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Malaria: Country Profiles

Version 1.1

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Cover photo: RBM/Vergaard Frandsen

Contents

Introduction to the profiles

DFID commissioned these profiles for health advisers in our country offices. Profiles were prepared for all countries where DFID has an office and where malaria is a public health issue. However, this is not meant to imply that DFID will have a malaria programme in any given country. **This is not a policy document and does not represent DFID's policy position**. Further information on DFID's policy commitments on malaria can be found here.

Please note that the interpretation of the evidence and the views expressed in these profiles are entirely those of the authors and do not necessarily represent the views of DFID.

The profiles were written in October 2010 as rapid reviews from the Malaria Consortium,[1] with minor updates and the separation of Sudan and South Sudan profiles in July 2011. First published in July 2011, **version 1.1 has some updated maps** provided by the Malaria Atlas Project; no other changes have been made.[2] The profiles should be read in conjunction with country data available in the World Malaria Reports published and updated by the World Health Organization (WHO).[3]

The profiles use evidence from multiple sources, much of which is country specific, and so profiles are not necessarily directly cross-comparable. Further, whilst peer reviewed evidence is used where available and appropriate, reported data is not necessarily from peer reviewed sources (for example, many profiles use data from national statistics bureaus or health department strategy documents).

For a broader and more detailed overview of evidence related to the burden of malaria and interventions, please see the accompanying DFID evidence paper *Malaria: Burden and Interventions*.

[1] Oliver Williams and Sylvia Meek with Tarekegn Abeku, Ebeneezer Baba, Kate Brownlow, Baltazar Chilundo, Masela Chinyama, Prudence Hamade, Maxwell Kolawole, Caroline Lynch, Stephen Moore, Antonia Pannell, Clare Riches, Richard Ato Selby, David Sintasath, Agonafer Tekalegne. Additional contributions by Mark Rowland and Allan Schapira.

[2] The 'spatial distribution' maps show the mean probability than an individual will have *P. falciparum* parasites in their blood. The 'risk' maps show where clinical malaria case are found. For further information on the methods used to construct the Malaria Atlas Project maps, go to: http://www.map.ox.ac.uk/data/.

[3] www.who.int/malaria/about_us/en/index.html

Africa

Democratic Republic of Congo

Summary table: malaria in Democratic Republic Congo

Parasites	*P. falciparum, P. vivax*
Vectors	*A. gambiae, A. funestus, A. nili, A. moucheti, A. brunnipes, A. paludis*
% of people under ITNs and variation across the country	37% of population covered by ITNs (2008).
First-line drug for *P. falciparum* (unconfirmed)	AS+AQ
First-line drug for *P. falciparum* (confirmed)	AS+AQ
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	CQ and SP resistance was first identified in 2000 and both were discontinued as malaria treatments in 2001 as policy.
IRS use	Not widely used, with just 83,000 people covered in 2008.
IPTi use	Not in use.
IPTp use	In use due to high ANC coverage (80%), but IPTp utilisation is low (7% IPT2 in 2007).
Evidence of diagnostics being used to direct antimalarial treatment	Microscopy is only mandatory when first-line treatment fails, RDTs not available at the community level. Majority of malaria cases are clinically diagnosed.
	July 2011

1. Introduction

The Democratic Republic of Congo (DRC) is the third largest country in Africa, and one of the poorest. It has just emerged from two decades of civil war, and sporadic violence continues in places. This has led to a highly fragmented and dilapidated health system, a complex supply management and distribution system, and the presence of a myriad of partners providing a highly variable coverage of basic essential services.[1] Health System Strengthening (HSS) is underway, but in the mean time the poor state of the public health system is hindering malaria control. Further constraints include the inaccessibility of many populated areas of DRC, the poor state of transport infrastructure and the lack of financial resources needed to procure malaria control commodities.[2]

2. The Burden of Disease

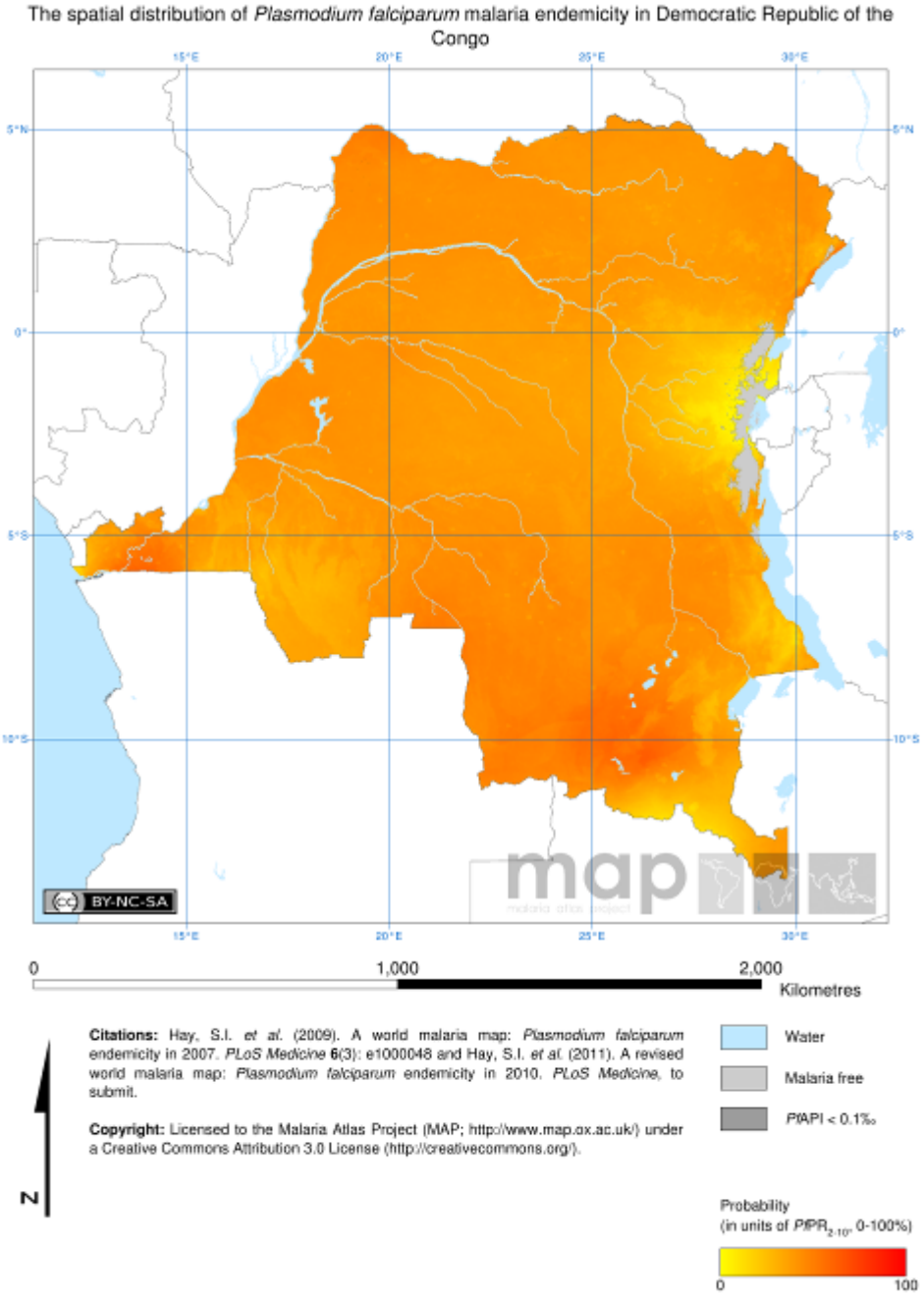
Malaria is the biggest cause of morbidity and mortality in the DRC, with 5 million cases and 18,928 deaths in 2008. While this represents a pattern of increasing reported cases and mortality rates, it is unclear whether this is due to rising infection rates or more accurate reporting.[3] Malaria causes 59% of outpatient consultations and 48% of hospitalisations of

children under five. Malaria is also the cause of 37% of deaths in hospital of children under five.[4]

In the DRC, 97% of the population live in areas experiencing high and stable malaria transmission, and 3% of the population live in more mountainous, epidemic prone areas in the east (Kivu and Katanga). DRC has three different epidemiological zones; the equatorial forest zone with high morbidity in under fives; the tropical zone where transmission increases during the long rainy season which lasts between 5 – 8 months and where morbidity is highest in children under 10; and the mountainous area of the Kivus and Katanga provinces in the east which are fringe areas, and prone to epidemics. 97% of the population live in equatorial forest and tropical zones where malaria transmission is highest. *Plasmodium falciparum* is the most common parasite species in DRC, causing 95% of infections. *P. vivax* accounts for the other 5% of cases. The main vectors are *Anopheles gambiae* (92%) and *A. funestus* (the main vector in the eastern high plateaux); *A. arabiensis* has been reported in the east. *A. nili*, *A. moucheti*, *A. brunnipes*, and *A. paludis* represent secondary vectors.

Vector	**Breeding places**	**Biting habits**	**Resting habits**
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

In 1983 DRC registered its first cases of *P. falciparum* resistance to chloroquine; seven studies were conducted across the country between May 2000 and November 2001 and resistance to chloroquoine was shown to vary between 29 and 80% and 0 and 18% for sulfadoxine-pyrimethamine (SP). In 2001 therefore, DRC temporarily replaced chloroquine with SP as its first line treatment of uncomplicated malaria over a two year period, during which potential alternatives to SP were evaluated. Six studies were undertaken between 2002 and 2004 on the therapeutic efficacy of SP and the alternative combination therapies. The results led to Artemisinin-based Combination Therapy (ACT) containing amodiaquine (AQ) being adopted for first-line malaria treatment.[5]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Malaria control interventions in DRC are coordinated by the National Malaria Control Programme (NMCP), which operates based on the National Malaria Strategic Plan 2007 – 2011. The stated goal of this is to reduce malaria-related mortality and morbidity by 50% by 2011. The specific objectives of the NMSP are:[6]

- to achieve Long-Lasting Insecticidal Net (LLIN) coverage of at least 80% of the national population
- to achieve LLIN coverage of at least 80% of children under one year and of pregnant women

- to achieve Intermittent Preventive Treatment (IPT) coverage of at least 80% of pregnant women
- to achieve case management in conformity with the national directives in at least 80% of cases.

3.2 Prevention

LLIN distribution forms the core aspect of preventive malaria control interventions in DRC. The lack of LLINs has been one of the major problems hindering malaria control in the past, but this is being tackled by intensive net distribution through both mass campaigns and targeted provision. Recently the distribution of LLINs through mass campaigns to under fives has been successfully implemented in a progressive way in three provinces, by integrating distributions with Expanded Program of Immunisation (EPI), nutritional campaigns and antenatal care (ANC) appointments.[7] Between 2006 and 2008 11.2 million LLINs were distributed in DRC, sufficient to cover 37% of the population.[8] Issues that have constrained net distribution in the past, and will continue to be a problem, are the inaccessibility of much of the country, the poor quality of the transport system and coordination problems caused by the lack of an adequate communication network. The majority of LLIN distribution is done by air, although the use of the River Congo is being considered.[9] Other problems include the lack of guidelines for partners on methods of LLINs distribution, costings for LLINs by type of campaign, or guidance on standard registration of LLIN distributions. In addition, there is no clearly standardised tracking system of LLINs from province out to zone and down to health facility level or community. Nor does there exist a centralised database which aggregates who is distributing LLINs, where they are being distributed by zone, or when they were distributed. Finally, increased financial support will be required, as there are still insufficient LLINs in-country to protect all those at risk from malaria.[10]

IPT is also being used as a preventive measure in DRC, facilitated by the high levels of ANC attendance, with the intention of covering 80% of pregnant women by 2011. This target is to be reached through dissemination of the national IPT protocol; training of ante-natal health care providers on integration of IPT in routine activities; and ensuring supply of the necessary medications for IPT in health zones. There are no mobile teams used to give out SP. However, despite high ANC attendance IPT treatment rates remain low. The timing of ANC visits and the costs involved for the patient are possible reasons for this.[11]

Indoor Residual Spraying (IRS) has historically had no role in malaria control in DRC, but was introduced on a small scale in selected districts in 2008, sufficient to cover 83,000 people. IRS does not have a major role to play in the NMCP current Strategic Plan.[12,13]

3.3 Case Management

There is very low capacity in DRC for the parasitological confirmation of cases. NMCP guidelines state that a case should be treated presumptively based on symptoms at the peripheral level, and only referred for laboratory confirmation when the patient does not respond to first line treatment, or in complicated malaria cases. There is currently no quality assurance for microscopy and poor maintenance of equipment. The number of trained microscopists in the country is unknown.[14] Rapid Diagnostic Tests (RDTs) were introduced for the first time as part of the NMCP's successful Round 8 Global Fund proposal. RDTs are not used at the community level, however.[15]

ACTs have been adopted in DRC for first-line treatment of *P. falciparum,* but there is inadequate supply to treat all cases. In 2008 1.7 million treatment courses were delivered, sufficient to treat just 32% of cases.[16] A lack of funding is the main cause for this lack of

ACTs, but the problem is complicated by poor management, transportation difficulties and ineffective or non-existent M&E and centralised data collection.[17] Due to the cost-recovery nature of healthcare, which places the costs of treatment on the patient, only partly subsidised ACTs led to an uptake of just 25% in 2007. Furthermore, healthcare staff are currently insufficiently trained to administer ACTs, and in some areas there is public resistance to AQ due to its side affects. Therefore SP and chloroquine continue to be used across the country to treat malaria; despite rising resistance to which their continued use is contributing.[18]

3.4 Supporting Interventions

The NMCP recognises the importance of communicating information about malaria to the population, and has devised a Programme for National Communication and Mobilisation (PNCM) that concentrates on advocacy, social mobilisation, Behaviour Change Communication (BCC) and social marketing. However, most departments and programmes develop their own materials with little input from the PNCM, which has few resources to be able to coordinate communications and mobilisation for the whole ministry. The Ministry of Health (MOH) has a website which includes some information on malaria, but this is not kept up to date regularly. At the central level of the NMCP the communications department has two trained communications specialists, but there are no further trained staff. Coordination around communications activities takes place within the Task Force, but regular meetings are not held.[19]

The main areas for advocacy are the removal of tariffs and taxes on malaria control goods and the regulation of the local manufacture of LLINs. Other than a brief mention of malaria during his speech to the UN assembly, neither the president nor any other key political figures have been involved in advocacy or message reinforcement for malaria control in DRC. Social mobilisation and BCC approaches are to use famous singers, civil society, opinion leaders, schools, businesses (employers) and community health workers to convey messages. Theatre is also used to reinforce messages occasionally and radio spots, t-shirts, posters and occasionally SMS messages are used as promotional materials. The development of Information, Education and Communication (IEC) materials is based on multi-sectoral involvement, with tools updated to reflect changes in implementation. IEC is targeted, generally towards pregnant women and caregivers. Approaches include household visits and radio, but the extent of these activities is dictated by the availability of resources on the ground. The lack of qualified personnel at the intermediary level to mobilise advocacy and education at lower levels and the lack of financial resources for the reproduction of IEC/BCC materials represent the two biggest problems.[20]

Monitoring and evaluation (M&E) and surveillance systems are neither well developed nor strong in DRC. In particular, M&E of LLIN distribution and usage is poor, with only some areas recording register lists, the incomplete collection of data and no central database for recording such information. Sentinel sites have been established, but it is not clear how often and accurately data are being collected. There appears to be a problem in the reproduction of basic registers for use at health facilities. In addition, Health Management Information Systems (HMIS) data registers are not delivered through the national supply system when medications are being distributed. Lastly, because of the multiple supply routes being used by various donors and partners, HMIS data are often not collected at health facilities as partners are collecting data for their specific activity or donor-related reports.[21]

3.5 Delivery Systems

With the erosion of the health system over the last 20 years caused by war and a lack of funding, the private sector has proliferated in DRC. The public health system is currently thought to reach about 26.2% of the population, and thus it is estimated that most people

seek their health care from private practitioners.[22] There are no current estimates about how many private health practitioners there are in DRC, but some private clinics are incorporated into the public health system and are included in training and provision of ACTs; in some provinces private provision can account for as much as 60%. Beyond those that are integrated into the system there is little or no regulation of private sector healthcare.[23] Furthermore, a survey by the *École de Santé Publique* (public health school) in March 2008 showed that nearly half (48%) of the children under 5 presenting with fever were treated at home. Among these, only 21.5% received antimalarial drugs, and 17.8% within 24 hours after the occurrence of the fever.[24] The NMCP is therefore attempting to expand treatment of suspected fever through Home Management of Malaria (HMM), which is being piloted in 224 sites within the framework of the National Program for Integrated Management of Childhood Illnesses in the Community (PCIME-C).[25]

In addition to private-for-profit health care, non-governmental and faith-based organisations are an important source of service provision, particularly in the east of DRC. However, coordination with the government has been limited.

4. Health System Issues

Effective malaria control in DRC is significantly hindered by the failings and inadequacies of the health system. Under-funded and neglected through 20 years of conflict, the health system provides poor quality service that varies hugely across the country. This has led to low public confidence in the health system, which has caused low utilisation of these services. Healthcare workers are poorly paid, unmotivated and lack training, which has contributed to high staff turnover and a debilitating human resource shortages. The human resource situation is so dire that it is not actually known how many health workers there are in DRC. An audit is in progress.[26,27]

The DRC government is attempting to address these health system issues with a Health System Strengthening Strategy (HSSS) which steers all interventions in the health sector. This involves a major reorganisation and restructuring of the public healthcare system, the improvement and expansion of services, increased training and supervision of workers, the production of new guidelines and quality assurance procedures, revised data collection, transmission and analysis mechanisms, and concentrated BCC to support the overall programme of Health System Strengthening (HSS).[28] Furthermore, the National Essential Medicines Supply System has been established in order to rectify the fragmented and complex supply management systems for health commodities.[29]

5. Current Funding and Technical Support

Financing of the malaria programme is fragmented and largely dependent on external donors, with just $2 million a year provided by the government budget. There is a funding gap of $464 million which needs to be filled if DRC is to meet its 2013 malaria prevention and control targets. The total need for the country, according to the estimated malaria burden, is over $1 billion between 2008-2013. The major area of intervention requiring support is the provision of LLINs.[30]

The Global Fund is supporting malaria control in DRC through a Round 8 grant of $138,332,628 for the period 2009 – 2012. The primary focus of this grant is LLIN distribution, IPTp provision and ACT scale-up.[31]

The World Bank is providing $100 million through Phase II of the Booster Programme for Malaria Control in Africa, which is going towards LLIN, ACT and SP procurement and distribution. $40 million was provided in 2008.[32]

The African Development Bank (ADB) supports case management activities through the provision of ACTs(12, 000 doses of ACT in 2007), SP for use in IPTp, and 78,000 LLINs in 26 health zones of the Eastern Province between 2008 to 2010.[33]

UNICEF, from 2008 to 2012, is providing substantial support for the acquisition and distribution of ACTs, SP to pregnant women and LLINs in 40 health zones in all 11 provinces of the DRC.[34]

The European Union provides financial support for the strengthening of the HMIS.[35]

In addition to technical expertise, the WHO provides materials for the coordination of epidemic control.[36]

6. Major Gaps

There are multiple gaps, ranging from basic inadequate quantities of commodities to major inadequacies in human resources and information systems, all of which make malaria control a challenge.

Ethiopia

Summary table: malaria in Ethiopia

Parasites	*P. falciparum, P. vivax, P. malariae, P. ovale*
Vectors	*A. arabiensis, A. pharoensis, A. funestus, A. nili, A. pharoensis*
% of people under ITNs and variation across the country	ITN coverage rose to 65.6% in 2007.
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	QN(7d)
Treatment of *P. vivax*	CQ
Evidence of insecticide &/or drug resistance	Resistance to DDT has been detected in places. SP resistance is high, which has contributed to the absence of IPTp.
IRS use	IRS is used for epidemic prevention and control in target areas with seasonal and intense transmission. IRS coverage was 20% in 2007.
IPTi use	Not in use.
IPTp use	Not in use.
Evidence of diagnostics being used to direct antimalarial treatment	39% of reported cases were confirmed by RDT or microscopy in 2008.
	July 2011

1. Introduction

Ethiopia represents one of the greatest malaria control success stories of the last five years. The rapid scaling-up of preventive and case management interventions has had a dramatic impact on malaria prevalence, case numbers and overall mortality.[37] Despite these successes, challenges remain. These include strengthening the health system, improving monitoring and evaluation (M&E), surveillance and other support interventions, and further scaling-up the provision of preventive measures.

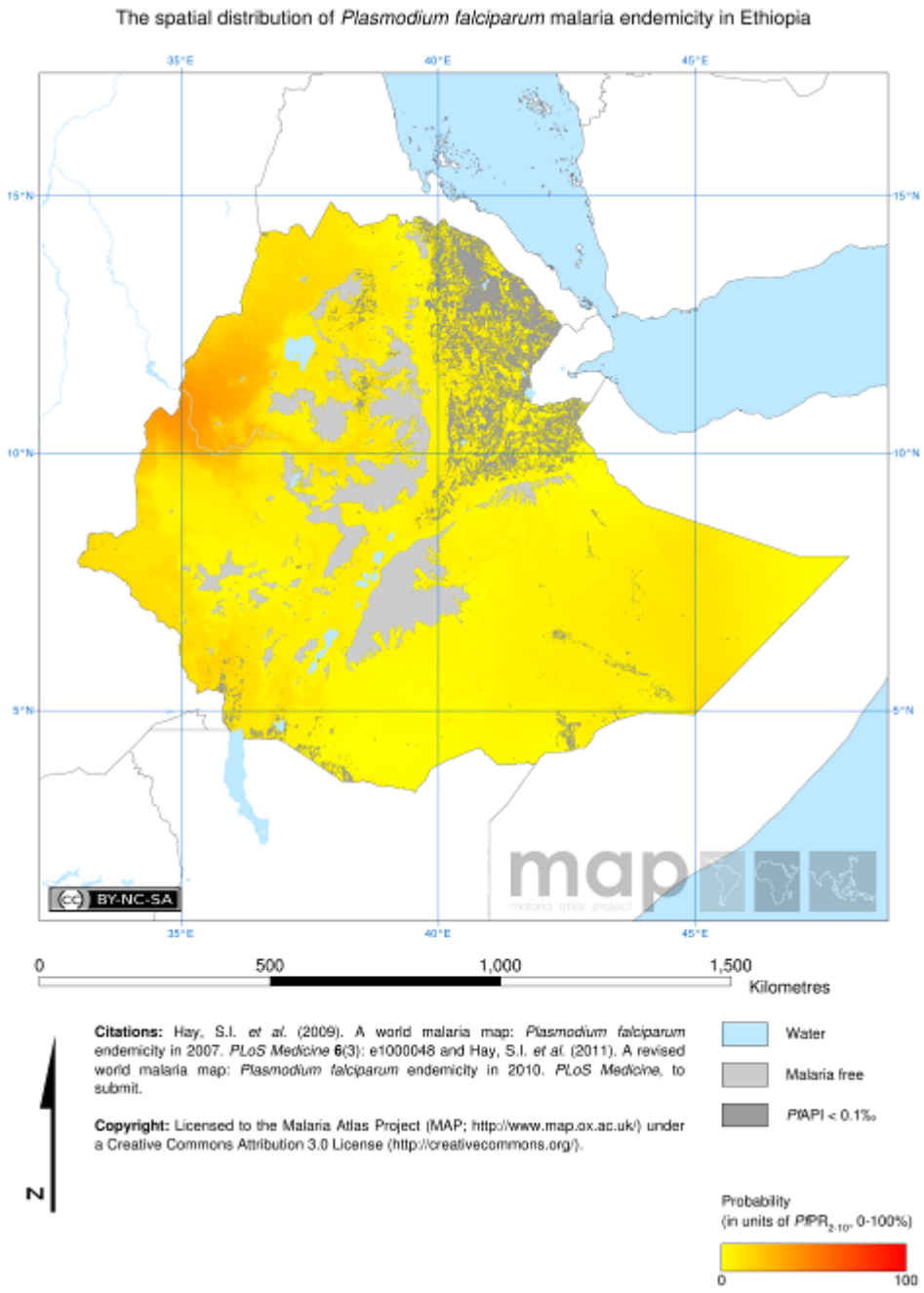
2. The Burden of Disease

Malaria is a serious problem in Ethiopia, where 68% of the 85.2 million people living there are at risk from the disease. Besides the individual suffering caused by malaria, the agriculture-dependent economy of Ethiopia is being weakened by the burden of this devastating disease.[38] Malaria is the leading cause of outpatient visits and it affects all age groups. The estimated number of malaria deaths in 2006 was 41,000;[39] however, there is a substantial inter-annual variation in incidence in most areas. In recent years, the number of cases has been falling; from an average of 3.2 million between 2001 and 2006 to 2,532,645 in 2008.[40]

Malaria in Ethiopia is unstable, seasonal and geographically-determined by climate and altitude. The country's geography ranges from vast low-lying areas intersected with lakes and rivers to high plateaus and mountain ranges. Epidemics are common, occurring every 5 to 8 years in various geographic areas.[41] Transmission rates peak on an annual basis following the two rainy seasons of mid-June to mid-September and February to April. In most areas, the main transmission season is between September and November. The highlands and highland-fringe areas are especially vulnerable to epidemic outbreaks.[42,43]

The most common malaria parasites in Ethiopia are *P. falciparum* and *P. vivax*, accounting for around 60% and 40% of infections respectively. *P. malariae* accounts for less than 1% and *P. ovale* is extremely rare.[44] The major malaria vector in Ethiopia is *Anopheles arabiensis* followed by *A. pharoensis, A. funestus* and *A. nili*. *A. pharoensis* in particular is widely distributed in Ethiopia, and while its exact role in malaria transmission is unclear, it has shown high levels of insecticide resistance.[45] Resistance to DDT has been detected in several sentinel sites, and the alternative insecticide in use is deltamethrin.[46]

Vector	Breeding places	Biting habits	Resting habits
A. arabiensis	Temporary rainwater pools.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals).	Mainly endophilic (rest indoors after feeding).
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The Federal Ministry of Health National Malaria Control Programme (NMCP) has made good progress towards the goal, set in the Strategic Plan 2006 – 2010, of reducing the overall burden of malaria (mortality and morbidity) by 50% by the year 2010.[47]

An updated National Strategic Plan for 2011 – 2015 aims to sustain the impact made by the successes of the 2006 – 2010 National Strategic Plan, while also striving to achieve malaria elimination within specific geographical areas with historically low malaria transmission, and to achieve near zero malaria transmission in the remaining malarious areas of the country.[48]

The objective of the 2011-2015 NMSP is to consolidate the achievements of the 2006-2010 NMSP, and sustain its impacts. This overall objective will be attained through the following specific objectives:[49]

- 100% of suspected malaria cases are diagnosed using RDTs and/or microscopy within 24 hours of fever onset;
- 100% of positive malaria cases are treated according to national guidelines;
- 100% of households in malarious areas own one Long-lasting Insecticidal Net (LLIN) per sleeping space;
- At least 80% of people at risk of malaria use LLINs;
- Indoor Residual Spraying (IRS) coverage is increased and maintained to 90% of households in IRS-targeted areas;
- 100% of health posts in malarious localities (Kebeles) provide the full malaria prevention and treatment package, including outreach services;
- To achieve a high quality, broadly-based malaria infection detection, investigation and response surveillance system in 100% elimination targeted malarious districts of the country.

3.2 Prevention

Malaria prevention in Ethiopia is based on the use of a range of vector control approaches, including the distribution of LLINs, IRS and source reduction through environmental management.[50] Over the last few years the scaling-up of preventive measures has been remarkably successful.[51] 19.6 million LLINs have been distributed between 2006 and 2008, covering 40 million people.[52] ITN coverage has increased from just 3% in 2005 to 65.6% in 2007, and 60.1% of children under five and 65.7% of pregnant women now sleep under an ITN.[53] However, some regions currently lag behind the national average and therefore require targeted preventive action.[54] To maintain these recent successes and to further increase ITN coverage, net distribution must continue in order to replace worn nets. Furthermore, Information, Education and Communication (IEC) and Behaviour Change Communication (BCC) must be strengthened in order to increase the level of net utilisation.[55]

IRS is used for epidemic prevention and control, and targets areas with seasonal and intense transmission. IRS has been used for several decades in Ethiopia, mainly using DDT. In recent years, coverage has increased from 17% of households in 2005 to 20% of households in 2007.[56] Challenges and limitations to IRS identified in the national strategic plan include the timing and quality of IRS; the development of high levels of resistance in vector populations, particularly to DDT; limited funds for insecticides, pumps, spare parts and vehicles; and the re-plastering of houses once sprayed. Although the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) is providing funds for IRS training in 40 districts, there is a critical need for the expansion of training for effective implementation of IRS activities.[57]

Intermittent Preventive Treatment (IPT) for pregnant women is not part of Ethiopia's malaria prevention strategy, as it is mainly recommended for stable malaria transmission settings.[58]

3.3 Case Management

Accurate diagnosis and prompt treatment is the core of the case management strategy in Ethiopia. Emphasis is being placed on accurate diagnosis of malaria through the use of microscopy and RDTs, in order to limit the unnecessary prescription of expensive ACTs. In 2008, 986,000 of reported cases (39%) were tested by microscopy or RDT, and 460,000 cases confirmed.[59] Artemisinin-based Combination Therapy (ACT) is used as the front-line

drug for treating *P. falciparum*, and chloroquine is used for treating *P. vivax*. Eight million treatment courses of ACT were delivered in 2008, double the number procured in 2007, which was sufficient to treat all cases reported in the public sector.[60]

However, only 40% of the population has access to public health facilities, which hinders the diagnosis of malaria by microscopy. Most diagnosis and treatment is carried out at the community level by Health Extension Workers (HEWs), 24,000 of which have been trained since 2005.[61] Even though case management has improved since 2005, with 11.9% of children under five with a fever taking an anti-malarial drug in 2007 compared to 4.0% in 2005, it is still below the RBM target.[62] ACT supply systems should be strengthened to prevent stock-outs. Malaria diagnostics services, including the use of RDTs, should also be strengthened and expanded.[63]

3.4 Supporting Interventions

The public's understanding of malaria and knowledge about interventions remains low. Of 4,438 surveyed women, 3,519 (79.5%) had heard of malaria, but only 2,244 (50.8%) recognised fever as a sign of malaria, 1,763 (41.2%) mentioned mosquito bites as the cause of malaria, and just 1,792 (38.2%) cited mosquito nets as a prevention method for malaria.[64] IEC and BCC has not matched the scale-up of preventive and case management interventions, which is hindering the uptake and utilisation of control commodities. The focus of BCC activities has been on the commodities being introduced, with little elaboration on the appropriate use of these products. Furthermore the financial, logistical and infrastructure resources allocated for BCC activities were not commensurate with the effort needed for comprehensive and long-term behaviour change. The current community-based, interactive social communication tools in use are still limited in scope, consequently resulting in low impact on behaviour change.[65]

Monitoring and evaluation (M&E) procedures, Health Information Systems (HIS) and surveillance systems are currently inadequate, and require significant strengthening. They do not provide sufficient quality and timely data, which has hindered the ability of the NMCP to determine the existing coverage of, and continuing need for malaria prevention and control interventions. Additionally, the lack of a comprehensive commodities tracking system to monitor procurement, distribution and stock levels of malaria commodities, including LLIN, RDTs, ACTs and insecticide for IRS, has hampered planning, commodity procurement and distribution, and programme M&E.[66] As Ethiopia continues to scale up malaria interventions, and moves towards the pre-elimination stage, M&E, research and surveillance will become increasingly important for identifying and tackling remaining malaria endemic areas.[67]

3.5 Delivery Systems

Private sector involvement in malaria prevention and treatment is not well developed in Ethiopia, and what little true commercial activity exists is focused around the larger urban areas. The LLIN commercial sector turnover is around 1,000 – 1,200 nets per month or 12,000 – 14,000 per year.[68]

At the same time the public healthcare system needs to be strengthened, with just 40% of the population covered by health services. The Health Extension Programme has contributed significantly to community-level implementation of malaria prevention and treatment interventions. The Health Extension Workers, who are paid workers, carry out vital health promotion, prevention and basic treatment across Ethiopia, and are especially important in rural areas.[69]

There is also a strong Malaria Control Support Team comprising of multilateral and bilateral donors, governmental and non-governmental organisations (NGOs), which contributes to collaborative actions such as mobilising resources.[70]

4. Health System Issues

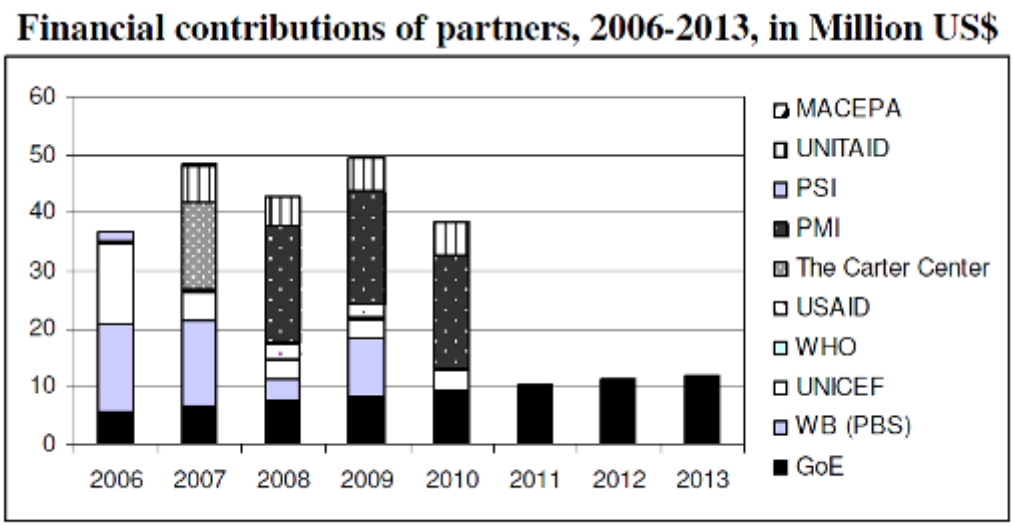
The public healthcare system needs to be strengthened in Ethiopia. Access to health care is unevenly distributed across the country, service delivery of health commodities is significantly constrained by a lack of sufficient transport resources, and the lack of both an efficient Health Management Information System (HMIS) and M&E system hinders planning and implementation of malaria interventions.[71] The Federal Ministry of Health (FMOH) faces a severe HR shortage, an inadequate distribution of skilled staff, and a lack of the necessary staff skill mix. The supply management and procurement system is also weak; during the first year of GFATM-supported proposal implementation, international procurement of drugs and other health commodities was delayed due to the low capacity and lack of experience in international procurement at the Pharmaceutical and Logistic Department of Ministry of Health.[72]

The FMOH is in the process of implementing a Health Extension Programme (HEP) as part of its ongoing Health Service Development Programme (HSDP-III).[73] The aim of the HEP is to realise universal health coverage through the improvement of the health sector's human resources. This is to be achieved through the building of 15,000 posts, staffed by 30,000 HEWs in all 626 districts of the country. Two HEWs staff each post, and are responsible for carrying out malaria diagnosis and treatment at the community level.[74] To date, more than 24,000 (75% of the target) have been trained in integrated management of diseases including malaria. However, improved access (87% population) does not mean improved utilisation of services (32% of the population).[75]

5. Current Funding and Technical Support

The GFATM has allocated several grants to support Ethiopia's NMCP; Round 2 (2003 – 2008; $73 million), Round 5 (2005 – 2010; $140 million) and Round 8 (2009 – 2011; $276 million). With this support, the Government of Ethiopia's FMOH was able to dramatically scale up its efforts in malaria prevention and control.[76]

LLIN procurement and distribution is being supported by the World Bank, USAID (through PMI), Carter Centre and UNICEF. ACT procurement is being supported by UNITAID, GFATM and PMI. IRS coverage is being supported by USAID (PMI) and the World Bank. IrishAid provides support for health systems strengthening for malaria control.



Source: Global Fund 2008.[77]

6. Major Gaps

The following gaps in intervention scale-up were identified based on the MIS 2007 report and FMOH-led programme assessments:

Under-utilisation of interventions
Although the ITN utilisation rates reported in the MIS 2007 for children under five and pregnant women are among the highest in malarious countries throughout Africa, they remained below the Roll Back malaria (RBM) target: 60% of children under five and 65% of pregnant women reported having slept under an ITN the night preceding the survey in households that owned at least one ITN (in areas below 2,000m altitude). In addition, access to and use of anti-malarial treatment for fever episodes remained low. This may be due to lack of access to health facilities in some regions and/or poor understanding of the causes of fever and the danger of malaria. It is also important to note that interpreting malaria treatment data from population-based household surveys is complex, particularly in areas experiencing significant declines in the number of malaria cases due to scaling-up prevention measures and when diagnostics become more widely available. In these areas, measuring treatment among all febrile children is less useful for monitoring the success of programmes that are better targeted toward treating only confirmed cases. The RBM Monitoring and Evaluation Reference Group (MERG) therefore recommends that the proportion of children under the age of five with a fever in the two weeks preceding the survey that were given a finger- or heel stick be measured. This indicator is taken into account in the Strategic Plan (see Case Management component). The MIS 2007 also showed that only 44% of women aged 15-49 recognize fever as a symptom of malaria and < 5% reported IRS as an effective means of protection against malaria. These results may be due to the limited malaria BCC activities that have been implemented since 2005, which did not match the scale-up of main malaria commodities such as LLINs, RDTs and ACTs. The financial, logistical and infrastructure resources allocated for BCC activities were not aligned with the effort needed for comprehensive and long-term behaviour change.

Monitoring and evaluation system.
Currently, the established system does not provide sufficient, quality and timely data, and therefore has not enabled the Malaria Control Programme to determine coverage nor quantify needs for malaria prevention and control interventions. Additionally, the lack of a comprehensive commodities tracking system to monitor procurement, distribution and stock levels of main malaria commodities, including LLIN, RDTs, ACTs and insecticide for IRS has hampered planning, renewed commodity procurement and distribution as well as programme M&E. These weaknesses have been recognized and are addressed in the GFATM Round 8 proposal.

Gaps in service delivery:

- **LLINs***:* Following the successful scale-up of LLIN distribution to provide 100% of households with an average of two LLINs each, there is now a need to develop a net replacement strategy. In addition, the number of households in need was underestimated, and some nets were distributed to areas with little malaria. This gap was taken into account in the Global Fund Round 8 proposal and the need for additional LLINs partially addressed. The national LLIN strategy has been updated and now includes a replacement strategy and a targeted distribution strategy[4].

[4] Geographical targeting will be based on all *Kebeles* identified as malaria affected. The majority of these *Kebeles* lies below 2,000 meters altitude, although those above this altitude and subject to epidemic outbreaks will be targeted as well.

- **IRS***:* The previous Strategic Plan aimed to cover at least 60% of households in epidemic-prone areas (where 44.2% of the total population lives) by 2010. The MIS results showed that only 14% of households had been sprayed in the past 12 months. Even though this is a national percentage, the FMOH estimates that at best 30% of households in IRS target areas were sprayed in 2007-2008, largely due to a lack of funds available for this activity. The Global Fund Round 8 proposal includes a substantial budget for IRS activities (nearly 35% of the overall budget) and aims to cover at least 90% of households in epidemic-prone areas by 2013.
- **Supply of diagnostics***:* microscopes have been provided to most of the newly constructed health facilities through government and partner support, but because the coverage of hospitals and health centres in Ethiopia is low, only an estimated 30% of the population has access to microscopic diagnosis for malaria. The RDTs used to date do not detect *P. vivax* infections, which compromises adherence to the test results and, in turn, leads to misuse of anti-malarial treatments. Therefore multi-species RDTs are endorsed by the Ministry for use in Ethiopia. HEWs have been trained on the use and interpretation of results of multi-species RDTs.

Ghana

Summary table: malaria in Ghana

Parasites	*P. falciparum, P. ovale, P. malariae*
Vectors	*A. gambiae, A. funestus, A. melas, A. arabiensis*
% of people under ITNs and variation across the country	40% of the population are covered by an ITN (2008).
First-line drug for *P. falciparum* (unconfirmed)	AL, AS+AQ
First-line drug for *P. falciparum* (confirmed)	AL, AS+AQ
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	High levels of resistance to DDT, Bendiocarb, and some pyrethroids in *A. gambiae* and resistance to DDT and Bendiocarb in *A. funestus* have been recorded. The resistance levels vary from district to district.
IRS use	IRS began to be used in 2006, and in 2008 it protected 600,000 people.
IPTi use	Not in use.
IPTp use	In 2008 62% of pregnant women who visited health facilities were documented to have received IPTp1, 38% IPTp2, and 36% IPTp3.
Evidence of diagnostics being used to direct antimalarial treatment	Just 14% of treated malaria cases are confirmed by RDT or microscopy.
	July 2011

1. Introduction

Ghana is a hyper-endemic country with a large malaria burden. Malaria control interventions have had some impact in recent years, but a lack of financial resources and insufficient human resources are hindering further success.

