
Summary

There were an estimated 247 million malaria cases among 3.3 billion people at risk in 2006, causing nearly a million deaths, mostly of children under 5 years. 109 countries were endemic for malaria in 2008, 45 within the WHO African region.

The combination of tools and methods to combat malaria now includes long-lasting insecticidal nets (LLIN) and artemisinin-based combination therapy (ACT), supported by indoor residual spraying of insecticide (IRS) and intermittent preventive treatment in pregnancy (IPT). Despite big increases in the supply of mosquito nets, especially of LLIN in Africa, the number available in 2006 was still far below need in almost all countries. The procurement of antimalarial medicines through public health services also increased sharply, but access to treatment, especially of ACT, was inadequate in all countries surveyed in 2006.

Household surveys and data from national malaria control programmes (NMCPs) show that the coverage of all interventions in 2006 was far lower in most African countries than the 80% target set by the World Health Assembly. Supplies of insecticide-treated nets (ITN) to NMCPs were sufficient to protect an estimated 26% of people in 37 African countries. Surveys in 18 African countries found

that 34% of households owned an ITN; 23% of children and 27% of pregnant women slept under an ITN; 38% of children with fever were treated with antimalarial drugs, but only 3% with ACT; and 18% of women used IPT in pregnancy. Only 5 African countries reported IRS coverage sufficient to protect at least 70% of people at risk of malaria.

In regions other than Africa, intervention coverage is difficult to measure because household surveys are uncommon, preventive methods usually target high-risk populations of unknown size, and NMCPs do not report on diagnosis and treatment in the private sector.

While the link between interventions and their impact is not always clear, at least 7 of 45 African countries/areas with relatively small populations, good surveillance and high intervention coverage reduced malaria cases and deaths by 50% or more between 2000 and 2006 or 2007. In a further 22 countries in other regions of the world, malaria cases fell by 50% or more over the period 2000–2006. However, deeper investigations of impact are needed to confirm that these 29 countries are on course to meet targets for reducing the malaria burden by 2010.

Key points

Background and context

A renewed effort to control malaria worldwide, moving towards elimination in some countries, is founded on the latest generation of effective tools and methods for prevention and cure.

1. The advent of long-lasting insecticidal nets (LLINs) and artemisinin-based combination therapy (ACT), plus a revival of support for indoor residual spraying of insecticide (IRS), presents a new opportunity for large-scale malaria control.
2. To accelerate progress in malaria control, the 2005 World Health Assembly (WHA) set targets of $\geq 80\%$ coverage for four key interventions: insecticide-treated nets for people at risk; appropriate antimalarial drugs for patients with probable or confirmed malaria; indoor residual spraying of insecticide for households at risk; and intermittent preventive treatment in pregnancy. The WHA further specified that, as a result of these interventions, malaria cases and deaths per capita should be reduced by $\geq 50\%$ between 2000 and 2010, and by $\geq 75\%$ between 2005 and 2015.
3. The *World malaria report 2008* uses data from routine surveillance (≈ 100 endemic countries) and household surveys (≈ 25 countries, mainly in Africa) to measure achievements up to 2006 and, for some aspects of malaria control, to 2007 and 2008. In five main chapters, 30 country profiles and seven annexes, the report describes: (a) the estimated burden of disease in each of the 109 countries and territories with malaria in 2006; (b) how WHO-recommended policies and strategies on malaria control have been adopted, by country, region and globally; (c) the progress made in implementing control measures; (d) the sources of funding for malaria control; and (e) recent evidence that interventions can reduce cases and deaths.

Burden of malaria in 2006, by country, region and globally

Half of the world's population is at risk of malaria, and an estimated 250 million cases led to nearly 1 million deaths in 2006.

4. An estimated 3.3 billion people were at risk of malaria in 2006. Of this total, 2.1 billion were at low risk (< 1 reported case per 1000 population), 97% of whom were living in regions other than Africa. The 1.2 bil-

lion at high risk (≥ 1 case per 1000 population) were living mostly in the WHO African (49%) and South-East Asia regions (37%).

5. There were an estimated 247 million episodes of malaria in 2006, with a wide uncertainty interval (5th–95th centiles) from 189 million to 327 million cases. Eighty-six percent, or 212 million (152–287 million) cases, were in the African Region. Eighty percent of the cases in Africa were in 13 countries, and over half were in Nigeria, Democratic Republic of the Congo, Ethiopia, United Republic of Tanzania and Kenya. Among the cases that occurred outside the African Region, 80% were in India, Sudan, Myanmar, Bangladesh, Indonesia, Papua New Guinea and Pakistan.
6. There were an estimated 881 000 (610 000–1 212 000) malaria deaths in 2006, of which 91% (801 000, range 520 000–1 126 000) were in Africa and 85% were of children under 5 years of age.
7. Estimates of malaria incidence are based, in part, on the numbers of cases reported by national malaria control programmes (NMCPs). These case reports are far from complete in most countries. A total of 94 million malaria cases was reported by national malaria control programmes in 2006, or 37% of the estimated global case incidence. The true proportion of malaria episodes detected by NMCPs would have been lower than 37% because, in some countries, reported cases include patients that are diagnosed clinically but do not have malaria. NMCPs reported 301 000 malaria deaths, or 34% of estimated deaths worldwide in 2006.

