



## Scientific Facts on

# Malaria

status & challenges of the epidemic

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This Digest is a faithful summary of the leading scientific consensus report produced in 2008 by the World Health Organization (WHO):  
*"World Malaria Report"*

The full Digest is available at: <https://www.greenfacts.org/en/malaria/>

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## 1. Introduction

Malaria is one of the most common infectious diseases and a great public health problem worldwide, particularly in Africa and south Asia. About three billion people are at risk of infection in 109 countries. Each year, there are an estimated 250 million cases of malaria leading to approximately one million deaths, mostly in children under five years of age. The organism that causes the most dangerous form of malaria is a microscopic parasite called *Plasmodium falciparum*.



Anopheles mosquito, the vector for malaria  
Source: CDC

This parasite is transmitted by mosquito species belonging to the *Anopheles* genus and only by females of those species.

There is growing international agreement on how best to use prevention and treatment methods that are available. The most effective prevention measures include the use of mosquito bed nets treated with long-lasting insecticides – to avoid the mosquito bites and to kill the mosquitoes – and spraying the inside walls of houses with similar insecticides to kill malaria-carrying mosquitoes. The most effective treatment for malaria consists in using a combination of several anti-malarial drugs, one of which is a derivative of artemisinin. Preventive treatment of pregnant women with anti-malarial drugs can also reduce the harmful effects of malaria both on the mother and on the unborn child.

Several international organisations have set up ambitious objectives for large-scale malaria control. The target set by the World Health Organization (WHO) in 2005 is to offer malaria prevention and treatment services by 2010 to at least 80% of the people who need them. By doing so, it aims to reduce at least by half the proportion of people who become ill or die from malaria by 2010 and at least by three quarters by 2015 compared to 2005.

It is vital to monitor malaria trends to see if malaria control campaigns are being effective, and to make improvements.

The WHO World Malaria Report 2008 estimates the number of malaria cases and deaths for the period 2001-2006 in affected countries and investigates whether or not WHO recommendations are being implemented. It evaluates progress made against the disease it also describes the sources of funding and reviews the impact of malaria control programmes. The aim of the report is to support the development of effective national malaria control programmes.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Introduction, p.1*

## 2. Which strategies were adopted to prevent and treat malaria?

### 2.1 Which strategies and targets are recommended by the WHO?

The WHO recommends strategies on how to prevent malaria transmission by controlling the mosquito population and on how to diagnose and treat malaria infections.



Mosquito nets are the best prevention measure.

There are two main **prevention methods**:

- Protective bed nets treated with long-lasting insecticides prevent bites from malaria-infected mosquitoes and kill them. Nets should be

available for free or at low prices thanks to high subsidies. There should be one net per two people at risk. Priority should be given to pregnant women and children under five years of age, who are most vulnerable.

- Spraying the inside walls of houses with insecticide is an effective way to kill large numbers of mosquitoes. The best choice of insecticide for a given area depends on different factors such as costs, efficacy, product safety, and the mosquitoes' resistance to the insecticide. The spraying should be done just before the mosquito season starts and repeated over several consecutive years. If the timing is wrong or if the spraying activities are likely to be short-lived or interrupted, it is better not to do it at all to avoid generating resistant mosquitoes.

To be more effective, in high-risk areas (i.e. with one or more new malaria cases per 1000 inhabitants per year), these methods can be used together or be complemented, when needed, by other methods such as the management of mosquito breeding sites in order to reduce the larvae population. When using an insecticide, it is vital to check whether mosquitoes are becoming resistant to it.

The **anti-malarial treatment** recommended by the WHO aims to cure cases quickly before they become more serious, to protect unborn children, to avoid drug resistance and to prevent malaria in travellers. It includes the following recommendations:

- Only people in whom laboratory blood tests confirmed the presence of malaria should be treated with anti-malarial drugs. However, in high-risk areas, children under five years of age with malarial symptoms should be treated straight away.
- Malaria has become increasingly resistant to drugs and, at present, medicines based on artemisinin are the only recommended treatment measures against *Plasmodium falciparum*, which causes the deadliest form of malaria. To avoid this infectious agent from becoming drug-resistant, artemisinin should not be given on its own but should be combined with one or more effective anti-malarial drugs.
- People with severe malaria should be treated immediately and then transferred to a health facility where they can get full treatment and care. Patients who cannot swallow or are very young should initially be treated via injections or suppositories, and then be given a complete course of drugs.
- Effective diagnosis and treatment should be of good quality, affordable and available at all health facilities. Where quick treatment in a health facility is not possible, there should be a programme to manage the disease at the patient's home.
- Pregnant women in high-risk areas should be given suitable anti-malarial drugs at least twice during the second and the third trimester of pregnancy, and three times if they are also HIV positive.
- It is important to monitor how effective the treatment is and to identify any possible development of drug resistance, any adverse reactions to medicines, as well as any effects on pregnant women and on pregnancy outcomes.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 2. Policies, strategies and targets for Malaria Control, p.3-5*

## 2.2 What are the targets for the future and how is progress measured?

One of the United Nations Millennium Development Goals for 2015 is to have "halted, and begun to reverse, [...] the scourge of malaria and other major diseases that afflict humanity." Since the late 1990s, several international organizations have set targets to control malaria, reduce the number of malaria cases and deaths, and eliminate the burden it imposes on social and economic growth and development.

Intensive efforts to control malaria in most of the heavily-affected countries began in 2005 and 2006. Current targets are to reduce the number of cases and deaths caused by malaria to one half of the 2005 values by 2010, and to one quarter by 2015. To achieve this, the global objective is to provide access to preventive and treatment measures to at least 80% of the population at risk by 2010.

In 2007, malaria experts determined specific indicators to measure progress made.

**Trends in malaria cases and deaths** can be followed based on:

- the proportions of confirmed malaria cases and deaths inside and outside hospitals; and
- the proportions of confirmed malaria cases and deaths of children younger than five inside and outside hospitals.

The **coverage of prevention and treatment measures** can be assessed based on:

- the proportion of children younger than five who receive appropriate drugs within 24 hours of developing fever;
- the proportion of people within a specific population group (e.g. children younger than five and pregnant women) that have and use mosquito nets;
- the number of households at risk that are sprayed with insecticide; and
- the proportion of pregnant women that receive adequate preventive anti-malarial treatment.

The **effectiveness of health facilities and national malaria control programmes** can be assessed based on:

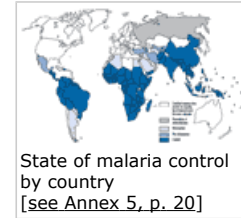
- the proportion of suspected malaria cases that are checked by laboratory tests;
- the proportion of laboratory tested suspected malaria cases that are confirmed;
- the number of patients attending clinics and hospitals without staying overnight that are given appropriate treatment;
- the proportion of people at risk who receive insecticidal nets;
- the proportion of health facilities with sufficient medicines, diagnostic kits and mosquito nets; and
- the quality of the records that each health facility sends to the WHO.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 2. Policies, strategies and targets for Malaria Control, p.5-7*

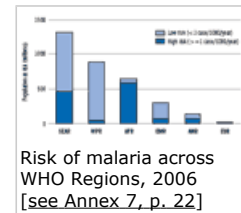
### 3. How many people were affected by malaria in 2006?

#### 3.1 Where are people at risk of being infected with malaria?

About half of the world population lives in areas where there is some risk of being infected with malaria. In 109 countries or territories worldwide, malaria is either constantly present (endemic) or not present anymore but with a risk of coming back. These countries are at different stages in the process of malaria elimination. The remaining countries are certified malaria-free or have had no local infections for over a decade (see Map [see Annex 5, p. 20] ).



The largest populations at any risk of malaria live in the WHO South-East Asia and Western Pacific Regions although the magnitude of the risk varies from one region to another (see Fig. 3.2 [see Annex 7, p. 22] ).



One fifth of the world population is at high risk of contracting malaria, living in areas with one or more new malaria cases per 1000 inhabitants per year. Nearly 50% of all persons at risk of malaria infection live in the WHO African Region and 37% in the WHO South-East Asia Region.

The vast majority of people at low risk of malaria infection live outside Africa in areas with one or more new malaria cases per 1000 inhabitants per year. Although low risk areas cover one third of the world population living across a huge area, they account for less than 3% of all reported malaria cases.

Table 3.1: Estimates of populations at risk of malaria, number of cases and deaths  
[see Annex 2, p. 18]

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>],  
3. Estimated burden of malaria in 2006, Population at risk, p.9*

### 3.2 How many malaria cases and deaths were there in 2006?

The numbers of malaria cases and deaths are difficult to determine with accuracy. In 2006, there were an estimated 247 million malaria cases but the real value could be lower than 200 million or over 300 million. That year, an estimated 881 000 people died from malaria (see Table of estimates by region [see Annex 2, p. 18] ).

Malaria cases in the WHO African Region are mostly caused by the parasite *Plasmodium falciparum*. Outside Africa, other *Plasmodium* species are more common.

In 2006 the vast majority of cases and deaths occurred in the WHO African Region (86% and 90% respectively), followed by the South-East Asia (9% and 4%) and Eastern Mediterranean WHO Regions (3% and 4%).

In the WHO African Region, 90% of the malaria cases occurred in the 19 countries with the largest populations and over half were in just five countries: Nigeria, Democratic Republic of the Congo, Ethiopia, Tanzania and Kenya (see number of cases [see Annex 8, p. 23] and number of deaths [see Annex 10, p. 25] by country).

