4 | Brazil

Overview of the situation

Figures 1-5

In 2008, Brazil had 315,630 registered cases of malaria. The extent of the country's malaria endemic area, the settlement process in the Amazon region and development of urban areas and municipalities make it the country with the heaviest burden of disease in the region. Malaria transmission in Brazil is essentially confined to the Amazon states. While there are areas of malaria transmission outside the Amazon region, these are very small and account for only 0.3% of the country's cases. Although efforts have been made to control malaria transmission in the Amazon region, perpetuation is associated with the intense population dynamics in the region, where all environmental factors favorable to anophelene proliferation and continuous infection coexist. The peaks in malaria transmission in Brazil have been historically determined by population movements to colonize the Amazon forest. A large number of municipalities today are undergoing development and a sizeable population continues to earn its living from harvesting activities and by exploitation of forest resources.

The country's geographic features make health service supply difficult and this, combined with harsh living conditions, is conducive to malaria dissemination. The number of reported cases declined considerably in 2008, continuing a declining trend that started in 2006.

The principal species of malaria vector in the Brazilian Amazon is the *Anopheles darlingi*, while the *Anopheles aquasalis* is important in the south. In 2008, Amazonas State reported 42% of the country's total cases, followed by the States of Para and Rondonia, and Acre, Amapa and Roraima at the third level. Malaria has declined considerably in recent years in the States of Maranhao and Tocantins.

Morbidity and mortality trends

Figures 4 – 9

Implementation of a plan to intensify malaria control efforts in Brazil was highly effective in 2001 and 2002 after the disease peaked in 1999 and 2000, but proved to be unsustainable. In 2003 – 2005, malaria once again increased to 600,000 cases a year. But as of 2006, Brazil has been reporting a marked reduction in cases and a sharp drop in *Plasmodium falciparum* transmission, which was 63% less in 2008 compared to 2000. Over the same period, *Plasmodium vivax* malaria declined by 44%. The drop in *P. falciparum* malaria has had a similar impact on hospitalizations and mortality due to malaria; in 2008, 51 deaths were reported, down from 231 in 2000.

Geographic distribution

Figures 1, 12-19

Although malaria cases are densely concentrated around the cities of Manaus and Porto Velho, which account for 14% of the country's total cases in 2008, malaria constitutes a heavy burden of disease for a large number of municipalities; the top 20 municipalities with the highest malaria burden accounted for 50% of Brazil's total cases. In 2008, 471 municipalities had one or more cases of malaria. Of these, 158 reported only 1 to 5 cases and 175 municipalities reported over 100 cases. This is still indicative of a highly scattered problem and poses a major challenge to the program. In 2008, 77 municipalities reported more than 100 cases of *P. falciparum* malaria and 11 reported over 1,000 cases. A group of municipalities noteworthy for having a large percentage of *P. falciparum* malaria, high API and high number of cases are Anajas (Para), Santa Isabel do Rio Negro (Amazonas), Oiapoque (Amapa) and Atalaia do Norte (Amazonas). Although the Municipalities of Itaituba and Novo Progreso in the state of Para had a lower API than those above, they also had a high percentage of *P. falciparum* malaria and a heavy burden of disease.

Several municipalities, particularly in the States of Amazonas, Amapa, and Rondonia, also showed a combination of an API > 100, more than 1,000 cases and over 10% of cases due to *P. falciparum*, thus also constituting an important focus for the control program.

The Mancio Lima and Rodrigues Alves municipalities in Acre State, in the western part of the country along the Peruvian border, showed a significant decline in malaria transmission starting from late 2006, due to a program that has had a strong impact. Unfortunately, ensuring its cost-efficiency, economic sustainability and integration with health services now poses a challenge.

Malaria in specific groups

Figures 25–28

In 2008, 11.6% of malaria cases (35,951) were among children under the age of 5. Children being a particularly malaria-prone group in several Brazilian municipalities, the malaria program has started to systematically monitor this parameter as a criterion for selecting priority localities for implementation of LLINs. A similar percentage (13.0%) of cases in 2008 was reported as being of urban origin. Large cities like Manaus and Porto Velho are urban poles with problems of unorganised peri-urban occupation and favorable conditions for malaria transmission. These cities and many other municipalities in the Amazon states continue to be malaria endemic. In 2008 4,315 cases of malaria in pregnant women were registered, corresponding to 7.6% of the cases reported among women of childbearing age. The malaria program has been promoting measures since 2006 to integrate the care of pregnant women infected with malaria with prenatal care programs. Although reported fertility rates appear to be in line with general rates in the region, it is clear that there are municipalities and states with very low registration of women of childbearing age and, as a result, a lack of special care.

Diagnosis and treatment

Figures 20-24, 29–30

In 2008, 2,718,821 slides were examined with a SPR of 11.6%. This rate is considerably lower than that in 2000, due to the intensification of active search efforts, better access at diagnostic centers

and more demand stimulation. Acre State has markedly improved early case detection since 2006, as reflected in a much lower SPR than the rest of the country. High SPR in some states like Amapa, Mato Grosso and Rondonia tends to indicate the need to intensify diagnostic efforts in selected municipalities and localities. One parameter worth stressing among Brazil's indicators is that 74% of the cases have an access to a parasitological diagnostic test within 72 hours after the onset of symptoms. Also noteworthy is the timeliness with which the information system is able to monitor this indicator in a country like Brazil where the problem is serious and the malaria endemic territory widely scattered.