Policies and strategies for malaria control

National malaria control programmes have adopted many of the WHO-recommended policies on prevention and cure, but with variation among countries and regions.

8. Nearly all of the 45 countries in the African Region had adopted, by the end of 2006, the policy of providing insecticidal nets free of charge to children and pregnant women, but only 16 aimed to cover all age groups at risk. ITNs are also used in a high proportion of countries in the South-East Asia and Western Pacific regions, but in relatively few countries in the other three WHO regions.

9. Indoor residual spraying is generally used in foci of high malaria transmission. IRS is the dominant method of vector control in the European Region. It is used in fewer countries in Africa, the Americas and South-East Asia, and least in the Western Pacific Region.
10. By June 2008, all except four countries and territories worldwide had adopted ACT as the first-line treatment for *P. falciparum*. Free treatment with ACT was available in 8 of 10 countries in the South-East Asia Region, but a smaller proportion of countries in other regions.
11. The systematic use of intermittent preventive treatment in pregnancy is restricted to the African Region; 33 of the 45 African countries had adopted IPT as national policy by the end of 2006.
16. Indoor residual spraying (IRS) is used focally in all regions of the world. In the African Region, NMCP data indicate that more than 70% of households at any risk of malaria were covered in Botswana, Namibia, Sao Tome and Principe, South Africa and Swaziland. In other regions of the world, relatively high coverage (> 20% of people at risk) was achieved only in Bhutan and Suriname.

Preventing malaria

Despite big increases in the supply of mosquito nets, especially of long-lasting insecticidal nets in Africa, the number available is still far below need in most countries.

12. Between 2004 and 2006, there were modest increases in the supply of conventional ITNs to countries in the African, South-East Asia and Western Pacific regions, the three regions where nets are most frequently used. By contrast, there was a large increase in the supply of LLINs to countries in the African Region, reaching 36 million in 2006.
13. Based on NMCP records of ITN supplies, however, only six countries in the African Region had sufficient nets (ITNs including LLINs) by 2006 to cover at least 50% of people at risk. These were Ethiopia, Kenya, Madagascar, Niger, Sao Tome and Principe, and Zambia. ITN supplies were sufficient to protect 26% of people in 37 African countries that reported in 2006.
14. Among 18 national household surveys carried out in the African Region in 2006–2007, relatively high ownership and usage of ITNs (including LLINs) was found in Ethiopia, Niger, Sao Tome and Principe, and Zambia. The proportion of family members (children, pregnant women) that slept under an ITN was typically smaller than the proportion of households that owned an ITN. There was wide variation in ITN ownership and use among countries: household ownership of at least 1 net varied from 6% in Côte d'Ivoire to 65% in Niger. Average ITN coverage across the 18 countries with surveys was far below the 80% target: 34% of households owned an ITN, and 23% of children under 5 years and 27% of pregnant women slept under an ITN.
15. In regions other than Africa, ITNs are usually targeted at high-risk populations. While the size of these targeted populations is not known, NMCP data indicate that relatively high coverage (> 20% of all people at risk) was achieved in Bhutan, Papua New Guinea, Solomon Islands and Vanuatu.
17. Between 2001 and 2006, NMCPs reported large increases in the number of courses of antimalarial drugs supplied through public health services. In particular, doses of ACT increased from 6 million in 2005 to 49 million in 2006, of which 45 million were for African countries. These NMCP figures probably underestimate usage, and the exact consumption of ACT is not known.
18. According to NMCP data, only 16 million rapid diagnostic tests (RDT) were delivered in 2006, of which 11 million were for countries in Africa, a small quantity in comparison with the number of malaria episodes.
19. Considering drugs supplied in the public sector (through NMCPs) in relation to estimated malaria cases, as a measure of potential demand, the African countries best-provisioned with any antimalarial drugs in 2006 were Botswana, Comoros, Eritrea, Malawi, Sao Tome and Principe, Senegal, United Republic of Tanzania and Zimbabwe. Among this group of countries, Eritrea, Sao Tome and Principe, and United Republic of Tanzania were also relatively well supplied with ACT.
20. According to national household surveys, however, none of the populations of 18 African countries surveyed in 2006 and 2007 had adequate access to antimalarial drugs. Only in Benin, Cameroon, Central African Republic, Gambia, Ghana, Uganda and Zambia were more than 50% of all children with fever treated with an antimalarial drug. In no country did access to treatment reach the 80% target, and the average across the 18 countries was 38%. The use of ACT was much lower: just 3% of children on average, ranging from 0.1% in Gambia to 13% in Zambia.
21. A subset of 16 national household surveys found that intermittent preventive treatment (IPT, ≥ 2 doses of sulfadoxine-pyrimethamine) was used most frequently by pregnant women in Gambia, Malawi, Senegal and Zambia (33–61%), and by an average of 18% of women in all 16 countries.
22. In regions other than Africa, access to treatment is more difficult to judge: household surveys that include questions on treatment for malaria are much less common and, as in Africa, national control programmes

