Summary and Key Points

The *World Malaria Report 2013* summarizes information received from malaria-endemic countries and other sources, and updates the analyses presented in the 2012 report. It highlights the progress made towards the global malaria targets set for 2015, and describes current challenges for global malaria control and elimination.

Since 2000, a tremendous expansion in the financing and coverage of malaria control programmes has led to a wide-scale reduction in malaria incidence and mortality. Based on reported data, 59 out of 103 countries that had ongoing malaria transmission in 2000 are meeting the Millennium Development Goal (MDG) target of reversing the incidence of malaria. Of these, 52 are on track to meet Roll Back Malaria (RBM) and World Health Assembly targets of reducing malaria case incidence rates by 75% by 2015, including 8 countries of the WHO African Region. In 41 countries it is not possible to assess trends using reported data because of inconsistencies in the completeness of reporting over time, changes in diagnostic practice or health-service use. For these countries, which accounted for 80% of cases in 2000, inferences about malaria trends need to be based on estimates of the malaria case incidence and mortality rates.

Worldwide, between 2000 and 2012, estimated malaria mortality rates fell by 42% in all age groups and by 48% in children under 5 years of age. If the annual rate of decrease that has occurred over the past 12 years is maintained, then malaria mortality rates are projected to decrease by 52% in all ages, and by 60% in children under 5 years of age by 2015; this represents substantial progress towards the World Health Assembly target of reducing malaria mortality rates by 75% by 2015.

Modelling suggests that an estimated 3.3 million malaria deaths were averted between 2001 and 2012, and that 69% of these lives saved were in the 10 countries with the highest malaria burden in 2000; thus, progress is being made where it matters most. About 3 million (90%) of the deaths averted between 2001 and 2012 are estimated to be in children under 5 years of age in sub-Saharan Africa. These account for 20% of the 15 million child deaths that are estimated to have been averted in sub-Saharan Africa since 2000 through overall reductions in child mortality rates. Thus, decreases in malaria deaths have contributed substantially to progress towards achieving the target for MDG 4, which is to reduce, by two thirds, the under-five mortality rate between 1990 and 2015.

Nevertheless, between 2011 and 2012, the pace of decrease in estimated malaria mortality rates slowed. This slowing is partly because the model that is used to estimate malaria deaths in children under 5 years of age in Africa uses insecticide-treated mosquito net (ITN) coverage as an input, and ITN coverage flattened in 2011–2012 following decreases in funding for malaria control in 2011. In 2012, financing of malaria programmes was estimated to be less than half of the estimated US$ 5.1 billion required globally. Thus, millions of people at risk of malaria still do not have access to interventions such as an ITN, indoor residual spraying (IRS), diagnostic testing and artemisinin-based combination therapies (ACTs). As a result, an estimated 207 million cases (uncertainty interval, 135–287 million) and 627 000 malaria deaths (uncertainty interval, 473 000–789 000) are estimated to have occurred in 2012. There is an urgent need to increase funding for malaria control and to expand programme coverage, in order to meet international targets for reducing malaria cases and deaths.

Policy development

Several new and updated malaria control policies, operational manuals, plans and initiatives were released in 2013, following meetings of WHO's Malaria Policy Advisory Committee (MPAC).

1. The MPAC, which came into operation in 2012, continued its work in 2013; its mandate is to provide strategic advice and technical input to WHO on all aspects of malaria control and elimination. In accordance with the MPAC recommendations, WHO issued guidance on a range of policy areas, including achieving universal coverage with long-lasting insecticidal nets (LLINs), estimating the longevity of LLINs, and capacity-building in malaria entomology and vector control.
2. Other WHO guidance published in 2013 includes (i) an operational manual for IRS; (ii) an operational manual for larval source management; (iii) test procedures for insecticide resistance monitoring in malaria vector mosquitoes; (iv) a field guide on seasonal malaria chemoprevention (SMC); (v) a handbook on the management of severe malaria; (vi) a framework for action to respond to artemisinin resistance in the Greater Mekong subregion; (vii) a field handbook on malaria control in complex emergencies (developed in conjunction with several partner agencies); and (viii) three training manuals.

