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Current Issues in Malaria Epidemiology and Control

2006 Information Brief

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**By the
Swiss Tropical Institute**

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Table of contents

1. Preamble.....	3
2. Trends in epidemiology.....	3
3. Progress in malaria control.....	6
3.1. Diagnosis and Treatment.....	6
3.2. Prevention.....	8
3.3. Malaria epidemics.....	11
References and Resources... ..	13

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Disclaimer

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List of abbreviations:

ACT	Artemisinin-based combination therapy
BMGF	Bill & Melinda Gates Foundation
Bt	Bacillus thuringiensis
DDT	Dichloro-diphenyl-trichloroethane
GDP	Gross Domestic Product
GNP	Gross National Product
GFATM	Global Fund against AIDS, TB and Malaria
GSK	Glaxo Smith Kline
HMM	Home management of malaria
IHRDC	Ifakara Health Research and Development Centre
IPT	Intermittent preventive treatment
IPTi	Intermittent preventive treatment in infants
IPTp	Intermittent preventive treatment in pregnant women
IPTc	Seasonal Intermittent preventive treatment
IRS	Indoor residual spraying
ITN	Insecticide- treated net
LSHTM	London School of Hygiene and Tropical Medicine
LLIN	Long-lasting insecticidal net
MDG	Millenium Development Goals
RBM	Roll Back Malaria
RDT	rapid diagnostic tests
RTS,S	Name of vaccine candidate
SDC	Swiss Agency for Development and Co-operation
SP	Sulfadoxine-pyrimethamine, Fansidar [®]
STI/ SCIH	Swiss Tropical Institute/ Swiss Centre for International Health
UNICEF	United Nations Children's Fund
WB	World Bank
WHO	World Health Organisation

1. Preamble

No single intervention, drug or other approach can control malaria in all endemic areas.

Any integrated approach needs to combine early diagnosis and treatment with prevention through the use of insecticide treated bednets and context-specific vector control measures.

This brief presents key figures on the burden of malaria and the impact of its economic burden. It outlines current and future gaps in evidence, information, funding and health systems resources. Furthermore, it refers to global health initiatives such as Roll Back Malaria and the Global Fund against AIDS, TB and Malaria (GFATM) which have been created to address precisely these gaps. It provides an overview of interventions to curb malaria, their state of implementation and their effectiveness. The brief is guided by the key concept that there is no single intervention, drug or approach that will control malaria in all endemic areas. Any malaria control strategy must entail an integrated approach that needs to be tailored to the specific endemic situation in question. In addition, any integrated approach is based on (i) **early diagnosis and effective treatment**, (ii) **prevention through the promotion and use of insecticide-treated nets and** (iii) - depending on the local setting – **specific vector control measures**. The following overview on the global malaria epidemic is based on key reviews and research findings. In particular the analyses from the Macroeconomic Commission for Health, the interim reports of the UN Millennium Project and the experience from Roll Back Malaria (RBM) of WHO are taken into account (*see references at the end of the document*).

2. State of the Global Malaria Epidemic in 2006

41% of the world's population lives in malaria endemic zones. Malaria kills more than a million people per year, the main burden is carried by children and the Sub Saharan African region.

Malaria kills at least one million¹ persons each year and affects some 3.2 billion people living in 107 countries. The percentage of the global population at risk has decreased from 77% at the turn of the 20th century to a low of 46% in 1994. This figure increased to 48% in 2002 (41%, 2005 World Malaria Report) due to population growth in an unchanged geographic distribution. In absolute terms the numbers of people at risk have increased consistently from 0.9 to 3 billion over the same period² (about 1900–2002).

One child dies every 40 seconds from malaria and equivalent to three times Africa's death toll from AIDS. The figures are on the increase due to rapidly changing transmission patterns, migration of populations, slow up-scaling of existing control tools and the emergence of new areas such as urban settings where malaria transmission proliferates. Despite being a preventable and curable disease, malaria has resurged in many parts of the tropics. It is estimated that in the absence of effective intervention strategies the number of malaria cases will double over the next 20 years. Malaria exacts its heaviest toll on the African continent.

