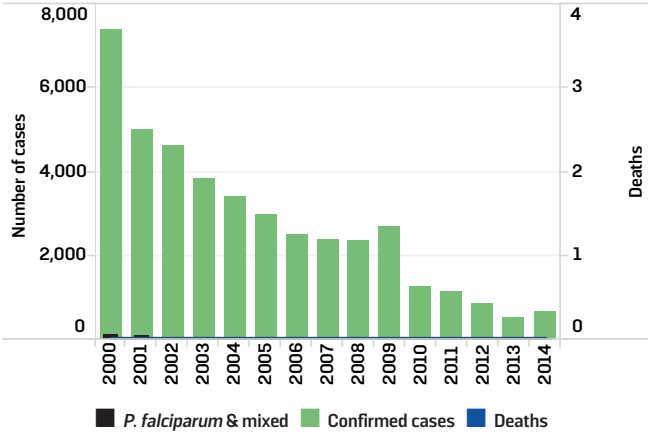
MEXICO

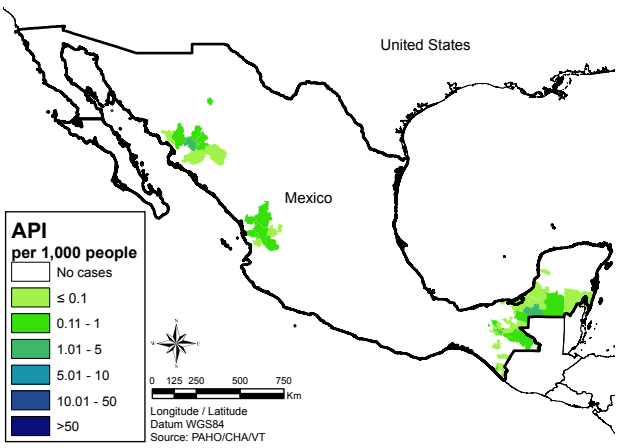
Mexico has had a 91.0% reduction in malaria cases since 2000, achieving the WHA 58.2 target for the MDG 6C of reducing malaria by 75% in 2010 (Figures 1 and 2). Mexico is currently in the pre-elimination phase, though some malaria endemic areas of substantial transmission intensity exist in the country. There were 664 cases reported in 2014, a 33.1% increase from the previous year. No malaria-related deaths have been reported since 1998.

Figure 2. Number of cases and deaths due to malaria in Mexico, 2000-2014



Malaria transmission in the country is exclusively due to *P. vivax* infections. Transmission has been largely limited to southern states of Chiapas, Campeche, and Quintana Roo along the border with Guatemala and Belize (Figure 3). Two other important areas of transmission exist along the borders of Sinaloa, Sonora, and Chihuahua states in the north and Nayarit, Durango, and Jalisco states in the center of the country.

Figure 1. Malaria by Annual Parasite Index (API) at municipality level (ADM2), Mexico 2014



All cases caused by *P. falciparum* have reportedly been imported in those returning from endemic countries during the 2010 to 2014 period (Table 1). Most of these imported cases have been imported from countries in the Americas (50%) followed by those in Africa (41%). In 2014, two imported cases of *P. vivax* were reported imported from Belize and Colombia each. The former reported new active foci of *P. vivax* malaria along its border with Mexico in 2014 with movement of people across the border being the reason for re-establishment of transmission. The primary malaria vectors are *An. albimanus* and *An. pseudopunctipennis*.

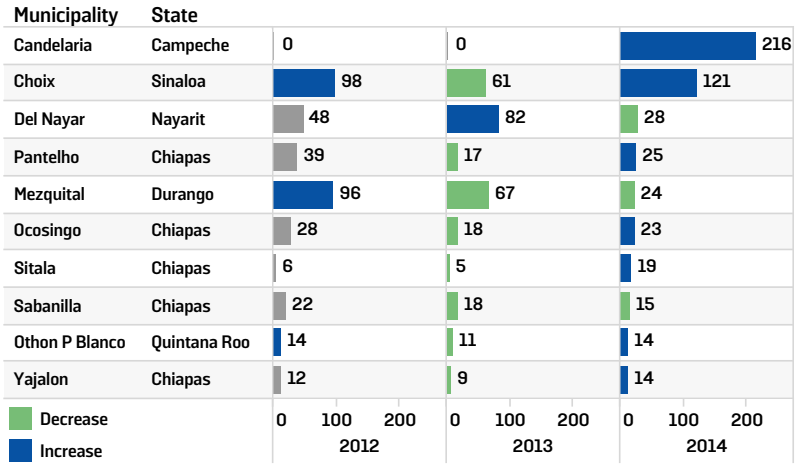
Men accounted for 56.3% of all cases in 2014 (Figure 4). There were more cases reported among children (5-9 years old) and teenagers (10-14 and 15-19 years old) than in any other 5-year age group. Information about number of malaria cases in pregnant women was not available as this is not presently captured by the national information system.