Financing malaria control

The total international and domestic funding committed to malaria control was estimated to be US$ 2.5 billion in 2012 – substantially less than the amount that will be needed to reach the global targets.

3. International disbursements to malaria-endemic countries have increased markedly, from less than US$ 100 million in 2000 to US$ 1.6 billion in 2011, and an estimated US$ 1.94 billion in 2012 and US$ 1.97 billion in 2013. However, increases in international funding have slowed in recent years, to an average of 4% per year between 2009 and 2013, compared to an average of 43% per year between 2005 and 2009.
4. Reported data suggest that global domestic financing for malaria increased over the period 2005–2012, from US$ 436 million in 2005 to US$ 522 million in 2012. It is estimated that domestic government malaria spending rose at a rate of 4% per year between 2005 and 2012.

5. Global resource requirements for malaria control were estimated in the 2008 RBM Global Malaria Action Plan (GMAP) to exceed US$ 5.1 billion per year between 2011 and 2020. Combining both domestic and international funds, the resources available for malaria control globally were estimated to be US$ 2.5 billion in 2012, leaving a gap of US$ 2.6 billion. Projections of both domestic and international resources available between 2013 and 2016 indicate that total funding for malaria control will reach approximately US$ 2.85 billion between 2014 and 2016, which is substantially below the amount required to achieve universal access to malaria interventions.
6. International investments in malaria control have been targeted to countries with higher mortality rates and lower national incomes, particularly those in Africa. However, domestic government investments are highest in wealthier countries and lowest in countries with the highest malaria mortality rates. The low rates of domestic spending in countries with higher disease burdens is principally because these countries have lower national incomes per capita.
7. There is variation in the priority given to malaria control by domestic governments that have similar levels of resource availability. Countries that display greater commitment – as measured by a domestic investment priority index – showed greater success in reducing malaria case incidence between 2000 and 2012 than did other countries.

Progress in vector control

In sub-Saharan Africa, the proportion of the population with access to an ITN in their household increased dramatically from 2005 to 2011 but the rate flattened during the last 2 years, reaching 42% in 2013. Increased deliveries of ITNs during the next 2 years should increase ITN coverage.

Insecticide-treated mosquito nets

8. By 2012, 34 countries in the African Region and 83 countries worldwide had adopted the WHO recommendation to provide ITNs to all persons at risk for malaria. A total of 88 countries, including 39 in Africa, distribute ITNs free of charge.
9. Every year, at least 150 million ITNs are needed to maintain a supply of 450 million ITNs in households over each 3-year period and protect all populations at risk of malaria in sub-Saharan Africa. Between 2004 and 2010, the number of ITNs delivered annually by manufacturers to malaria-endemic countries in sub-Saharan Africa increased from 6 million to 145 million. However, only 92 million ITNs were delivered by manufacturers in 2011, and only 70 million were delivered in 2012. The estimated numbers of ITNs delivered in 2013 (136 million) and financed by donors for 2014 (approximately 200 million) are close to the number of ITNs required annually to protect all populations at risk. However, even with the increase in yearly deliveries, the projected 3-year total of ITNs delivered in 2012–2014 (about 400 million) will still be below the minimum number needed to protect all persons at risk of malaria. The appropriate levels of ITN deliveries need to be maintained each year, to ensure the availability of ITNs in households and access to an ITN for every person at risk of malaria.
10. The percentage of households owning at least one ITN in sub-Saharan Africa is estimated to have risen from 3% in 2000 to 56% in 2012, but declined slightly to 54% in 2013. The proportion of the population with access to an ITN in their household increased during the same period, reaching 42% in 2013. The proportion of the population sleeping under an ITN – which represents the population directly protected – was estimated to be 36% in 2013.
11. A comparison of the proportion of the population with access to an ITN, and the proportion sleeping under an ITN, suggests that a high percentage (86%) of the population with access to an ITN actually uses it, indicating that efforts to encourage ITN use have been successful. Lack of availability of nets is the main constraint to increasing the number of at-risk persons sleeping under an ITN.
12. Use of ITNs among vulnerable populations, pregnant women and children under 5 years of age is higher than use among the population as a whole. This indicates that these groups remain protected as countries scale up for universal ITN coverage, and it highlights the need to increase access to ITNs among all persons at risk.

