



Eliminating malaria in MEXICO

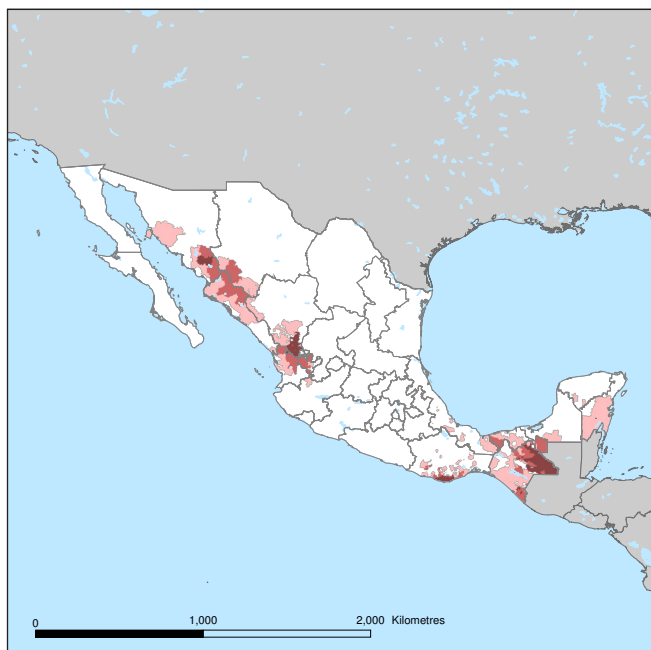
Mexico has nearly eliminated *Plasmodium falciparum* and reduced malaria cases by 91 percent between 2000 and 2014 as it works to eliminate all remaining malaria transmission foci.

At a Glance¹

- 656** Reported cases of malaria (99% *P. vivax*)
- 0** Deaths from malaria (last death reported in 1996)
- 2.7** % of population in areas of active transmission (total population: 125.4 million)
- 0.005** Annual parasite incidence (cases/1,000 total population/year)
- 0.07** % Slide positivity rate

Malaria Transmission Limits






Plasmodium vivax



Overview

Mexico is categorized in the elimination phase by the World Health Organization (WHO) and achieved a 91 percent decrease in reported malaria cases between 2000 and 2014, from 7,390 cases to 656 cases.¹ In 2014, nearly all reported cases were due to *Plasmodium vivax* and since 2007, only five cases of *P. falciparum* have been reported.¹ More than two-thirds of Mexican states have been malaria-free since 2004, and the endemic region has been primarily concentrated in the southeast along Mexico's border with Guatemala, where more than 80 percent of all cases occurred in 2008.² A majority of cases in 2008 were reported in rural areas and 40 percent of all cases occurred in children under 15 years of age.² The primary malaria vector is *Anopheles albimanus* which is found in coastal areas and is more active during the rainy season.³ *An. pseudopunctipennis* has been identified as a malaria vector in rural areas of Chiapas and thrives primarily during the dry season in inland areas.⁴

Mexico began malaria control initiatives in the 1930s and has achieved significant progress despite the challenges associated with its endemic southern border region and rural populations. The ministry of health has outlined specific, measurable goals for its malaria program and developed a plan for 2007 to 2012 to improve surveillance capacity through: use of

-  Water
-  *P. vivax* free
-  Unstable transmission (API < 0.1)
-  Low stable transmission (0.1 ≥ API < 1.0)
-  Stable transmission (≥ 1.0 API)

P. vivax malaria risk is classified into no risk, unstable risk of < 0.1 case per 1,000 population (API), low stable risk of ≥ 0.1 to < 1.0 case per 1,000 population (API), and stable risk of ≥ 1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.



geographic information systems mapping; enhanced vector control activities to reduce mosquito populations; use of rapid diagnostic tests to decrease time between diagnosis and treatment; and targeting high-transmission areas in southeast Mexico.⁵