Outside the WHO African Region: ten countries accounted for 90% of the malaria cases: mainly India, which accounted for a third of cases, followed by Sudan, Myanmar, Bangladesh, Indonesia, Papua New Guinea, Pakistan, Brazil, Somalia and Afghanistan (see Fig. 3.6 [see Annex 9, p. 24] for number of cases and Fig.3.10 for number of deaths).

The majority of the malaria deaths (85%) occurred in children under five years of age. The proportion is much higher in the African and Eastern Mediterranean WHO Regions than in other regions (see Table of estimates by region [see Annex 2, p. 18] ).

According to data and estimates, only one in five malaria deaths was reported worldwide in 2006.

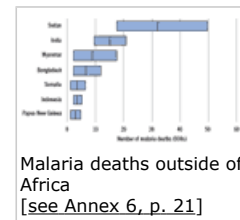
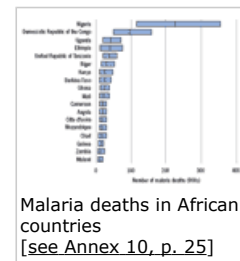
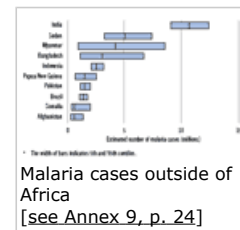
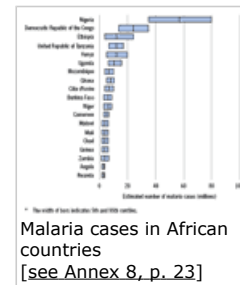
*This text is a summary of: WHO, World Malaria Report (2008) [see http://www.who.int/malaria/wmr2008/], 3. Estimated burden of malaria in 2006, Malaria cases, Malaria Deaths, p.10-12*

### 3.3 Why is there a wide range of estimates?

It is very hard to calculate the number of malaria cases and deaths accurately.

Estimates are based, in part, on the numbers of cases reported by national malaria control programmes. Therefore, whether or not reported cases are a true reflection of the number of malaria cases in a region depends on three factors:

- The quality of reports from routine surveillance systems.
- The proportion of patients that use public health facilities compared to those that use private health facilities or who do not seek treatment at all. For instance, in South-East Asia a large number of patients use private services, which results in official statistics that often report too few new malaria cases.



- The proportion of cases with a confirmed diagnosis. For instance, in the WHO African Region only a small number of samples from patients are sent for laboratory analysis, and diagnosis is only based on malaria symptoms such as fever, headache, vomiting and diarrhoea. This is likely to result in too many cases being reported because not everyone with signs that could be attributed to a malaria infection really has the disease.

In 2006, the WHO estimated that 1.2 billion people were at high risk of being infected with malaria and a further 2.1 billion were at low risk. These figures are consistent with those from studies carried out in 2003 and 2005 where similar data and techniques were used. Estimates of the number of deaths (around 1 million deaths per year) are also broadly consistent with those obtained in a study in 2004. The main difference is that the new estimates include fewer deaths in the WHO Western Pacific Region, mainly because malaria seems to have declined in Cambodia and Viet Nam.

However, the figures are not consistent with those from studies carried out in the 1990s and from a publication from 2008. Some of the discrepancies can be due to differences in the way data are analysed. Others could be due to the way in which results were analysed or to a true decline in the number of malaria cases since the 1990s.

With all methods, the calculated values for the number of cases and deaths are very uncertain. This affects estimates for each country and the ranking of countries within regions. There are two methods to calculate the numbers of malaria cases and deaths: by estimating the likely values from limited data, or by using routine surveillance data. This latter method is better but depends critically on the information that each country gives to the WHO and on data from published surveys. If information is incomplete but the number of missing reports is registered, the estimates can be adjusted properly. However, if these records are not kept, the adjustments could overestimate or underestimate the number of malaria cases and deaths. Unfortunately, surveillance systems and registration is weakest in countries most affected by malaria and that could lead to very large differences between calculated and actual values.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 3. Estimated burden of malaria in 2006, Comment, p.12-15*

## 4. What is being done to prevent and treat malaria?

### 4.1 Which policies and strategies have been adopted?

The WHO developed policy recommendations to prevent, diagnose and treat malaria. The extent to which these policies are adopted varies between countries (see overview table by region [[see Annex 16, p. 30](#)] ).

With regard to **malaria prevention**, the WHO recommends the use of mosquito bed nets treated with long lasting insecticide and indoor spraying to control the numbers of infected mosquitoes.

By the end of 2006, nearly all 45 countries in the WHO African Region had adopted the policy of providing free insecticide-treated nets to children and pregnant women, but only 16 of these countries aimed to cover the whole population at risk. Nets are also used in many countries in the South-East Asia and the Western Pacific WHO Regions, but in relatively few countries in other WHO Regions.

Spraying the inside of houses with insecticide is the main method used in the WHO European Region to reduce the numbers of infections, especially in Azerbaijan, Tajikistan and Turkey. This method is less used in the WHO Regions of Africa, the America's and South-East Asia, and least used in the Western Pacific region.

Approximately half of the countries where malaria is endemic have strategies for avoiding and managing insecticide resistance of malaria-carrying mosquitoes.

Another prevention measure consists in giving at least two treatment doses of anti-malarial drugs during pregnancy to decrease the impact of malaria in pregnant women and newborns. This preventive method is only used systematically in 33 countries of the WHO African Region.

With regard to **malaria treatment**, the WHO recommends a "combination therapy" of several anti-malarial drugs including an artemisinin derivative as first-line treatment. Since 2001, this measure has become increasingly popular and, by 2008, only Cape Verde, Dominican Republic, French Guyana and Swaziland had not adopted it. Free treatment with combination therapy is widely available in the WHO South-East Asia Region (eight out of ten countries) but less so in the WHO Western Pacific Region (6 out of 10 countries) and in the WHO African Region (23 out of 46 countries).

In 2001, the WHO reached an agreement with the pharmaceutical industry Novartis to make a particular drug combination (Coartem ®) available at cost price (i.e. at a price excluding profit to Novartis) through public health services. During 2006 and 2007 most of these drugs were bought for children below 15 kg, predominantly in the African and South-East Asia WHO Regions. UNICEF and several other humanitarian aid agencies have made agreements with Novartis to buy the drug at the same price negotiated by the WHO.

In 2007, the WHO urged Member States to discourage or forbid the use of tablets containing a single anti-malarial drug derived from artemisinin, to promote artemisinin-based combination therapies and to forbid the distribution of fake anti-malarial medicines. By 2007, more than half of the drug companies identified by the WHO had said they would stop producing tablets with a single anti-malarial agent based on artemisinin. However, only one quarter of the countries had introduced measures leading to the withdrawal of these single anti-malarial medicines.

Table 4.1 Number of countries having adopted WHO-recommendations for malaria control  
[see Annex 16, p. 30]

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>],  
4. Interventions to control malaria, Adoption of policies and strategies for malaria control, p.16-18*



## 4.2 How many people at risk of malaria are covered by prevention measures?

The main method of preventing malaria in high risk areas with one or more malaria cases per 1000 inhabitants per year is the use of insecticide-treated bed nets and the spraying of insecticide on the inside walls of houses.

### Insecticide-treated nets:

Since 2004, the supply of conventional insecticide-treated nets (ITNs), which are assumed to be effective during one year, appears to have increased in the African, South-East Asia and Western Pacific WHO Regions.

**In the WHO African Region**, much more strikingly, the supply of long-lasting insecticidal nets (LLINs) which are effective for three years have increased tremendously from 2005 onwards. Overall about 66 million nets were distributed in Africa in 2006, which is still far below the estimated 324 million nets that were needed in the region that year. For instance, only 6 out of the 45 countries in the WHO African Region had sufficient nets by 2006 to cover at least 50% of people at risk (see coverage by country [see Annex 12, p. 27] ).

In this WHO Region, there is a wide variation in the ownership and use of mosquito nets among countries, ranging from 65% in Niger to 6% in Cote d'Ivoire, but all remain well below the WHO target of 80% coverage by 2010. According to surveys carried out in 2006–2007, on average, about a third of African households owned at least one net but only about a quarter of all pregnant women and children under five years slept under a bed net (see ownership and usage by country [see Annex 14, p. 29] ).

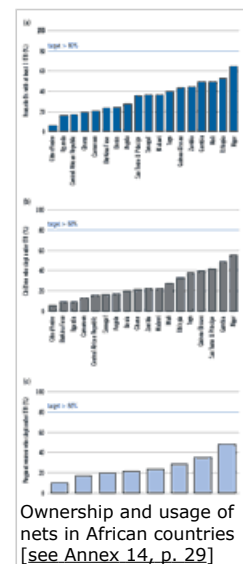
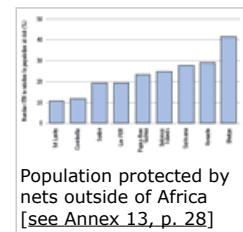
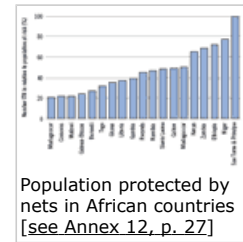
**Outside the WHO African Region**, treated nets are targeted at populations that are at the highest risk, including children, and therefore only protect a small proportion of the population. Data indicate that a relatively high coverage was achieved in Bhutan, Papua New Guinea, Solomon Islands and Vanuatu with more than 20% of all people at risk having access to insecticidal nets (see coverage by country [see Annex 13, p. 28] ).

