17 Paraguay

Overview of the situation

Figures 1-5

The number of malaria cases reported by Paraguay has declined in recent years, as it has in several countries in the Region. A total of 340 cases were reported in 2008; this represents the lowest number for Paraguay in the last decade and is higher only than the number of cases reported by Argentina and El Salvador. Malaria in is due exclusively to *Plasmodium vivax* and is concentrated in the Departments of Caaguazu and Alto Parana, west of the country's center. Of the total number of cases reported in 2008, seven were imported *P. falciparum* malaria. The vector species in this country is the *Anopheles darlingi* mosquito.

The focalization of malaria transmission in the departments to the east is attributable to the densely forested terrain and high humidity in this part of the country. The Parana River and its tributaries, along with the Acaray and Itaipu dams, create a natural system of irrigation that is conducive to mosquito breeding. The deforestation also prevalent in these areas contributes to environmental changes and favors vector proliferation. Unregulated development and migration among at-risk populations complete the epidemiological picture.

The epidemiological outlook today is very different from that of the 1940s, when the entire country was considered malaria-endemic, with the exception of the capital, Asuncion. Cases at that time approached 80,000, and caused over 2,000 deaths.

Morbidity and mortality trends

Figures 4-9

There were fewer cases of malaria in 2008 than in the previous year. Five people were hospitalized with the illness, but there were no malaria deaths. In addition, a low rate of transmission was firmly established. In 1999, when malaria reached epidemic proportions, there were 9,946 cases; the situation remained relatively unchanged in 2000, when a total of 6,853 cases were reported. By the end of 2008, however, there were 95% fewer cases than in 2000.

Geographical distribution

Figures 1, 12-19

The District of Mariscal Francisco Solano Lopez, in Caaguazu Department, reported the largest number of cases (74) in 2008. The districts of Raul A. Oviedo and Hernandarias, in the Departments of Caaguazu and Alto Parana, respectively, followed. These three districts together accounted for 54% of the country's cases. The two districts in Caaguazu are geographically close to each other, and constitute a malaria-endemic area that is also close to the districts with malaria transmission in Alto Parana. The District of Pre-

sidente Franco, on the border with the Province of Misiones in Argentina, reported 31 cases in 2008. A similar number of cases (20) was recorded in Iguazu, on the other side of the border.

API in Paraguay was 0.1 per 1,000 inhabitants at risk in 2008. This is one of the Region's lowest, and is similar to rates in Costa Rica, El Salvador and Nicaragua. Despite the small number of cases countrywide, API reached between 2 and 11 cases per 1,000 inhabitants in the highest risk municipalities.

Malaria in specific populations

Figures 25-28

In 2008, 14.4% of the country's malaria cases were among children under the age of 5 years, and 38% were among those under the age of 15 years. This percentage is similar to that observed in the Region as a whole, and is at a midway point vis-à-vis other countries with similar burden of disease (Argentina, Belize, El Salvador, Nicaragua and Panama). However, in 2008, 50% of the malaria cases in the Department of Caaguazu were among children under the age of 15 years. This high percentage of malaria cases in children may be due to the fact that the infection is transmitted in the peridomestic or indoor environment, and is prevalent among the country's indigenous population. Of the cases reported in Caaguazu, 32% were among indigenous people.

Malaria transmission in Paraguay is confined to rural areas, where conditions are conducive to the vector species' proliferation, and to the exposure of susceptible population groups.

Diagnosis and treatment

Figures 20-24, 29-30

A total of 80,610 blood slide examinations were conducted in 2008, of which, as in previous years, 0.4% tested positive. Although the number of tests conducted in 2008 and in 2007 was similar, far fewer cases were reported in 2008, which could mean that efforts at early malaria diagnosis were successful. The slide positivity rate was low in the two eastern departments where transmission is highly focalized.

The use of rapid diagnostic tests for malaria was introduced in 2008. A total of 1,977 RDTs were used that year, a ratio of 40:1 slides examined per RDT. The information system does not record the length of time elapsed between the onset of symptoms and treatment, despite the fact that this variable should be taken into account in an environment with very low transmission.

Cases of *P. falciparum* malaria, all of which were imported, were treated using artemisinin-based combination therapies. The therapies are recommended for Amazon countries, and in situations where the possibility of receiving cases from areas with multidrug resistance is heightened.