¹ In some sources (e.g. Breman and Mills in American Journal Trop.Med.) the figure "up to 3 million" is cited. We use the RBM figure of "more than 1 million" malaria deaths per year. Particularly in South East Asia estimates are vague, since plasmodium vivax mortality is not as clearly established as the plasmodium falciparum mortality (two different forms of malaria parasites),

² Hay et al; The global distribution and population at risk of malaria: past, present and future. THE LANCET Infectious Diseases Vol 4 June 2004
http://mednet3.who.int/prioritymeds/report/append/610review_and_opinion.pdf

90% of malaria deaths occur in sub-Saharan Africa, and the great majority in children under five years of age. In this region, malaria is the primary reason that people attend health services, accounting for 20-50% of patients. The heavy malaria burden on the African continent is explained by climatic and ecological variables that determine mosquito breeding and by the high prevalence of the **most deadly malaria parasite- *Plasmodium falciparum***. Widespread poverty exacerbates the situation and interacts detrimentally with weak health systems and control programmes.

In the 1950s the **epidemiological classification for malaria** was established by the World Health Organization on the basis of the spleen index among children aged 2 to 9 years and the intensity of transmission.³ Four levels were established:

Holoendemic malaria - when more than 75% of the children aged 2 to 9 years present a palpable spleen and the spleen index among adults is low. This occurs in areas with intense and continuous transmission.

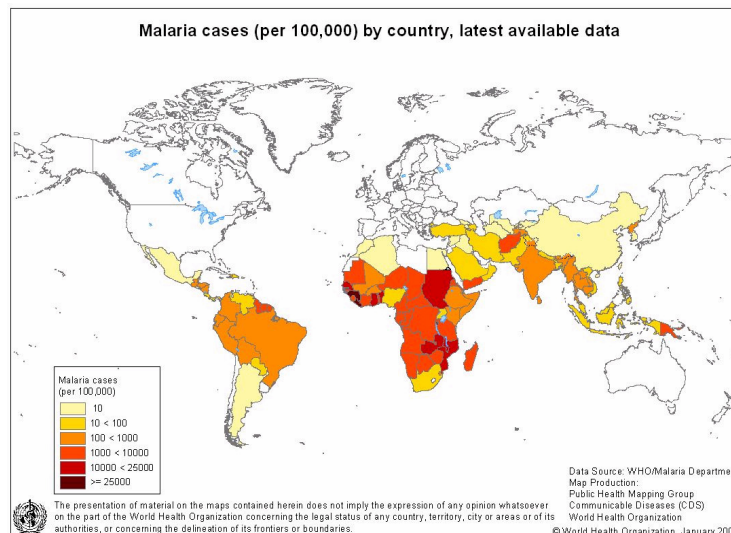
Hyperendemic malaria - when 50-75% of the children have splenomegaly and the spleen index among adults is also high. This occurs in areas with intense but seasonal transmission.

Mesoendemic malaria - when 10-50% of the children have an enlarged spleen. This is characteristic of areas with wide variations in transmission.

Hypoendemic malaria - when less than 10% of the children have a palpable spleen. This occurs in areas with low and irregular transmission.

In 2004, the world wide distribution of malaria cases presented as shown in the graph below. The darker the colour, the higher the burden.

Malaria and poverty are closely interlinked with one feeding the other in a two way, causal relationship.



³ The spleen is an organ that produces lymphocytes, filters the blood, stores blood cells and destroys those that are aging. It is located on the left side of the abdomen near the stomach.

It is estimated that African countries spend up to 40 percent of their health care budgets on efforts to prevent, control, and treat malaria.

It is estimated that GNP in Sub-Saharan Africa would be 32% higher if malaria had been eliminated 35 years ago.

Efficient and effective interventions are available.

Despite the efforts of the GFATM and other international initiatives, the fight against malaria remains grossly underfunded.

Only few countries are on track for meeting MDG 6 in relation to malaria.

Link between malaria and HIV established.