2. The Burden of Disease

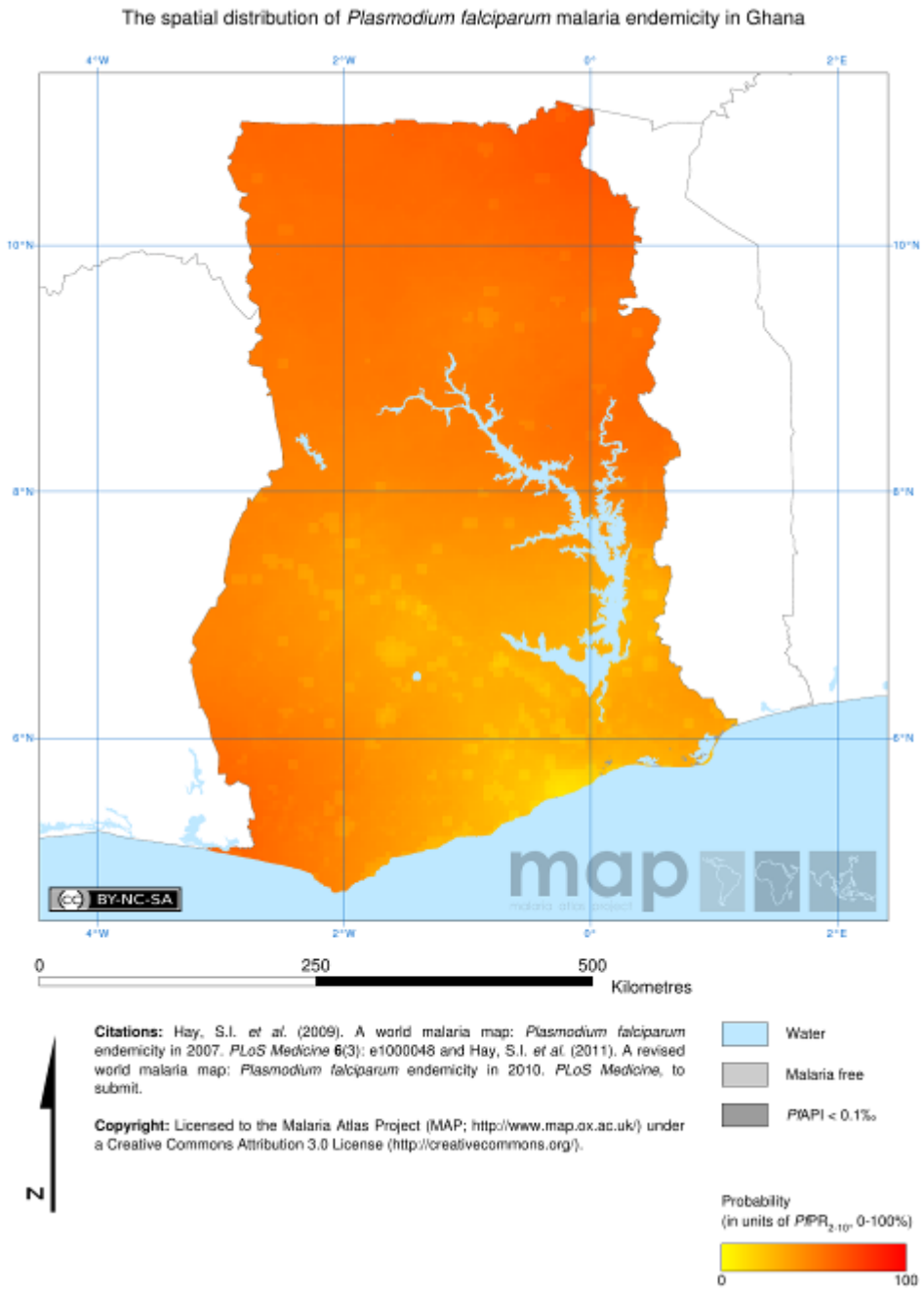
There were 3.2 million reported cases of malaria in Ghana in 2008, 900,000 of which were children under five years old; 26% of these cases were confirmed.[78,79] There was no evidence of a reduction in the number of cases between 2001 and 2007, and the numbers of reported inpatient cases and deaths have increased. It is not known if the rise is due to better reporting or a change in the incidence of malaria.[80] Presumptively diagnosed outpatient malaria cases account for 37.5% of all outpatient illnesses, 36% of all admissions and 33.4% of all deaths in children under-five years. Amongst pregnant women it accounts for 13.8% of all out patient department attendances, 10.6% of admissions and 9.4% of deaths.[81]

Malaria is hyperendemic in all parts of the country, with the entire population of 23.5 million at risk. Ghana can be stratified into three malaria epidemiologic zones: the northern savannah; the tropical rainforest; and the coastal savannah and mangrove swamps.

Accounting for 95% of all cases, the principal vectors are *Anopheles gambiae* and *A. funestus*. *A. melas* is found in the mangrove swamps of the southwest and *A. arabiensis* in savannah areas of northern Ghana, both in small proportions. Characteristically, these species bite late in the night, are indoor resting, and are commonly found in the rural and peri-urban areas where socio-economic activities lead to the creation of breeding sites. Transmission occurs year-round with pronounced seasonal variations in the northern part of the country, which has a prolonged dry season from September to April. The normal duration of the intense malaria transmission season in the northern part of the country is about seven months beginning in April/May and lasting through to September. There are no areas of epidemic malaria in Ghana. *Plasmodium falciparum* accounts for about 90–98% of all infections, *P. malariae* for 2–9%, and *P. ovale* for 1%. Mixed infections of *P. falciparum* and *P. malariae* are not uncommon.[82,83]

Recent vector susceptibility studies found high levels of resistance to DDT, bendiocarb, and some pyrethroids in *A. gambiae ss* and resistance to DDT and bendiocarb in *A. funestus*. The resistance levels vary from district to district.[84]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. melas	Salt water lagoons, mangrove swamps.	Endophagic and exophagic, anthropophilic and zoophily. Bite late at night.	Exophilic and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The National Malaria Control Programme (NMCP) is in the process of implementing its National Malaria Strategic Plan (NMSP) 2010 – 2015. The overall goal of the NMSP is to facilitate human development by reducing the malaria disease burden by 75% by 2015. This goal is to be achieved through overall health sector development, improved strategic investments in malaria control, and increased coverage towards universal access to malaria treatment and prevention interventions, including at the community level.

The specific objectives of the NMSP are:[85]

- deploy multiple prevention methods, including Long Lasting Insecticidal Nets (LLINs), Indoor Residual Spraying (IRS), Intermittent Preventive Treatment for pregnant women (IPTp)
- improve access to prompt and effective treatment
- strengthen monitoring and evaluation, and operational research
- strengthen the health systems at all levels
- create and sustain partnerships for malaria control.

3.2 Prevention

The NMSP sets an ambitious target of universal Insecticide-Treated Net (ITN) coverage by 2015, with 80% of the population sleeping under a net.[86] Coverage has been increasing recently, with 4.7 million LLINs being delivered between 2006 and 2008, enough to cover 40% of the population.[87] Further mass distributions are underway in 2010. According to the Demographic and Health Survey (DHS), the proportion of households owning at least one ITN has been increasing steadily, from 3% in 2003 to 19% in 2006 and 33% in 2008.[88] Furthermore, the proportion of pregnant women reported to have slept under an ITN the night before the survey increased from 3% in 2003 to 20% in 2008.[89] Nets are provided through free national campaigns, but also through a vibrant commercial sector. DFID, the GFATM and the President's Malaria Initiative (PMI) subsidise private sector nets, allowing ITNs to be sold at a reduced price.[90] Current problems include ITN stock-outs, a lack of secure storage at the sub-district level, logistical problems in traversing Ghana's terrain, prohibitive costs, and cultural and social barriers to increased net use.[91]

IRS only began to be used on a large scale in Ghana in 2006, and in 2008 it protected 600,000 people in selected high-risk areas.[92] The NMSP aims to cover one third of Ghana's districts by 2015, facilitated by a pending $110 million Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) grant for scaling up IRS.[93]

IPTp is now available at 94% of public health facilities, and a 2008 PMI survey showed that 62% of pregnant women who visited health facilities were documented to have received IPTp1, 38% IPTp2, and 36 % IPTp3. However, the same survey indicated that 27% of facilities experienced SP stock-outs, partly due to the continued use of SP as a general antimalarial despite NMCP guidelines prohibiting it. Furthermore, inadequate human, technical, and financial resources are contributing to less than full coverage of IPTp.[94,95]

Other vector control measures in the NMSP include larviciding, space spraying and environmental management.[96]

3.3 Case Management

Accurate diagnosis and prompt treatment are the essential components of the NMCPs case management strategy, but both face considerable problems in Ghana. Currently fewer than 14% of all malaria diagnoses in Ghanaian health facilities are based on laboratory examination, and the quality of those diagnoses is unknown.[97] It is generally recognised that laboratory services in the public sector are weak, with inadequate infrastructure, insufficient stocks and quality of equipment and supplies, and inadequately trained laboratory personnel. Routine supportive supervision and quality control activities do not take place consistently due to financial and human resource constraints at all levels. In 2008, a PMI–supported nationwide malaria laboratory assessment found that only 37% of facilities surveyed had a laboratory, and of the facilities with laboratories, 36% did not have all items for malaria microscopy (functioning electric binocular microscope, slides, Giemsa stain, and a trained laboratory technician).[98]

Clinical/symptomatic diagnosis is still the norm, especially at remote community level facilities where Rapid Diagnostic Tests (RDTs) are used on limited and inconsistent basis. This is an area needing greater attention to complement the adoption of new treatment guidelines.[99]

Scaling up appropriate malaria treatment remains one of the greatest challenges in Ghana. According to the preliminary report of the 2008 DHS, just 12% of children under five years old with fever were treated with an Artemisinin Combination Therapy (ACT) within 24 hours.[100] In 2004 Ghana adopted ACTs for first-line therapy, recommending the use of artesunate and amodiaquine (AS/AQ). However, reports of serious adverse side affects were recorded, causing a loss of public confidence in ACTs. A new revised policy was approved in January 2009 which recommended AS/AQ combination for uncomplicated malaria, either as a co-blistered formulation or a fixed dose combination formulation, and artemether-lumefantrine (AL) and dihydroartemisinin-piperaquine (DHAP) therapies as second-line treatments.[101] The 2007 NMCP survey showed that only 2% of community respondents indicated ACT use for a recent suspected child malaria episode. Chloroquine was still the largest single drug used (27%), while monotherapy artemisinin derivatives accounted for 5%. The Ministry of Health (MOH) has faced a difficult challenge of regaining public confidence in the new malaria treatment. People still prefer the old antimalarials even though these are no longer efficacious.[102] However, progress is being made. In mid-2008, a PMI–supported national health facility survey recorded that 91% of public facilities were using AS/AQ in their outpatient dispensaries. However, only 63% of healthcare providers knew the correct AS/AQ dose for a 20 kg patient, which may signal constraints in prescribing appropriate doses of ACTs.[103]

3.4 Supporting Interventions

Behaviour Change Communication (BCC) is an essential component of the NMSP, and is vital for the success of other malaria control interventions. The NMCP working in partnership with the Ghana Sustainable Change Project (GSCP) and other stakeholders (including PMI, the Roll Back Malaria Partnership and 47 local NGOs) has undertaken an evidence-based approach to developing a malaria communication campaign. Through the processes of desk reviews, formative research, community and national design workshops, a communication concept dubbed "*Let's come together to drive malaria away"* has been developed and is being implemented. The goal is to inform the general population about malaria transmission and available services and commodities, as well as to promote the proper use of AS/AQ as the first-line drug for treatment of malaria. With the overriding concept of mobilising the community to take prompt action for malaria, a set of materials has been developed to support a national discussion on malaria, inform the public on the new drug policy and support interpersonal communication at the community level.[104,105]

The NMCP has identified the following BCC gaps and challenges:[106]

- The NMCP 2007 Survey indicates that, while a large majority of people can state the role of mosquitoes in malaria transmission, many still hold additional and conflicting notions.
- There is a need to reinforce understanding that may lead to acceptance of malaria interventions — for example reluctance to use ACTs (especially AS/AQ).
- The longevity of ITNs is undermined by poor net maintenance practices, such as washing too often with harsh detergents and hanging to dry in direct sunlight.
- There is a special need to educate private providers, including the chemical sellers, on the correct malaria medicines.

- More attention is needed to prepare mothers for home management of malaria responsibilities.
- In IRS campaigns, it is well known that a key determinant of success is community and household acceptance of the spray operations.

Monitoring & evaluation (M&E) systems in Ghana are relatively good, but are fragmented, with problems relating to insufficient human resources, slow and inaccurate data collection and poor central data collation.[107] The M&E mechanisms in Ghana are, however, being restructured and strengthened under the MOH's National Malaria Control Monitoring and Evaluation Plan 2008-2015. This has been developed within the context of the internationally accepted framework for M&E, and it aims to establish an efficient and effective system of timely and accurate data collection, in order to facilitate better planning and implementation of malaria control.[108]

3.5 Delivery Systems

About 83% of all health facilities in Ghana are in the public sector, 10% are faith-based institutions and 7% are in the private sector.[109] Adherence to national malaria treatment policy in the private sector is considerably worse than in the public, which is problematic because approximately 60% of Ghanaians seek their initial treatment for malaria outside of public health facilities.[110] This is due to, for example: confidence in herbal treatments; the high direct and indirect costs of accessing care at facilities (including lost work time, the cost of transportation, and the cost of medical services and drugs if not insured); the perception of poor quality of services, including ill treatment by staff; and local attitudes and beliefs about fever, convulsion, and other malarial symptoms. The 2008 health facility survey found that just 69% of private for-profit facilities dispensed AS/AQ. When asked the dosage of AS/AQ for a 20 kg child, only 20% of private providers could provide the answer correctly, even if permitted to use reference materials. Ghana's private sector is also rife with multiple ACTs and artemisinin monotherapies that undermine the national drug policy and contribute to development of drug resistance.[111] More must be done to bring private treatment into line with NMCP guidelines if the ambitious targets within the NMSP are to be met. However, the NMCP has established some strong private sector partnerships, such as their collaboration with the Ghana Chamber of Mines and the "Ghana Club 100," as well as the convening of a business forum in April 2007.[112]

4. Health System Issues

Ghana has a decentralised health system which reaches from the national to regional, district and recently community level. The Community Health Planning and Services (CHPS) programme is developing a system of zones within the districts to ensure that eventually all communities will have access to a community health officer (usually a nurse or midwife).[113] There are several key challenges facing the national health system in its efforts to scale up priority interventions. These include poor access to quality basic health services, a lack of health infrastructure and equipment, and limited human resource capacity, which has been worsened by the exodus of key technical staff in the formal sector. There is weak management capacity in the health system, including poorly developed Health Management Information Systems (HMIS), procurement and supply systems and M&E mechanisms. Furthermore, there remains a large funding gap for the massive investment required to achieve the Millennium Development Goals (MDGs).[114,115]

Within the NMCP itself, human resources are a particular problem. The main concern is that half of the technical and administrative staff are not permanent, but are paid from GFATM grants. There are no dedicated NMCP staff at all below at the district and community level; instead the responsibility for malaria control interventions is placed upon overburdened

health sector employees. Health System Strengthening (HSS) has largely been neglected in GFATM grants, but the Round 8 grant for the first time directs considerable resources to the issue. An expected Round 9 application was expected to build upon this contribution to HSS but did not go through.[116,117]

5. Current Funding and Technical Support

Funding for malaria control in Ghana has increased from almost nothing in 2005 to about $90 million during 2006–2008, with annual expenditure of $30 million.[118] The Government of Ghana is committed to spending $86,217,602 between 2009 and 2013 on malaria control, mainly on human resources and IPTp.[119]

The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) has allocated funding to Ghana through several rounds over the last decade. A Round 2 grant ($8.9 million) expired in September 2008 and a Round 4 grant ($38.8 million) expired in March 2009. A six-year Rolling Continuation Channel (RCC) for $175 million was accepted in 2009, focusing on scaling up provision of prompt and effective treatment of malaria at health facilities, provision of IPTp to all pregnant women, and targeted provision of ITNs/LLINs to pregnant women and children under five. Finally, a Round 8 grant of $154,964,121 has been accepted for 2009 – 2014, focusing on IRS, Home Based Management of Fever (HBMF), HSS.[120]

UNICEF has committed $1,000,000 a year to provide support to IPTp provision and LLIN distribution.[121]

The President's Malaria Initiative (PMI) has pledged $36 million for 2010 to support IRS, LLIN, Procurement and Supply management, home based care, malaria diagnosis and operational research.[122] PMI provides support through the Promoting Malaria Prevention and Treatment (ProMPT) implementing project led by the University Research Co. (URC), with partners Malaria Consortium and Population Council, designed to provide technical and implementation support to Ghana's Ministry of Health to scale up key malaria interventions.

The World Bank is currently funding a $25 million Nutrition and Malaria Control Project for Child Survival. The Malaria component is a $10 million ITN distribution facility targeting 35 districts in the Volta, Central and the 3 regions in the Northern part of the country. The project has a Technical Advisory Group (TAG) as the governing council.[123]

In 2005 AngloGold Ashanti (AGA), a mining company operating in Obuasi (Ashanti Region) initiated a comprehensive malaria control programme in the Obuasi municipality with an initial cost of over $1.5million. Control interventions supported by AngloGold Ashanti include IRS, targeted larviciding, prompt and effective case management and ITN distribution. AngloGold Ashanti (AGA) has maintained that it will continue to play its part in the National Malaria Control initiatives implemented in Ghana.[124]

6. Major Gaps

High among NMCP's challenges is the desire to reach universal coverage, which is hampered by insufficient funds to procure the needed quantities of mosquito nets. The Programme needs to fill a gap of over 6 million LLINs in order to reach the target for universal coverage.

The numerous challenges can be summarised as follows:

- High rate of presumptively diagnosed malaria in health facilities
- Inadequate functional microscopes and skilled laboratory personnel to manage the anticipated increase in laboratory test requests

- Ensuring an uninterrupted supply of RDTs to all health facilities without microscopy
- Access to WHO pre-qualified quality ACTs, especially in the private sector
- Unsustained Behavioural Change Communication to positively affect people's perception, attitude and practices regarding malaria
- Bridging the wide gap between ITN ownership and usage
- Improving the quality of data management at all levels
- Scaling up and sustaining other preventive interventions including IRS
- Inadequate resources to support ITN procurement and distribution towards achieving the universal coverage
- Inherent bottlenecks in the health care delivery system that militate against effective malaria control

Kenya

Summary table: malaria in Kenya

Parasites	*P. falciparum, P. malariae, P. vivax*
Vectors	*A. gambiae, A. funestus, A. arabiensis, A. merus*
% of people under ITNs and variation across the country	48% of households owned an ITN in 2008.
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	Pyrethroid resistance has been detected in western Kenya. CQ resistance is high and therefore not used in malaria treatment as policy.
IRS use	IRS is implemented in selected districts, covering 307,207 households in 2008 and protecting about 3 million people at risk.
IPTi use	Not in use.
IPTp use	IPTp is in use, but just 15% of pregnant women received two doses of SP in 2008.
Evidence of diagnostics being used to direct antimalarial treatment	Most cases of malaria are not examined by microscopy or RDT and are diagnosed by clinical symptoms.
	July 2011

1. Introduction

Kenya has seen some success in the scaling-up of malaria control interventions, particularly in regard to preventive measures. Recent reports indicate a gradual decline in malaria prevalence and incidence in many parts of the country.[125] However, the quality and coverage of diagnosis and treatment still need to be strengthened. Greater financial support and considerable health system and support intervention strengthening is required in Kenya.

2. The Burden of Disease

Approximately 27 million people in Kenya are at risk from malaria (70% of the 39 million population), and there were 9 million suspected cases in 2007. The number of reported cases increased between 2001 and 2007; it is not known whether this represents improved reporting or an increase in incidence. Malaria accounts for about 30% of all outpatient consultations, 19% of all hospital admissions and roughly 40,000 deaths. Annually, an estimated six thousand pregnant women suffer from malaria-associated anaemia, and four thousand babies are born with low birth weight as a result of maternal anaemia. Economically, it is estimated that 170 million working days are lost each year because of malaria illness. There is evidence of progress however; since 2003 childhood mortality rates have reduced by 30% in part due to malaria control interventions.[126,127]

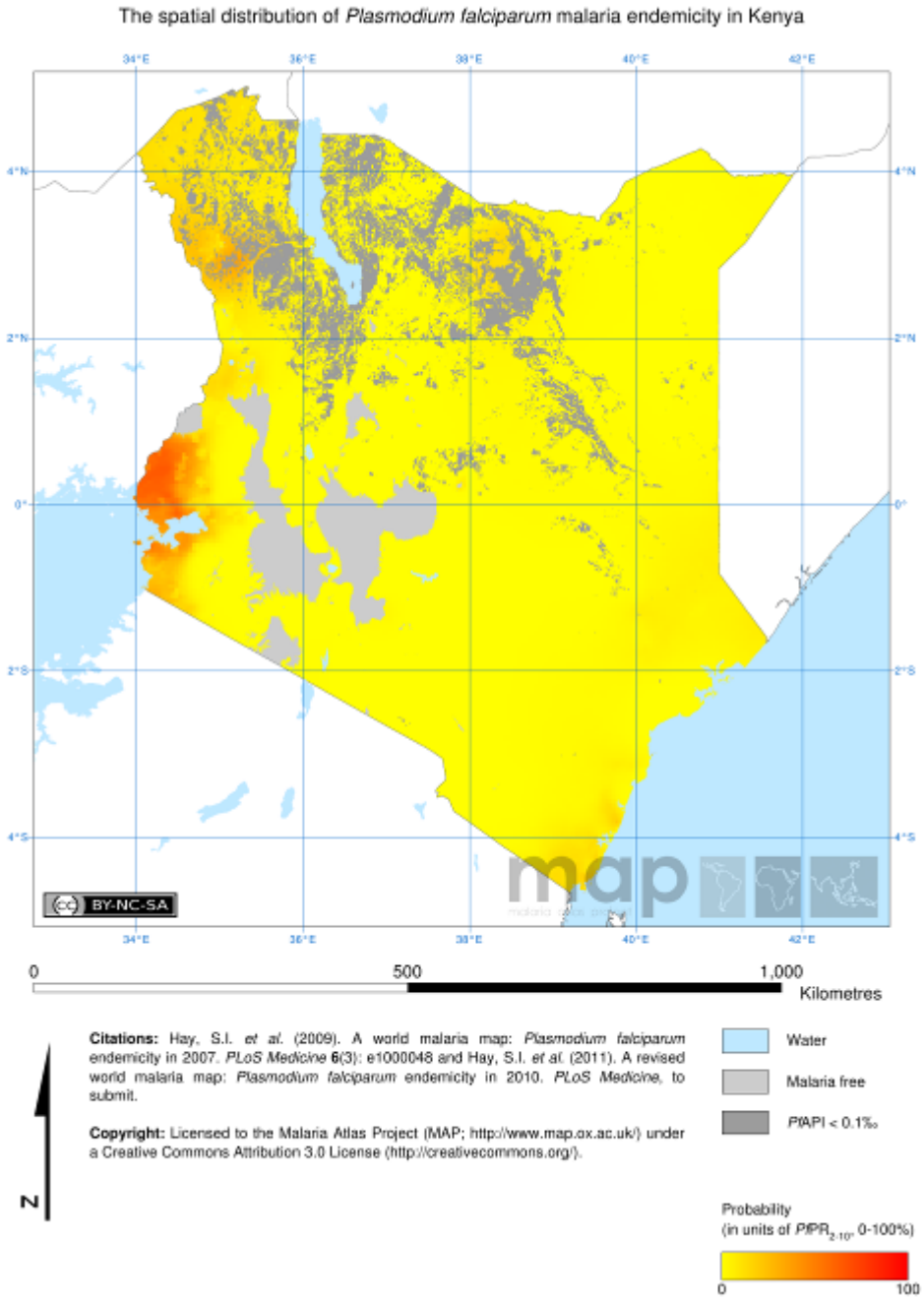
Kenya's districts can be divided into four malaria epidemiological zones. Districts along the shores of Lake Victoria and the south coast are endemic areas where malaria transmission

is stable and perennial, but with peaks from June to August and again in late November. The highly populated highlands, and arid/semi-arid sparsely populated lowlands, represent epidemic-prone areas. Transmission in the epidemic-prone and seasonal areas is highest from April through June. Finally, the highlands above 2,000 metres are generally transmission-free or at very low risk from malaria.[128]

Nationally, *Plasmodium falciparum* is the predominant species, accounting for 98.2% of cases, and *P. malariae* accounts for the remaining 1.8%. However, *P. vivax* may account for up to 40-50% of infections in the Northern and North Eastern parts of Kenya where the prevalence of malaria is on average <0.1%. The principal vectors in Kenya are members of the *Anopheles gambia*e complex and *A. funestus*. The species of *A. gambiae* complex found in Kenya are *A. gambiae s.s., A. arabiensis*, which are usually predominant during and after the rains, and *A. merus*, which is mainly restricted to the coastal strip. *A. funestus* occurs in low densities throughout the year.[129]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and zoophilic (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. merus	Salt water lagoons, mangrove swamps.	Endophagic and exophagic, mainly zoophilic. Bite mainly late at night.	Exophilic and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

Routine monitoring of the susceptibility of malaria vectors to insecticides used for Indoor Residual Spraying (IRS) is important for the judicious use of insecticides. In 2006 minimal resistance to used insecticides was recorded, with mortality rates of 98-100%.[130] However, studies in 2009 showed resistance had developed rapidly, to the point that mortality rates were 66.67% for permethrin, 68% for deltamethrin, 79.05% for DDT, 75.5% for bendiocarb and 70.3% for fenitrothion. This illustrates the importance of ongoing surveillance and operational research.[131]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The Kenyan Ministry of Health (MOH) executes malaria control through the National Malaria Control Programme (NMCP), which is based on the Kenyan National Malaria Strategy (KNMS), which has recently been revised for 2009 – 2017. The goal of the KNMS is to reduce morbidity and mortality associated with malaria by 30% by 2009 and to maintain it to 2017. The strategies for achieving this are:[132]

- clinical management: providing effective, prompt treatment

- management of Malaria and anaemia in Pregnancy (MIP)
- vector control using Insecticide-Treated Nets (ITNs) and other methods
- epidemic Preparedness and Response (EPR)
- information, Education and Communications (IEC)
- monitoring & Evaluation (M&E) and Research.

3.2 Prevention

ITN distribution represents one of the central components of Kenya's preventive malaria control interventions, with the latest KNMS targeting universal coverage. 10.4 million Long-Lasting Insecticidal Nets (LLINs) were distributed during 2006–2008, adequate to cover 31% of the population at risk.[133] Data from the Demographic Health Surveys (DHS) and Malaria Indicator Surveys (MIS) suggests that ITN coverage has been successfully scaled up over the last few years, with households owning at least one ITN increasing from 6% in 2003 to 49% in 2007 and to 54% in 2008. This is further illustrated by the proportion of children under-five sleeping under an ITN, which increased from 5% in the 2003 DHS to 51% in the preliminary 2008-09 DHS results.[134] Kenya currently has a multifaceted ITN distribution strategy, which includes providing free or heavily subsidised ITNs through routine distribution channels to vulnerable groups, subsidised distribution via commercial outlets and rural community based net sales, and periodic mass campaigns where free nets are given to targeted groups.[135] However, the success of recent campaigns will only be sustained if further ITNs are procured in order to replace nets as they wear out. Currently there is a gap of 7.4 million between the required number of ITNs for 2010 and the number funded and procured.[136]

IRS is being implemented in selected districts, covering 307,207 households and protecting about 3 million people at risk in 2008.[137] Sixteen districts are currently targeted for IRS in western Kenya, with a total population of approximately 6.5 million people. However, due to a shortage of funds in 2008, fewer than 400,000 houses were sprayed in the 14 highland districts. In 2009, the spray programme was delayed due to the late disbursement of Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) funds. By the end of the 2009 spray season, no structures had been sprayed. The GFATM Round 4 support for IRS activities in the highland districts continues through 2011, at which point the government plans to end its spraying programme in these districts. The impact IRS has had in reducing transmission rates, especially in the highland areas, has led to the NMCP looking to phase-out IRS in the highland, epidemic-prone districts, while increasing IRS activities in endemic districts, particularly those bordering the highlands. Greater levels of funding, and of a more consistent nature, will be necessary for the success of IRS in Kenya.[138]

Intermittent Preventive Treatment for pregnant women (IPTp) is another key aspect of the malaria control programme. The Division of Malaria Control (DOMC) estimates that approximately 80-90% of women attend one or more ANC clinic visits. One of the major challenges in increasing the uptake of sulfadoxine-pyrimethamine (SP) for IPTp appears to be the availability of SP at health facilities, which is connected to supply chain issues. Another problem is lingering negative community beliefs and counter-productive service provider attitudes. Consequently the proportion of women who received two or more doses of SP during pregnancy has stagnated. The rate was 4% in the 2003 DHS, which increased to12% as reported by the 2007 MIS and then to only 15% in the 2008-09 DHS. Improving the attitudes of the population through targeted IEC and Behaviour Change Communication (BCC) could help improve IPTp uptake.[139]

3.3 Case Management

The case management component of Kenya's malaria control strategy still needs to be strengthened. While the KNMS aims to scale up access to prompt and effective treatment to at least 80% by 2015, current diagnostic services are extremely poor. The health infrastructure should be developed further, more trained staff are required, and diagnosis using microscopy and rapid diagnostic tests (RDTs) needs be expanded. Unsurprisingly therefore, most reported cases of malaria are not confirmed. Rapid Diagnostic Tests (RDTs) are starting to be introduced in order to increase the coverage of diagnostic services in the light of the limited microscopy capacity.[140]

While Kenya has switched to the use of Artemisinin-based Combination Therapy (ACT) for first-line treatment following the widespread failure of SP treatment, access to early diagnosis and prompt treatment with an effective antimalarial has not yet reached the required level. The 2003 DHS showed that among those reporting a fever in the two weeks before the survey, only 11% of children under-five had taken antimalarial drugs the same or following day in accordance with national policy. This increased to just 12% in the 2008-09 DHS survey. Furthermore, the 2007 MIS found that although the national malaria treatment policy (2006) recommends prompt treatment with ACT, only 4% of children under-five received an ACT within 24 hours. The poor quality and limited national coverage of the public health system is a reason for this failure in provision, as are problems with drug procurement and supply management.[141]

3.4 Supporting Interventions

As has been mentioned, BCC is urgently required to support the preventive and case management interventions being implemented in Kenya. The policy environment is highly conducive to supporting BCC programming in Kenya; the various malaria partners have agreed upon a set of core prevention strategies, behaviours and target groups, and a National Communication Strategy for Malaria has been adopted and put into action. There is a full-time BCC staff person at the DOMC, as well an IEC technical working group in the DOMC that coordinates BCC efforts among donors. However, BCC efforts at the community levels is especially weak and faces particular challenges. There has been only limited community-level BCC in malaria prevention or treatment, and NGOs working in malaria BCC currently report that their staff and volunteers are overstretched due to limited funding and a high demand for malaria information and prevention. The MIS 2007 reported that 39% of women had heard about ACT, and that 61% of these received information from radio, 27% from a health worker and 11% from television. Only 0.6% heard about it at a community *baraza* (chief's meeting).[142] Additionally, local BCC programmes are faced with high community expectations of service provision such as free net distribution, over which the BCC programs have little control. Increased financial and human resources need to be allocated to BCC activities.[143]

Monitoring and evaluation (M&E) is predominantly part of the Health Management Information System (HMIS), which is the primary healthcare monitoring system and is responsible for collecting, collating, analysing, publishing and disseminating health data to all stakeholders for evidence-based decision making. The deficiencies of the HMIS include incompleteness and lack of timeliness in data collections, which is due to inadequate reporting forms at collection centres, insufficient funding for supervision, and inadequate staff to compile the data at the peripheral facilities. At the central level there has been a problem of late reporting and consequently delays in processing and reporting the information. HMIS is attempting to address these issues as detailed in the "Annual Health Sector Status Report 2005-2007".[144] In the western highlands, a district-based epidemic surveillance system was implemented as a pilot project supported by the Gates Malaria

Partnership.[145] An improved system of reporting and analysis of weekly malaria incidence data from selected sentinel health facilities was developed and used for detection of epidemics. Support is needed to expand such district-oriented information systems to more districts.

3.5 Delivery Systems

Of Kenya's 6,000 health facilities, approximately 67% are public sector facilities, of which 74% are managed by the Government of Kenya and 26% by NGOs or faith-based organizations (FBOs). One-third of health facilities registered in Kenya are managed by the private sector.[146] In seeking treatment, 47% of people suffering from suspected malaria receive medicines from government facilities. Use of retail shops as a source of treatment was low at 12% in some areas.[147] Therefore, while the private sector remains an important channel for malaria control interventions, the public sector remains the dominant delivery system. Of greatest concern is the extent to which non-regulation ACTs, quinine and chloroquine are available from commercial providers, undermining government drug policy. Greater regulation and coordination with the private sector are required in Kenya.[148]

4. Health System Issues

The government of Kenya is committed to reforming the public health sector, which is reflected in the Second National Health Sector Strategic Plan (NHSSP II). The vision of the National Health Sector Strategic Plan II is to provide an efficient and high quality health care system that is accessible, equitable, and affordable for every Kenyan. As part of support of this vision and the key pillar of NHSSP II, the Kenya Essential Package for Health represents the integration of all health programmes into a single package that focuses on the improvement of health at different phases of the human development cycle and through service delivery at six different levels of the health care system. Malaria prevention and treatment are key components of the Kenya Essential Package for Health. An essential component of this is the Community Health Strategy through which Community Health Extension Workers (CHEWs) are being trained to communicate health messages, mobilise their communities, and promote utilization of health services at the village level.[149]

The biggest challenge facing the public health system is the quantity, quality and distribution of health professionals. In 2003, there were 4,813 physicians (15.3/100,000 population) and 9,869 registered nurses (33.1/100,000 population) working in the public sector. While these ratios are within World Health Organization (WHO) norms, these figures hide the large disparity in population-to-provider ratios between rural and urban areas. In 2004, a human resource mapping and verification study found that 47% of dispensaries had just one community nurse and one or two support staff, while 3% had only support staff that were not qualified to administer drugs. Provincial and district hospitals were found to be overstaffed with nurses, and the number of doctors varied hugely; with about half of hospitals having fewer than six (12 are required), while others had over 20.[150]

5. Current Funding and Technical Support

Funding for malaria control in Kenya increased from less than $1 million in 2003 to about $62 million in 2008. 78% of this funding comes from the GFATM, with the United States President’s Malaria Initiative (PMI), the United Kingdom Department for International Development (DFID) and non-governmental organizations also providing financial support.[151]

The GFATM has provided $162 million over five years (2006 – 2011) through a Round Four grant for the scaling up of malaria control interventions.[152]

The US Government (USG) has a long-standing presence in Kenya working in malaria research and control through USAID, Centers for Disease Control and Prevention, and the Walter Reed Army Institute of Research. PMI's first two years of investment totalled $39.5 million, and significantly increased the role of the USG in malaria control efforts in Kenya. PMI funding for 2010 is increasing to $40 million.[153]

DFID support to Kenyan malaria control since 2002 includes the purchase and distribution of 17 million ITNs, the provision of 5 million ACTs, and support to BCC and IEC programmes. DFID's current health programme includes £7m support to malaria strategy through WHO and £40m for ITN procurement and distribution (both over the period 2010 – 2015).

The World Bank Booster Project has provided $4 million dollars for ITN distribution to people living with HIV/AIDS in malaria transmission zones.[154]

The WHO provided $4 million in 2008 for a wide range of malaria control interventions.[155]

6. Major Gaps

The LLIN coverage achieved so far should be maintained by continuous support of routine distribution systems. The BCC component of the programme should be developed to increase use of ITNs as there is disparity between ownership and use. Capacity of health services to carry out IRS and monitor the quality of the intervention needs to be developed.

The information system should be well developed both for programme monitoring and evaluation and disease surveillance. The focus should be on a decentralized and efficient use of data generated by health facilities.

Diagnosis and treatment service coverage and provision of basic health services to under-served rural communities need to be expanded.

Malawi

Summary table: malaria in Malawi

Parasites	*P. falciparum, P. vivax*
Vectors	*A. gambiae, A. funestus, A. arabiensis*
% of people under ITNs and variation across the country	38% of households own at least one ITN (2006).
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	AS+AQ
Evidence of insecticide &/or drug resistance	Resistance to SP is relatively high, causing the shift to AL in 2006 as policy.
IRS use	IRS is currently being trialed with signs of early success, but does not yet form part of the general Malaria Control Programme.
IPTi use	Not in use.
IPTp use	Facilitated by high ANC attendance (97%), 46% of pregnant women receive at least one dose of SP and 46% receive two.
Evidence of diagnostics being used to direct antimalarial treatment	Most cases of malaria are clinically diagnosed. Microscopy services do exist but are of poor quality and few in number. RDTs are currently being trialed.
	July 2011

1. Introduction

Despite increased funding and significant progress in the scaling-up of malaria control over the last few years, Malawi is experiencing a growing malaria burden. Part of the problem is regular stock-outs of essential malaria control commodities such as anti-malarials and diagnostic tests. While funding has increased, further financial support is necessary if Malawi is to successfully reverse the current negative trend.

2. The Burden of Disease

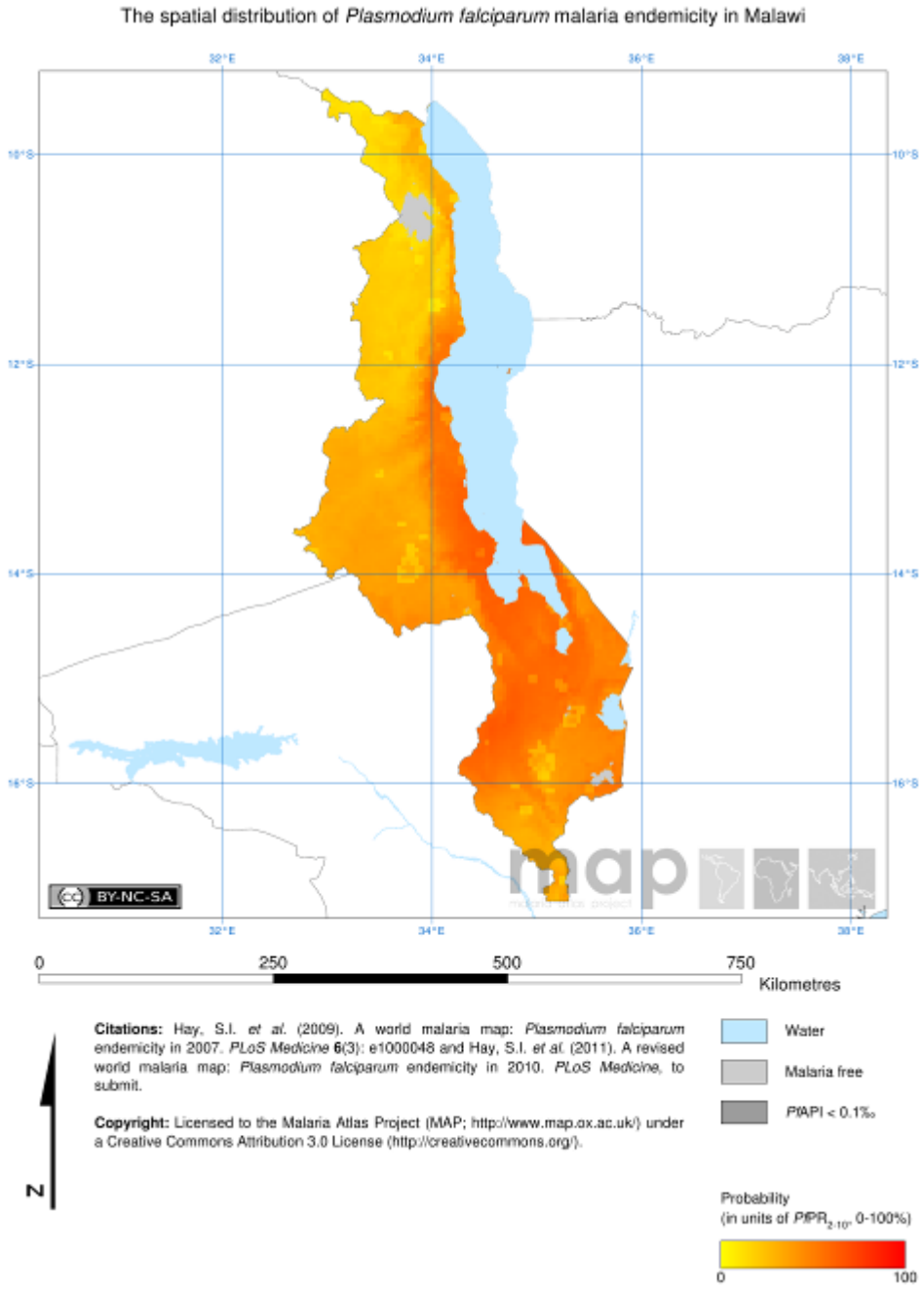
Malaria is the leading cause of morbidity and mortality in Malawi, with almost 5 million reported cases in 2008.[156] Malaria accounts for 33% of all outpatient visits and 39% of all in-patient admissions. Malaria-related morbidity among in-patients is about 50%, and the disease is the number one cause of hospital admissions among children under five.[157,158] Data from the Health Management Information System (HMIS) shows a worrying upward trend in the malaria burden in Malawi. Between 2005 and 2008 reported malaria cases increased from 3,688,389 to 4,986,779, malaria-related hospital admissions increased from 92,517 to 181,248, and malaria-related mortality rose from 5,070 to 7,748.[159] However, it remains uncertain whether this is due to improved reporting or an increased incidence rate.