Table 1. Elimination profile of Mexico, 2012-2014

	2012	2013	2014
Total Cases	842	499	664
Cases Investigated	842	499	664
Autochthonous Cases	833	495	656
Autochthonous- P. f	0	0	0
Autochthonous- P. v	833	495	656
Imported Cases	9	4	8
Imported- P. f	9	4	6
Imported- P. v	0	0	2
Active Foci	71	61	56

*P. f-*Plasmodium falciparum*
P. v.-*Plasmodium vivax*

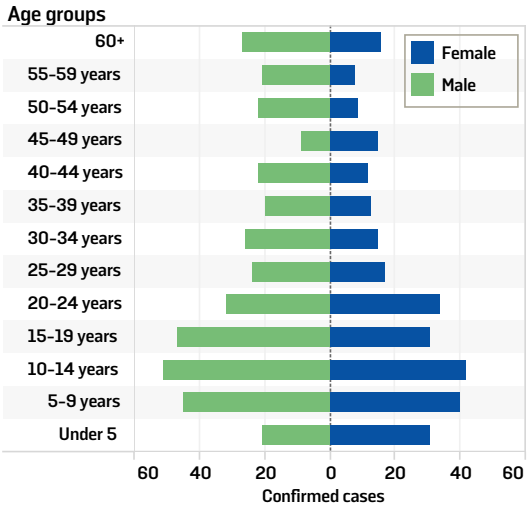
Figure 3. Municipalities with the highest number of malaria cases in Mexico, 2012-2014



The municipality of Candelaria in Campeche state, near the Guatemalan border, reported an outbreak of malaria in 2014, although it had no cases in previous years. A change in migratory patterns has been suggested as a possible reason for this outbreak. This area is endemic as a result of human trafficking and movement of illegal migrants along the train routes. Inadequate surveillance quality was another reason for the outbreak in Candelaria wherein detected cases were reported to have been infected elsewhere upon case investigation thereby delaying the detection of increasing transmission and consequently the response.

Another vulnerable group affected by malaria is the indigenous people who live in rural areas. The states of Chiapas and Oaxaca have large indigenous populations that have been affected due to lack of healthcare access. Development of intervention programs is difficult because of language barriers. Prevention efforts have been implemented in Chiapas along the train route and focused on increasing microscopy, improving access to treatment, distributing bed nets, and engaging indigenous peoples. The Oaxaca state in particular has demonstrated significant achievements in eliminating malaria; no malaria case was reported in 2014, decreasing from 902 cases in 2009. This has been achieved by modifying the treatment scheme to the PAHO/WHO recommended 14-day treatment with chloroquine and primaquine for *P. vivax* in 2011, supervised treatment, vector control interventions, and improving access to prompt diagnosis and treatment.

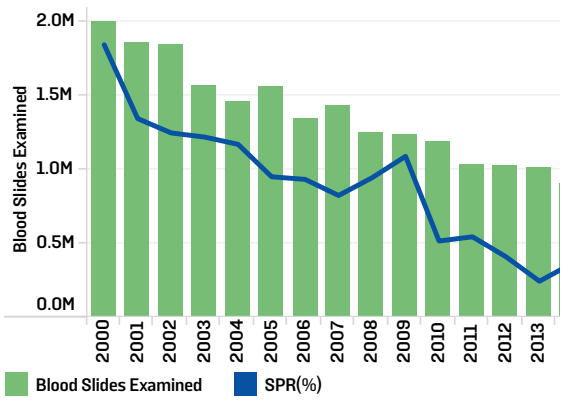
Figure 4. Malaria cases by age and sex in Mexico, 2014



Diagnosis and Treatment

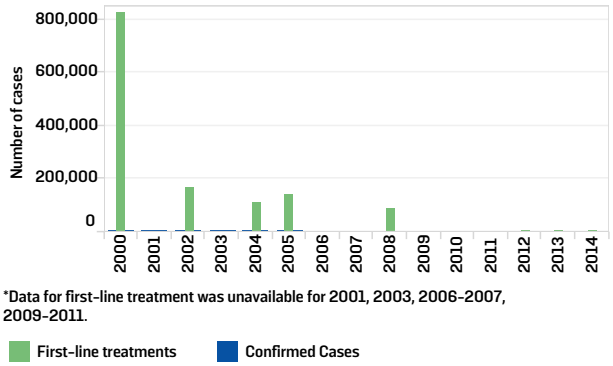
Microscopy has been the primary method of diagnosis. The number of blood slides examined has decreased by 55.1% since 2000 (Figure 5); however, this follows the trend of decrease in cases. In 2014, all 282 laboratories were reported to have been included in a program of quality assurance for microscopic diagnosis.