Indoor residual spraying

13. IRS remains a powerful vector control tool for reducing and interrupting malaria transmission. In 2012, a total of 88 countries, including 40 in the African Region, recommended IRS for malaria control.
14. In 2012, 135 million people (4% of the global population at risk of malaria) were protected by IRS worldwide. In the African Region, the proportion of the population at risk that was protected rose from less than 5% in 2005 to 11% in 2010, but fell to 8% in 2012, with 58 million people benefiting from the intervention. The decrease in the number of people protected by IRS in Africa appears to be partly due to increased use of more costly non-pyrethroid insecticides (in response to the threat of insecticide resistance) in a setting of limited IRS budgets. The use of non-pyrethroids for IRS may become increasingly important as a resistance-management tool, because all currently approved LLINs are pyrethroid based.

Insecticide resistance

15. Mosquito resistance to at least one insecticide used for malaria control has been identified in at least 64 malaria-endemic countries worldwide. In May 2012, WHO and RBM released the Global Plan for Insecticide Resistance Management (GPIRM) in malaria vectors; the GPIRM is a five-pillar strategy for managing the threat of insecticide resistance. Stakeholders in the global malaria community have begun activities related to implementing the strategy laid out in the GPIRM.
16. Monitoring insecticide resistance is a necessary element of the implementation of insecticide-based vector control interventions. In 2012, a total of 58 countries reported that they had adopted a policy of routine monitoring of insecticide resistance.

Progress on chemoprevention

Among African countries reporting this information to WHO, the median percentage of pregnant women attending antenatal care (ANC) who received at least one dose of intermittent preventive treatment (IPT) during pregnancy in 2012 was 64%, whereas 38% received at least two doses and 23% received at least three doses, indicating that there is considerable scope for improving protection for pregnant women.

17. In sub-Saharan Africa, an estimated 35 million pregnant women and a large portion of the estimated 26 million infants born each year would benefit from IPT. In addition, about 25 million children in the Sahel subregion of Africa could be protected from malaria through SMC.

18. A total of 36 sub-Saharan African countries with moderate to high malaria transmission had adopted IPT for pregnant women (IPTp) as national policy by the end of 2012. This policy was also adopted by Papua New Guinea (in the Western Pacific Region) in 2009.

19. Among 26 of the 36 moderate to high transmission countries in the African Region that have adopted IPTp as national policy – and for which data are available – a median of 64% of pregnant women attending ANC received at least one dose of IPTp in 2012, 38% received at least two doses and 23% received at least three doses. In 13 countries in the African Region for which household survey data were available for 2010–2012, the weighted average of all pregnant women who received one dose of IPTp during pregnancy was 37%, whereas 23% received two doses and 8% received three doses.

20. Since October 2012, WHO has recommended that IPTp be given at each scheduled antenatal visit after the first trimester. Analysis of household survey data reveals that the proportion of pregnant women who receive IPTp is well below the proportion who attend ANC. The estimated proportion of ANC visits in which IPTp could be given but is not is high, at 72%. A lower proportion of women receive IPTp during ANC visits than receive tetanus toxoid (another key component of ANC). This indicates that the capacity to deliver preventive services during ANC visits is high, and that barriers to IPTp can be overcome.