The entire population of Malawi is at risk from malaria (97% at endemic risk, 3% at epidemic risk). Located at the southern end of the east African Rift, malaria transmission in Malawi varies by climate, geography and season. Along the lake shore and in the Shire River valley

transmission is perennial with a peak in the November to April rainy season. Over the rest of the country malaria transmission remains stable, although less intense during the dry season.[160] *Anopheles gambiae, A. funestus* and *A. arabiensis* are the most common malaria vectors in Malawi, and *Plasmodium falciparum* causes 98% of cases and the majority of severe cases and mortalities. The remaining 2% are caused by *P. vivax* and other non-falciparum malarias.[161]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

Insecticide resistance studies conducted between 2000-2003 in sentinel sites at Karonga, Rumphi, Chikwawa, Lilongwe, Nkhotakota and Mangochi showed that all three malaria vectors were 100% sensitive to commonly used insecticides; pyrethroids, organophosphates and organochlorides.[162] Recent preliminary data, however, shows pyrethroid resistance in both *A. funestus* and *A. gambiae* s.l. Carbamate (bendiocarb) resistance was detected in *A. funestus*, but not in *A. gambiae* s.l. There was no DDT nor malathion resistance reported. These results are of concern, and further data are urgently needed to determine the types of resistance present.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The National Malaria Strategic Plan (NMSP) for 2005-2010, entitled “Scaling Up Malaria Control Interventions”, was developed and approved by the Ministry of Health (MOH) in June 2005. The goal of this NMSP is to reduce malaria mortality and morbidity by 50% by 2010, with further reduction of morbidity and mortality by 75% by 2015. There are three strategic areas that have been identified for the scale-up of malaria control activities. These are:

- Case management
- Intermittent Preventive Treatment (IPT)
- Insecticide Treated Nets (ITNs)

Within the NSMP there are four main targets. These are:[163]

- at least 80% of those suffering from malaria fever have access to and are able to use correct and appropriate treatment within 24 hours
- at least 80% of the population has access to appropriate treatment by 2010
- at least 80% of pregnant women have access to malaria prevention by 2010
- at least 80% of children under five and pregnant women sleep under insecticide treated nets by 2010.

Development of the next strategic plan is in progress.

3.2 Prevention

The main component of Malawi's preventive malaria control programme is the scaling-up of ITN coverage, with a particular focus upon pregnant women and children under five but with universal coverage as the ultimate goal. LLINs are distributed through a three-pronged approach: routine distribution of free LLINs through antenatal care (ANC) and Expanded Programme on Immunisation (EPI) clinics; periodic mass campaigns; and traditional social marketing through private sector outlets. Since 2006 this policy has resulted in the distribution of over 4.5 million ITNs, of which about 1.2 million were Long Lasting Insecticidal Nets (LLINs).[164] The 2006 Multiple Indicator Cluster Survey (MICS), which represents the most up-to-date national survey on malaria control in Malawi, indicated that 38% of households had at least one ITN, and that 25% of children under five had slept under an ITN the previous night.[165] A recent Population Services International (PSI) Tracking Results Continuously Survey of households with a child under five found that 64% of households owned an ITN, and 48% of children under five and 50% of pregnant women had slept under an ITN the previous night. In households that owned an ITN, 73% of children under five and 76% of pregnant women had slept under an ITN the previous night, indicating that these vulnerable groups are preferentially sleeping under the ITN. This suggests that ITN ownership is rising and that a culture of using ITNs is developing. However, based on the calculations of the President's Malaria Initiative (PMI), which apart from the Global Fund represents the largest supporter of ITN distribution in Malawi, a gap of 2.7 million ITNs remains for the NMCP to reach universal coverage.[166]

The second major component of preventive malaria control in Malawi is Intermittent Preventive Treatment in pregnancy (IPTp). ANC attendance is very high in Malawi (97% of women attend at least once, and 92% of women attend twice or more). According to the 2006 MICS, the percentage of pregnant women receiving one dose of sulfadoxine-pyrimethamine (SP) was 81%, but only 46% of pregnant women received at least two doses or more of SP despite high ANC attendance rates (97% of women attend at least once and 92% attend more than once). Remedying this discrepancy between ANC attendance and multiple IPTp treatment remains a challenge. It is being tackled by providing training to staff, job aides to simplify treatment, and Information, Education and Communication (IEC) materials to educate staff and pregnant women alike to the benefits of IPTp. All SP needs are being provided by the MOH as part of the Essential Health Package (EHP).[167,168]

Historically Indoor Residual Spraying (IRS) has not been used widely in Malawi. However, IRS was piloted in the Nkhotakota District in late 2007 and 2008, and a third round of trials is currently under way. Preliminary results show a significant reduction in the vector population following IRS, but the analysis of these insect collections are not yet complete. Based on these early signs of success, the NMCP, with PMI support, plan to scale up IRS in the future.[169]

3.3 Case Management

National guidelines on malaria treatment state that all cases except children under five must be confirmed by clinical diagnosis before treatment. However, despite the NMSP's goal of 60% of health centres having the capacity to perform diagnosis of malaria, these services remain few and of poor quality. Therefore, most cases are treated presumptively. Even where diagnostic testing for malaria is available, malaria microscopy is the only diagnostic test available. Laboratory hours are limited and patient loads can be overwhelming, with more than 200 fever cases being seen each day. In addition, a recent assessment by the Strengthening Pharmaceutical Systems (SPS) Project demonstrated that 75% of patients with a negative diagnostic test for malaria were still prescribed treatment for malaria. Despite this, there has been some strengthening of laboratory capacity. Furthermore, two comparative assessments of selected Rapid Diagnostic Tests (RDTs) have recently been completed, and on the basis of these assessments Global Fund financial support will be used to procure 3.1 million RDTs.[170]

Malawi's pharmaceutical management system has been plagued with problems. Stock outs of SP and other essential drugs occur regularly due to issues related to quantifications of need, ordering, tendering, receipt, storage, and the logistics of distribution. Currently, Central Medical Stores (CMS) handles the procurement, storage, and distribution of most drugs to all government health facilities. Because of budget constraints, procurement issues, and management problems, CMS has not able to procure a full supply of the national requirements for drugs. There is significant pressure from the Global Fund and other donors to reform CMS. The MOH is in the process of converting CMS to a public trust with a private sector model of doing business. This conversion will allow CMS to hire staff outside the MOH staff structure and to enforce results-oriented management practices.[171]

Following drug efficacy studies that showed SP sensitivity of 35%, Malawi adopted artemether-lumefantrine (AL) as the first line drug for uncomplicated malaria in November 2007.[172] However, artemisinin-based combination therapy (ACT) procurement problems, connected to the weak pharmaceutical management system, mean that ACTs are not widely available. Only 25% of febrile children under five years were treated with any antimalarial medicine in 2008.[173] ACTs were supposed to be included in the Integrated Management of Childhood Illness (IMCI) Programme, but problems procuring AL has delayed this. A considerable increase in funding for ACTs is required if they are to be used effectively as the first line antimalarial drug.[174]

3.4 Supporting Interventions

IEC and Behaviour Change Communication (BCC) is used in Malawi to support preventive and case management interventions. Each year IEC campaigns are carried out during Malaria Week and Africa Malaria Day. IEC materials include posters, billboards, radio messages, TV programmes and IEC video vans. There is a good partnership with civil society stakeholders, particularly in the media. Areas of BCC/IEC focus include LLIN usage, multiple IPTp uptake and healthcare seeking behaviour.[175,176]

In 2007, the NMCP's Monitoring & Evaluaton (M&E) Technical Working Group developed a comprehensive M&E plan for malaria in Malawi. The National Malaria Monitoring and Evaluation Plan 2007-2011 covers a broad range of issues including drug quality surveillance, strengthening of sentinel site surveillance for monitoring of impact indicators, vector assessments for IRS and ITN program monitoring, household and facility surveys, post-market surveillance, pharmacovigilance, and drug resistance testing following the introduction of AL. The M&E strategy complements the Malawi Five-Year Strategic Plan and will assist in mapping and coordinating operational research and M&E activities of all malaria prevention and control partners.[177]

3.5 Delivery Systems

Health services in Malawi are provided by three main agencies: the Ministry of Health (60%) and local government (1%) across 754 health facilities; the Christian Health Association of Malawi (CHAM) (37%); and private sector providers including private hospitals and clinics and commercial companies (2%).[178] Access to health facilities for rural populations is generally good. Within a 5km radius, access is estimated at 54%. Using an 8km radius, access to health facilities increases to 80% and increases to 90% within 10km. Using the 8km standard and including urban population, then accessibility stands at 84% nationally. The NMCP is actively engaged with the non-public sector, especially CHAM, in order to bring their malaria treatment activities in-line with national procedures.[179] As well as treatment, the private sector has a role in the sale of ITNs; although they account for just 100,000 nets annually, mainly in urban areas.[180]

4. Health System Issues

The public health system in Malawi faces three main problems. The first is inadequate storage capacity at the central and regional medical stores, and an ineffective pharmaceutical management system. As mentioned above, CMS is in the progress of being reformed to tackle these problems.[181] The second problem is a lack of health workers at all levels of the health care delivery system, particularly in areas of primary health care - the pillar of the health care delivery system. Only 56% of Nurse/Midwives, 32% of doctors, 67% of clinical officers and 48% of medical assistants are in place.[182] The third is the heavy burden of HIV/AIDS.

The MOH has been engaged in a process of Health System Strengthening (HSS) over the last five years through its Essential Health Package (EHP). The MOH is implementing health sector improvements through a Sector Wide Approach (SWAp), which is common funding mechanism that pools resources from partners to achieve sustained improvements in a particular sector. The human resources problem is being tackled through a six year Human Resources Development Plan focusing on training, retention and attraction of health workers into the system. To improve access to primary healthcare at the community level Home-based Malaria Management (HMM) is being introduced, and while it is not yet fully established, 5,000 Health Surveillance Assistants (HSAs) have been trained. Another 3,000 HSAs will join them in the near future, and ACT roll out will be facilitated through HMM.[183] The HSAs have long been an important and effective link between the health system and the community.

5. Current Funding and Technical Support

Funding for malaria has increased significantly over the past 3 years, reaching a total of US$ 49 million in 2007 and US$ 41 million in 2008.[184]

PMI is one of the biggest supporters of Malawian malaria control, and has pledged $27 million for 2010. Of this funding, 42% will support malaria prevention through the promotion and procurement of LLINs, 20% will support improved case management interventions including procurement of ACTs with supportive health systems strengthening activities, and 19% will support the IRS campaign.[185]

Funding for malaria control other than from PMI comes mainly from the Health Sector-wide Approach (SWAp). The SWAp mechanism provides a coordination mechanism to allow the MOH to work more effectively with its partners, particularly Global Fund, the United Nations Children's Fund (UNICEF), WHO, the German Development Agency (GTZ), the USG, the United Kingdom Department for International Development (DFID), World Bank, and the

European Union. These partners support malaria control either through “basket funding” or as discrete donors, with the USG being the largest discrete donor in the health sector. The main source of malaria funding in the SWAp comes from the Global Fund. Malawi has two approved Global Fund Grants from Rounds 2 and 7, which were consolidated in 2008 and will provide a total of $36.5 million in funding over five years.[186]

6. Major Gaps

Major gaps include:

- Logistics. The pharmaceutical management system has serious problems with stockouts and record keeping
- Systems for monitoring and evaluation need to be strengthened
- Diagnosis capacity is still very low, and where diagnosis is available, adherence to results is a problem.[187]
- Operational research capacity is limited

Mozambique

Summary table: malaria in Mozambique

Parasites	*P. falciparum, P. malariae, P. ovale*
Vectors	*A. funestus, and A. gambiae.*
% of people under ITNs and variation across the country	16% of households owned an ITN in 2007.
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	AS+AQ
Evidence of insecticide &/or drug resistance	Fears over SP resistance led to the adoption of AL in 2007. Insecticide efficacy tests have shown all major insecticides to be effective.
IRS use	IRS covered 2 million households, protecting 6.5 million people in 2008 (36% of the population at risk).
IPTi use	Not in use.
IPTp use	52.5% of pregnant women received IPTp in 2008.
Evidence of diagnostics being used to direct antimalarial treatment	Most malaria cases are diagnosed based upon clinical symptoms, with just 20% of confirmed cases being examined by microscopy.
	July 2011

1. Introduction

Mozambique has a population of 21.3 million people and an average population growth rate of 2.3% between 2001 and 2007.[188] In 2005, it was ranked 172 out of 177 countries on the UNDP Human Development Index.[189] Political stability and governance, combined with rapid economic growth, have resulted in a reduction in the proportion of people living below the poverty line, from 69% in 1997 to 54% in 2003.[190]

Although the disease burden in Mozambique is still amongst the highest in the world, mortality rates in children have declined in the last decade. The under five mortality rate decreased from 201/1000 live births in 1997 to 153/1000 in 2003 and 138/1000 in 2008.[191,*192*,193] The national maternal mortality ratio decreased from 1000/100,000 live births in 1997 to 408/100,000 in 2003.[194,195] However, recent UNICEF figures show a rise to 520/100,000 live births.[196]

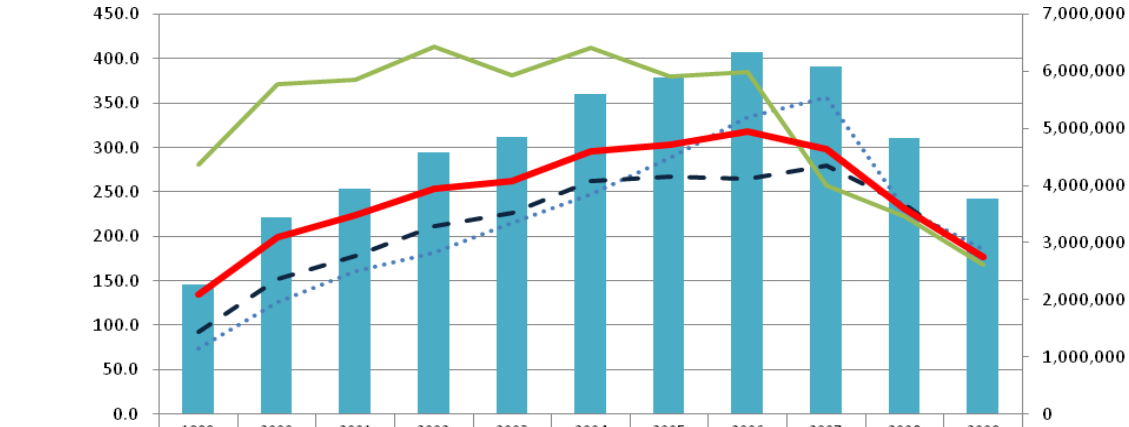
Access to health services remains extremely low. Nationwide, 56% of the population travels almost an hour to reach the nearest health facility and only about 50% of the population have access to public health services.[197] As in many other low income countries, Mozambique still depends on external aid to finance the health sector. In 2008, 73% of the health budget came from 26 international health partners comprising bilaterals, multilaterals, global funds and development banks.[198]

2. The Burden of Disease

Malaria is the leading cause of mortality in Mozambique, accounting for 29% of all deaths and 42.3% of mortality in children under five.[199] The average parasite prevalence in children under five was shown by the 2007 Malaria Indicator Survey to be 38.5%, ranging from 3.8%

to 60.4% depending on geographic location.[200] Among pregnant women, the mean prevalence is estimated at 16.3%, with 30.1% of women in their first pregnancy demonstrating parasites on blood slides. Anaemia due to malaria is a major cause of morbidity and mortality in children and pregnant women; 67.7% of children age 6-59 months and 48.1% of pregnant women in the survey population were anaemic (haemoglobin less than 11 gm/dl), and 11.9% and 5.1%, respectively, had severe anaemia (haemoglobin less than 8 gm/dl).[201]

Drawing on data reported from the national surveillance system, eleven years of weekly malaria data have been processed. Figure 1 presents malaria cases per 1000 person-years and the trends of malaria cases (either clinical or laboratory) from the year 1999 to 2009. Between 1999 and 2006 malaria was increasing in Mozambique. However, from 2007 a decline is visible; yet this decrease of malaria cases should be interpreted with caution. Whilst all malaria related prevention and control activities have increased, these control measurements have included the roll out of the malaria rapid diagnostic tests (RDT) to confirm suspected cases even in community settings. This factor may have also significantly contributed to the reduction in malaria cases being reported.



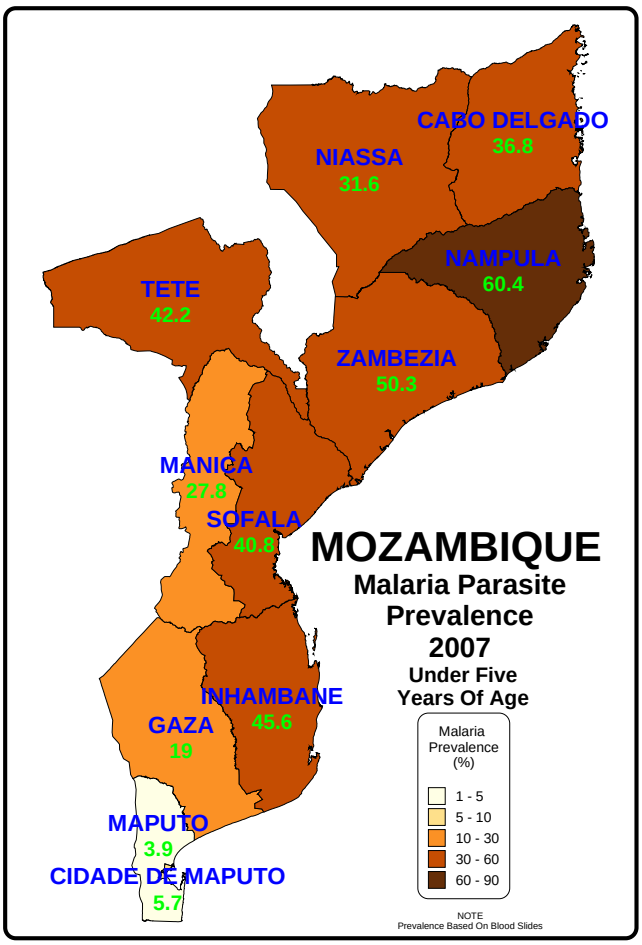
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
National N	2,273,640	3,446,230	3,947,335	4,592,383	4,863,559	5,621,052	5,896,411	6,335,757	6,094,234	4,831,491	3,771,619
North	74.4	125.9	160.9	181.7	214.9	247.8	288.6	333.4	356.0	230.8	186.2
Centre	92.7	152.1	178.7	212.1	226.4	262.6	267.9	265.2	279.9	237.0	174.1
South	281.6	372.1	376.3	413.6	381.7	412.0	379.7	385.4	258.0	223.0	168.6
National per 1000 PY	135.0	199.9	223.6	254.0	262.6	296.3	303.4	318.2	298.7	231.4	176.6

Figure 1 - Malaria cases per 1,000 person-year and total (N), 1999 - 2009, Mozambique.
Source: Weeekly Epidemiological Bulletin

Malaria transmission is stable throughout the country. The year-round transmission has peaks during and after the rainy season (December to April). Few areas have the potential for epidemics, but Mozambique is prone to natural disasters such as cyclones and floods, which can contribute to dramatic increases in malaria transmission. The major malaria vectors in Mozambique are *Anopheles funestus*, and *A. gambiae*, and *A. arabiensis* has also been found. *Plasmodium falciparum* accounts for more than 90% of all malaria infections, with *P. malariae* (9%) and *P. ovale (1%)* responsible for the remainder.[202]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

Figure 2 depicts the geographical variation of malaria parasite prevalence. It indicates the prevalence of *P. falciparum* among children less than five years old per province according to the 2007 MIS.[203] As can be seen, the malaria burden remains very high in Mozambique, except in Maputo province and city.



3. Malaria control programme

The National Malaria Control Programme (NMCP) is in the process of finalising a new strategic plan for 2011 to 2015. This National Prevention and Control Plan for Malaria in

Mozambique focuses on the national scale-up of key malaria prevention and control interventions, as follows:

- **Integrated Vector Management** (Indoor Residual Spraying (IRS); Long Lasting Insecticidal Nets (LLIN) and Environmental Management)

IRS has been a core malaria control strategy in Mozambique for a number of years, with national targets aiming for coverage of at least 40% of the population, mainly in suburban settings. Free LLIN distribution focuses on people at risk of malaria outside the areas covered by IRS. At present, LLIN distribution has been quite regular through ANC, targeting pregnant women (Table 2). A recently revised policy calls for universal access to LLINs (currently defined as one net for every two inhabitants). However, LLIN universal access campaigns have only been realised in an ad hoc manner in a few districts of some provinces. For example, Malaria Consortium provided technical and financial support to Manica and Cabo Delgado provinces and UNICEF helped the provinces of Gaza and Sofala.[204]

Table 2 – Key IRS and LLIN execution indicators

	Indicators	2007	2008	2009
IRS	Number of Houses Sprayed	1,537,825	1,945,389	2,554,565
	Number of supervision sessions held during IRS campaign	N.A.	2/province	2/province
	Number district supervisors trained on IRS	-	106	100
	Number of IRS Sprayed trained	-	3,952	4,000
	% target houses sprayed	84,7%	74%	85%
LLIN	Number of LLIN distributed (all mechanisms)	1,506,475	2,540,228	1,292,159
	Number of LLIN distributed to pregnant women	425,126	838,721	838,130
	Number of pregnant women (projected from Census 2007)	1,018,340	1,026,535	1,093,843
	% of pregnant women who received an LLIN	41,7%	81,7%	76,6%

Source: MISAU-PNCM.[205]

The most serious weaknesses in the IRS programme are: insufficient and inadequately qualified and trained personnel at all levels; ineffective monitoring and supervision; poor insecticide warehousing conditions and stock management; and limited vehicles available for spray teams.[206]

The major constraints to scaling up to universal LLIN coverage include insufficient funding to procure free LLIN for target groups and, to a lesser extent, inadequate warehouse space. Insufficient attention at antenatal clinics (ANC) to reporting and by District Health Authorities to monitoring have led to stock outs at health facility level, contributing to the low ANC distribution figures reported.[207]

- **Prompt diagnosis and correct treatment**:

To scale up and improve diagnosis, the NMCP has adopted a policy that all persons with suspected malaria should be tested with a rapid diagnostic test (RDT) or microscopy prior to treatment at both facility and community level. During 2009, 8,518 health workers and community health agents were trained to use RDTs/microscopy and AL, and 1.1 million RDTs were distributed.[208] The Ministry of Health (MOH) has recently finished the process of introducing artemether-lumefantrine (AL) as its first-line treatment; no second-line has been formally announced, however it is most likely to be artesunate-amodiaquine (AS-AQ). Quinine remains the treatment for severe or complicated malaria.[209]

There are several system weaknesses which limit access to prompt diagnosis and correct treatment, and improvements in rational drug use with diagnosis are needed. There is inadequate observance of medicine and RDT storage conditions, which affects their quality. The MOH does not have its own quality control (QC) system in place for imported medicines and the existing quality assurance (QA) system is limited. Furthermore, there are few trained microscopists in-country, and little supervision or quality control of them. Finally, understanding and application of RDT usage criteria is poor, and the imperfect roll-out of RDT training and supervision has resulted in the overuse of tests among non-target groups and reduced confidence in test results.[210]

- **Intermittent preventive treatment in pregnancy**

Use of IPTp with sulfadoxine-pyrimethamine (SP) was scaled up nationally beginning in early 2006. Every pregnant woman should receive three monthly doses of IPTp during the course of her pregnancy. Uptake figures are low (23.3% in MIS 2007, with variation of 2% in Niassa province to 52.5% in Maputo city[211]) considering over 80% of pregnant women attend ANC at least once during their pregnancy. In 2007, the IPTp strategy was quite new and had just started to be implemented nationwide, so this may help explain these low figures (Table 3). Routine data from the activities report in 2008 and 2009 show better progress, with a national average of 52.5% in 2008 (Table 3).

Training and supervision for Mother and Child Health (MCH) personnel has been insufficient, as has integration with other ANC services. Despite the high proportion of pregnant women attending ANC at least once, this visit generally occurs late in pregnancy, limiting the possibility of providing the recommended second and third IPT doses, thereby reducing the desired benefits to mother and child survival.[212]

Table 3 - Intermittent preventive treatment in pregnancy (IPTp) national and provincial figures

Province	**% of pregnant women receiving IPTp2 if >1ANC visit**		
	2007 (MIS 2007)	2008 (activities report)	2009 (activities report)
Niassa	2.0	44,71	37.6
Cabo Delgado	3.2	33,32	18.7
Nampula	4.6	35,75	38.9
Zambézia	22.1	91,47	82.9
Tete	32.1	67,96	N.A.
Manica	37.5	52,86	51.2
Sofala	47.6	67,31	52.2
Inhambane	14.7	51,06	49.4
Gaza	35.8	67,55	52.4
Maputo Province	45.6	64,87	17.3
Maputo City	52.5	44,68	82.0
National	**23.3**	**52.5**	-

Source: MoH-NMCP

- **Health promotion, community participation and involvement**

To improve the knowledge of rural communities, the NMCP promotes increased community participation in developing solutions to significantly impact malaria mortality and morbidity. Malaria commemoration days (April 25th and November 11th) are being used as platforms on which to increase Information, Education and Communication (IEC) activities.

In addition, a cadre of community health workers, known as Agente Polivalente Elementares (APEs), is being revitalised. APEs will play a key role for the largely rural population in Mozambique in both health promotion and malaria case management. Malaria Consortium is

one of the key implementing partners of this revitalisation strategy, particularly in Inhambane province.

- **Programme management, monitoring and evaluation (M&E), health systems strengthening, including operational research**

The inadequate number of qualified personnel in management, planning and M&E at all levels of the health system seriously limits the programming, planning, coordinating and monitoring of all activities. There is minimal routine malaria-related data management and analysis for all interventions; most activity plans are not based on analysis of reported data. Routine supervision of on-going data collection, and data flow, is inadequate. These factors make reporting on and assessing the impact of malaria-related interventions very difficult.[213]

4. Health System Issues

Although the MOH is committed to increasing access to health services, as well as their efficiency and quality nationwide, weak health infrastructure and a shortage of healthcare workers present obstacles. The public health sector is by far the largest provider of health services in Mozambique, yet it is estimated only about 50% of the country's population readily accesses these.[214]

The National Health Service (NHS) operates in 11 provinces, 128 districts and 30 urban municipalities. The administrative and public health delivery system consists of a national level responsible for health sector policy and strategic direction, a provincial level providing technical and policy oversight to the operational level (districts). The NHS referral system comprises 4 levels; however, it does not function well due to staff and drug shortages, long distances to health facilities, and user fees. Patients with severe malaria and other diseases, who require referral to a higher level of health service, are themselves often responsible for this transfer as (throughout the NHS) transportation and notification to the higher level are limited.

APEs are volunteers selected by their communities (which to date should contribute to their costs and workplace) and fall outside the most basic NHS level. Within the new community involvement strategy, incentives will be paid to APEs in order to improve adherence and skills, in addition, training of and reporting by APEs will be standardised and closer supervision and linkages with the NHS developed through the revitalisation of the system. There are currently no official, updated data on APEs and, since their original conception, many other community health volunteers/activists/ promoters have emerged, with varying levels of training, responsibility and recognition. Most original APEs received up to 6 months of training – however, this training has not occurred systematically in at least a decade. In theory, only those APEs who have had 6 months of training should receive the basic kit of essential drugs and materials (Kit C) through a "push" supply system from the District Health Authority and report to the health facility nearest them. In practice, there is little control of or follow-up on who receives Kit C at this level, but in 2007, 1924 APEs were trained in the prescription of artemisinin-based combination therapy (ACT). The referral system between the community (APE) and the NHS remain tenuous.[215]

The absence of an NHS M&E plan means the health information system (HIS) lacks inputs and reorientation on data and analysis needs. This has led to parallel and uncoordinated information gathering, with multiple reporting requirements at implementation level further straining overstretched health workers and impacting on the reliability of data collected.

Anti-malarial drug needs have been calculated based on unreliable and incomplete morbidity data and inexact consumption data. Most anti-malarials consumed in Mozambique move through the Kit system, however the new first line treatment is bulkier than the previous one and does not fit into the standard box in which Kits arrive, thus requiring repacking at provincial level.[216]

The MOH and health partners have developed a roadmap towards a one country, one plan, one budget and one reporting system framework in the context of developing its International Health Partnership (IHP+) compact – "Scaling up for better Health in Mozambique".[217]

Current efforts to strengthen the health system include the following:

- **Revitalisation of the community health worker system (APE)**

  The APE revitalisation plan is key to improving the reach of health services, and specifically for malaria services, to the rural population. The APEs' role is to promote health prevention activities and provide malaria diagnosis and treatment at community level. They will also link the community to the NHS as the first step in the referral system.

  Civil society will be key in planning and supporting implementation of these activities. A number of donors are committed to support this initiative, including the World Bank, USG, Gates and CIDA (through Malaria Consortium); the approved Global Fund Round 8 health systems strengthening component will also contribute to filling the geographical and financial gap.[218] The training curriculum is being developed and malaria modules are adequately addressed, including the new case management policy. A new cadre of 2400 APEs were scheduled to start training in 2009; these activities will allow for mapping of APEs.

- **Development of overarching human resource capacity**

  The lack of human resource capacity is one of the major constraints to overall health sector delivery as well as being a barrier to disease specific targets such as reducing malaria, tuberculosis (TB), HIV/AIDS and maternal, infant and child mortality. The costed Health Human Resource Development Plan for 2008-2015[219] defines realistic understanding of the resource implications of scaling up. Several aspects of the HRDP are already being implemented through increased training, employment, rational deployment and retention of skilled health professionals. The costing of the PESS (health sector strategic plan) 2007-2012,[220]and programmatic Medium Term Expenditure Framework (MTEF) are near completion, defining the resource implications of the PESS, pinning sectoral long-range policies, plans, targets and monitoring and evaluation frameworks to those of the MDG.

  The NMCP has increased its staff since 2008 by recruiting 8 biologists and now relies upon one biologist in each province who acts as the provincial malaria manager. These biologists received malaria control training led by MOH, including entomology training, prior to assuming their responsibilities. They are tasked with supervising prevention, mainly IRS-related activities, in their provinces.[221]

- **Improvement of laboratory capacity**

  A National Laboratory Strategic Plan will assist in the prioritization of overall laboratory improvements. For malaria, all existing and all newly recruited APEs will receive training on the use of RDT, a key component of the new case management policy. Support for training of existing APEs for the AL phase-in is mainly from the President's Malaria Initiative (PMI). In addition, 80 microscopes have been purchased and are being distributed in all provinces, as directed by MOH and training for laboratory technicians on malaria microscopy techniques is being supported by PMI.[222]

- **Health commodity procurement systems including the development of a National Pharmaceutical Logistics Master Plan (PLMP)**

  The distribution of the new first line of treatment, artemether-lumefantrine (AL), has required the establishment of a temporary parallel distribution system due to the bulkiness of the AL packaging. This temporary system will be integrated into the PLMP which is being developed with support from the United Stated Government (USG).

5. Recent and Current Funding and Technical Support

a) Current Funding

From the year 2004 to the year 2007, financial support to malaria interventions has increased fourfold (Figure 3).[223] Mozambique received GFATM resources starting in 2004; prior to that, the resources for malaria control came primarily from the Mozambique Government, with a small amount from very few other sources. Since that time, substantial investments have been added from USAID, DFID, Italy, Spain, JICA, and the Government has also increased funding substantially for the drug funds. In 2007, the contribution from GFATM and PMI has proved a challenge to the absorption capacity of the established structure. This suggests the funding base for malaria control has increased substantially and has broadened in terms of the number of supporters and the breadth of interventions and issues supported (Figure 3)

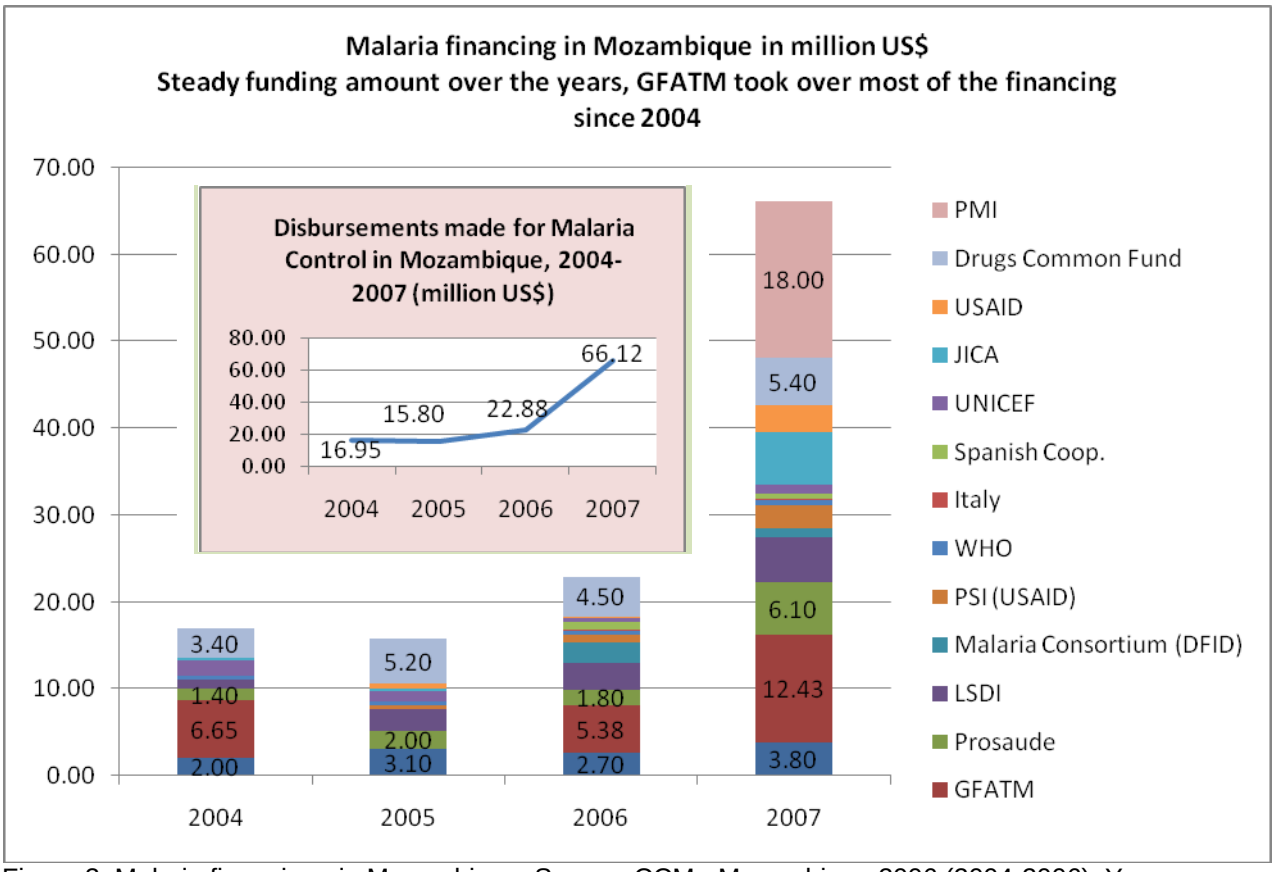


Figure 3: Malaria financing gin Mozambique. Source: CCM - Mozambique 2006 (2004-2006). Year 2007 - various reports and informal notifications mainly from DAF and DPC at the MOH and some partners.

b) Malaria partners

All NMCP partners provide support in coordination with the MOH and central (NMCP), provincial and district levels and with a view to achieving the objectives in the National Strategic Planning.

GFATM is supporting Mozambique through the rounds 2, 6 and 9. Rounds 2 and 6 will be terminated at the end of 2010 and the final phases of both have been used to procure malaria commodities thorough compulsory use of the GFATM's Voluntary Pooled Procurement facility.

Through the GFATM Round 9, The World Vision Mozambique (civil society Principal Recipient) and sub-recipients (Malaria Consortium, International Relief and Development, Foundation for Community Development and Médicos do Mundo – Portugal) will build essential links between the formal health service, the APE and the community. In addition, they will support the NMCP universal coverage LLIN campaigns in the seven provinces where they plan to implement this project. All organizations have ongoing interventions to improve community access to health services, with work undertaken in close coordination with the provincial and district health authorities, and community structures, emphasizing the strengthening of community capacity and primary health care services to meet community health needs, as well as supporting necessary linkages between the community and different NHS levels. Malaria Consortium will provide malaria-related training to existing community structures to promote understanding of and access to prevention methods and treatment-seeking behaviour and case referral.[224]

PMI's current commitment is guaranteed until fiscal year 2010 (which covers activities into 2011) and is realised through a number of implementing partners. Mozambique will receive PMI support for phase 2 of the initiative. The annual PMI budget, which has ranged from US$18 to 35 million, supports the procurement and distribution of commodities, in addition to financing activities to assure their proper use. Specifically, PMI supports the distribution of free LLIN, mostly to children under five through campaigns and to pregnant women during ANC, having purchased 1,956,000 LLIN from 2007 to 2008. PMI plans to procure 1,000,000 LLIN in 2009 and 2,000,000 LLIN in 2010. PMI has piloted a universal coverage campaign in Sofala province in 2009. PMI supports the IRS programme in Zambézia Province, and currently supports strengthened NMCP entomological capacity. Together with partners, the NMCP developed a strategy for the use of microscopy and RDT in the NHS, which is integral to the roll out of the newly implemented first line of treatment (artemether-lumefantrine) and updated the national malaria treatment guidelines to reflect this new policy. Implementation of the roll out, planning, training and supervision, received extensive support through PMI and other partners; *more support is required to consolidate advances in this area*. Since 2007 PMI has purchased almost 5 million AL treatments. PMI purchased 80 microscopes for provinces and is coordinating with NMCP and partners for refresher and pre-service training on microscopy. The new case management policies being rolled out with PMI support rely on further support for commodities, training and supervision from this proposal.[225]

DFID's GB£8 million project implemented by Malaria Consortium is supporting ANC distribution of LLIN to pregnant women and under fives in 5 provinces, with additional LLIN procured by JICA being distributed through established systems in 2008. This programme will conclude in December 2010, and has assisted in the development of sustainable LLIN delivery systems, in addition to building health service capacity in delivery, support supervision and monitoring of LLIN distribution. The NMCP still requires support to extend this system to other provinces and ensure continuation of the ANC routine distribution system developed and the benefits of the user-friendly net tracking systems it set up. Malaria Consortium is active in developing and implementing net distribution strategies to a variety of target groups and is providing essential technical support to the NMCP in the development of its LLIN universal coverage strategy. Extensive experience in designing behaviour change and communications strategies continues to contribute to the national strategy development and implementation. Malaria Consortium has also supported roll out of training in the 2007 malaria treatment and diagnosis policies to APEs as well as for the transition to use of AL as first line treatment and is a key partner in the implementation of the reviewed APE strategy through support to integrated community case management. Malaria Consortium is supporting the NMCP in the development and finalisation of its new strategic and monitoring and evaluation plans. Having supported the NMCP in the implementation of the national Malaria Indicator Survey in 2007, Malaria Consortium has continued to undertake key evaluation and research activities across the provinces in which it works.[226]

The World Bank Booster programme for 3 northern provincial health authorities plans to integrate 3 modes of service delivery: facility-based, outreach and community services. US$ 20million over 5 years is scheduled to become available in 2010, with the first year's activities being a pilot conducted in one district of each province. Irish Aid through Malaria Consortium supports health systems strengthening in Inhambane province through technical assistance to the provincial and district health authorities to improve and consolidate the continuum of care in relation to malaria prevention, case management, drug storage and management, diagnosis, treatment and supportive supervision. WHO provides support to training and through technical assistance at central level. UNICEF provides support to net procurement and distribution, community mobilization and treatment, in addition to technical assistance at central level.

6. Major Gaps

The unpredictability of GFATM disbursements to the MOH, in addition to continued systemic difficulties which hamper the MOH ability to report progress to GFATM with the level of detail required, means gaps may exist where or when they should not. For example, in 2009 no disbursement was received from GFATM, and the termination of rounds 2 and 6 is now being completed through use of funds for commodity purchases. Unpredictability or non disbursement seriously affects the NMCP ability to work consistently towards achieving its strategic objectives; existence of successful grant applications inhibits donors from committing additional funding.

Despite projected procurements through GFATM and with support of USG, significant gaps remain in the procurement of key commodities in order to ensure pipelines remain filled, avoid stock outs and achieve universal coverage. The country is currently suffering from a shortage of RDT, ACT and although stocks are beginning to arrive, international or regional stock levels mean this is occurring on a monthly basis, affecting the supply chain. The APE is being prioritised for receipt of the first line anti-malarial, with health facilities reverting to AS+AQ blister packs whilst stocks are being replenished. It is known stocks will be deficient for national needs for at least the next two years. Although Round 9 provides for the purchase of significant numbers of LLIN, and the termination of rounds 2 and 6 has included LLIN procurement, the country will still struggle to meet universal coverage targets, even when prioritising areas not receiving IRS.

Capacity within the NMCP and at provincial and district level remains weak. Technical as well as planning and managerial skills are broadly required.

Nigeria

Summary table: malaria in Nigeria

Parasites	*P. falciparum, P. ovale, P. malariae*
Vectors	*A. gambiae, A. funestus, A. arabiensis, A. melas*, *A. moucheti, A. nili, A. pharaoensis, A. coustani, A. hancocki, A. longipalpis*
% of people under ITNs and variation across the country	Between 2006 and 2008 ITNs were distributed to cover 5% of the population, but in 2009 to 2010 mass campaigns have taken place.
First-line drug for *P. falciparum* (unconfirmed)	AS+AQ, AL
First-line drug for *P. falciparum* (confirmed)	AS+AQ, AL
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	Resistance to CQ and SP is high, which led to the discontinuation of their use as malaria treatments as policy.
IRS use	Recently introduced as a complimentary strategy, with just 30,000 households covered in 2008.
IPTi use	Not in use.
IPTp use	In use, but only 2.9% of pregnant women received IPT in 2007.
Evidence of diagnostics being used to direct antimalarial treatment	Lack of accurate data hinders an accurate assessment, but use of diagnostics to direct treatment is estimated to be low.
	July 2011

1. Introduction

Nigeria accounted for a quarter of all malaria cases in Africa in 2006; representing the single biggest challenge in the global fight against malaria.[227] The country has a massively underfunded and under developed health system that requires strengthening. The private sector is an important factor in Nigeria, but it needs regulation, coordination and support.

