscopy	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
	RDT examined	273 324	181 489	1 148 965	2 933 869	2 903 679	5 076 107	8 307 007	8 058 231	7 009 165
	Confirmed with RDT	163 539	86 542	666 400	1 775 253	1 866 882	3 194 844	5 753 440	5 400 346	3 818 195
	Imported cases	–	–	–	–	–	–	–	–	–
Cabo Verde	Presumed and confirmed	47	36	–	–	46	28	48	446	21 [5]
	Microscopy examined	–	–	8 715	10 621	6 894	3 117	8 393	3 857	16 623
	Confirmed with microscopy	47	–	36	46	46	28	75	446	21
	RDT examined	–	26 508	–	–	–	–	–	–	–
	Confirmed with RDT	–	36	–	–	–	–	–	–	–
	Imported cases	–	29	35	24	20	21	27	23	19
Cameroon	Presumed and confirmed	1 845 691	1 829 266	1 589 317	1 824 633	1 369 518	2 321 933	1 790 891	2 488 993	2 471 514
	Microscopy examined	–	1 110 308	1 182 610	1 236 306	1 086 095	1 024 306	1 373 802	627 709	658 017
	Confirmed with microscopy	–	–	–	–	–	592 351	810 367	390 130	428 888
	RDT examined	–	120 466	93 392	591 670	1 254 293	1 128 818	1 740 375	1 420 522	1 337 354
	Confirmed with RDT	–	–	–	–	–	570 433	864 897	801 127	820 817
	Imported cases	–	–	–	–	–	–	–	–	–
Central African Republic	Presumed and confirmed	66 484	221 980	459 999	407 131	495 238	953 535	1 400 526	1 267 673	995 157
	Microscopy examined	–	–	–	63 695	55 943	139 241	189 481	112 007	163 370
	Confirmed with microscopy	–	–	–	36 943	41 436	106 524	144 924	28 855	117 267
	RDT examined	–	–	55 746	136 548	369 208	724 303	1 249 963	483 714	1 181 578
	Confirmed with RDT	–	–	46 759	79 357	253 652	492 309	887 840	354 454	854 852
	Imported cases	–	–	–	–	–	–	–	–	–

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Chad	Presumed and confirmed	544 243	528 454	660 575	1 272 841	1 513 772	1 490 556	1 402 215	1 962 372	1 364 706 [3]
	Microscopy examined	89 749	–	69 789	–	–	–	1 063 293	1 584 525	190 006
	Confirmed with microscopy	75 342	86 348	–	206 082	160 260	149 574	720 765	1 064 354	137 501
	RDT examined	309 927	114 122	–	621 469	1 137 455	937 775	861 561	1 359 070	1 751 483
	Confirmed with RDT	125 106	94 778	–	548 483	753 772	637 472	574 003	898 018	1 227 205
	Imported cases	–	–	–	–	–	–	–	–	–
Comoros	Presumed and confirmed	103 670	76 661	65 139	62 565	2 465	1 517	1 333	2 274	19 682 [5]
	Microscopy examined	87 595	63 217	125 030	154 824	93 444	89 634	71 902	130 134	90 956
	Confirmed with microscopy	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	11 479	22 219	60 691	24 567
	Confirmed with RDT	1 339	2 578	4 333	7 026	216	337	507	949	6 416
	Imported cases	–	–	–	–	–	–	–	–	–
Congo	Presumed and confirmed	446 656	277 263	117 640	183 026	248 159	264 574	374 252	297 652	324 615 [4]
	Microscopy examined	–	–	–	69 375	88 764	87 547	202 922	153 203	178 017
	Confirmed with microscopy	–	37 744	120 319	43 232	54 523	51 529	134 612	127 939	116 903
	RDT examined	–	–	–	0	19 746	0	60 927	0	0
	Confirmed with RDT	–	–	–	0	11 800	0	37 235	0	0
	Imported cases	–	–	–	–	–	–	–	–	–
Côte d'Ivoire	Presumed and confirmed	1 721 461	2 588 004	2 795 919	4 708 425	4 658 774	3 606 725	3 471 024	3 391 967	5 297 926 [5]
	Microscopy examined	–	49 828	195 546	395 914	568 562	811 426	975 507	1 221 845	1 132 659
	Confirmed with microscopy	62 726	29 976	107 563	215 104	306 926	478 870	579 566	588 969	696 124
	RDT examined	–	–	1 572 785	3 384 765	4 904 066	4 174 097	4 202 868	5 007 162	5 042 040
	Confirmed with RDT	–	–	1 033 064	2 291 849	3 405 905	2 897 034	2 891 458	2 685 714	4 070 353
	Imported cases	–	–	–	–	–	–	–	–	–
Democratic Republic of the Congo	Presumed and confirmed	9 252 959	9 442 144	9 128 398	11 363 817	9 749 369	10 878 974	15 397 717	15 272 767	18 208 440 [3]
	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
	Confirmed with microscopy	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
	RDT examined	54 728	2 912 088	3 327 071	6 096 993	11 114 215	13 574 891	18 630 636	18 994 861	20 671 006
	Confirmed with RDT	42 850	1 861 163	2 134 734	4 103 745	7 842 429	9 724 833	13 483 698	13 885 210	15 976 630
	Imported cases	–	–	–	–	–	–	–	–	–
Equatorial Guinea	Presumed and confirmed	78 095	37 267	20 890	25 162	19 642	8 581	7 542	7 787	8 962
	Microscopy examined	42 585	23 004	33 245	27 039	47 322	21 831	239 938	13 127	8 395
	Confirmed with microscopy	39 636	20 601	13 196	11 235	17 685	8 564	125 623	6 800	4 135
	RDT examined	16 772	2 899	6 826	5 489	9 807	46 227	78 841	78 090	33 174
	Confirmed with RDT	14 177	1 865	1 973	1 894	2 732	6 578	22 091	8 925	4 827
	Imported cases	–	–	–	–	–	–	–	–	–
Eritrea	Presumed and confirmed	53 750	39 567	42 178	34 678	35 725	24 310	47 055	32 444	23 808 [4]
	Microscopy examined	79 024	67 190	84 861	81 541	63 766	59 268	83 599	74 962	70 465
	Confirmed with microscopy	13 894	15 308	11 557	10 890	10 993	8 332	24 251	14 519	10 325
	RDT examined	–	25 570	33 758	39 281	53 032	47 744	–	45 144	74 917
	Confirmed with RDT	22 088	19 540	10 258	10 427	19 775	11 040	–	16 967	12 630
	Imported cases	–	–	–	–	–	–	–	–	–
Eswatini	Presumed and confirmed	1 722	797	626	669	–	651	487	1 127	656 [5]
	Microscopy examined	–	–	–	–	–	–	1 249	371	1 526
	Confirmed with microscopy	87	130	345	488	711	43	141	68	656
	RDT examined	–	–	–	–	–	–	–	2 841	8 311
	Confirmed with RDT	181	419	217	474	–	152	209	1 059	–
	Imported cases***	–	170	153	234	322	282	221	403	348
Ethiopia	Presumed and confirmed	4 068 764	3 549 559	3 876 745	3 316 013	2 513 863	2 174 707	1 962 996	1 755 748	1 206 891 [5]
	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
	Confirmed with microscopy	1 158 197	1 480 306	1 692 578	2 645 454	2 118 815	1 867 059	1 718 504	1 530 739	962 087
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	–	–	–	–	–	–	–

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Gabon	Presumed and confirmed	185 105	178 822	188 089	185 196	185 996	217 287	161 508	157 639	797 278
	Microscopy examined	54 714	–	66 018	90 185	90 275	79 308	62 658	70 820	264 676
	Confirmed with microscopy	12 816	–	18 694	26 432	27 687	20 390	22 419	28 297	88 112
	RDT examined	7 887	–	4 129	10 132	11 812	12 761	2 738	18 877	71 787
	Confirmed with RDT	1 120	–	1 059	2 550	4 213	3 477	1 496	6 947	23 607
	Imported cases	–	–	–	–	–	–	–	–	–
Gambia	Presumed and confirmed	194 009	261 967	271 038	279 829	166 229	249 437	155 456	75 559	88 654 [4]
	Microscopy examined	290 842	172 241	156 580	236 329	286 111	272 604	165 793	77 491	171 668
	Confirmed with microscopy	52 245	71 588	29 325	65 666	66 253	49 649	26 397	11 343	14 510
	RDT examined	123 564	–	705 862	614 128	317 313	609 852	677 346	508 107	533 994
	Confirmed with RDT	64 108	190 379	271 038	175 126	99 976	190 733	127 377	58 588	72 938
	Imported cases	–	–	–	–	–	–	–	–	–
Ghana	Presumed and confirmed	3 849 536	4 154 261	10 676 731	7 200 797	8 453 557	10 186 510	10 448 267	10 228 988	11 154 394 [5]
	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
	Confirmed with microscopy	1 029 384	624 756	2 971 699	721 898	970 448	934 304	1 189 012	1 089 799	1 105 438
	RDT examined	247 278	781 892	1 438 284	1 488 822	3 610 453	5 478 585	5 532 416	5 677 564	6 660 205
	Confirmed with RDT	42 253	416 504	783 467	917 553	2 445 464	3 385 615	3 346 155	3 286 140	3 826 106
	Imported cases	–	–	–	–	–	–	–	–	–
Guinea	Presumed and confirmed	1 092 554	1 189 016	1 220 574	775 341	1 595 828	895 016	992 146	1 335 323	1 599 625 [5]
	Microscopy examined	–	43 549	–	–	116 767	78 377	79 233	99 083	131 715
	Confirmed with microscopy	20 936	5 450	191 421	63 353	82 818	52 211	53 805	64 211	77 119
	RDT examined	–	139 066	–	–	–	1 092 523	1 423 802	2 035 460	2 445 164
	Confirmed with RDT	–	90 124	125 779	147 904	577 389	758 768	938 341	1 271 112	1 137 877
	Imported cases	–	–	–	–	–	–	–	–	–
Guinea-Bissau	Presumed and confirmed	140 143	174 986	129 684	132 176	98 952	142 309	150 903	143 554	171 075
	Microscopy examined	48 799	57 698	61 048	58 909	106 882	123 810	146 708	157 970	149 423
	Confirmed with microscopy	30 239	21 320	23 547	17 733	35 546	45 789	53 014	53 770	45 564
	RDT examined	56 455	139 531	97 047	102 079	197 536	261 868	234 488	303 651	320 217
	Confirmed with RDT	20 152	50 662	26 834	36 851	57 885	96 520	97 889	89 784	125 511
	Imported cases	–	–	–	–	–	–	–	–	–
Kenya	Presumed and confirmed	6 071 583	11 120 812	9 335 951	9 750 953	9 655 905	7 676 980	8 322 500	7 961 444	9 950 781
	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
	Confirmed with microscopy	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
	RDT examined	–	–	164 424	655 285	850 884	1 965 661	3 588 676	3 314 695	2 329 005
	Confirmed with RDT	–	–	26 752	274 678	392 981	473 519	1 214 801	999 451	693 619
	Imported cases	–	–	–	–	–	–	–	–	–
Liberia	Presumed and confirmed	2 675 816	2 480 748	1 800 372	1 483 676	1 066 107	1 781 092	2 343 410	1 342 953	–
	Microscopy examined	335 973	728 443	772 362	818 352	1 318 801	509 062	649 096	715 643	–
	Confirmed with microscopy	212 927	577 641	507 967	496 269	302 708	305 981	381 781	425 639	–
	RDT examined	998 043	1 593 676	1 276 521	1 144 405	912 382	947 048	1 304 021	1 045 323	–
	Confirmed with RDT	709 246	1 338 121	899 488	747 951	561 496	625 105	809 356	644 474	–
	Imported cases	–	–	–	–	–	–	–	–	–
Madagascar	Presumed and confirmed	293 910	255 814	395 149	382 495	433 101	752 176	475 333	800 661	972 790 [4]
	Microscopy examined	24 393	34 813	38 453	42 573	37 362	39 604	33 085	34 265	43 759
	Confirmed with microscopy	2 173	3 447	3 667	4 947	3 853	4 748	3 734	5 134	7 400
	RDT examined	604 114	739 572	906 080	1 026 110	926 998	1 488 667	1 496 990	1 974 518	2 290 797
	Confirmed with RDT	200 277	221 051	355 753	380 651	374 110	739 355	471 599	795 527	965 390
	Imported cases	–	–	–	–	712	1 167	1 212	–	–
Malawi	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 [3]
	Microscopy examined	–	119 996	406 907	132 475	198 534	216 643	240 212	127 752	129 575
	Confirmed with microscopy	–	50 526	283 138	44 501	77 635	75 923	96 538	46 099	34 735
	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
	Confirmed with RDT	–	253 973	1 281 846	1 236 391	2 827 675	3 585 315	4 730 835	4 901 344	5 830 741
	Imported cases	–	–	–	–	–	–	–	–	–