Prevention and vector control

Figures 31-33

IRS continues to be among the main vector control strategies used in Paraguay. In 2008, 47,525 people were protected by IRS. Although a substantially smaller number of homes were sprayed than in the two previous years, the ratio of people protected to people infected was one of the highest in the Region.

LLINs are not yet used as a vector control strategy in Paraguay. Even so, the program conducted a pilot test with 1,000 nets in 2008 in four localities in two of the districts with the highest malaria incidence (Mariscal Francisco Solano Lopez and Raul A. Oviedo, in Caaguazu). The goal was to evaluate their level of adoption by potential users.

Financing of malaria control

Figure 34

The funds for malaria control in Paraguay come exclusively from the Government, and correspond to 0.5% of the worker-employee contribution to social security. Between 2005 and 2008, this contribution amounted to between US$1.8 and $3.9 million. The amount of available funding has increased dramatically in recent years. The increase is aimed primarily at reinforcing and broadening epidemiological surveillance by increasing community surveillance in malaria-endemic areas.

Figure 1. Number of cases by ADM 2 level (municipality, district), 2008

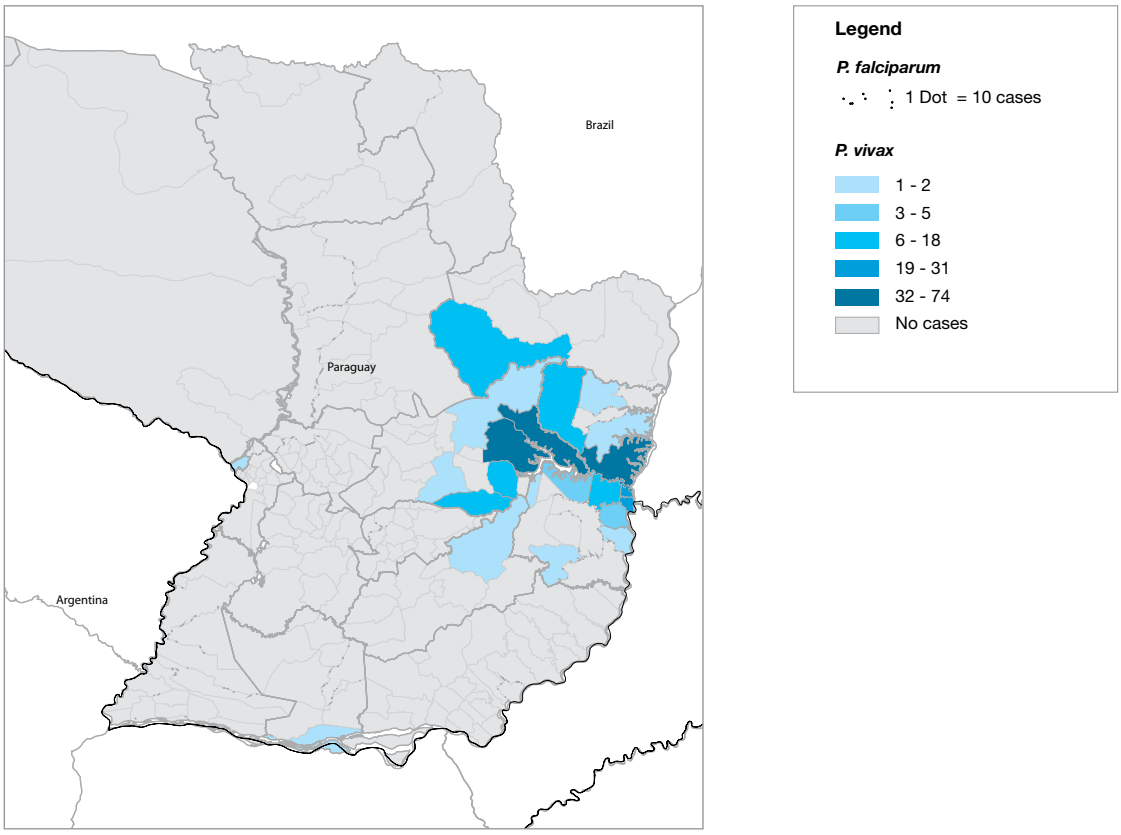


Figure 2. Proportion of cases by species, 2008

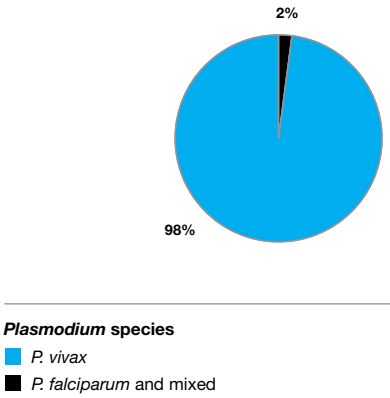


Figure 3. Number of malaria cases by species by ADM1 level in 2008

ADM1	*P. falciparum* + mixed	*P. vivax*	Total cases
Caaguazu	0	177	177
Alto Parana	1	140	141
Canendiyu	0	13	13
Asuncion	2	1	3
Central	3	0	3
Caazapa	0	2	2
Guaira	0	1	1
Misiones	0	1	1

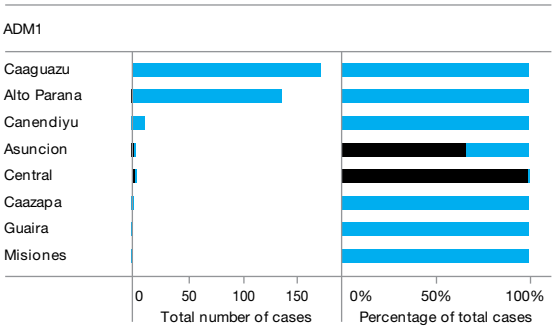


Figure 4. Number of cases by species, 2000-2008

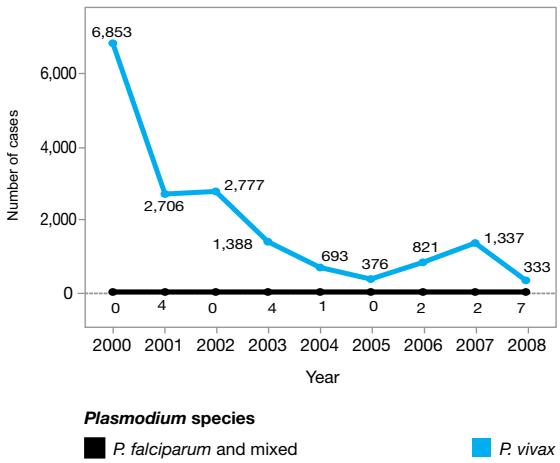


Figure 5. Number of malaria cases, 2000 - 2008

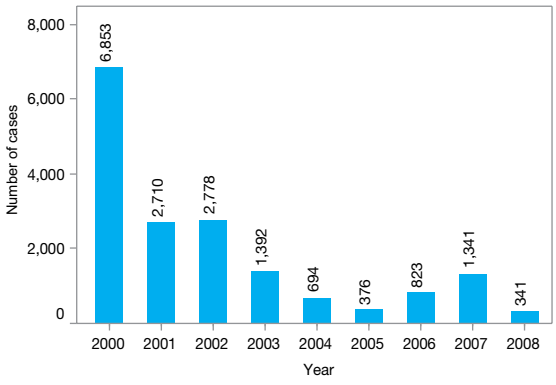
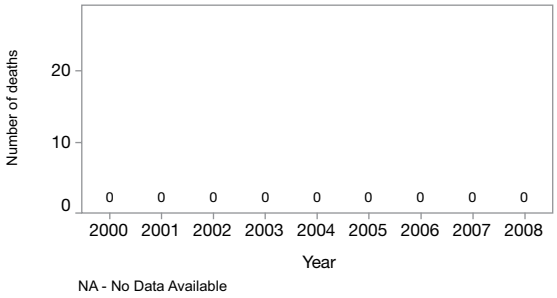