Analysis of this information by municipalities leads to identification of situations where access to the malaria diagnosis needs improvement. The recently approved Global Fund project to intensify actions in the 47 priority municipalities will include specific efforts to that effect, including, among others, widespread use of RDTs for malaria, an instrument little used in Brazil in comparison with microscopy.

In 2006, Brazil replaced quinine + doxycycline combination with ACT treatment as its first-line of treatment for uncomplicated *P. falciparum* malaria. This resulted in a considerable decrease in *P. falciparum* malaria. Although this reduction can be attributed to a number of factors, especially since there was a simultaneous reduction of *P. vivax* malaria as well, reduction of *P. falciparum* malaria cases has been considerably higher since 2006. It has dropped from 21.5% of all malaria cases in 2000 to 15.6% in 2008.

Prevention and vector control

Figures 31-33

IRS is still widely used by Brazil's malaria program, despite major operational limitations stemming from limited insecticide residuality and the rejection of pyrethroids, in use today, by a part of the population. In recent years, the malaria program has produced guidelines to promote more effective actions through strict compliance with spraying cycle coverage and periodicity criteria and by concentrating efforts in localities with a heavy burden of disease. This measure, combined with the implementation of LLINs, had a significant impact in Acre State. In 2008 it even made it possible to eliminate spatial application of insecticides altogether.

LLIN implementation was started in Brazil in December 2007 through a pilot project conducted in the State of Acre with funding from the US-AID/PAHO AMI project. The malaria program carefully monitored the intervention, which will be disseminated over the rest of the country using financing from the project recently approved by the Global Fund.

Financing of malaria control

Figure 34

Brazil spends a significant amount of public resources on malaria control. Efforts are underway to integrate this spending with the unified health system of the country. USAID funding support provided since 2002, while not used in the program's operation, has served as a catalyst for obtaining technical and south-south cooperation under PAHO coordination. The Global Fund in 2008 approved a malaria control project in 47 priority municipalities that is expected to contribute significantly towards reaching the MDG targets set for 2015.

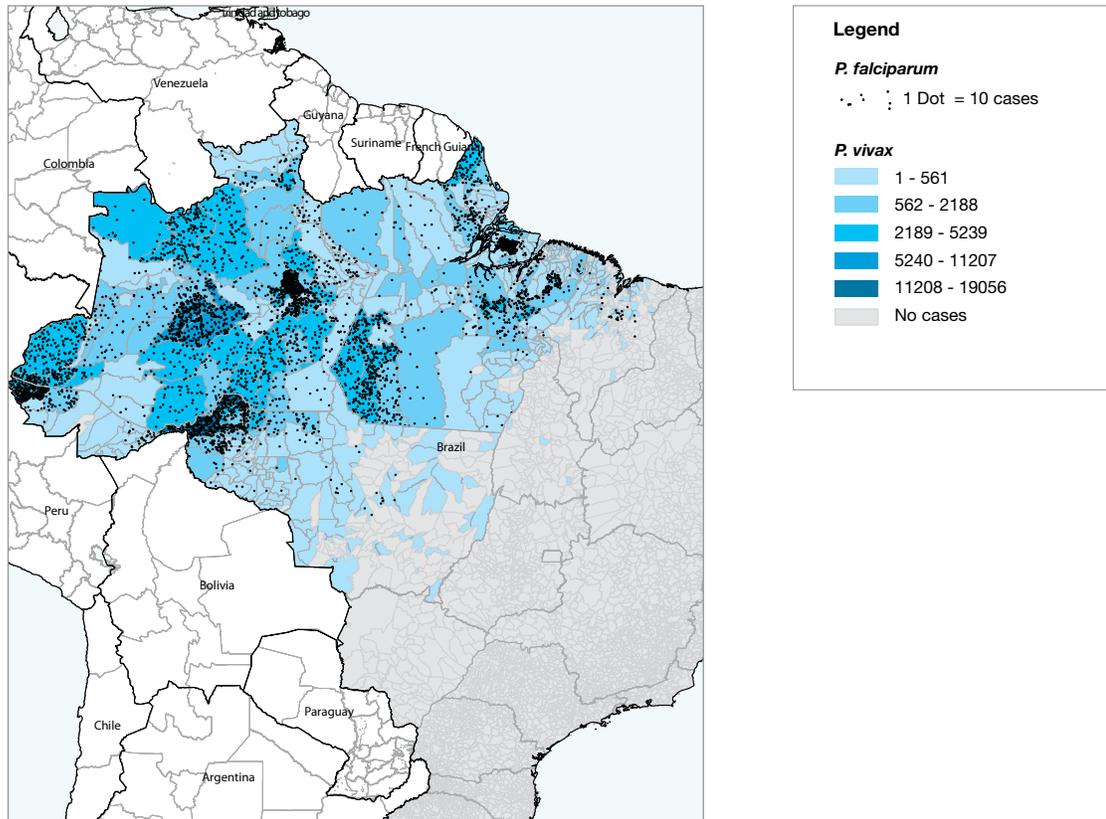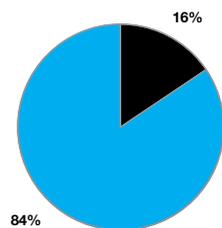## Figure 1. Number of cases by ADM 2 level (municipality, district), 2008