Treating malaria

The procurement of antimalarial medicines through public health services increased sharply between 2001 and 2006, but access to treatment, especially of artemisinin-based combination therapy, was inadequate in all countries surveyed in 2006.

do not report on diagnosis and treatment in the private sector. Nevertheless, as far as can be judged from NMCP data, the countries relatively well provisioned with antimalarial drugs were: Bhutan, Lao People's Democratic Republic, Vanuatu and Viet Nam.

Financing malaria control

Funding for malaria control in 2006 was reported to be greater than ever before, but it is not yet possible to judge from NMCP budgets which countries have adequate resources for malaria control.

23. According to NMCP data for 2006, the African Region had more funds for malaria control than any other, and reported a larger increase in funding than any other region between 2004 and 2006. However, the total of US\$ 688 million for the African Region in 2006 is certain to be an underestimate because reports were submitted by only 26 of 45 countries. The US\$ 4.6 available per (estimated) malaria case in the 26 reporting countries is unlikely to be adequate to meet targets for prevention and cure.
24. The major sources of extra funds for African countries between 2004 and 2006 were reported to be the national governments of the affected countries plus the Global Fund to Fight AIDS, Tuberculosis and Malaria. These two sources dominated funding for malaria control in the African Region and worldwide in 2006.
25. The balance of funding support varied among WHO regions. In the Americas, the European and South-East Asia regions, the majority of funds were from the governments of endemic countries. In the Eastern Mediterranean and Western Pacific regions, the Global Fund was reported to be the principal source of financial support. The Western Pacific Region placed greatest reliance on external funding, followed by the African and Eastern Mediterranean regions. Countries in the African Region presented the most diverse portfolio of support from external agencies.

Impact of malaria control

Some countries that have implemented aggressive programmes of prevention and treatment, in Africa and other regions, have reported significant reductions in the malaria burden.

26. While the effect of malaria control can be evaluated by repeated population surveys – of parasite prevalence, anemia, malaria-specific mortality or all-cause mortality – this report focuses on the inferences that can be drawn from national surveillance reports.
27. Among 41 African countries that provided case and death reports over the period 1997–2006, the most persuasive evidence for impact comes from four countries, or parts of countries, with relatively small populations, good surveillance, and high intervention coverage. They are Eritrea, Rwanda, Sao Tome and Principe, and Zanzibar (United Republic of Tanzania). All four coun-

tries/areas reduced the malaria burden by 50% or more between 2000 and 2006–2007, in line with WHA targets.

28. In other African countries where a high proportion of people have access to antimalarial drugs or insecticidal nets, such as Ethiopia, Gambia, Kenya, Mali, Niger and Togo, routine surveillance data do not yet show, unequivocally, the expected reductions in morbidity and mortality. Either the data are incomplete, or the effects of interventions are small.
29. The reportedly high coverage of indoor residual spraying in Namibia, South Africa and Swaziland is consistent with the observed declines in case numbers in these countries, and evidently builds on earlier successes achieved with IRS.
30. Surveillance reports for many countries outside Africa indicate that malaria declined during the decade 1997–2006. Malaria cases were falling in at least 25 endemic countries in five WHO regions. In 22 of these countries, the number of reported cases fell by 50% or more between 2000 and 2006–2007, in line with WHA targets.
31. The recorded number of malaria deaths has fallen in at least six countries in the Americas, and in the South-East Asia and Western Pacific regions. These countries are Cambodia, Lao People's Democratic Republic, Philippines, Suriname, Thailand and Viet Nam, and all six are on course to meet WHA targets for reductions in malaria mortality by 2010.
32. Reductions in cases and deaths can be linked to specific interventions in some countries, for example the targeted use of ITNs in Cambodia, India, Lao People's Democratic Republic and Viet Nam. In general, however, the links between interventions and trends remain ambiguous, and more careful investigations of the effects of control are needed in most countries.
33. WHO has identified four phases on the path to malaria elimination. By July 2008, the 109 countries/territories affected by malaria were classified as follows: control (82), pre-elimination (11), elimination (10), and the prevention of reintroduction (6). In January 2007, the United Arab Emirates was the first formerly-endemic country since the 1980s to be certified malaria-free by WHO, bringing the total number of malaria-free countries/territories to 92.