As can also be seen in this graph, there is a striking correlation between malaria and resource constrained countries. Different ways in which malaria impedes development include effects on fertility, population growth, saving and investment, worker productivity, absenteeism, premature mortality and medical costs. In malaria-endemic countries, the disease can account for a large percentage of public expenditures and reduce annual GNP per capita growth by over one percent. In Tanzania for example malaria is the leading cause of outpatient hospital visits and drains 3.4% from the annual GDP. The World Health Organization estimates that African countries spend up to 40% of their health care budgets on efforts to prevent, control, and treat malaria. **Malaria has been estimated to cost Africa more than US\$ 12 billion every year in lost GDP**, even though it could be controlled for a fraction of that sum. According to Jeffrey Sachs, it is estimated that GNP in Sub-Saharan Africa would be 32% higher if malaria had been eliminated 35 years ago.

Significant progress in the fight against malaria can be made with low-cost interventions. According to the report of the Commission on Macroeconomics and Health, **up to US\$ 2 billion will be needed each year to achieve the goal of halving the burden of malaria by 2010**. Currently, only US\$ 600 million are being spent. **Malaria accounts for less than 0.5% of all global spending on health-related research and development** - a mere \$ 323 million in 2004. Since the establishment of the GFATM in 2002, it has become the largest financier of the global fight against malaria with a total of US\$ 230 million largely allocated for the procurement of artemisinin-based combination therapy (ACT) in African countries. However, new rounds of funding are now at risk with many important donors failing to follow up their pledges. Another initiative to increase available funding is the World Bank's *"Rolling Back Malaria: The Global Strategy and Booster Program"*.

The **Roll Back Malaria Partnership**, initiated in 1998, set the target to halve the burden of malaria by 2010. Malaria is also part of the MDGs, with the target "to have halted and begun to reverse the incidence by 2015". While reaching these targets does not appear to be likely on a global scale, at the country level progress has been seen with Brazil, Eritrea, India and Vietnam all reporting recent successes in reducing the burden of malaria.

Malaria is being further fuelled by **HIV** and to a considerable extent both diseases are concentrated in the same geographical regions. The implications include that HIV-infected people are particularly vulnerable to malaria; antenatal care needs to address both diseases and their interactions; and where both diseases occur, more attention must be given to specific diagnosis for febrile patients.

3. Progress in Malaria Control

3.1. Diagnosis and treatment- what's new?

The gold standard remains clinical diagnosis combined with microscopically read slide.

Early diagnosis and prompt, effective treatment requires timely, accurate diagnosis, use of efficacious drugs, information and education of patients and their families about the disease and home management.

Rapid diagnostic tests are increasingly used in national control programmes, but need further development and evaluation.

While the clinical diagnosis combined with a microscopically read slide still represents a gold standard, **rapid diagnostic tests (RDT)** have been developed, validated and introduced in national control programmes. In high endemic areas clinical diagnosis remains the diagnostic approach at first contact level. The position and role of RDT within a control strategy depends largely on the endemic situation. Numerous RDTs are currently available at affordable prices even for peripheral health services levels. For example, in Cambodia, a low endemic country, RDTs have been introduced in health facilities and reduced the number of cases of severe malaria. Higher cost of rapid tests can be justified where they can confirm diagnosis and allow more rational use of very expensive first-line treatments. The promotion and broad use of artemisin-based combination therapy, as explained below, imply the need for improved diagnostic tools. In this case, RDTs can help to contain costs as well as to reduce misdiagnosis resulting in over-treatment with antimalarials. Despite the availability of RDT there is still an ongoing need for their further development and evaluation in particular with regard to field feasibility and costs in different endemic settings.

Resistance is widespread against "old" drugs, such as Chloroquine and Fansidar.

The main issues regarding **drug treatment** include the widespread distribution and use of substandard drugs and the increased spread of resistance to monotherapy with the broad range of conventional antimalarial drugs. A country map by WHO shows failure rates of conventional drugs maps in Africa⁴. Chloroquine, which served for many decades as a drug for effective malaria treatment, can no longer be used for plasmodium falciparum malaria. SP (sulfadoxine-pyrimethamine, Fansidar®) is still used in some countries, but is gradually being replaced in Africa by Artemisinin-based combination therapies. As explained below, SP will remain in use for intermittent treatment of pregnant women and infants.