Legend

P. falciparum

1 Dot = 10 cases

P. vivax

- 1 - 561
- 562 - 2188
- 2189 - 5239
- 5240 - 11207
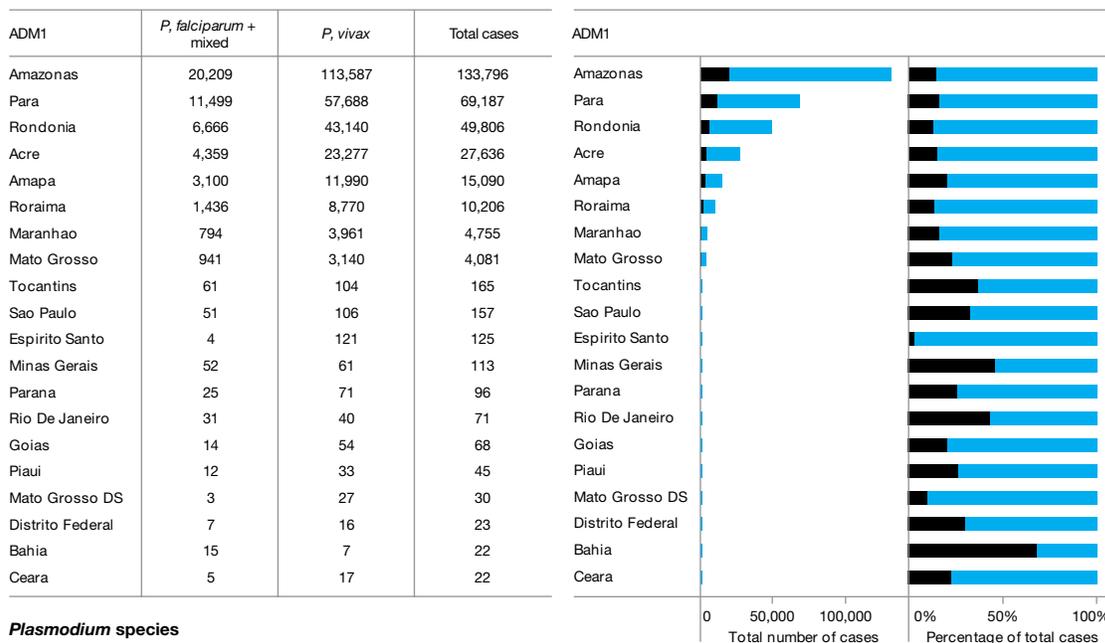- 11208 - 19056
- No cases

Figure 2. Proportion of cases by species, 2008

16%

84%

Plasmodium species

- *P. vivax*
- *P. falciparum* and mixed

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

ADM1	P, falciparum + mixed	P, vivax	Total cases
Amazonas	20,209	113,587	133,796
Para	11,499	57,688	69,187
Rondonia	6,666	43,140	49,806
Acre	4,359	23,277	27,636
Amapa	3,100	11,990	15,090
Roraima	1,436	8,770	10,206
Maranhao	794	3,961	4,755
Mato Grosso	941	3,140	4,081
Tocantins	61	104	165
Sao Paulo	51	106	157
Espirito Santo	4	121	125
Minas Gerais	52	61	113
Parana	25	71	96
Rio De Janeiro	31	40	71
Goias	14	54	68
Piaui	12	33	45
Mato Grosso DS	3	27	30
Distrito Federal	7	16	23
Bahia	15	7	22
Ceara	5	17	22

Plasmodium species

■ *P. falciparum* and mixed   ■ *P. vivax*

* See Annex A for a complete list.

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

Plasmodium species

■ *P. falciparum* and mixed   ■ *P. vivax*
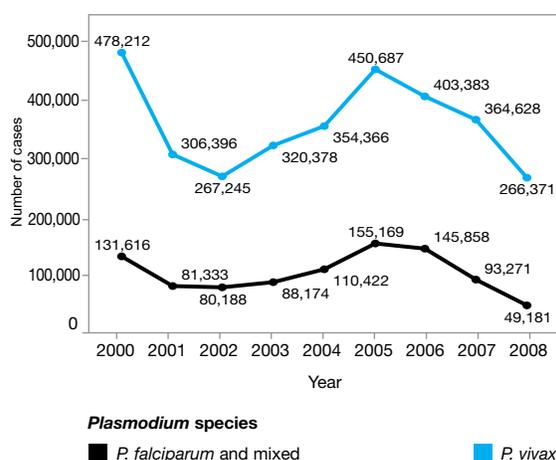
Figure 5. Number of malaria cases, 2000-2008
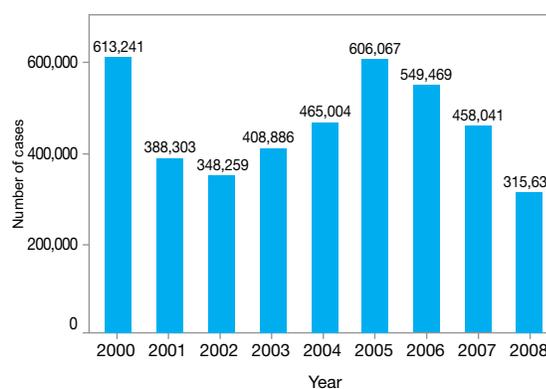
Figure 6. Number of malaria deaths, 2000-2008

Number of deaths by year: 2000: 231; 2001: 142; 2002: 93; 2003: 103; 2004: 100; 2005: 122; 2006: 105; 2007: 94; 2008: 51.