21. All infants at risk of *Plasmodium falciparum* infection in sub-Saharan African countries with moderate-to-high malaria transmission and low levels of parasite resistance to the recommended agent sulfadoxine-pyrimethamine (SP) should receive preventive malaria treatment through immunization services at defined intervals that correspond to routine vaccination schedules. Only one country, Burkina Faso, has adopted a national policy of IPT for infants (IPTi) since the WHO recommendation was issued in 2009.

22. In March 2012, WHO issued a recommendation on SMC for children aged 3–59 months, and in August 2013, WHO released a field guide for implementation of SMC. Two endemic countries have adopted SMC, and several countries involved in evaluating the policy have indicated that they plan to adopt this policy and expand SMC coverage beyond their study populations.

Progress in diagnostic testing and malaria treatment

The numbers of procured rapid diagnostic tests (RDTs) and ACTs are increasing, as is the reported rate of diagnostic testing in the public sector in the African Region, which increased from 37% in 2010 to 61% in 2012. As a result, there has been a decrease in the number of suspected malaria cases treated presumptively with antimalarial drugs. However, millions of people with suspected malaria still do not receive a diagnostic test, and many people with confirmed infections do not receive appropriate treatment with a quality assured antimalarial.

Diagnostic testing

23. Implementation of universal diagnostic testing in the public and private sectors would substantially reduce the global requirements for antimalarial treatment. In 2012, 41 of 44 countries with ongoing malaria transmission in the African Region, and 49 of 55 countries in other WHO regions, reported having adopted a policy of providing parasitological diagnosis for all age groups. This represents an increase of 6 countries in the African Region since 2009.

24. Malaria diagnostic testing is provided free of charge in the public sector in 85 countries around the world. From 2010 to 2012, the proportion of suspected malaria cases receiving a diagnostic test in the public sector increased from 37% to 61% in the African Region, and from 44% to 64% globally. Most of the increase in testing in the African Region is attributable to increased use of RDTs, which accounted for 40% of all cases tested in the region in 2012.

25. The number of patients tested by microscopic examination increased to a peak of 188 million in 2012, with India accounting for over 120 million blood-slide examinations. The number of RDTs supplied by manufacturers increased from 88 million in 2010 to 205 million in 2012. This included increased sales for both *P. falciparum*-specific tests and combination tests that can detect more than one parasite species.

26. A total of 48 countries reported deployment of RDTs at the community level, and 15 million patients were reported as having been tested through such programmes in 2012. Household survey data from 14 countries collected during 2010–2012 suggest that diagnostic testing is not as widely available in the private sector as it is in the public sector.

27. RDTs are increasingly used for diagnostic testing of suspected malaria cases in health facilities, including for the diagnosis of *P. vivax*. Among 42 countries reporting the type of RDTs used, 15 reported deploying RDTs that could detect *P. vivax* specifically. In these countries, the proportion of *P. vivax* cases confirmed by RDT (rather than microscopy) was similar to the proportion of *P. falciparum* cases confirmed by RDT.

Treatment

28. ACTs are recommended as the first-line treatment of malaria caused by *P. falciparum*, the most dangerous of the Plasmodium parasites that infect humans. By 2012, 79 countries and territories had adopted ACTs as first-line treatment

for *P. falciparum* malaria. *P. vivax* malaria should be treated with chloroquine where that drug is effective, or by an appropriate ACT in areas where *P. vivax* is resistant to chloroquine. Treatment of *P. vivax* should include an effective schizontocidal medicine combined with a 14-day course of primaquine to prevent relapse.

29. From reports of manufacturers and the Affordable Medicines Facility-malaria (AMFm) initiative, the number of ACT treatment courses delivered to the public and private sectors increased from 11 million globally in 2005 to 76 million in 2006, and reached 331 million in 2012. The increases in ACT procurement in routine public sector in 2012 were due primarily to an increase of about 50% in public sector deliveries between 2011 to 2012. Drugs procured for the public and private sector through the AMFm initiative – which is now in a transitional phase towards eventual integration into the routine grant-making process for the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) – decreased slightly from 156 million treatment courses in 2011 to 150 million in 2012.