WHO recommends artemisinin-based combination therapies (ACTs)

WHO **recommends combination therapies** as the treatment policy in all countries experiencing resistance. This applies to the whole of Africa (Resolution 19.1.2006). The same WHO resolution also calls for a ban of artemisinins monotherapies which are still widely used in Africa. Artemisinin-based *combination* therapies (ACTs) are the most efficacious treatment regimens currently available. To ensure the quality of products and guide those involved in procuring ACTs, WHO and UNICEF have established a list of products and manufacturers that comply with internationally recommended standards. http://www.unicef.org/supply/index_23995.html#List.

⁴ <http://www.who.int/malaria/resistance.html>

To date, only three co-formulated ACTs (i) the well-established artemether–lumefantrine (Coartem®) from Novartis Pharma AG and the recently registered (ii) artesunate-amodiaquine from Sanofi-Synthelabo/Guilin and (iii) pyronaridine – Artesunate PYRAMAX™ from Shin Poong (S-Korea) - prequalify for the list⁵.

ACTs are scaled up progressively in national control programmes in highly endemic countries. Main bottlenecks are at the financing level.

Since 2001, 42 malaria-endemic countries (23 of them in Africa) have adopted ACTs: 38 as first-line treatment and 14 as second-line treatment. However, the distribution of ACTs has so far failed to reach the scale envisaged. Countries that have in principle committed to buy ACTs are moving very slowly, reflecting internal bottlenecks as well as a lack of financial resources. While ACTs offer a much needed, life-saving approach, the move towards establishing their use poses difficult questions regarding the long-term affordability of malaria control interventions. Estimates indicate that the additional annual costs of ACT range from US\$ 300 million to US\$ 500 million globally. For African countries, the switch to ACTs implies a long-term dependence on substantial, external funding. The GFATM is currently providing the major leadership and resources for securing ACTs. The **Road Map for Scaling Up ACTs** is an initiative of the RBM Partnership and aims to meet the short-term needs of those countries that have, or will, adopt ACTs by outlining the critical steps, possible bottlenecks, and milestones for the production, prequalification, registration and procurement of ACTs.

Besides the above mentioned three co-formulated ACTs, there are no new drug candidates in the late stage development pipeline. Consequently, new molecular entities cannot be expected to reach clinical trials within the next 5 years. Unfortunately, the most promising new candidate, first generation synthetic peptides, failed in the clinical trials (phase 1 and 2) in 2006 and new generation molecules need to be developed.

In high transmission areas with low access to health services home management of malaria is an effective strategy - particularly for children.

Home management of malaria (HMM) is recommended in areas of high malaria transmission where access to facility-based health care is poor. RBM advocates home management of malaria in children under 5 years of age as a strategy to achieve high coverage of prompt and effective antimalarial treatment in this highly vulnerable group. This involves informing and educating mothers, training community-level providers - including shopkeepers - and supplying pre-packaged quality-assured medicines. The HMM strategy aims to improve the quality of commonly ineffective self-medication practices through community based approaches. Burkina Faso, Ethiopia, and Uganda have all demonstrated a reduction of malaria related mortality and morbidity in children through educating mothers and community health workers to dispense treatment. HMM is now included in the national control strategies in 22 African countries and 2 countries in the Eastern Mediterranean.

⁵ Coartem-price: 1USD/adult treatment and 0.5USD/children treatment. The price of an adult treatment with artesunate-amodiaquine is around 1.50 USD, depending largely on the procurement modalities. The price of the third substance is not known yet.

The integrated management of childhood illnesses (IMCI) has resulted in significantly reduced childhood mortality.

Integrated approaches to diagnosis and treatment: The integrated management of childhood illnesses (IMCI) offers new possibilities for the effective diagnosis and treatment of malaria. IMCI does not consider single disease entities but the comprehensive assessment and management of the “sick child” at each level of the health care system. Significant reductions in childhood mortality could be achieved in countries where the approach was introduced (see Lancet child mortality series 2004/2005). Besides the direct impact on the morbidity and mortality, IMCI also contributes to a more rational use of drugs, as e.g. the differential diagnosis between ARIs and malaria forms a key IMCI component.