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Mali	Presumed and confirmed	2 171 542	1 961 070	2 171 739	2 327 385	2 590 643	3 317 001	2 311 098	2 097 797	2 614 104 [5]
	Microscopy examined	–	–	–	–	–	–	–	397 723	437 903
	Confirmed with microscopy	–	–	97 995	190 337	219 637	243 151	235 212	276 673	301 880
	RDT examined	1 380 178	974 558	–	1 889 286	–	3 389 449	3 408 254	2 755 935	3 019 364
	Confirmed with RDT	227 482	307 035	788 487	1 176 881	1 820 216	2 052 460	1 921 070	1 821 124	2 043 595
	Imported cases	–	–	–	–	–	–	–	–	–
Mauritania	Presumed and confirmed	244 319	154 003	169 104	128 486	172 326	181 562	159 225	162 572	175 841
	Microscopy examined	5 449	3 752	1 865	5 510	–	–	–	–	–
	Confirmed with microscopy	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
	Confirmed with RDT	1 085	1 796	1 633	630	15 835	22 631	29 156	20 105	30 609
	Imported cases	–	–	–	–	–	–	–	–	–
Mayotte	Presumed and confirmed	396	92	72	–	–	–	18	19	47
	Microscopy examined	2 023	1 214	1 463	–	–	–	–	–	–
	Confirmed with microscopy	396	92	72	82	15	11	28	19	47
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	–	–	–	–	–	–	–	–	–
	Imported cases***	224	51	47	71	14	10	10	–	44
Mozambique	Presumed and confirmed	3 381 371	3 344 413	3 203 338	3 924 832	5 485 327	5 830 322	7 546 091	8 993 352	9 320 557
	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
	Confirmed with microscopy	644 568	1 093 742	886 143	774 891	1 009 496	735 750	674 697	700 282	743 435
	RDT examined	2 287 536	2 966 853	2 234 994	5 215 893	9 944 222	11 928 263	13 567 501	14 134 096	15 190 949
	Confirmed with RDT	878 009	663 132	927 841	2 223 983	6 108 152	6 983 032	7 845 679	8 220 799	8 549 493
	Imported cases	–	–	–	–	–	–	–	–	–
Namibia	Presumed and confirmed	25 889	14 406	3 163	4 745	15 914	12 050	23 568	66 141	36 451*
	Microscopy examined	14 522	13 262	7 875	1 507	1 894	1 471	1 778	1 778	1 215
	Confirmed with microscopy	556	335	194	136	222	118	329	364	289
	RDT examined	–	48 599	–	32 495	185 078	207 612	308 414	616 513	394 822
	Confirmed with RDT	–	1 525	–	4 775	15 692	12 050	24 869	66 141	36 451
	Imported cases***	–	–	–	–	–	2 888	3 980	11 874	4 021
Niger	Presumed and confirmed	3 643 803	3 157 482	4 592 519	4 288 425	3 222 613	3 817 634	5 056 393	2 638 580	3 358 058 [5]
	Microscopy examined	165 514	130 658	1 781 505	1 799 299	2 872 710	295 229	3 198 194	203 583	213 795
	Confirmed with microscopy	49 285	68 529	1 119 929	1 176 711	0	206 660	2 120 515	125 856	121 657
	RDT examined	7 426 774	1 130 514	1 781 505	1 799 299	2 872 710	2 657 057	3 066 101	3 615 853	4 285 516
	Confirmed with RDT	570 773	712 347	1 119 929	1 176 711	1 953 309	2 065 340	2 027 652	2 512 724	2 924 793
	Imported cases	–	–	–	–	–	–	–	–	–
Nigeria	Presumed and confirmed	3 873 463	4 306 945	6 938 519	12 830 911	16 512 127	15 157 491	16 740 560	18 690 954	18 870 214
	Microscopy examined	–	672 185	1 953 399	1 633 960	1 681 469	839 849	901 141	1 055 444	1 428 731
	Confirmed with microscopy	523 513	–	–	–	1 233 654	556 871	618 363	749 118	1 023 273
	RDT examined	45 924	242 526	2 898 052	7 194 960	9 188 933	8 690 087	11 765 893	14 808 335	15 848 248
	Confirmed with RDT	27 674	–	–	–	6 593 300	6 261 971	8 616 024	10 822 840	11 930 310
	Imported cases	–	–	–	–	–	–	–	–	–
Rwanda	Presumed and confirmed	638 669	208 498	483 470	939 076	1 610 812	2 505 794	3 324 678	4 413 473	1 975 926
	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
	Confirmed with microscopy	638 669	208 858	422 224	879 316	1 528 825	2 354 400	2 916 902	2 927 780	1 657 793
	RDT examined	–	–	190 593	201 708	168 004	281 847	898 913	920 295	720 026
	Confirmed with RDT	–	–	61 246	83 302	81 987	151 394	463 666	475 403	318 133
	Imported cases	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	Presumed and confirmed	3 346	8 442	12 550	7 418	1 337	2 058	2 238	2 241	2 940 [5]
	Microscopy examined	48 366	83 355	103 773	73 866	33 355	11 941	3 682	2 146	13 186
	Confirmed with microscopy	2 233	6 373	10 706	6 352	569	140	33	109	148
	RDT examined	9 989	33 924	23 124	34 768	58 090	72 407	117 727	94 466	156 697
	Confirmed with RDT	507	2 069	1 844	2 891	1 185	1 918	2 205	2 132	2 792
	Imported cases***	–	–	–	–	–	2	4	2	3

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Senegal	Presumed and confirmed	707 772	604 290	634 106	772 222	628 642	502 084	356 272	398 377	536 745 [5]
	Microscopy examined	27 793	18 325	19 946	24 205	19 343	26 556	38 748	21 639	12 881
	Confirmed with microscopy	17 750	14 142	15 612	20 801	12 636	17 846	9 918	10 463	3 997
	RDT examined	651 737	555 614	524 971	668 562	697 175	1 384 834	1 513 574	2 011 383	2 077 442
	Confirmed with RDT	325 920	263 184	265 468	325 088	252 988	474 407	339 622	385 243	526 947
	Imported cases***	–	–	–	–	–	352	1 905	0	292
Sierra Leone	Presumed and confirmed	934 028	856 332	1 945 859	1 715 851	1 898 852	1 569 606	1 845 727	1 741 512	1 781 855 [3]
	Microscopy examined	718 473	46 280	194 787	185 403	66 277	75 025	120 917	10 910	20 155
	Confirmed with microscopy	218 473	25 511	104 533	76 077	39 414	37 820	60 458	5 717	8 719
	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
	Confirmed with RDT	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
	Imported cases	–	–	–	–	–	–	–	–	0
South Africa	Presumed and confirmed	8 060	9 866	6 846	8 851	13 988	8 976	4 323	28 295	18 638 [3]
	Microscopy examined	–	178 387	121 291	364 021	300 291	13 917	20 653	–	–
	Confirmed with microscopy	3 787	5 986	1 632	2 572	4 101	785	1 219	9 592	2 666
	RDT examined	276 669	204 047	30 053	239 705	240 622	17 446	42 624	56 257	–
	Confirmed with RDT	4 273	3 880	3 997	6 073	7 604	3 572	3 104	18 703	8 123
	Imported cases	–	–	–	–	–	3 568	3 075	6 234	5 742
South Sudan[2]	Presumed and confirmed	900 283	795 784	1 125 039	1 855 501	2 433 991	3 789 475	–	3 602 208	4 697 506
	Microscopy examined	–	–	–	–	27 321	22 721	6 954	800 067	1 204
	Confirmed with microscopy	900 283	112 024	225 371	262 520	18 344	11 272	2 357	335 642	634
	RDT examined	–	–	–	–	102 538	26 507	10 751	2 024 503	1 805 912
	Confirmed with RDT	–	–	–	–	53 033	13 099	5 262	1 152 363	98 209
	Imported cases	–	–	–	–	–	–	–	–	–
Togo	Presumed and confirmed	983 430	519 450	768 287	881 611	1 113 928	1 113 928	1 183 265	1 209 034	1 381 410 [4]
	Microscopy examined	478 354	502 977	579 507	560 096	621 119	621 119	435 164	445 035	267 028
	Confirmed with microscopy	224 087	237 305	260 535	272 855	310 207	305 727	231 819	209 626	108 146
	RDT examined	575 245	390 611	660 627	882 475	1 135 581	1 135 581	1 410 290	1 597 463	1 488 587
	Confirmed with RDT	393 014	282 145	436 839	609 575	820 044	808 200	951 446	999 408	982 188
	Imported cases	–	–	–	–	–	–	–	–	–
Uganda	Presumed and confirmed	13 208 169	12 173 358	13 591 932	16 541 563	13 724 345	13 421 804	13 657 887	12 273 076	8 895 436 [5]
	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
	Confirmed with microscopy	1 581 160	134 726	1 413 149	1 502 362	578 289	1 248 576	1 542 091	1 694 441	458 909
	RDT examined	–	194 819	2 449 526	7 387 826	7 060 545	12 126 996	17 473 299	16 803 712	12 741 670
	Confirmed with RDT	–	97 147	1 249 109	–	3 053 650	5 889 086	7 843 041	9 973 390	5 300 265
	Imported cases	–	–	–	–	–	–	–	–	–
United Republic of Tanzania	Presumed and confirmed	12 893 535	10 164 967	8 477 435	8 585 482	7 403 562	7 746 258	6 053 868	5 597 715	6 220 485 [2]
	Microscopy examined	3 637 659	5 656 907	6 931 025	6 804 085	727 130	673 223	1 386 389	2 888 538	3 015 052
	Confirmed with microscopy	1 277 024	1 813 179	1 772 062	1 481 275	572 289	412 702	1 262 679	916 742	831 903
	RDT examined	136 123	1 628 092	1 091 615	813 103	17 740 207	16 620 299	15 538 709	15 257 462	19 603 825
	Confirmed with RDT	1 974	337 582	214 893	71 169	107 728	3 830 030	3 930 841	4 437 744	5 221 811
	Imported cases***				719	1 583	2 550			1 754
Mainland	Presumed and confirmed	12 819 192	10 160 478	8 474 278	8 582 934	7 399 316	7 741 816	6 050 097	5 593 544	6 215 115 [4]
	Microscopy examined	3 573 710	5 513 619	6 784 639	6 720 141	592 320	532 118	1 285 720	2 826 948	2 937 666
	Confirmed with microscopy	1 276 660	1 812 704	1 771 388	1 480 791	571 598	411 741	1 261 650	915 887	830 668
	RDT examined	–	1 315 662	701 477	369 444	17 566 750	16 416 675	15 379 517	15 052 571	19 338 466
	Confirmed with RDT	–	333 568	212 636	69 459	106 609	3 827 749	3 926 855	4 435 250	5 219 714
	Imported cases	–	–	–	–	–	–	–	–	–
Zanzibar	Presumed and confirmed	74 343	4 489	3 157	2 548	4 246	4 442	3 771	4 171	5 370 [4]
	Microscopy examined	63 949	143 288	146 386	83 944	134 810	141 105	100 669	61 590	77 386
	Confirmed with microscopy	364	475	674	484	691	961	1 029	855	1 235
	RDT examined	136 123	312 430	390 138	443 659	173 457	203 624	159 192	204 891	265 359
	Confirmed with RDT	1 974	4 014	2 257	1 710	1 119	2 281	3 986	2 494	2 097
	Imported cases***	–	–	–	719	1 583	2 550	–	–	1 754