2. The Burden of Disease

Over 140 million people in Nigeria (97% of the population) are at risk from malaria, with an estimated 50% of the adult population suffering from at least one case of the disease a year.[228] Malarial cases account for 60% of outpatient visits and 30% of hospitalisations a year, and kill an estimated 300,000 children.[229] The surveillance data show neither the true magnitude of the malaria burden nor evidence of a systematic decrease due to inconsistent and incomplete reporting.[230] Malaria costs the Nigerian economy roughly 132 billion Naira every year and severely limits economic growth.[231]

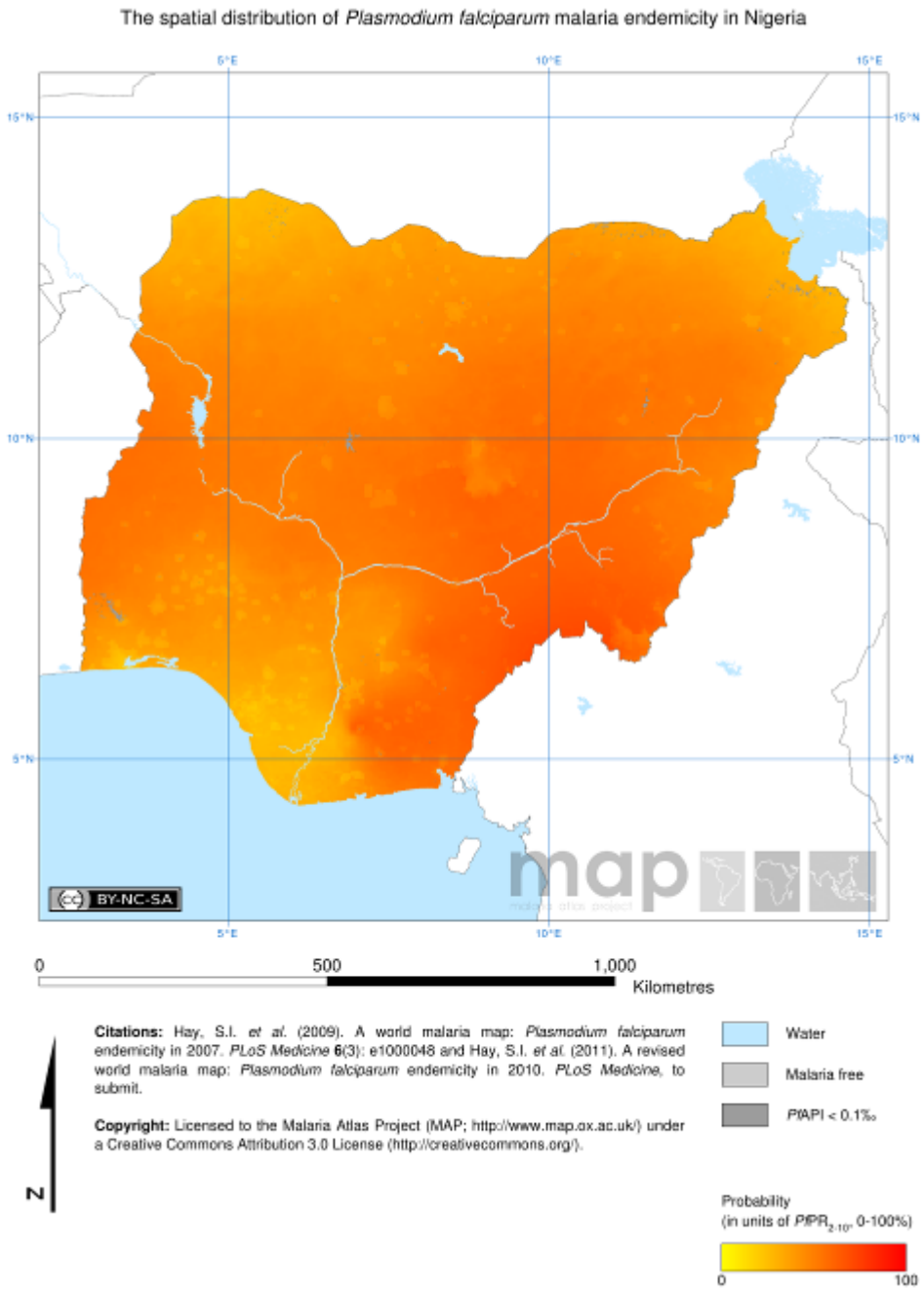
There is large geographical variation in the prevalence of malaria in Nigeria. In the north, which is characteristically flat, arid savannah, malaria is seasonally prevalent during the three to four months of the rainy season. In the south of the country the geography and vegetation differ from savannah lowlands in the centre to rain forest in the south, mangrove forests along the coast and mountains in the south-east. In Southern Nigeria malaria is

perennial but differentiated; endemicity is highest around the two river valleys in the centre of the country. 30% of the population live in very high transmission zones and 67% live in moderate transmission zones.[232]

By far the most dominant species of malarial parasite is *Plasmodium falciparum,* accounting for over 95% of cases*. P. ovale* and *P. malariae* play only a minor role, with the latter being quite common as a mixed infection in children. The dominant vector species are *Anopheles gambiae s.l.* and the *A. funestus* group, with some other species playing a minor or local role*: A. moucheti, A nili , A.pharaoensis, A. coustani, A. hancocki* and *A.longipalpis*. Within the *Anopheles gambiae* complex A*. gambiae s.s.* is the dominant species with *A. arabiensis* being found more often in the North and *A. melas* only in the mangrove coastal zone.[233]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. melas	Salt water lagoons, mangrove swamps.	Endophagic and exophagic, anthropophilic and zoophily. Bite late at night.	Exophilic and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

There has been an increase in malaria drug resistance in Nigeria, as identified by the 2002 efficacy studies that showed that chloroquine and sulfadoxine-pyrimethamine (SP) were no longer adequate for national first line use. This led to further efficacy trials in 2004. They showed the effectiveness of two artemisinin-based combination therapies (ACTs) for treating malaria in Nigeria (artemether-lumefantrine and artesunate-amodiaquine), both of which have been adopted for front line use.[234]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The Federal Government of Nigeria has a National Malaria Control Strategic Plan that has recently been updated for 2009 – 2013.[235] The goal is to reduce by 50% malaria related morbidity and mortality in Nigeria by 2010 and minimise the socio-economic impact of the disease.

Overall objectives for the period 2009 – 2013 are:

- To nationally scale up for impact (SUFI) a package of interventions which include appropriate measures to promote positive behaviour change, prevention and treatment of malaria.
- To sustain and consolidate these efforts in the context of a strengthened health system and create the basis for the future elimination of malaria in the country.

The core interventions for malaria control are:

- Prevention of malaria transmission through an Integrated Vector Management (IVM) strategy.
- Prompt diagnosis and adequate treatment of clinical cases at all levels and in all sectors of health care.
- Prevention and treatment of malaria in pregnancy.

3.2 Prevention

Universal Insecticide-Treated Net (ITN) distribution is the main aspect of Nigeria's malaria preventive strategy. The aim of the NMCP is to distribute two Long-Lasting Insecticidal Nets (LLINs) to all households, increasing coverage to 80% by 2013.[236] This translates into the need to distribute 63 million nets by the end of 2010. By the end of July 2010 about 24 million LLINs had been distributed in 14 out of 37 states in Nigeria, representing a significant step in malaria control.[237] The main factor restricting complete coverage seems to be a lack of funding and the size of the at-risk population which needs to be reached, within the context of a weak national health system.[238] ITN distribution is being carried out through a mixed distribution model which utilises public sector, commercial and civil society channels.[239] The main public sector activities are mass campaigns, house-to-house campaigns, integration with immunisation programmes, and rolling distribution through pre-existing healthcare facilities, such as pregnant women's antenatal care (ANC) appointments.[240] [241]

The vibrant commercial sector is being utilised in several ways. Long-lasting insecticidal technology is being transferred to local net manufacturers and importers, taxes and tariffs are being reduced and price support implemented in order to reduce the retail price of LLINs.[242] The DFID funded Support to National Malaria Programme (SuNMaP) is playing a key role in facilitating better policy development, planning and coordination at the national and state level. It is also supporting the development of the commercial sector as a viable mechanism of preventive and treatment provision. It is doing this by advocating price reductions, encouraging competition and supporting generic marketing campaigns.[243]

Indoor Residual Spraying (IRS) is being deployed as a complementary strategy to LLIN distribution, with the aim of covering 20% of the population.[244] However, so far only pilot schemes have been implemented, with over 30,000 households being sprayed.[245] The NMCP aims to administer Intermittent Preventive Treatment (IPT) to 100% of pregnant women attending ANC, but as of 2007 only 2.9% of all pregnant women received IPT.[246] The lack of accurate data means we cannot determine how successful this has been in recent years.

3.3 Case Management

The core case management strategy in Nigeria is to increase the number of malaria cases confirmed by microscopy or RDT prior to treatment by 80% by 2013. This is a highly ambitious target considering the poor state of the health system, the prevalence of drugs in the private sector and the widespread habit of taking antimalarials without being properly

diagnosed. Although the lack of accurate data means we cannot be sure, it is likely that diagnosis by microscopy or RDT remains extremely low.[247] [248]

Secondly, the NMCP aims to rapidly scale up access to ACTs within 24 hours of the onset of symptoms, reaching 80% of the population by 2013.[249] This is to be achieved by expanding free access to ACTs through primary healthcare facilities, and by working more closely with the commercial sector.[250] In 2008 a confirmed 12 million ACT treatment courses were administered. This is, however, far below the required provision, meeting just 10% of treatment needs.[251] Furthermore, the provision of children under five with access to ACTs within 24 hours is still well below the target of 80%; measured as 0.1% in the malaria survey of 2005 and 1.0% in a selective survey in 2007.[252]

Nigeria is a pilot for the Global Fund's Affordable Medicines Facility – Malaria (AMFm) programme, which is a financing mechanism designed to make ACTs more accessible, and by so doing to reduce the use of less effective treatments. The AMFm involves negotiating a reduced price for ACTs with primary suppliers, and then making a co-payment to further lower their sales price to end-users in malaria-endemic countries. These affordable ACTs are then distributed through providers across the public, private and not-for-profit sectors. By reducing the cost of ACTs available across all providers, the AMFm aims to support countries in scaling up access to ACTs and curtailing emerging resistance to artemisinin brought about by the use of artemisinin-based monotherapies (AMTs).[253] SuNMaP is developing complementary support for the implementation of AMFm and working on promoting rational use of ACT through improved parasitological diagnosis of malaria.[254]

3.4 Supporting Interventions

The NMCP has plans for extending Behaviour Change Communication (BCC) and Information Education Communication (IEC) to support the scaling up of preventive and case management interventions, which have been developed by the Technical Working Group on Behaviour Change Communication. There is a recently finalised Advocacy Communication and Social Mobilisation strategic and implementation plan aimed at guiding and coordinating all malaria-related communication activities in Nigeria.[255] A comprehensive communication campaign on correct net use is creating a net culture in order to ensure that the population derive full health benefits from the malaria control interventions.[256] Communication around other malaria interventions is also ongoing, but is hindered by the lack of financial resources.[257]

Monitoring and evaluation (M&E) are weak, with gross under reporting and poor coverage. A rough estimate is that the data collected through monitoring systems represent only 15-20% of the information they should be capturing from public sector health facility attendance, and about 3% of the annual malaria cases.[258] The Health Information System (HIS) is fragmented, uncoordinated and not linked to the national M&E framework.[259] There is therefore considerable scope for improvements in M&E and operational research, which are both crucial for the accurate analysis of the success of malaria control interventions and for tracking drug and insecticidea resistance. SuNMaP is providing valuable support through its M&E and research activities, including health facility assessment (in collaboration with the World Bank), post net campaign surveys, and baseline surveys to track the impact of scaled up malaria interventions.[260]

3.5 Delivery Systems

Malaria control is integrated into the existing health care delivery system. However, this needs considerable strengthening.[261] The scaling up of malaria interventions is therefore being realised through private and civil society channels as well as the public sector. This is necessary due to the weakness of the public health system and the vibrancy of the private

sector. 56% of malaria patients seek treatment from the private sector; just 35% rely on the national healthcare system.[262] Currently the private sector is relatively expensive, fragmented and largely unregulated, resulting in use of products that are not in line with approved national malaria guidelines. Furthermore, coordination with the private sector is weak. These issues are starting to be addressed by the NMCP and projects such as SuNMaP.[263] [264]

4. Health System Issues

The health system in Nigeria is still suffering from the decline in performance that occurred during the 1990s, and which has left infrastructure dilapidated, staff morale low and confidence in public provision amongst the population seriously lacking. The situation is compounded by the persistence of vertical programmes, the absence of appropriate skilled health workers, particularly at the community-level and in rural areas, poor inter-sectoral collaboration, weak managerial capacity and the poor HIS already indicated. Furthermore, the commodity procurement, storage and distribution systems are uncoordinated and thus hinder health care provision.[265] Low funding is a big problem that has contributed to the state of the public healthcare system and which hinders its improvement. Just 5% of government spending is directed to health, and federal government malaria control spending is just 1% of the approved national budget.[266]

The proposed National Health Bill (which has not been passed at this point, as it had to be presented to the new national Assembly), aims to make structural changes to the various tiers of government involved in the health system. Changes include alterations to the eligibility for exemptions from payment for health services, the establishment of a Tertiary Hospital Commission and the primary healthcare development fund, and the defining of the rights of healthcare users.[267] Furthermore, the NMCP is engaging in Health System Strengthening (HSS), focusing on training and motivating the health workforce, improving the health management information system, strengthening leadership and governance, and carrying out more informative operational research. Other issues include the capacity for scale-up at all levels. These include policy formulation, coordination, planning and budgeting. NMCP is responding by putting together a national coordination framework to guide activities of all players in malaria control.[268]

Other issues include the capacity for scale-up at all levels. These include policy formulation, coordination, planning and budgeting. NMCP is responding to this by putting together a national coordination framework to guide activities of all players in malaria control. It has also commenced the support to the State Malaria Control teams in the country building their capacity in developing malaria control operational plans based on the national strategic plan.

To complement recent huge investments in commodities, the programme has commenced a comprehensive capacity building exercise covering both the service delivery topics including case management and programme management for service providers both at the community level and health facility.

5. Current Funding and Technical Support

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) approved a $600 million grant in Round 8 of its funding cycle for the period 2009 - 2013.[269]

The World Bank has provided Nigeria with $300 million through its Malaria Booster project.[270]

UNICEF, USAID, DFID/SuNMaP and the Federal MDG Fund have committed $1.2 billion for the period 2009 – 2013.[271]

6. Major Gaps

Capacity for malaria control at state and local government authority level is very limited, and the numbers of people needing upgraded skills and updates according to new strategies are huge.

Information systems have been highlighted as a major weakness at different levels including collecting adequate monitoring data on drug and insecticide resistance.

There is a need to use the findings of surveys and research to revise malaria control strategies on a continuous basis.

The commodity requirement to cover the population at risk (in this case about 97% of the total population) is huge, and for it to have any serious impact on malaria prevalence this high coverage must be maintained for a prolonged period.

Access by all at-risk populations to effective treatment is too low.

Rwanda

Summary table: malaria in Rwanda

Parasites	*P. falciparum, P. vivax*
Vectors	*A. gambiae, A. funestus*
% of people under ITNs and variation across the country	68% of households own an ITN (2008).
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	SP resistance has increased over recent years, leading to the abandonment of SP use, including IPT.
IRS use	IRS is used selectively to target high transmission areas and control endemics.
IPTi use	Not in use due to SP resistance.
IPTp use	Not in use due to SP resistance.
Evidence of diagnostics being used to direct antimalarial treatment	40% of malaria cases were diagnosed using microscopy or RDT in 2008.
	July 2011

1. Introduction

Rwanda is a small, land-locked country bordered by some of the most malaria-endemic countries in the world. It has a population of approximately 10 million, making it one of the most densely populated countries in Africa.[272] Despite this, Rwanda has made incredible progress in malaria control in recent years; malaria mortality has decreased from 42% in 2006 to 19% in 2010.[273] A key difference in Rwanda as opposed to other malaria-endemic countries is the strong political will and good leadership shown by the government in strengthening the health system and extending antimalarial drug access.[274] This has also been matched by a recent increase in funding to implement the rapid scale-up of interventions.

2. The Burden of Disease

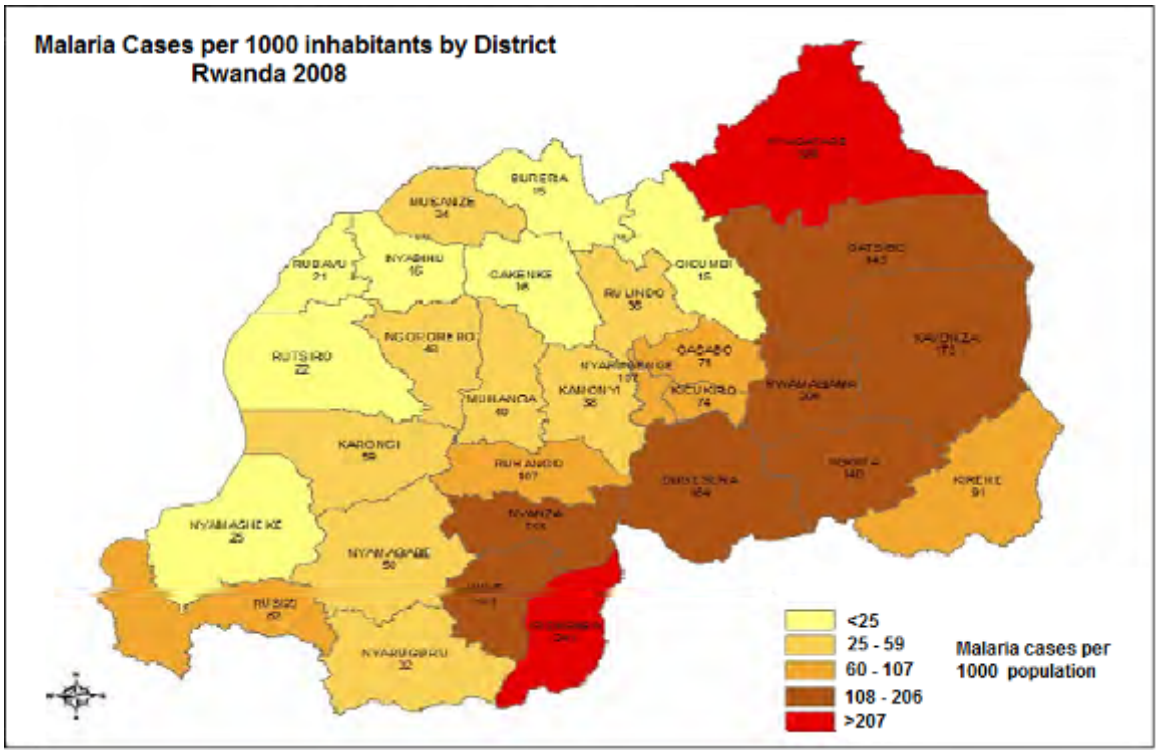
The entire population of Rwanda is at risk for contracting malaria, which in 2003 was the leading cause of mortality in the country, resulting in 2,500 deaths.[275] Recent malaria control interventions have, however, drastically reduced the malaria burden in Rwanda. The prevalence of malaria has decreased from a range of 12 to 32% in 2004 to 0.4 to 4.9% in 2007 in children under five.[276] The reported number of episodes of uncomplicated malaria (confirmed and presumed) treated in public sector health facilities fell from 1.5 million in 2005 to 1.3 million in 2006 to 900,000 in 2007 and 800,000 in 2008. In 2006, malaria was the leading cause of morbidity and mortality, representing 37% of outpatient consultations and 40.9% of hospital deaths - of which 42% were children under five. In 2008, malaria accounted for just 12% of outpatient consultations and 16% of hospital deaths. None-the-less, malaria remains a serious health concern that remains the third leading cause of morbidity after pneumonia and diarrhea.[277] Furthermore, owing to the reduced productivity of

the sick people and the time wasted to take care of them, malaria costs the nation about 2% of the GDP and 34% of household income and 20% of health expenditure.[278]

Rwanda is divided into four natural “malarial eco-zones” based on altitude, climate, level of transmission, and disease vectors. In terms of epidemiological stratification, malaria is mesoendemic in the plains, while the high plateaus and hills are epidemic prone. The NMCP has classified 19 of the 30 districts as endemic and the remaining 11 as epidemic prone; however, due to the reduction in malaria prevalence countrywide, migration and increased coverage of malaria control interventions, the National Malaria Control Programme (NMCP) is currently remapping malaria transmission to better reflect current epidemiology. Of note, the high malaria incidence along the eastern border districts of the country is probably in part due to imported cases in the large transient population from neighbouring countries.[279,280]

Malaria transmission in Rwanda is seasonal, with highest transmission following the rainy season. The main vectors are *Anopheles gambiae s.l. and A. funestus. Plasmodium falciparum* accounts for most cases of malaria, but *P. vivax* is also present.[281]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Malaria control in Rwanda is led by the NMCP, who implement interventions based on a National Malaria Strategic Plan (NMSP) 2008 – 2012. Rwanda is currently in transition from malaria control to pre-elimination, and the goal of the NMSP is therefore to scale up current interventions and consolidate recent achievements in order to reach the malaria pre-elimination phase in Rwanda by 2013. The objectives of this are:[282]

- Reduce the all-cause under-5 mortality rate by 50% by 2013.
- Reduce the incidence of confirmed malaria cases by more than 90% by 2013.
- Reduce malaria prevalence by 90% by 2013.
- Reduce deaths attributed to malaria by 90% nationwide by 2013.

3.2 Prevention

Insecticide-Treated Net (ITN) distribution has formed the central component of preventive malaria control in Rwanda over recent years, and the NMCP has been remarkably successful in its scale-up over such a short time period. Since 2006 more than three million Long-Lasting Insecticidal Nets (LLINs) have been distributed, and results from the 2008 interim Demographic Health Survey (DHS) indicate high ownership and use. Household ownership of at least one LLIN has increased from below 5% in 2000, to 15% in 2005, 33% in 2006 and, according to the DHS, 59% in 2008.[283,284] Sixty per cent of children under five and 65% of pregnant women now sleep under either an ITN or LLIN.[285] The main delivery channels are mass distribution during vaccination campaigns and routine distribution at antenatal care (ANC) and Expanded Program on Immunizations (EPI) clinics.[286,287] However, despite high levels of net ownership and large proportion of children under five and pregnant women sleeping under LLINs, the proportion of the entire population currently covered is estimated to be just 25.2%.[288] Furthermore, the Malaria Indicator Survey 2007 indicates that use of nets is lagging slightly behind ownership.[289] Therefore Behaviour Change Communication (BCC) is necessary, alongside net distribution in order to facilitate proper net usage. To this end the NMSP has set an ambitious target of universal LLIN coverage, and an additional six million nets have been procured with Global Fund and President's Malaria Initiative (PMI) funding.[290]

Owing to declining malaria incidence in Rwanda, since 2008 Indoor Residual Spraying (IRS) has been used in selected districts to control epidemics and reduce transmission rates. In particularly, IRS is being used along Rwanda's borders, where cross-border migration is causing persistently higher malaria transmission. The next several years will see a continuation of the transition from IRS as an independent insecticide-based vector control strategy to IRS as a “knock-down” technique in tandem with universal LLIN coverage for “keep-down”.[291]

Because of increasing parasite resistance to sulfadoxine-pyrimethamine (SP) and decreasing malaria prevalence in Rwanda, the NMCP discontinued Intermittent Preventive Treatment of malaria in pregnancy (IPTp) in 2008.[292]

3.3 Case Management

Improving the quality of diagnosis and the speed of treatment is a core aspect of the NMSP. The infrastructure for malaria diagnosis in Rwanda has improved in the past few years, such that 98% of health facilities currently have a functioning microscope and a laboratory technician. The number of technicians will further increase in 2009 as the Ministry of Health (MOH) implements plans to support at least two technicians per facility. Rapid Diagnostic

Tests (RDTs) have a limited role in facilities, only being used in emergency situations and when the laboratory technician is not available. RDTs are also being rolled out at the community level. The NMCP was expecting to scale up the use of RDTs at the community level by 2012, but senior MOH managers have changed this target to the end 2010.[293] Artemisinin-based Combination Therapies (ACTs) are now in use for first-line treatment across the country. Improvements in case management are reflected in the findings of the MIS, which indicated that 62% of children under five received treatment in under 24 hours in 2007.[294,295]

In 2008, despite improvements in diagnostic capabilities at health facilities, only 40% of facility-based malaria cases were confirmed by microscopy; and with decreasing transmission, the total reported case-load undoubtedly reflected significant over-treatment. More than 95% of malaria cases reported to public health facilities have been confirmed in 2010. This represents a rapid improvement on the previous year, when clinical confirmation was around 40%.[296] A significant challenge in the upcoming year, in addition to strengthening quality laboratory services, will be changing provider behaviour and understanding of the new guidelines. Furthermore, regular stock-outs have affected the ability of health facilities to diagnose and treat malaria effectively. These stock-outs reflect the need to better coordinate the supply chain system for laboratory commodities.[297,298]

3.4 Supporting Interventions

With Rwanda moving towards very good control of malaria, characterised by falling transmission rates and fewer reported cases, BCC is essential to encourage LLIN use, prompt healthcare seeking behaviour, and correct diagnosis and treatment procedures. Communities, caretakers, health providers and leaders at all levels within Rwanda will need to be sensitised to the importance of maintaining key malaria prevention and control behaviours and practices, especially regarding the significant changes in malaria prevention and control policies and shifts in epidemiological trends. Currently BCC and Information, Education and Communication (IEC) is carried out at the national, district and community levels, utilising multiple forms of media such as radio, staff training, drama and Mobile-Video-Unit (MVU) programmes, with particular focus on encouraging LLIN use.[299,300]

Epidemic Surveillance and Response (ESR) will also be critical in Rwanda's drive to eliminate malaria. The population will become increasingly vulnerable to malaria because of reduced immunity; and the country's capacity to minimise outbreaks will depend on the speed of their detection and the effectiveness of the response. Rwanda's ESR system features 20 sentinel sites, weekly TRAC+ reporting procedures, and response committees established at national and district levels. While gradually strengthening in recent years, all these systems are sub-optimal and need significant reinforcement.[301]

Monitoring and Evaluation (M&E) continue to be weak points in the national programme, although significant progress has been made since 2008. In addition to routine monitoring of reported malaria cases through the Health Management Information Systems (HMIS), monitoring is needed for such routine processes as commodity procurement and distribution, fever case management at both facility and community levels, roll-out of community case management, insecticide resistance, and entomology. Somewhat longer term evaluation and operational research are needed for the rapidly evolving community case management program, for the roll-out of RDTs, and for the effectiveness of the overall NMSP. In general, such data have become increasingly vital as Rwanda approaches pre-elimination and enters into a regional leadership role in malaria reduction. The relative weakness of M&E capabilities has led to increased attention from the MOH, the Global Fund and other donors.[302]

3.5 Delivery Systems

While the public sector is the principal delivery system for malaria control interventions, the private sector also has an important role in Rwanda. The private healthcare sector is strong in Rwanda, and since 26% of private health funds go towards malaria efforts, they represent an essential partner in malaria control.[303]

The NMCP has adopted a strategy of utilising the private sector in order to facilitate the rapid scaling-up of ACT availability. Activities to this end include officially registering private pharmacies, developing a system of accreditation to encourage recommended treatment practices, and developing a marketing and subsidised pricing scheme to promote appropriate treatment of malaria for children under five. In addition to increasing accessibility to AL, this strategy discourages the sale and use of non-recommended antimalarials that are either no longer efficacious (e.g. SP) or that could undermine the efficacy of the newly introduced treatment by promoting drug resistance (e.g., artemisinin monotherapy). The current private sector strategy provides highly subsidized AL to a population most at risk from severe malaria, and has been successfully implemented nationwide. When the national policy shifts to treatment of laboratory confirmed cases only, ensuring that the guidelines are followed in the private sector will be a challenge.[304] The commercial sector also plays an important role in the distribution of LLINs; 48% of the 233,500 LLINs distributed in 2005 were channelled through the private sector.[305]

4. Health System Issues

The Rwandan government has increased healthcare expenditure substantially over the last decade, by 304% between 2002 and 2007.[306] This increase in investment was critical, as much of the health infrastructure in Rwanda is over thirty years old and in poor condition. There are inadequate human resources for the system to operate efficiently, and community-level primary care was weak. The government's Strategic Health Plan and Strategic Plan for Human Resources have begun to address these issues, but further work is required.[307]

Recognising the importance of a strong and effective public health system for the successful control of malaria, the MOH made Health System Strengthening (HSS) a key component of the successful Global Fund Round 8 application. This contained a focus upon Home based Management of Malaria (HMM) as a means to strengthen community-level primary care. Community Heath Workers (CHWs) are being trained and empowered to carry out malaria diagnosis using RDTs in-line with NMCPs focus on improving diagnosis.[308] There is now an average of 4 CHWs per village. Since 2006 there has been a significant increase in the quality, capacity and usage of the health system, which is testament to the government's commitment to HSS. Key changes have been the enrolling of people in 'fee for service' health insurance schemes (from 7% in 2003 to 92% in 2009) and the introduction of performance-based pay for health workers, thus improving staff motivation.[309]

5. Current Funding and Technical Support

Rwanda has received four Global Fund grants to date: Round 3 (completed), Round 5 (under way), Rolling Continuation Channel (RCC), and the recently signed Round 8. Phase 1 of the Round 8 grant includes $58 million to support the expansion of community case management and universal coverage of LLINs. Global Fund financing totals $337 million as of August 2010.[310,311]

Rwanda submitted a proposal for the Affordable Medicines Facility for Malaria which will provide further subsidised ACTs and allow the program to direct funds towards other case management and supply chain interventions.[312]

The World Bank has provided $9 million for malaria control activities since 2006, and the WHO has granted $1 million over the same period (WHO 2009).

PMI is a major supporter of Rwanda, with disbursements of $17 million a year since 2007. PMI is providing $18 million in 2010 to support IRS, the procurement and distribution of LLINs, the implementation of community-based treatment of malaria and to strengthen malaria laboratory diagnosis, monitoring and evaluation and epidemic surveillance.[313]

6. Major Gaps

Rwanda can now be considered to have good control of malaria. A key emphasis is thus surveillance, yet data quality remains an issue – up to 15% discrepancies during recent quality assessments. The HMIS remains overly complex, and community and private sector information is not complete. Furthermore, feedback mechanisms are constrained by time and resources.[314]

Sustaining recent achievements will also be a challenge. For example, ITN usage tends to reduce as the prevalence of malaria falls. The population's level of immunity is also likely to drop as fewer Rwandans are exposed to malaria. There may also be a potential drop in funding to support interventions.[315]
Drug resistance continues to need constant monitoring and insecticide resistance is a growing concern.

Sierra Leone

Summary table: malaria in Sierra Leone

Parasites	*P. falciparum, P. malariae, P. ovale*
Vectors	*A. gambiae s.l., A. funestus, A. melas*
% of people under ITNs and variation across the country	78% of children under five and 61% of pregnant women sleep under an ITN (2007).
First-line drug for *P. falciparum* (unconfirmed)	AS+AQ
First-line drug for *P. falciparum* (confirmed)	AS+AQ
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	Growing resistance to CQ, SP and AQ monotherapies caused a shift to ACT use as policy. AQ resistance is continuing to be monitored.
IRS use	Not in use.
IPTi use	Not in use.
IPTp use	IPTp is in use, with an uptake of 42% in 2009.
Evidence of diagnostics being used to direct antimalarial treatment	Most malaria cases are not confirmed by either microscopy or RDT and are diagnosed based upon clinical symptoms.
	July 2011

1. Introduction

Sierra Leone has a large and increasing malaria burden, which has been exacerbated by 10 years of civil conflict that has resulted in substantial population displacement and damage to the health system. The scale-up of malaria control interventions in Sierra Leone have been hindered by the state of the country following the civil war, poor human resources and a weak health system. Critically, malaria control is hugely under-resourced and under-funded, which has been exacerbated by the failure of a GFATM Round 9 proposal.

2. The Burden of Disease

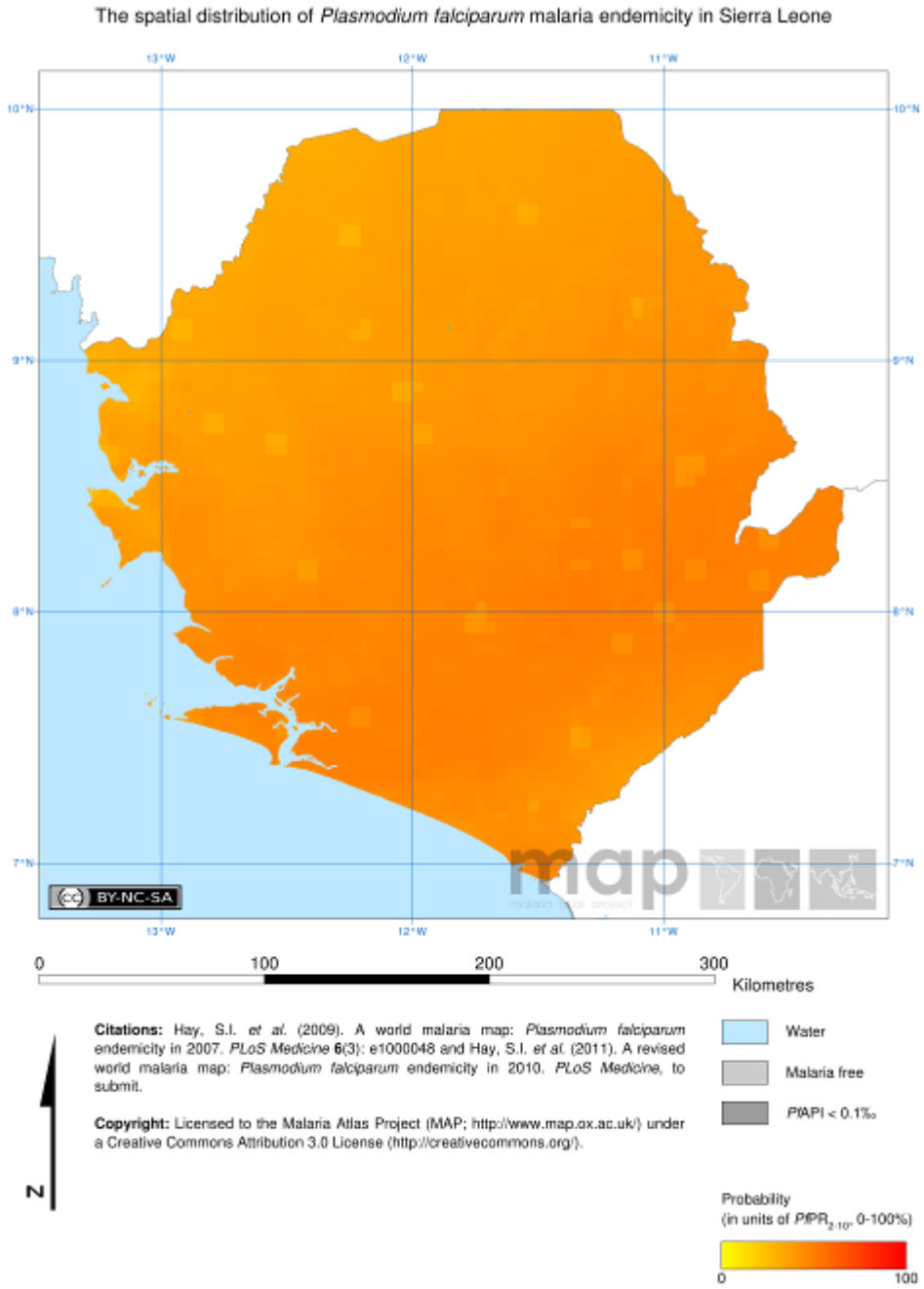
With an under-five mortality rate of 267/1000 live births, Sierra Leone has the highest under-five mortality in the world, and malaria is the number one cause of deaths. Malaria is also one of the major causes of maternal anaemia; 87% of pregnant women are anaemic, and 70% of maternal anaemia is caused by malaria. It is estimated that 11% of maternal deaths are related to malaria. However, the malaria burden is extremely heavy for the entire population: malaria cases were more than 500 per 1000 population in 2003 and about 330 per 1000 in 2007. In 2007 the disease accounted for 48% of all outpatient consultations, 38% of hospital admissions, and remains a major threat to socioeconomic development.[316] The high burden of malaria is responsible for an estimated average annual reduction of 1.3% in economic growth and serious social disruptions arising from absence from work or school (7-12 days) due to acute disease episodes. Studies showed that the direct cost of a single episode of malaria to a household ranges from $4.50 to $6.87.[317] There were 932,819 reported cases in 2008, an increase of 280,000 on 2007.[318] Evidence from the National Health Management Information System (HMIS) corroborates these figures, and shows an increasing trend of malaria incidence in Sierra Leone. This is also confirmed from district

data (International Rescue Committee) and other NGOs operating in different part of the country.[319]

Malaria transmission occurs throughout the year, with peaks at the beginning and at the end of the rainy season. The endemicity ranges from mesoendemic to hyper/holoendemic, and the prevalence rate of infection is about 65%. *Plasmodium falciparum* accounts for 90% of infections, with mixed infection with *P. malariae* and *P. ovale* occurring occasionally. The main vectors are *Anopheles gambiae s.l., A. funestus* and *A. melas.* The whole population of Sierra Leone is at risk for the disease.[320] [321]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. melas	Salt water lagoons, mangrove swamps.	Endophagic and exophagic, anthropophilic and zoophilic. Bite late at night.	Exophilic and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

The emergence and spread of multi-drug resistant *P. falciparum* has been one of the most significant changes in the dynamics and epidemiology of malaria in Sierra Leone. Drug efficacy studies conducted in 2003 on chloroquine (CQ), sulfadoxine-pyrimethamine (SP) and amodiaquine (AQ) as mono-therapeutic agents showed *P. falciparum* resistance to these drugs. The day-28 treatment failures rates for CQ and SP were 39-78% and 17-46% respectively. This has necessitated their replacement with artemisinin-based combination therapy (ACT) containing artesunate + amodiaquine (AS+AQ). Parasite resistance to amodiaquine was lower with the exception of an isolated report of 29.8% failure rate in one district (Kailahun), which has been a source of concern. This calls for close monitoring of the therapeutic efficacy of artesunate + amodiaquine combination, and therefore since the introduction of ACTs across Sierra Leone sentinel sites have been established, with support from the Round 4 GFATM grant, to this end.[322]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The National Malaria Control Programme (NMCP) in Sierra Leone is implementing malaria control interventions in line with the Strategic Plan on Malaria Control and Prevention 2009 – 2015. The overall objective of the plan is to reduce mortality and morbidity due to malaria by 50% by 2010 and by 75% by 2015.[323]

3.2 Prevention

One of the key preventive malaria control interventions is the distribution of Insecticide Treated Nets (ITNs), including Long Lasting Insecticidal Nets (LLINs), to pregnant women

and children under five, who are most vulnerable to malaria. Distribution is integrated into existing healthcare strategies, primarily childhood immunisation and antenatal care (ANC) appointments. ITN coverage was successfully scaled up between 2004 and 2007, with coverage of children under five and pregnant women increasing from 10% to 78% and 12.4% to 61% respectively.[324] However, LLIN coverage is just 22%, while the target is 80%.[325] 3 million LLINs are estimated to be needed in 2010, but just 1.4 million are currently expected to be funded and delivered by the end of the year. This leaves a gap of 1.6 million LLINs.[326] A lack of funding is the primary reason for this gap.