### Indoor spraying of insecticide:

In all regions of the world, indoor spraying is typically used only in locations where risk is the highest. In 2006, indoor spraying protected more than 100 million people, including 22 million in the WHO African Region and 70 million in India.

**In the WHO African Region**, more than 70% of households at any risk of malaria had their walls sprayed with insecticide in Botswana, Namibia, Sao Tome and Principe, South Africa and Swaziland. In 9 out of 11 countries providing information, coverage would have been sufficient to protect at least 10% of the population at risk.

**Outside the WHO African Region** indoor spraying of insecticide is targeted and coverage of populations at risk remains quite low in many countries. Only in Bhutan and Suriname



did it exceed 20%. In 2006 only 11 countries sprayed enough houses to protect more than 5% of the population at risk (see coverage by country [see Annex 11, p. 26] ).

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>],  
4. Interventions to control malaria, Coverage of interventions, p.18-20*

### 4.3 How many people were covered by diagnosis and treatment measures?

Only 16 million rapid diagnostic tests were delivered in 2006, of which 11 million were for countries in the WHO African Region. This is a small quantity compared with the number of malaria cases. Distribution was very uneven and Ethiopia received more than 90% of the diagnostic tests attributed to the WHO African Region. Of the 4.8 million tests distributed outside the WHO African Region, more than half were used in India.

Between 2001 and 2006, public health services distributed an increasing number of anti-malarial drugs (80 million complete treatments in 2006) to treat approximately one third of all cases. In 2006, there was a large increase in the distribution of artemisinin-based combination drugs: it rose from 6 million in 2005 to 49 million in 2006, 45 million of which were for countries in the WHO African Region. Other sources indicate that these figures are probably underestimates. Most of the drugs were distributed in a limited number of countries and access to treatment varied widely. In any case, achievements for all treatment indicators are well below the WHO target of 80% coverage by 2010.

**In Africa**, treatment with any anti-malarial drugs ranged from 10% in Ethiopia to 63% in Gambia, and artemisinin-based combination therapies from 0.1% in Gambia to 13% in Zambia. Overall, only 38% of children under five years of age with fever took an anti-malarial drug, and 19% took it on the same day that the fever is detected or the next day.

Just 3% of children in the 18 African countries surveyed were given artemisin-based combination drugs. Besides Zambia, only Sao Tome and Principe gave them to more than 5% of children with fever (see figures by country [see Annex 3, p. 19] ).

On average, less than one pregnant woman in five received preventive treatment. This ranged from 0.3% in Niger to 61% in Zambia (see figures by country [see Annex 4, p. 19] ).

**In WHO Regions other than Africa**, twelve countries distributed more than one complete treatment course per malaria case through public health services. Bhutan, Laos, Papua New Guinea, Vanuatu and Viet Nam were among the best provisioned countries.

Access to anti-malarial drugs is better in cities compared to rural areas. For instance, the proportion of children under five years of age treated with anti-malarial drugs on the same day the fever appears or the following day was on average 27% higher in urban areas.

The proportion of malaria patients who sought treatment in the private sector was relatively high in South-East Asia and the Eastern Mediterranean WHO Regions, and low in the European and American WHO Regions. In the African and the Western Pacific WHO Regions, treatment was divided almost equally between the public and private sectors.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>],  
4. Interventions to control malaria, Diagnosis and cased management, p.20-22*

## 4.4 What is the situation in the WHO African Region?

The general picture for the WHO African Region is that despite some progress, most countries are far from meeting targets for prevention and cure (see question 4.2 & 4.3 respectively).

In 2006, one third of the households in the 18 countries surveyed owned an **insecticidal net** and one quarter of children and pregnant women slept under a net. Overall, up to 39% of people at risk of malaria in the WHO African Region could have been protected in 2007 but this figure is still well below the WHO target of 80% by 2010.



Child holding mosquito net in Togo. There are still insufficient numbers of nets in many countries. Source: Leslie Hallman

**Indoor spraying** is typically used in specific high-risk areas (i.e. with one or more malaria cases per 1000 inhabitants per year).

Mozambique and Zimbabwe covered an estimated one third to one half of their population at risk, but much higher coverage was achieved in Botswana, Namibia, Sao Tome and Principe, South Africa and Swaziland.

One in five **pregnant women** in 16 African countries surveyed received anti-malarial drugs as a preventive treatment.

With respect to **drug availability**, there is a large gap between provision and need. The countries with the best provisioned health systems are Botswana, Comoros, Eritrea, Malawi, Sao Tome and Principe, Senegal, Tanzania and Zimbabwe. Older anti-malarial drugs are less effective and their use is steadily declining while the supply of alternative drugs such as artemisinin-based combination drugs is bound to increase. Supply is especially high in Eritrea, Sao Tome and Principe, and Tanzania; but at present is still insufficient to fulfil the need.

**Access to treatment** is difficult to estimate but is clearly inadequate and well below of the 80% target. About one in three children with fever got some anti-malarial drug in 2006, but only one in 33 was given the more effective artemisinin-based combination therapies, even though there has been a big increase in its supply. There is much variation in access to treatment among and within countries, and it is better in cities than in the countryside.

A small group of African countries are performing well and there are some hopeful signs that prevention and treatment initiatives are starting to reduce malaria cases and deaths in some of these countries (see also question 6.2).

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 4. Interventions to control malaria, WHO African Region, p.23-24*

## 4.5 What is the situation in other regions of the world?

Outside the WHO African Region it is more difficult to estimate the coverage of prevention and treatment programmes because of several reasons:

- Only people at relatively high risk are targeted by prevention measures and the numbers involved are not reported to the WHO.
- There are no records on the patients who do not use the public health system.
- Household surveys are infrequent.

Data reported here are very uncertain and could give an unduly pessimistic view of malaria control in these regions.

In terms of prevention, coverage with insecticidal nets is relatively high in Bhutan, Papua New Guinea, Solomon Islands and Vanuatu. Coverage of indoor spraying with insecticide is also comparatively high in Bhutan, Solomon Islands and Suriname (see also question 4.2).

In terms of treatment, the countries best provisioned with anti-malarial drugs are Bhutan, Laos, Nicaragua, Turkey, Vanuatu and Viet Nam (see also question 4.3).

In some of the countries where prevention and treatment programmes have reached large proportions of people at risk (e.g. Bhutan, Laos and Viet Nam) the numbers of malaria cases and deaths have fallen. It seems that malaria control has had a significant impact on disease burden in these countries.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 4. Interventions to control malaria, Regions other than Africa, p.25-26*

## 5. How much funding is allocated to malaria control?

The picture of funding for malaria control is incomplete because many countries have not submitted information. The general conclusion is that although funding for malaria control was greater in 2006 than ever before, it is not yet possible to judge which countries have adequate resources for malaria control and it is also currently impossible to tell whether the money available has been used effectively. In Africa, funding is probably still far below needs.

In 2006, the WHO African Region received more than US \$688 million for malaria control, which was considerably more than for any other region and which represented the sharpest increase in funding between 2004 and 2006 anywhere in the world. During that time period, the amount of money available to fight malaria in this region increased by more than three-fold. Yet, despite the huge amount of money involved, only \$4.6 were available for each estimated malaria case in the 26 countries (out of 45) that submitted a report in 2006, which is unlikely to be sufficient to meet targets for prevention and cure.

The two major funding sources worldwide are national governments and the Global Fund to Fight AIDS, Tuberculosis and Malaria. In the Americas, European and South East Asia WHO Regions, the main contributors are the national governments. In the Eastern Mediterranean and the Western Pacific WHO Regions, the Global Fund is the biggest source of financial support. The WHO Western Pacific Region relied most on external funding, followed by the African and Eastern Mediterranean WHO Regions. African countries received support from the greatest number of different external agencies.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 4. Interventions to control malaria, Comment, p.23 and Funding for malaria control, p.26*

## 6. How effective is malaria control?

### 6.1 Can malaria control be properly evaluated from routine surveillance data?

In the WHO World Malaria Report 2008, the impact of malaria control is evaluated based on annual records of malaria cases and deaths from national surveillance reports. The data are highly variable in quality but are the most abundant source of information on the effects of malaria control worldwide. These data are used to see if the number of malaria cases and deaths are changing over time, and whether any changes are due to specific prevention and treatment measures.



Mural to promote the use of mosquito nets.  
[see Annex 1, p. 17]  
Source: Eric Thibodeau

Information on the numbers of patients, laboratory tests, and malaria deaths, is available for the period 2001-2006 for most endemic countries. For a few countries in the WHO African Region, there is also information available on the scale and timing of interventions and on numbers of cases and deaths before and after such prevention and treatment interventions. Although these are not scientifically controlled experiments, they give an indication of the effectiveness of anti-malaria policies.

It is important to bear in mind that changes could be due not only to malaria control efforts, but also to other factors such as improvements in surveillance or changes in the weather and other environmental conditions that could affect the transmission of the disease. In any case it seems that some countries implementing aggressive prevention and treatment programmes have reported significant reductions in the malaria burden.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 5. Impact of malaria control, Evaluating malaria control from routine surveillance data, p.27*

### 6.2 What has been the impact of malaria control the WHO African Region?

In the WHO African Region, the reported number of malaria patients attending, but not staying in clinics increased steadily from 3.2 million in 2001 to 8.4 million in 2006, and hospital admissions and deaths due to malaria more than doubled over the same period. This increase most likely reflects improved surveillance or more complete records for recent years.