30. It has been difficult to track the extent to which patients with confirmed malaria received antimalarial medicines, because information linking diagnostic testing and treatment has been limited in both household surveys and routine health-information systems. An estimate of the proportion of patients in the public sector potentially treated with ACTs (rather than a less effective antimalarial) can be made by comparing the number of ACT treatments distributed by national malaria control programmes (NMCPs) with the number of presumed (i.e. treated without testing) and confirmed (i.e. confirmed by microscopy or RDT) cases of *P. falciparum* malaria (adjusted for reporting completeness or estimated, in situations where reported data are lacking). This proportion varies by WHO region, but has increased over time in the African Region, where it reached 60% in 2012.

31. In nine countries in the African Region with more than one household survey between 2006 and 2012, the proportion of febrile children given antimalarial treatment comprising ACTs increased over time, in both the public and private sectors. In the most recent surveys, the median proportion of children receiving an antimalarial who received an ACT was 68%; however, because a substantial portion of children are not brought for care of fever, and not all children with suspected malaria are given a diagnostic test, the proportion of all children with malaria who receive an ACT is likely to be substantially lower. In an analysis of 26 household surveys conducted in 2010–2012 that used a positive RDT among febrile children as a proxy for confirmed malaria, the mean proportion of all children with confirmed malaria who received an ACT was 16% (range, 1%–42%). Increased access to care for fever, as well as appropriate diagnostic testing and therapeutic management at all places of care, is needed to ensure that all patients with malaria receive prompt and effective treatment.

32. In the African Region in 2012, the total number of tests (both microscopy and RDTs) was almost equal to the number of ACTs distributed by NMCPs – an increased ratio compared to previous years. However, in most malaria-endemic areas, the ratio is expected to exceed 2, because less than half of suspected malaria cases will have confirmed malaria and require treatment with an ACT.

Antimalarial drug resistance

33. WHO recommends that oral artemisinin-based monotherapies be progressively withdrawn from the market and replaced with ACTs – a policy that was endorsed by the World Health Assembly in 2007. The number of countries that still allow the marketing of these products decreased from 55 in 2008 to 9 as of November 2013; 6 of those 9 countries are in the African Region. The number of pharmaceutical companies marketing these products dropped from 38 in 2010 to 30 in 2013. Most of the countries that allow marketing of these medicines are in the African Region, whereas most of the manufacturers are in India.

34. Therapeutic efficacy studies remain the gold standard for guiding drug policy; such studies should be undertaken every 2 years. In 2011 and 2012, studies of first- or second-line antimalarial treatments were completed in 48 of 67 (72%) countries where *P. falciparum* efficacy studies were possible – an increase from 31 of 75 (41%) countries during 2008–2009. (In 32 countries with ongoing malaria transmission, efficacy studies are currently impracticable because of low malaria incidence, or because the countries are endemic for *P. vivax* only.)

35. Parasite resistance to artemisinins has now been detected in four countries of the Greater Mekong subregion: Cambodia, Myanmar, Thailand and Viet Nam. Despite the observed changes in parasite sensitivity to artemisinins, ACTs continue to cure patients, provided that the partner drug is still efficacious. In Cambodia's Pailin province, resistance has been found to both of the components of multiple ACTs; therefore, special provisions for directly observed therapy using a non-artemisinin-based combination (atovaquone + proguanil) have been introduced.

    In April 2013, WHO released the *Emergency response to artemisinin resistance in the Greater Mekong subregion: Regional framework for action 2013–2015*. The document describes priority areas in which action is needed in the coming years to contain artemisinin resistance.

