

Summary

The *World Malaria Report 2010* summarizes information received from 106 malaria-endemic countries and other partners and updates the analyses presented in the 2009 Report. It highlights continued progress made towards meeting international targets for malaria control to be achieved by 2010 and 2015. The report outlines the evolving situation of financing for malaria control, how these growing resources have resulted in increased coverage of WHO-recommended malaria control interventions, and the association between this rapid scale-up and substantial reductions in malaria burden.

International funding for malaria control has risen steeply in the past decade. Disbursements reached their highest ever levels in 2009 at US\$ 1.5 billion, but new commitments for malaria control appear to have stagnated in 2010, at US\$ 1.8 billion. Countries with smaller populations at risk continue to receive more funding per person at risk than more populous countries. The amounts committed to malaria, while substantial, still fall short of the resources required for malaria control, estimated at more than US\$ 6 billion for the year 2010.

The increased financing has resulted in tremendous progress in increasing access to insecticide-treated mosquito nets (ITNs) in the past 3 years. By the end of 2010, approximately 289 million ITNs will have been delivered to sub-Saharan Africa, enough to cover 76% of the 765 million persons at risk of malaria. It is estimated that 42% of households in Africa owned at least one ITN in mid-2010, and that 35% of children slept under a ITN. The percentage of children using ITNs is still below the WHA target of 80% partly because up to the end of 2009, ITN ownership remained low in some of the largest African countries. Low rates of use reported in some surveys are primarily due to a lack of sufficient nets to cover all household members; household survey results suggest that most (80%) of the available ITNs are used.

While the rapid scale-up of ITN distribution in Africa represents an enormous public health achievement, it also represents a formidable challenge for the future in ensuring that the high levels of coverage are maintained. The lifespan of a long-lasting ITN is currently estimated to be 3 years. Nets delivered in 2006 and 2007 are therefore already due for replacement, and those delivered between 2008 and 2010 soon will be. Failure to replace these nets could lead to a resurgence of malaria cases and deaths.

IRS programmes have also expanded considerably in recent years, with the number of people protected in sub-Saharan Africa increasing from 13 million in 2005 to 75 million in 2009, corresponding to protection for approximately 10% of the population at risk in 2009.

Current methods of malaria vector control are highly dependent on a single class of insecticides, the pyrethroids, which are the most commonly used compounds for IRS and the only insecticide class used for ITNs. The widespread use of a single class of insecticide increases the risk that mosquitoes will develop resistance, which could rapidly lead to a major public health problem. The risk is of particular concern in Africa, where insecticidal vector control is being deployed with unprecedented levels of coverage and where the burden of malaria is greatest.

WHO now recommends that all cases of suspected malaria be confirmed with a diagnostic test prior to treatment. As the incidence of malaria decreases through much of sub-Saharan Africa, the need to differentiate malaria from non-malarial fevers becomes more pressing. The proportion of reported cases in Africa confirmed with a diagnostic test has risen substantially from less than 5% at the beginning of the decade to approximately 35% in 2009, but low rates persist in the majority of African countries and in a minority of countries in other regions. A small number of countries have shown that it is possible to scale up rapidly the availability of malaria diagnostic testing on a national scale, provided that attention is given to adequate preparation, training, monitoring, supervision and quality control. Such experiences have been linked with large savings in the use of artemisinin-based combination therapies (ACTs) and with improved malaria surveillance.

Information from manufacturers indicates that the number of ACTs procured has increased in every year since 2005. By the end of 2009, 11 African countries were providing sufficient courses of ACTs to cover more than 100% of malaria cases seen in the public sector; a further 8 African countries delivered sufficient courses to treat 50%–100% of cases. These figures represent a substantial increase since 2005, when only 5 countries were providing sufficient courses of ACT to cover more than 50% of patients treated in the public sector. However, information on access to treatment is generally incomplete, particularly for the significant proportion of patients treated in the private sector.