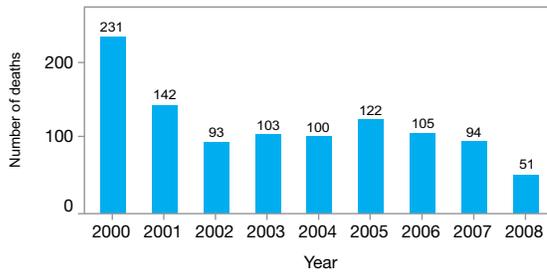**Figure 7. Number of hospitalized malaria cases, 2000 - 2008**

Number of cases by year: 2000: NA; 2001: 14,751; 2002: 11,500; 2003: 10,690; 2004: 11,762; 2005: 12,542; 2006: 9,884; 2007: 6,772; 2008: 4,039.

NA - No Data Available
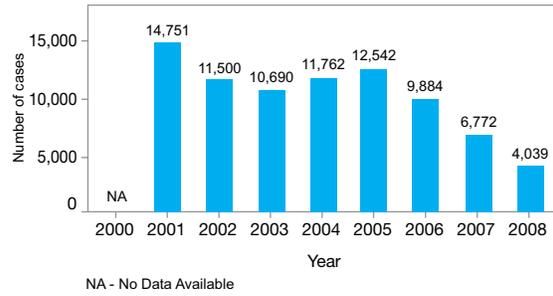
Figure 8. Annual variations in number of cases

Difference in number of cases. *P. falciparum* and mixed values: 2002: 7,986; 2003: -1,145; 2004: 33,988; 2005: 44,747; 2006: -9,311; 2007: -38,755; 2008: -44,090. *P. vivax* values: 2002: -39,151; 2003: 53,133; 2004: 22,248; 2005: 96,321; 2006: -47,304; 2007: -52,587; 2008: -98,257. Other: -50,283; -171,816.
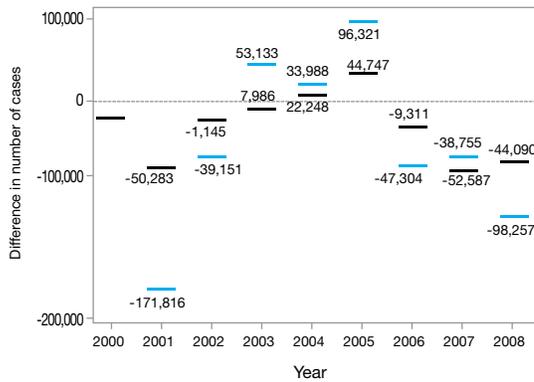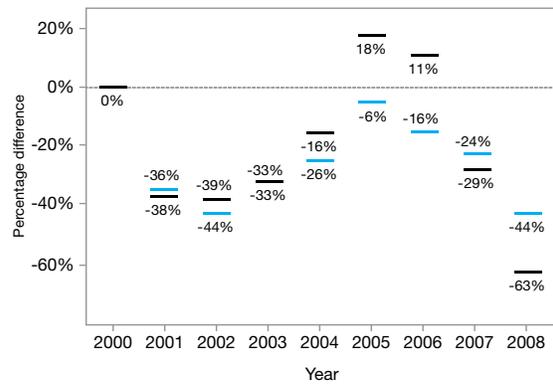
**Plasmodium species**

- *P. falciparum* and mixed
- *P. i a*

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

Percentage difference. *P. falciparum* and mixed: 2000: 0%; 2001: -36%; 2002: -39%; 2003: -33%; 2004: -16%; 2005: 18%; 2006: 11%; 2007: -24%; 2008: -44%. *P. vivax*: 2001: -38%; 2002: -44%; 2003: -33%; 2004: -26%; 2005: -6%; 2006: -16%; 2007: -29%; 2008: -63%.
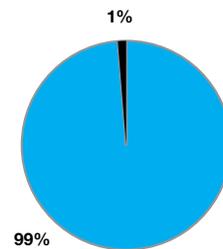
Plasmodium species

- *P. falciparum* and mixed
- *P. vivax*

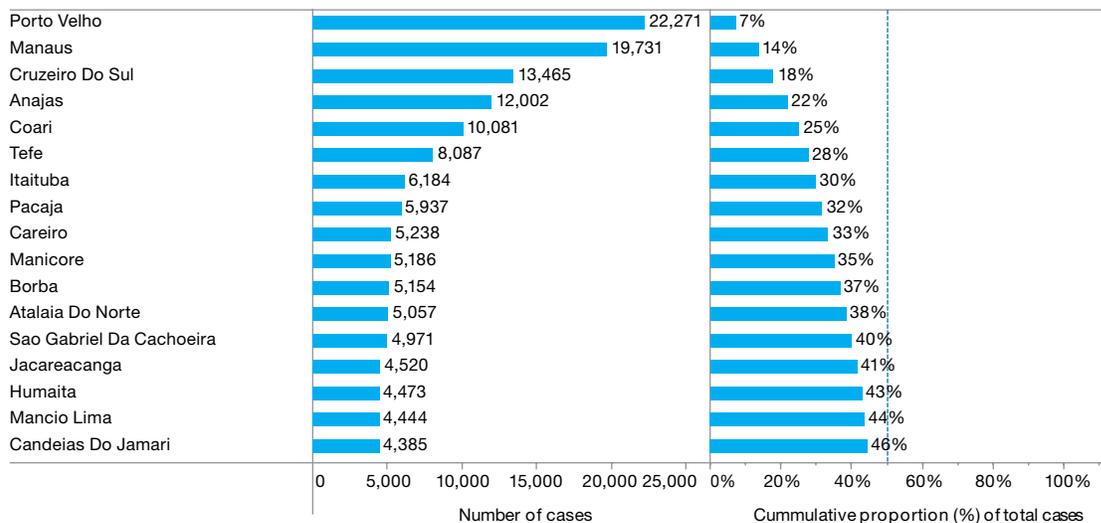**Figure 10. Number of cases and RBM / MDG targets for 2010 and 2015**
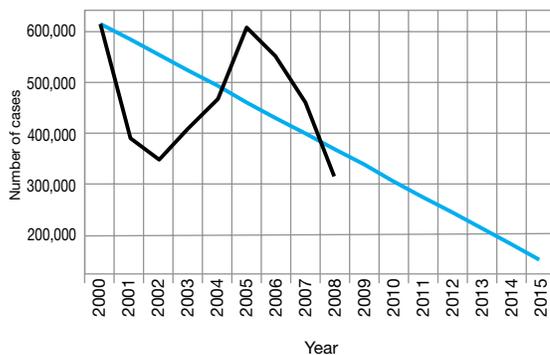
- Reported cases
- RBM / MDG Targets