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Zambia	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 [3]
	Microscopy examined	–	–	–	–	–	–	–	–	180 697
	Confirmed with microscopy	–	–	–	–	–	–	–	–	49 855
	RDT examined	–	–	–	–	5 964 354	7 207 500	8 502 989	10 403 283	9 718 666
	Confirmed with RDT	–	–	–	–	4 077 547	4 184 661	4 851 319	5 505 639	4 989 824
	Imported cases	–	–	–	–	–	–	–	–	–
Zimbabwe	Presumed and confirmed	648 965	319 935	276 963	422 633	535 983	391 651	280 853	316 392	184 427 [4]
	Microscopy examined	–	10 004	–	–	–	–	–	0	2 771
	Confirmed with microscopy	–	–	–	–	–	–	–	0	0
	RDT examined	513 032	470 007	727 174	1 115 005	1 420 894	1 384 893	1 223 509	1 110 705	995 715
	Confirmed with RDT	249 379	319 935	276 963	422 633	535 931	391 651	279 988	316 392	184 427
	Imported cases***	–	–	–	–	–	180	358	768	672
AMERICAS										
Argentina[1]	Presumed and confirmed	72	18	4	4	4	8	5	15	23
	Microscopy examined	2 547	7 872	7 027	4 913	5 691	3 862	3 479	2 114	345
	Confirmed with microscopy	72	18	4	4	4	11	7	18	23
	RDT examined	–	–	–	0	0	0	0	0	0
	Confirmed with RDT	–	–	–	0	0	0	0	0	0
	Imported cases	57	18	4	4	4	8	5	15	23
Belize	Presumed and confirmed	150	79	37	26	19	13	5	9	7 [5]
	Microscopy examined	27 366	22 996	20 789	25 351	24 122	26 367	20 936	26 995	17 642
	Confirmed with microscopy	150	79	37	26	19	13	5	9	7
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	–	7	4	4	0	4	1	2	4
Bolivia (Plurinational State of)	Presumed and confirmed	13 769	7 143	7 415	7 342	7 401	6 907	5 553	4 587	5 354 [3]
	Microscopy examined	133 463	143 272	121 944	133 260	124 900	159 167	155 407	151 697	139 938
	Confirmed with microscopy	12 252	6 108	6 293	6 272	7 401	6 907	5 553	4 334	5 261
	RDT examined	7 394	7 390	10 960	10 789	–	–	–	–	–
	Confirmed with RDT	1 517	1 035	1 122	1 070	–	–	–	253	93
	Imported cases	–	–	–	–	–	33	11	15	12
Brazil	Presumed and confirmed	334 668	267 146	242 758	178 595	144 128	143 161	129 245	194 426	194 512 [4]
	Microscopy examined	2 711 432	2 476 335	2 325 775	1 873 518	1 744 640	1 573 538	1 341 639	1 656 688	1 753 972
	Confirmed with microscopy	334 667	266 713	237 978	174 048	142 744	139 844	124 210	184 877	181 923
	RDT examined	–	1 486	23 566	19 500	11 820	16 865	23 273	39 378	46 201
	Confirmed with RDT	–	433	4 780	3 719	1 384	3 318	5 034	9 549	12 589
	Imported cases	–	–	–	8 905	4 847	4 915	5 068	4 867	6 819
Colombia	Presumed and confirmed	117 650	64 436	60 179	51 722	40 768	55 866	83 227	54 102	63 143 [5,8]
	Microscopy examined	521 342	396 861	346 599	284 332	325 713	316 451	242 973	244 732	195 286
	Confirmed with microscopy	117 637	60 121	50 938	44 293	36 166	48 059	–	38 349	42 810
	RDT examined	–	21 171	70 168	42 723	77 819	11 983	53 118	9 648	13 252
	Confirmed with RDT	13	4 188	9 241	7 403	4 602	3 535	5 655	5 056	3 407
	Imported cases	–	–	–	–	–	7 785	618	1 297	1 948
Costa Rica	Presumed and confirmed	114	17	8	6	6	8	13	25	108* [4]
	Microscopy examined	15 599	10 690	7 485	16 774	4 420	7 373	5 160	9 680	9 000
	Confirmed with microscopy	114	17	8	6	6	8	13	25	108
	RDT examined	–	–	–	0	0	0	0	0	700
	Confirmed with RDT	–	–	–	0	0	0	0	0	44
	Imported cases	27	7	1	4	5	8	9	13	38
Dominican Republic	Presumed and confirmed	2 482	1 616	952	579	496	661	755	324	484*
	Microscopy examined	469 052	421 405	415 808	431 683	362 304	317 257	51 329	226 988	33 420
	Confirmed with microscopy	–	1 616	952	579	496	661	484	398	322
	RDT examined	26 585	56 150	90 775	71 000	54 425	7 530	22 450	38 547	42 425
	Confirmed with RDT	932	–	–	–	–	–	–	–	286
	Imported cases	–	–	–	105	37	30	65	57	50

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS										
Ecuador	Presumed and confirmed	1 888	1 232	558	378	242	686	1 191	1 380	1 806 [5]
	Microscopy examined	481 030	460 785	459 157	397 628	370 825	261 824	311 920	306 894	237 995
	Confirmed with microscopy	1 888	1 232	558	378	242	686	1 191	1 380	1 589
	RDT examined	7 800	–	–	–	–	–	–	–	6 782
	Confirmed with RDT	–	–	–	–	–	–	–	–	217
	Imported cases	–	14	14	10	–	59	233	105	153
El Salvador[7]	Presumed and confirmed	24	15	21	7	8	9	14	4	2
	Microscopy examined	115 256	100 883	124 885	103 748	106 915	89 267	81 904	70 022	52 216
	Confirmed with microscopy	24	–	21	7	8	9	14	4	2
	RDT examined	–	1	–	–	0	0	0	0	0
	Confirmed with RDT	–	1	–	–	0	0	0	0	0
	Imported cases	7	6	6	1	2	7	1	3	2
French Guiana	Presumed and confirmed	1 608	1 209	900	877	448	434	258	597	–
	Microscopy examined	14 373	14 429	13 638	22 327	14 651	11 558	9 430	–	–
	Confirmed with microscopy	–	505	401	–	242	297	173	468	–
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	944	704	499	551	206	137	58	129	–
	Imported cases	–	–	–	–	–	60	41	43	–
Guatemala	Presumed and confirmed	7 198	6 817	5 346	6 214	4 931	5 538	4 854	3 744	4 769**
	Microscopy examined	235 075	195 080	186 645	153 731	250 964	295 246	333 535	372 158	438 833
	Confirmed with microscopy	7 198	6 817	5 346	6 214	–	–	4 854	3 744	3 021
	RDT examined	2 000	–	0	0	50 025	6 500	74 859	0	75 300
	Confirmed with RDT	0	–	0	0	–	1 298	–	0	1 748
	Imported cases	–	–	–	–	1	2	1	2	3
Guyana	Presumed and confirmed	22 935	29 471	31 610	31 479	12 354	9 984	11 108	13 936	17 038
	Microscopy examined	212 863	201 693	196 622	205 903	142 843	132 941	110 891	100 096	99 806
	Confirmed with microscopy	22 935	–	–	31 479	12 354	9 984	–	13 734	15 599
	RDT examined	–	35	–	0	0	0	5 409	–	–
	Confirmed with RDT	–	35	55	0	0	0	1 461	202	1 439
	Imported cases	–	–	–	–	–	–	411	–	–
Haiti	Presumed and confirmed	84 153	32 969	25 423	26 543	17 696	17 583	21 430	19 135	8 828* [5]
	Microscopy examined	270 427	184 934	167 726	165 823	134 766	69 659	61 428	62 539	59 803
	Confirmed with microscopy	84 153	–	–	20 957	10 893	5 224	4 342	2 119	1 586
	RDT examined	–	–	46	5 586	126 637	233 081	245 133	232 741	228 491
	Confirmed with RDT	–	–	–	–	6 803	12 359	18 115	17 739	7 526
	Imported cases	–	–	–	–	–	–	–	–	–
Honduras	Presumed and confirmed	9 685	7 618	6 439	5 428	3 380	3 575	4 097	1 287	653*
	Microscopy examined	152 961	152 451	155 165	144 436	151 420	150 854	167 836	148 160	142 780
	Confirmed with microscopy	–	7 465	–	5 364	–	3 555	3 695	1 251	653
	RDT examined	4 000	4 000	4 000	237	1 427	3 052	14 930	17 376	18 620
	Confirmed with RDT	–	45	10	64	102	20	401	35	229
	Imported cases***	–	–	–	–	2	0	3	10	21
Mexico	Presumed and confirmed	1 226	1 124	833	499	666	551	596	765	826 [5]
	Microscopy examined	1 192 081	1 035 424	1 025 659	1 017 508	900 578	867 853	798 568	644 174	548 247
	Confirmed with microscopy	1 233	1 130	842	499	–	551	596	765	826
	RDT examined	–	–	–	0	0	0	0	0	0
	Confirmed with RDT	–	–	–	0	0	0	0	0	0
	Imported cases	7	6	9	4	10	34	45	29	23
Nicaragua	Presumed and confirmed	692	925	1 235	1 194	1 163	2 307	6 284	10 949	15 934
	Microscopy examined	535 914	521 904	536 278	519 993	605 357	604 418	553 615	660 452	831 077
	Confirmed with microscopy	692	925	1 235	1 194	1 163	2 307	6 284	10 949	15 934
	RDT examined	18 500	14 201	16 444	19 029	0	–	800	2 680	44 905
	Confirmed with RDT	0	–	0	–	0	–	–	–	0
	Imported cases	–	–	–	34	21	29	12	3	17

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS										
Panama	Presumed and confirmed	418	354	844	705	874	562	811	689	715
	Microscopy examined	141 038	116 588	107 711	93 624	80 701	64 511	50 772	38 270	23 383
	Confirmed with microscopy	418	354	844	705	874	562	811	689	715
	RDT examined	–	0	0	0	0	0	0	0	–
	Confirmed with RDT	–	0	0	0	0	0	0	0	–
	Imported cases	–	–	–	9	10	16	42	40	31
Paraguay[1]	Presumed and confirmed	27	10	15	11	8	8	10	5	–
	Microscopy examined	62 178	48 611	31 499	24 806	24 832	6 687	3 192	8 014	–
	Confirmed with microscopy	27	10	15	11	8	8	–	5	–
	RDT examined	–	–	–	–	–	0	1	1 267	–
	Confirmed with RDT	–	–	–	–	–	0	1	0	–
	Imported cases	9	9	15	11	8	8	10	5	–
Peru	Presumed and confirmed	31 545	25 005	31 436	48 719	65 252	63 865	56 623	55 367	45 619*
	Microscopy examined	744 627	702 894	758 723	863 790	864 413	865 980	566 230	388 699	304 785
	Confirmed with microscopy	–	–	31 436	48 719	65 252	66 609	56 623	55 367	45 619
	RDT examined	23	58	562	858	1 634	0	–	13 924	160 000
	Confirmed with RDT	1	34	–	–	–	–	–	2 325	1 000
	Imported cases	–	–	–	–	0	0	0	–	176
Suriname	Presumed and confirmed	1 771	795	569	729	729	376	327	551	235 [5]
	Microscopy examined	16 533	15 135	17 464	13 693	17 608	15 083	14 946	12 536	11 799
	Confirmed with microscopy	1 574	751	306	530	–	345	315	412	218
	RDT examined	541	1 025	4 008	6 043	15 489	153	8 498	9 498	8 037
	Confirmed with RDT	138	20	50	199	303	31	12	139	17
	Imported cases	–	–	–	204	–	274	252	414	199
Venezuela (Bolivarian Republic of)	Presumed and confirmed	45 155	45 824	52 803	78 643	91 918	137 996	242 561	411 586	404 924* [3]
	Microscopy examined	400 495	382 303	410 663	476 764	522 617	625 174	852 556	1 144 635	699 130
	Confirmed with microscopy	45 155	45 824	52 803	78 643	91 918	137 996	240 613	411 586	404 924
	RDT examined	–	–	–	–	–	–	–	–	48 117
	Confirmed with RDT	–	–	–	–	–	–	–	–	48 117
	Imported cases	–	–	–	1 677	1 210	1 594	2 974	2 942	2 127
EASTERN MEDITERRANEAN										
Afghanistan	Presumed and confirmed	392 463	482 748	391 365	319 742	295 050	366 526	384 943	326 625	299 863
	Microscopy examined	524 523	531 053	511 408	507 145	514 466	538 789	598 556	611 904	665 200
	Confirmed with microscopy	69 397	77 549	54 840	46 114	83 920	103 377	151 528	194 866	104 960
	RDT examined	–	0	0	0	–	–	94 975	161 925	216 240
	Confirmed with RDT	–	0	0	0	–	–	38 631	53 823	68 533
	Imported cases	–	–	–	–	–	–	–	–	–
Djibouti	Presumed and confirmed	1 010	230	27	1 684	9 439	9 557	13 804	14 671	25 319 [4]
	Microscopy examined	–	124	1 410	7 189	39 284	10 502	19 492	24 504	–
	Confirmed with microscopy	1 010	–	22	1 684	9 439	1 764	2 280	1 283	–
	RDT examined	–	–	–	–	–	–	–	50 104	104 800
	Confirmed with RDT	–	–	3	–	–	7 709	11 524	13 388	25 319
	Imported cases	–	–	–	–	–	–	–	–	–
Iran (Islamic Republic of)[7]	Presumed and confirmed	3 031	3 239	1 629	1 373	1 238	799	705	939	625 [5]
	Microscopy examined	614 817	530 470	479 655	385 172	468 513	610 337	418 125	383 397	477 914
	Confirmed with microscopy	3 031	3 239	1 629	1 373	1 243	799	705	939	625
	RDT examined	–	–	0	–	–	–	–	–	64 061
	Confirmed with RDT	–	–	0	–	–	–	–	–	436
	Imported cases	1 184	1 607	854	879	874	656	620	881	622
Pakistan	Presumed and confirmed	4 281 356	4 065 802	4 285 449	3 472 727	3 666 257	3 776 244	2 121 958	2 209 768	1 069 248 [4]
	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
	Confirmed with microscopy	220 870	287 592	250 526	196 078	193 952	137 401	154 541	132 580	119 099
	RDT examined	279 724	518 709	410 949	628 504	779 815	691 245	1 296 762	1 821 139	2 207 613
	Confirmed with RDT	19 721	46 997	40 255	85 677	81 197	64 612	169 925	237 237	255 411
	Imported cases	–	–	–	–	–	–	–	–	–