Sierra Leone has adopted the use of Intermittent Preventive Treatment for malaria in pregnancy (IPTp) as one of the intervention packages aimed at making pregnancy safer. The implementation of IPTp started in 2006 in the UNICEF supported districts (Bombali, Kono, Kailahun, Kambia, Pujehun and Kambia district.). IPTp is now widely available at health facilities in Sierra Leone, but despite this the uptake has only increased from 31.4% in 2007 to 42% in 2009.[327] [328] To increase coverage, the NMCP, in collaboration with the Reproductive Health Unit and non-governmental subrecipients, is implementing a community-based IPTp delivery system. Maternal and Child Health (MCH) assistants continue to conduct the majority of deliveries in Sierra Leone and have frequent, sustained contact with pregnant women throughout gestation. As such, MCHs are a key resource for ensuring that all pregnant women receive at least two doses of IPTp during the second and third trimesters of pregnancy, as they also deliver other aspects of ANC such as providing iron and folic acid supplements. Targeted Behaviour Change Communication (BCC) is also required in order to educate women about the benefits of IPTp and to encourage them to seek at least two doses during their pregnancy.[329]

Other preventive measures, such as environmental management measures, such as draining breeding sites, are not regularly practiced. The feasibility and large-scale impact of such measures are questionable, except in particular settings, which do not cover the bulk of the malaria burden. The feasibility of Indoor Residual Spraying (IRS) has not been explored and therefore is not in use.[330]

3.3 Case Management

Case management in Sierra Leone needs considerable strengthening. In 2004, the first line treatment for uncomplicated malaria was changed from chloroquine to artesunate-amodiaquine, with artemether-lumefantrine as the alternative medicine in cases of contraindications or adverse side effects to the first option. ACT implementation is now nationwide.[331] However, despite ACTs being available, illustrated by the finding that 85.5% of Peripheral Health Units (PHUs) experience no ACT stock-outs, only 10% of children under five obtained prompt and appropriate treatment in 2007.[332] Amongst the entire population, the treatment of malaria using ACT was 40%, with the rest receiving CQ, SP or artemisinin-based monotherapies. Furthermore, most patients who receive ACT do so without confirmatory diagnosis by microscopy or Rapid Diagnostic Test (RDT), which leads to the waste of expensive medicines and the mistreatment of other febrile conditions.[333] ACTs have been made widely available through the GFATM Round 7 grant, but with this coming to an end in 2012 and no further GFATM support yet agreed, an ACT gap is expected. Finally, although policy guidelines and training materials have been produced and disseminated, and primary and secondary level health workers trained, ineffective and inappropriate case management is common throughout Sierra Leone.[334]

3.4 Supporting Interventions

BCC and Information Education and Communication (IEC) efforts are currently low, with just a few fragmented and programme-specific activities. The public are not well informed of the benefits of malaria prevention and control interventions, as there is evidence that only 26%

of those who receive a LLIN sleep under it, and that most cases of malaria are still incorrectly treated at home.[335] Through the GFATM Round 7 grant efforts are being made to increase BCC/IEC activities, focusing on encouraging the uptake of Home Management of Malaria (HMM), improving knowledge of, and the demand for IPTp, increasing the number of people who sleep under distributed LLINs, and improving the general malaria knowledge and treatment-seeking behaviour of the population. BCC materials include posters, flyers, billboards, and radio messages.[336]

Monitoring and evaluation (M&E) in Sierra Leone are predominantly carried out through the Health Management of Information System (HMIS). However, the HMIS is relatively weak; characterised by late and incomplete reporting. There is currently no national M&E plan. Both of these issues are being tackled through a collaborative initiative with the Health Metrics Network (HMN), which aims to strengthen the HMIS and develop an integrated national M&E plan. Continuing problems to be solved include the personnel responsible for M&E at the national and district levels, who need more training to improve their data and information management skills, and the lack of adequate logistics for supervision and M&E due to the difficult terrain in rural Sierra Leone.[337]

3.5 Delivery Systems

Malaria control interventions are delivered through a range of channels in Sierra Leone. LLIN distribution and IPTp are integrated into childhood immunisation and ante-natal care appointments. Malaria case management of children under five, a major weakness of the current NMCP, is carried out at national health facilities in only 10% of cases, due to the weakness and inaccessibility of the health system. Many people treat their symptoms at home, or seek treatment from unlicensed private retailers.[338] The NMCP is in the process of implementing a system of Home Management of Malaria in order to extend case management and primary healthcare to the large proportion of the population who are unable to access national healthcare facilities. HMM relies on local community volunteers, trained in the use of RDTs, ACTs and other primary care skills, to provide care where possible and act as the first point of contact for referral in more complex cases. With support from the EU, HMM was successfully implemented in 5 of the 13 districts in 2008, and its extension to all 13 districts is currently under way.[339] However, while the government claims that malaria care is free, people often have to pay because the HMM volunteers do not receive salaries. This is a major barrier to improved access (Personal Communication).

4. Health System Issues

Due to 10 years of civil war and Sierra Leone's low GDP, the public health system needs a lot of strengthening. The healthcare delivery system in Sierra Leone is publicly and privately funded and operates through a variety of different providers, including the public sector, NGOs, church related agencies, private-for-profit clinics, commercial companies and traditional health practitioners. Given the limited resources available, the Ministry of Health and Sanitation has focused on primary health care, which is the first point of contact for malaria cases. There are an estimated 83 hospitals, 862 Primary Healthcare Units (PHUs), 44 pharmacies, 145 retailers and 78 wholesalers. No public health insurance scheme exists, and the cost of healthcare predominantly falls upon the patient. Medicines represent by far the largest proportion of out-of-pocket health expenditure.[340]

Human resources are a key weakness in the health system. There is a very high attrition rate among indigenous key staff, leading to an acute shortage of medical, nursing and other health staff in all health facilities. For instance the number of medical officers available in the health service declined from 203 in 1993 to 99 in 2006, while the number of obstetricians and nurses fell from 22 and 623 in 1993 to 7 and 202 in 2006 respectively.[341]

The ten year civil war caused a devastating and massive destruction of health facilities nationwide, resulting in a deplorable health care delivery system. Inadequate transportation, communication and other logistics support are among the key areas of weakness. Nurses have no transportation to conduct outreach clinics, and when medical emergencies occur, PHUs often have no way to call for an ambulance for referral. The inadequate equipment of health facilities has contributed to the low community confidence in the formal health system, and consequently, has led to low utilisation.[342]

On the whole, the government has a well-structured procurement and supply management system at the national and district levels. However, this system has been weakened by the loss of human resources, infrastructure and logistic support in the course of the civil war. Furthermore, stock outs of ACTs are estimated to be much higher than is reported, which contributes to low public confidence in the public health system and adds to the cost of treatment for patients (Personal Communication). Therefore there is a need to strengthen this system.[343]

5. Current Funding and Technical Support

Sierra Leone lacks the financial support to successfully implement the current Strategic Plan on Malaria Control and Prevention 2009 – 2015. The estimated budget required to implement the strategic plan is $129 million, but just $16 million is projected to be available through GFATM and from government sources, leaving a gap of $113 million to support implementation of the plan.[344]

The Global Fund to Fight Aids, Tuberculosis and Malaria (GFATM) is providing support to malaria control in Sierra Leone through Round 4 and Round 7 (2008 – 2012) grants, worth a total of $37.5 million. However, disbursements are considerably behind schedule; 45 months in the case of the Round 4 grant, and no new grants have been agreed for when Round 7 ends.[345]

The main international bilateral and multilateral bodies contributing financially to the control of malaria in Sierra Leone, besides the GFATM, are the EU, DFID, World Bank, UNICEF and WHO.

The EU is providing approximately $1.5 million to Plan International from 2007 – 2011 in Port Loko and Moyamba districts, for malaria prevention and control in health facilities.

DFID, in collaboration with the World Bank and Irish Aid, will be providing approximately £50 million 2008 - 2017 for the Accelerated Child Survival and Maternal Mortality Reduction Project, which has a malaria aspect due to its place as the leading cause of childhood mortality.[346]

6. Major Gaps

The major gaps thus identified include:

- 1.6 million LLINs and the means to distribute them.
- A comprehensive diagnostics policy including the need for all cases to be parasitologically confirmed before treatment.
- The strengthening of the diagnostic services including the central laboratory to ensure a quality assured diagnostic policy.
- A comprehensive training plan to ensure the correct use of RDTs and ACTs in the public and privates sector.

- A strengthened HMIS to quantify and forecast the need for RDTs and ACTs.
- A comprehensive M&E plan to strengthen data collection, improve procurement and supply, and increase the supervision and training of staff to ensure a better quality of care at all levels.
- Training of VHW and MCH aides to deliver malaria care at the peripheral level.
- Consideration of an integrated community care of childhood diseases to be delivered at community level to reduce the high level of child mortality, especially as malaria becomes a less common cause of fever.
- Training to improve the hospital care for severely ill patients, including improvement of lab services and emergency treatment.
- Provision of safe blood transfusion services in all places where severe cases are treated to reduce both maternal and child deaths.
- Improvement of the referral system, including the provision of rectal artesunate in remote areas for pre-referral treatment to prevent deaths.
- A comprehensive plan to address the causes and treatment of non malaria fevers, including clear instructions for peripheral health workers of what to do if RDT results are negative.
- The use of the fixed dose ASAQ instead of the blister packs to increase adherence and prevent the use of monotherapies.
- Regular review of the efficacy of AS+AQ in view of previous concerns as to its efficacy in Kailahan.
- A comprehensive BCC plan to improve utilisation of nets and early treatment seeking in case of fever. BCC should also increase the demand for high quality services including diagnosis before treatment and the use of ACTs, especially in the private sector.
- The BCC programme should also discourage the use of traditional medicines for treating fever cases and be directed at improving adherence to a proper treatment regime which has been found to be very low.
- Ability to pay for treatment is very low as people are very poor in rural areas and incur much cost in transport etc. Malaria prevention, diagnosis and treatment should be provided free of charge (it is supposed to be now but usually is not).
- Greater financial support from the government and donors considering the importance of malaria as a cause of mortality and morbidity in Sierra Leone.
- Trained personnel.

Somalia

Summary table: malaria in Somalia

Parasites	*P. falciparum, P. vivax*
Vectors	*A. arabiensis*, *A. funestus*
% of people under ITNs and variation across the country	40-47% of households own at least 2 LLINs (2009).
First-line drug for *P. falciparum* (unconfirmed)	AS+SP
First-line drug for *P. falciparum* (confirmed)	AS+SP
Second-line drug for *P. falciparum*	QN
Evidence of insecticide &/or drug resistance	Resistance to CQ and SP is increasing. CQ has been discontinued and SP is being phased out as policy.
IRS use	IRS is used selectively to control epidemics and outbreaks, currently protecting 21,000 a year.
IPTi use	Not in use.
IPTp use	IPTp is in use, but accurate data on the number of pregnant women receiving IPTp is not available.
Evidence of diagnostics being used to direct antimalarial treatment	Microscopy and RDT coverage is 46%, but the quality and accuracy of diagnosis remains a problem.
	July 2011

1. Introduction

Somalia is a heavily divided country which has no functioning national government and is currently engulfed in civil war. Somaliland, Puntland and the Central South Zone (CSZ) are administered separately; resulting in different levels of effective healthcare and malaria control. The current estimated population of Somalia is thought to be roughly 9.3 million people, although estimates range from 6 - 11 million. The last available Human Development ranking placed Somalia 161/163 in the world.[347] Despite this, malaria transmission seems to have fallen in recent years, in part due to the introduction of malaria control interventions.

2. The Burden of Disease

The malaria burden in Somalia is extremely hard to quantify, due to hugely inaccurate and patchy reporting and a completely inadequate monitoring and evaluating system. Estimates of morbidity and mortality therefore vary massively.

In 2008 the Health Management Information System (HMIS) reported 45,826 uncomplicated cases and 4,456 severe cases. However, since HMIS has not been rolled out to all health facilities this is probably an underestimation.[348] The WHO World Malaria Report (2008) estimated 608,831 cases and 3,491 deaths. However, Snow et al predicts that there were 744,590 clinical malaria episodes and 7,460 malaria deaths in 2009– this represents a 57% and 67% reduction in episodes and deaths since 2005.[349] However, it cannot be stated conclusively that these reductions are due to malaria interventions; changes in climatic conditions are thought to have contributed too. Regardless, there has been good progress towards Scale Up For Impact (SUFI) targets since 2006, and the current situation is markedly better than five years ago (Global Fund to fight AIDS, Tuberculosis and Malaria).[350] However, current models identify remaining areas of high transmission risk which need to continue to be targeted, especially in the southern region (approximately 3.7 million people), and foci "hotspots" in Somaliland and Puntland (approximately 45,000 households).[351]

Malaria transmission is high and intense in the South, unstable and epidemic-prone in Puntland and Somaliland, and moderate and unstable in the centre. It is estimated that approximately 75% of Somalia's people live in areas that support unstable or very low transmission and less than 0.1% live in areas classified as high, intense transmission.[352]

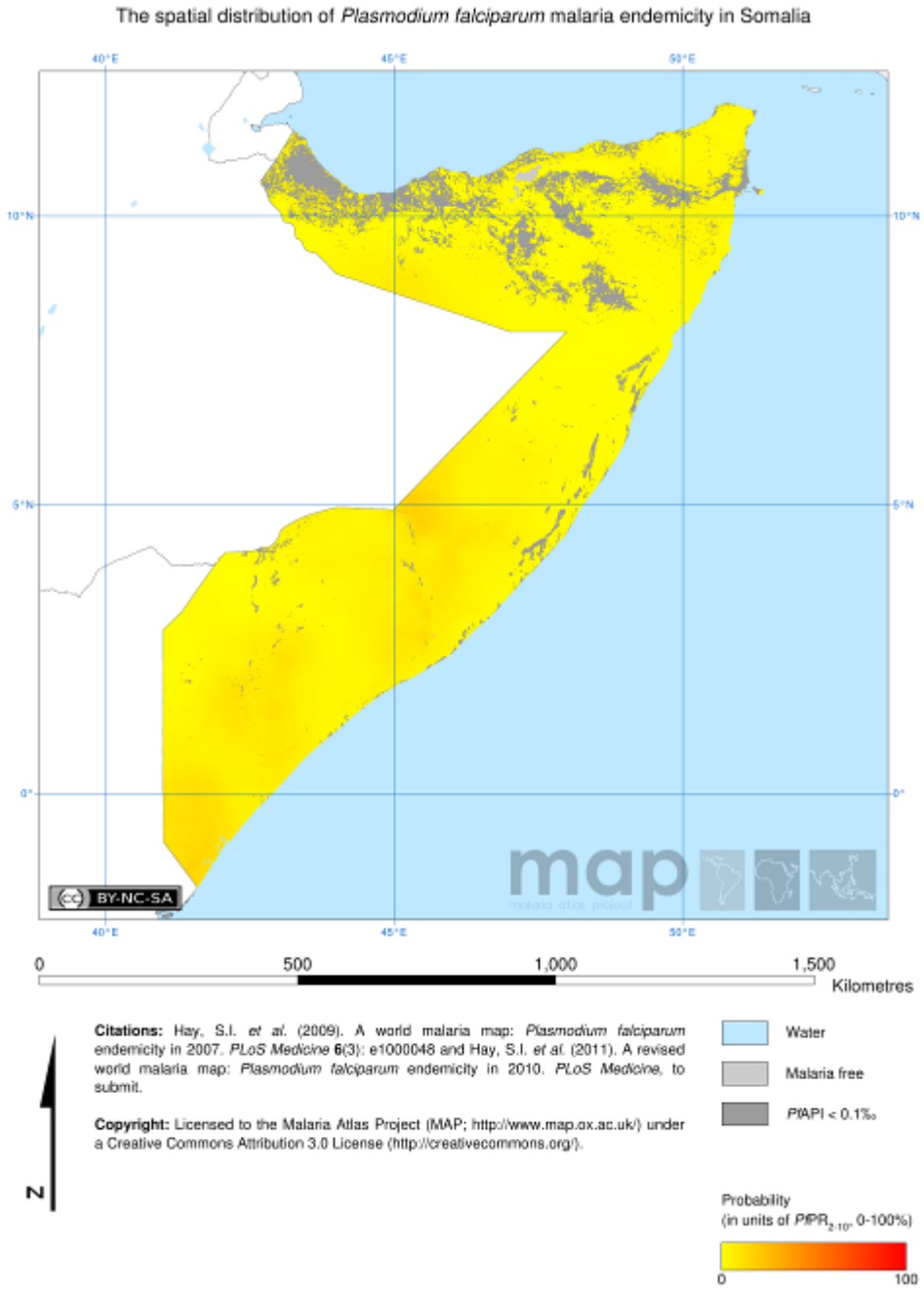
Vector	Breeding places	Biting habits	Resting habits
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

The dominant species of malaria throughout Somalia is overwhelmingly *Plasmodium falciparum*, although *P. vivax* has been identified in some regions. However, it is thought to count for no more than 2% of infections at its most prevalent in the Central Zone. The primary vector in Somalia is *Anopheles arabiensis*, which is found in all four regions. *A. funestus* is also present, but only in the Central and Southern Zones.[353]

	Somaliland	Puntland	Central Zone	Southern Zone
Epidemic potential	High	High	Moderate	Moderate-Low
Populations at risk	All age groups	All age groups	All age groups, but particularly pregnant women and children under 5	Pregnant women and children under 5
Mosquito vectors	*An arabiensis*	*An arabiensis*	*An. arabiensis* *An. Funestus*	*An. arabiensis* *An. funestus*
Plasmodium	*P. falciparum*	*P. falciparum*	*P. falciparum*	*P.*

species (in order of assumed prevalence)	*P. vivax* *P. malariae*	*P. vivax* *P. malariae*	*P. vivax* *P. malariae*	*falciparum* *P. vivax* *P. malariae*

Parasite resistance to antimalarial drugs has been increasing over several years. In 2003 it was observed that Chloroquine (CQ) treatment failure rates were between 76% - 88%. Sulfadoxine-pyrimethamine (SP) failure rates were between 8 – 12% in the same year. CQ has therefore been discontinued as an antimalarial, and SP is being phased out.[354]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The National Malaria Control Programme (NMCP) has been implementing malaria control interventions based on the National Malaria Strategic Plan (NMSP) 2005 – 2010, the goal of which was to reduce the malaria burden by 50% by 2010. While scale-up has is not complete, reductions in morbidity and mortality related to malaria have been recorded. An updated NMSP 2011 – 2015 has therefore been drafted, in order to sustain and improve upon this success. The specific goals of the new NMSP are:

- By 2015, achieve near zero (<1% parasite prevalence) malaria prevalence within areas of historically low transmission (Somaliland, Puntland and Central parts of Central South Zone).
- By 2015, achieve and sustain universal coverage resulting in 50% reduction of malaria prevalence in malarious areas of the country (Southern parts of Central South Zone).[355]

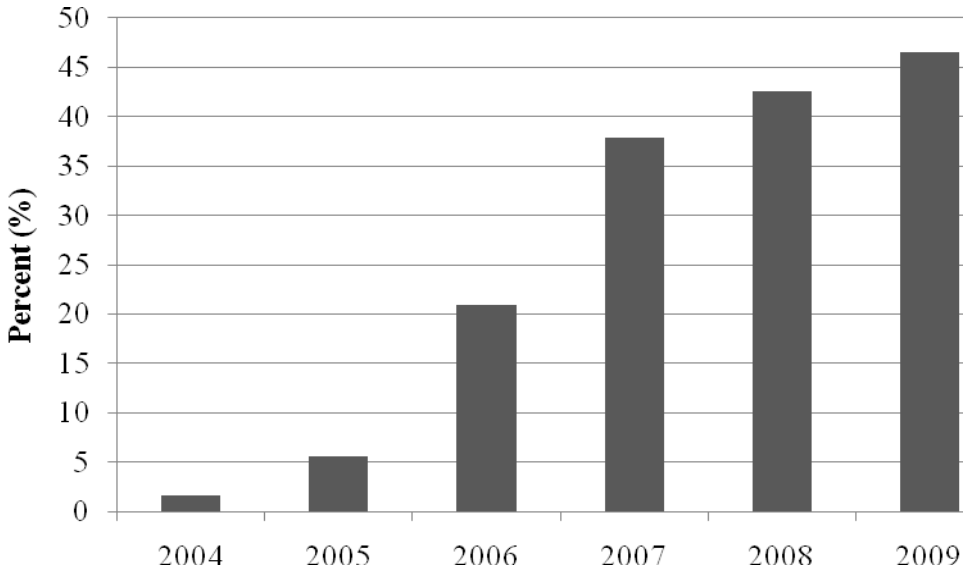
3.2 Prevention

The primary preventive malaria control intervention in Somalia is the distribution of Insecticide-Treated Nets (ITNs), including Long Lasting Insecticidal Nets (LLINs). Up until 2007, target groups for LLINs were children under five and pregnant women throughout Somalia. However, during 2007, there was a major strategic shift to universal coverage with LLINs in line with global policies. In addition, areas of higher transmission intensity were identified through mapping and modelling of parasite prevalence and since then high transmission districts and foci have been targeted for mass distribution campaigns. Estimated possession rates of 2 LLINs per household as of late 2009 were between 40-47%, for groups living in high malaria transmission areas. This almost meets the 50% goal set in the NMSP 2005 – 2010.[356] Those estimates were confirmed in some areas where Food Security and Nutrition Analysis Unit (FSNAU) surveys have been undertaken in 2009. Utilisation rates are lower, estimated at 25% to 30%. The lower rates may be as a result of seasonal usage, or lack of education as to how to use the nets. Areas of remaining high transmission, the South in particular, will be targeted with universal net distribution.[357]

Aside from LLIN distribution, Indoor Residual Spraying (IRS) has seen limited use in recent years, mostly in order to control epidemic outbreaks. IRS was not previously an aspect of the NMSP, but the increasingly clearer picture of the distribution of malaria transmission, and especially malaria foci, allowed for a nascent IRS campaign to begin in 2009. Campaigns respond to outbreaks identified through FSNAU surveys or in areas of high malaria transmission targeted because of history of epidemics in those areas. A team of 33 spray operators, 11 per zone, have been trained with standard training materials, 250 sets of safety equipment and 150 spray pumps. Campaigns currently target 21,000 people (5,742 households) in malaria transmission foci once a year until 2012.[358]

Intermittent Preventive Treatment (IPTp), using SP, is used for the control of malaria in pregnancy. However, it is unknown what proportion of pregnant women receive IPT.[359]

Estimated LLIN ownership in malarious areas of Somalia (estimated population 6 m) based on distributions by partners 2004 – 2009



3.3 Case Management

Diagnosis is carried out through either microscopy or Rapid Diagnostic Test (RDT) diagnostics. Presently, there are 100 trained microscopists operating from Mother and Child Health facilities (MCHs) and hospitals in Somalia; thus microscopy coverage is approximately 19%.[360] RDTs have been provided to many facilities, but their roll-out has been problematic; staff require training and supervision to avoid improper use of RDTs. It is estimated that microscopy and RDT coverage combined is 46%.[361] However, the quality of these diagnostic services is unknown, and it is believed that most cases are unconfirmed. Artemisinin-based Combination Therapy (ACT), using Artesunate (AS) + SP, has been recommended as first-line treatment in Somalia since April 2006 due to evidence showing high resistance to CQ. At present, all hospitals (11) and MCHs (285) have access to ACTs, 100 MCHs/hospitals have access to microscopy and all 285 MCHs have access to RDTs. SP is being phased out at Health Post (HP) level to be replaced with ACTs by the end of 2011.[362]

The security situation in Somalia is causing critical supply problems. There are regular stock-outs of antimalarials and diagnostics, and importing supplies into the country is costly due to high local transport costs. In addition, supplies are sometimes looted or unreachable because of localised insecurity. This situation has a direct impact on the availability of malaria treatment to all groups accessing care, and thus on malaria-related morbidity and mortality and undermines public confidence in the public health system.[363]

3.4 Supporting Interventions

Behaviour Change Communication (BCC) and Information, Education and Change (IEC) in Somalia are guided by the Malaria Communication Strategy 2006 – 2010, which has trained 35 Community Mobilisers (CMs) and 122 community educators. However, so far efforts have been largely unsuccessful. BCC/IEC has been implemented through a network of partners, which has led to fragmented activities and uneven coverage of the country. The results of these activities are not known, but it can be assumed that knowledge relating to malaria

interventions, quality treatment for malaria following diagnosis and use of LLINs is not high among the population. The current NMSP seeks to improve BCC/IEC, with both mass media and community mobilisation as complementary approaches.[364]

Monitoring and Evaluation (M&E) in Somalia has been extremely poor – illustrated by the lack of accurate data regarding malaria-related morbidity and mortality. The Health Management Information System (HMIS), which represents the primary source of data for M&E, has many problems. These include poor access to health facilities, low human resource capacity, and many different data demands from different programmes leading to an over-burdened system. On-going attempts to strengthen the HMIS have resulted in some improvements, particularly in Somaliland and Puntland. However, there is still a large gap in South Central Zone as a result of a lack of leadership, due to the highly insecure environment. These constraints are related to the poor overall infrastructure and staff capacity at different levels of the health system.[365] The recently devised National Malaria Prevention and Control Monitoring and Evaluation Plan 2011 – 2015 is part of renewed efforts to improve the M&E systems in Somalia, which are key for effective malaria control intervention planning and implementation.[366]

3.5 Delivery Systems

Malaria control interventions are predominantly delivered through the public health system and non-governmental organisations (NGOs). Years of conflict and neglect has left the public health system extremely weak, with insufficient infrastructure, human resources or capacity to provide healthcare to the population. Therefore, it is not surprising that the majority of people in Somalia will delay seeking treatment, and then attend a private sector facility rather than a public one; especially since both public and private healthcare must be paid for. Noor et al reported that in three sentinel districts in Somaliland, Puntland and the CSZ private pharmacies outnumber public health facilities 4:1.[367] However, only 8.8% of the private pharmacies prescribed Artesunate+SP, while 53.1% prescribed CQ as first-line therapy. One-third of pharmacies also provided diagnostic services using RDT or microscopy. There is little or no regulation of the private sector at present in Somaliland, Puntland or CSZ. Recognising the reach of the private health sector in Somalia, through a recently submitted Round 10 GFATM grant the NMCP will attempt to engage with private providers. They will identify private sector outlets and pharmacies that are supplying ACTs, wholesalers and suppliers will be consulted and encouraged to supply ACTs & RDTs, and workers in private sector clinics will be trained in their use.[368]

4. Health System Issues

The poor quality of the health system is one of the greatest hindrances to malaria control, as there is very little capacity for the effective case management necessary to tackle malaria. Facilities are in poor condition, lack basic commodities and are often under-staffed. Of the staff in place, most are barely literate, without any formal training and unmotivated. In Somaliland there are an estimated 400 health staff, but a recent assessment of MCHs found 70% of staff without any formal training or certification.[369] The public health system in Somalia is so fragmented no-one knows exactly how many facilities serve the population. The current estimates of functioning health facilities is 63 Hospitals, 234 MCHs, and 625 Health Posts (HPs). Very little is known about the functional capacity of these health posts; RDT and ACT kits are supplied to the health posts but in many cases it is not known how these kits are used, and by whom. International and national support in recent years has been concentrated at the MCH level, but even those MCHs that are functioning are doing so to varying degrees and do not have enough resources, capacity and support to provide full range of health services included in the Essential Package of Health Services (EPHS). While a mapping exercise has been carried out for MCHs, no equivalent exercise has been done

for the HPs. Thus, the actual number of functional HPs, and their location remains largely unknown.
Ideally, partners would like to know what the capacity HPs have, and how they use current resources, in order to build a national strategy for developing HPs into the community care providers for a large proportion of the under-served population.[370]

Health System Strengthening (HSS) is being implemented in order to improve public healthcare provision. HSS is focusing on three key areas: quality assurance, especially with regards to laboratory diagnosis; institutional and human resource capacity building; and improving the HMIS and operational research. The problems to be faced include low financial resources and the difficult political and logistical context.[371] However, HSS is also taking place through the GFATM HIV Round 8 grant, focusing on improving quality of the health network and piloting female Community Health Workers (CHWs), who will undertake treatment of malaria as well as HIV and other diseases.[372]

5. Current Funding and Technical Support

The financial input of local authorities to overall public health services is less than 2% of the overall funding of the public health sector, which is estimated to be below $5 per head. Apart from the funding provided through the GFATM to Fight Aids, Tuberculosis and Malaria (GFATM) Round 6, support for malaria programming is minimal. The GFATM Round 6 grant, worth $25 million, will come to an end in September 2012.[373]

Few potential donors for malaria programming exist for Somalia in the current context outside of the GFATM. If peace is established, substantial amounts of funds may be available via donor pledges geared towards the reconstruction and development of the country. Presently, donors tend to focus on the establishment of Federal Transitional Institutions rather than funding the health sector. In the meantime, in addition to the GFATM, it is anticipated that UNICEF and WHO will continue to support malaria disease control.[374]

However, the EU is funding HSS, which is also taking place through the GFATM HIV/Aids Round 8 proposal as mentioned above (Personal Communication).

6. Major Gaps

There is a lack of political stability caused by the ongoing conflict. Peace would allow reconstruction to begin and bring greater international financial assistance.

There is a lack of sustained funding and diversity in donors. All current funding is short-term, and the NMCP is reliant on the GFATM. This reliance has skewed the health system towards dealing with malaria and HIV/Aids foremost, although they are not the biggest health priorities in Somalia.

The health system is fragmented and under-developed, and it suffers from a critical lack of human resources, financial support, infrastructure and necessary health commodities.

An integrated M&E framework is required in order to tackle the fragmented nature of current M&E efforts which hinders the development of a clear picture of malaria in Somalia. A full-scale health facility audit in all three zones is required, so that a map of what health facilities exist where, can be drawn. Then areas where a community-based network of female CHWs should be established can be identified.

South Sudan

Summary table: malaria in South Sudan

Parasites	*P. falciparum, P. vivax*
Vectors	*A. arabiensis*, *A. gambiae s.s, A. arabiensi*s, *A. funestus*
% of people under ITNs and variation across the country	10 million LLIN distributed 2008-2010, unsure how many reach the at-risk population.
First-line drug for *P. falciparum* (unconfirmed)	AS+SP (North), AS+AQ.
First-line drug for *P. falciparum* (confirmed)	AS+SP (North), AS+AQ.
Second-line drug for *P. falciparum*	AL
Treatment of *P. vivax*	CQ+PQ(14d)
Evidence of insecticide &/or drug resistance	Resistance to CQ and SP has increased over recent years, causing a shift to ACTs as policy.
IRS use	Not in use.
IPTi use	Not in use.
IPTp use	Approximately 15% coverage (South).
Evidence of diagnostics being used to direct antimalarial treatment	Most cases of malaria are treated without microscopy or RDT diagnosis. Where diagnostics are used, the quality of the results is extremely poor.
	July 2011

1. Introduction

Together, 75% of the Sudan and South Sudan population is at risk from malaria, and accounting for 50% of the Eastern Mediterranean region's malaria burden.[375] Differences in first line therapy between Sudan and South Sudan, differences in malaria endemicity and capacity/infrastructure differences highlight why it is important that the donor community treats malaria control in Sudan and South Sudan as separate discussions (Personal Communication).

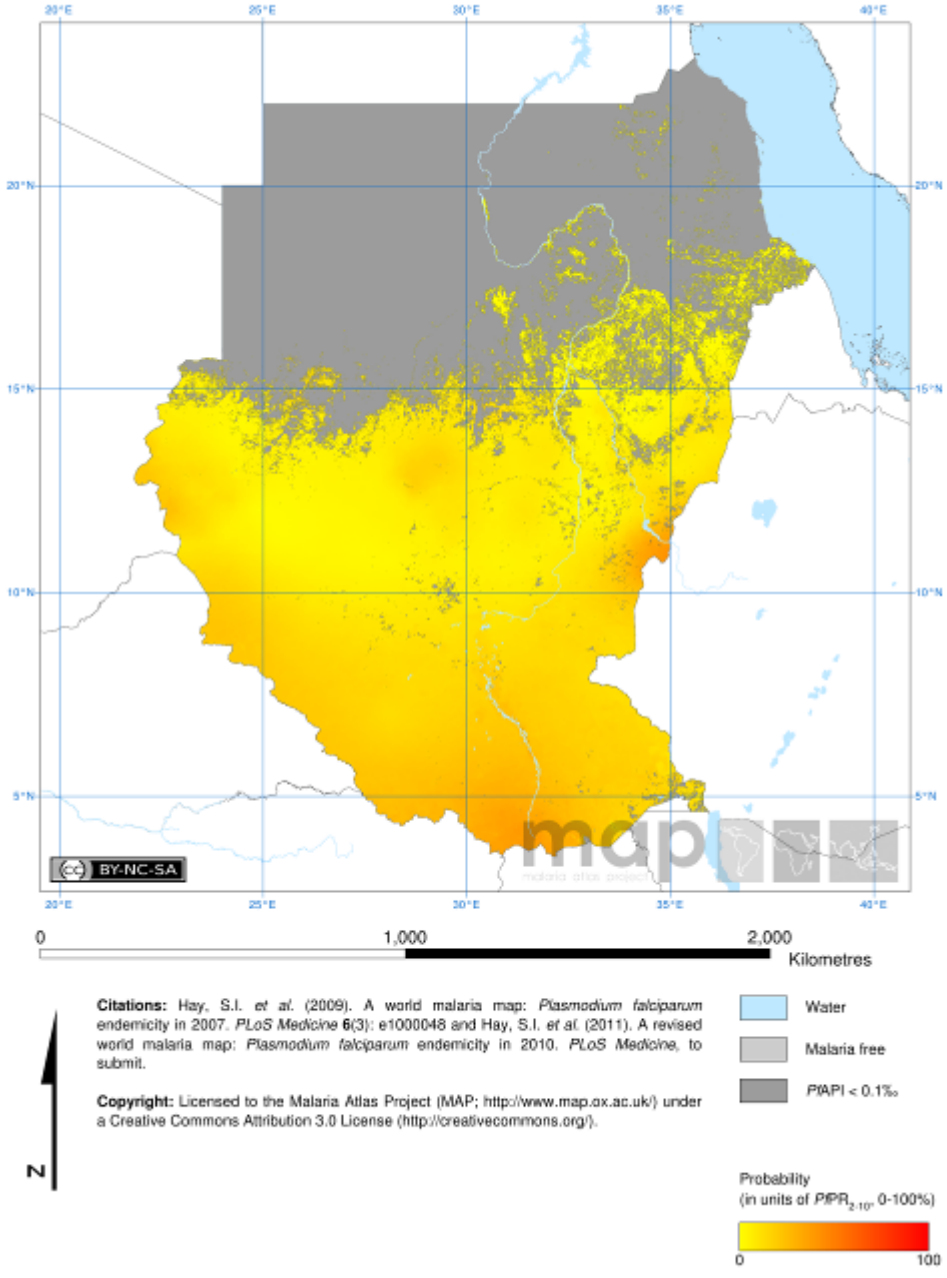
2. The Burden of Disease

A serious problem in assessing and dealing with malaria in South Sudan is the lack of information regarding confirmed cases, mortality rates and the epidemiology of the disease. While the exact burden of the disease in South Sudan is unclear, it is estimated to account for 22-29% of the country's disease burden.[376] Malaria transmission is considerably worse in rural areas.[377]

In South Sudan malaria is perennial, with a significant seasonal peak for six months during the rainy season, and of moderate to high intensity.[378] On-going conflict within Sudan and South Sudan and the damage this has caused to state infrastructure means that there are few data available about the epidemiology and distribution of parasite species. The major vectors are *A. gambiae s.s, A. arabiensi*s and *A. funestus*.[379] [380]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) & zoophilic (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

The spatial distribution of *Plasmodium falciparum* malaria endemicity in Sudan



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The NMCP has a Malaria Control Strategic Plan (MCSP) for 2006 – 2011. The Strategic Plan was reviewed in 2010 and the Ministry of Health took the decision to extend the life of the Strategic Plan for two more years making it effective until 2013. The decision to extend was based on the continued relevance of the existing strategic priorities and the need to systematically review the Strategic Plan upon finalisation of the recent Malaria Indicator Survey conducted at the end of 2009. The aims of the current Strategic Plan is to reduce malaria related morbidity and mortality in South Sudan and to minimise the socio-economic impact of the disease.[381] To achieve this goal the MCSP aims to:

- Rapidly scale up preventive as well as curative interventions for malaria delivered as a comprehensive, integrated package with focus on the most vulnerable populations.

3.2 Prevention

ITN/LLIN distribution is also the key preventive strategy in South Sudan. Table 1 indicates the approximate numbers of LLINs distributed in South Sudan between 2008 and 2010. 2008 was the first year in which significant LLIN distribution campaigns were carried out in South Sudan. These were largely funded by the Multi-Donor Trust Fund which is a pooled funding mechanism (including DFID support). Initially the MDTF was funded with £1 of donor funds for every £2 worth of Government of Southern Sudan contributions. With increasing fiscal constraints that ratio reduced to a 1:1 contribution and finally only donor contributions. A significant number of the LLINs distributed in 2009 and 2010 were contributed by the Global Fund for AIDS, TB, and Malaria (GFATM) with an additional 1.6 million LLIN contribution from UNITAID. All LLINs listed under 2010 are in country but it is as yet unclear how many of these will actually reach beneficiaries before the end of the calendar year. It is worth noting that many NGOs running Primary Health Care projects in South Sudan also distribute LLINs through ANC services but the numbers of LLINs distributed through this channel are relatively small (and not easily aggregated) compared to the numbers of LLINs listed below (Personal Communication).

IRS is not currently being applied in South Sudan.[382] Although the NMCP proposed 60% coverage for IPT, just 30,125 pregnant women are expected to be treated by the end of 2010. This is well short of the target and leaves 165,690 women without IPT.[383] A significant constraint to delivering IPT at scale in South Sudan is the access to service delivery points (facilities providing ANC services). This in turn is constrained by the numbers of trained health workers in South Sudan. Task shifting could address gaps in ANC coverage to some extent but issues such as assisted delivery will require longer term solutions such as improved leadership and resourcing of health training institutes.

Table 1: Approximate numbers of LLINs distributed in South Sudan between 2008 and 2010 by State

State	2008	2009	2010
Upper Nile		1,785	534,100
Jonglei		502,660	170,817
Unity			567,300
Warrap	779,182	54,469	2,906
Northern Bahr-El-Ghazel		816,394	
Western Bahr-El-Ghazel	246,988		
Lakes		533,887	26,613
Western Equatoria	100,000	116,683	190,299
Central Equatoria	37,896	316,576	499,500
Eastern Equatoria		259,567	211,505
Total	1,164,066	2,602,021	2203040

3.3 Case Management

In South Sudan the focus is upon treating children under five and improving the quality of diagnostics. Almost 1 million RDTs and 3.4 million courses of ACT will have been delivered by the end of 2010 through the coordinated efforts of the Roll Back Malaria Partnership (RBM) since September 2009.[384] Early diagnosis and treatment is being hindered, however, by the poor state of the health system, the remoteness of many communities and the corresponding high self-diagnosis and treatment through the private sector. Recognising that the weak health system prevents the majority of the population having access to healthcare, Malaria Consortium (along with other partners) is implementing a community case management programme to ensure that vulnerable communities have access to reliable malaria treatment at the community level. Malaria Consortium is training 3,000 volunteer community drug distributors to be able to diagnose and treat malaria at the community level (Personal Communication). Extreme poverty also hinders people's access to treatment. South Sudan relies on NGOs for a large proportion of their malaria case management, where it has been estimated that 80% of health services are provided by NGOs.[385] The ACTs prescribed in South Sudan are different from those used in Sudan; artesunate and amodiaquine (AS + AQ) rather than AS + SP.[386] The decision to use AS + AQ as the first line treatment for malaria in South Sudan was taken as a measure to try to safeguard the efficacy of SP which is used in South Sudan for IPT.

Steps are being taken to improve the quality of diagnosis in South Sudan in line with the WHO recommendations for universal diagnosis of all suspected malaria cases. Recent WHO work on the existing MoH approved Rapid Diagnostic Test (RDT) found that Paracheck is not very sensitive at low parasitaemia (54.4%) and has average heat stability at 35C and 45C. The MoH has taken the decision to field test the First Response RDT as a likely successor to Paracheck to test its improved sensitivity (100%) and low false positive rate (0%) in addition to assessing factors such as the ease of transition from Paracheck to First Response. First Response is a cassette type RDT similar in format and procedure to the existing Paracheck (Personal Communication).

3.4 Supporting Interventions

South Sudan suffers from poor data and underdeveloped research, monitoring and evaluation and surveillance systems. This significantly hampers the planning and monitoring of malaria control activities including the interpretation of, and response to reported

epidemics.[387] BCC has been implemented by individual partners in support of their own interventions in an ad hoc manner, but these are starting to be coordinated and standardised under South Sudan's GFATM Round 7 project. A national BCC Strategic Plan for the health sector has been designed and partners are beginning to align behind this strategy. More specifically, the Malaria Department of the Ministry of Health developed a Malaria BCC Strategic Plan in 2009 which focuses on community outreach and mass media in order to ensure high uptake and the correct use of LLINs. Substantial support is needed to ensure BCC plans are implemented alongside the core interventions they are designed to support.[388]

3.5 Delivery Systems

South Sudan is plagued by similar problems in the public provision of health, and relies heavily on NGOs for malaria intervention execution and the private sector for the provision of malaria control commodities. There is a growing network of Community Drug Distributors (CDDs) being established to carry out Integrated Community Case Management for malaria as well as pneumonia and diarrhoea, with a focus on reaching children under five.[389] There are over 3,000 CDDs currently active in South Sudan. The community based model is very decentralised, with one CDD to support forty households on a voluntary basis. The CDDs are supported by supervisors at a ratio of one supervisor per 15 to 20 CDDs. Where possible the supervisors are health workers affiliated to a nearby health facility. There is some scope for CDDs to play a role in preventing malaria through LLIN distribution and BCC in addition to their current curative only roles. In terms of sustainability, there are exciting opportunities to use the community based networks to identify committed and qualified candidates to enter formal health worker training for higher cadres. This can serve both as a non-monetary incentive structure for the community based network and also as a means to ensures sustainability of the network and development of the facility level health system. Implementing such an approach requires sustained funding of a duration sufficient to allow candidates to be identified, enter and complete the higher level nursing and/or clinical officer training programmes (Personal Communication).

4. Health System Issues

Only 25% of South Sudan’s population is covered by public provision. Even where health facilities exist, the quality of services is low, due to frequent stock outs of medicines, inadequate staffing, a lack of equipment and poor infrastructure. In addition, the network of private health service outlets such as clinics, pharmacies and registered drug shops is limited, particularly in rural areas. There are insufficient skilled health workers and they are unequally distributed around the country. In addition, systems for recruitment, deployment, payroll management, as well as promotional and retention schemes, are inadequate. This leads to high staff turn over and low staff motivation. HIS, PSM and monitoring and evaluation systems are all inadequate, suffering from serious structural problems.[390] The MoH is currently developing its Health Strategic Plan, which will cover the period from 2011 to 2015 and guide the MoH and partners engagement in the post-referendum period. The Strategic Plan is currently in a late draft format and is intended to be finalised before the end of the calendar year. HSS is being implemented through the Health Sector Recovery Strategy, the Southern Sudan Interim Health Policy and the recently developed Basic Health Services Package, but financial constraints may limit their success.[391] Malaria Consortium implemented a Health Systems Strengthening (HSS) project in 2008-9 (funded by DFID), working to strengthen the capacity of MOH at county and state level in the three states of Northern Bahr el Ghazal, Unity and Upper Nile. This project now receives funds from the Basic Services Fund (to which DFID is the main contributor) to strengthen the health systems in Manyo county, Upper Nile and Aweil North county in Northern Bahr el Ghazal (Personal Communication).