Figure 5. Blood slides examined, RDTs examined, and SPR in Mexico, 2000-2014



Both *P. falciparum* and *P. vivax* infections are treated with chloroquine and primaquine as a first-line treatment (Figure 6). A 3x3x3 treatment scheme for *P. vivax* is recommended in the country wherein a single dose is administered monthly for 3 months, followed by 3 months without treatment. This is repeated twice in a year and continued for 3 years; in total 18 single doses are given per patient. A recent study demonstrated that this scheme (50% relapsed after 1 year of follow-up) is not efficacious in preventing relapses compared to the WHO recommended 14-day treatment with chloroquine and primaquine (12.1% relapsed) (44). Some states, especially Chiapas and Oaxaca, have switched to the WHO recommended 14-day treatment and the latter has nearly eliminated malaria.

Figure 6. Number of malaria cases and those treated with first-line treatment in Mexico, 2000-2014

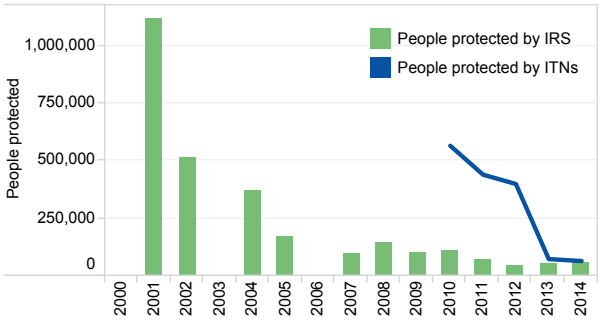


*Data for first-line treatment was unavailable for 2001, 2003, 2006-2007, 2009-2011.

Presently the 14-day treatment is also recommended in the national treatment guidelines although its adoption is patchy.

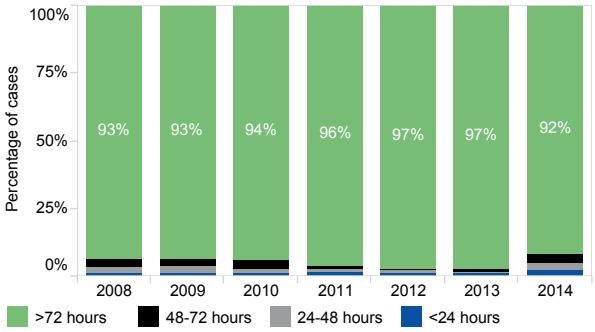
The country reported that 92% of all cases in 2014 were diagnosed in more than 72 hours after onset of the first symptoms (Figure 7). This was only slightly less than in previous years suggesting that access to malaria diagnosis and consequently treatment is limited and a continuing challenge for malaria elimination. Information about time taken to treat was not available.

Figure 8. People protected by IRS and by ITNs in Mexico, 2000-2014



*IRS data unavailable for 2000, 2003, and 2006. ITN data unavailable for 2000-2009.

Figure 7. Time between first symptom and result of diagosis in Mexico, 2008 - 2014



Vector Control

IRS usage has declined since 2011, but it has remained near constant in the past 4 years and an estimated 57,000 people were still protected by it in 2014 (Figure 8). In 2010, about 350,000 ITNs were distributed, protecting an estimated 567,000 people. As of 2014, an estimated 65,000 people are protected by ITNs. Larval control is used in the country, especially in endemic foci. Insecticide resistance surveillance for *Anopheles* has not been conducted in recent years.

Funding

Malaria prevention and elimination is almost exclusively funded by the government who provided an estimated US$23.8 million in 2014, US$1.5 million less than 2013 (Figure 9). This decline is due to a change in the exchange rate between those 2 years. Information about funding is reported from national level, which does not take into account funds available at the state and other lower levels. PAHO/WHO provides technical assistance and financial resources for specific malaria related activities. No other external funding is received by the country.

Figure 9. Funding for malaria in Mexico, 2000-2014