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
EASTERN MEDITERRANEAN										
Saudi Arabia	Presumed and confirmed	1 941	2 788	3 406	–	2 305	2 620	5 382	3 151	2 711
	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
	Confirmed with microscopy	1 941	2 788	3 406	2 513	2 305	2 620	5 382	3 151	2 711
	RDT examined	–	–	0	–	–	–	–	–	–
	Confirmed with RDT	–	–	0	–	–	–	–	–	–
	Imported cases	1 912	2 719	3 324	2 479	2 275	2 537	5 110	2 974	2 650
Somalia	Presumed and confirmed	24 553	41 167	23 202	9 135	26 174	39 169	58 021	37 156	31 030
	Microscopy examined	20 593	26 351	–	–	–	–	–	–	–
	Confirmed with microscopy	5 629	1 627	–	–	–	–	–	–	–
	RDT examined	200 105	35 236	37 273	67 464	64 480	100 792	183 360	226 894	253 211
	Confirmed with RDT	18 924	1 724	6 817	7 407	11 001	20 953	35 628	35 138	31 021
	Imported cases	–	–	–	–	–	–	–	–	–
Sudan	Presumed and confirmed	1 465 496	1 214 004	964 698	989 946	1 207 771	1 102 186	897 194	1 562 821	3 581 302 [4]
	Microscopy examined	–	–	–	–	–	3 586 482	3 236 118	2 426 329	6 668 355
	Confirmed with microscopy	625 365	506 806	526 931	592 383	579 038	586 827	378 308	588 100	1 251 544
	RDT examined	1 653 300	2 222 380	2 000 700	1 800 000	788 281	–	632 443	422 841	1 080 601
	Confirmed with RDT	95 192	–	–	–	489 468	–	187 707	132 779	355 289
	Imported cases	–	–	–	–	–	–	–	–	–
Yemen	Presumed and confirmed	198 963	142 152	165 687	149 451	122 812	104 831	144 628	114 004	192 895
	Microscopy examined	645 463	645 093	685 406	723 691	643 994	561 644	960 860	1 070 020	419 415
	Confirmed with microscopy	78 269	60 751	71 300	63 484	51 768	42 052	45 886	28 936	64 233
	RDT examined	97 289	108 110	150 218	157 457	141 519	121 464	174 699	560 449	219 250
	Confirmed with RDT	28 428	30 203	41 059	39 294	34 939	34 207	52 815	85 068	53 419
	Imported cases	–	–	–	–	–	–	–	–	–
EUROPEAN										
Armenia[1]	Presumed and confirmed	1	0	4	0	1	1	1	2	–
	Microscopy examined	31 026	–	–	–	–	1 213	465	350	–
	Confirmed with microscopy	1	–	–	–	–	2	2	2	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	1	0	4	0	1	1	1	2	–
Azerbaijan[7]	Presumed and confirmed	52	8	4	4	2	1	1	1	–
	Microscopy examined	456 652	449 168	497 040	432 810	399 925	405 416	465 860	373 562	–
	Confirmed with microscopy	52	8	4	4	2	1	1	1	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	2	4	1	4	2	1	1	1	–
Georgia[7]	Presumed and confirmed	0	6	5	7	6	5	7	8	–
	Microscopy examined	2 368	2 032	1 046	192	440	294	318	416	–
	Confirmed with microscopy	0	6	5	7	6	5	7	8	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	0	6	5	7	5	5	7	8	–
Kyrgyzstan[1]	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	–
	Confirmed with microscopy	6	5	3	4	0	1	6	2	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	3	5	3	4	0	1	6	2	–
Tajikistan[7]	Presumed and confirmed	112	78	33	14	7	5	1	3	–
	Microscopy examined	173 523	173 367	209 239	213 916	200 241	188 341	198 766	191 284	–
	Confirmed with microscopy	112	78	33	14	7	5	1	3	–
	RDT examined	–	–	–	–	–	–	34 570	41 218	–
	Confirmed with RDT	–	–	–	–	–	–	1	3	–
	Imported cases	1	25	15	11	5	5	1	3	–

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
EUROPEAN										
Turkey[7]	Presumed and confirmed	90	132	376	285	249	221	209	214	–
	Microscopy examined	507 841	421 295	337 830	255 125	189 854	211 740	144 499	115 557	–
	Confirmed with microscopy	78	128	376	285	249	221	209	214	–
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	–	–	–	–	–	–	–	–	–
	Imported cases	81	128	376	251	249	221	209	214	–
Turkmenistan[1]	Presumed and confirmed	0	0	0	0	0	0	0	0	–
	Microscopy examined	81 784	–	–	–	–	83 675	85 536	84 264	–
	Confirmed with microscopy	0	–	–	–	–	0	0	0	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	0	0	0	0	0	0	0	0	–
Uzbekistan[1]	Presumed and confirmed	5	1	1	3	1	0	0	0	–
	Microscopy examined	921 364	886 243	805 761	908 301	812 347	800 912	797 472	655 112	–
	Confirmed with microscopy	5	1	1	3	1	0	0	0	–
	RDT examined	–	–	–	–	–	0	0	0	–
	Confirmed with RDT	–	–	–	–	–	0	0	0	–
	Imported cases	3	1	1	3	1	0	0	0	–
SOUTH-EAST ASIA										
Bangladesh	Presumed and confirmed	91 227	51 773	9 901	3 864	10 216	6 608	5 063	5 133	1 919
	Microscopy examined	308 326	270 253	253 887	74 755	78 719	69 093	65 845	70 267	57 557
	Confirmed with microscopy	20 519	20 232	4 016	1 866	3 249	1 612	1 022	1 077	377
	RDT examined	152 936	119 849	35 675	19 171	46 482	53 713	73 128	80 251	75 990
	Confirmed with RDT	35 354	31 541	5 885	1 998	6 967	4 996	3 765	3 835	1 542
	Imported cases***	–	–	–	–	–	129	109	19	41
Bhutan	Presumed and confirmed	487	207	82	–	–	104	74	62	54 [5]
	Microscopy examined	54 709	44 481	42 512	31 632	33 586	26 149	23 442	22 885	19 778
	Confirmed with microscopy	436	194	82	45	48	84	59	51	49
	RDT examined	–	–	–	–	–	47 938	95 399	19 250	113 720
	Confirmed with RDT	–	–	–	–	–	20	15	0	5
	Imported cases	–	–	0	23	0	70	59	51	48
Democratic People's Republic of Korea	Presumed and confirmed	15 392	18 104	23 537	15 673	11 212	7 409	5 113	4 626	3 598
	Microscopy examined	25 147	26 513	39 238	71 453	38 201	29 272	22 747	16 835	28 654
	Confirmed with microscopy	13 520	16 760	21 850	14 407	10 535	7 010	4 890	4 463	3 446
	RDT examined	–	–	0	0	0	61 348	182 980	172 499	657 050
	Confirmed with RDT	–	–	0	0	0	12	143	140	252
	Imported cases	–	–	0	0	0	205	0	0	0
India	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 [3]
	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
	Confirmed with microscopy	1 599 986	1 310 656	1 067 824	881 730	1 102 205	1 169 261	1 087 285	306 768	230 432
	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
	Confirmed with RDT	–	–	–	–	–	–	–	537 790	199 496
	Imported cases	–	–	–	–	–	–	–	–	–
Indonesia	Presumed and confirmed	465 764	422 447	417 819	343 527	252 027	217 025	218 450	261 617	223 468 [5]
	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	1 111 931
	Confirmed with microscopy	465 764	422 447	417 819	343 527	252 027	217 025	218 450	261 617	190 782
	RDT examined	255 734	250 709	471 586	260 181	249 461	342 946	365 765	395 685	362 705
	Confirmed with RDT	–	–	–	–	–	–	–	–	32 686
	Imported cases***	–	–	–	–	–	–	–	–	11
Myanmar	Presumed and confirmed	693 124	567 452	481 204	333 871	205 658	182 616	110 146	85 019	74 392 [3]
	Microscopy examined	275 374	312 689	265 135	138 473	151 258	99 025	122 078	107 242	58 126
	Confirmed with microscopy	103 285	91 752	75 192	26 509	12 010	6 782	6 717	4 648	2 577
	RDT examined	729 878	795 618	1 158 420	1 162 083	1 415 837	2 564 707	3 063 167	3 261 455	3 041 650
	Confirmed with RDT	317 523	373 542	405 394	307 362	193 648	175 986	103 429	80 371	71 815
	Imported cases	–	–	–	–	–	345	–	–	–

Annex 3 – H. Reported malaria cases by method of confirmation, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
SOUTH-EAST ASIA										
Nepal	Presumed and confirmed	96 383	71 752	71 410	38 113	25 889	19 375	10 185	3 269	2 930 [5]
	Microscopy examined	102 977	95 011	152 780	100 336	127 130	63 946	84 595	163 323	160 904
	Confirmed with microscopy	3 115	1 910	1 659	1 197	1 469	1 112	1 009	1 293	1 158
	RDT examined	17 887	25 353	22 472	32 989	48 444	49 649	52 432	48 625	93 378
	Confirmed with RDT	779	1 504	433	777	–	725	–	329	0
	Imported cases***	–	1 069	592	–	667	521	502	670	539
Thailand	Presumed and confirmed	32 480	24 897	32 569	41 362	37 921	14 755	11 522	7 342	5 817
	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
	Confirmed with microscopy	22 969	14 478	32 569	33 302	37 921	14 135	11 301	7 154	5 171
	RDT examined	81 997	96 670	–	97 495	–	10 888	158 173	31 898	12 580
	Confirmed with RDT	9 511	10 419	–	8 300	–	0	221	188	218
	Imported cases	–	–	–	–	–	9 890	5 724	4 020	1 618
Timor-Leste[7]	Presumed and confirmed	119 072	36 064	6 458	1 240	406	101	107	26	8* [5]
	Microscopy examined	109 806	82 175	64 318	56 192	30 515	30 237	35 947	37 705	45 976
	Confirmed with microscopy	40 250	19 739	5 208	1 025	347	80	94	17	8
	RDT examined	85 643	127 272	117 599	121 991	86 592	90 817	114 385	91 470	108 840
	Confirmed with RDT	7 887	–	–	–	0	0	0	–	–
	Imported cases	–	–	–	–	–	–	0	13	8
WESTERN PACIFIC										
Cambodia	Presumed and confirmed	47 910	51 611	45 553	24 130	26 278	29 957	23 492	36 932	42 285
	Microscopy examined	90 175	86 526	80 212	54 716	48 591	49 357	42 802	38 188	42 834
	Confirmed with microscopy	14 277	13 792	10 124	4 598	5 288	7 423	3 695	5 908	8 318
	RDT examined	103 035	130 186	108 974	94 600	92 525	114 323	123 893	130 057	123 804
	Confirmed with RDT	35 079	43 631	30 352	16 711	19 864	26 507	19 797	31 024	33 967
	Imported cases	–	–	–	–	–	–	–	–	–
China[7]	Presumed and confirmed	7 855	4 498	2 716	4 127	–	3 116	3 143	2 675	2 513
	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
	Confirmed with microscopy	4 990	3 367	2 603	4 086	2 921	3 088	3 129	2 666	2 513
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	–	–	–	–	–	–	–	–	–
	Imported cases	–	–	2 343	3 823	2 864	3 055	3 125	2 663	2 510
Lao People's Democratic Republic	Presumed and confirmed	23 047	17 904	46 819	41 385	38 754	36 056	11 753	9 336	8 913 [3]
	Microscopy examined	150 512	213 578	223 934	202 422	133 916	110 084	89 998	110 450	89 622
	Confirmed with microscopy	4 524	6 226	13 232	10 036	8 018	4 167	1 597	1 549	1 091
	RDT examined	127 790	77 825	145 425	133 337	160 626	173 919	133 464	163 856	197 259
	Confirmed with RDT	16 276	11 306	32 970	28 095	40 053	31 889	9 626	7 779	7 822
	Imported cases***	–	–	–	–	–	0	–	–	16
Malaysia[7]	Presumed and confirmed	–	–	–	–	3 923	2 311	2 302	4 114	4 630 [5,6]
	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
	Confirmed with microscopy	6 650	5 306	4 725	3 850	3 923	2 311	2 302	4 114	4 630
	RDT examined	–	–	–	–	–	–	0	0	0
	Confirmed with RDT	–	–	–	–	–	–	0	0	0
	Imported cases	897	1 168	840	891	776	435	444	423	506
Papua New Guinea	Presumed and confirmed	1 379 787	1 151 343	878 371	1 125 808	644 688	553 103	728 798	881 697	940 646
	Microscopy examined	198 742	184 466	156 495	139 972	83 257	112 864	146 242	139 910	121 766
	Confirmed with microscopy	75 985	70 603	67 202	70 658	68 114	64 719	80 472	70 449	59 652
	RDT examined	20 820	27 391	228 857	468 380	475 654	541 760	772 254	857 326	967 566
	Confirmed with RDT	17 971	13 457	82 993	209 336	213 068	233 068	398 025	407 891	456 597
	Imported cases	–	–	–	–	–	–	–	–	–
Philippines	Presumed and confirmed	19 106	9 617	8 154	7 720	4 972	8 301	6 690	3 827	1 574
	Microscopy examined	301 031	327 060	332 063	317 360	287 725	224 843	255 302	171 424	122 502
	Confirmed with microscopy	18 560	9 552	7 133	5 826	3 618	5 694	2 860	874	569
	RDT examined	–	–	–	1 523	28 598	35 799	66 536	113 140	156 913
	Confirmed with RDT	–	–	–	688	1 285	2 572	3 820	2 953	1 005
	Imported cases***	–	–	–	–	68	18	55	69	79

