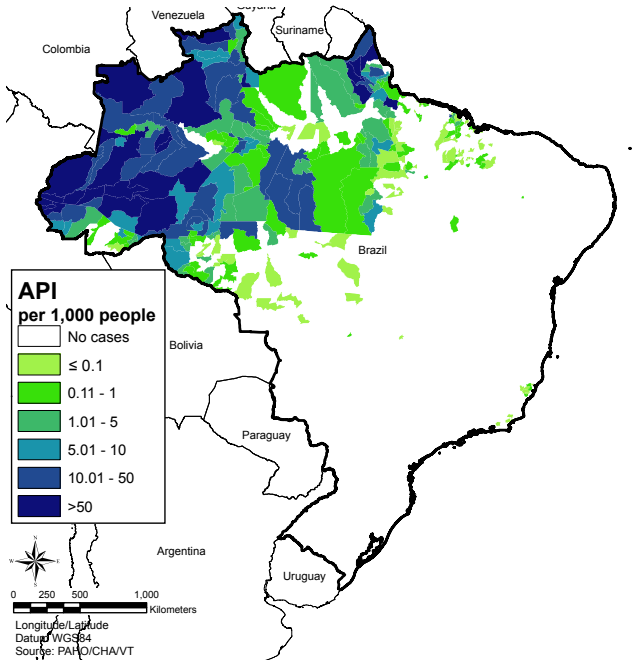
BRAZIL

Brazil has had a significant decrease in malaria morbidity and mortality since 2000. As of 2014, the country officially met the WHA 58.2 target of reducing the malaria burden by 75%. There were 143,145 confirmed cases of malaria in 2014, a 76.7% decrease from cases reported in 2000 (Figures 1-2). The number of cases decreased each year during 2011-2014, with an average of 19% decrease for these years. There were also 36 malaria deaths reported for 2014, an 85% decrease from deaths reported in 2000.

Malaria is highly prevalent in the Amazon forest area located in the northwestern part of the country (Figure 1). Incidence of malaria in the Amazon basin accounts for 99.8% of cases in the country, but only 13% of the country's population lives in this area. Cases from the top 15 municipalities account for 57.3% of all cases in the country (Figure 3). Cruzeiro do Sul in Acre state had the highest number of cases in 2013 and 2014, though there was a 14% decrease in cases between those years.

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



Municipalities in the state of Para have had a dramatic reduction in incidence in recent years following an outbreak in 2009. Factors that may have contributed to the outbreak were limited access to treatment, non-adherence to treatment by patients, noncompliance of national treatment guidelines, lack of prevention measures, and increased surveillance (23).

The Ministry of Health focused malaria efforts on 5 municipalities (Anajas, Oeiras, Cameta, Curralinho, Jacareacanga, and Itaituba) in Para state, all of which have decreased malaria incidence. Anajas and Oeiras municipalities in particular have had a decline of more than 90% from 2012.

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

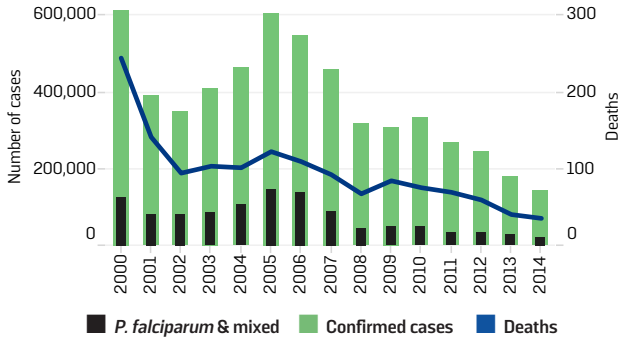
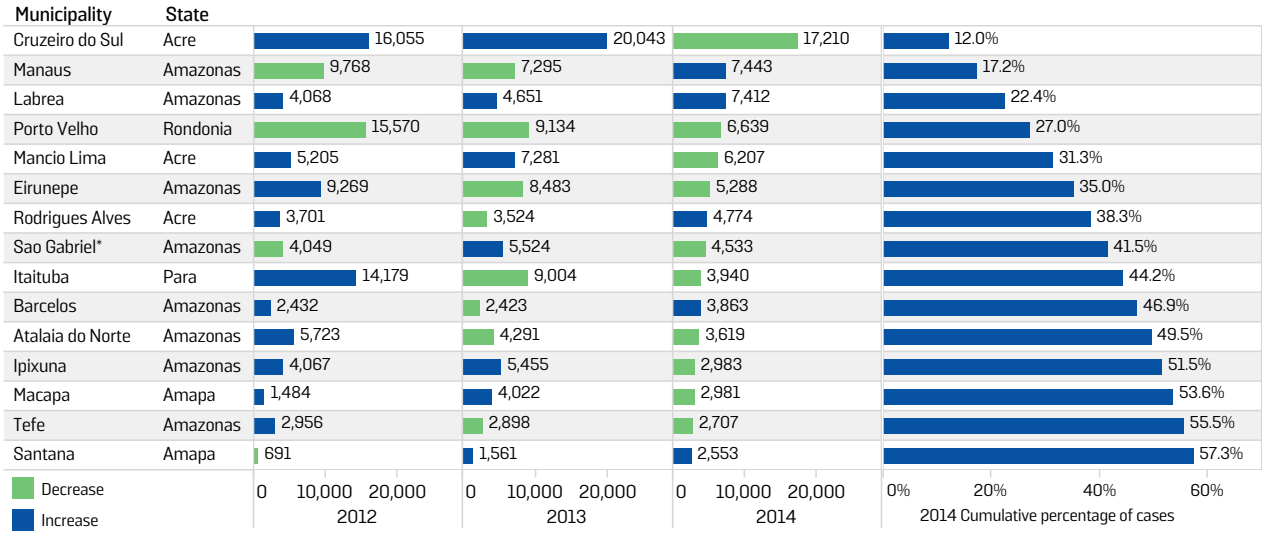