The use of oral artemisinin-based monotherapies threatens the therapeutic life of ACTs by fostering the spread of resistance to artemisinins. By November 2010, 25 countries were still allowing the marketing of these products and 39 pharmaceutical companies were manufacturing them. Most of the countries that still allow the marketing of monotherapies are located in the African Region and most of the manufacturers are in India.

The spread of resistance to antimalarial medicines over the past few decades has led to an intensification of efficacy monitoring to allow early detection of resistance. Despite the observed changes in parasite sensitivity to artemisinins, the clinical and parasitological efficacy of ACTs has not yet been compromised, even in the Greater Mekong sub-region. Nonetheless, both components of the drug combination are currently at risk and using an ACT with an ineffective partner medicine can increase the risk of development or spread of artemisinin resistance.

A total of 11 countries and one area in the WHO African Region showed a reduction of more than 50% in either confirmed malaria cases or malaria admissions and deaths in recent years. A decrease of more than 50% in the number of confirmed cases of malaria between 2000 and 2009 was found in 32 of the 56 malaria-endemic countries outside Africa, while downward trends of 25%–50% were seen in 8 other countries. Morocco and Turkmenistan were certified by the Director-General of WHO in 2009 as having eliminated malaria.

In 2009, the European Region reported no cases of *P. falciparum* malaria for the first time.

It is estimated that the number of cases of malaria rose from 233 million in 2000 to 244 million in 2005 but decreased to 225 million in 2009. The number of deaths due to malaria is estimated to have decreased from 985 000 in 2000 to 781 000 in 2009. Decreases in malaria burden have been observed in all WHO Regions, with the largest proportional decreases noted in the European Region, followed by the Region of Americas. The largest absolute decreases in deaths were observed in Africa.

While progress in reducing the malaria burden has been remarkable, there was evidence of an increase in malaria cases in 3 countries in 2009 (Rwanda, Sao Tome and Principe, and Zambia). The reasons for the resurgences are not known with certainty. The increases in malaria cases highlight the fragility of malaria control and the need to maintain control programmes even if numbers of cases have been reduced substantially. The experiences in Rwanda and Zambia also indicate that monthly monitoring of disease surveillance data, both nationally and subnationally, is essential. Since many countries in sub-Saharan Africa had inadequate data to monitor disease trends, it is apparent that greater efforts need to be made to strengthen routine surveillance systems. Major epidemiological events could be occurring in additional countries without being detected and investigated.

Key points

● Background and context

Malaria-endemic countries and the global community are scaling up effective interventions to attain both coverage and impact targets for 2010 and beyond.

1. On World Malaria Day 2008, the United Nations Secretary-General called for efforts to ensure universal coverage with malaria prevention and treatment programmes by the end of 2010.
2. The goal established by the World Health Assembly in 2005 and by the Roll Back Malaria (RBM) Partnership is to reduce the numbers of malaria cases and deaths recorded in 2000 by 50% or more by the end of 2010 and by 75% or more by 2015.
3. In September 2008, the RBM Partnership launched the Global Malaria Action Plan, which defines the steps required to accelerate achievement of the 2010 and 2015 targets for malaria control and elimination.

● Policies and strategies for malaria control

To attain the 2010 and 2015 targets, countries must reach all persons at risk for malaria with an insecticide-treated mosquito net (ITN) or indoor residual spraying (IRS) and provide laboratory-based diagnosis for all suspected cases of malaria and effective treatment of all confirmed cases.