Since control campaigns in most African countries had not reached large proportions of the population by 2006, an overall reduction in the malaria burden in the region is not yet expected. However, in six countries or parts of countries the number of malaria cases and deaths declined and nationwide effects of malaria control were particularly clear in four of those:

- In **Eritrea**, the distribution of insecticidal nets, the annual rounds of indoor spraying as well as the distribution of anti-malarial medicines coincided with a drop in reported malaria cases and deaths. Between 2001 and 2006, the number of people admitted to hospital with malaria fell by 64%, that of malaria patients who were not staying overnight by more than 90% and that of malaria deaths by approximately 80%. These local trends could be due to environmental or other factors but are most likely due to the malaria control measures.
- Between 2001 and 2006, efforts to control malaria in **Rwanda** seem to have had no effect. However, malaria cases and deaths declined rapidly after the distribution in 2006 of long-lasting insecticidal nets and artemisinin-based

combination drugs. This trend was observed in a number of health facilities and needs to be confirmed on a national basis.

- In 2005 and 2006, there were enough nets and anti-malarial drugs in **Sao Tome and Principe** to protect and treat nearly the whole population. Compared to the average for 2001-2003, the number of confirmed malaria cases in 2006 declined by more than 80%, and the number of deaths by more than 90%.
- In **Zanzibar**, improved access to artemisinin-based combination drugs since September 2003 onwards reduced malaria across the island and, by 2006, cases and deaths had diminished by more than 80% compared to 2001-2002. The decline could be partly due to less reporting but there is some evidence that these changes are due to real improvements in malaria control.
- In **Madagascar**, preventive measures have approximately halved the numbers of reported cases and deaths between 2001 and 2007. However, it is possible that this decline was due to less reporting rather than to an improvement in control.
- In **Zambia**, a country heavily affected by malaria, efforts to control the disease with insecticidal nets, indoor spraying, and anti-malarial drugs resulted in the numbers of both cases and deaths decreasing at an average of 9% per year between 2001 and 2006. This decline in malaria is very likely due to improved control.
- In other African countries where a high proportion of people have access to anti-malarial 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.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 5. Impact of malaria control, Impact of malaria control in the WHO African Region, p.27-29*

### 6.3 What has been the impact of malaria control in other parts of the world?

Between 1997 and 2006, malaria cases declined in at least 25 endemic countries outside the WHO African Region. In 22 of these countries, the number of reported cases fell by 50% or more during that time period, in line with WHO targets. In addition, six countries - Cambodia, Laos, Philippines, Suriname, Thailand and Viet Nam - are currently on track to meet the WHO targets of reducing malaria deaths by at least 50% by 2010. In some instances, these declines in malaria cases and deaths can be attributed to control campaigns but, in others, the cause is not so clear.

For instance, in the **WHO Region of the Americas**, the reduction in malaria in some countries (Belize, Honduras, Nicaragua, Peru, Suriname, Argentina, El Salvador and Mexico) coincided with improved control measures. However, malaria has not declined in the three countries with the highest number of cases: Bolivia, Brazil and Colombia.

In the **WHO Eastern Mediterranean Region**, the countries that have shown the greatest reductions in malaria cases are those where the national governments have made the strongest political and financial investments in malaria control. However, in six of the region's most affected countries (Afghanistan, Djibouti, Pakistan, Somalia, Sudan and Yemen) there is little evidence that the efforts made have had any effect.

Three quarters of malaria cases in the **WHO European Region** are in Tajikistan and in Turkey, particularly along the borders with Iraq and Syria. However, in both countries malaria has declined sharply since the 1990s as a result of indoor insecticide spraying and prompt medical treatment. At present, Tajikistan is the only place in the WHO European Region where transmission of the infectious malaria agent *P. falciparum* occurs.

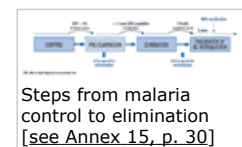


In the **WHO South-East Asia and Western Pacific Regions**, recent reductions in malaria cases and deaths have been associated with the targeted use of insecticidal nets, prompt diagnosis and effective treatment.

*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 5. Impact of malaria control, Impact of malaria control in other regions, p.30-31*

## 7. Can malaria be completely eradicated?

The WHO Global Malaria programme aims not only to reduce the burden of malaria in countries where it is present, but also to reduce the geographical extent of malaria in the world and therefore to eliminate it completely at the local level.



The WHO identified four phases on the path to malaria elimination: malaria control, pre-elimination, elimination, and prevention of reintroduction (see chart [see Annex 15, p. 30]). The 109 countries in the world that are affected by malaria were classified according to how far they had progressed towards malaria elimination by July 2008:

- Eleven countries are in the **pre-elimination** phase: Azerbaijan, Georgia, Iran, Kyrgyzstan, Malaysia, Mexico, North Korea, Sri Lanka, Tajikistan, Turkey and Uzbekistan. In those countries, diagnostic tests showed that less than 5% of suspected malaria cases are actually malaria.
- Another ten countries have gone further in the path towards malaria control and are in the **elimination** phase: Algeria, Argentina, Armenia, Egypt, El Salvador, Iraq, Paraguay, Republic of Korea, Saudi Arabia and Turkmenistan. Those have fewer than one malaria case per 1000 inhabitants per year in areas at risk.
- Six countries are in the phase of **preventing malaria reintroduction**: Jamaica, Mauritius, Morocco, Oman, Russia and Syria. These countries have no malaria infections carried by mosquitoes. If this is achieved for three or more consecutive years, countries are certified malaria-free. In addition, China, Indonesia, Philippines, Solomon Islands, Sudan, Vanuatu and Yemen are attempting to establish malaria-free zones in parts of their territory.

In January 2007, the United Arab Emirates was the first formerly-endemic country to eliminate malaria since the 1980s, bringing the total number of malaria-free countries or territories in the world to 92.

Despite some successes, there is no evidence yet to show that malaria elimination can be achieved and maintained in areas where malaria transmission is currently high (one or more malaria cases per 1000 inhabitants per year).

It is not easy to say with certainty whether or not a particular control measure has had any specific impact on malaria as the effects of different interventions are not easily separable.

A few countries with relatively small populations and very thorough malaria control programmes seem to have cut malaria burden significantly. There have also been some successes with insecticide indoor spraying campaigns. However, the effects of malaria control measures are less obvious in countries with larger populations. In several African countries, malaria has not declined despite offering prevention and treatment services to a high proportion of their populations.

In many countries outside the WHO African Region, the numbers of reported cases and deaths were falling over the period 1997–2006 but it is not clear that this decline in malaria is caused by improved control measures.

Using records of numbers of cases and deaths to estimate the progress of malaria can be misleading. However, if the data are compiled and analysed carefully they are very useful to estimate trends and to get continuous feedback on the progress of malaria in different countries, regions and health centres. This would not only result in more accurate statistics but would also help make control programmes more effective.

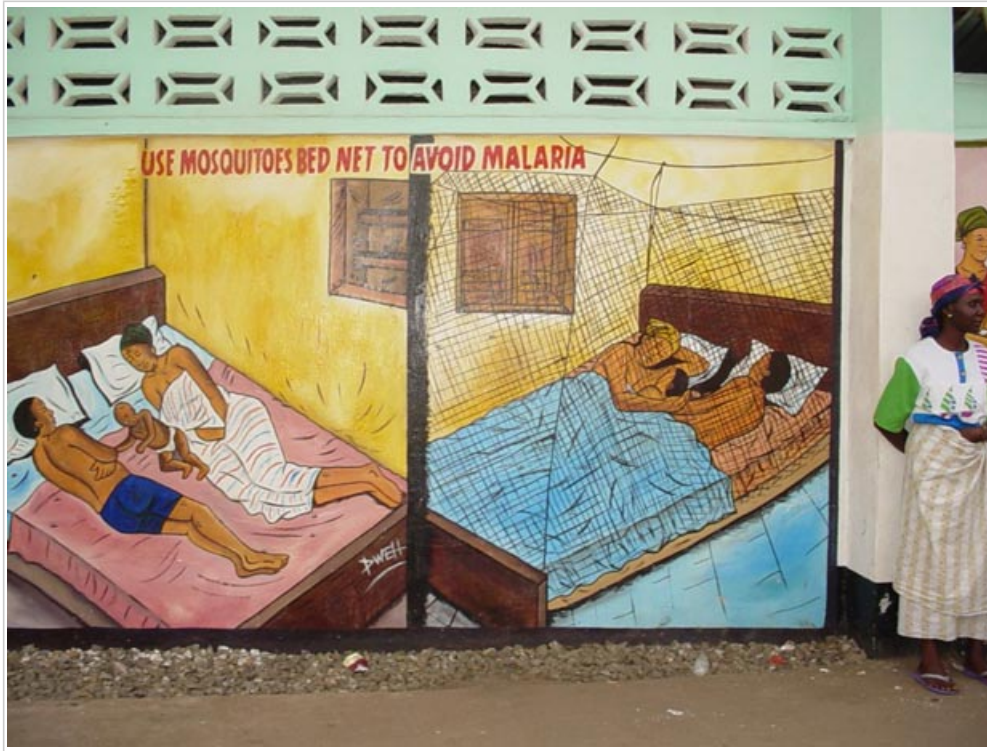
*This text is a summary of: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>],  
5. Impact of malaria control, Malaria Elimination and Comment, p.31-32*