Figure 11. Percentage of hospitalized cases, 2008

1%

99%

Percentage of cases

- Oupatients
- Hospitalized

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

District	Number of cases	Cummulative proportion (%)
Porto Velho	22,271	7%
Manaus	19,731	14%
Cruzeiro Do Sul	13,465	18%
Anajas	12,002	22%
Coari	10,081	25%
Tefe	8,087	28%
Itaituba	6,184	30%
Pacaja	5,937	32%
Careiro	5,238	33%
Manicore	5,186	35%
Borba	5,154	37%
Atalaia Do Norte	5,057	38%
Sao Gabriel Da Cachoeira	4,971	40%
Jacareacanga	4,520	41%
Humaita	4,473	43%
Mancio Lima	4,444	44%
Candeias Do Jamari	4,385	46%

Number of cases / Cummulative proportion (%) of total cases

* See Annex A for a complete list.

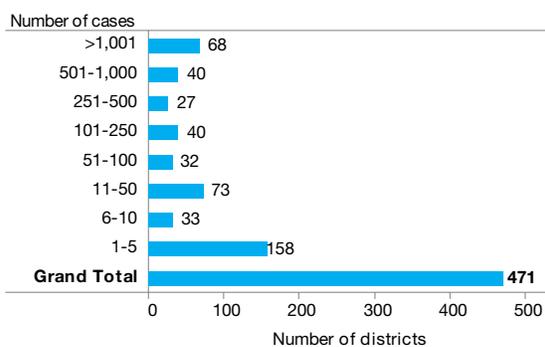**Figure 13. Districts (ADM2) by number of malaria cases, 2008**

Number of cases

Number of cases	Number of districts
>1,001	68
501-1,000	40
251-500	27
101-250	40
51-100	32
11-50	73
6-10	33
1-5	158
Grand Total	**471**

Number of districts

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

Number of *P. falciparum* cases

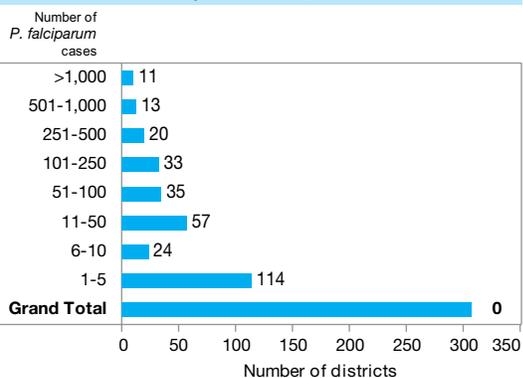| Number of P. falciparum cases	Number of districts
>1,000	11
501-1,000	13
251-500	20
101-250	33
51-100	35
11-50	57
6-10	24
1-5	114
Grand Total	**0**