Prevention

4. In 2009, 23 countries in the WHO African Region and 42 in other WHO Regions had adopted the WHO recommendation to provide ITNs for all persons at risk for malaria, not just women and children; this represents an increase of 13 countries since 2008. A total of 83 countries, of which 39 are in the African Region, distribute ITNs free of charge.
5. IRS with WHO-approved chemicals (including DDT) remains one of the main interventions for reducing and interrupting malaria transmission by vector control in all epidemiological settings. In 2009, 71 countries, including 27 in the African Region, reported implementation of IRS and 17 countries reported using DDT for IRS.
6. Intermittent preventive treatment (IPT) is recommended for population groups in areas of high transmission who are particularly vulnerable to contracting malaria or suffering its consequences, particularly pregnant women and infants. A total of 35 of 45 sub-Saharan African countries had adopted IPT for pregnant women (IPTp) as national policy by the end of 2008. Papua New Guinea, in the Western Pacific Region, also adopted this policy in 2009. No country has yet adopted a national policy of IPT for infants (IPTi).

Diagnosis and treatment

7. Prompt parasitological confirmation by microscopy or with a rapid diagnostic test (RDT) is recommended for all patients with suspected malaria, before treatment is started. In 2008, 33 of 43 malaria-endemic countries in the African Region and 45 of 63 countries in other Regions reported having a policy of parasitological testing of suspected malaria cases in persons of all ages, and 77 of 86 countries with endemic *Plasmodium falciparum* reported a policy of treatment with an artemisinin-based combination therapy (ACT) for *P. falciparum* malaria.
8. Confirmed cases of uncomplicated *P. falciparum* malaria should be treated with an ACT. *P. vivax* malaria should be treated with chloroquine where it is effective, or an appropriate ACT in areas where *P. vivax* is resistant to chloroquine. Treatment of *P. vivax* should be combined with a 14-day course of primaquine to prevent relapse.
9. WHO recommends that oral artemisinin-based monotherapies be withdrawn from the market and replaced with ACTs. By November 2010, 25 countries were still allowing the marketing of these products (down from 37 in 2009) and 39 pharmaceutical companies were manufacturing them. Most of the countries that still allow the marketing of monotherapies are in the African Region, while most of the manufacturers of these medicines are in India.

● Financing malaria control

The funds committed to malaria control from international sources have increased consistently between 2004 and 2009; funds remained at US\$ 1.8 billion in 2010, substantially lower than the resources required to achieve global targets, estimated at more than US\$ 6 billion for the year 2010.

10. International funds disbursed for malaria control are estimated to have increased from US\$ 200 million in 2004 to US\$ 1.5 billion million in 2009. Spending by national governments on malaria control appears to have risen in all WHO Regions between 2004 and 2009; thus large increases in donor financing do not appear to have resulted in an overall reduction in the level of domestic financing, although countries which had reduced their spending received more external financing than those which had increased their domestic spending on malaria.
11. Of 106 malaria-endemic countries and areas, 77 received external assistance for malaria control between 2000 and 2008. The highest per capita expenditure continued to be seen in countries with smaller populations at risk. External financing appears to be concentrated on programme activities, particularly the procurement of ITNs, antimalarial medicines and IRS. A larger proportion

of national government financing is directed towards human resources although significant amounts are also spent on anti-malarial medicines and IRS.

12. Countries in the pre-elimination and elimination phases appear to spend more per person at risk of malaria than countries in the control phase. While the increased spending is partly due to larger amounts of external financing, government financing exceeds that of external financing in countries in the pre-elimination and elimination stages.

● Progress in preventing malaria

Coverage with ITNs is increasing rapidly in some countries of Africa, household ITN ownership having risen to 42% by mid-2010.