Figure 3. Municipalities with the highest number of malaria cases in Brazil, 2012-2014



*Sao Gabriel da Cachoeira

Plasmodium vivax caused 82.9% of all cases in 2014, while *P. falciparum* and mixed cases caused 16.3% of cases. The primary vector in the Amazon area is *An. darlingi*.

Men have been more affected by malaria than women, in 2014 accounting for 60.4% of confirmed cases (Figure 4). In 2014, incidence of malaria in pregnant women was 93 cases per 100,000 pregnant women per year, which was 1.75-fold higher than non-pregnant women of child-bearing age. Throughout all ages, malaria incidence was higher in men than in women (Figure 5). In both sexes, children aged 5-9 years had the highest incidence among all groups. When coupled with higher rates of incidence in pregnant women, this suggests transmission occurrence in households.

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

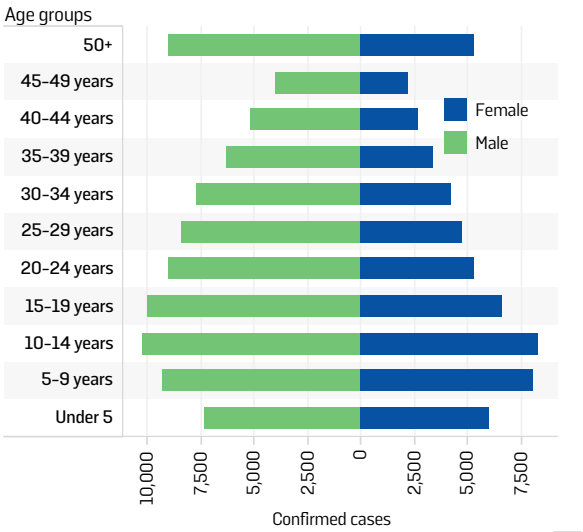
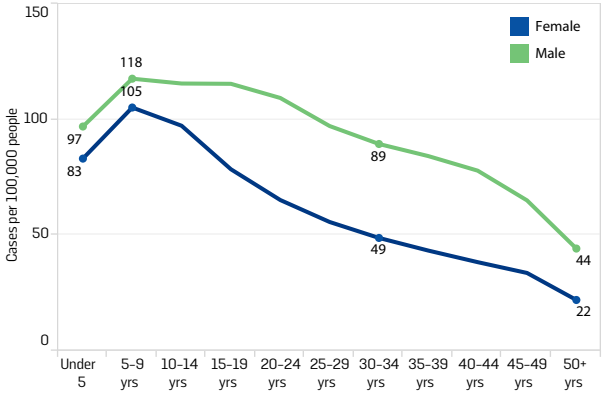
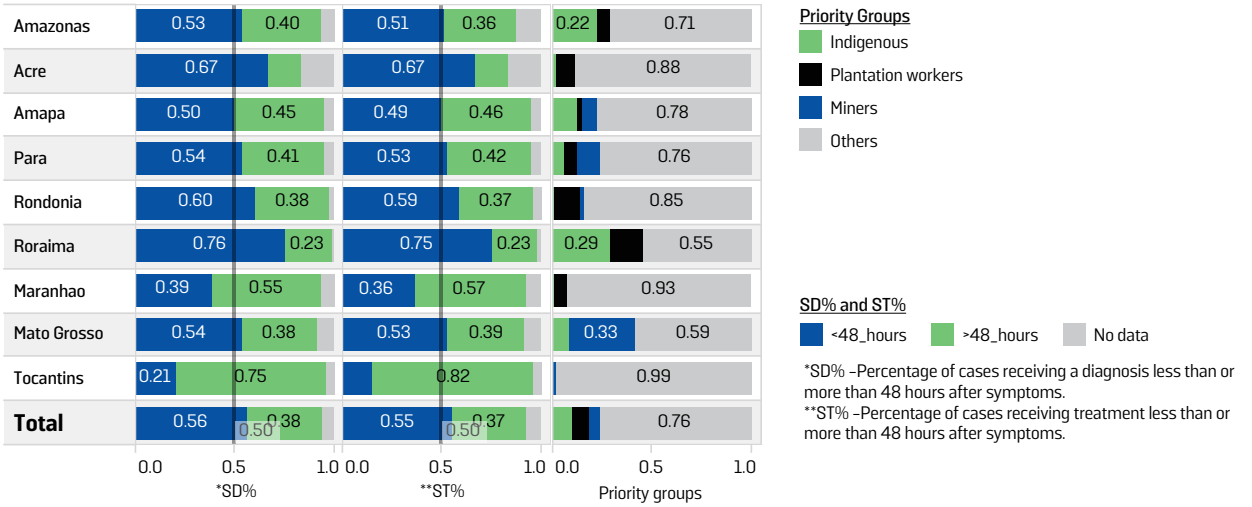