Malaria surveillance, monitoring and evaluation

In 2012, in 62 countries of 103 that had ongoing malaria transmission in 2000, reporting was considered to be sufficiently consistent to make a reliable judgement about malaria trends for 2000–2012. In the 41 remaining countries, which account for 80% of estimated cases, it is not possible to reliably assess malaria trends using the data submitted to WHO. Information systems are weakest, and the challenges for strengthening systems are greatest, where the malaria burden is greatest.

36. In 2012, routine health information systems detected only 14% of the cases estimated to occur globally. Case detection rates were lowest in countries with the highest numbers

of malaria cases. Similarly, the proportion of deaths that are reported was lowest in countries with the greatest number of malaria deaths. Surveillance systems do not need to detect all cases in order to reliably assess trends; however, case detection efforts do need to be reasonably uniform over time. Countries with fewer estimated cases of malaria appear to be most able to assess trends in incidence. In the 41 countries that account for 80% of estimated cases in 2000, it is not possible to reliably assess malaria trends 2000—2012 using the data submitted to WHO. Thus, information systems are weakest where the malaria burden is greatest.

37. In contrast to routinely reported data, household surveys are more commonly undertaken in countries with the highest number of malaria cases. Fifty countries, of which 34 were in the African Region, had at least one household survey over the 3 year period 2011–2013. Indicators most commonly measured were those on the availability of ITNs and the use of antimalarial medicines. Only 25% of surveys included questions on fever cases receiving a finger stick or heel prick, whereas 90% enquired about malaria treatment – a finding that will need to change if progress towards universal diagnostic testing is to be tracked. The number of surveys that measure parasite prevalence has increased since 2005, rising to 81% of all surveys conducted between 2011 and 2013.

Impact of malaria control

Since 2000, more than half of the countries that had ongoing malaria transmission in 2000 have recorded decreases in the incidence of confirmed malaria, or in reported admissions and deaths (or both). Estimated malaria mortality rates worldwide fell by 42% between 2000 and 2012 in all age groups, and by 48% in children under 5 years of age. If the annual rate of decrease that has occurred over the past 12 years is maintained, then malaria mortality rates are projected to decrease by 52% in all ages, and by 60% in children under 5 years of age, by 2015.

38. An estimated 3.4 billion people were at risk of malaria in 2012. Of this total, 2.2 billion were at low risk (<1 reported case per 1000 population), of whom 94% were living in geographic regions other than the African Region. The 1.2 billion at high risk (>1 case per 1000 population) were living mostly in the African Region (47%) and the South-East Asia Region (37%).

39. Based on *reported* data, 59 out of 103 countries that had ongoing malaria transmission in 2000 are meeting the MDG target of reversing the incidence of malaria. Of these, 52 are on track to meet RBM and World Health Assembly targets of reducing malaria case incidence rates by 75% by 2015, including 8 countries of the African Region.

40. Decreases in the incidence of *P. falciparum* are, on average, larger than those of *P. vivax*, suggesting that *P. vivax* responds more slowly to control measures, possibly because of its biological characteristics. As a result, many NMCPs need to give greater attention to the control of *P. vivax* as they near elimination, particularly in areas outside sub-Saharan Africa. In countries where both species are transmitted, *P. vivax* predominates in countries that are in the pre-elimination and elimination phases.

41. Of 97 countries with ongoing transmission in 2013, 12 are classified as being in the pre-elimination phase of malaria control, and 7 as being in the elimination phase. A further 7 countries are classified as being in the prevention of introduction phase. In 2012, the European Region reported only 255 indigenous cases; hence, it is close to attaining the goal of eliminating malaria from the region by 2015, as set out in the 2005 Tashkent Declaration. Nonetheless, recent outbreaks in Greece and Turkey highlight the continual threat of reintroduction, and the need for continued vigilance to ensure that any resurgence is rapidly contained.