5. Current Funding and Technical Support

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) granted $33,512,896 in Round 7 for Scaling-up Malaria Interventions (SMI) in 2007 for the period 2007 – 2012. The GFATM is providing significant malaria-specific funding, but there is also funding for malaria and other interventions through more horizontal funding streams.[392]

USAID has funded Management Sciences for Health to implement a Support to Pharmaceutical Systems (SPS) programme which includes secondment of one national M&E Officer and one international malaria specialist to the Ministry of Health's Malaria Department. It also provides three similar secondments to the Pharmaceuticals Directorate, the Extended Programme for Immunisation team, and the National TB, Leprosy, and Buruli Ulcer Control Programme (Personal Communication).

Primary Health Care programmes such as those funded by USAID's Sudan Health Transformation Project ($44.3 million over 3 years) and the health arm of the Basic Services Fund (£15.3) are implementing some malaria work as a small component of a broader Primary Health Care package (Personal Communication).

CIDA is funding iCCM programming in several counties of selected States. The level of funding is approximately $3 million per year for three years (Personal Communication).

6. Major Gaps

The major gaps in current malaria control in South Sudan are:

1. **Routine LLIN distribution**: There are roughly just 500,000 LLINs per year coming into South Sudan through Phase II of the GFATM Round 7 grant. An estimated 833,333 LLINs per year are needed in total, so a 333,333 LLIN per year gap remains to ensure universal coverage is maintained (8 million population/ 1.6 people per LLIN / 3 year average life of an LLIN x 0.5 because only half the LLINs are lost by year 3). In addition to steady state routine distribution mop-up distribution is needed in three states (Upper Nile, Unity, and Central Equatoria) where numbers of LLINs for distribution are about 200,000 LLINs too few per state. Furthermore, two states (Warrap and WbeG) had campaign distributions in 2008 with no significant routine distribution since. This suggests that almost half of those LLINs will be worn, torn, chewed by rats, burned by cooking fires, or otherwise rendered useless.

2. **Community Fever Management**: Currently this work targets children under 5, but it also needs to include complementary work for treating older age groups. This would not have tremendous impact on malaria mortality, but it is critical to ensure we are protecting the efficacy of ACTs by providing options so that adults have apropriate treatment doses and do not start taking a sub-optimal drugs, leading to potential resistance issues in the medium term. DFID might want to support integration of the treatment of malaria at community level with treatment for pneumonia and diarrhoea alongside malaria to ensure good case management.

3. **Diagnosis**: There is almost no laboratory diagnostic capacity in South Sudan. Rolling out RDTs for malaria would be cost effective through improved rational drug use, and thus minimising excess ACT commodity costs due to treating non-malaria related fevers. RDTs for malaria have also shown marked improvements in outcomes for childhood pneumonia by ensuring that non-malaria causes of fever are recognised early and treated more promptly.

4. **IRS**: There is a strong argument, given the very fragile human resource and infrastructure situation, not to push for introducing IRS in South Sudan, but the MoH is showing increasing

interest in IRS, which it sees as part of integrated vector management, although integrated vector management is more about decision making and management. If IRS is to be introduced, it has to be done to high technical and operational standards, or it is a waste of money, so it is important to ensure that MOH aproaches IRS in a technically sound fashion. This could include developping some demonstration sites in the key urban centers such as Juba, Wau, Malakal or implementing in a Kala-Azar endemic area along with some operational research to look at vector behaviour and impact. Technical support around IRS is critical, and needs to consider strategies to avoid insecticide resistance which could then compromise the effectiveness of LLINs.

5. **Surveillance for Resistance**: Monitoring for both ACT and SP (for IPTp) resistance as well as insecticide resistance is becoming increasingly important given scale up in both access to treatment and LLINs. This could again be a step to inform MoH interest in IRS implementation. Immediate value for money implications of this work would be in ensuring that treatment and insecticide choices (for LLINs or IRS) are known to be effective. Longer term this kind of work can help ensure sustainability of our currently available malaria control tools.

6. **Systems Strengthening**: This could be a stand alone project or packaged together with some of the implementation work outlined above. State level secondments for malaria control could be very useful. There is still a tremendous amount of work to be done at county level to get the County Health Departments up and functioning. A secondment to the MoH to focus on supporting the current Community Case Management focal point would help the MoH give more effective leadership in this growing area. The case management guidelines need to be revised to accommodate the switch to Fixed Dose Combination (FDC) therapy for malaria and the new RDT. The malaria strategic plan should be updated and costed. Guidelines and a tool kit for routine LLIN distribution would be valuable. There could even be scope to review and revise existing malaria pre-service training modules for clinical and / or laboratory staff.

7. **Behaviour Change Communication**: This would be ineffective as a stand-alone intervention, but if combined with access to treatement interventions or improved diagnostics then it would be very useful. In malaria diagnosis and treatment there remains a considerable knowledge and behaviour gap to fill.

Sudan

Summary table: malaria in Sudan

Parasites	*P. falciparum, P. vivax*
Vectors	*A. arabiensis*, *A. gambiae s.s, A. arabiensis*, *A. funestus*
% of people under ITNs and variation across the country	Estimated 74% LLIN coverage by end of 2010.
First-line drug for *P. falciparum* (unconfirmed)	AS+SP.
First-line drug for *P. falciparum* (confirmed)	AS+SP.
Second-line drug for *P. falciparum*	AL
Treatment of *P. vivax*	CQ+PQ(14d)
Evidence of insecticide &/or drug resistance	Resistance to CQ and SP has increased over recent years, causing a shift to ACTs as policy.
IRS use	Used to control outbreaks.
IPTi use	Not in use.
IPTp use	22% coverage.
Evidence of diagnostics being used to direct antimalarial treatment	Most cases of malaria are treated without microscopy or RDT diagnosis. Where diagnostics are used, the quality of the results is extremely poor.
	July 2011

1. Introduction

Together, 75% of the Sudan and South Sudan population is at risk from malaria, and accounting for 50% of the Eastern Mediterranean region's malaria burden.[393] Differences in first line therapy between Sudan and South Sudan, differences in malaria endemicity and capacity/infrastructure differences highlight why it is important that the donor community treats malaria control in Sudan and South Sudan as separate discussions (Personal Communication).

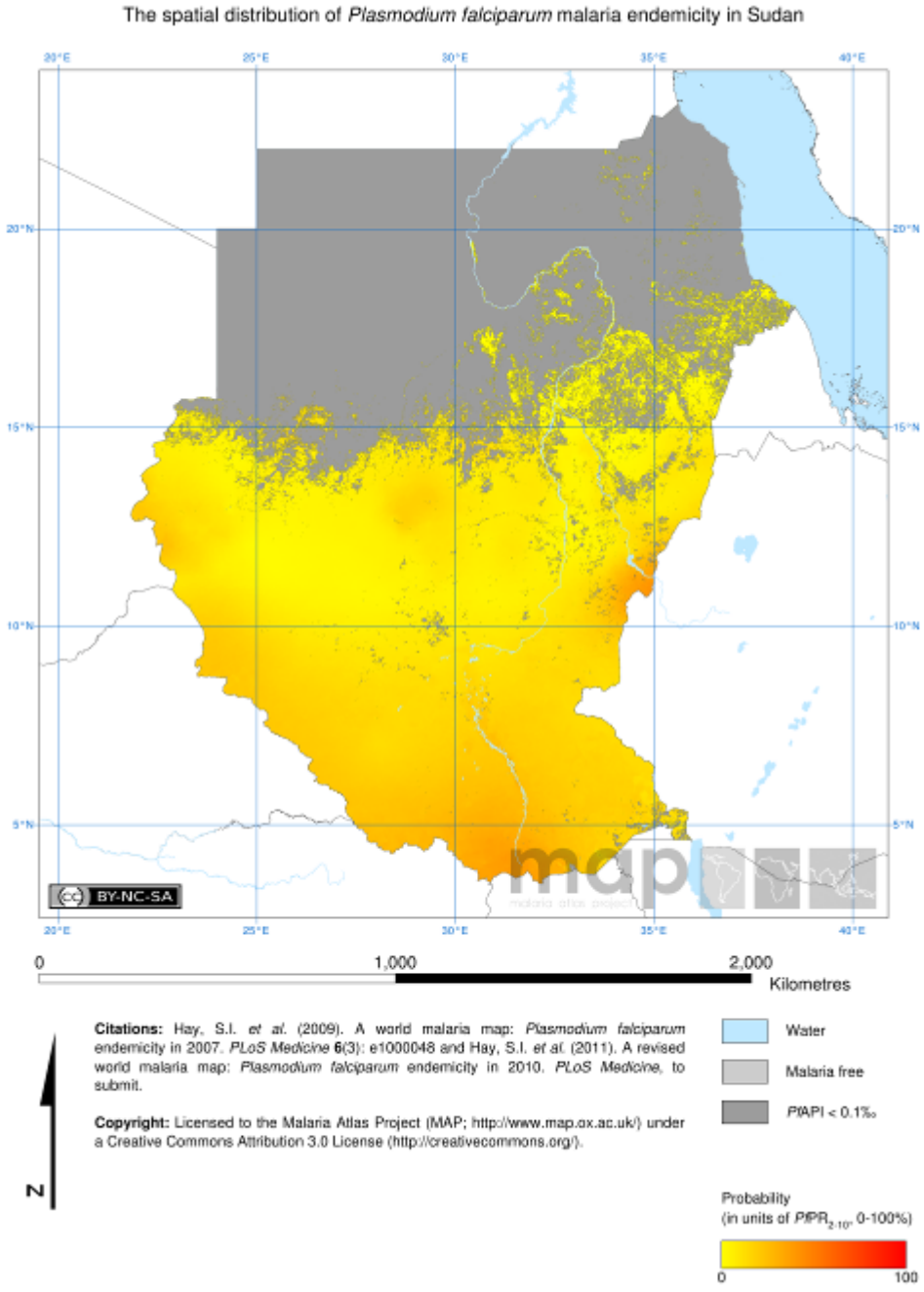
2. The Burden of Disease

A serious problem in assessing and dealing with malaria in Sudan is the lack of information regarding confirmed cases, mortality rates and the epidemiology of the disease. In 2008 there were over 3 million reported cases of malaria in Sudan, and 1,125 malaria-related mortalities. This represents a mortality reduction of almost 50% since 2000.[394] Malaria transmission is considerably worse in rural areas.[395]

The geography of Sudan varies widely and so the malaria endemicity of the country varies too. The far North has no malaria transmission, while the North, East and West are seasonal, low-to-moderate transmission areas, and in the South malaria is perennial, with a significant seasonal peak for six months during the rainy season, and of moderate to high intensity.[396] On-going conflict within Sudan and the damage this has caused to state infrastructure means that there are few data available about the epidemiology and distribution of parasite species. *Plasmodium falciparum* is responsible for most malaria cases, causing 95%.[397] The major vector in is *Anopheles arabiensis*.[398]

Vector	Breeding places	Biting habits	Resting habits
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) & zoophilic (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.

P. falciparum's resistance to the cheaper antimalarials Chloroquine (CQ) and sulfadoxine-pyrimethamine (SP) has been increasing since first being detected in 2001. This has led Sudan to adopt artemisinin-based combination therapies (ACTs) for treatment.[399] [400] A recent study has shown that resistance to DDT and permethrin in vectors is increasing across Africa, including in Sudan.[401] This is a situation which needs further research and more effective surveillance.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The Government of Sudan has a National Malaria Control Programme (NMCP) for 2007 – 2012 which has as its goal to reduce malaria morbidity and mortality by half by the end of 2012. It aims to do this by concentrating on four key areas. These are:

- Case Management
- Multiple Prevention Interventions
- Epidemic Forecasting, Detection and Control
- Capacity Building

As well as reducing transmission and mortality rates, Sudan is aiming to move towards the partial elimination of malaria over the coming period. [402]

3.2 Prevention

Sudan is implementing Integrated Vector Management (IVM) interventions which involve Insecticide-Treated Net and Long-Lasting Insecticidal Net (ITN/LLIN) distribution, targeted Indoor Residual Spraying (IRS), Intermittent Preventive Treatment (IPT) for pregnant women and larva control.[403] Sudan has been relatively successful in meeting its preventive targets, reflected in the reduction in malaria-related mortality. 3.3 million LLINs were distributed between 2006 and 2008, and with the completion of several campaigns at the end of 2010 an estimated 74.3% of the population will be protected by an LLIN.[404] While IPT is included in the NMCP, only 22% of pregnant women attending antenatal care received treatment in 2007.[405] Sudan is the site of large project, funded by the Global Environment Facility (GEF), which aims to phase out the use of DDT and other Persistent Organic Pollutants (POPs). It is also supporting the Ministry of Health in its efforts to identify and develop alternatives to DDT for use in its vector control programme.[406]

3.3 Case Management

The use of diagnosis by microscopy or RDT is very low in Sudan; up to 50% of microscopy slides produced false positives in Khartoum state.[407] Most RDTs come from the private sector and are expensive.[408] The NMCP aims to increase coverage of effective diagnosis to 80%, and to provide treatment within 24 hours of the onset of symptoms.[409] 3 million treatment courses of ACT were delivered in 2008, which was enough to treat all reported cases of the disease, and 90% of public health facilities now provide ACTs free of charge.[410] The ACTs administered in Sudan are artesunate and sulfadoxine pyrimethamine (AS + SP).[411] Accurate diagnosis remains a problem however.

3.4 Supporting Interventions

Behaviour Change Communication (BCC) is an essential support intervention that requires further development in Sudan. Recent BCC has utilised the school system and mass media, such as radio, for raising awareness and increasing the uptake of malaria interventions.[412] Operational research, monitoring and evaluation and surveillance are extremely important activities in Sudan, and ones that need improvement. The lack of data on the prevalence and distribution of different vectors and parasite species needs to be rectified, and because it is considered an epidemic-prone area, effective outbreak detection and response is important. These activities have begun to improve, but support interventions still require further funding and development.[413]

3.5 Delivery Systems

The national health system is extremely weak in Sudan, but efforts are being made to strengthen it in order to improve its capacity and coverage of the population. The private sector remains an important source of malaria intervention commodities, but is relatively expensive. Recent changes to the law have reduced the cost of commercially-acquired LLINs by 60%. Home Management of Malaria (HMM) is being implemented in areas of high transmission and low public health provision.[414]

4. Health System Issues

The national health system in Sudan faces many problems. Government spending on health is low and previously free services have seen fees introduced to cover the cost of the system. Over 70% of healthcare expenditure is estimated to come from patients themselves, which hits the poorest the hardest. The human resources situation is poor, with low morale, under-trained staff and an urban bias in the distribution of specialised workers. Health System Strengthening (HSS) is being carried out, with the training of local staff and the improvement of Procurement and Supply Management (PSM) systems receiving specific attention. The 'brain drain', which has seen up to 70% of recent graduates leaving the country for employment in the Gulf States, is being tackled through incentives and offers of further training and education. Furthermore, health infrastructure is seriously dilapidated and effectively non-functioning in many places. The Health Information System (HIS) suffers from structural problems, and does not provide the information required for timely and evidence-based decisions regarding resource allocation.[415]

5. Current Funding and Technical Support

The Sudanese government is providing $68.4 million for malaria control over the period 2007 – 2012.

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) granted $38,296,873 in Round 7 for Scaling-up Malaria Interventions (SMI) in 2007 for the period 2007 – 2012.

UNICEF is providing $1.5 – 2 million per year for RDTs, LLINs and ACTs over the period 2007 – 2012.

The WHO is providing $500,000 per year for technical training over the period 2007 – 2012.

UNITAID is providing 3.6 million doses of ACT over the period 2008 – 2012.[416]

The Global Environment Facility (GEF) has provided a grant of $500,000 for the implementation of the Stockholm Convention on POPs. This includes the development of DDT alternatives for use in Sudan's vector control programmes.[417]

6. Major Gaps

Some of the key gaps in Sudan relate to the health system challenges noted above, and include the affordability of care to the individual and the need to strengthen information systems.

Tanzania (Mainland)

Summary table: malaria in Tanzania

Parasites	*P. falciparum, P. vivax*
Vectors	*A. gambiae, A. arabiensis, A. funestus, A. merus, A. nili, A. paludis, A. pharoensis*, *A. coustani*
% of people under ITNs and variation across the country	39% of households own at least one ITN (2008), with a higher proportion of ownership among wealthier, urban families.
First-line drug for *P. falciparum* (unconfirmed)	AS+AQ, AL
First-line drug for *P. falciparum* (confirmed)	AS+AQ, AL
Second-line drug for *P. falciparum*	AL, QN(7d)
Evidence of insecticide &/or drug resistance	SP resistance is high and is therefore not used in first-line treatment as policy. Insecticide efficacy testing has shown all major insecticides to be effective in IRS.
IRS use	IRS covers 100,000 households, protecting 190,000 people (2008).
IPTi use	Not in use.
IPTp use	IPTp coverage is 30% (2008).
Evidence of diagnostics being used to direct antimalarial treatment	The availability and quality of diagnostics is poor, and as a result most cases of malaria are treated based on clinical symptoms.
	July 2011

1. Introduction

Malaria remains a serious health concern in Tanzania, both on the mainland and the islands of Zanzibar. While Zanzibar is a semi-autonomous part of the United Republic of Tanzania, the level to which malaria control is separate and different from that on the mainland means it would not be practical to cover both in this document. Please see the Zanzibar country profile for details of malaria control on the islands.

2. The Burden of Disease

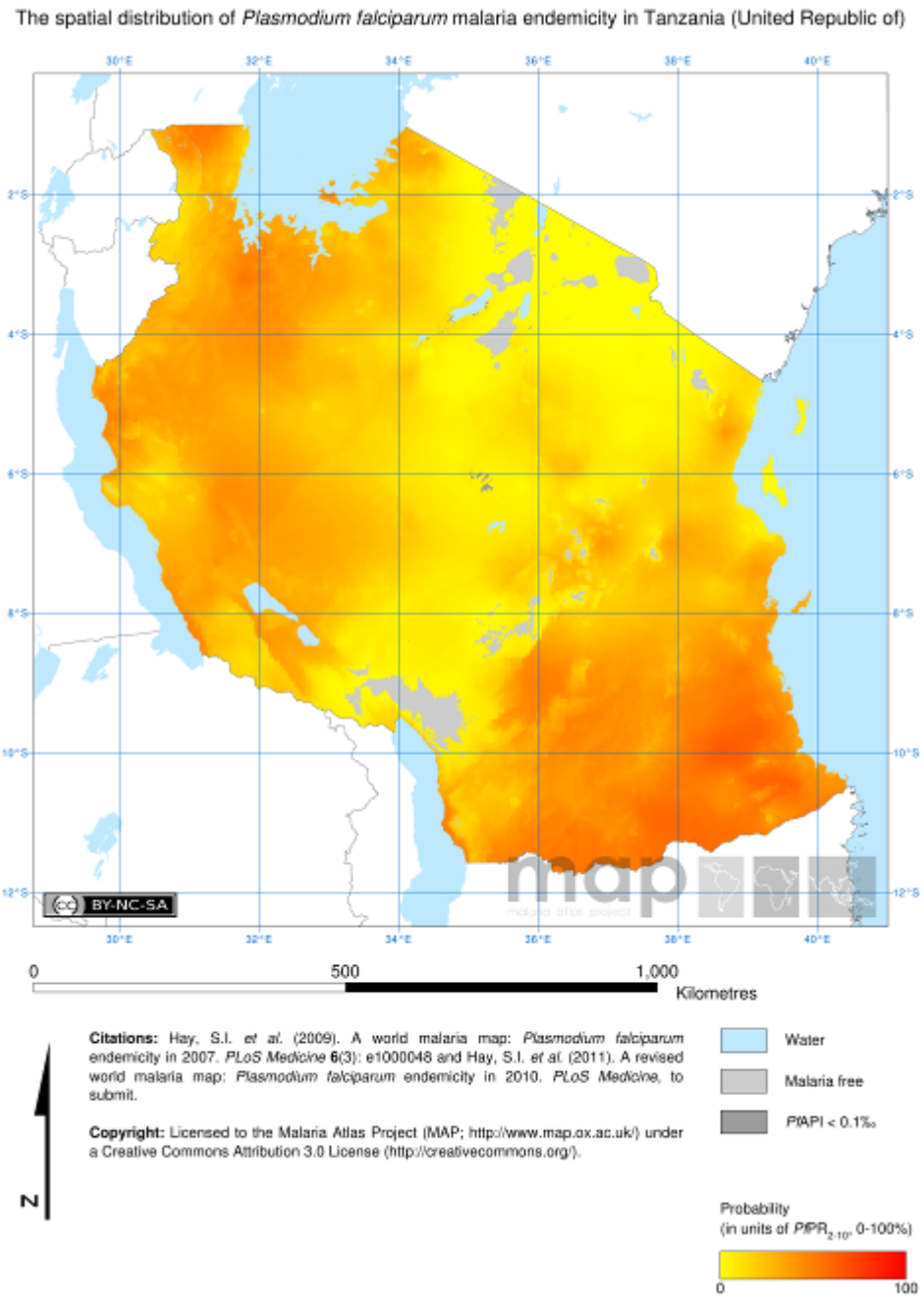
93% of Tanzania's population of 41 million are at risk for malaria. This equates to 38 million people being at risk from a disease that kills an estimated 60,000 a year, 80%of which are children under five years of age. Approximately 14 -18 million clinical malaria cases are reported annually by public health services, and over 40% of all outpatient attendances are attributed to malaria.[418] However, it is extremely hard to judge the true malaria burden or identify recent trends in malaria control. This is because only a fraction of reported cases are clinically confirmed, not all suspected cases are reported, and the collection of data at all levels is inconsistent and inaccurate. The Tanzania HIV/AIDS and Malaria Indicator Survey (THMIS) 2007-08, the most complete survey carried out in Tanzania, suggests that malaria control interventions in the United Republic of Tanzania have made some progress in tackling the disease. Prevalence of malaria among children 6 to 59 months of age ranges from 0.4% in the elevated region of Arusha to 41.1% in the north western region of Kagera, with a national prevalence of 18.1% in 2007-08. While no earlier national estimates of

parasite prevalence exist for comparison purposes, this estimate is lower than would be expected in the absence of a strengthened malaria control infrastructure.[419]

Malaria is perennial in Tanzania, with a seasonal peak following the monsoon season. About 20 districts in the highland regions and on the fringes of arid lands, home to 25% of the population, are prone to malaria epidemics, which occur every 4-5 years. *P. falciparum* accounts for 96% of malaria infection in Tanzania, with *P. vivax* causing the remaining 4%. The principal malaria vector is *Anopheles gambiae,* but *A. arabiensis, A. funestus,* and *A. merus* are other primary vectors in certain areas. *A. nili, A. paludis, A. pharoensis*, and *A. coustani* represent secondary vectors that are also present.[420] [421]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and zoophilic (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. merus	Salt water lagoons, mangrove swamps.	Endophagic and exophagic, mainly zoophilic. Bite mainly late at night.	Exophilic and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

Antimalarial drug resistance is an ongoing threat to malaria control. Tanzania introduced Artemisinin-based Combination Therapies (ACTs) as first-line treatment of malaria in 2006, and while it is hoped that the development of resistance will be delayed through the use of combination therapy, the higher cost of these therapies may encourage people to use them incorrectly (for example, by using only a fraction of the recommended dose), which could accelerate the development of resistance. It is essential to continue to evaluate current drug efficacy in a way that provides timely, relevant, reliable and understandable information. Data derived from these evaluations are essential to maintain confidence in current treatment recommendations, or to generate convincing evidence that current treatment recommendations must change.[422]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The context of malaria prevention and control has changed in Tanzania, and a much more aggressive approach is now being taken by the National Malaria Control Programme (NMCP). The current goal is to reduce the burden of malaria on the mainland by 50% by the end of 2012, and by 80% by 2015. The means by which this will be achieved is outlined in the National Malaria Medium Term Strategic Plan (NMMTSP) 2008-2013.

There are five components in the NMMTSP:

- Malaria Diagnosis and Treatment

- Integrated Malaria Vector Control
- Monitoring, Evaluation and Surveillance
- Community Mobilisation and Behaviour Change Communication (BCC)
- Regional/ District support and capacity building [423]

3.2 Prevention

The distribution of Insecticide Treated Nets (ITNs), including Long Lasting Insecticidal Nets (LLINs), forms a key aspect of preventive malaria control in Tanzania. The distribution channels used include mass campaigns, subsidised ITNs targeting pregnant women through the Tanzania National Voucher Scheme (TNVS), and commercial sales supported by social marketing. The THMIS 2007-08 indicates that 39% of mainland households own at least one ITN, with 25% of children under five and 26% of pregnant women sleeping under an ITN. This represents a 16% increase over ITN ownership in 2004-05, which was just 23%.[424] The NMCP is now targeting universal coverage of ITNs in Tanzania, through the Under Five Coverage Campaign which distributes free nets to all children under five. This campaign started in late 2008, is ongoing through 2010, and aims to distribute 7.2 million LLINs. This will be followed by the Universal Coverage Campaign (UCC), which will distribute an additional 14.6 million LLINs, targeting 2.5 LLINs per household.[425]

However, ITN coverage is lagging in the lowest socioeconomic groups and in rural areas generally. Re-treatment and replacement of short-lived (2-3 years) bundled polyester nets remains a problem. These issues are being tackled through Tanzania's Rolling Continuation Channel (RCC) grant and will be further addressed by attempting to achieve universal coverage (Global Fund to fight AIDS, Tuberculosis and Malaria).[426] Furthermore, the TNVS faces several problems, including insufficiently large subsidises to encourage purchase, and the undermining of the commercial ITN market by the distribution of free nets through mass campaigns.[427]

Indoor Residual Spraying (IRS) was used to spray 100,000 households in 2008, protecting 190,000 people, mainly in Muleba and Karagwe districts in Kagera Region, North Western Tanzania. The Government of Tanzania (GoT) does not currently fund IRS; the only financial support comes from the President's Malaria Initiative (PMI). Currently IRS activities are preliminary, to assess the utility of scaling-up IRS as a national malaria control strategy. These trials are being expanded to include several other districts in the North Western Lakes Zone, where the malaria burden is highest in Tanzania.[428]

Intermittent Preventive Treatment in pregnancy has only been partially scaled-up in recent years, from 22% coverage in 2004 to 30% in 2008.[429] Focused Antenatal Care (FANC) is the WHO-supported strategy into which IPTp has been integrated in Tanzania. The current policy for IPTp is two doses of sulfadoxine-pyrimethamine (SP), given at a woman's first ANC visit (from 20 weeks) and second dose within the third trimester, no less than four weeks following the first dose. The Tanzania Service Provision Assessment (TSPA 2006) found that only 9% of first visit ANC clients are counseled regarding the second dose of IPTp – a missed opportunity to increase further the uptake of IPTp. Recent data collected through the USAID ACCESS programme sentinel site surveillance system indicate that higher IPTp rates correlate well with sites reporting no SP stock outs during the reporting period. This indicates that availability and timely procurement of SP continues to be an issue. Other key issues remain related to policy and quality of services. For example, the policy regarding free distribution of SP for IPTp appears not to have been fully understood throughout the health system, and has not yet been widely disseminated to District Medical Officers, District Pharmacists, and other parties. Continued attention and communication are required to ensure the availability of SP at the facility level.[430]

3.3 Case Management

Effective diagnosis is a key area for improving case management in Tanzania, as the availability and quality of existing diagnostic services are generally poor. Rapid Diagnostic Tests (RDTs) have recently been trialed and found applicable for national use. The opinions of health workers show RDTs are actually preferred to microscopy, so poor is the quality of the latter.[431] The GFATM Round 7 award allocated $15,517,564 for RDT procurement, and quality assurance of both RDTs and microscopy.[432]

Due to the lack of diagnostic capacity, the poor quality of that which does exist, and low confidence in the results microscopy produces, the over-prescription of anti-malarials based on a presumptive, symptom-based diagnosis is rampant. Artemisinin-based Combination Therapies (ACTs) were introduced in Tanzania at the end of 2006, adopting artemether-lumefantrine (AL) as the first-line treatment for malaria on the Mainland. Quinine is used for treatment of severe malaria. As of December 2008, approximately 31 million treatments had been distributed to 4,800 health facilities in Tanzania. However, ensuring a reliable pipeline to fund ACTs is a challenge. There was an ACT funding gap that would leave Tanzania short by approximately 8.2 million treatments in 2009, but the NMCP successfully applied for further funding through GFATM Round 9 and is also one of the first phase countries for the Affordable Medicines Facility-Malaria (AMFm).[433] [434]

This shortage of ACTs, combined with insufficiently trained staff, has resulted in critical weaknesses in facility-level case management quality. There is a lack of supervision, and evidence suggests that treatment guidelines are not followed at the facility level. For example, the end use verification exercise revealed that only 79% of patients clinically diagnosed with malaria received an ACT. The 2007-08 THMIS household survey revealed that only 20% of children under five years of age with fever received an ACT, and only 13% of children under five with fever received an ACT within 24 hours of onset of fever.[435] Quality of care and referral for severe malaria treatment also is weak. The PMI-funded severe malaria project documented that only 31% of children classified with severe febrile illness at peripheral health facilities were referred to a higher level facility. Additionally, the curriculum for pre-service training for Clinical Officers, Nurses and Midwives, and Health Officers is out-dated and does not reflect current practices.[436]

3.4 Supporting Interventions

Behaviour Change Communication (BCC) is used in Tanzania to support the successful implementation of preventive and case management interventions. Until late 2007, BCC activities in mainland Tanzania were piecemeal, with different interventions implemented by various NGOs and funders. Generic social marketing of ITNs was supported by the Population Services International (PSI) Tanzania SMARTNET project. ACT related BCC activities were supported by PSI, World Vision and Tanaam, and IRS activities were supported by RTI. The Government of Tanzania's capacity to implement BCC was weak. The Health Promotion Unit of the Ministry of Health was severely understaffed and unable to perform its supervisory role of leading BCC efforts in the field, and had been mostly limited in its role to review BCC messages and materials, to ensure accuracy and coordination. The NMCP's Information, Education, Communication (IEC) cell had created a National Communications Strategy, but had been unable to update or disseminate this critical document to the field to inform activity implementation. In October 2007, PMI started Tanzania's first comprehensive BCC initiative, the "Communication and Malaria Initiative in Tanzania" (COMMIT) project. COMMIT was designed to address household behaviours across key PMI interventions, in particular ITNs, case management, ACT use and IPTp in an integrated fashion. COMMIT is expected to achieve national coverage of BCC activities by end of 2010.[437]

Monitoring & Evaluation (M&E) is relatively weak in Tanzania, evident in the lack of accurate morbidity and mortality data for identifying trends in the true malaria burden. The NMCP is attempting to improve M&E through the strengthening of Regional Health Management Teams (RHMTs), and the establishment of Regional Malaria and IMCI Focal Persons (RMIFP) to facilitate effective M&E at the district level.[438] The Health Management Information System (HMIS), which is used to collect routine data from all health facilities, is also weak. Currently, a major initiative is underway to reform the existing HMIS system. Multiple donors have committed over $5 million to strengthen the system and an operational plan has been developed.[439]

3.5 Delivery Systems

The public health sector does not have sufficient capacity or reach to provide services to the entire population. There are problems with the quality of care and the competence of staff; all of which has damaged the reputation of the public health system. Consequently, 35% of the population reporting fever seek care in the private sector, primarily through informal medicine shops.[440] While ACTs are available through the private sector, they are of variable quality, account for just 7% of available antimalarials, and are sold alongside aretemisinin monotherapies and other inappropriate drugs, such as SP. The NMCP has made efforts to tackle the unregulated private sector; permitting the sale of subsidised ACTs and establishing a regulation process called the Accredited Drug Dispensing Outlet (ADDO). The ADDO programme transforms unlicensed drug vendors, called the Duka La Dawa Baridi (DLDB), into outlets licensed to dispense ACTs along with other specified prescription drugs, although not, as yet, RDTs. There are currently 893 ADDOs in four regions in Tanzania.[441]

4. Health System Issues

One of the greatest weaknesses in Tanzania's health system is the inadequate number of skilled health workers at various levels of service delivery. In twelve districts surveyed in the Joint External Evaluation of the Health Sector, shortages in the health workforce were the most significant constraint to improving service quality. This institutional weakness in both the public and non-governmental sectors inflicts an exceptionally large impact on rural health service delivery. According to the Primary Health Services Development Programme (PHSDP), 2007-2012, human resources for health are operating at approximately a third of the required skilled workforce.[442]

The training of health workers has failed to keep pace with health sector needs or the rapid technological advancements in health. The country has 126 training institutions and 6 medical universities, 5 of which are privately owned. Efforts to recruit, deploy, and retain public sector health workers, especially those assigned to hardship posts or remote locations, are undermined by administrative problems, inadequate incentive schemes, and the loss of professional staff to other areas. This weakness is further compounded by the fact that nominal staffing requirements of each primary health facility have, to date, been based on the level (health centre or dispensary), rather than the observed workload of the facility.[443]

There are also weaknesses in the supervision of malaria control activities at the regional level. Malaria focal persons have been trained in every district but there is a gap as far as their supervision and management from the regional level is concerned.[444]

The Medical Stores Department (MSD) is the central drug procurement and distribution organization tasked with the forecasting, procurement, consignment and delivery of ALu to health facilities. Pharmaceutical logistics has been managed well and no major supply issues have been observed to date. However, key weaknesses remain in inventory management and the information systems required to track medicine availability at different

levels of the system. In the past year, MSD has focused on implementing a new Integrated Logistics System (ILS) designed to address some of these issues. The ILS is a transition from a push to a pull system. Integrating the new ALu into this logistics pull system has remained a key challenge for malaria programmes. This new system is expected to result in better quantification and rational use of all medicines, including ALu.[445]

5. Current Funding and Technical Support

Financing of malaria activities for the Mainland is highly dependent on outside sources. According to the gap analysis prepared as part of the GFATM Round 8 proposal, the GoT malaria budget allocation has been drastically reduced from a high of $5.2 million (2006-2007) to $2.8 million (2007-2008) as GoT financing has shifted to support other priorities.[446]

Tanzania has multiple grants from the GFATM (Round 1, 4, 7, Rolling Continuation Channel, and 8). A Round 9 proposal has been agreed, but not yet signed. The total value of GFATM support is $474,677,524. These awards have provided most of the funding for ACTs and the ITN distribution, including NMCP's Under Five Coverage Campaign. [447] [448]

With the conclusion of the SMARTNET programme in 2007, DFID no longer provides project funding, but continues to channel its contributions through the Health Basket and General Budget Support.[449]

The United States Government (USG) has been funding the rapid scale-up of malaria control in Tanzania since the start of PMI in 2005. Now entering year five of PMI, a total of $52 million has been allocated to malaria control in Tanzania; $46,770,000 of which is to spent on the Mainland. The commodity portion of the total budget is 41%. Of the total allocated, 7.98% is ITNs, 42.79% is for IRS, 37.24% is for case management and IPTp, 5.86% is for monitoring and evaluation, and 3.54% for management and administration.[450] No provision has been made for the extension of PMI funding beyond year five, although a continuation of this support is widely expected from a new US administration.[451]

The World Bank is another donor supporting the NMCP. A credit for $60 million dollars was approved (July 4, 2007) by the World Bank to support the health sector. Of the total, $25 million has been allocated to support the malaria programme—approximately $10.2 million for a national re-treatment campaign ($8.2 million for insecticide and $2 million for implementation and logistics costs) and $14.8 million to support the catch-up campaign for children under five.[452]

Major External Sources of Funding for Malaria Control Mainland

Source	Amount ($Millions)	Period Covered	What is covered?
GFATM Round 4	54.2	Jun 05 – May 07	Provision of ACTs (Received approval for second phase).
GFATM Round 7	52.5	2008 – 2013	Improved malaria diagnosis through the introduction of RDTs; Access to ACTs in the private sector; Improved quality of care in children with severe malaria; Monitoring and evaluation.
GFATM RCC	59.8	2008 – 2011	Support to the pregnant woman voucher; LLIN catch-Up campaign for under fives; BCC; and monitoring and evaluation. Program will be evaluated after two and one half years to assess whether to continue voucher scheme support.
GFATM Round 8	113.3	2009 - 2014	Attain universal coverage through distribution of 14.6 million LLINs to 8.7 million households through a one-time mass "catch-up" campaign. Strengthen regional malaria IMCI focal persons on monitoring and evaluation.
DfID/Royal Netherlands Embassy (RNE)	7.0	2007 - 2011	Insecticide subsidy
World Bank	25	Jul 07 – Dec 09	Under-five LLIN catch-up campaign, national re-treatment campaign.
Italian Cooperation 2	1.3 *Proposed*	Jan 08 – Dec 09	Activities not yet determined.
Swiss Development Corporation	1.5	Sep 08 – Aug11	ITN Cell within NMCP
Japanese International Cooperation Agency	.1	Jan 07 – Dec 09	Establishment of acute pediatric care units in tertiary and regional hospitals.

* Adapted from GFATM Round Seven proposal. National Malaria Control Programme, Ministry of Health and Social Welfare. July 2007.

6. Major Gaps

Gaps in the current NMCP include:

- Uneven LLIN coverage, especially amongst poorer sections of the population.
- ACT funding gap causing a shortage of ACTs.
- Uncoordinated BCC/IEC.
- Inadequate number of skilled workers at all levels of the health system.
- Unregulated private sector providing sub-standard ACTs, monotherapies and other unsuitable antimalarials.
- Poor M&E and surveillance systems.

Uganda

Summary table: malaria in Uganda

Parasites	*P. falciparum, P. malariae, P. vivax, P. ovale*
Vectors	*A. gambiae, A. funestus, A. arabiensis*
% of people under ITNs and variation across the country	46% of households have at least one ITN (2009).
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	Resistance to SP is high and growing. While AL remains effective, increasing resistance requires careful monitoring.
IRS use	500,000 households were sprayed in 2008, protecting 1.9 million people.
IPTi use	Not in use.
IPTp use	32.5% of pregnant women receive two doses of IPT.
Evidence of diagnostics being used to direct antimalarial treatment	20% of malaria cases were confirmed by microscopy or RDT in 2007. While this represents an improvement on previous years, most treatment continues to be based upon a clinical diagnosis.
	July 2011

1. Introduction

Uganda has the third largest malaria burden in Africa and the sixth largest in the world.[453] Factors hindering malaria control in Uganda include the weak public health system, too few and untrained staff, and a poor procurement and supply system.

2. The Burden of Disease

90% of Uganda's 29.4 million people are at risk from malaria.[454] The disease is the leading cause of morbidity and mortality, and accounts for 25-40% of outpatient visits, 15-20% of all hospital admissions and 9-14% of all hospital deaths.[455] It is estimated that malaria kills between 70,000 and 100,000 people every year in Uganda, the majority of which are children under the age of five.[456] The fluctuating numbers of inpatient malaria cases and deaths reported in 2006–2008, due to inconsistent and incomplete surveillance, do not provide a basis for evaluating prevalence or incidence trends, although the programme reports show a decrease in cases and deaths between 2005 and 2006.[457] Malaria also has negative economic effects, reportedly reducing the number of days a patient can work by 7 per episode.[458] Furthermore, malaria-related expenditure is estimated to account for 34% of total expenditure for the poorest sections of society.[459]

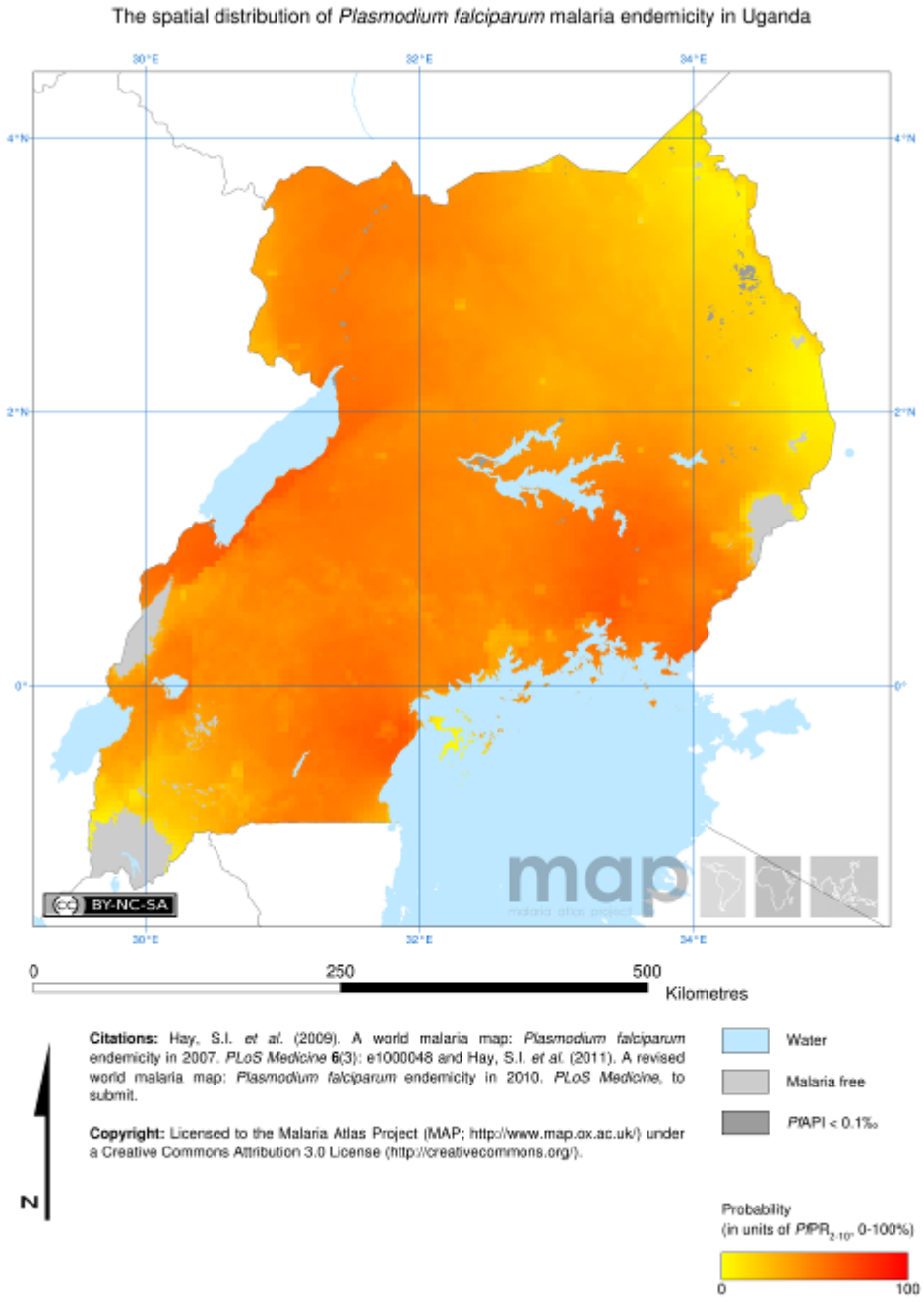
Uganda's climate and high rainfall allows stable, perennial, and high levels of malaria transmission in 90 to 95% of the country. In the highland areas of the south and mid-west, and along the Kenyan and Sudanese borders, transmission is low and unstable, with the potential for epidemics. Whilst transmission is largely stable, there is some seasonal variation associated with the rainy seasons in different geographic areas of Uganda, with the

highest transmission levels following the rainy seasons.[460] In some areas of northern Uganda, the entomological inoculation rates (infective biting rates) are among the highest in the world.[461]

All four human *Plasmodia* species exist in Uganda, but *P. falciparum* is by far the most common, responsible for 90 to 98% of diagnosed cases and almost all cases of severe malaria.[462] *P. malariae* contributes to about 1 to 3% of all malaria cases, but both *P. vivax* and *P. ovale* are rare, not exceeding 1-1.5% of malaria cases.[463] The most common malaria vectors in Uganda are *Anopheles gambiae s.l*. and *A. funestus,* with *A. gambiae* being the dominant species in most places. *A. arabiensis* is also found. *A. funestus* are generally found at higher altitudes and during the short dry seasons (September through November), when permanent water bodies are the most common breeding sites. In some areas of Northern Uganda, such as Apac and Oyam, *A. funestus* is the most common vector. *Anopheles gambiae* and *A. funestus* feed and rest indoors, making Insecticide-Treated Nets (ITNs) and Indoors Residual Spraying (IRS) viable vector control strategies in Uganda.[464]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and zoophilic (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.