## Annex

### Annex 1:

### Campaign to promote the use of mosquito nets.



Source: Eric Thibodeau

## Annex 2:

### Estimates of populations at low and high risk of malaria by WHO Region, 2006

Population at risk (millions)	Population	% any risk	Total at risk	Low risk	High risk	High risk (as % of any risk)
Africa	774	84 %	647	61	586	91 %
Americas	895	15 %	137	76	61	45 %
Eastern Mediterranean	540	55 %	295	230	66	22 %
Europe	887	2 %	22	19	2	11 %
South-East Asia	1 721	77 %	1 319	863	457	35 %
Western Pacific	1 763	50 %	888	833	54	6 %
World	6 581	50 %	3 308	2 082	1 226	37 %

### Estimates of cases compared with NMCP\* reports, by WHO Region, 2006

Cases (Thousands)	Reported	% Falciparum	Estimated	Lower	Upper	Reported/ Estimated (%)
Africa	83 618	98 %	212 000	152 000	287 000	36 %
Americas	1 042	29 %	2 700	2 400	3 200	39 %
Eastern Mediterranean	2 914	76 %	8 100	7 000	11 400	84 %
Europe	2	2 %	4	4	5	63 %
South-East Asia	4 338	56 %	21 000	19 000	29 000	20 %
Western Pacific	2 133	67 %	2 200	1 500	3 200	95 %
World	94 048	92 %	247 000	189 000	327 000	37 %

### Estimates of deaths compared with NMCP\* reports, by WHO Region, 2006

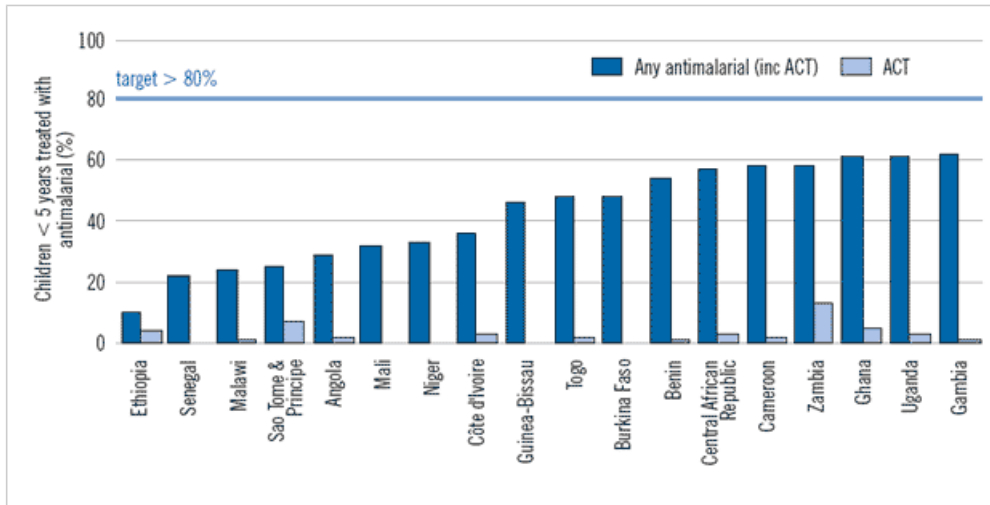
Deaths (Thousands)	Reported (all ages)	Reported (% < 5 years)	Estimated (all ages)	Lower	Upper	Reported/ Estimated (%)
Africa	156	88 %	801	529	1 126	20 %
Americas	0	29 %	3	2	3	8 %
Eastern Mediterranean	2	76 %	38	20	60	5 %
Europe	0	0 %	0	0	0	0 %
South-East Asia	2	35 %	36	24	50	5 %
Western Pacific	1	40 %	4	2	6	33 %
World	161	85 %	881	610	1 212	18 %

\*NMCP : National Malaria Control Programmes

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.10.

**Annex 3:**

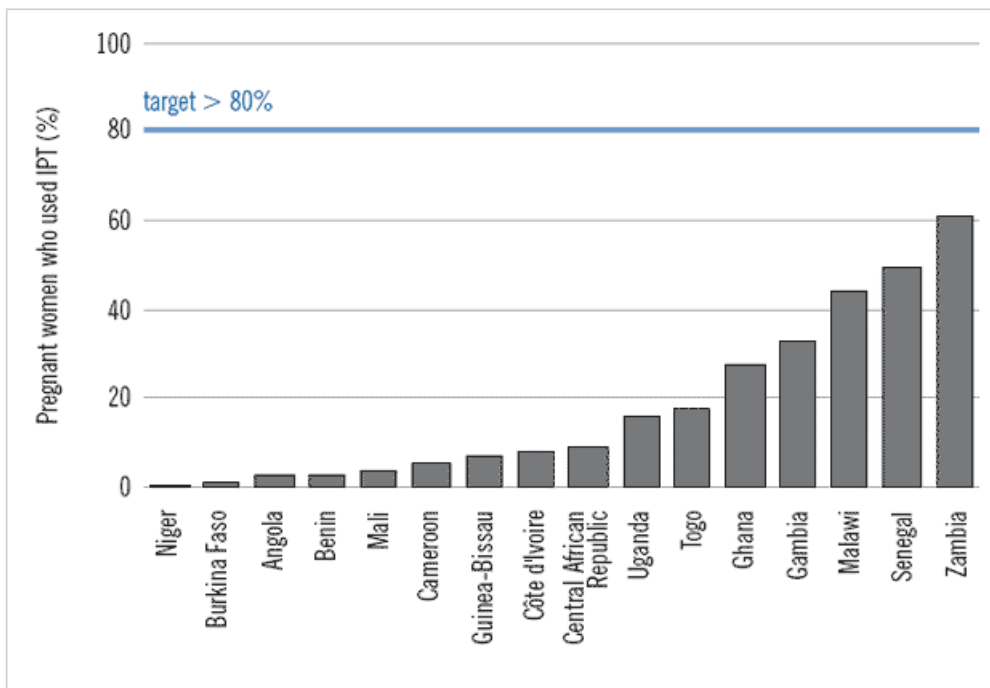
**Fig. 4.14 Availability of antimalarial drugs to children with fever**



Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 4. Interventions to control malaria, Diagnosis and cased management, p.22

**Annex 4:**

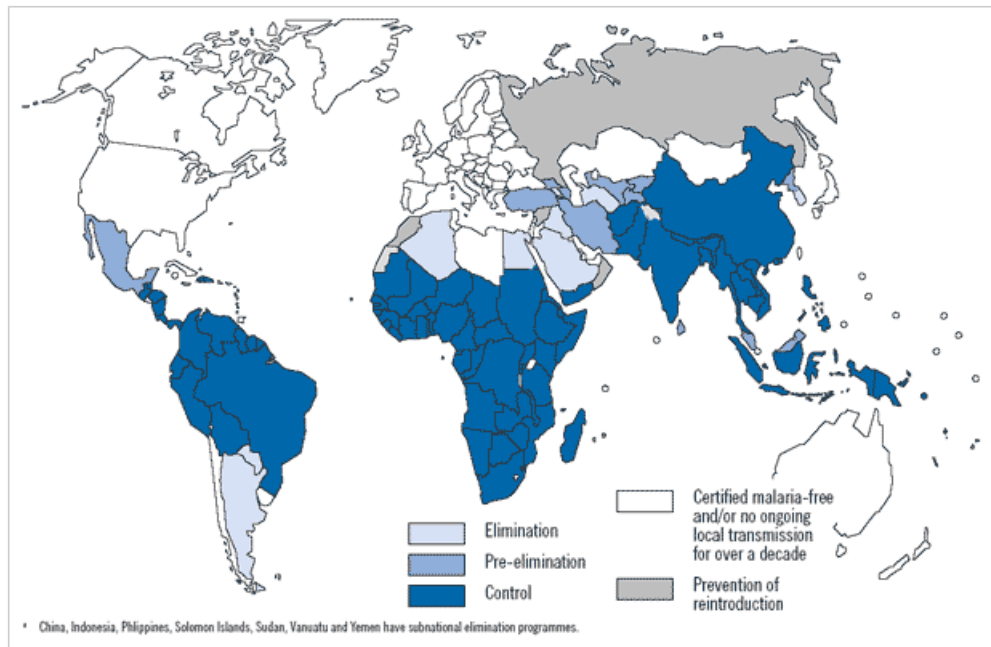
**Fig. 4.15 Pregnant women who used preventive treatments**



Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], 4. Interventions to control malaria, Diagnosis and cased management, p.22

**Annex 5:**

**Fig.3.1 Malaria-free countries and malaria-endemic countries in phases of control, pre-elimination, elimination and prevention of reintroduction (end 2007).**

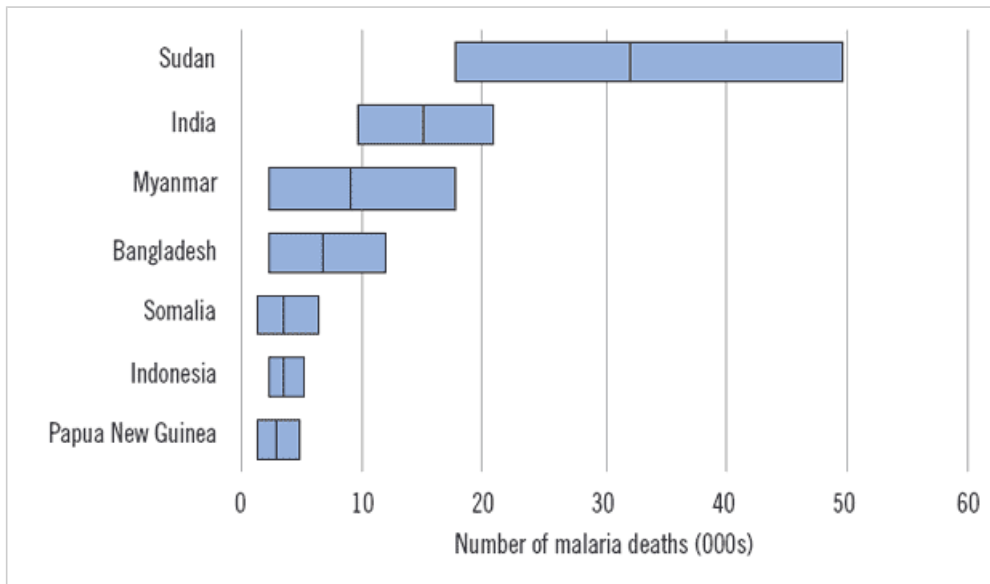


China, Indonesia, Philippines, Solomon Islands, Sudan, Vanuatu and Yemen have subnational elimination programmes.