42. The 52 countries that are projected (based on reported data) to decrease malaria incidence by 75% by 2015 accounted for only 8 million (4%) of the total estimated cases of 226 million in 2000. This is partly because progress has been faster in countries with lower numbers of cases, but is also influenced by the poorer quality of surveillance data submitted by countries with larger numbers of cases. Improved surveillance and evaluation in countries with higher malaria burdens is essential for the impact of malaria investments to be properly assessed.

43. Because countries with higher numbers of cases are less likely to submit sufficiently consistent data for assessing trends, it is necessary to draw inferences about trends in these countries using estimated numbers of cases rather than surveillance data. There were an estimated 207 million cases of malaria worldwide in 2012 (uncertainty interval, 135–287 million). Most of the estimated cases (80%) occur in sub-Saharan Africa. About 9% of estimated cases globally are due to *P. vivax*, although the proportion outside the African continent is 50%. The estimated incidence of malaria fell by 25% globally between 2000 and 2012, and by 31% in the African Region. If the annual rate of decrease that has occurred over the past 12 years is maintained, then malaria case incidence is projected to decrease by 36% globally by 2015, and by 44% in the African Region.

44. There were an estimated 627 000 malaria deaths worldwide in 2012 (uncertainty interval, 473 000–789 000). Of the estimated deaths, most occur in sub-Saharan Africa (90%) and in children under 5 years of age (77%). Between 2000 and 2012, estimated malaria mortality rates decreased by 42% worldwide and by 49% in the African Region; they are estimated to have decreased by 48% in children under 5 years of age globally and by 54% in the African Region. If the annual rate of decrease that has occurred over the past 12 years is maintained, then malaria mortality rates are projected to decrease by 52% globally and by 62% in the African Region by 2015. In children under 5 years of age, they are projected to decrease by 60% globally and by 68% in the African Region by 2015.

45. The pace of decrease in estimated malaria mortality rates accelerated from 2005, but slowed between 2011 and 2012. This slowing is partly because the model that is used to estimate malaria deaths in children under 5 years of age in Africa uses ITN coverage to adjust the proportion of all deaths that are attributed to malaria, and ITN coverage flattened in 2011—2012 following decreases in funding for malaria control in 2011.

46. More than 80% of estimated malaria deaths in 2012 occur in just 17 countries, and 80% of cases occur in 18 countries, with the Democratic Republic of the Congo and Nigeria together accounting for 40% of the estimated global total. Targets for reduction of cases and deaths will not be attained unless substantial progress can be made in countries that account for the vast majority of the malaria burden.
47. Four countries account for more than 80% of estimated cases of *P. vivax* cases (Ethiopia, India, Indonesia and Pakistan). *P. vivax* infection has been associated with severe malaria and death, although the risks of severe disease and case fatality rates for *P. vivax* infection have not been firmly established. The presence of comorbidities – in particular, concomitant malnutrition – is suspected to increase the risk of severe disease in *P. vivax* infection, although this risk also remains poorly defined. Further study is required to refine existing knowledge of the spectrum of severe *P. vivax* malaria, and the risks of severe disease and death with this infection.
48. Progress in reducing malaria case incidence and mortality rates has been faster in countries with lower numbers of cases and deaths in 2000. However, the vast majority of *numbers* of cases and deaths averted between 2000 and 2012 have been in countries that had the highest malaria burdens in 2000. If the malaria incidence and mortality rates in 2000 had remained unchanged over the decade, 500 million more cases and 3.3 million deaths would have occurred between 2001 and 2012. Most of the malaria cases averted (67%) and lives saved (93%) have been in the African Region.
49. Of the 3.3 million deaths averted between 2001 and 2012, 3 million (90%) are estimated to be in children under 5 years of age in sub-Saharan Africa. They account for 20% of the 15 million child deaths that are estimated to have been averted in sub-Saharan Africa since 2000 through overall reductions in child mortality rates. Thus, decreases in malaria deaths have contributed substantially to progress towards achieving the target for MDG 4 of reducing, by two thirds, the under-five mortality rate between 1990 and 2015.