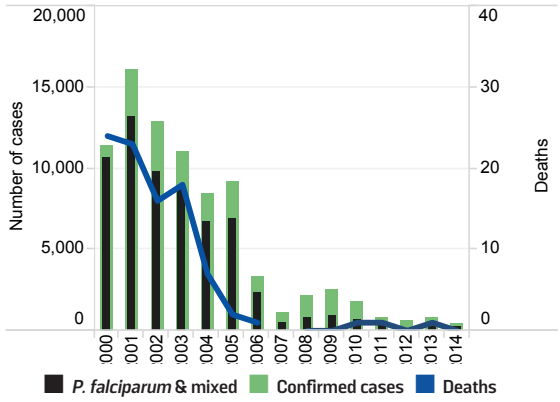
SURINAME

Suriname had 401 confirmed cases of malaria and no recorded deaths in 2014 (Figures 1 and 2). Morbidity has decreased by 96.5% compared to 2000. In the past 9 years, there have only been 6 malaria-related deaths reported.

The Guiana Shield, an area rich in minerals and lush with rainforest, encompasses Suriname, French Guiana, Guyana, and parts of Venezuela, Colombia, and Brazil. Many people move to this area to participate in legal and sometimes illegal gold mining, leading to a large mobile population that transcends borders. The Maroni River area between Suriname and French Guiana has been of particular concern.

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

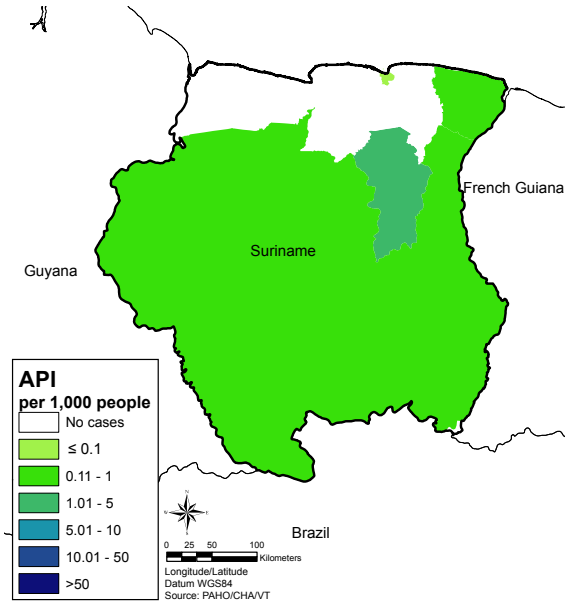


Although the map (Figure 1) shows malaria in most of the interior parts of the country, malaria is largely focalized to mining areas along the French Guiana border. Transmission in the villages in interior areas used to be primarily due to *P. falciparum* and has been almost eliminated. It has been suggested that the Maroon people who live in that part of the country may have protected it due to the lack of the Duffy antigen that is needed to manifest *P. vivax* in red blood cells (45). A significant proportion of cases are imported from French Guiana. In 2014, 76% of cases were imported from French Guiana, where miners become infected and cross into Suriname to obtain treatment.

Men were more affected than women, accounting for 55.7% of all cases in 2014 (Figure 3). The malaria incidence in men was higher than that in women, being 82 and 66 cases per 100,000 people per year, respectively. Men aged 30-34 were the highest incidence (Figure 4). Occupation is a risk factor for men, especially those working in mines.

An. darlingi is the main vector in Suriname and *P. falciparum* has been the primary malaria species of

Figure 1. Malaria by Annual Parasite Index (API) at district level (ADM1), Suriname 2014



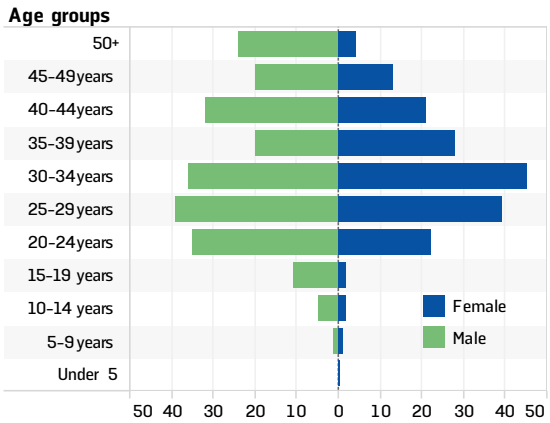
infection in previous years. In 2014, 41% of cases were caused by *P. falciparum* and mixed infections as malaria is now largely limited to mining areas.

Priority Groups

The program *Decreasing the incidence of malaria in the populations of the interior of Suriname* started in 2006 and focused on case detection, IRS, and LLIN interventions in villages within the interior of the country who had limited access to healthcare. The results of this project were successful and decreased malaria in this area.