Figure 6. Number of malaria deaths, 2000-2008



NA - No Data Available

Figure 7. Number of hospitalized malaria cases, 2000 - 2008

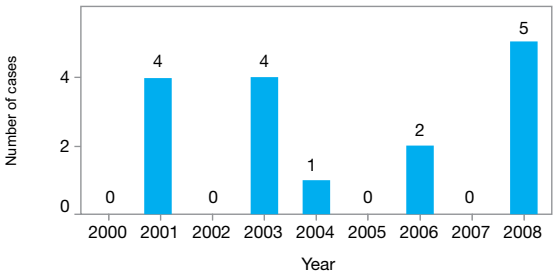
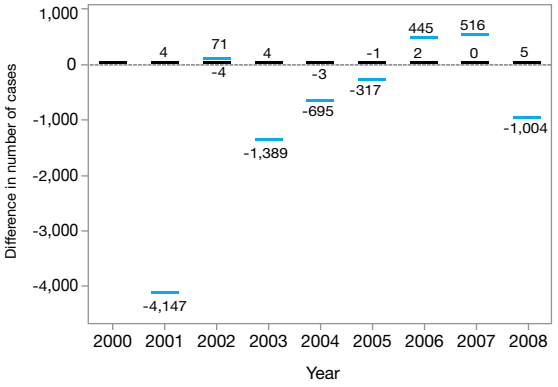


Figure 8. Annual variations in number of cases

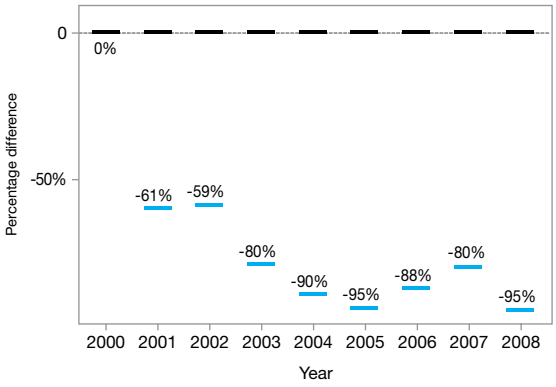


***Plasmodium* species**

P.falciparum and mixed

P. vivax

Figure 9. Percentage difference in number of cases compared to 2000

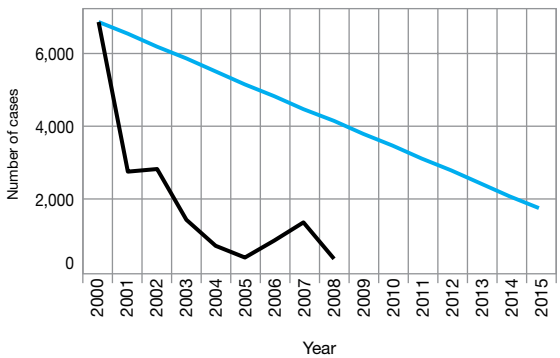


***Plasmodium* species**

P. falciparum and mixed

P. vivax

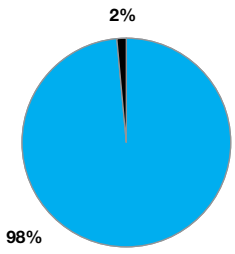
Figure 10. Number of cases and RBM / MDG targets for 2010 and 2015