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
WESTERN PACIFIC										
Republic of Korea	Presumed and confirmed	–	–	–	–	638	699	673	515	576
	Microscopy examined	–	–	–	–	–	247	673	515	576
	Confirmed with microscopy	1 772	838	555	443	638	699	673	515	576
	RDT examined	–	–	–	–	–	–	–	–	–
	Confirmed with RDT	–	–	–	–	–	–	–	–	–
	Imported cases	55	64	46	50	78	71	67	79	75
Solomon Islands	Presumed and confirmed	95 006	80 859	57 296	53 270	51 649	50 916	84 513	68 676	72 430
	Microscopy examined	212 329	182 847	202 620	191 137	173 900	124 376	152 690	89 061	89 169
	Confirmed with microscopy	35 373	23 202	21 904	21 540	13 865	14 793	26 187	15 978	17 825
	RDT examined	17 300	17 457	13 987	26 216	26 658	40 750	92 109	133 560	142 115
	Confirmed with RDT	4 331	3 455	2 479	4 069	4 539	9 205	28 244	36 505	41 366
	Imported cases	–	–	–	–	–	–	–	–	–
Vanuatu	Presumed and confirmed	16 831	5 764	3 309	2 381	982	697	2 147	1 072	644 [3]
	Microscopy examined	29 180	19 183	16 981	15 219	18 135	4 870	6 704	9 187	5 935
	Confirmed with microscopy	4 013	2 077	733	767	190	15	225	120	53
	RDT examined	10 246	12 529	16 292	13 724	17 435	9 794	14 501	21 126	20 996
	Confirmed with RDT	4 156	2 743	2 702	1 614	792	408	1 643	952	591
	Imported cases***	–	–	–	–	–	0	9	1	12
Viet Nam	Presumed and confirmed	54 297	45 588	43 717	35 406	27 868	19 252	10 446	8 411	6 661 [5]
	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
	Confirmed with microscopy	17 515	16 612	19 638	17 128	15 752	9 331	4 161	4 548	4 813
	RDT examined	7 017	491 373	514 725	412 530	416 483	459 332	408 055	603 161	492 270
	Confirmed with RDT	–	–	–	–	–	–	–	1 594	1 848
	Imported cases***	–	–	–	–	–	–	–	–	1 681

	2010	2011	2012	2013	2014	2015	2016	2017	2018
REGIONAL SUMMARY (presumed and confirmed malaria cases)									
African	103 145 240	100 204 662	110 881 358	124 426 890	128 466 431	131 302 726	142 439 487	149 021 618	150 887 242
Americas	677 230	493 823	469 385	439 700	392 491	450 098	568 967	773 483	764 980
Eastern Mediterranean	6 368 813	5 952 130	5 835 463	4 944 058	5 331 046	5 401 932	3 626 635	4 269 135	5 202 993
European	266	230	426	317	266	234	225	230	0
South-East Asia	3 113 915	2 503 352	2 110 804	1 659 380	1 645 534	1 617 254	1 447 945	1 211 652	742 114
Western Pacific	1 643 839	1 367 184	1 085 935	1 294 227	799 752	704 408	873 957	1 017 255	1 080 872
Total	**114 949 303**	**110 521 381**	**120 383 371**	**132 764 572**	**136 635 520**	**139 476 652**	**148 957 216**	**156 293 373**	**158 678 201**

Data as of 14 February 2020

RDT: rapid diagnostic test; WHO: World Health Organization.

"–" refers to not applicable or data not available.

* Corrected for double counting of microscopy and RDT.

** Double counting of microscopy and RDT reported, but proportion is not indicated.

*** Case investigation is less than 100%.

[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] 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.

[7] There are no indigenous cases.

[8] Incomplete laboratory data. This country has no presumed cases reported.

Note: Imported cases also include introduced cases.

Annex 3 – I. Reported malaria cases by species, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Algeria	Suspected	12 224	11 974	15 790	12 762	8 690	8 000	6 628	6 469	10 081
	Indigenous: *P. falciparum*	–	–	–	–	–	0	0	0	0
	Indigenous: *P. vivax*	–	–	–	–	–	0	0	0	0
	Indigenous: mixed	–	–	–	–	–	0	0	0	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Angola	Suspected	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
Benin	Suspected	1 432 095	1 565 487	1 875 386	2 041 444	1 955 773	2 009 959	1 817 605	2 306 653	2 646 070
	Total: *P. falciparum*	–	68 745	0	–	1 044 235	1 268 347	1 324 576	1 696 777	1 768 450
	Total: *P. vivax*	–	0	0	–	0	0	0	0	0
	Total: mixed cases	–	0	0	–	0	0	0	0	0
	Total: other species	–	0	0	–	0	0	0	0	0
Botswana	Suspected	12 196	1 141	308	506	1 485	1 298	12 986	12 605	13 979
	Indigenous: *P. falciparum*	1 046	432	193	456	1 346	188	333	1 713	534
	Indigenous: *P. vivax*	0	0	0	0	0	0	0	4	0
	Indigenous: mixed	0	0	0	0	0	0	13	0	0
	Indigenous: other species	0	0	0	0	0	0	0	0	0
Burkina Faso	Suspected	6 037 806	5 446 870	7 852 299	7 857 296	9 272 755	9 783 385	11 992 686	14 384 948	14 910 311
Burundi	Suspected	5 590 736	4 768 314	4 228 015	7 384 501	7 622 162	8 414 481	12 357 585	12 336 328	8 734 322
Cabo Verde	Suspected	47	26 508	8 715	10 621	6 894	3 117	8 393	3 857	16 623
	Indigenous: *P. falciparum*	–	–	–	–	26	7	48	423	2
	Indigenous: *P. vivax*	–	–	–	–	0	0	0	0	0
	Indigenous: mixed	–	–	–	–	0	0	0	0	0
	Indigenous: other species	–	–	–	–	0	0	0	0	0
Cameroon	Suspected	1 845 691	3 060 040	2 865 319	3 652 609	3 709 906	3 312 273	3 229 804	3 345 967	3 217 180
	Total: *P. falciparum*	–	–	–	–	–	592 351	1 675 264	1 191 257	1 249 705
	Total: *P. vivax*	–	–	–	–	–	0	0	0	0
	Total: mixed cases	–	–	–	–	–	0	0	0	0
	Total: other species	–	–	–	–	–	0	0	0	0
Central African Republic	Suspected	66 484	221 980	468 986	491 074	625 301	1 218 246	1 807 206	1 480 085	1 367 986
	Total: *P. falciparum*	–	–	–	–	295 088	598 833	1 032 764	383 309	972 119
	Total: *P. vivax*	–	–	–	–	0	0	0	0	0
	Total: mixed cases	–	–	–	–	0	0	0	0	0
	Total: other species	–	–	–	–	0	0	0	0	0
Chad	Suspected	743 471	528 454	730 364	1 272 841	1 737 195	1 641 285	2 032 301	2 943 595	1 941 489
Comoros	Suspected	159 976	135 248	168 043	185 779	103 545	101 330	94 388	190 825	119 592
	Total: *P. falciparum*	33 791	21 387	43 681	45 669	2 203	1 300	1 066	2 274	15 613
	Total: *P. vivax*	528	334	637	72	0	0	0	0	0
	Total: mixed cases	0	0	0	363	0	0	0	0	0
	Total: other species	880	557	0	363	0	0	0	0	0
Congo	Suspected	446 656	277 263	117 640	209 169	290 346	300 592	466 254	322 916	385 729
	Total: *P. falciparum*		37 744	120 319	43 232	66 323	51 529	171 847	127 939	116 903
	Total: *P. vivax*		0	0	0	0	0	0	0	0
	Total: mixed cases		0	0	0	0	0	0	0	0
	Total: other species		0	0	0	0	0	0	0	0
Côte d'Ivoire	Suspected	1 721 461	2 607 856	3 423 623	5 982 151	6 418 571	5 216 344	5 178 375	6 346 291	6 706 148
	Total: *P. falciparum*	–	–	–	2 506 953	3 712 831	3 375 904	3 471 024	3 274 683	4 766 477
	Total: *P. vivax*	–	–	–	0	0	0	0	0	0
	Total: mixed cases	–	–	–	0	0	0	0	0	0
	Total: other species	–	–	–	0	0	0	0	0	0
Democratic Republic of the Congo	Suspected	10 568 756	12 018 784	11 993 189	14 871 716	14 647 380	16 452 476	21 507 579	21 072 322	23 833 694
	Total: *P. falciparum*	0	0	0	0	–	–	–	–	–
	Total: *P. vivax*	0	0	0	0	–	–	–	–	–
	Total: mixed cases	0	0	0	0	–	–	–	–	–
	Total: other species	0	0	0	0	–	–	–	–	–

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Equatorial Guinea	Suspected	83 639	40 704	45 792	44 561	57 129	68 058	318 779	91 217	43 533
	Total: *P. falciparum*	53 813	22 466	15 169	13 129	17 452	–	–	–	–
	Total: *P. vivax*	0	0	0	0	0	–	–	–	–
	Total: mixed cases	0	0	0	0	0	–	–	–	–
	Total: other species	0	0	0	0	0	–	–	–	–
Eritrea	Suspected	96 792	97 479	138 982	134 183	121 755	111 950	106 403	121 064	146 235
	Total: *P. falciparum*	9 785	10 263	12 121	12 482	23 787	14 510	20 704	21 849	16 553
	Total: *P. vivax*	3 989	4 932	9 204	7 361	6 780	4 780	2 999	9 185	6 108
	Total: mixed cases	63	94	346	1 391	166	70	543	429	268
	Total: other species	57	19	0	83	35	12	5	23	26
Eswatini	Suspected	1 722	797	626	669	711	651	1 386	3 212	9 837
	Indigenous: *P. falciparum*	87	130	345	487	710	157	63	668	271
	Indigenous: *P. vivax*	0	0	0	0	1	0	0	0	0
	Indigenous: mixed	0	0	0	0	0	0	0	0	0
	Indigenous: other species	0	0	0	1	0	0	0	0	0
Ethiopia	Suspected	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
	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
	Total: *P. vivax*	390 252	665 813	745 983	958 291	868 705	678 432	576 269	470 892	102 412
	Total: mixed cases	73 801	0	0	0	0	0	0	0	0
	Total: other species	0	0	0	0	0	0	0	0	0
Gabon	Suspected	233 770	178 822	238 483	256 531	256 183	285 489	202 989	212 092	1 022 022
	Total: *P. falciparum*	2 157	–	–	26 432	26 117	–	23 915	35 244	111 719
	Total: *P. vivax*	720	–	–	0	0	–	0	0	0
	Total: mixed cases	55	–	–	0	0	–	0	0	0
	Total: other species	0	–	–	0	1 570	–	0	0	0
Gambia	Suspected	492 062	261 967	862 442	889 494	603 424	891 511	844 821	591 226	706 868
	Total: *P. falciparum*	64 108	190 379	271 038	240 792	99 976	240 382	153 685	69 931	87 448
	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
Ghana	Suspected	5 056 851	5 067 731	12 578 946	8 444 417	10 636 057	13 368 757	14 040 434	14 026 149	15 542 218
	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
	Total: *P. vivax*	0	0	0	0	0	0	0	0	0
	Total: mixed cases	0	0	0	0	0	0	83 654	82 153	0
	Total: other species	102 937	31 238	0	0	0	0	29 725	27 245	27 635
Guinea	Suspected	1 092 554	1 276 057	1 220 574	775 341	1 595 828	1 254 937	1 503 035	2 134 543	2 961 508
	Total: *P. falciparum*	20 936	5 450	191 421	63 353	660 207	810 979	992 146	1 335 323	1 214 996
	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
Guinea-Bissau	Suspected	195 006	300 233	237 398	238 580	309 939	385 678	381 196	461 621	469 640
	Total: *P. falciparum*	–	–	–	–	–	96 520	97 889	89 784	125 511
	Total: *P. vivax*	–	–	–	–	–	0	0	0	0
	Total: mixed cases	–	–	–	–	–	0	0	0	0
	Total: other species	–	–	–	–	–	0	0	0	0
Kenya	Suspected	7 557 454	13 127 058	12 883 521	14 677 837	15 142 723	15 915 943	15 294 939	14 013 376	15 041 132
	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
	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
Liberia	Suspected	3 087 659	2 887 105	2 441 800	2 202 213	2 433 086	2 306 116	3 105 390	2 033 806	–
	Total: *P. falciparum*	212 927	577 641	1 407 455	1 244 220	864 204	2 086 600	1 191 137	1 760 966	–
	Total: *P. vivax*	0	0	0	0	0	0	0	0	–
	Total: mixed cases	0	0	0	0	0	0	0	0	–
	Total: other species	0	0	0	0	0	0	0	0	–
Madagascar	Suspected	719 967	805 701	980 262	1 068 683	1 019 498	1 536 344	1 530 075	2 008 783	2 334 556