Gold miners working in the Guiana Shield were the next target population for interventions, especially

Figure 3. Malaria cases by age and sex in Suriname, 2014



illegal foreigners such as those from Brazil known as *garimpeiros*. A subsequent program called *Looking for gold, finding malaria* targeted the mining workers specifically.

Figure 4. Malaria incidence by age and sex in Suriname, 2014

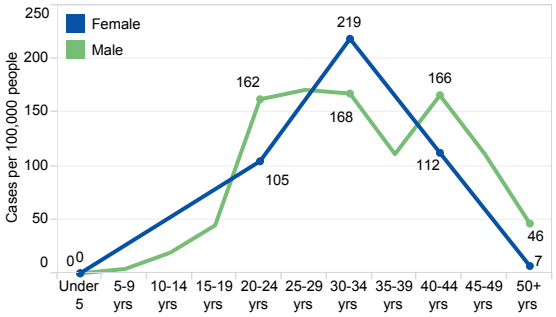
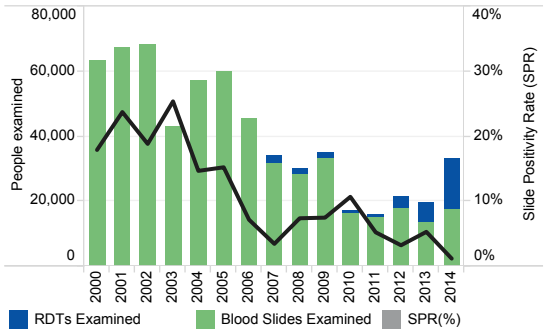


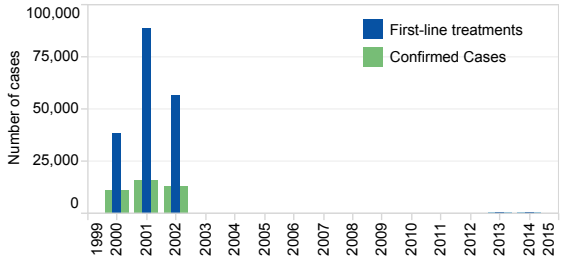
Figure 5. Blood slides examined, RDTs examined, and SPR in Suriname, 2000-2014



Diagnosis and Treatment

Suriname began to use RDTs in 2007, yet they have become pivotal in identifying cases in gold miners where tests are performed by lay persons trained as health workers. As of 2014, the number of RDTs examined almost equaled the number of slides examined (Figure 5). All RDTs are supposed to be followed by microscopy diagnosis according to country guidelines. Although owing to the precarious conditions in the field, it is not possible to enforce or implement this directive. The SPR was 1.21 in 2014, and a total of 17,608 slides were examined. Artemether-lumefantrine combination therapy is the first-line of treatment used for *P. falciparum* cases, while chloroquine and primaquine are used for *P. vivax* (Figure 6). The decrease in sensitivity of artemisinin was reported in *P. falciparum* in Suriname, though further unpublished studies demonstrate no such decrease. However, conditions in the Guiana Shield, especially mining areas are propitious for development of resistance. Artemisinin monotherapy is available though it is of low quality and the treatment regimen not completely adhered to by miners.

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



*Data unavailable for 2003-2012.

Vector Control

ITNs have been used in Suriname as a means of vector control, but usage has been declining since 2010 and only 6,164 people were protected by them in 2014 (Figure 7). IRS is not used in the country for malaria prevention.

Funding

The Global Fund has supported the two projects mentioned previously, while USAID supports AMI/RAVREDA. The USAID has continually provided funding to Suriname since 2001 (Figure 8). Governmental funding for malaria was not reported from 2006-2010. Estimates were made for the concept note submitted to the Global Fund in 2015. They indicate that over the years the government has provided the majority of the financial resources.

Figure 7. People protected by IRS and by ITNs in Suriname, 2000-2014

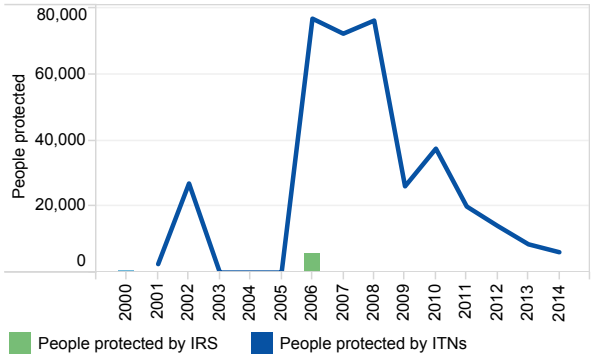


Figure 8. Funding for malaria in Suriname, 2000-2014