Reported cases

Reported cases

Figure 11. Percentage of hospitalized cases, 2008

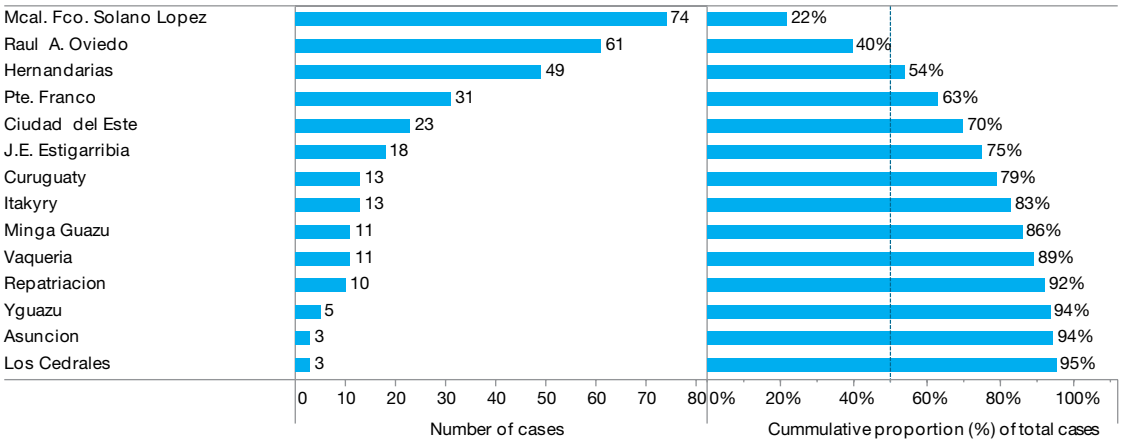


Percentage of cases

Oupatients

Hospitalized

Figure 12. Districts (ADM2) with highest malaria burden and cummulative proportion of total cases in the country, 2008



* See Annex A for a complete list.

Figure 13. Districts (ADM2) by number of malaria cases, 2008

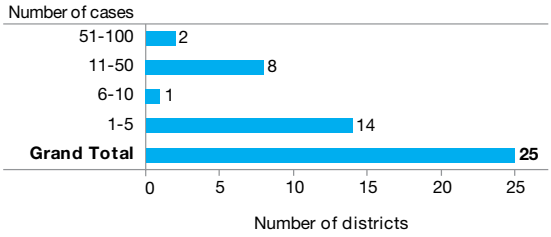


Figure 14. Districts (ADM2) by number of *P. falciparum cases*, 2008

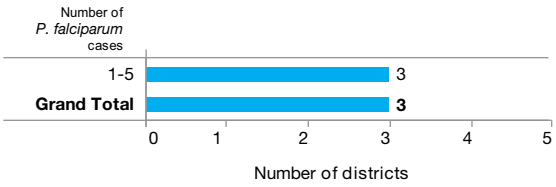


Figure 15. Districts (ADM2) by number of cases, API and percentage of *P. falciparum* cases, 2008