Annex 3 – I. Reported malaria cases by species, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
Malawi	Suspected	6 851 108	5 734 906	6 528 505	5 787 441	7 703 651	8 518 905	9 239 462	10 530 601	11 513 684
	Total: *P. falciparum*	–	–	1 564 984	1 280 892	2 905 310	3 585 315	4 730 835	4 901 344	5 830 741
	Total: *P. vivax*	–	–	0	0	0	0	0	0	0
	Total: mixed cases	–	–	0	0	0	0	0	0	0
	Total: other species	–	–	0	0	0	0	0	0	0
Mali	Suspected	3 324 238	2 628 593	2 171 739	2 849 453	2 590 643	4 410 839	3 563 070	3 333 079	3 725 896
Mauritania	Suspected	239 795	191 726	209 955	190 446	203 991	233 362	192 980	214 087	221 121
Mayotte	Suspected	2 023	1 214	1 463	82	15	–	12	–	–
	Indigenous: *P. falciparum*	–	–	–	–	–	–	–	–	–
	Indigenous: *P. vivax*	–	–	–	–	–	–	–	–	–
	Indigenous: mixed	–	–	–	–	–	–	–	–	–
	Indigenous: other species	–	–	–	–	–	–	–	–	–
Mozambique	Suspected	6 097 263	7 059 112	6 170 561	8 200 849	12 240 045	14 241 392	15 453 655	15 905 956	17 127 629
	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
	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
Namibia	Suspected	39 855	74 407	10 844	34 002	186 972	209 083	310 192	618 291	400 337
	Total: *P. falciparum*	556	335	194	136	15 914	12 050	329	364	280
	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
Niger	Suspected	10 616 033	3 637 778	5 915 671	5 533 601	7 014 724	4 497 920	7 172 521	3 819 436	4 810 919
	Total: *P. falciparum*	601 455	757 449	2 185 060	2 306 354	3 828 486	2 267 867	3 961 178	2 638 580	3 046 450
	Total: *P. vivax*	0	0	0	0	0	0	0	0	0
	Total: mixed cases	17 123	21 370	22 399	46 068	78 102	0	0	0	0
	Total: other species	0	0	0	0	0	4 133	186 989	0	0
Nigeria	Suspected	3 873 463	5 221 656	11 789 970	21 659 831	19 555 575	17 388 046	20 173 207	22 982 775	23 193 610
	Total: *P. falciparum*	523 513	–	–	–	–	–	–	–	–
	Total: *P. vivax*	0	–	–	–	–	–	–	–	–
	Total: mixed cases	0	–	–	–	–	–	–	–	–
	Total: other species	0	–	–	–	–	–	–	–	–
Rwanda	Suspected	2 708 973	1 602 271	3 095 386	3 064 585	4 178 206	6 093 114	7 502 174	7 557 866	6 221 481
	Total: *P. falciparum*	638 669	208 858	483 470	962 618	1 623 176	–	–	2 927 780	1 657 793
	Total: *P. vivax*	0	0	0	0	0	–	–	0	0
	Total: mixed cases	0	0	0	0	0	–	–	0	0
	Total: other species	0	0	0	0	0	–	–	0	0
Sao Tome and Principe	Suspected	58 961	117 279	126 897	108 634	91 445	84 348	121 334	96 612	169 883
	Total: *P. falciparum*	2 219	6 363	10 700	9 242	1 754	2 057	2 238	2 241	2 940
	Total: *P. vivax*	14	4	1	1	0	0	0	0	0
	Total: mixed cases	0	0	0	0	0	0	0	0	0
	Total: other species	0	6	0	0	0	1	0	0	0
Senegal	Suspected	739 714	628 096	655 294	802 227	741 835	1 421 221	1 559 054	2 035 693	2 096 124
	Total: *P. falciparum*	343 670	277 326	281 080	345 889	265 624	492 253	349 540	395 706	530 944
	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
Sierra Leone	Suspected	2 327 928	1 150 747	2 579 296	2 576 550	2 647 375	2 337 297	2 996 959	2 935 447	2 895 596
	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
	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

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AFRICAN										
South Africa	Suspected	276 669	382 434	152 561	603 932	543 196	35 982	63 277	56 257	–
	Indigenous: *P. falciparum*	–	–	–	–	–	554	1 113	21 442	9 540
	Indigenous: *P. vivax*	–	–	–	–	–	0	0	0	0
	Indigenous: mixed	–	–	–	–	–	1	0	0	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
South Sudan[1]	Suspected	900 283	795 784	1 125 039	1 855 501	2 492 473	3 814 332	17 705	4 938 773	6 405 779
	Total: *P. falciparum*	–	112 024	–	–	–	24 371	7 619	1 488 005	3 242
	Total: *P. vivax*	–	0	–	–	–	0	0	0	0
	Total: mixed cases	–	0	–	–	–	0	0	0	0
	Total: other species	–	0	–	–	–	0	0	0	0
Togo	Suspected	1 419 928	893 588	1 311 047	1 442 571	1 756 700	1 756 701	1 845 454	2 042 498	2 046 691
	Total: *P. falciparum*	224 080	237 282	260 526	272 847	1 130 234	1 113 910	1 174 116	1 208 957	1 090 110
	Total: *P. vivax*	0	0	0	0	0	0	0	0	0
	Total: mixed cases	0	0	0	8	0	0	0	0	0
	Total: other species	7	23	0	8	17	17	9 149	77	224
Uganda	Suspected	15 294 306	12 340 717	16 845 771	26 145 615	19 201 136	22 095 860	26 238 144	22 319 643	17 484 262
	Total: *P. falciparum*	1 565 348	231 873	2 662 258	1 502 362	3 631 939	7 137 662	9 385 132	11 667 831	5 759 174
	Total: *P. vivax*	15 812	0	0	0	0	0	0	0	0
	Total: mixed cases	47 435	0	0	0	0	0	0	0	0
	Total: other species	0	0	0	0	0	0	0	0	0
United Republic of Tanzania	Suspected	15 388 319	15 299 205	14 513 120	14 650 226	25 190 882	20 797 048	17 786 690	18 389 229	22 785 648
	Total: *P. falciparum*	2 338	4 489	2 730	2 194	1 810	414 983	5 015	1 733	2 240
	Total: *P. vivax*	0	0	0	0	0	0	0	0	0
	Total: mixed cases	0	0	212 837	69 511	106 764	175	89	1 606	1 020
	Total: other species	0	0	0	0	0	0	0	10	26
Mainland	Suspected	15 116 242	14 843 487	13 976 370	14 122 269	24 880 179	20 451 119	17 526 829	18 121 926	22 440 865
	Total: *P. falciparum*	–	–	0	0	0	411 741	–	–	–
	Total: *P. vivax*	–	–	0	0	0	0	–	–	–
	Total: mixed cases	–	–	212 636	69 459	106 609	0	–	–	–
	Total: other species	–	–	0	0	0	0	–	–	–
Zanzibar	Suspected	272 077	455 718	536 750	527 957	310 703	345 929	259 861	267 303	344 783
	Total: *P. falciparum*	2 338	4 489	2 730	2 194	1 810	3 242	5 015	1 733	2 240
	Total: *P. vivax*	0	0	0	0	0	0	0	0	0
	Total: mixed cases	0	0	201	52	155	175	89	1 606	1 020
	Total: other species	0	0	0	0	0	0	0	10	26
Zambia	Suspected	4 229 839	4 607 908	4 695 400	5 465 122	7 859 740	8 116 962	9 627 862	10 952 323	10 055 407
	Total: *P. falciparum*	–	–	–	–	4 077 547	4 184 661	4 851 319	5 505 639	5 039 679
	Total: *P. vivax*	–	–	–	–	0	0	0	0	0
	Total: mixed cases	–	–	–	–	0	0	0	0	0
	Total: other species	–	–	–	–	0	0	0	0	0
Zimbabwe	Suspected	912 618	480 011	727 174	1 115 005	1 420 946	1 384 893	1 224 374	1 110 705	998 486
	Total: *P. falciparum*	249 379	319 935	276 963	422 633	535 931	391 651	279 988	316 392	184 427
	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

Annex 3 – I. Reported malaria cases by species, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS										
Argentina[2]	Suspected	2 547	7 872	7 027	4 913	5 691	3 862	3 479	2 114	345
	Indigenous: *P. falciparum*	0	–	–	–	0	0	0	0	0
	Indigenous: *P. vivax*	14	–	–	–	0	0	0	0	0
	Indigenous: mixed	–	–	–	–	0	0	0	0	0
	Indigenous: other species	–	–	–	–	0	0	0	0	0
Belize	Suspected	27 366	22 996	20 789	25 351	24 122	26 367	20 936	26 995	17 642
	Indigenous: *P. falciparum*	–	0	0	0	0	0	0	0	1
	Indigenous: *P. vivax*	–	72	33	20	19	9	4	5	2
	Indigenous: mixed	–	–	–	0	0	0	0	2	0
	Indigenous: other species	–	0	0	0	0	0	0	0	0
Bolivia (Plurinational State of)	Suspected	140 857	150 662	132 904	144 049	124 900	159 167	155 407	151 697	139 938
	Indigenous: *P. falciparum*	1 557	526	385	959	325	77	4	0	0
	Indigenous: *P. vivax*	13 694	7 635	8 141	6 346	7 060	6 785	5 535	2 849	5 342
	Indigenous: mixed	35	17	11	37	16	12	3	0	0
	Indigenous: other species	0	0	0	0	0	0	0	0	0
Brazil	Suspected	2 711 433	2 477 821	2 349 341	1 893 018	1 756 460	1 590 403	1 364 917	1 695 805	1 800 173
	Indigenous: *P. falciparum*	–	–	–	26 178	21 295	14 762	13 160	18 614	17 852
	Indigenous: *P. vivax*	–	–	–	141 391	117 009	122 746	110 340	169 887	168 499
	Indigenous: mixed	–	–	–	2 090	939	683	669	1 032	1 331
	Indigenous: other species	–	–	–	31	28	38	8	26	11
Colombia	Suspected	521 342	418 032	416 767	327 055	403 532	332 706	296 091	265 077	225 464
	Indigenous: *P. falciparum*	–	–	–	–	–	27 875	47 232	29 558	29 953
	Indigenous: *P. vivax*	–	–	–	–	–	19 002	32 635	22 132	30 063
	Indigenous: mixed	–	–	–	–	–	739	2 742	1 115	1 179
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Costa Rica	Suspected	15 599	10 690	7 485	16 774	4 420	7 373	5 160	9 680	9 700
	Indigenous: *P. falciparum*	–	–	–	0	0	0	0	0	9
	Indigenous: *P. vivax*	110	10	–	0	0	0	4	12	61
	Indigenous: mixed	–	–	–	0	0	0	0	0	0
	Indigenous: other species	–	–	–	0	0	0	0	0	0
Dominican Republic	Suspected	495 637	477 555	506 583	502 683	416 729	324 787	302 600	265 535	76 007
	Indigenous: *P. falciparum*	2 480	1 614	950	473	459	631	690	341	433
	Indigenous: *P. vivax*	0	0	0	0	0	0	0	0	0
	Indigenous: mixed	0	0	0	0	0	0	0	0	0
	Indigenous: other species	0	0	0	0	0	0	0	0	0
Ecuador	Suspected	488 830	460 785	459 157	397 628	370 825	261 824	311 920	306 894	244 777
	Indigenous: *P. falciparum*	–	–	–	–	–	184	403	309	149
	Indigenous: *P. vivax*	–	–	–	–	–	434	788	963	1 504
	Indigenous: mixed	–	–	–	–	–	0	0	3	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
El Salvador	Suspected	115 256	100 884	124 885	103 748	106 915	89 267	81 904	70 022	52 216
	Indigenous: *P. falciparum*	–	–	–	0	0	0	0	0	0
	Indigenous: *P. vivax*	–	–	–	6	6	2	13	0	0
	Indigenous: mixed	–	–	–	0	0	0	0	0	0
	Indigenous: other species	–	–	–	0	0	0	0	0	0