Number of districts

Figure 15. Districts (ADM2) by number of cases, API and percentage of *P. falciparum* cases, 2008
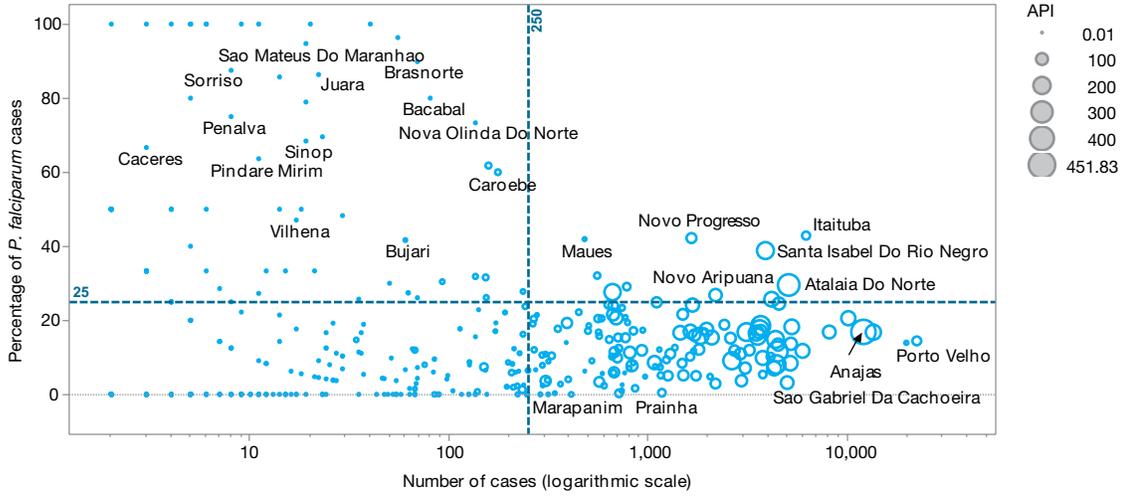
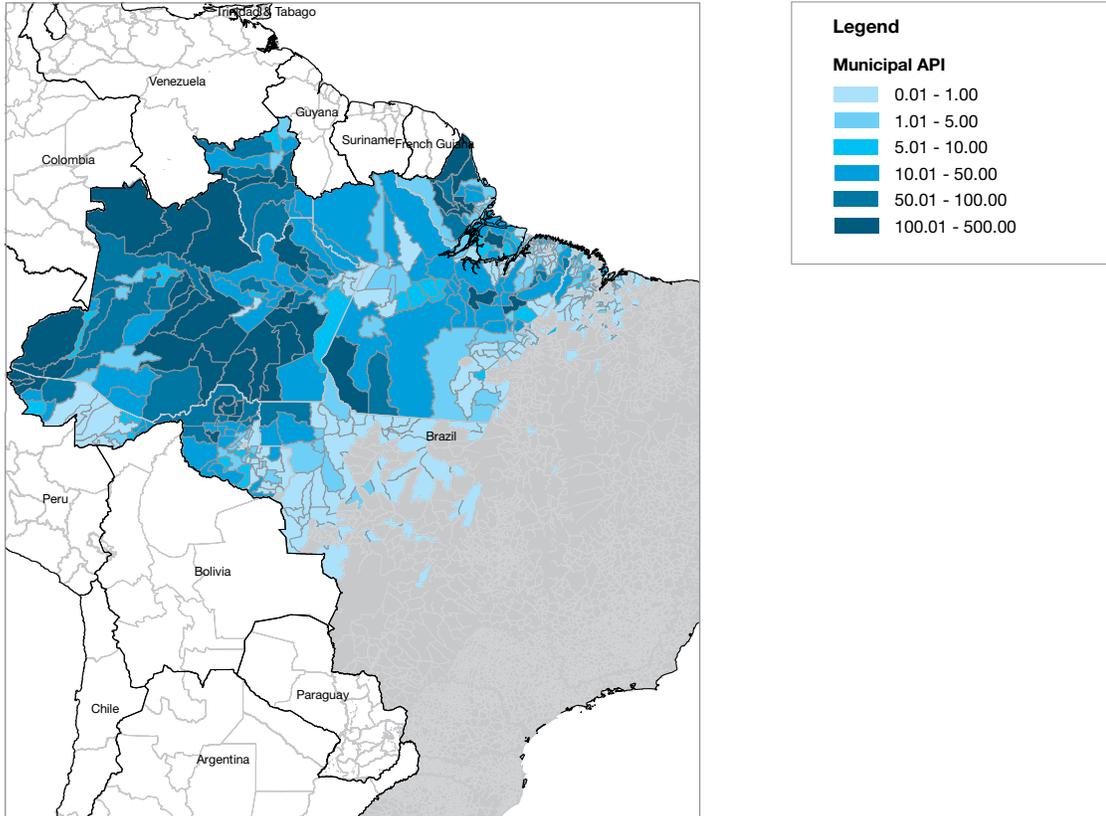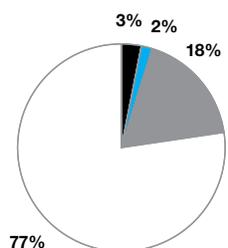**Figure 16. Annual Parasite Index (API) by districts (ADM2), 2008**

Legend

Municipal API

- 0.01 - 1.00
- 1.01 - 5.00
- 5.01 - 10.00
- 10.01 - 50.00
- 50.01 - 100.00
- 100.01 - 500.00

Figure 17. Population by malaria transmission risk, 2008
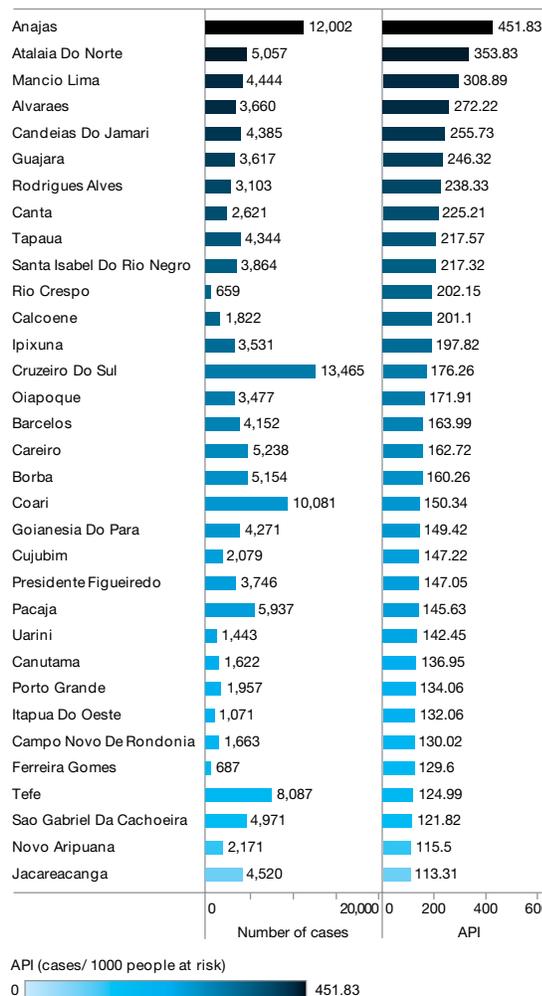