3.2. Progress in prevention

Insecticide-treated nets (ITNs) are a key strategy for cost-effective malaria prevention and can reduce up to 30-50% of malaria-related morbidity and mortality.

Insecticide-treated nets (ITNs) are a key strategy for cost-effective malaria prevention and can reduce malaria-related morbidity and mortality by up to 30-50%. An insecticide-treated bed net that remains effective for at least four years costs \$4 to \$6. According to J. Sachs *"Here's a quick win. We could save more than one million children per year that are dying of malaria by helping to distribute bed nets on a mass basis, like we do with immunizations.."*. However, only two percent of children in Africa currently sleep under a bed net treated with insecticide. Methods for promoting usage of ITNs include: stimulating the growth of commercial markets; reducing taxes and tariffs; cost-sharing; social marketing subsidies; and ITN distribution free of charge among vulnerable groups, including children and pregnant women. Tanzania, for example, implemented a national voucher scheme to provide every pregnant woman with a free ITN. In Togo a net is provided to children at the time of measles vaccination. ITN programmes have been adopted by all countries in Africa south of the Sahara, the majority of Asian malaria-endemic countries and some American countries. There is a clear evidence base on the high impact of ITN programmes which has been established through a comprehensive number of systematic reviews and field experiences of large-scale ITN programmes conducted in countries as diverse as China, Tanzania and Vietnam. Overall, ITNs account for a 19% reduction in child mortality in Africa. The **international debate** is no longer around the question of whether ITNs should reach the population through social marketing or free distribution systems, but **how an ITN strategy can be tailored to a given national control programme whereby free distribution and social marketing can effectively complement each other**. Retreatment of nets on a large-scale remains an operational challenge and free distribution of insecticide as achieved in Vietnam and China appears to be the best way forward. Given these persisting operational challenges, the recently developed **long-lasting insecticidal nets (LLINs)** are clearly the future for ITN programmes. LLINs are now being adopted in many countries. Production of LLINs was initially focused on Asia. However, African countries have also started producing LLINs such as Tanzania in 2004. Whilst the purchase cost is higher as compared to conventional ITNs, the maintenance costs are lower since the nets remain effective for 4 to 5 years. Technology transfer to producers

ITNs account for a 19% reduction in child mortality in Africa.

Long-lasting insecticidal nets (LLINs) are clearly the future for ITN programmes.

in highly endemic malaria settings may bring prices further down.

Indoor residual spraying is a highly effective strategy, particularly in outbreaks and emergency situations.

Vector control includes indoor residual spraying (IRS) and/ or source reduction (larval control). Approaches chosen need to be tailored to the local setting and endemic situation. If well timed with high coverage, IRS is a highly effective method for malaria vector control. Countries in Europe as well as Central and South America achieved near eradication of malaria using IRS. IRS is especially recommended during epidemics and other emergency situations. For long-term impact in highly endemic and epidemic contexts, insecticide treated bed nets are generally recommended for better sustainability.

The choice of the insecticide for spraying depend on the local situation. DDT is being used again in certain contexts.

WHO recommends that countries select the insecticide for IRS upon the basis of a local situation analysis. In the Americas and in Asia vector control, mostly involving IRS, is included in the national control policies of all countries. About half of African countries also include IRS as part of their malaria control efforts. Dichlorodiphenyl-trichloroethane spraying pesticide (**DDT**) is one of the 12 insecticides that can be used for this purpose. Concerns over environmental damage led to a ban on DDT in the U.S. in 1972 and subsequently in many parts of the world, including several African nations. The 2004 Stockholm Convention on Organic Pollutants permits spraying small amounts of DDT at inner walls to prevent malaria. While European Union officials recently stated that African countries would be "taking a risk" by reintroducing DDT, others argue that DDT is needed to stem the malaria epidemic and accuse high income countries of holding a double standard.

Insecticides are used for treating mosquito breeding sites with best effect in urban settings.