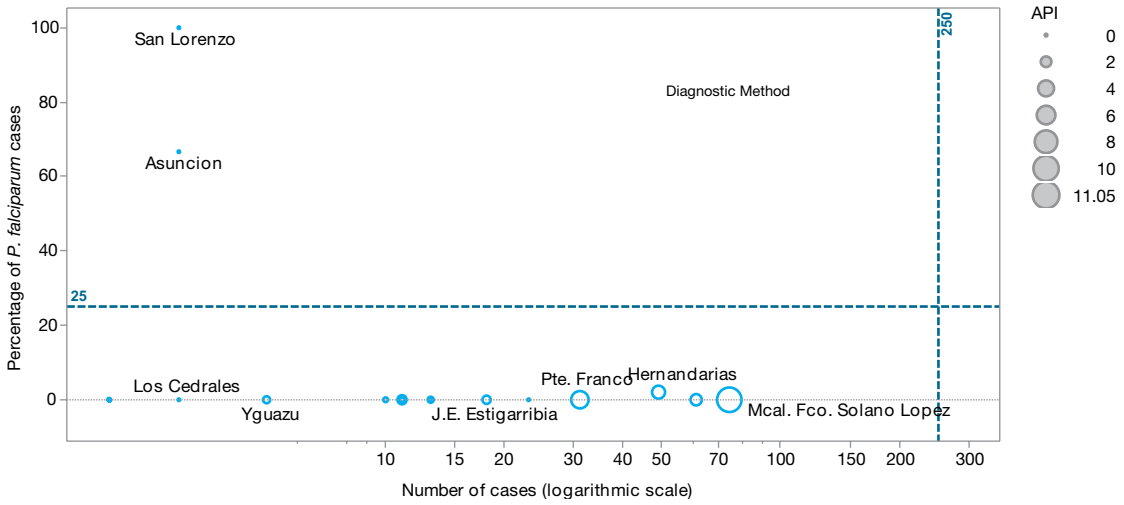


Figure 16. Annual Parasite Index (API) by districts (ADM2), 2008

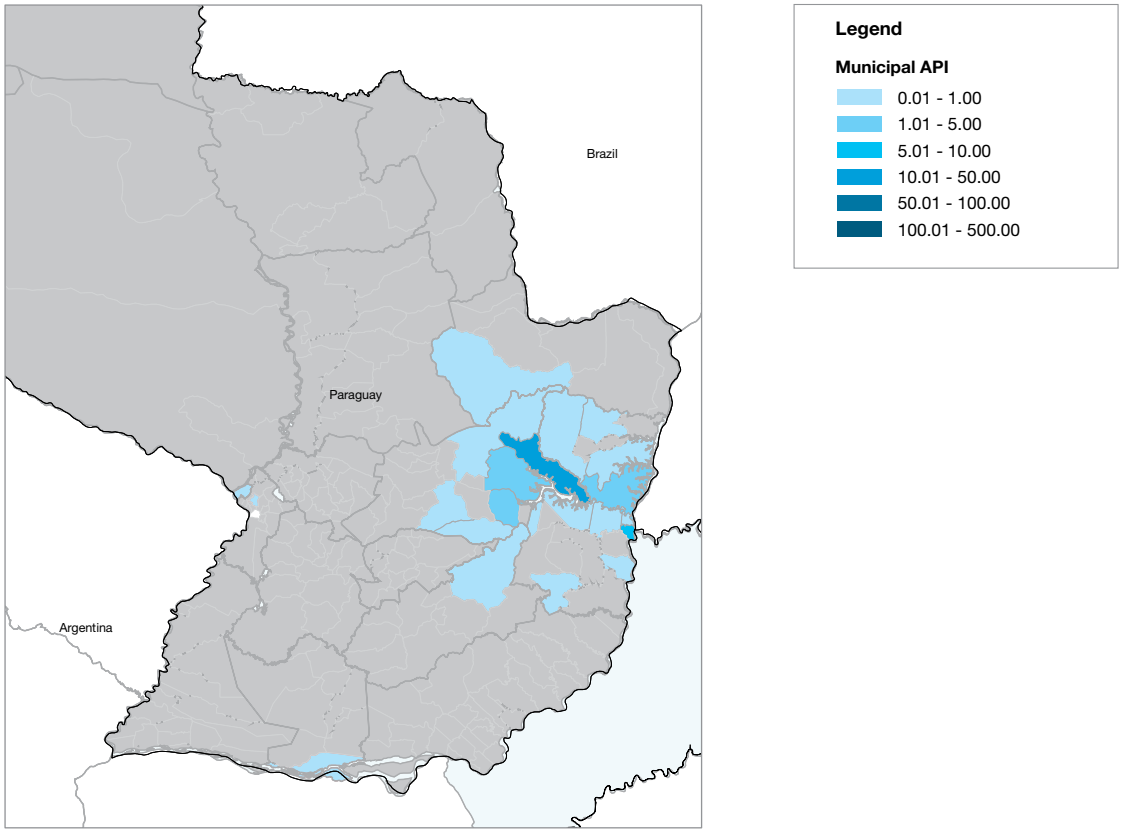
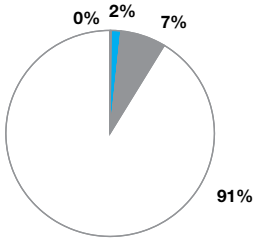


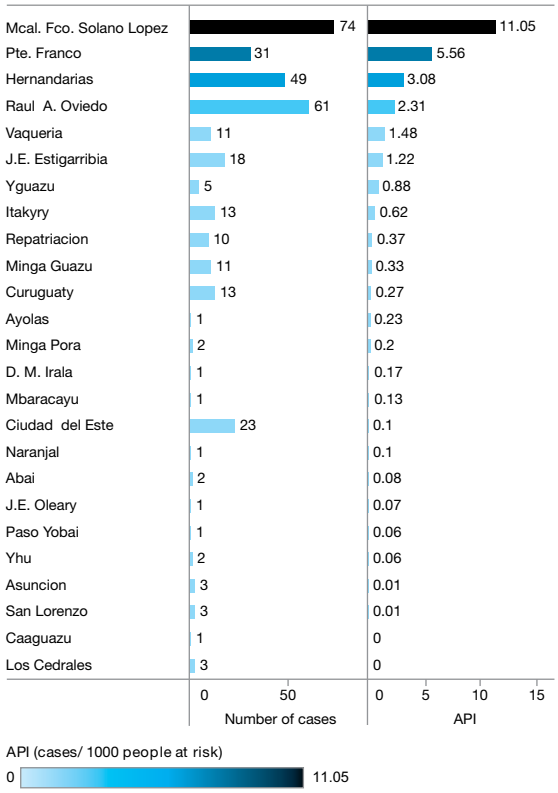
Figure 17. Population by malaria transmission risk, 2008



Population

- High risk (API > 10/1000)
- Medium risk (1/1000 < API < 10/1000)
- Low risk (API < 1/1000)
- Malaria free areas (No indigenous transmission)

Figure 18. Annual Parasite Index (API) and number of cases by district, 2008



* See Annex A for a complete list.