Source: WHO, *World Malaria Report (2008)* [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: *Estimated burden of Malaria in 2006*, p.9.

### Annex 6:

**Fig.3.10 Seven countries estimated to have 90% of malaria deaths in regions other than Africa, 2006**

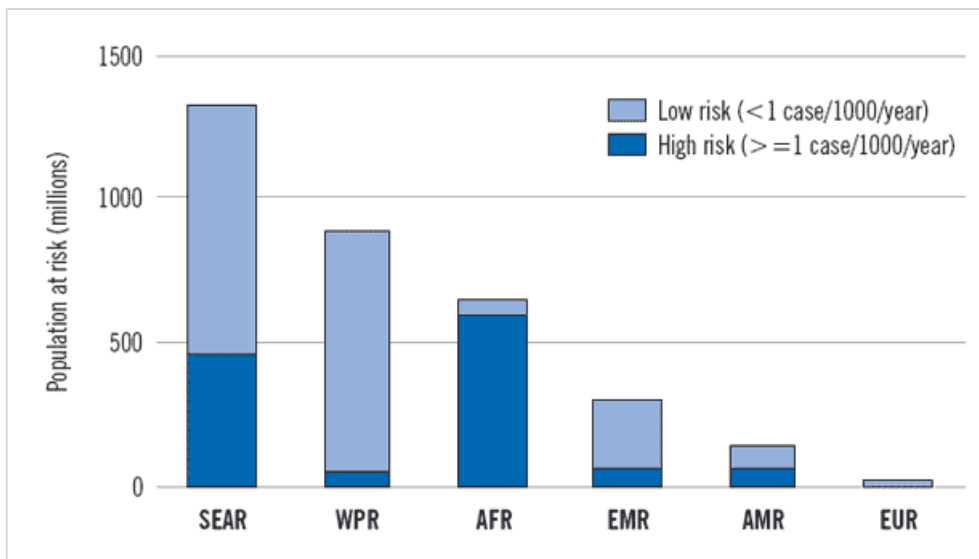


\*The width of bars indicates 5<sup>th</sup> and 95<sup>th</sup> centiles.

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.14.

**Annex 7:**

**Fig.3.2. Number of people estimated to be at low and high risk of malaria, by WHO Region, 2006**

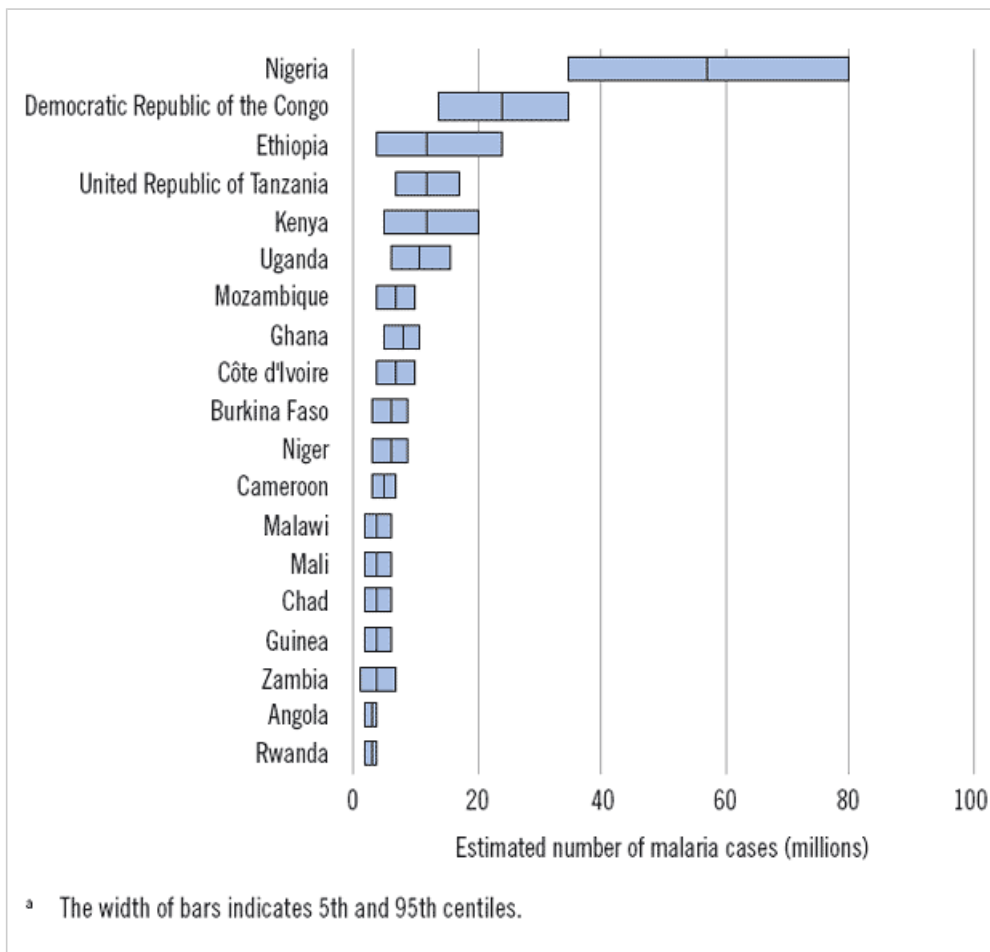


SEAR (South East Asia region); WPR (Western Pacific region); AFR (African region); EMR (Eastern Mediterranean region); AMR (Americas region); EUR (European region)

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.10.

**Annex 8:**

**Fig.3.5. Nineteen countries estimated to have 90% of cases in the African Region, 2006\***

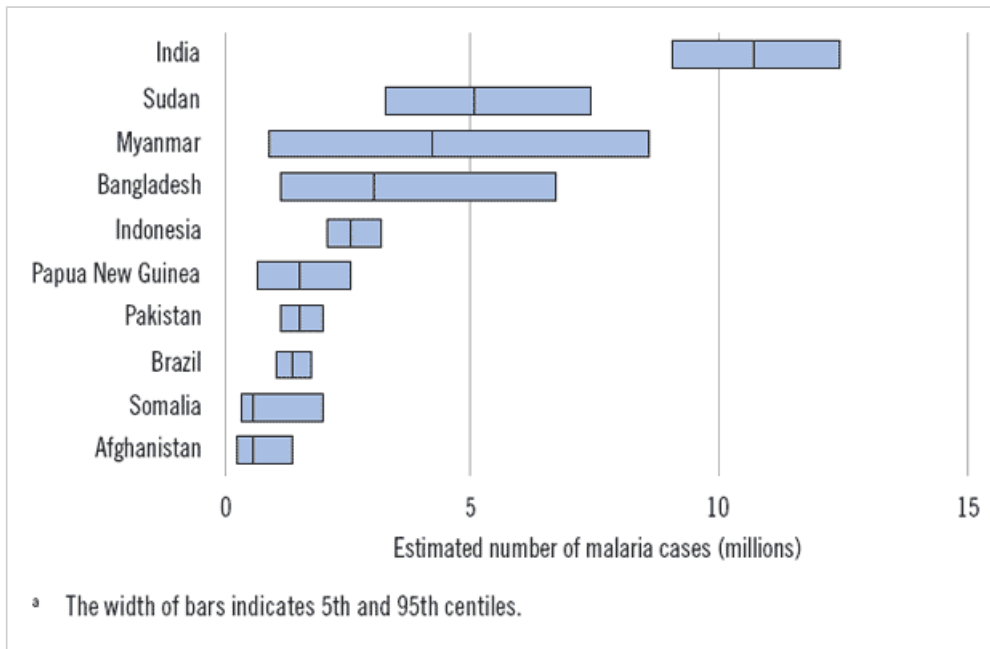


\* The width of bars indicates 5th and 95th centiles.

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.12.