To control mosquito larvae, formulations containing the insecticide *Bacillus thuringiensis* (Bt) are added to standing water at mosquito breeding sites. These approaches to eliminate/reduce breeding sites have a great potential and have shown to be effective in the past, although a great deal depends upon careful tailoring to the specific endemic situation. The most interesting potential seems to lie in **urban areas** where source reduction can effectively complement diagnosis and treatment and the promotion of ITNs. Currently noteworthy examples include urban malaria control projects in Dar-es-Salaam, Abidjan, Ouagadougou and Cotonou.

Long term-chemoprophylaxis is not a recommended strategy for residents of endemic areas.

Chemoprophylaxis is generally only advised for non-residents of endemic areas who are exposed to malaria for short periods (short-term visitors). WHO does not recommend long-term chemoprophylaxis for residents of endemic areas because of low feasibility, compliance and relatively low cost-effectiveness. There may be potential benefits of its use in specific epidemic emergency situations.

Country-specific recommendations for short-term visitors are available at:

<http://www.safetravel.ch/safetravel/servlet/ch.ofac.wv.wv104j.pages.Wv104ListeCtrl?action=afficheDetail&elementCourant=2>.

Intermittent preventive treatment (IPT) involves the provision of a curative dose of an antimalarial drug as part of a routine service within a health system without prior clinical diagnosis. It can be

Intermittent malaria treatment of pregnant women and infants is an recommended and very effective strategy for highly endemic areas.

provided to pregnant women as part of the antenatal care package. Currently two treatments are provided during pregnancy with SP (SP= sulfadoxine-pyrimethamine, Fansidar[®]: being the only recommended drug) (IPT_p). In addition IPT is provided to infants during contacts with the routine childhood vaccination services such as the Expanded Programme of Immunization (IPT_i) or on a cyclical basis in high endemic areas with high and strictly seasonal transmission patterns (IPT_c). IPT_p with SP is already an established WHO policy, has a high cost-effectiveness and is recommended for application in all highly endemic areas. As part of the WHO Making Pregnancy Safer strategy, IPT is included in the control policies of 26 African countries with highly endemic malaria. Several other countries in Africa are reviewing their policies in the light of the WHO recommendation, or are piloting IPT_p and/or IPT_i in selected areas. The majority of highly endemic countries recommend that pregnant women have also access to ITNs. The IPT_p policy is based on the evidence that IPT_p significantly contributes to a reduction in child mortality and abortion. It is not to be understood as a form of chemoprophylaxis, but reflects a repeated treatment of the pregnant women with the aim of reducing parasite load and improving birth weight of the newborns.

The Swiss Tropical Institute is part of the Bill & Melinda Gates Foundation funded IPTi consortium.

IPT_i and IPT_c are currently being evaluated with the objective of reaching a policy recommendation. The proof of principle trials of IPT_i, administering SP for infants at three time points, usually at 2, 3 and 9 months in combination with EPI, showed that the incidence of clinical episodes could be reduced by 60% and that the incidence of severe anaemia in infants could be halved. It is on this highly promising basis that a large consortium, supported by the Bill & Melinda Gates Foundation (BMGF), has formed to address all relevant questions and deliver policy recommendations by 2007. The Swiss Tropical Institute, STI, was involved in the early proof-of-principle trials in Tanzania and is also part of the **BMGF-supported IPTi-consortium** thereby collaborating with the IHRDC and LSHTM in the large-scale IPTi-effectiveness trial in southern Tanzania (population-base 1 million people). STI acts also as grant-holder for this largest programme of the Consortium.

Iron supplementation remains an important component of malaria control programmes.

Iron supplementation, particularly in the first year of life, also shows promising results for complementing malaria control strategies. Malaria associated severe anaemia in children is the most important complication of Plasmodium falciparum infection in sub-Saharan Africa. This problem is further aggravated by iron deficiency anaemia, which is the most prevalent micronutrient disorder worldwide. Anaemia causes a substantial proportion of malaria related mortality. There is no single effective intervention for the elimination of iron deficiency. An appropriate set of intervention strategies must be selected, weighed, integrated and adapted to the needs of different populations, environments and the availability of resources. Research is ongoing to define the role of iron supplementation within malaria control strategies in different endemic settings.