Figure 19. Population by malaria transmission risk, 2000-08

Year	High risk (API > 10/1000)	Medium risk (1/1000 < API < 10/1000)	Low risk (API< 1/1000)	Malaria free areas (No indigenous transmission)
2000	1,313,000	818,000	1,054,000	2,311,784
2001	150,000	752,000	1,291,000	3,441,000
2002	0	1,557,000	834,000	3,383,000
2003	0	480,000	1,492,000	3,945,000
2004	0	1,786,000	1,263,000	2,868,000
2005	0	1,281,000	348,000	3,205,333
2006	1,099,000	318,000	319,000	2,823,558
2007	0	584,086	701,968	948,707
2008	6,697	96,653	438,250	5,688,543

Figure 20. Slides examined and Slide Positivity Rate (SPR). 2000-2008

Year	Number of slides examined	Number of slides positive	Slide Positivity Rate (%)
2000	97,026	6,853	7.06
2001	71,708	2,710	3.78
2002	99,338	2,778	2.98
2003	126,582	1,392	1.2
2004	97,246	694	0.71
2005	85,942	376	0.39
2006	111,361	823	0.74
2007	92,339	1,341	1.45

Figure 21. Cases diagnosed by microscopy and RDTs, 2000-08

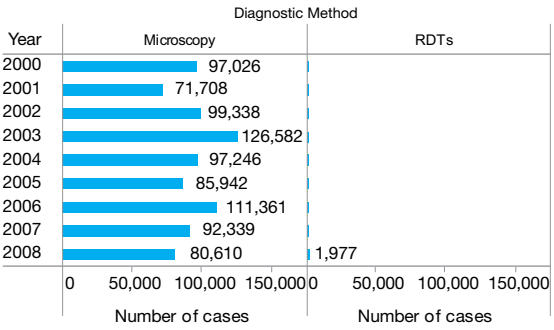


Figure 22. Number of cases diagnosed and cases treated, 2000-2008

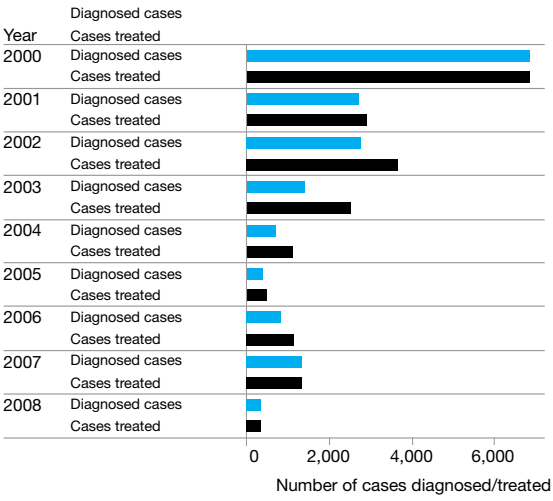


Figure 23. Slide Positivity Rate (SPR) by ADM1, 2008

ADM1	Examined	Total cases	SPR (%)
Caaguazu	24,325	177	0.73
Alto Parana	23,366	141	0.6
Canendiyu	9,375	13	0.14
Asuncion	9	3	33.33
Central	12	3	25
Caazapa	9,550	2	0.02
Guaira	4,442	1	0.02
Misiones	132	1	0.76
Alto Paraguay	0	0	0
Amambay	2,726	0	0
Boqueron	0	0	0
Concepcion	690	0	0
Cordillera	5	0	0
Itapua	1,705	0	0
Neembucu	0	0	0
Paraguari	167	0	0
Presidente Hayes	1	0	0
San Pedro	4,105	0	0