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS										
French Guiana	Suspected	14 373	14 429	13 638	22 327	14 651	11 558	9 457	597	–
	Total: *P. falciparum*	987	584	382	304	136	84	72	70	–
	Total: *P. vivax*	476	339	257	220	129	230	119	400	–
	Total: mixed cases	561	496	381	348	182	120	67	127	–
	Total: other species	5	5	2	0	1	0	0	0	–
Guatemala	Suspected	237 075	195 080	186 645	153 731	300 989	301 746	408 394	372 158	514 133
	Indigenous: *P. falciparum*	30	64	54	101	24	43	4	0	3
	Indigenous: *P. vivax*	7 163	6 707	5 278	6 062	4 838	5 487	4 849	1 781	3 018
	Indigenous: mixed	5	3	14	51	67	8	–	–	0
	Indigenous: other species	0	0	0	0	0	0	–	0	0
Guyana	Suspected	212 863	201 728	196 622	205 903	142 843	132 941	116 300	100 096	99 806
	Total: *P. falciparum*	11 244	15 945	16 722	13 655	3 943	3 219	4 200	5 141	6 032
	Total: *P. vivax*	8 402	9 066	11 244	13 953	7 173	6 002	7 144	7 645	9 853
	Total: mixed cases	3 157	4 364	3 607	3 770	1 197	731	966	1 078	1 089
	Total: other species	132	96	92	101	41	32	57	72	64
Haiti	Suspected	270 427	184 934	167 772	176 995	261 403	302 740	302 044	295 572	288 294
	Total: *P. falciparum*	84 153	32 969	25 423	20 957	17 696	17 583	22 457	19 858	9 112
	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
Honduras	Suspected	156 961	156 559	159 165	144 673	152 847	153 906	182 767	165 536	161 400
	Indigenous: *P. falciparum*	866	585	560	1 113	564	404	–	99	55
	Indigenous: *P. vivax*	8 759	7 044	5 865	4 269	2 881	1 250	–	773	564
	Indigenous: mixed	120	34	24	46	37	7	–	–	1
	Indigenous: other species	0	0	0	0	0	0	–	0	–
Mexico	Suspected	1 192 081	1 035 424	1 025 659	1 017 508	900 580	867 853	798 568	644 174	548 247
	Indigenous: *P. falciparum*	–	–	–	0	0	0	0	0	0
	Indigenous: *P. vivax*	–	–	–	495	656	517	551	736	803
	Indigenous: mixed	–	–	–	0	0	0	0	0	0
	Indigenous: other species	–	–	–	0	0	0	0	0	0
Nicaragua	Suspected	554 414	536 105	552 722	539 022	605 357	604 418	554 415	663 132	875 982
	Indigenous: *P. falciparum*	–	–	–	208	155	338	1 285	1 836	1 319
	Indigenous: *P. vivax*	–	–	–	954	985	1 937	4 965	9 080	14 553
	Indigenous: mixed	–	–	–	0	2	4	22	33	45
	Indigenous: other species	–	–	–	0	0	0	0	0	0
Panama	Suspected	141 038	116 588	107 711	93 624	80 701	64 511	50 772	38 270	23 383
	Indigenous: *P. falciparum*	–	–	–	–	0	0	21	1	0
	Indigenous: *P. vivax*	–	–	–	–	864	546	748	648	684
	Indigenous: mixed	–	–	–	–		0	0	0	0
	Indigenous: other species	–	–	–	–	0	0	0	0	0
Paraguay	Suspected	62 178	48 611	31 499	24 806	24 832	6 687	3 193	9 281	–
	Indigenous: *P. falciparum*	–	–	–	–	–	0	0	0	–
	Indigenous: *P. vivax*	18	1	–	–	–	0	0	0	–
	Indigenous: mixed	–	–	–	–	–	0	0	0	–
	Indigenous: other species	–	–	–	–	–	0	0	0	–
Peru	Suspected	744 650	702 952	759 285	864 648	866 047	867 980	566 230	402 623	464 785
	Indigenous: *P. falciparum*	2 291	2 929	3 399	7 890	10 416	12 569	15 319	13 173	9 438
	Indigenous: *P. vivax*	29 169	21 984	28 030	40 829	54 819	49 287	41 287	42 044	36 005
	Indigenous: mixed	83	89	102	213	0	0	0	0	0
	Indigenous: other species	3	3	7	11	17	9	17	2	0

Annex 3 – I. Reported malaria cases by species, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS										
Suriname	Suspected	17 133	16 184	21 685	19 736	33 425	15 236	23 444	22 034	19 836
	Indigenous: *P. falciparum*	638	310	115	322	165	17	6	1	5
	Indigenous: *P. vivax*	817	382	167	322	78	61	69	17	23
	Indigenous: mixed	83	21	11	85	158	3	1	1	1
	Indigenous: other species	36	17	2	0	0	0	0	0	0
Venezuela (Bolivarian Republic of)	Suspected	400 495	382 303	410 663	476 764	522 617	625 174	932 556	1 144 635	747 247
	Indigenous: *P. falciparum*	10 629	9 724	10 978	22 777	21 074	24 018	46 503	69 076	71 504
	Indigenous: *P. vivax*	32 710	34 651	39 478	50 938	62 850	100 880	179 554	316 401	307 622
	Indigenous: mixed	286	909	2 324	4 882	6 769	11 491	14 531	26 080	25 789
	Indigenous: other species	60	6	23	46	15	13	25	29	9
EASTERN MEDITERRANEAN										
Afghanistan	Suspected	847 589	936 252	847 933	787 624	743 183	801 938	939 389	932 096	932 614
	Total: *P. falciparum*	6 142	5 581	1 231	1 877	3 000	4 004	6 369	6 907	6 437
	Total: *P. vivax*	63 255	71 968	53 609	43 369	58 362	82 891	132 407	154 468	166 583
	Total: mixed cases	0	0	0	0	0	0	311	403	473
	Total: other species	0	0	0	0	0	0	0	0	0
Djibouti	Suspected	1 010	354	1 410	7 189	39 284	10 586	19 492	74 608	104 800
	Total: *P. falciparum*	1 010	–	20	0	–	–	11 781	9 290	16 130
	Total: *P. vivax*	0	–	0	0	–	–	2 041	5 381	9 189
	Total: mixed cases	0	–	0	0	–	–	0	0	0
	Total: other species	0	–	0	0	–	–	0	0	0
Iran (Islamic Republic of)	Suspected	614 817	530 470	479 655	385 172	468 513	630 886	418 125	383 397	541 975
	Indigenous: *P. falciparum*	–	–	–	–	–	8	0	2	0
	Indigenous: *P. vivax*	–	–	–	–	–	157	79	55	0
	Indigenous: mixed	–	–	–	–	–	1	2		0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Pakistan	Suspected	8 601 835	8 418 570	8 902 947	7 752 797	8 514 341	8 885 456	8 072 464	8 122 212	7 123 228
	Total: *P. falciparum*	73 857	73 925	95 095	46 067	33 391	30 075	42 011	54 467	55 639
	Total: *P. vivax*	143 136	205 879	228 215	283 661	232 332	163 872	257 962	300 623	314 572
	Total: mixed cases	0	0	2 901	10 506	9 426	8 066	24 493	14 787	4 299
	Total: other species	0	0	0	0	0	0	0	0	0
Saudi Arabia	Suspected	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
	Indigenous: *P. falciparum*	–	–	82	–	–	83	270	172	57
	Indigenous: *P. vivax*	–	–	–	–	–	0	2	5	4
	Indigenous: mixed	–	–	–	–	–	0	0	0	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Somalia	Suspected	220 698	99 403	53 658	69 192	79 653	119 008	205 753	228 912	253 220
	Total: *P. falciparum*	5 629	–	–	–	–	–	–	–	–
	Total: *P. vivax*	0	–	–	–	–	–	–	–	–
	Total: mixed cases	0	–	–	–	–	–	–	–	–
	Total: other species	0	–	–	–	–	–	–	–	–
Sudan	Suspected	2 398 239	2 929 578	2 438 467	2 197 563	1 207 771	4 101 841	4 199 740	3 691 112	9 723 425
	Total: *P. falciparum*	–	–	–	–	–	–	333 009	580 145	1 286 915
	Total: *P. vivax*	–	–	–	–	–	–	82 175	58 335	143 314
	Total: mixed cases	–	–	–	–	–	–	32 557	82 399	187 270
	Total: other species	–	–	–	–	–	–	24 105	0	0
Yemen	Suspected	835 018	804 401	888 952	927 821	821 618	711 680	1 181 486	1 630 469	713 908
	Total: *P. falciparum*	77 271	59 689	109 504	102 369	86 428	75 898	45 469	109 849	112 823
	Total: *P. vivax*	966	478	398	408	267	334	347	1 833	970
	Total: mixed cases	30	7	0	0	12	27	70	2 322	63
	Total: other species	2	33	0	0	0	0	0	0	69

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
EUROPEAN										
Armenia	Suspected	31 026	0	821 860	825 443	–	–	–	350	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	0	0	0	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	–	–	–	–	0	0	0	–
Azerbaijan	Suspected	456 652	449 168	497 040	432 810	399 925	405 416	465 860	373 562	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	50	4	3	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Georgia	Suspected	2 368	2 032	1 046	192	440	294	318	416	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	0	1	1	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Kyrgyzstan[2]	Suspected	30 190	27 850	18 268	54 249	35 600	–	–	–	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	3	0	0	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Tajikistan	Suspected	173 523	173 367	209 239	213 916	200 241	188 341	233 336	232 502	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	111	65	18	7	2	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Turkey	Suspected	507 841	421 295	337 830	255 125	189 854	221	144 499	115 557	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	9	4	219	34	5	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Turkmenistan[2]	Suspected	81 784	–	–	–	–	83 675	85 536	84 264	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	0	0	0	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
Uzbekistan[2]	Suspected	921 364	886 243	805 761	908 301	812 347	800 912	797 472	655 112	–
	Indigenous: *P. falciparum*	0	0	0	0	0	0	0	0	–
	Indigenous: *P. vivax*	3	0	0	0	0	0	0	0	–
	Indigenous: mixed	0	0	0	0	0	0	0	0	–
	Indigenous: other species	0	0	0	0	0	0	0	0	–
SOUTH-EAST ASIA										
Bangladesh	Suspected	461 262	390 102	309 179	93 926	125 201	122 806	138 973	150 518	133 547
	Total: *P. falciparum*	52 012	49 084	9 428	3 597	8 981	5 351	3 509	4 224	1 609
	Total: *P. vivax*	3 824	2 579	396	262	489	488	427	522	280
	Total: mixed cases	37	110	36	5	746	769	851	166	30
	Total: other species	0	0	0	0	0	0	0	0	0

Annex 3 – I. Reported malaria cases by species, 2010–2018

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
SOUTH-EAST ASIA										
Bhutan	Suspected	54 760	44 494	42 512	31 632	33 586	74 087	118 841	42 146	133 498
	Indigenous: *P. falciparum*	–	–	–	–	–	13	1	0	1
	Indigenous: *P. vivax*	–	–	–	–	–	21	13	11	5
	Indigenous: mixed	–	–	–	–	–	0	1	0	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Democratic People's Republic of Korea	Suspected	27 019	27 857	40 925	72 719	38 878	91 007	205 807	189 357	685 704
	Total: *P. falciparum*	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	3 598
	Total: mixed cases	0	0	0	0	0	0	0	0	0
	Total: other species	0	0	0	0	0	0	0	0	0
India	Suspected	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
	Total: *P. falciparum*	830 779	662 748	524 370	462 079	720 795	774 627	706 257	525 637	204 733
	Total: *P. vivax*	765 622	645 652	534 129	417 884	379 659	390 440	375 783	315 028	222 730
	Total: mixed cases	3 585	2 256	0	1 767	1 751	4 194	5 245	3 893	2 465
	Total: other species	0	0	0	0	0	0	0	0	0
Indonesia	Suspected	1 591 179	1 212 799	1 900 725	1 708 161	1 550 296	1 567 450	1 457 858	1 441 679	1 474 636
	Total: *P. falciparum*	220 077	200 662	199 977	170 848	126 397	103 315	118 844	143 926	101 736
	Total: *P. vivax*	187 583	187 989	187 583	150 985	107 260	94 267	81 748	95 694	70 867
	Total: mixed cases	21 964	31 535	29 278	20 352	16 410	13 105	16 751	18 899	16 068
	Total: other species	2 547	2 261	981	1 342	1 960	1 387	1 106	1 818	1 902
Myanmar	Suspected	1 277 568	1 210 465	1 423 555	1 300 556	1 567 095	2 663 732	3 185 245	3 368 697	3 099 776
	Total: *P. falciparum*	70 941	59 604	314 650	223 303	138 311	110 539	62 917	50 730	37 566
	Total: *P. vivax*	29 944	28 966	135 386	99 037	61 830	65 590	43 748	32 070	31 389
	Total: mixed cases	2 054	3 020	30 419	12 255	5 511	6 632	3 476	2 214	1 474
	Total: other species	346	162	103	25	6	14	5	5	3
Nepal	Suspected	213 353	188 702	243 432	168 687	200 631	131 654	146 705	214 265	256 912
	Total: *P. falciparum*	550	219	612	273	195	250	137	103	47
	Total: *P. vivax*	2 349	1 631	1 480	1 659	1 154	1 516	846	1 173	1 106
	Total: mixed cases	216	30	0	22	120	71	26	17	5
	Total: other species	0	0	0	0	0	0	0	0	0
Sri Lanka[2]	Suspected	1 001 107	985 060	948 250	1 236 580	1 069 817	1 156 151	1 090 760	1 104 796	1 149 897
	Indigenous: *P. falciparum*	6	3	4	–	–	0	0	0	0
	Indigenous: *P. vivax*	668	119	19	–	–	0	0	0	0
	Indigenous: mixed	–	–	–	–	–	0	0	0	0
	Indigenous: other species	0	0	0	–	–	0	0	0	0
Thailand	Suspected	1 777 977	1 450 885	1 130 757	1 927 585	1 756 528	1 370 461	1 461 007	1 149 546	921 548
	Indigenous: *P. falciparum*	–	–	–	–	–	3 291	1 609	846	447
	Indigenous: *P. vivax*	–	–	–	–	–	4 655	5 765	4 802	3 575
	Indigenous: mixed	–	–	–	–	–	57	40	36	34
	Indigenous: other species	–	–	–	–	–	19	14	10	21
Timor-Leste	Suspected	266 386	225 858	182 857	178 200	117 107	121 054	150 333	129 175	154 816
	Indigenous: *P. falciparum*	–	–	–	–	–	–	46	5	0
	Indigenous: *P. vivax*	–	–	–	–	–	–	8	3	0
	Indigenous: mixed	–	–	–	–	–	–	28	8	0
	Indigenous: other species	–	–	–	–	–	–	0	0	0
WESTERN PACIFIC										
Cambodia	Suspected	193 210	216 712	194 263	152 137	142 242	163 680	166 695	168 245	166 638
	Total: *P. falciparum*	8 213	7 054	14 896	7 092	8 332	17 830	12 156	20 328	10 525
	Total: *P. vivax*	4 794	5 155	19 575	11 267	10 356	13 146	9 816	15 207	30 680
	Total: mixed cases	1 270	1 583	4 971	2 418	6 464	2 954	1 520	1 397	1 080
	Total: other species	0	0	0	0	0	0	0	0	0