Vaccines remain a cause of great hope and would greatly assist malaria control strategies. Close to 60 candidates have already been tested in the long search for a malaria vaccine. There are

The most advanced vaccine candidate (RTS,S) is in an advanced trial stage. If all goes well, RTS,S could be registered by 2010.

currently several promising vaccine candidates – one of the most advanced is RTS,S/AS02A manufactured by GSK. In 2004, a proof-of-principle phase 2b trial undertaken among 2000 children aged 1 to 4 years in Mozambique showed the potential of this vaccine: it reduced 30% of clinical episodes, close to 50% of infections and exhibited a strong effect on severe malaria. Consequently, a comprehensive clinical development plan focusing on vaccination of infants according to child health epidemiology was developed for RTS,S and is now being implemented (supported by the Malaria Vaccine Initiative, funded by Bill and Melinda Gates Foundation). If all goes well RTS,S could be registered by 2010, which would mean that a significant step towards large-scale application within integrated national malaria control strategies could be achieved. Meanwhile, preclinical and clinical studies with other, less advanced vaccine candidates are remain on-going.

3.3. Malaria epidemics and the role of complex emergencies

Malaria epidemics occur in populations not previously exposed to malaria and are closely linked with complex emergencies.

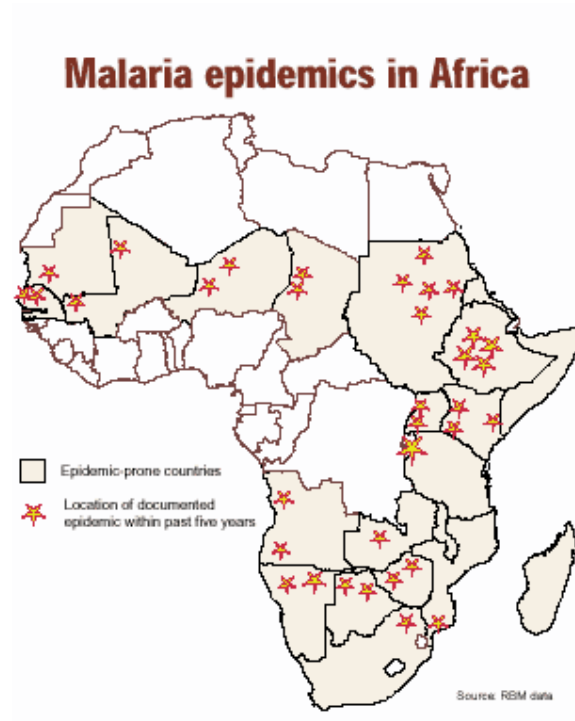
Epidemics can occur when malaria attacks vulnerable populations with little or no immunity- people that are not otherwise exposed to malaria. The map below shows, where malaria is currently epidemic in Africa. Malaria epidemics often overlap with **complex emergencies, both natural and manmade**. A considerable proportion of global malaria deaths occurs among populations affected by conflicts. In Africa alone this is the case in 18 countries. The risk factors that lead to a higher malaria burden include population displacement, increased vulnerability as a result of malnutrition and concurrent infections, exposure to malaria vectors from poor or lack of housing, collapse of health services and supply lines, and environmental deterioration resulting in increased vector breeding. Case management with ACTs is recommended in complex emergencies, with ACTs made widely available in health facilities and through outreach to affected populations. Vector control measures need to be assessed carefully for each setting and to aim for high coverage to be effective.

Malaria epidemics can largely be predicted through a combination of socioeconomic and meteorological information and local epidemiological knowledge. For timely **prevention of malaria epidemics** early detection through **weekly disease surveillance** (population based health information systems with case notifications) **is called for** and control tools need to be available for rapid deployment. Malaria early warning systems can predict the risk of epidemics from seasonal changes based on satellite observations. Currently at least 8 African countries are developing malaria early warning systems, whilst the effective use of the weekly surveillance data for timely interventions remains an area of ongoing operational research.

For further information, see also:

http://www.rbm.who.int/cmc_upload/0/000/015/365/RBMInfosheet_8.htm

Source map: Roll Back Malaria



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