**Annex 9:**

**Fig.3.6 Ten countries estimated to have 90% of cases in regions other than Africa, 2006\***

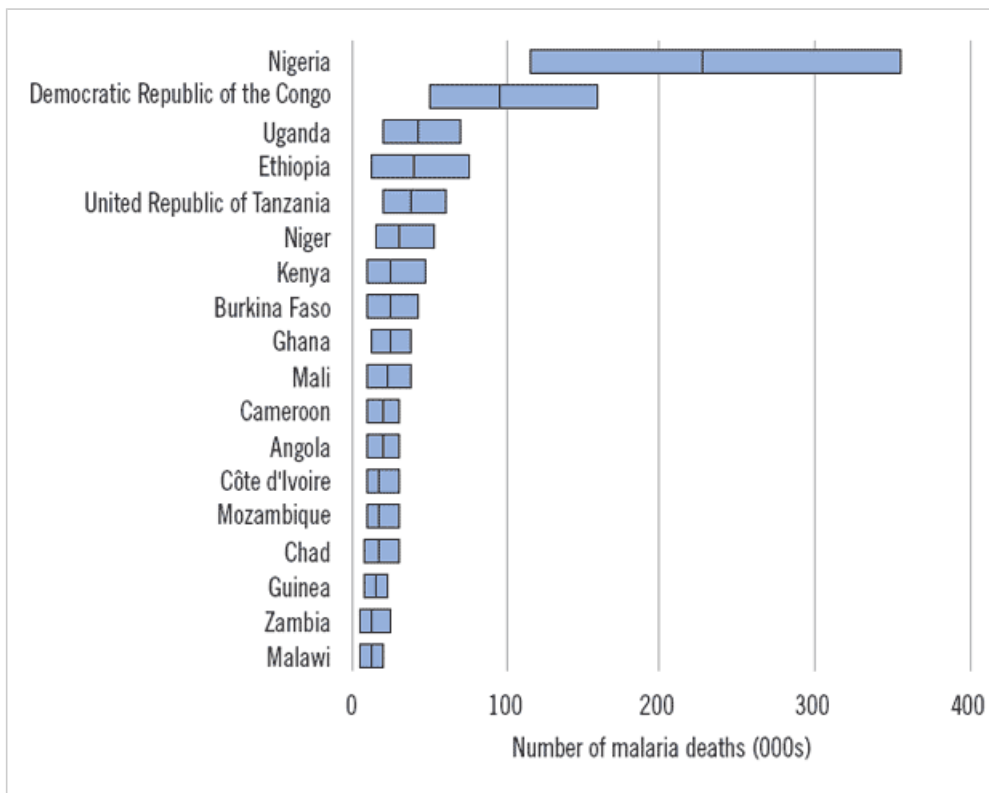


Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.12.



**Annex 10:**

**Fig.3.9 Eighteen countries estimated to have 90% of malaria deaths in the African Region, 2006**



\*The width of bars indicates 5<sup>th</sup> and 95<sup>th</sup> centiles.

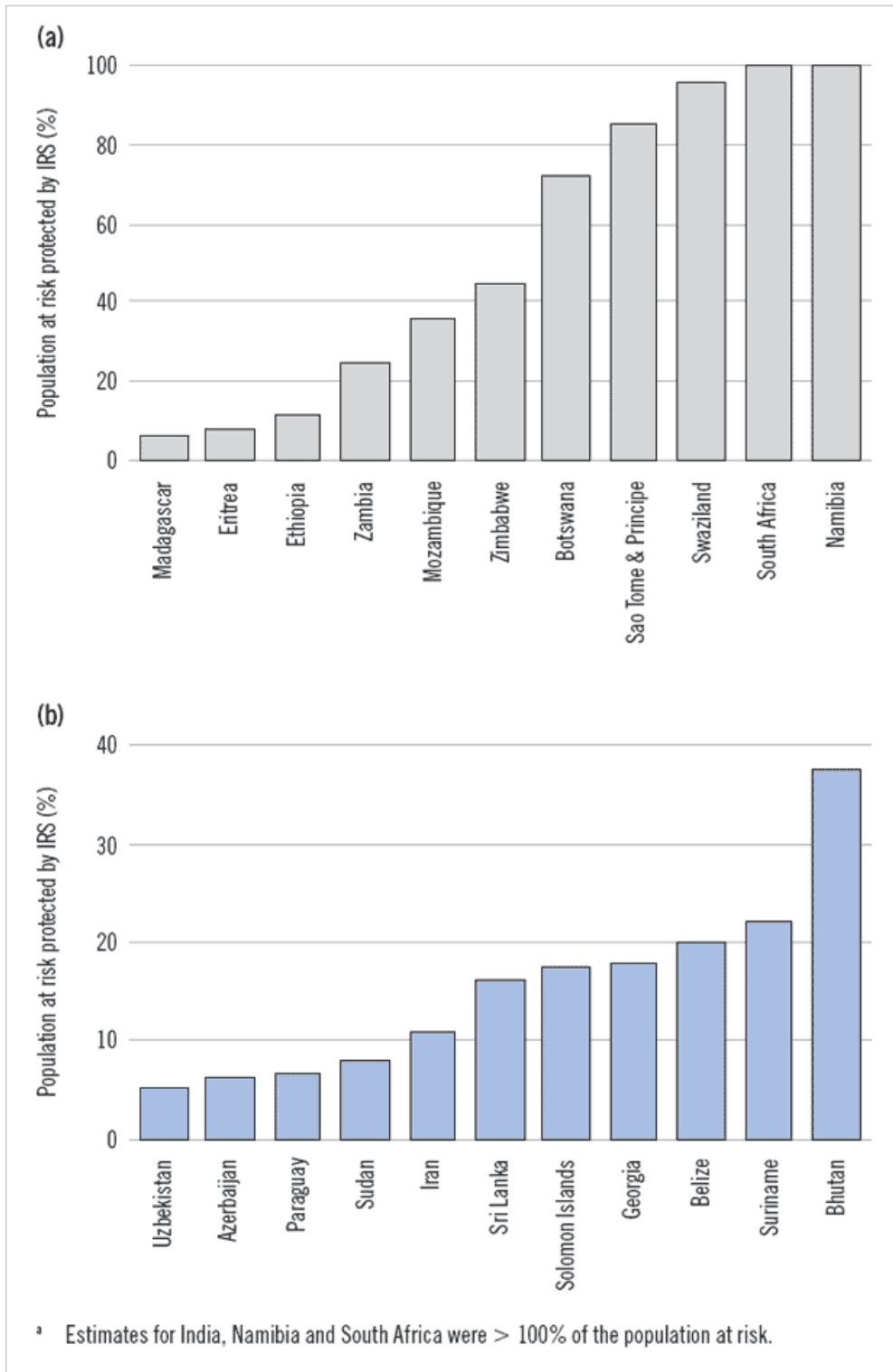
Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 3: Estimated burden of Malaria in 2006, p.14.

**Annex 11:**

**Fig.4.10 Countries in:**

**(a) the African and**

**(b) other regions where > 5% of the population at risk was protected by Indoor Residual Spraying (IRS) in 2006\***

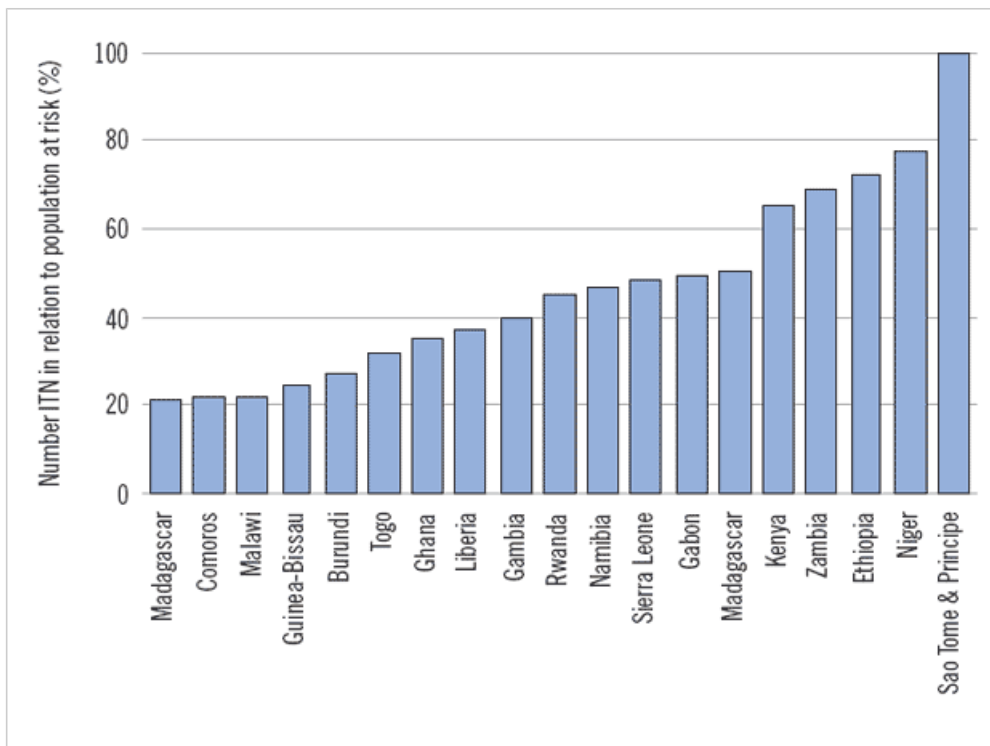


\*Estimates for India, Namibia and South Africa were > 100% of the population at risk

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 4: Interventions to control malaria, p.21.