Resistance to anti-malarial drugs has been a problem in Uganda, fuelled in part by the availability and widespread use of sub-standard or counterfeit drugs and monotherapies. Resistance to sulfadoxine-pyrimethamine (SP), used for intermittent preventive treatment for malaria in pregnancy (IPTp), is high. While artemether lumefantrine (AL), the first line artemisinin-based combination therapy (ACT) in Uganda, remains effective, growing resistance must be monitored carefully. The National Drug Authority (NDA) is responsible for regulated drug quality, partners, including the Ugandan Malaria Surveillance Project (UMSP), are attempting to monitor the development of drug resistance.[465]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The current National Malaria Control Programme (NMCP) for 2005 – 2010 is coming to an end, and is due to be replaced by a new plan for 2010 – 2015. The overall goal is to reduce the level of malaria infections and consequent malaria deaths in Uganda by 75% by the year 2015, and to sustain that improved level of control to 2020.

The specific objectives for the period 2010 – 2015 are:

- To provide universal coverage and encourage utilisation of preventive measures, such as Long-Lasting Insecticidal Nets (LLINs) and selective IRS, singly or in combination.

- To provide definitive diagnosis to at least 85% of suspected malaria cases treated in the public sector, including at community level.
- To provide effective treatment using ACTs to at least 85% of people with uncomplicated malaria within 24 hours of onset of symptoms, regardless of whether they seek treatment in the public or private sectors.
- To provide effective treatment for pregnant women with at least two doses of Intermittent Preventive Treatment (IPTp).
- To provide an enabling environment for the implementation of key malaria interventions.[466]

3.2 Prevention

Given the biting and resting habits of the primary vectors in Uganda, preventive measures are a key aspect in the country's malaria control programme. 5.9 million LLINs were distributed between 2006 and 2008, and a recent Ugandan Malaria Indicator Survey suggests that 46% of families have at least one LLIN, compared to 12% in 2006.[467] [468] Since 2008, significant strides have also been made towards the achievement of universal coverage of LLINs in Uganda, with the aim of distributing one net for every two people. A further 2 million LLINs have been distributed since November 2009 in the western and central regions of Uganda through the campaign approach, with the whole country expected to be covered by July 2011, particularly with the support of Global Fund Round 7. [469]

Since 2007, Uganda has also developed a routine distribution system of LLINs through ante-natal care (ANC), which first covered the north of Uganda under PMI and UNICEF and will soon be scaled up in the south. The system was developed, supported and evaluated under implementation by Malaria Consortium. The system works well in the Ugandan context because of the relatively high attendance of ANC. The system has also been shown to be effective in raising the attendance of ANC in some areas where a regular supply of LLINs is available. [470]

While only 33% of children under five years old and 44% of pregnant women reported sleeping under an ITN, this is a substantial improvement upon the 2006 figure of 10% for both at-risk groups.[471] Evidence suggests that ITN usage is increasing. In October – December 2007, a net retention and use evaluation was conducted in Gulu district at four health facilities where LLINs had been distributed through antenatal care (ANC). The evaluation showed that use of LLINs received at the ANC by pregnant women was 89%, and use of any ITN by pregnant women was 96%.[472] Therefore, while there remains a long way to go to reach universal coverage, LLIN distribution is being successfully scaled up in Uganda.

While Uganda's malaria prevention strategy has recently been to focus on the distribution of LLINs, over the last few years IRS has been used in Uganda to target epidemic-prone areas, high transmission settings, and high-risk situations, such as internally displaced persons and refugee camps.[473] More recently, the focus has been solely on targeting 6 high transmission districts in the North of the country, covering a population of 2.2 million people. In 2008 500,000 households and 1,858,149 people were protected, although the quality of IRS is an issue.[474] There are three major challenges to implementing IRS in Uganda. Firstly, the intensity of transmission and perennial nature of malaria means more than one round of spraying per year is necessary. Secondly, vector resistance to insecticides in Uganda is creating a problem, which is exacerbated by poor and uneven monitoring and surveillance. Finally, the NMCP has limited capacity to oversee and coordinate large-scale IRS operations.[475]

The Ministry of Health recommends pregnant women make four visits to an ANC clinic, and that they should receive two doses of IPTp. While 96% of women attend an ANC clinic at least once, the number of subsequent visits pregnant women tend to make is much fewer and only 32.5% receive two doses of IPT.[476] This is substantially higher than the 16% of women receiving treatment in 2006, but falls short of universal coverage.[477] Two possible reasons for the discrepancy between the number of women attending ANC appointments and the number receiving IPTp is the reluctance of pregnant women to take SP for fear of damaging the foetus or a lack of clean water or cups available for the women to take SP as directly observed therapy at the health centre. While SP remains policy for IPTp, there are concerns regarding growing resistance to it, and there is a need to monitor this carefully (Personal Communication).

3.3 Case Management

The NMCP states that parasitological diagnosis with either microscopy or a rapid diagnosis test (RDT) should be part of malaria case management at all health facilities. However, despite this policy, most malaria diagnosis in health facilities in Uganda is still based on clinical symptoms since many facilities lack laboratory diagnostic capacity. Currently, microscopy is only available at hospitals, Health Centre (HC) IVs (Sub-district) and some HC IIIs (Sub-county), but there remain some problems regarding supplies of microscopes at all levels. RDT supply has been dependent on donors and there have been delays in the Global Fund Round 4 grant which was meant to fund RDT procurement (as of September 2010 supplies are now in country for a select number of districts for a six month period) (Personal Communication). The introduction of RDTs to health facilities has therefore been slow. RDT introduction at the community level is also dependent upon donor support, and is taking place as part of the recent roll out under the new Integrated Community Case Management (ICCM) programme, which involves the differential diagnosis and treatment of malaria, pneumonia and diarrhoea at the community level, the three key causes of childhood morbidity and mortality in Uganda.[478]

While the level of malaria diagnosis is increasing, only 20% of malaria cases were confirmed by microscopy or RDT in 2007.[479] Initial experience in Uganda has shown relatively good adherence to the RDT result, but acceptability among patients and providers will need close monitoring and supervision. It is possible that some clinicians may continue to lack confidence in the results and continue to treat based on clinical symptoms.[480] Among older children and adults, and among all age groups in areas of low-to-moderate transmission, improper diagnosis based on symptoms alone often results in fevers being presumptively treated for malaria, resulting in the overuse of ACTs and the incorrect management of alternative infections.[481] Greater availability of diagnosis equipment, training for its effective use, and ongoing quality control for diagnosis are urgently required.

As of 2006, the first line therapy for uncomplicated malaria in Uganda has been Artemether-Lumefantrine (AL). The first line treatment for severe malaria is IV quinine or artesunate followed by quinine tablets or ACTs once the patient can take oral medications. The UMIS recently indicated that 60% of children under five with fever took an anti-malarial drug, which is one of the highest rates in Sub-Saharan Africa. Of these children taking anti-malarials, 23% took an ACT.[482] A significant constraint to the widespread prescription of ACTs is the regular stock-outs experienced by health facilities and procurement problems caused by the weakness in the supply chain system. The 2007 Service Provision Assessment revealed that about 80% of health facilities experienced stock outs at some time during the six months preceding the survey. Furthermore, delays in Global Fund disbursements has caused significant delays in ACT procurement, as the Global Fund is the largest funder of ACTs in Uganda.[483]

3.4 Supporting Interventions

Knowledge of how malaria is transmitted and prevented is high in Uganda, with 60% of the population reporting that they have been exposed to malaria messages in the last 12 months.[484] Behaviour Change Communication (BCC) is an essential component of the NMCP, and an attempt is made to include it in every stage of intervention. However, this is not always the case. Previous mass communication campaigns have resulted in more than 90% of the population being aware of malaria and its dangers, and more than 70% of households knowing what interventions and measures should be taken.[485] The Round 10 proposal to the Global Fund, submitted in 2010, builds on the use of radio for mass media and interpersonal communication through health workers; approaches which, according to the UMIS, seemed to have had the widest reach and penetration.[486] However, there are still gaps in BCC and Information, Education and Communication (IEC), including a need for better integration of BCC/IEC into service delivery and malaria control programmes, more effective evaluation of these activities and the sustaining of the population's level of malaria knowledge.[487]

Malaria monitoring and evaluation (M&E) remains a significant weakness within the public health sector. While a new national M&E plan was launched in early 2009, which is closely aligned with the Roll Back Malaria (RBM) Monitoring and Evaluation Reference Group recommendations, the Ministry of Health and the NMCP continues to lack the technical and human resource capacity, tools, equipment and resources for carrying out effective M&E. The management, dissemination and storage of the Health Management and Information System (HMIS) data at the central also requires clarification. Structural weaknesses in the accuracy and timeliness of data collection, poor quality and incompleteness of collected data, and poor analysis of results have hindered successful intervention monitoring .[488] Attempts are being made to strengthen M&E through the Global Fund Round 10 proposal.[489] Furthermore, there have been successful pilot projects adopted to improve M&E under the Malaria Consortium Clover project.[490]

3.5 Delivery Systems

The private sector plays a major role in malaria treatment in Uganda. As of 2009, approximately 600 pharmacies and over 6,200 drug shops licensed by NDA provide a wide range of antimalarial drugs, including AL, at prices between $5 and $10 per treatment. Up to 82% of patients first seek healthcare through the private sector. However, because most of the private health sector is unlicensed, it is difficult to accurately assess the true scale of private provision. There is currently insufficient regulation of, and coordination with the private sector in malaria control.[491] The public sector health system has been characterised by various problems, but these have begun to be tackled through several Ministry of Health and partner projects.

4. Health System Issues

The public health system in Uganda is decentralised, with the Ministry of Health responsible for policy development, strategic planning and orientation, technical support, guidance and supervision and M&E. Historically, community level healthcare has been hindered by a lack of trained, motivated and competent staff in order to deliver effective health programmes. Those skilled workers that exist were unevenly distributed across the country.[492] [493] Public provision of ACTs was affected by procurement problems associated with the poorly run pharmaceutical management system operated by NMS.[494] However, the situation has improved under a range of Health System Strengthening (HSS) initiatives including the Clover project.[495] In order to improve community-level healthcare, a system of Home-Based

Management of Fever (HBMF) was established in 2002, through which two trained Community Medicine Distributors (CMD) would provide malaria treatment. However, procurement problems have meant that the HBMF system has effectively ceased to exist.[496] The HBMF programme has now been superseded by five to ten-person Village Health Teams (VHTs) with two CMDs providing treatment for pneumonia, diarrhoea, and malaria. Studies have shown that, where they are well supported and supervised, and the programme is well resourced, VHTs can deliver good programmes which have the potential to reduce significantly the onset of infection (through promotion of healthy behaviours and knowledge of prevention) and related morbidity and mortality. However, the VHTs are currently under-resourced, which is hindering their effectiveness.[497]

5. Current Funding and Technical Support

The Global Fund to Fight Aids, Tuberculosis and Malaria (GFATM), through Rounds 2, 4 and 7, have provided grants for malaria control in Uganda amounting to $212,100,635 over five years. A grant application for Round 10 is currently pending. These funds have been used for the establishment of HBMF, ACT procurement, RDT trials and delivery, IRS and LLIN provision.[498]

Furthermore, Uganda has applied for GFATM funding as part of the Affordable Medicines Facility- malaria (AMFm), an innovative financing mechanism designed to expand access to the ACTs through subsidized pricing.[499]

The United States Agency for International Development (USAID) and the USG provide project support rather than direct budget support.[500] USAID/President's Malaria Initiative (PMI) have allocated $35 million of funding to projects in Uganda for 2010. These include the provision of ITNs, IRS, IPT and improved diagnosis and treatment.[501]

Many donors, including the United Kingdom Department for International Development (DFID), the World Bank , the Swedish International Development Coordination Agency, Irish Aid, the United Nations Children's Fund (UNICEF), WHO, Norwegian Agency for Development Cooperation, Italian Development Cooperation, Japanese International Cooperation Agency (JICA), and the African Development Bank, channel a large portion, if not all of their aid, into budget support.[502] Previously, DFID was a major bilateral supporter of malaria control in Uganda, in particular facilitating the process of policy change for first line treatment to use of ACTs.

6. Major Gaps

LLIN Distribution

There are still gaps in the NMCPs knowledge on the determinants of LLIN use. This information is vital to the development of effective IEC/BCC. There is a need to explore 'what next? strategies'. Regular large scale universal coverage free distributions can not be sustainable.

Case Management

The public health system lacks models to show how parasitological-based diagnosis should be phased in. Questions still remain as to whether to tackle all age groups and whether to begin in areas of low-moderate transmission.

Determinants of acceptance and use among providers and patients, particularly relating to RDTs needs further exploration, especially over the long term.

Triage and emergency care of severely ill children is poorly practised. There is a need to address this lack of knowledge and skill relating to triage, fluid management and emergency care among health workers at hospitals and HC IV.

Private health care sector

There is very little engagement of this sector at the moment. Work is needed to show how parasitological-based diagnosis can be introduced and practised effectively in this sector. The combination of ACT(treatment) + RDT (diagnosis) needs to be promoted in a manner that gives acceptance to the diagnosis as a determinant of treatment. The appropriate price for the ACT + RDT needs to be estimated, and the determinants of acceptance and use among health providers needs to be established.

Integrated Community Case Management (ICCM)

Fever case management requires knowledge, skills and commodities to handle the common causes of fever in children. Resources to scale up this approach within the VHT are grossly lacking, which is hindering their ability to treat malaria in communities.

The impact of ICCM on health facility functionality (motivation, HR, supply management, case flow, quality of care, support to VHTs) must be monitored and evaluated.

BCC/IEC

Whereas there is a focus on behaviour change, little effort has been made on behaviour maintenance. As the coverage with LLINs and ACT increases, there is need to keep repeatedly reminding the population to make use of these and other interventions.

Health System Strengthening (HSS)

There are still significant quality issues in the public health system, particularly relating to the timeliness, accuracy, validity and completeness of the health management and information system (HMIS) data.

Zambia

Summary table: malaria in Zambia

Parasites	*P. falciparum, P. vivax*
Vectors	*A. gambiae, A. arabiensis, A. funestus, A. nili, A. pharoensis, A. quadriannulatus*
% of people under ITNs and variation across the country	62.8% of households own at least one ITN (2008).
First-line drug for *P. falciparum* (unconfirmed)	AL
First-line drug for *P. falciparum* (confirmed)	AL
Second-line drug for *P. falciparum*	QN(7d)
Evidence of insecticide &/or drug resistance	SP resistance is widespread in Zambia, with failure rates between 7-35% depending upon the region.
IRS use	IRS is in use, with 1,149,599 households covered in 2008, protecting 5.7 million (48%) of the people at risk.
IPTi use	Not in use.
IPTp use	88.1% of pregnant women received at least one dose of IPT in 2008, with 66.1% of pregnant women receiving two or more doses.
Evidence of diagnostics being used to direct antimalarial treatment	Microscopy is available at just 30% of health centres, but RDTs are becoming increasingly available and are contributing to an increasing number of cases being correctly diagnosed.
	July 2011

1. Introduction

Zambia has seen a huge increase in international funding for malaria control over the last four years, and this is reflected in its successes. The challenge now is to expand public healthcare to the entire population, increase accurate diagnosis of malaria and reach universal preventive and curative coverage. This will only be possible with the continued high levels of financial commitment seen recently.

2. The Burden of Disease

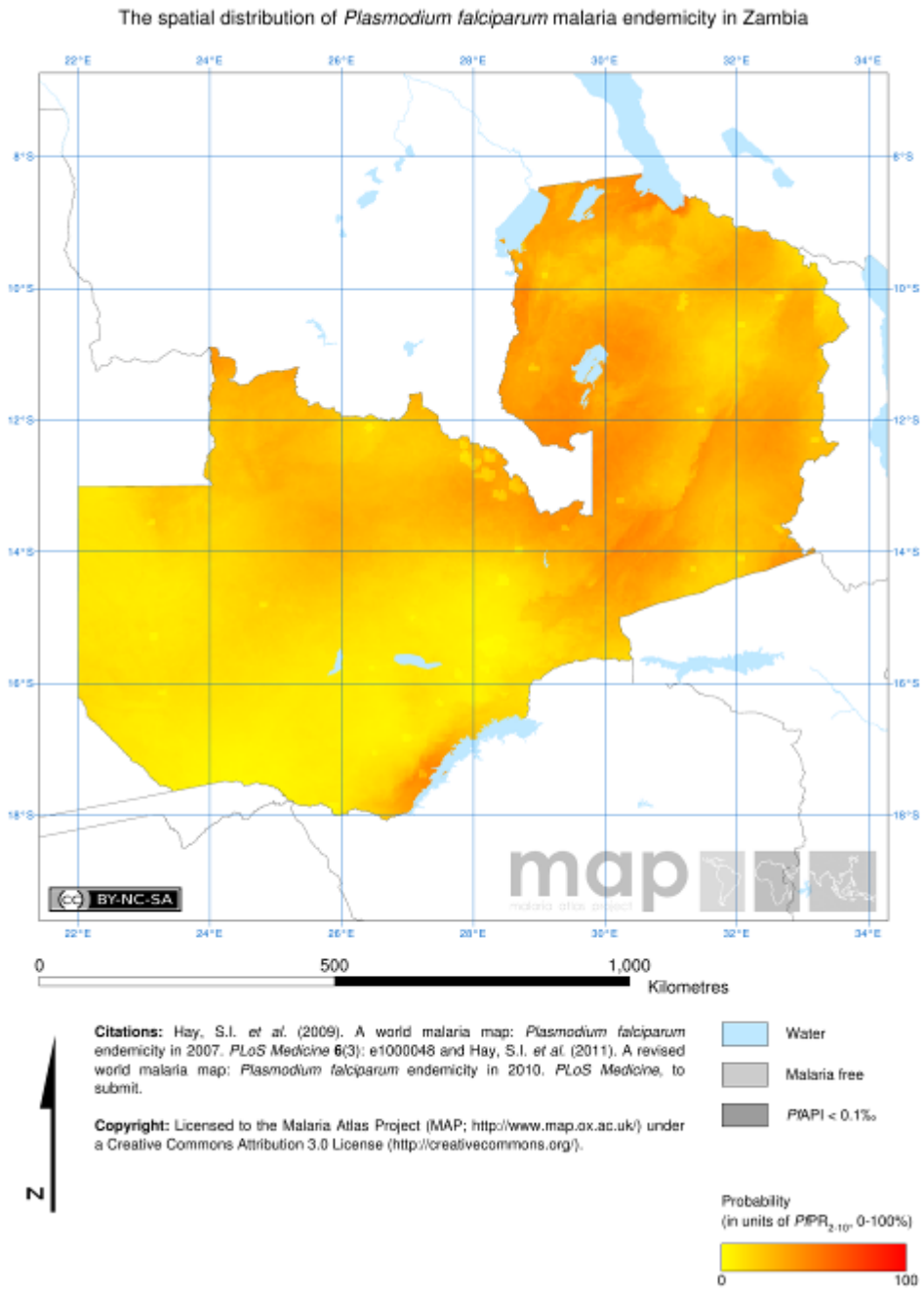
Malaria is the most significant health problem in Zambia, accounting for the greatest number of paediatric outpatient consultations and hospital admissions.[503] In recent years the scaling-up of malaria control interventions has helped to reduce by 55% the number of inpatient malaria cases and by 79% the number of deaths in children under 5, against the average for 2001 – 2003. There have also been reductions of 52% for inpatient malaria cases, 59% for inpatient deaths and 19% for outpatient cases.[504] Despite this, however, there were still over 3 million reported cases and 3,781 deaths related to malaria in 2008.[505] Furthermore, malaria is estimated to reduce Zambia's GDP by 1.5%.[506]

Malaria is endemic in all 9 provinces and 72 districts of Zambia, and 90-100% of the 13 million population is at risk from the disease.[507] Transmission is seasonal, with the

highest transmission during the rainy season beginning in November-December and lasting through April into May. This is followed by a cool dry season in June-July and a hot dry season in August-October characterised by low malaria transmission. The level of transmission, and therefore the malaria disease burden, fluctuates yearly because of variations in rainfall.[508] Unstable malaria transmission occurs in the districts on the higher altitude plateau, specifically Mpika, Serenje, Mkushi, Kapiri Mposhi, Chibombo, Mazabuka, Monze, Choma, and Lusaka. This is due to breaks in transmission of malaria during the cold, dry season, resulting in lowered malaria immunity, unstable transmission and predisposition to outbreaks.[509]

The major vector in Zambia is *Anopheles gambiae,* but *A. arabiensis, A. funestus, A. nili, A. pharoensis,* and *A. quadriannulatus* are also present. Above 90% of malaria cases are caused by *Plasmodium falciparum*, but a small proportion are also caused by *P. vivax.*[510] [511] Sulfadoxine-pyrimethamine (SP) resistance is widespread in Zambia, with treatment failing between 7% and 35% of the time, depending on the location. Artemisinin resistance has yet to be reported.[512]

Vector	Breeding places	Biting habits	Resting habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).
A. arabiensis	Temporary pools, rice fields.	Endophagic and exophagic (bite outdoors), anthropophilic (bites humans) and Zoophily (bites animals). Bite late at night.	Exophilic (rest outdoors after feeding) and endophilic.
A. funestus	Semi-permanent and permanent water, especially within vegetation, swamps, slow streams, ditch edges.	Endophagic, bite mainly late at night.	Endophilic.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Zambia's National Malaria Control Centre (NMCC) implements malaria control interventions based upon their National Malaria Strategic Plan (NMSP) 2006 – 2010. The driving vision of this NMSP is to achieve "A Malaria-Free Zambia" in the future. The goals being pursued are:

- To reduce the number of malaria cases by 75% by the end of 2010.
- Through the attainment of a 75% reduction, malaria control will ultimately contribute to the reduction of all-cause mortality by 20% in children under five.

- Malaria control will not only improve the main health prognostic indicators but also provide economic payoffs at the household and national levels.[513]

3.2 Prevention

Long-Lasting Insecticidal Net (LLIN) distribution represents the main preventive activity in Zambia. Distribution systems include nation-wide campaigns, rural-focused, district-based community distribution, and regular provision through antenatal clinic (ANC) appointments.[514] 4.8 million LLINs were distributed between 2006 and 2008, enough to cover 80% of the population.[515] The Malaria Indicator Survey in 2008 suggests that nationally 62.8% of households own at least one Insecticide Treated Net (ITN), which represents a 37% increase from 2006 and a 5-fold increase since 2001. [516] [517] However, increased financial resources are needed to sustain these recent successes; a gap of 2.8 million ITNs is estimated for 2010.[518] The map below shows the dramatic increase in households which own three ITNs.

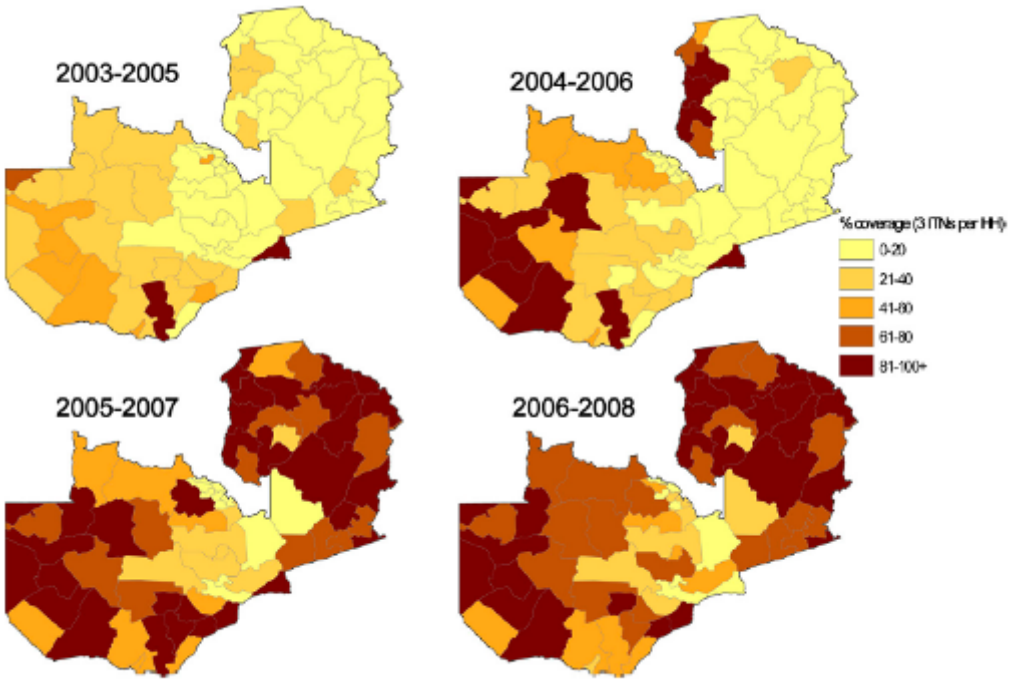


FIGURE 3. Estimated operational coverage of 3 insecticide-treated mosquito nets (ITNs) per household in overlapping 3-year intervals based on ITN distributions by district in Zambia during 2003–2008. This figure appears in color at www.ajtmh.org.

Indoor Residual Spraying (IRS) is another key aspect of preventive malaria control in Zambia, which is being carried out in 15 urban and peri-urban target districts.[519] IRS coverage increased 66% between 2006 and 2008, covering 1,149,599 households and protecting 5.7 million (48%) people at risk in 2008.[520] [521]

Zambia was one of the first countries in Africa to provide Intermittent Preventive Treatment (IPT) to pregnant women, and has been relatively successful in achieving a high level of coverage.[522] The Malaria Indicator Survey (MIS) 2008 suggests that 88.1% of pregnant women took an antimalarial drug during pregnancy, 73% of whom received it during a routine ANC visit. 66.1% of pregnant women took the recommended two or more doses of IPT.[523] To further improve IPT uptake, focused Information, Education and Communication (IEC) and Behaviour Change Communication (BCC) are necessary to address patient knowledge, attitudes and behaviour.[524]

3.3 Case Management

Zambia was one of the first countries in Africa to shift to treating malaria with more expensive, but more effective artemisinin-based combination therapies (ACTs). The current case management focus is on accurate diagnosis and swift treatment.[525] However, while preventive interventions have been successfully scaled-up in Zambia over the last few years, improvements in case management have been less pronounced. According to a human resource assessment conducted in 2008 by the Ministry of Health (MOH) with support from the Clinton Foundation, only 417 laboratory personnel were reported in-post at government health facilities against a total of 1,560 established posts. In 2006, training for a new cadre of specialist microscopists was initiated in order to address this critical staffing gap. Since then 234 microscopists have been trained.[526] 2 million Rapid Diagnostic Tests (RDTs) and over 3 million courses of artemisinin-based combination therapies (ACTs) were delivered in 2008, but only 13% of febrile children received ACT treatment.[527] [528] The number of children treated with any type of anti-malarial reduced by 18% from 2006, while the number of children seeking treatment remained stable. However, the number of children treated with ACTs rather than other drugs increased by 10.4% over the same period. This suggests that more children were clinically tested for malaria by microscopy or RDT before treatment, resulting in fewer erroneous prescriptions of anti-malarials. Due to the lack of information on RDT use, however, this is not certain.[529] Currently only 30% of health clinics are equipped for microscopy, RDT coverage needs to be increased and procurement problems causing stock-outs rectified.[530] Malaria Consortium has demonstrated that training of heath workers improves their confidence in using RDTs, resulting in a considerable reduction of irrational ACT use.[531]

3.4 Supporting Interventions

The NMCC in Zambia recognises the importance of support interventions for the overall success of malaria control. IEC and BCC are being implemented alongside other efforts in order to ensure the uptake and use of malaria control interventions. Zambia has an effective IEC/BCC programme that includes broadcast on national radio and television, community health information brochures, posters, handouts and skits, and focuses separate activities at the national and community level.[532] These efforts have resulted in a high ITN ownership rate and good knowledge about malaria, how it is transmitted and what can be done to prevent it in Zambia, with 71.1% of women able to spot the symptoms of malaria and 81.3% of women aware that an ITN is an effective preventive measure.[533] The impact that government IEC/BCC is having is illustrated by the finding that 74.5% of women had been exposed to malaria messages, and that 69.9% of these messages came from government hospitals or clinics.[534] However, while malaria knowledge is high, the uptake of malaria commodities such as LLINs and IPT lag behind their availability. Greater community focus, utilising community radio, drama and TV is required. With the changing nature of malaria control interventions, IEC/BCC must continue and expand in order to ensure the acceptance of malaria control interventions.[535]

The NMCC has a Monitoring and Evaluation (M&E) Plan that aims to strengthen M&E, widen sentinel surveillance, improve Health Management Information Systems (HMIS) and carry out better population and disease prevalence research.[536] [537] [538] [539] These recent efforts have led to more accurate data on the success of malaria control interventions, which facilitates the planning and implementation of future interventions. Zambia is an example of excellent cooperation between M&E partners—all support one M&E plan and provide technical assistance and resources for M&E activities. The Global Fund Monitoring and Evaluation System Strengthening Tool has given an overall grade of almost 85% to Zambia for a “completed and mostly completed” monitoring and evaluation plan—one of the highest of all Global Fund countries.[540] Continued financial and technical support is required to

sustain these improvements and further develop Zambia's M&E capacity; particularly at the community level.

3.5 Delivery Systems

In Zambia the majority of healthcare, including malaria diagnosis and treatment, is provided by government health facilities. The private sector is small, exclusively concentrated in urban areas, where the majority of the population lives, and focused mainly on case management using ACTs (but with little use of RDTs). Private mining companies provide preventive and curative medical services for their workers and dependents, as well as surrounding communities in some cases. Several of the larger mining companies, such as Konkola Copper Mining, have been carrying out IRS for many years within and around their compounds.[541] An estimated 1.5 million households are protected by the actions of mining companies in Zambia.[542] Between 20,000 – 50,000 nets are sold annually through the commercial sector, which represents a distribution channel that requires strengthening as part of a multi-sector approach.[543] As well as public health provision, the Churches Health Association of Zambia (CHAZ) provides as much as 30% of overall health care through a network of 129 mission hospitals, health centres and community programmes. CHAZ also supports health programmes, pharmaceutical services, and institutional development activities, and leverages resources for the collective procurement of drugs and other health related commodities for its member facilities. There is a good level of coordination between government and Faith Based Organisations (FBO) health provision in Zambia.[544]

4. Health System Issues

While the public health system provides the vast majority of healthcare in Zambia, it remains rather weak. Access is most limited in rural areas and the health infrastructure is inadequate, both in terms of the number and quality of health facilities and the coverage of diagnostic services. The capacity of M&E at the community level is also problematic. The biggest problem, however, is the huge lack of human resources, which is dramatically hindering attempts to expand malaria case management services.[545] [546]

Since 1992, the MOH has been implementing health sector reforms aimed at decentralizing health service delivery to the district and hospital levels and focusing on preventive rather than curative care. The reforms have focused on improving primary health care and implementing a basic health care package of carefully selected high-impact interventions offered through the public health system. This package has ten priority areas—one of which is malaria. Services included in this basic health care package are provided free-of-charge or on a cost-sharing basis depending on the location and level of the system. In rural and poor districts in Zambia, these services are free.[547] Recently the MOH has focused upon tackling the lack of human resources through the Human Resource Strategic Plan 2006 – 2011. Financial support will be crucial for the success of health system strengthening, which in turn is key for the success of malaria control in Zambia.[548]

Malaria Consortium has used malaria as a successful entry point for health systems strengthening that could contribute to improvements in the health outcomes with beneficial effects on control of other communicable diseases such as tuberculosis. The major areas in the Zambia Health system that need support include;

- leadership strengthening for better planning and budgeting of health services
- enhanced capacity and use of scarce human resources
- enhanced partnerships and improved coordination of different organisations and partners to improve planning and delivery of services at delivery points (districts)

- improved skills and systems for supply of essential medicines and health supplies
- improved access and utilisation of routine information for improved planning and implementation of health services [549]

5. Current Funding and Technical Support

The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) has provided funding for malaria control through Round 4 ($43,495,326) and Round 7 ($37,502,022). The principal recipients are the MOH and the CHAZ. A Round 9 application was submitted to obtain funding to meet an anticipated gap in funding for a planned IRS scale-up to 54, and ultimately all 72 districts. The total requested for Round 9 is $55 million over five years.[550]

USAID, through the **President's Malaria Initiative (PMI)**, has provided almost $30 million in funding since 2008, and is providing an additional $25.6 million in 2010. PMI funds go towards preventive and case management commodity procurement and distribution and M&E and administrative support.[551]

The Bill and Melinda Gates Foundation is providing support for malaria control in Zambia through the **Malaria Control and Evaluation Partnership in Africa (MACEPA)**, which is a nine-year, $35 million project intended to demonstrate the impact of full implementation of malaria control interventions and establish a proven, flexible model for national malaria control programme scale-up. MACEPA's support to the NMCC includes technical assistance for M&E of malaria interventions, support for emergency procurement and distribution of LLINs in 2006, an integrated IEC/BCC/advocacy initiative, and programme support that includes information technology, infrastructure, and staff training opportunities.[552]

The **World Bank** is providing $20 million through the **Malaria Booster Project** for the period 2006 – 2010. Due to rapid scale up, $15 million was spent by the end of 2007, $5 million in 2008 and $4.8 million in 2009. Funds were used to support IRS training and operational costs, LLIN procurement, active case detection, RDT procurement and community health worker (CHW) training.[553]

The **WHO** provides technical assistance in the areas of M&E, integrated management of childhood illnesses (IMCI) training, job aide development for community management through CHWs, and microscopy quality assurance.[554]

UNICEF procures ACTs, supports case management through IMCI training and supervision, and assists in ITN mass distribution.[555]

IrishAid, through Malaria Consortium, has provided support over seven years, to strengthen health systems through malaria control.

6. Major Gaps

Uptake of interventions is not as high as it could be with current rate of supply.

There is a lack of financial resources for expanding preventive measures and the provision of RDTs, and for training and paying much-needed healthcare workers.

Zanzibar

Summary table: malaria in Zanzibar

Parasites	*P. falciparum*
Vectors	*A. gambiae*
% of people under ITNs and variation across the country	72% of households own at least one ITN (2007).
First-line drug for *P. falciparum* (unconfirmed)	AS+AQ, AL
First-line drug for *P. falciparum* (confirmed)	AS+AQ, AL
Second-line drug for *P. falciparum*	AL, QN(7d)
Evidence of insecticide &/or drug resistance	SP resistance is high and is therefore not used in first-line treatment. Insecticide efficacy testing has shown all major insecticides to be effective in IRS.
IRS use	Several rounds of IRS since 2004 have achieved 90% coverage of at-risk households.
IPTi use	Not in use.
IPTp use	IPTp is in use, with IPTp2 coverage of 55%.
Evidence of diagnostics being used to direct antimalarial treatment	Microscopy or RDTs are available at almost every healthcare facility in Zanzibar, and 76% of cases of malaria in children under five are diagnosed prior to treatment.
	July 2011

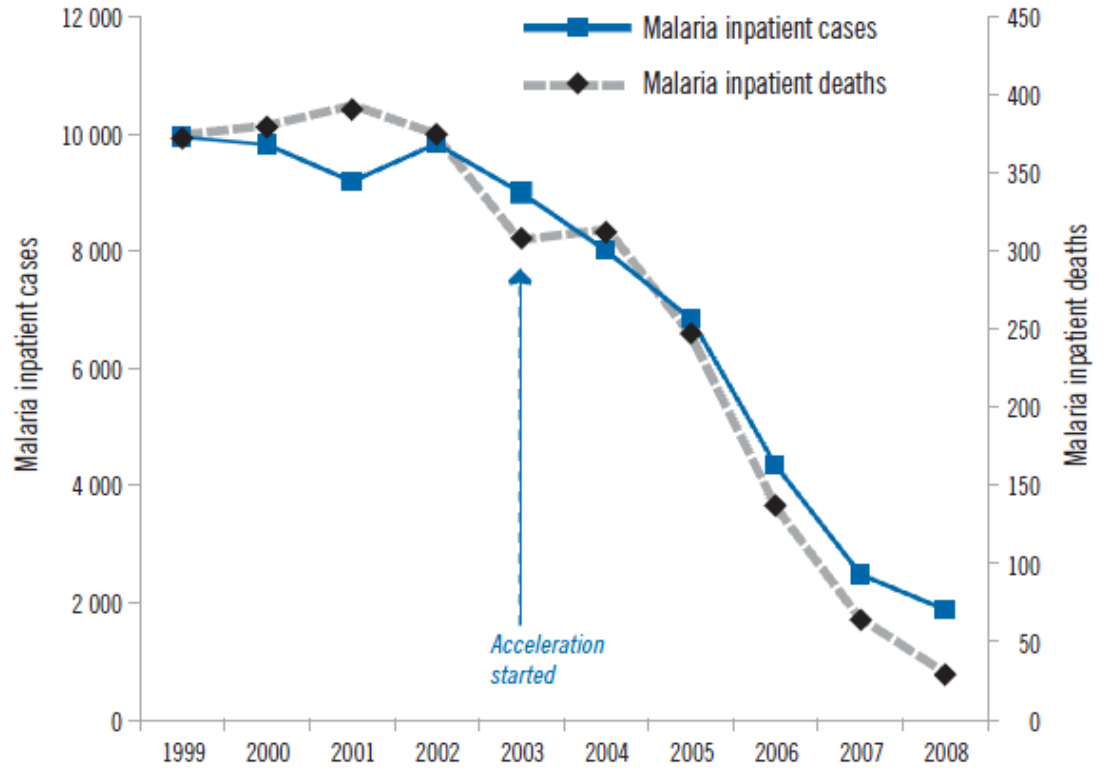
1. Introduction

Zanzibar is a semi-autonomous part of the United Republic of Tanzania, and while several aspects of the malaria situation are similar to that on the mainland, the extent and success of malaria control has been different. The government of Zanzibar also retains almost all government functions, including the Ministry of Health and Social Welfare (MOHSW) and its own Zanzibar Malaria Control Programme (ZMCP). Therefore Zanzibar will be covered separately from Tanzania mainland.