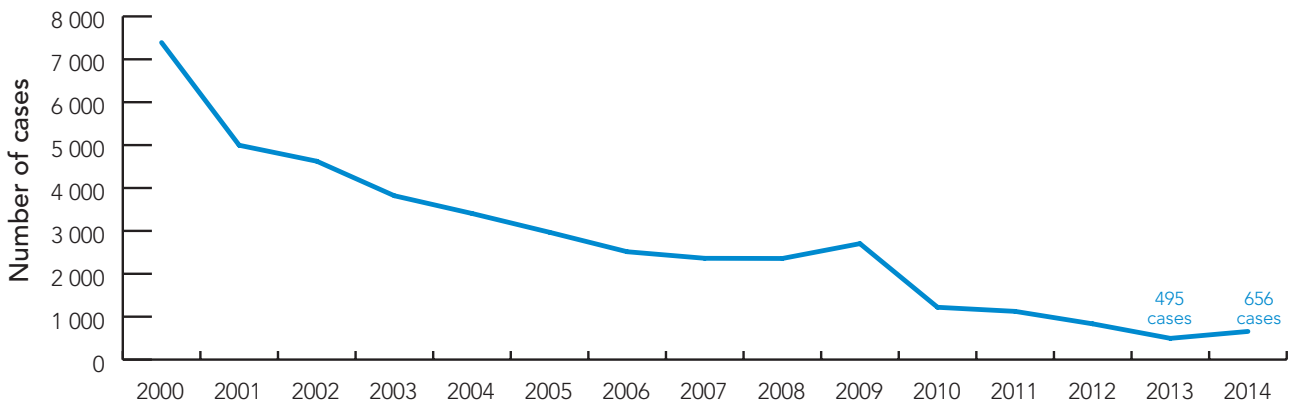
Progress Toward Elimination

Malaria control in Mexico began in 1938 when two million cases of malaria and 25,000 deaths prompted the Mexican government to develop the Anti-Malaria Sanitary Commission⁷ which spearheaded the 1944 launch of a national DDT spraying campaign.⁸ The WHO Eighth World Health Assembly, where the Global Malaria Eradication Program was established, was held in Mexico City in 1955.⁷ The assembly's presence highlighted Mexico's malaria situation, prompting UNICEF's donation to the national government—\$15 million to Mexico for malaria control.⁷

From 1957 to 1962, Mexico implemented an intensive elimination program, spraying more than four million homes with DDT, testing over six million people for malaria, and distributing 11.2 million antimalarial drugs as prophylaxis.⁹ By 1960, malaria morbidity was greatly reduced, from 1.3 cases per 1,000 population in 1955 to only 0.1 cases per 1,000 population.⁹ By 1961, Mexico's extensive DDT spraying efforts eliminated the *Aedes aegypti* mosquito,⁴ but more than 60 percent of the country was still living in areas at-risk for malaria.⁹

Mexico continued its intensive DDT spraying program in the pursuit of eliminating malaria by 1968.⁹ However, by the mid-1960s DDT resistance had developed, and its use was greatly reduced in the 1970s due to concerns over the potential impact to human health and the environment.¹⁰ In 1986, 140,000 cases were reported,⁷ which was a marked increase from the 3,665 cases reported in 1960.⁹ In 1989, in response

Reported Malaria Cases



*Graph shows total reported cases from 2000–2009; as of 2010, only local cases are shown.

Source: World Health Organization, World Malaria Report 2015

Goal:⁶ Regional goal of zero local malaria cases in Mesoamerica and Hispaniola by 2020*

*Participating countries include: Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama



to the increase in cases, Mexico implemented the intensive simultaneous action plan, a mass antimalarial drug administration and indoor residual spraying program aimed at high-transmission areas.¹¹ In 1996, because of environmental and health concerns, Mexico set the goals of reducing DDT spraying by 80 percent by 2002 and completely stopping its use by 2006.⁴

In 1998, there was a malaria outbreak in Oaxaca State of more than 25,000 cases due to destruction caused by Hurricane Pauline.² To address at-risk areas, Mexico improved its malaria control program by conducting indoor residual spraying, mobilizing inland at-risk communities to remove algae from stagnant water, and employing rapid diagnostic testing to help reduce lag time between diagnosis and treatment.¹²

In 2008, approximately 30,000 homes in 200 locations were sprayed mainly in Mexico's southern states bordering Guatemala and Belize. The program also empowered more than 82,000 community volunteers to participate in vector control activities by removing mosquito breeding grounds within their communities.²

Eligibility for External Funding¹²⁻¹⁴

The Global Fund to Fight AIDS, Tuberculosis and Malaria	No
U.S. Government's President's Malaria Initiative	No
World Bank International Development Association	No

Economic Indicators¹⁵

GNI per capita (US\$)	\$9,860
Country income classification	Upper middle
Total health expenditure per capita (US\$)	\$664
Total expenditure on health as % of GDP	6
Private health expenditure as % total health expenditure	48

Challenges to Eliminating Malaria

Indigenous population

A majority of cases occur in indigenous people living in rural areas.² Indigenous people living in rural areas of the states of Chiapas and Oaxaca have less access to health facilities due to poor transportation infrastructure.¹⁶ Additionally, the ministry of health is challenged with developing malaria education programs for nonnative Spanish speakers and addressing vector control for a population that may live in less-enclosed housing structures.¹⁶

Migration

More than two million documented and undocumented migrants cross into Mexico each year. More than 250,000 undocumented Guatemalans now live in Mexico, many of whom fled from Guatemala during its civil war (1960–1996).¹⁷ Cross-border migration along Mexico's border with Guatemala increases malaria transmission in this area.²

Conclusion

Mexico has developed a plan to reduce cases and eliminate transmission in targeted states.⁵ Mexico's malaria program will benefit from cross-border initiatives with Guatemala and Belize, including focalized control of transmission in high-risk states such as Chiapas and Oaxaca. With continued success in reducing malaria, Mexico will be able to achieve its goals toward malaria elimination.