WHO region Country/area		2010	2011	2012	2013	2014	2015	2016	2017	2018
WESTERN PACIFIC										
China	Suspected	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
	Indigenous: *P. falciparum*	–	–	–	–	–	1	0	0	0
	Indigenous: *P. vivax*	–	–	–	–	–	26	3	0	0
	Indigenous: mixed	–	–	–	–	–	0	0	0	0
	Indigenous: other species	–	–	–	–	–	6	0	0	0
Lao People's Democratic Republic	Suspected	280 549	291 775	369 976	339 013	294 542	284 003	223 992	274 314	286 881
	Total: *P. falciparum*	4 393	5 770	37 692	24 538	23 928	14 430	4 255	4 550	4 726
	Total: *P. vivax*	122	442	7 634	12 537	22 625	20 804	6 795	4 590	4 077
	Total: mixed cases	8	0	769	956	1 517	822	173	193	110
	Total: other species	1	14	0	1	1	0	0	0	0
Malaysia	Suspected	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
	Indigenous: *P. falciparum*	–	–	–	–	–	110	67	18	0
	Indigenous: *P. vivax*	–	–	–	–	–	84	178	59	0
	Indigenous: mixed	–	–	–	–	–	22	9	1	0
	Indigenous: other species	–	–	–	–	–	26	12	7	0
Papua New Guinea	Suspected	1 505 393	1 279 140	1 113 528	1 454 166	922 417	909 940	1 168 797	1 400 593	1 513 776
	Total: *P. falciparum*	56 735	59 153	58 747	119 469	120 641	118 452	183 686	163 160	174 818
	Total: *P. vivax*	13 171	9 654	7 108	7 579	78 846	62 228	95 328	113 561	138 006
	Total: mixed cases	4 089	1 164	0	1 279	79 574	115 157	197 711	200 186	201 658
	Total: other species	1 990	632	0	1 279	2 125	1 950	1 772	1 433	1 767
Philippines	Suspected	301 577	327 125	333 084	320 089	316 323	280 222	321 838	284 564	282 385
	Total: *P. falciparum*	11 824	6 877	4 774	4 968	3 760	4 781	5 320	3 160	1 370
	Total: *P. vivax*	2 885	2 380	2 189	1 357	834	760	826	538	129
	Total: mixed cases	214	166	0	83	235	196	391	83	26
	Total: other species	175	127	0	67	74	87	142	46	49
Republic of Korea	Suspected	1 772	838	555	443	638	699	0	0	576
	Indigenous: *P. falciparum*	–	–	–	–	–	0	0	0	0
	Indigenous: *P. vivax*	–	–	–	–	–	628	602	436	501
	Indigenous: mixed	–	–	–	–	–	0	0	0	0
	Indigenous: other species	–	–	–	–	–	0	0	0	0
Solomon Islands	Suspected	284 931	254 506	249 520	245 014	233 803	192 044	274 881	238 814	244 523
	Total: *P. falciparum*	22 892	14 454	14 748	13 194	9 835	10 478	16 607	15 400	15 771
	Total: *P. vivax*	12 281	8 665	9 339	11 628	7 845	12 150	33 060	30 169	35 072
	Total: mixed cases	200	83	232	446	724	1 370	4 719	6 917	8 341
	Total: other species	0	0	0	0	0	0	46	33	7
Vanuatu	Suspected	48 088	32 656	33 273	28 943	35 570	14 938	21 484	30 313	26 931
	Total: *P. falciparum*	1 545	770	1 257	1 039	279	150	186	273	49
	Total: *P. vivax*	2 265	1 224	1 680	1 342	703	273	1 682	799	595
	Total: mixed cases	193	81	470	0	0	0	0	0	0
	Total: other species	10	2	0	0	0	0	0	0	0
Viet Nam	Suspected	2 803 918	3 312 266	3 436 534	3 115 804	2 786 135	2 673 662	2 497 326	2 614 663	2 167 376
	Total: *P. falciparum*	12 763	10 101	11 448	9 532	8 245	4 327	2 323	2 858	2 966
	Total: *P. vivax*	4 466	5 602	7 220	6 901	7 220	4 756	1 750	1 608	1 751
	Total: mixed cases	0	0	0	0	287	234	73	70	83
	Total: other species	0	0	0	0	0	14	15	12	13

Data as of 14 February 2020

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

"–" refers to not applicable or data not available.

[1] 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).

[2] Certified malaria free countries are included in this listing for historical purposes.

Note: Indigenous cases are reported for countries with elimination programmes and/or with >99% of total confirmed cases investigated. For countries in the WHO Region of the Americas, the number of Total: *P. falciparum*, Total: *P. vivax*, Total: mixed cases and Total: other species are indigenous cases for all years apart from Dominican Republic and Venezuela (Bolivarian Republic of) (2013 onwards), Argentina, Guatemala and Peru (2014 onwards) and Bolivia (Plurinational State of), Honduras and Suriname (2015 onwards). Indigenous cases are reported for Botswana and Eswatini from 2015 onwards. Suspected cases include indigenous and imported cases. For countries with only suspected cases shown, no species breakdown was provided.

Annex 3 - J. Reported malaria deaths, 2010–2018

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018
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
Benin	964	1 753	2 261	2 288	1 869	1 416	1 646	2 182	2 138
Botswana	8	8	3	7	22	5	3	17	9
Burkina Faso	9 024	7 001	7 963	6 294	5 632	5 379	3 974	4 144	4 294
Burundi	2 677	2 233	2 263	3 411	2 974	3 799	5 853	4 414	2 481
Cabo Verde	1	1	0	0	1	0	1	1	0
Cameroon	4 536	3 808	3 209	4 349	4 398	3 440	2 639	3 195	3 256
Central African Republic	526	858	1 442	1 026	635	1 763	2 668	3 689	1 292
Chad	886	1 220	1 359	1 881	1 720	1 572	1 686	2 088	1 948
Comoros	53	19	17	15	0	1	0	3	8
Congo	–	892	623	2 870	271	435	733	229	131
Côte d'Ivoire	1 023	1 389	1 534	3 261	4 069	2 604	3 340	3 222	3 133
Democratic Republic of the Congo	23 476	23 748	21 601	30 918	25 502	39 054	33 997	27 458	18 030
Equatorial Guinea	30	52	77	66	–	28	109	–	–
Eritrea	27	12	30	6	15	12	21	8	5
Eswatini	8	1	3	4	4	5	3	20	2
Ethiopia	1 581	936	1 621	358	213	662	510	356	158
Gabon	182	74	134	273	159	309	101	218	591
Gambia	151	440	289	262	170	167	79	54	60
Ghana	3 859	3 259	2 855	2 506	2 200	2 137	1 264	599	428
Guinea	735	743	979	108	1 067	846	867	1 174	1 267
Guinea-Bissau	296	472	370	418	357	477	191	296	244
Kenya	26 017	713	785	360	472	15 061	603	–	–
Liberia	1 422	–	1 725	1 191	2 288	1 379	1 259	758	–
Madagascar	427	398	552	641	551	841	443	370	927
Malawi	8 206	6 674	5 516	3 723	4 490	3 799	4 000	3 613	2 967
Mali	3 006	2 128	1 894	1 680	2 309	1 544	1 344	1 050	1 001
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
Namibia	63	36	4	21	61	45	65	104	82
Niger	3 929	2 802	2 825	2 209	2 691	2 778	2 226	2 316	3 576
Nigeria	4 238	3 353	7 734	7 878	6 082	–	–	–	–
Rwanda	670	380	459	409	496	516	715	376	341
Sao Tome and Principe	14	19	7	11	0	0	1	1	0
Senegal	553	472	649	815	500	526	325	284	555
Sierra Leone	8 188	3 573	3 611	4 326	2 848	1 107	1 345	1 298	1 949
South Africa	83	54	72	105	174	110	34	301	69
South Sudan[2]	1 053	406	1 321	1 311	–	–	–	3 483	1 191
Togo	1 507	1 314	1 197	1 361	1 205	1 205	847	995	905
Uganda	8 431	5 958	6 585	7 277	5 921	6 100	5 635	5 111	3 302
United Republic of Tanzania	15 867	11 806	7 820	8 528	5 373	6 313	5 046	3 685	2 753
Mainland	15 819	11 799	7 812	8 526	5 368	6 311	5 045	3 684	2 747
Zanzibar	48	7	8	2	5	2	1	1	6
Zambia	4 834	4 540	3 705	3 548	3 257	2 389	1 827	1 425	1 209
Zimbabwe	255	451	351	352	406	200	351	527	192
AMERICAS									
Argentina[1]	0	0	0	0	0	0	0	0	0
Belize	0	0	0	0	0	0	0	0	0
Bolivia (Plurinational State of)	0	0	0	0	1	0	0	0	0
Brazil	76	70	60	40	36	35	35	34	44
Colombia	42	23	24	10	17	18	36	19	9
Costa Rica	0	0	0	0	0	0	0	0	0
Dominican Republic	15	10	8	5	4	3	1	1	1
Ecuador	0	0	0	0	0	0	0	0	0
El Salvador[3]	0	0	0	0	0	0	0	0	0
French Guiana	1	2	2	3	0	0	0	0	–
Guatemala	0	0	0	1	1	1	0	0	0
Guyana	24	36	35	14	11	12	13	11	6
Haiti	8	5	6	10	9	15	13	12	12
Honduras	3	2	1	1	2	0	0	1	1
Mexico	0	0	0	0	0	0	0	0	0
Nicaragua	1	1	2	0	0	1	2	1	3
Panama	1	0	1	0	0	0	0	0	0

WHO region Country/area	2010	2011	2012	2013	2014	2015	2016	2017	2018
AMERICAS									
Paraguay[1]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Peru	0	1	7	4	4	5	7	*10*	*4*
Suriname	1	1	0	1	1	*0*	*0*	*1*	*0*
Venezuela (Bolivarian Republic of)	18	16	10	6	5	8	105	333	257
EASTERN MEDITERRANEAN									
Afghanistan	22	40	36	24	32	49	47	10	1
Djibouti	0	0	0	17	28	23	5	–	–
Iran (Islamic Republic of)[3]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Pakistan	–	4	260	244	56	34	33	113	102
Saudi Arabia	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Somalia	6	5	10	23	14	27	13	20	31
Sudan	1 023	612	618	685	823	868	698	1 534	3 129
Yemen	92	75	72	55	23	14	65	37	57
EUROPEAN									
Armenia[1]	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Azerbaijan[3]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Georgia[3]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Kyrgyzstan[1]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Tajikistan[3]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Turkey[3]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Turkmenistan[1]	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Uzbekistan[1]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SOUTH-EAST ASIA									
Bangladesh	37	36	11	15	45	9	17	13	7
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*
India	1 018	754	519	440	562	384	331	194	96
Indonesia	432	388	252	385	217	157	161	47	34
Myanmar	788	581	403	236	92	37	21	30	19
Nepal	6	2	0	0	0	0	*3*	*0*	*0*
Sri Lanka[1]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Thailand	80	43	37	47	38	33	27	15	8
Timor-Leste[3]	58	16	6	3	1	0	*0*	*0*	*0*
WESTERN PACIFIC									
Cambodia	151	94	45	12	18	10	3	1	0
China[3]	19	33	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lao People's Democratic Republic	24	17	44	28	4	2	1	2	6
Malaysia[4]	*13*	*12*	*12*	*10*	*4*	*4*	*2*	*10*	*12*
Papua New Guinea	616	523	381	307	203	163	306	273	216
Philippines	30	12	16	12	10	20	*7*	*3*	*1*
Republic of Korea	*1*	*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Solomon Islands	34	19	18	18	23	13	20	27	7
Vanuatu	1	1	0	0	0	*0*	*0*	*0*	*0*
Viet Nam	21	14	8	6	6	3	*2*	*5*	*1*
REGIONAL SUMMARY									
African	150 335	104 057	104 105	116 354	99 380	118 362	103 748	94 212	73 276
Americas	190	167	156	95	91	98	212	423	337
Eastern Mediterranean	1 143	736	996	1 048	976	1 015	861	1 714	3 320
European	0	0	0	0	0	0	0	0	0
South-East Asia	2 421	1 821	1 229	1 126	955	620	560	299	164
Western Pacific	910	727	524	393	268	215	341	321	243
Total	**154 999**	**107 508**	**107 010**	**119 016**	**101 670**	**120 310**	**105 722**	**96 969**	**77 340**

Data as of 26 November 2019

[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 is no indigenous malaria deaths.

[4] In Malaysia, there is no local transmission of human malaria in 2018. Malaria deaths are imported non-human malaria.

Note: Deaths reported before 2000 can be probable and confirmed or only confirmed deaths depending on the country. Indigenous malaria deaths are in italics.

Notes

Notes

Notes

malaria atlas project

Imperial College London

The mark "CDC" is owned by the US Dept. of Health and Human Services and is used with permission. Use of this logo is not an endorsement by HHS or CDC of any particular product, service, or enterprise.

For further information please contact:

Global Malaria Programme
World Health Organization
20, avenue Appia
CH-1211 Geneva 27
Web: www.who.int/malaria
Email: infogmp@who.int

ISBN 978 92 4 156572 1