13. In less than 3 years between 2008 and 2010 a cumulative total of 254 million ITNs were delivered to sub-Saharan Africa, enough to cover 66% of the 765 million persons at risk. An additional 35 million ITNs are scheduled for delivery before the end of 2010, sufficient to cover a further 10% of the population at risk. However, considerably more work is required to ensure that ITNs reach all households where they are needed, and that persons at risk of malaria sleep under an ITN every night.
14. A model-based estimate showed that 42% of African households owned at least one ITN, and 35% of children < 5 years of age slept under an ITN in 2010. Household ITN ownership was estimated in this model to have reached $\geq 50\%$ in 19 African countries in 2010.
15. Household surveys undertaken between 2007 and 2009 found that 11 countries (Equatorial Guinea, Ethiopia, Gabon, Mali, Rwanda, Senegal, Sao Tome and Principe, Senegal, Sierra Leone, Togo, and Zambia) had reached a household ITN ownership rate of more than 50%. The median percentage of children < 5 years of age sleeping under an ITN in these countries was 45%. Low rates of use reported in some surveys are primarily due to a lack of sufficient nets to cover all household members; a very high proportion (80%) of available ITNs is used.
16. Persons aged 5–19 years are least likely to use an ITN compared to those in the younger and older age groups. Women are slightly more likely to sleep under an ITN than men (ratio women: men = 1.1); this is partly because pregnant women are more likely to sleep under an ITN than other women. There is no difference in usage rates between female and male children < 5 years of age (ratio girls: boys = 0.99).
17. The number of people protected by IRS increased in sub-Saharan Africa from 13 million in 2005 to 75 million in 2009, a quantity which corresponds to protection for 10% of the population at risk in 2009.
18. In other WHO Regions, the number of ITNs delivered by manufacturers or distributed by NMCPs is smaller than in Africa (16.4 million 2009), but has been increasing at a similar rate. IRS implementation is generally being maintained at historic levels with 98 million people protected in 2009 (69 million in India). With the exception of India, the proportion of the population protected by IRS tends to be smaller than in the African countries

which use IRS, possibly because of the more focal nature of malaria outside Africa.

19. Current methods of malaria control are highly dependent on a single class of insecticides, the pyrethroids, which are the most commonly used compounds for IRS and the only insecticide class used for ITNs. The widespread use of a single class of insecticide increases the risk that mosquitoes will develop resistance, which could rapidly lead to a major public health problem, particularly in Africa, where chemical vector control is being deployed with unprecedented levels of coverage and where the burden of malaria is greatest.

● Progress on the prevention of malaria during pregnancy

Coverage with intermittent preventive treatment for pregnant women (IPTp) remains far from target levels, although a few countries have made notable progress.

20. The percentage of pregnant women who received the second dose of IPTp ranged from 2.4% in Angola to 62% in Zambia, according to household surveys in 8 countries for which data were available for 2007–2009. The weighted average, representing a population of 270 million, remained low, at 12%, due primarily to low coverage rates in Nigeria.
21. Data reported by NMCPs in 22 high-burden countries in the African Region indicate that the percentage of women attending antenatal clinics who received the second dose of IPTp was 55% (inter-quartile range 47%–61%).

● Progress in the diagnosis and treatment of malaria

The number of RDTs and ACTs procured is increasing, and the percentage of reported suspected cases receiving a parasitological test has increased from 67% globally in 2005 to 73% in 2009. Many cases still are treated without a parasitological diagnosis.

22. The percentage of reported suspected malaria cases receiving a parasitological test has increased between 2005 and 2009, particularly in the African Region (from 26% to 35%), Eastern Mediterranean Region (47% to 68%) and South-East Asia Region excluding India (from 58% to 95%). Low rates persist in the majority of African countries: in 21 out of 42 countries which reported on testing, the percentage of cases tested was less than 20%. Data from a limited number of countries suggest that both microscopy and RDTs are less widely available in the private sector than the public sector.
23. A small number of countries, including the Lao People's Democratic Republic and Senegal, have shown that it is possible to scale up rapidly the availability of malaria diagnostic testing nationwide, provided that attention is given to adequate preparation, training, monitoring, supervision and quality control.