Sources

1. WHO. *World Malaria Report 2015*. Geneva: World Health Organization; 2015.
2. PAHO. Informe de la Situación del Paludismo en las Américas 2008: México; 2009.
3. Sinka ME, Rubio-Palis Y, Manguin S, Patil AP, Temperley WH, Gething PW, et al. The dominant Anopheles vectors of human malaria in the Americas: occurrence data, distribution maps and bionomic precis. *Parasit Vectors*. 2010; 3: 72.
4. Secretaría de Salud. *El Paludismo en México*; 2006.
5. Secretaría de Salud. Programa de Acción Específico 2007–2012 Paludismo. México, D.F: Secretaría de Salud; 2008.
6. Population Services International. The Global Fund to Fight Aids, Tuberculosis and Malaria Program Grant Agreement: Elimination of Malaria in Mesoamerica and the Island of Hispaniola. 2014.
7. Malagón F. Malaria eradication in Mexico: Some historico-parasitological views on Cold war, deadly fevers, by Marcos Cueto. *Philosophy, Ethics, and Humanities in Medicine*. 2008; 3(15): 8.
8. Stapleton D. Lessons of History? Anti-Malaria Strategies of the International Health Board and the Rockefeller Foundation from the 1920s to the Era of DDT. *Public Health Reports*. 2004; 119: 9.
9. Cueto M. Appropriation and Resistance: Local Responses to Malaria Eradication in Mexico, 1955–1970. *J Lat Amer Stud* 2005; 37: 533–59.
10. Rodríguez M. Improving Malaria Control Towards Elimination in Mesoamerica. Hainan, China; 2009.
11. Ministerio de Salud. *Paludismo en México: ¿Eliminable?*; 2001.
12. Eberlee J. Controlling Malaria in Mexico Using Alternatives to DDT: International Development Research Center; 2001.
13. IDA. International Development Association Eligibility. 2013; Available from: <http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/IDA/0,,contentMDK:20054572~menuPK:3414210~pagePK:51236175~piPK:437394~theSitePK:73154,00.html>.
14. PMI. U.S. Government's President's Malaria Initiative (PMI). 2013; Available from: <http://www.fightingmalaria.gov/countries/index.html>.
15. The Global Fund to Fight AIDS Tuberculosis and Malaria. The Global Fund Eligibility List. 2013; Available from: <http://www.theglobalfund.org/en/application/applying/ecfp/eligibility>.
16. World Bank. World Development Indicators Database. 2013; Available from: <http://data.worldbank.org>.
17. Carter ED. God bless General Peron: DDT and the endgame of malaria eradication in Argentina in the 1940s. *J Hist Med Allied Sci*. 2009; 64(1): 78–122.
18. Migration Policy Initiative. Guatemala: Economic Migrants Replace Political Refugees. 2006; Available from: <http://www.migrationinformation.org/feature/display.cfm?ID=392>.

Transmission Limits Map Sources

Guerra, CA, Howes, RE, Patil, AP, Gething, PW, Van Boeckel, TP, Temperley, WH, Kabaria, CW, Tatem, AJ, Manh, BH, Elyazar, IRF, Baird, JK, Snow, RW and Hay, SI. (2010). The international limits and population at risk of *Plasmodium vivax* transmission in 2009. *Public Library of Science Neglected Tropical Diseases*, 4(8): e774.

Juan E. Hernandez (2009), Instituto Nacional de Salud Pública, Cuernavaca, Mexico (Data years 2005–2008)



About This Briefing

This Country Briefing was developed by the UCSF Global Health Group's Malaria Elimination Initiative (MEI). To send comments or for additional information about this work, please email Anne.Bulchis@ucsf.edu.



The **Global Health Group** at the University of California, San Francisco is an 'action tank' dedicated to translating new approaches into large-scale action that improves the lives of millions of people. Launched in 2007, the UCSF Global Health Group's **Malaria Elimination Initiative (MEI)** works at global, regional, and national levels to accelerate progress toward malaria elimination in countries and regions that are paving the way for global malaria eradication. The MEI believes that global eradication of malaria is possible within a generation.

shrinkingthemalariamap.org



malaria atlas project

The **Malaria Atlas Project (MAP)** provided the malaria transmission maps. MAP is committed to disseminating information on malaria risk, in partnership with malaria endemic countries, to guide malaria control and elimination globally.

map.ox.ac.uk