**Annex 12:**

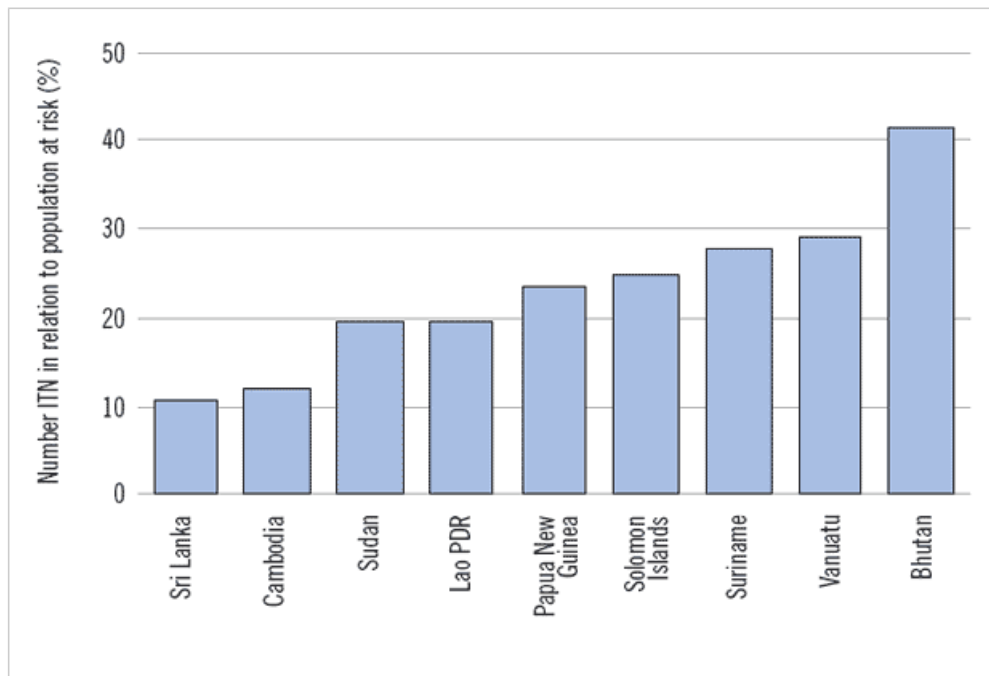
**Fig.4.6 Nineteen African countries with Insecticide-Treated Nets (ITN) sufficient to cover >20% of the population at risk in 2006-2007 (data from the National Monitoring Control Programmes (NMCP))**



Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 4: Interventions to control malaria, p.18.

**Annex 13:**

**Fig.4.7 Nine countries in the Americas, South-East Asia and Western Pacific with Insecticide-Treated Nets (ITN) sufficient to cover > 10% of the population at risk in 2006-2007 data from the National Monitoring Control Programmes (NMCP))**

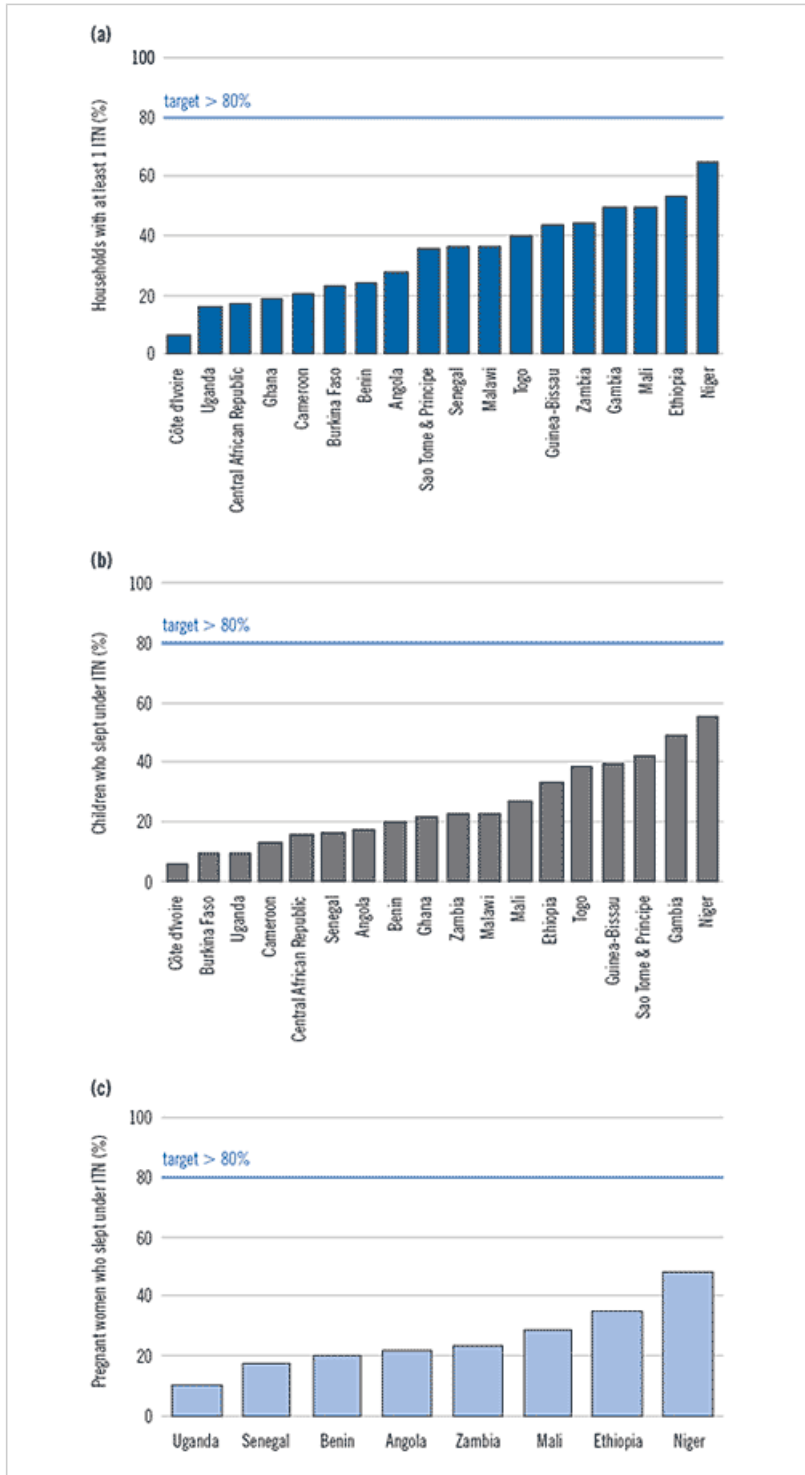


Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 4: Interventions to control malaria, p.19.

**Annex 14:**

**Fig.4.8 Household surveys of :  
 (a) Insecticide-Treated Net ownership,  
 (b) use by children < 5 years and  
 (c) pregnant women, Africa, 2006–2007**

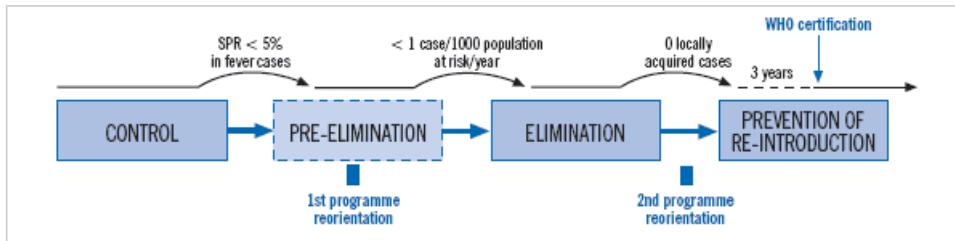
(DHS, MICS and MIS surveys)



Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>].

**Annex 15:**

**Fig.5.4. Steps from malaria control to elimination**



SPR: slide or rapid diagnostic test positivity rate. A country moves from the control to the pre-elimination step when diagnostic tests show that less than 5% of suspected malaria cases are actually malaria.

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 5: Impact of malaria control, p.31.

**Annex 16:**

**Table 4.1 Number of countries having adopted WHO-recommended policies and strategies for malaria control, by WHO Region**

Data are reported by National Malaria Control Programmes at the end of 2006 except for policy on ACT treatment, which has been updated to June 2008.

WHO region	Insecticide-Treated Nets			Indoor Residual Spraying		
	for all	IT- targeting children under 5 years and pregnant women	for children under 5 years and pregnant women	free distribution	Indoor Residual Spraying (IRS)	DDT used
Africa	16	37	33	16	23	8
Americas	12	6	5	12	9	1
Eastern Mediterranean	6	4	7	5	6	0
Europe	3	3	4	8	5	0
South-East Asia	9	6	9	6	6	3
Western Pacific	8	4	7	2	4	1
<b>Total</b>	54	60	65	49	53	13

WHO region	Treatment		Intermittent Preventive Treatment during pregnancy	Number of endemic countries
	Artemisinin combination therapies	Treatment-act is free in public sectors		
Africa	40	23	33	45
Americas	8	6	0	22
Eastern Mediterranean	10	7	0	13
Europe	1	1	0	9
South-East Asia	9	8	0	10
Western Pacific	9	6	0	10
<b>Total</b>	77a	51	33	109

a Out of 81 countries endemic for P. falciparum.

Source: WHO, World Malaria Report (2008) [see <http://www.who.int/malaria/wmr2008/>], Chapter 4: Interventions to control malaria, p.16.

## Partner for this publication

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