Figure 5. Malaria incidence by age and sex in Brazil, 2014



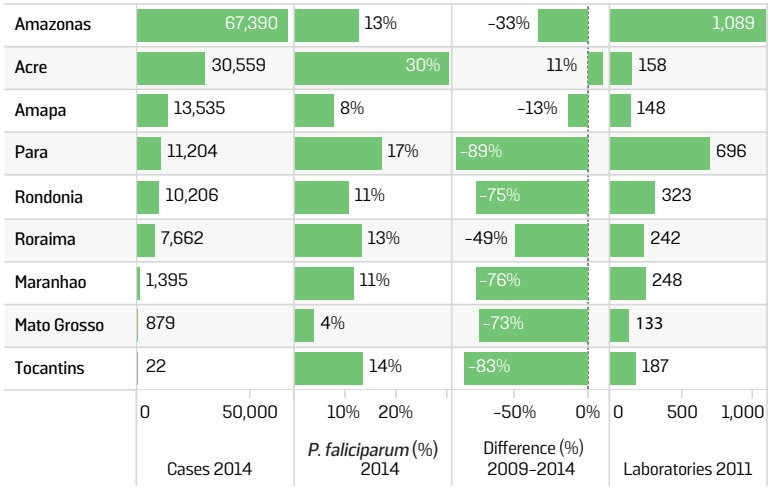
Gold mining has historically been associated with malaria incidence affecting miners; however, other occupational associations have also been established especially among those working in timber extraction and fish farming (Figure 6). In 2014, mining cases decreased by 47% and loggers decreased by 19% from 2013. The arrival of workers into the Amazon area has contributed to deforestation as rural areas urbanize to support this new population. Initially, deforestation was accompanied by higher malaria incidence that flourished in chaotic environments, but urbanization eventually led to the stabilization of physical environments, thereby decreasing vector proliferation (24).

Figure 6. Comparative analysis of malaria situation in states of the Amazon basin, 2011



*SD% -Percentage of cases receiving a diagnosis less than or more than 48 hours after symptoms.
**ST% -Percentage of cases receiving treatment less than or more than 48 hours after symptoms.

Figure 7. Comparative analysis of malaria situation in states of the Amazon basin



Figures 6 and 7 compare the malaria situation states of that are a part of the Amazon basin based on data obtained from a report (25). Para has had the largest decrease since 2009, while Acre has had an 11% increase of cases. In 2011, Amazonas state had the most laboratories; however, in 2014 this state had the highest number of cases. Despite having a high number of laboratories, the state only diagnosed about half of their patients in less than 48 hours since the start of symptoms in 2011. In that same year, the time in which the patient received treatment after diagnosis was not prompt. Around 36% of patients received treatment after more than 48 hours following diagnosis.

The priority groups of concern are indigenous peoples, who account for 15.1% of all cases in 2014, and plantation workers, who account for 23.7%. During 2011, in the Amazon basin indigenous populations were primarily affected in the states of Amazonas (22%) and Roraima (29%) (Figure 6). In Mato Grosso, miners were the most affected group comprising 33% of all cases in the state during 2011.