24. The number of ACT treatment courses procured increased greatly from 11.2 million in 2005 to 76 million in 2006, and reached 158 million in 2009. By the end of 2009, 11 African countries were providing sufficient courses of ACTs to cover more than 100% of malaria cases seen in the public sector; a further 8 African countries delivered sufficient courses to treat 50%–100% of cases. These figures represent a substantial increase since 2005, when only 5 countries were providing sufficient courses of ACT to cover more than 50% of patients treated in the public sector. However, the number of ACTs distributed by NMCPs in the African Region in 2009 exceeded the number of RDTs procured more than five-fold, and the total number of tests carried out (microscopy + RDTs) by a factor of 2.4, indicating that many patients are receiving ACTs without confirmatory diagnosis.
25. By combining household survey data with health facility data it can be estimated that, on average, 65% of treatment needs are fulfilled for patients attending public health facilities. Estimates are more difficult to construct for patients who are treated in the private sector, but household surveys indicate febrile patients treated in the private sector are 25% less likely to receive an anti-malarial than those visiting public sector facilities, while those that stay at home are 60% less likely.
26. The use of oral artemisinin-based monotherapies threatens the therapeutic life of ACTs by fostering the spread of resistance to artemisinin. By November 2010, 25 countries were still allowing the marketing of these products and 39 pharmaceutical companies were manufacturing these products. Most of the countries that still allow the marketing of monotherapies are located in the African Region and most of the manufacturers are in India.
27. Parasite resistance has rendered previous antimalarial medicines ineffective in most parts of the world, jeopardizing malaria control. The highly effective artemisinin derivatives and their partner drugs are vulnerable to the same risk. Resistance of *P. falciparum* to artemisinins was confirmed at the Cambodia-Thailand border in 2009 but despite the observed changes in parasite sensitivity to artemisinins, the clinical and parasitological efficacy of ACTs has not yet been compromised. Since 2008, containment activities to limit the spread of artemisinin-resistant parasites have been ongoing.
29. In 2009 there was evidence of an increase in malaria cases in three countries that had previously reported reductions (Rwanda, Sao Tome and Principe, and Zambia). The reasons for these resurgences are not known with certainty, but they highlight the fragility of progress in malaria control and the need to rigorously maintain control programmes even when cases have been reduced substantially.
30. In other WHO Regions, the number of reported cases of confirmed malaria decreased by more than 50% in 32 of the 56 malaria-endemic countries between 2000 and 2009 and downward trends of 25%–50% were seen in 8 other countries. In 2009, the European Region reported no cases of *P. falciparum* malaria for the first time. The number of cases fell least in countries with the highest incidence rates, indicating that greater attention should be given to countries which harbour most of the malaria burden outside Africa.
31. There were 8 countries in the pre-elimination stage of malaria control in 2009 and 10 countries are implementing elimination programmes nationwide (8 having entered the elimination phase in 2008). A further 9 countries (Armenia, Bahamas, Egypt, Jamaica, Morocco, Oman, Russian Federation, Syrian Arab Republic, and Turkmenistan) have interrupted transmission and are in the phase of preventing re-introduction of malaria. Morocco and Turkmenistan were certified as free of malaria by the WHO Director-General in 2010.
32. It is estimated that the number of cases of malaria rose from 233 million in 2000 to 244 million in 2005 but decreased to 225 million in 2009. The number of deaths due to malaria is estimated to have decreased from 985 000 in 2000 to 781 000 in 2009. Decreases in malaria burden have been observed in all WHO Regions, with the largest proportional decreases noted in the European Region, followed by the Region of the Americas. The largest absolute decreases in deaths were observed in Africa.

● Impact of malaria control

A growing number of countries have recorded decreases in the number of confirmed cases of malaria and/ or reported admissions and deaths since 2000. Global control efforts have resulted in a reduction in the estimated number of deaths from nearly 1 million in 2000 to 781 000 in 2009.

28. A total of 11 countries and one area in the African Region showed a reduction of more than 50% in either confirmed malaria cases or malaria admissions and deaths in recent years (Algeria, Botswana, Cape Verde, Eritrea, Madagascar, Namibia, Rwanda, Sao Tome and Principe, South Africa, Swaziland, Zambia, and Zanzibar, United Republic of Tanzania). In all countries, the decreases are associated with intense malaria control interventions.