3% 2%

18%

77%

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

District	Number of cases	API
Anajas	12,002	451.83
Atalaia Do Norte	5,057	353.83
Mancio Lima	4,444	308.89
Alvaraes	3,660	272.22
Candeias Do Jamari	4,385	255.73
Guajara	3,617	246.32
Rodrigues Alves	3,103	238.33
Canta	2,621	225.21
Tapaua	4,344	217.57
Santa Isabel Do Rio Negro	3,864	217.32
Rio Crespo	659	202.15
Calcoene	1,822	201.1
Ipixuna	3,531	197.82
Cruzeiro Do Sul	13,465	176.26
Oiapoque	3,477	171.91
Barcelos	4,152	163.99
Careiro	5,238	162.72
Borba	5,154	160.26
Coari	10,081	150.34
Goianesia Do Para	4,271	149.42
Cujubim	2,079	147.22
Presidente Figueiredo	3,746	147.05
Pacaja	5,937	145.63
Uarini	1,443	142.45
Canutama	1,622	136.95
Porto Grande	1,957	134.06
Itapua Do Oeste	1,071	132.06
Campo Novo De Rondonia	1,663	130.02
Ferreira Gomes	687	129.6
Tefe	8,087	124.99
Sao Gabriel Da Cachoeira	4,971	121.82
Novo Aripuana	2,171	115.5
Jacareacanga	4,520	113.31

API (cases/ 1000 people at risk)

0 — 451.83

* 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	3,452,000	5,404,000	22,741,000	138,809,000
2001	2,001,000	4,020,000	12,464,000	149,775,000
2002	1,926,000	4,929,000	13,553,000	154,225,000
2003	6,133,686	4,849,251	22,875,719	143,017,595
2004	6,255,508	4,449,984	17,603,716	150,798,926
2005	6,670,624	4,516,396	34,093,730	138,903,324
2006	6,491,482	4,359,216	18,391,977	157,527,938
2007	6,121,682	3,903,969	37,196,762	142,112,778
2008	5,866,214	3,275,375	33,820,536	146,650,689

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

Year	Number of slides examined	Number of slides positive	Slide Positivity Rate (%)
2000	2,562,576	613,241	23.93
2001	2,274,610	388,303	17.07
2002	2,118,491	348,259	16.44
2003	2,269,359	408,886	18.02
2004	2,584,397	465,004	17.99
2005	3,196,788	606,067	18.96
2006	3,504,379	549,469	15.68
2007	2,979,566	458,041	15.37
2008	2,718,821	315,630	11.61

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

Diagnostic Method

Year	Microscopy	RDTs
2000	2,562,576	
2001	2,274,610	
2002	2,118,491	
2003	2,269,359	
2004	2,584,397	
2005	3,196,788	
2006	3,504,379	
2007	2,979,566	
2008	2,718,821	

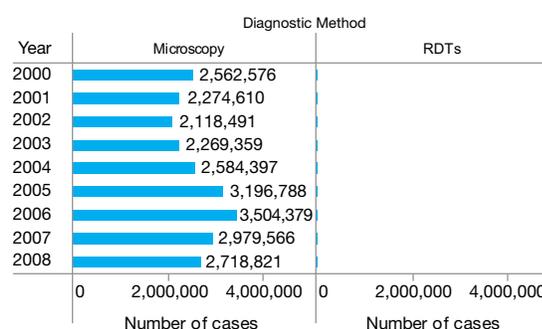Number of cases   Number of cases

Figure 22. Number of cases diagnosed and cases treated, 2000-2008
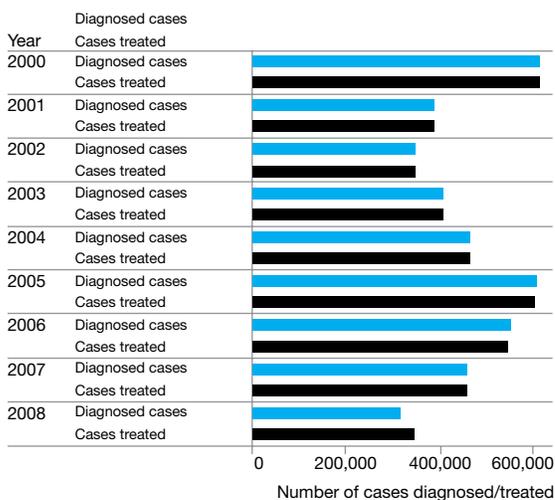
Figure 23. Slide Positivity Rate (SPR) by ADM1, 2008

ADM1	Examined	Total cases	SPR (%)
Amazonas	1,094,698	133,796	12.22
Para	407,940	69,187	16.96
Rondonia	269,354	49,806	18.49
Acre	611,580	27,636	4.52
Amapa	74,522	15,090	20.25
Roraima	131,082	10,206	7.79
Maranhao	107,223	4,755	4.43
Mato Grosso	21,123	4,081	19.32
Tocantins	1,299	165	12.7
Sao Paulo	293	157	53.58
Espirito Santo	407	125	30.71
Minas Gerais	300	113	37.67
Parana	302	96	31.79
Rio De Janeiro	151	71	47.02
Goias	183	68	37.16
Piaui	92	45	48.91
Mato Grosso DS	98	30	30.61
Distrito Federal	49	23	46.94
Bahia	56	22	39.29
Ceara	90	22	24.44
Pernambuco	56	21	37.5
Rio Grande Do Sul	33	13	39.39
Santa Catarina	57	13	22.81
Alagoas	7	5	71.43
Rio Grande Do Norte	15	5	33.33
Sergipe	3	2	66.67