Diagnosis and Treatment

Microscopy is the main method of diagnosing malaria. In 2014, the SPR was 8.57%, but it has been on a steady decline since 2010 (Figure 8). The decline in both API and SPR further confirms the decreasing morbidity trends in Brazil.

First-line treatment for *P. vivax* is chloroquine and primaquine, while artemether-lumefantrine combination

Figure 8. Blood slides examined, RDTs examined, and SPR in Brazil, 2000-2014

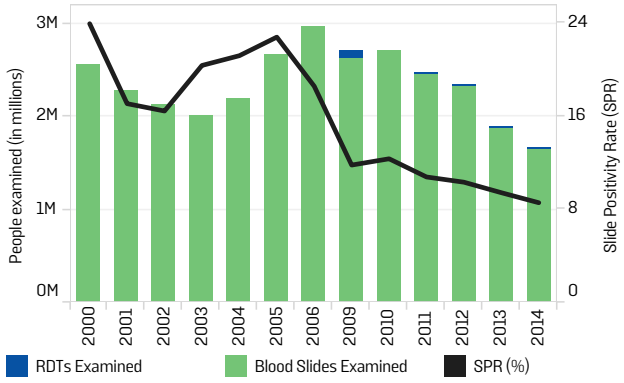
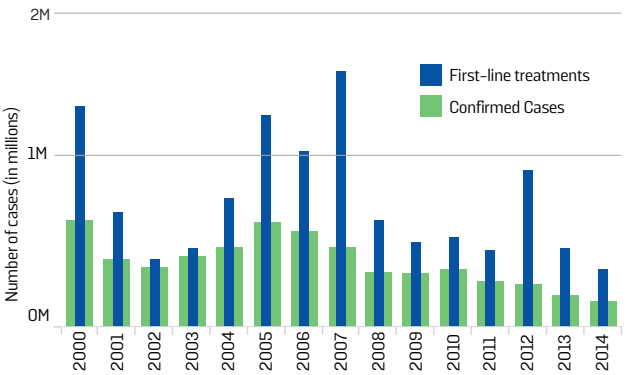


Figure 9. Number of malaria cases and those treated with first-line treatment in Brazil, 2000-2014



and artesunate–mefloquine are used for *P. falciparum* infections. A 2014 study found first-line treatment failure of 5.2% in *P. vivax* cases and an association with high initial mean parasitemia (26). Brazil reports more first-line treatment provided to people than actual confirmed cases; this is probably because estimates of first-line treatments could be based on actual number of tablets used in a year, which is higher than actual tablets used owing to losses due to the expiration of medicines and decay of quality among other reasons (Figure 9).

Vector Control

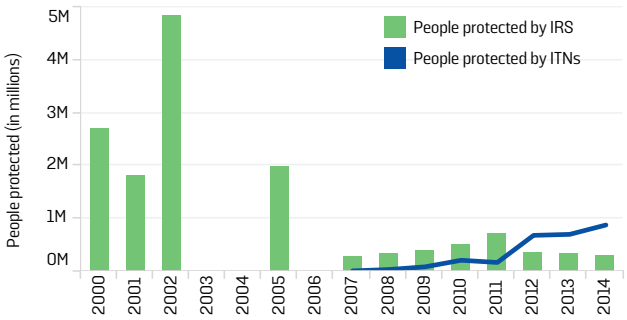
Brazil has recently reinforced efforts on distributing ITNs as a method of vector control. Almost 884,000 people were protected by ITNs in 2014, which has been the highest estimate for Brazil thus far (Figure 10). The number of people protected has increased in the past 3 years, while IRS usage has decreased. At nearly 290,000 people in 2014, the number of people protected by IRS was the lowest recorded since 2007.

Finances

Funding for malaria has mostly come from the government and is managed in a decentralized manner. In 2014, Brazil spent a little more than US$72 million (Figure 11). The USAID has provided support to Brazil, particularly the Amazon area, via the AMI/RAVREDA initiative since its inception in 2002. The Global Fund to Fight AIDS, Tuberculosis and Malaria has also contributed to malaria control efforts and in 2009 provided a grant to make bed net usage a national policy. After 2011, Brazil decided to sustain the project with domestic funds.

The private sector is also obligated to contribute to malaria funding if their enterprise is located in the Amazon area and their operations are found to have an impact on malaria transmission. Companies must develop social responsibility programs for malaria prevention and control that follow that of the municipalities in which they are located.

Figure 10. People protected by IRS and by ITNs in Brazil, 2000–2014



*IRS information unavailable for 2003, 2004, and 2006.

Figure 11. Funding for malaria in Brazil, 2000–2014