Figure 24. Time span between onset of symptoms and diagnosis, 2008

No Data Available

Figure 25. Number and percentage of cases by age group, 2008

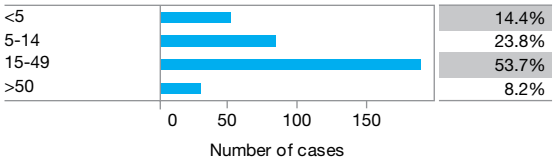


Figure 26. Number and percentage of cases by locality type, 2008

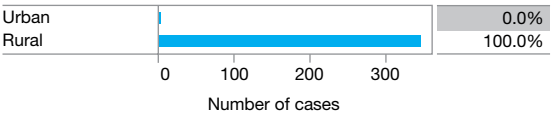


Figure 27. Number and percentage of cases in pregnant women among women of child bearing age, 2008

No Data Available

Figure 28. Number and percentage of cases in indigenous population, 2008

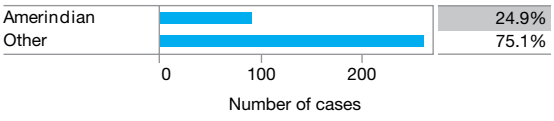


Figure 29. Proportion of *P. falciparum* cases, 2000-2008

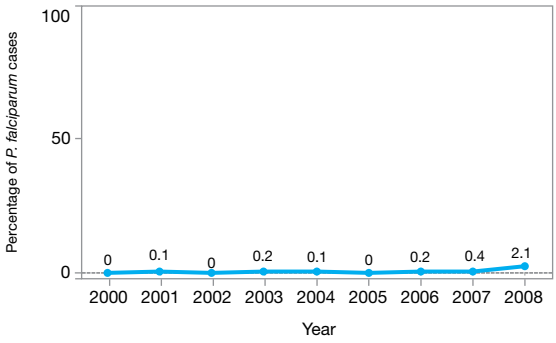


Figure 30. Number of ACT treatments distributed by year, 2000-08

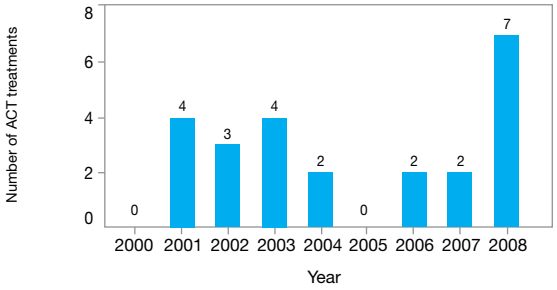


Figure 31. Indoor residual spraying coverage by year, 2000-08

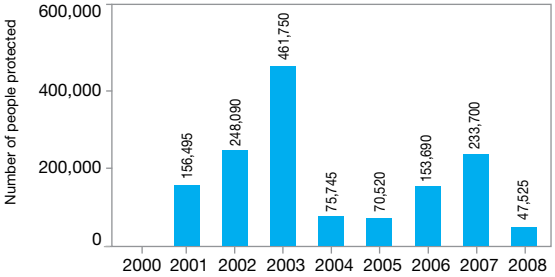


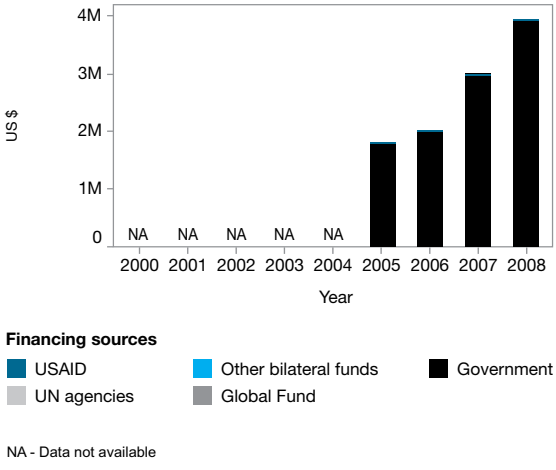
Figure 32. Number of LLINs distributed by year, 2000-2008

Not Distributed

Figure 33. Number of ITNs distributed by year, 2000-08

Not Distributed

Figure 34. Sources for malaria control funds by year, 2000-08



NA - Data not available