Figure 24. Time span between onset of symptoms and diagnosis, 2008
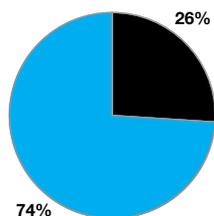
Time span between onset of symptoms and diagnosis
- ■ >72 hours
- ■ <72 hours

Figure 25. Number and percentage of cases by age group, 2008
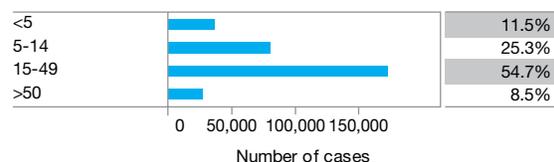
Figure 26. Number and percentage of cases by locality type, 2008
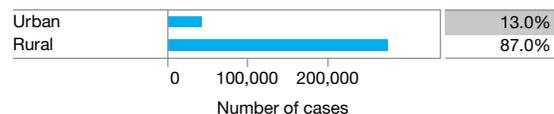
Figure 27. Number and percentage of cases in pregnant women among women of child bearing age, 2008
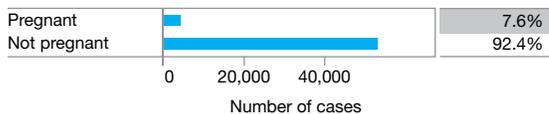

Figure 28. Number and percentage of cases in indigenous population, 2008
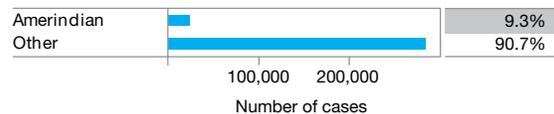
Figure 29. Proportion of *P. falciparum* cases, 2000-2008
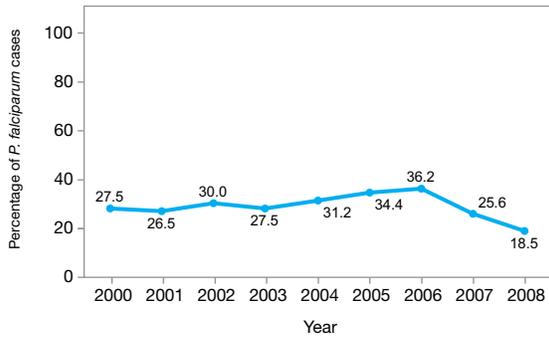

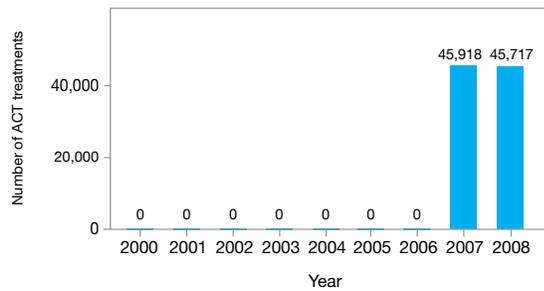Figure 30. Number of ACT treatments distributed by year, 2000-08

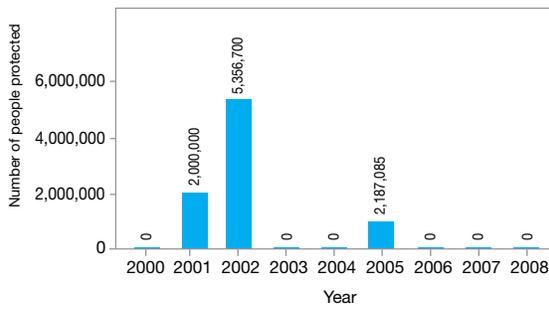Figure 31. Indoor residual spraying coverage by year, 2000-08

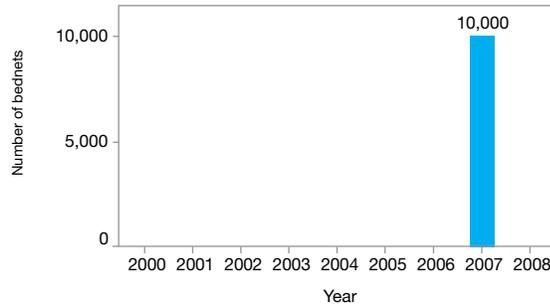Figure 32. Number of LLINs distributed by year, 2000-2008

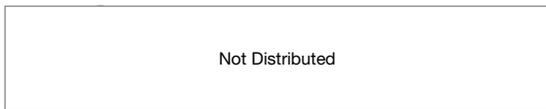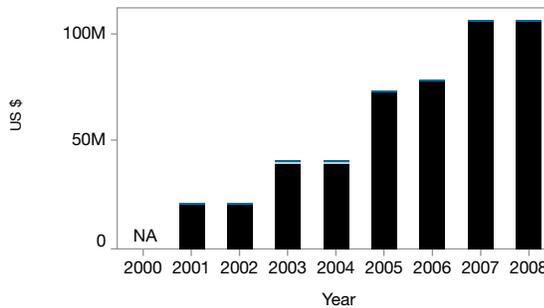Figure 33. Number of ITNs distributed by year, 2000-08

Not Distributed

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

Financing sources

USAID	Other bilateral funds	Government
UN agencies	Global Fund	

NA - Data not available