2. The Burden of Disease

The entire 1.2 million population of Zanzibar is at risk from malaria, and in 2003 malaria accounted for 43% of all outpatient consultations and was the primary cause of hospital morbidity and mortality.[556] However the scaling up and acceleration of malaria control interventions which began in 2003 has had an impact on malaria-related morbidity and mortality rates. By 2008, case and mortality rates were 80% and 92% lower than those recorded in 2001-2002. In particular, the largest reductions can be seen after the acceleration of malaria control in 2003.[557] Parasite prevalence in Zanzibar is now below 1%.[558]

Figure 4.6 Malaria inpatient cases and deaths, all ages, by year, 1999–2008, six of seven hospitals in Zanzibar, United Republic of Tanzania

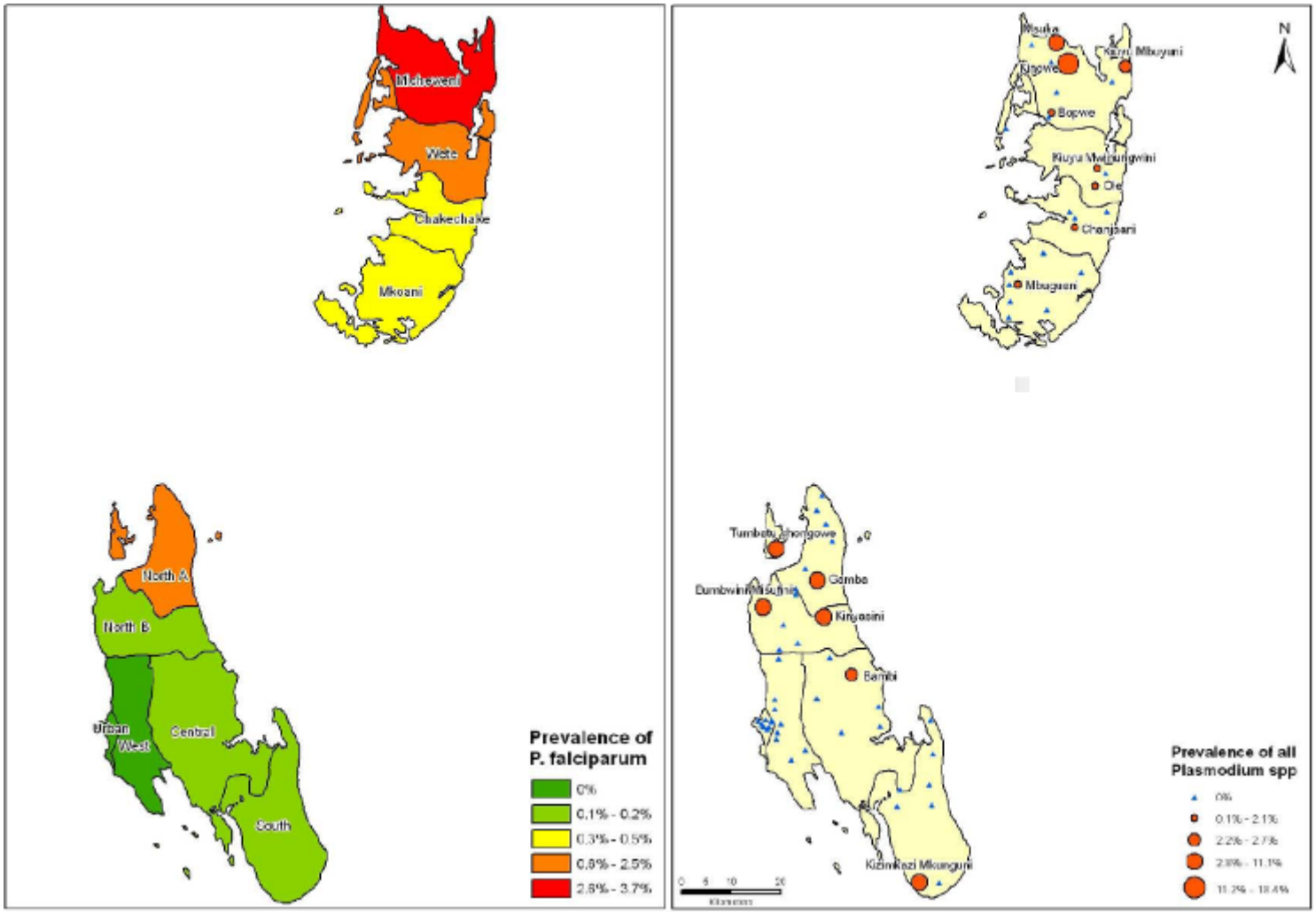


Source: Ministry of Health routine surveillance data

Malaria transmission is stable and perennial on the two islands of Zanzibar, with slight seasonal variations during the monsoon season. Zanzibar is situated a few degrees south of the equator. Its tropical climate is characterised by hot and humid weather, with the hottest weather generally occurring from December to March. During this time, the Islands experience short rains that typically only last a few hours. The main rainy season occurs from April to June when the long monsoon rains occur. *Anopheles gambiae* is the dominant vector in Zanzibar, and the principal parasite responsible for almost all infections is *Plasmodium falciparum*.[559]

Vector	Breeding places	Biting habits	Resting Habits
A. gambiae	Sunlit temporary pools, rice fields.	Endophagic (bites indoors), bite late at night.	Mainly endophilic (rest indoors after feeding).

The recent Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08 (THMIS) has highlighted that malaria is more prevalent in the northern districts of the two islands, and that there is near zero prevalence of malaria in urban settings. The maps below highlight malaria prevalence by district on the two main islands. The areas of higher malaria prevalence found in the northern districts also overlap with greater economic and social marginalisation found within these same districts.[560]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Zanzibar operates its own ZMCP under the jurisdiction of the MOHSW. Based on the exceptional successes of the Zanzibar Malaria Strategic Plan (ZMSP) 2003 – 2007, the current ZMSP 2008 – 2012 aims to sustain and further scale up the impact on malaria, and move towards pre-elimination in Zanzibar. The overall goal is to reduce malaria-related health facility-based morbidity by 70%.

There are four areas of focus in the ZMSP:[561]

- Prevention of Infection
- Early Diagnosis and Prompt Treatment
- Malaria in Pregnancy (MIP)
- Surveillance and Operational Research

3.2 Prevention

The distribution of Long Lasting Insecticidal Nets (LLINs) forms a key aspect of preventive malaria control in Zanzibar. ITN coverage has largely been achieved through LLIN campaigns, the provision of LLINs through Antenatal Care (ANC) clinics, as well as net re-

treatment interventions. The government removed all tariffs on publicly and privately procured LLINs. Approximately 245,000 LLINs were distributed in 2006, enough to cover 40% of the population, while a further 213,000 were distributed in 2007–2008. At the end of 2007 Insecticide-Treated Net (ITN) household ownership was 72%.[562] The THMIS (2007-08) demonstrated the increase in coverage and use that has been achieved. ITN use has gone from 2.8% of the population in 2002 to 60% in 2007, with use by pregnant women and children under five increasing from 3% to 73% and from 0.3% to 74% respectively.[563] However, sustaining this high level of LLIN coverage is proving a challenge. In 2007, the ZMCP introduced a voucher scheme as a sustainable distribution model based on that introduced on mainland Tanzania. The intention was to stimulate small businesses to deliver needed products such as ITNs to poor and remote populations. The voucher scheme has not performed according to intentions; the cost of the LLIN has remained high, and its narrowly-focused targeting (children under one and pregnant women) has meant that very few LLINs have been distributed through the scheme. Although the scheme was intended to stimulate the availability of ITNs in local businesses, it has been suggested that conventional nets, not ITNs, are now more readily available than previously.[564] It has therefore been decided to discontinue the voucher system, and instead concentrate on universal LLIN distribution through other mechanisms.[565]

Indoor Residual Spraying (IRS) has also been implemented in Zanzibar. One round of IRS was carried out in 2006, followed by two further rounds in 2007 and a single round in 2008. Each round covered nearly all households, and it is estimated that total IRS coverage was above 90%.[566] In all four spray campaigns, the insecticide lambda cyhalothrin (Icon-CS) was used. Spray operators were trained for two weeks on personal protection against malaria, insecticide mixing and application, pump maintenance and safe transportation and storage of insecticides. Both men and women were recruited and trained as spray operators and community leaders were directly involved in sensitising local populations. The result was a high level of community acceptance, effective and efficient spraying, and accurate monitoring and evaluation that fed into planning for the next round.[567] With the huge reductions in malaria transmission and vector prevalence, the scaling-back of IRS is under consideration by the ZMCP. This will depend on the results of monitoring, evaluation and surveillance data.[568]

Intermittent Preventive Treatment in pregnancy (IPTp) was introduced in Zanzibar in 2004, and while coverage is increasing through ANC clinics, the Malaria in Pregnancy (MIP) strategy has been less successful than other preventive interventions. IPTp-2 coverage has increased to 55% of pregnant women in 2007-08, compared to 14% in 2004.[569] IPTp is being strengthened through the GFATM Round 8 grant, but there is an ongoing policy debate regarding the possibility of scaling down the national IPT strategy in the face of very low prevalence rates.[570]

3.3 Case Management

Zanzibar has been successful in scaling up accurate diagnosis and prompt, effective treatment. Artemisinin-based Combination Therapy (ACT) became free and universally available at all public health facilities in 2002, and appropriate use of ACTs has been documented at approximately 70%.[571] With the decrease in malaria case load in health facilities, there is now an increased focus on diagnosis and attention to non-malarial causes of fever and death in children under five. A recently completed survey showed that almost 95% of facilities in Zanzibar had either microscopy or Rapid Diagnostic Tests (RDTs) available for confirming malaria diagnoses. The MOHSW has implemented a comprehensive training programme that has resulted in there being at least one staff member trained in malaria case management at 94% of health facilities surveyed in the THMIS.[572] However, the THMIS also indicated that clinical assessment of malaria was

considered weak, implying that follow-up training through effective supportive supervision is inadequate. In addition, while confirmatory diagnosis has increased, THMIS findings show that this is not always requested by clinicians. [573] Some other areas for improvement noted in the RBM Needs Assessment in 2008 were the following:

- quantification of RDT needs was not accurate due to delay in compiling HMIS reports
- EQA not fully implemented for microscopy
- no QA system in place for RDTs at port of entry or at public/private health facility level.

RDTs are now available at all health facilities, so even if microscopy is not available case confirmation is still possible. Case confirmation in children under five was 76% in 2007-08.[574] With Zanzibar's move to pre-elimination, antimalarials are now only administered when malaria is clinically confirmed. These improvements have made possible, between 2002 and 2007, a reduction in confirmed malaria cases in children under five of 94%, and a three-fold reduction in malaria-related deaths.[575]

3.4 Supporting Interventions

Zanzibar has a well-developed and effective data management system where malaria-related data are housed and analysed. IRS spray forms are captured and used to calculate spray coverage, and summary sheets from clinics and hospitals are used to record malaria cases. However, effective data entry must evolve into a rigorous monitoring and evaluation effort. Without weekly reporting and appropriate programme action, outbreaks will become epidemics and recent successes in malaria control will not be sustained.[576] Furthermore, the ZMCP has been highly dependent upon information collected through surveys, particularly the THMIS survey which is conducted every two years. This results in a lack of timely information, analysis and adjustments to strategies. There is an over-reliance on parallel data collected by the programme due to a lack of confidence in routine reporting through the Health Management of Information System (HMIS). There is also little dissemination of malaria monitoring information across programmes and down through the health pyramid resulting in limited evidence-based decision making.[577]

The President's Malaria Initiative (PMI) have been supporting the ZMCP in developing a Malaria Early Epidemic Detection System (MEEDS) in Unguja and Pemba. The system includes a strategy to collect daily data for three key indicators among outpatients visiting peripheral health facilities (total visits, confirmed malaria positive, confirmed malaria negative). The system was inaugurated in ten facilities in April 2008 and is now operational in over 50 facilities. Weekly aggregate data, stratified by under five and over five years of age, are transmitted from each health facility using a customised cell phone menu. All data are received by a computer server operated by a Tanzanian telecommunications company. Epidemic thresholds are being refined to determine when an epidemic response should be elicited from ZMCP and district-level health officials. In June 2008, ZMCP appropriately responded to the first suspected malaria epidemic detected by this novel system.[578]

Behaviour Change Communication (BCC) and Information, Education and Communciation (IEC) are used to support preventive and case management interventions, and these have helped facilitate public acceptance of Zanzibar's malaria control programme. However, BCC efforts have been fragmented and applied in an ad-hoc manner, focusing on selective interventions (especially IRS). BCC efforts to date have not been evaluated to determine which methods are most effective.[579] Furthermore, significant gaps remain in the population's knowledge about malaria. For example, the THMIS (2007-08) found that only 30% of pregnant woman surveyed understood the purpose of IPT, while only 60% and 24% correctly understood the importance of ITNs and IRS respectively. MIS findings also showed that most of the health education materials were either ill placed or not used. There

is need to update IEC/BCC materials, to ensure adequate coverage of materials and to include more comprehensive community BCC activities.[580] As Zanzibar progresses to pre-elimination, BCC/IEC has become increasingly important in order to combat complacency in society, as malaria becomes less of a central health issue. The lack of sustained malaria control following reduced transmission rates (but not quite eradication) in the 1960s were a major reason for the return of the disease in the following decade. The THMIS illustrates the potential risk; already one third of caretakers did not take any action within 24 hours of onset of febrile illness in 2007, whereas almost two thirds did take action within 24 hours in 2002.[581,582] Therefore, it is essential that the population is educated that malaria remains a health threat, that prevention is still required, and what healthcare-seeking behaviour is required.[583]

3.5 Delivery Systems

Zanzibar has a relatively well developed public health system. Public healthcare on the islands is provided at three levels; three types of facility at the primary level located in or near each community (first-line primary healthcare units, second-line primary healthcare units and primary health care centres or cottage hospitals); district hospitals at the secondary level (mainly on Pemba island, with plans to build facilities on Unguja); and consultants, referral hospitals and specialised institutions at the tertiary level. Overall, the Government of Zanzibar estimates that 90% of the population lives within 10 kilometers of a health facility.[584]

While the majority of the population seek treatment at public health facilities, 23% of malaria cases are currently treated by private sector providers. Currently there is weak enforcement of national treatment guidelines in private health facilities, which include 3 private hospitals (all in Zanzibar town), 100 clinics, 60 pharmacies, and more than 200 over-the-counter shops. This means that a large proportion of malaria cases are likely being treated using monotherapy, and often without confirmed diagnosis. In addition, while efforts to integrate ZMCP diagnostic quality control support with selected private facilities has been undertaken, this currently only includes 7 facilities, leaving the majority of those providing some form of diagnosis unsupervised and unsupported.[585]

4. Health System Issues

Since independence in 1964, the Government of Zanzibar through the MOHSW has provided health care free at the point of delivery. To this end, a substantial health service delivery structure has been developed creating a service delivery capacity that can potentially ensure equity of access for primary health care services for all clients. Health service provision has also been decentralised to other recognised institutions, such as private practitioners, Faith-based Organisations (FBOs) and NGOs.[586]

However, at the level of local communities, activities are often conducted in an ad hoc and uncoordinated manner without the active participation of the peripheral facilities tasked to serve these same communities. This results in inadequate preventive activities, a lack of ownership in the health services by the communities, and a lack of local schemes for effectively dealing with referrals to these facilities. Currently, priority programmes are employing multiple community health strategies which respond to programmatic needs but not necessarily to the needs of communities or individuals within those communities.[587]

Problems in the health system identified by the ZMCP include an outdated training curriculum for the various health professions, the persistence of health workers prescribing antimalarials despite negative RDT results, continued use of monotherapy, inadequate differential diagnosis of severe febrile illnesses (e.g. septicaemia, pneumonia etc.) from

severe malaria; and the lack of a mechanism to supervise private health facilities on management of malaria.[588]

While the ZMCP itself is well staffed and highly motivated, there is still a need for strengthened capacity in certain areas to meet the demands of scaled up programme and pre-elimination. These areas are: entomology. epidemiology/information management and IEC/BCC.[589]

5. Current Funding and Technical Support

The MOHSW budget is approximately $6.1 million, with approximately $100,000 allocated to malaria control.[590]

The Global Fund to Fight Aids, TB and Malaria (GFATM) has provided a significant amount of financial support for malaria control in Zanzibar. A grant of $1,153,080 was awarded and disbursed under Round 1 in June 2003 to assist Zanzibar in implementing a new treatment policy using ACTs. A further $8,438,788 was awarded under Round 4 in January 2005 to continue support of the new treatment policy and scale up coverage of ITNs. Both Round 1 and Round 4 have now been completed, but a Round 8 grant for Scaling Up and Sustaining Impact of Malaria Control in Zanzibar, totalling $13,390,240, has been agreed. Disbursements began in 2010 and as of September 2010 $1,530,146 has been received.[591,592]

The President's Malaria Initiative (PMI) is the other major external donor supporting the malaria programme in Zanzibar. This programme has been operational since 2006, has provided approximately $3 million a year, and is managed separately from the ZMCP by the Research Triangle Institute (RTI).[593] PMI has committed itself to providing $5.3 million in 2010 for LLIN distribution, IRS, IPTp and RDT and ACT procurement.[594]

6. Major Gaps

With the significant reductions in malaria transmission and prevalence, and Zanzibar's move to pre-elimination, new challenges are arising. Accurate diagnosis, diagnosis and treatment quality assurance, private sector regulation, monitoring & evaluation and effective surveillance and research will be critical to sustain recent successes. In time the population's natural immunity will drop and the risk of epidemics will increase. Transmission via human migration, particularly from Tanzania mainland, could become a problem. Finally, malaria control in Zanzibar is currently heavily dependent upon external funding. The GDP of the country remains low, and therefore future funding for malaria control is not secure.[595,596,597]

Asia

Afghanistan

Summary table: malaria in Afghanistan

Parasites	*P. falciparum, P. vivax*
Vectors	*A. stephensi, A. culicifacies, A. fluviatilus, A. annularis, A. pulcherrimus, A. epiroticus, A. hyrcanus*
% of people under ITNs and variation across the country	20.6% of households have at least one ITN, with large urban and wealthy family bias (2007)
First-line drug for *P. falciparum* (unconfirmed)	CQ+SP
First-line drug for *P. falciparum* (confirmed)	AS+SP
Second-line drug for *P. falciparum*	QN(7d)
Treatment of *P. vivax*	CQ
Evidence of insecticide &/or drug resistance	60% *P. falciparum* resistance to CQ & AS, no resistance to ACTs.
IRS use	Not in use
IPTi use	Not in use
IPTp use	Not in use
Evidence of diagnostics being used to direct antimalarial treatment	Less than 20% of cases confirmed by diagnostics prior to treatment in 2007
	July 2011

1. Introduction

Attempts to control malaria in Afghanistan are taking place within the difficult context of an ongoing conflict and civil instability. The number of malaria cases fell between 2002 and 2008; by 95% for *P. falciparum* and 76.6% for *P. vivax*.[598] However, the scaling-up of malaria control interventions has failed to meet the ambitious targets of the National Malaria Control Programme (NMCP). In particular, the weakness of the health system, the unregulated nature of the private sector, inadequate diagnostic services, insufficient net distribution and poor and ineffective support interventions are problematic.

2. The Burden of Disease

Afghanistan has the fourth highest malaria rate outside of Africa, and the second highest in the WHO's Eastern Mediterranean Region. Malaria was effectively controlled in the 1970s with DDT, but a change in vectors, increasing vector resistance and decades of conflict and social instability have resulted in its resurgence as a serious public health concern.[599]

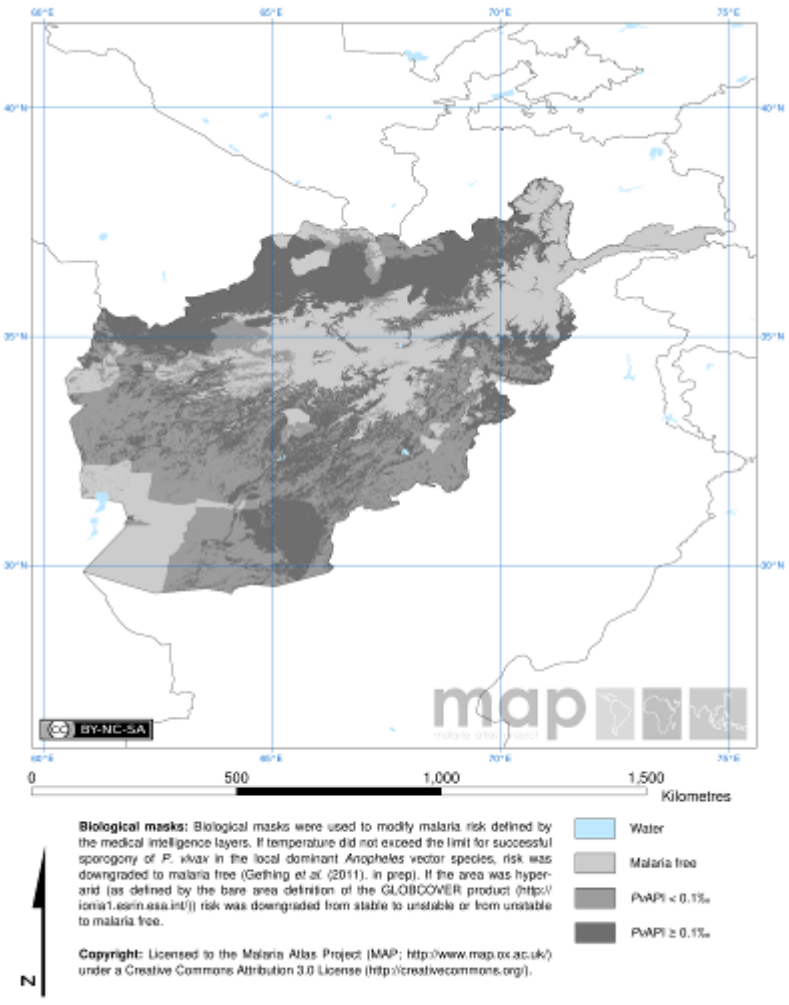
An estimated 14.5 million people live in areas at risk from malaria transmission, and there were 467,123 reported cases in 2008. This is down from a high of 2.5 – 3 million cases in 2002.[600,601,602] However, while 80% of the population live in at-risk areas, the incidence rate of malaria is relatively low, with just 15-30% positivity of examined blood slides. A low

incidence rate increases the importance of effective diagnostics in order to ensure only confirmed malaria cases are treated with antimalarial drugs.[603]

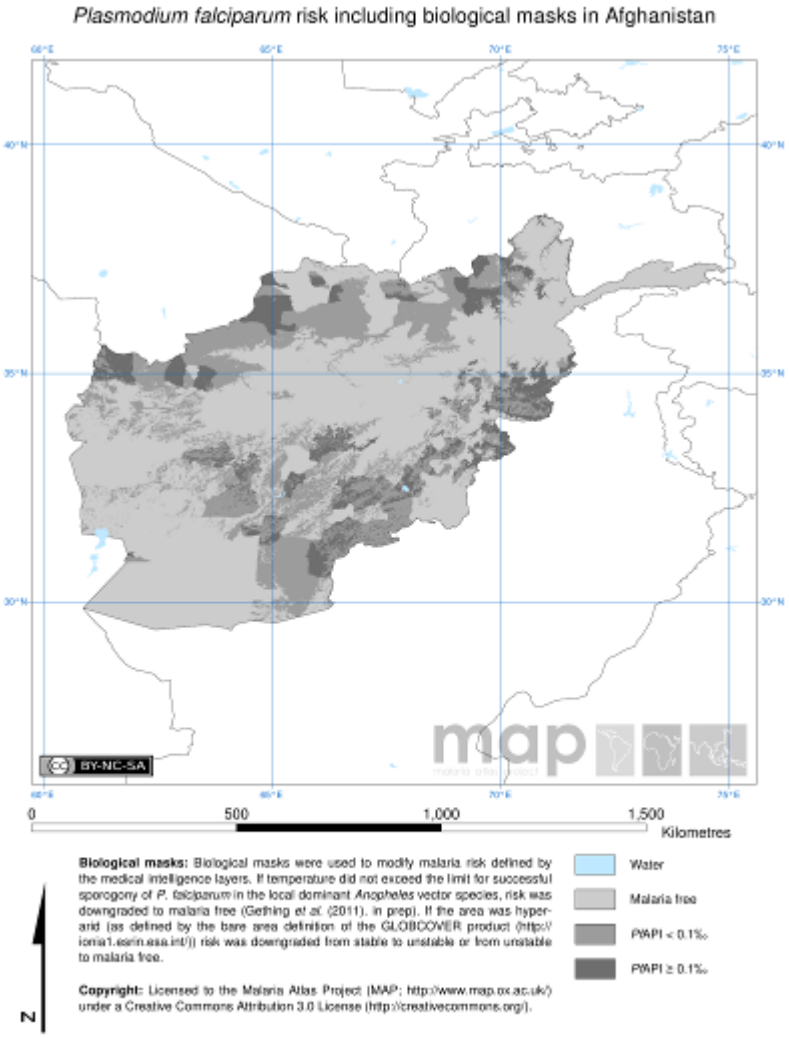
The major determinants of malaria transmission in Afghanistan are altitude and agricultural practices, with the greatest prevalence in the snow-fed river valleys and areas used for rice cultivation where water is plentiful for vector breeding.[604] Provinces with a medium to high transmission potential are Takhar, Kunduz, Ningarhar, Kunar, Laghman, Baghlan, Faryab, Badghis, Badakhshan, Herat, Khost, Kandahar, Helmand and Balkh.[605] The main vector in Afghanistan is *A. stephensi,* but *A. culicifacies, A. fluviatilus, A. annularis, A. pulcherrimus* and *A. epiroticus* (previously *A. superpictus*) are also present. The parasite species are *P. falciparum* and *P. vivax,* with the latter accounting for 80 – 90% of cases.[606] Malaria transmission in Afghanistan is seasonal – between June and November. *P. vivax* transmission peaks in July and *P. falciparum* peaks in October.[607]

From the first detection of resistance in 1989 the failure rate of chloroquine (CQ) and amodiaquine for treating *P. falciparum* malaria has risen to more than 60%, and as high as 90% in Jalalabad. However, CQ remains effective for treating *P. vivax*, and no resistance to Artemisinin Combination Therapies (ACTs) containing sulfadoxine-pyrimethamine (SP) and artesunate have been observed.[608,609]

Plasmodium vivax risk including biological masks in Afghanistan



Biological masks: Biological masks were used to modify malaria risk defined by the medical intelligence layers. If temperature did not exceed the limit for successful sporogony of *P. vivax* in the local dominant *Anopheles* vector species, risk was downgraded to malaria free (Gething *et al.* (2011). in prep). If the area was hyper-arid (as defined by the bare area definition of the GLOBCOVER product (http://ionia1.esrin.esa.int/)) risk was downgraded from stable to unstable or from unstable to malaria free.



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Malaria control interventions in Afghanistan are implemented in line with the National Malaria Strategic Plan (NMSP) 2006 – 2015 developed by the Islamic Republic of Afghanistan Ministry of Public Health (MOPH). The goal of the NMSP is to contribute to the improvement of the health status in Afghanistan through the reduction of morbidity and mortality associated with malaria. The objectives are:[610]

- to reduce malaria morbidity by 60% by the year 2015
- to reduce malaria mortality by 90% by the year 2015
- to reduce the incidence of *P. falciparum* malaria to sporadic cases by the end of 2015, with a vision to interrupt its transmission.

3.2 Prevention

The provision of Insecticide Treated Nets (ITNs), including Long-Lasting Insecticidal Nets (LLINs), forms the main aspect of Afghanistan's preventive malaria control strategy. The NMSP aims to provide sufficient ITNs to cover 85% of the population by 2013, which

translates into a need for 13 million nets.[611] These actions are currently being focused on the North, South and East of the country, where over 1.5 million nets have been distributed since 2006.[612] This is short of the target. Surveys have suggested that 20.6% of families have at least one ITN or LLIN, only 11% of which were provided for free. Furthermore, the distribution of nets is uneven, with a bias towards urban and wealthier families.[613] Net distribution requires significant scaling-up if the target for 2013 is to be met. Afghanistan currently has no policy regarding Intermittent Preventive Treatment for pregnant women (IPTp), because available data suggest that the incidence of *P. falciparum* is limited and because cultural traditions make it likely that pregnant women would object to taking medication.[614] Similarly, Indoor Residual Spraying (IRS) is currently not being used in Afghanistan, but may be considered for future use if research indicates its relevance.[615]

3.3 Case Management

With the divergence in treatments between *P. vivax* and *P. falciparum* malaria (CQ and AS + SP respectively), and the relatively high cost of ACT compared to chloroquine, there is a need for greater emphasis on diagnosis at all levels of the health system; if *P. falciparum* is mistakenly treated as *P. vivax* treatment failure is assured, and if *P. vivax* is treated as *P. falciparum* valuable drugs are needlessly wasted.[616] Unfortunately, diagnostic services in Afghanistan, in both the public and private sectors, are extremely poor; less than 20% of reported cases were confirmed by microscopy in 2007.[617] Microscopy is not available in most public health facilities, particularly in rural areas, and private services often ignore diagnosis altogether.[618] Across Afghanistan there is reliance on clinical diagnosis, which is notoriously inaccurate, and which leads to the unnecessary use of antimalarials. However, there has been slow progress over the last few years, with 30 microscopy centres being established in Laghman, Baghlan and Takhar provinces.[619] Rapid Diagnostic Tests (RDTs) are being introduced in order extend diagnosis services to remote rural communities that do not have access to public health facilities, and Quality Assurance Centres (QACs) are being strengthened.[620]

3.4 Supporting Interventions

Behaviour Change Communication (BCC) has only recently been implemented in Afghanistan, and the poor quality of materials and lack of impact it has achieved so far are evidence of this. The NMSP is aiming to increase its BCC activities in support of preventive and case management interventions, to promote the prompt recognition of illness, increase appropriate care-seeking behaviour, improve the understanding of how malaria is transmitted, and to facilitate greater acceptance and utilisation of malaria control commodities and services.[621] The National Malaria Indicators Assessment (NMIA) 2008 reported that: 59.8% of people with a fever attempted to seek treatment; 60.8% of people surveyed knew that malaria is transmitted by a mosquito bite; and 46% of people identified mosquito nets as the most effective form of prevention. The finding that only 43.1% of people had received malaria-related government messages illustrates the limitations of current BCC activities.[622] However, a recent survey on ITN ownership and usage found that knowledge about malaria was relatively high; 75% of respondents knew that mosquitoes caused malaria and 64% were aware that mosquitoes breed in water. Furthermore, both men and women claimed to receive health messages from clinics, indicating a degree of BCC success.[623] Regarding treatment knowledge, however, 73% of respondents believed chloroquine to be the most effective treatment, and 7% favoured traditional treatment (mainly due to costs). This shows that there remains work to be done in educating the population about malaria, preventive measures and the correct treatment seeking behaviour.[624]

Effective intervention planning and implementation are hindered by the inadequacy of the Health Management Information System (HMIS), surveillance systems and monitoring and

evaluation mechanisms. The HMIS lacks timeliness, reflects the clinical diagnostic facilities in place (resulting in reporting primarily of suspected and not confirmed cases), and relies on reporting from hundreds of facilities which are often inaccurate.[625] Similarly, the Disease Early Warning System (DEWS) and Epidemic Preparedness and Response (EPR) teams are only partially effective due to their limited capacity and experience in prompt response and implementation of control measures. Routine malaria data are reported to the provincial level on a monthly basis, which does not allow for an adequate response to suspected outbreaks and epidemics.[626] The strengthening of these systems is a core activity under the NMSP but remains far from adequate.

3.5 Delivery Systems

The public health sector is the primary delivery system for malaria control in Afghanistan, but its weakness and unequal distribution of access across the country limits the effectiveness of preventive and case management interventions. The NMIA reports that 51.5% of those who seek treatment for a fever at a health care facility do so at a government clinic. For those who did not seek treatment at a healthcare facility, public or private, the biggest reasons were the unavailability of a health care facility (24.5%) and the long travel distance (22.7%).[627]

Usage of the private sector for healthcare has been variably estimated at between 75% and 45%, and as such represents an unquantified provider of unregulated and variable treatment.[628] A national policy on Public-Private Partnerships has not yet been devised. Artemisinin-based Combination Therapy (ACT) has not yet been widely adopted by private sector health care providers, and pharmaceutical procurement, supply management, regulatory and quality assurance systems are undeveloped.[629]

Home-based Management of Malaria (HMM) is an innovative approach to extend early diagnostic, treatment and referral services through 17,000 Community Health Workers (CHWs) for rural populations with limited access to health care services. HMM is being implemented as part of a wider scaling-up of malaria control interventions funded by the GFATM (Round 8).[630]

4. Health System Issues

The public health care system in Afghanistan is extremely weak due to three decades of war and civil strife. Planning, management, diagnosis and treatment all suffer from a lack of skilled health workers and managers, low motivation due to a lack of career opportunities and low pay.[631] The government is attempting to reform the health system, with a focus on decentralised primary healthcare. The Basic Package of Health Services (BPHS) was announced in 2003 and is backed by the World Bank, USAID, and the European Union. The BPHS provides a minimum standard of healthcare which, on paper at least, is available to every Afghan. The programme is designed to cover the majority of the population of the country and to provide preventative as well as curative services. It conforms to a well defined pyramidal structure, from Health Posts (HP) at community level, through Basic Health Centres (BHC), the Comprehensive Health Centre (CHC) and up to District Hospital Level. The BPHS also provides other services, such as the Extended Programme of Immunisation (EPI), and community initiatives, such as midwifery and mental health.[632,633] A key aspect of this drive to extend primary healthcare to the remotest rural areas of Afghanistan is the HMM system described above. It is through the BPHS and CHWs that government efforts to increase microscopy and RDT diagnosis and improve effective treatment of malaria are based.

5. Current Funding and Technical Support

Afghanistan has secured approval for $90 million of funding from a wide variety of donors for malaria control 2009 – 2014.[634]

The Global Fund for AIDS, Tuberculosis and Malaria (GFATM) provided $ 7,785,075 for malaria control in 14 high risk provinces in 2008, and a further $15,043,320 has been granted for 2009 – 2011 under the second phase of Afghanistan's Round 5 project.

Euro 55,397,259 has also been granted by the GFATM for malaria control under Round 8 for the period 2009 – 2014.[635]

A project starting in 2009 to strengthen malaria control activities in Kandahar Province, in collaboration with WHO and costing $4 million is being funded by CIDA and the French government.[636]

USAID is providing $1.7 million for a capacity building programme and the establishment of 71 microscopy laboratories in the BHCs in Baghlan, Takhar and Badakhshan provinces.[637]

WHO is providing $ 90,000 for a pilot study on drug efficacy monitoring, case management activities and field-testing of the Global Malaria Database in 3 Provinces.[638]

A donation of $100,000 from the International Islamic Relief Organization (IIRO) was solicited through WHO to pilot-test Home-based Management of Malaria (HMM) in Basic Development Needs (BDN) villages to promote community support for CHWs in their areas of responsibility.[639]

USAID/Kabul is finalising a one-time grant of $1,141,133 to procure laboratory supplies and equipment for three Provinces along the border areas of Tajikistan.[640]

6. Major Gaps

The lack of capacity for undertaking adequate malaria diagnosis is a key bottleneck to better management of illness in Afghanistan. On the preventions side there is still a long way to go to achieve adequate coverage with LLINs. The systems problems, in particular the limited trained personnel, limit the scope for effectively reducing the malaria burden.

Burma

Summary table: malaria in Burma

Parasites	*P. falciparum, P. vivax*
Vectors	*A. dirus, A. minimus, A. epiroticus*
% of people under ITNs and variation across the country	Estimated 8 million nets in Burma, but most are not ITNs. Only 5.65% of medium and high-risk population protected by ITNs (2008).
First-line drug for *P. falciparum* (unconfirmed)	CQ
First-line drug for *P. falciparum* (confirmed)	DHA-PPQ, AL, AS+MQ
Second-line drug for *P. falciparum*	DHA-PPQ, AS+AM, AL
Treatment of *P. vivax*	CQ+PQ(14d)
Evidence of insecticide &/or drug resistance	Artemisinin-resistant *P. falciparum* has been identified on the Thai-Cambodian border. Extent of resistance largely unknown.
IRS use	Selectively targeted in order to contain outbreaks, especially in endemic areas such as development project sites and temporary settlements.
IPTi use	Not in use in Asia due to high SP resistance.
IPTp use	Not in use in Asia due to high SP resistance.
Evidence of diagnostics being used to direct antimalarial treatment	Most cases are not confirmed by diagnosis, in part due to RDT stock-outs and poor quality and coverage of microscopy.
	July 2011

1. Introduction

Burma has the highest rate of malaria-related mortality in south-east Asia, and the disease is the leading cause of morbidity and mortality within the country.[641,642] The tumultuous internal politics of Burma have resulted in an under-funded health system, an unregulated private drugs industry and difficult relationships with donors and NGOs that have drastically hindered malaria control interventions.

2. The Burden of Disease

284 of the 325 townships in Burma are malaria endemic, which amounts to an estimated 68% of Burma's population being at a risk of contracting the disease.[643] The most vulnerable segment of society is non-immune migrant workers who work in the gem-mining, logging, agriculture and construction industries.[644] Children under the age of five account for 13% of cases, and pregnant women, account for just 0.91%. Soldiers are also at risk.[645] Between 2000 and 2008 the number of reported malaria deaths decreased from 2,756 to 1,088, and hospital admissions over the same period fell from 187,289 to 47,553. The number of reported malaria cases, however, has more than doubled during this time, from 245,000 to 566,000.[646] This trend is most likely due to the improved access to malaria treatment services, resulting in higher reported cases and lower mortality rates.

75% of recorded malaria cases are caused by the *Plasmodium falciparum* parasite, with *P. vivax* accounting for the other 25%. The vectors found in Burma are *A. dirus*, *A. minimus*,

and *A. epiroticus*.[647] Artemisinin-resistant *P. falciparum* was reported on the Thai-Cambodian border in 2006-2007, and since then evidence from recent drug efficacy monitoring suggests that it may occur in north-eastern Burma.[648] There is concern that Burma's substandard drug problems and under-funded health sector will contribute to the regional drug resistance problem. Cross-border economic migration would facilitate the transmission of these resistant strains to neighbouring countries.[649]

The changing behaviour of mosquitoes may influence the effectiveness of vector control measures. *A. dirus* has adapted to certain village environments by breeding in village domestic wells, in addition to its usual breeding sites. Furthermore, *A. minimus* bite humans outdoors and early in the evening, diminishing the impact of insecticide treated nets (ITNs). However, evidence suggests that indoor biting remains more frequent, and therefore Indoor Residual Spraying (IRS) and ITNs should continue to be effective in preventing malaria.[650,651]

Vector[5]	Breeding places	Biting habits	Resting habits
A. dirus	Small water collections, footprints of animals, wheel-tracks, burrow-pits, usually in thick forest or forest fringe with heavy shade and high humidity	Exophagic (bites outdoors), highly anthropophilic (prefers to bite humans)	Exophilic (rests outdoors after feeding)
A. minimus	Edges of flowing waters such as foothill streams, and springs. Prefer shaded areas of sunlit habitats.	Both exophagic and endophagic (bites indoors), and anthropophilic, but frequently show zoophily) found to bite cattle more frequently than *A.dirus*	Mainly exophilic (rests outdoors after feeding).
A. epiroticus	Salt and brackish waters, lagoons, marshes, pools and seepages.	Exophagic as well as endophagic. More anthropophilic than zoophilic.	Exophilic and endophilic

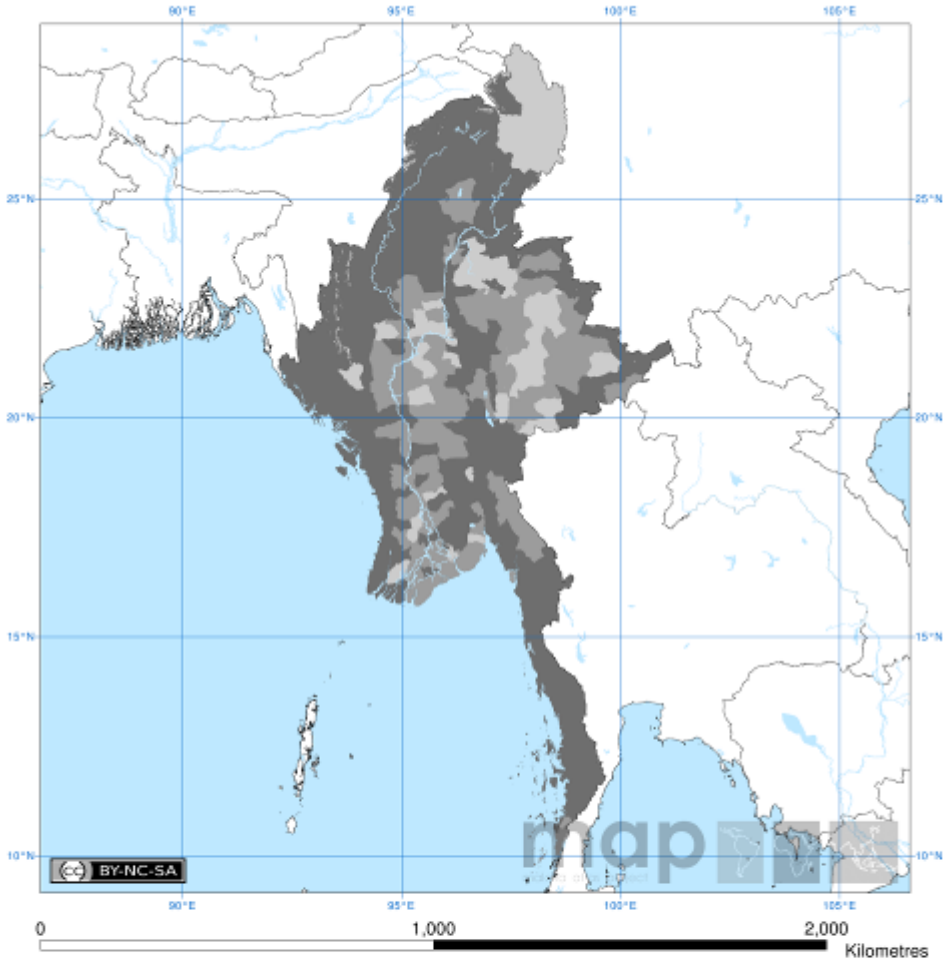
The transmission of malaria in Burma is perennial, with peaks in the rainy season.[652] The areas with highest transmission are the hilly and forested border areas, which are often inaccessible due to the terrain, poor infrastructure and ongoing conflict. The people who live in these areas are impoverished and rural ethnic minorities, whose land has been ravaged by decades of conflict.[653] The risk of malaria is related to:

- Short and long-term population mobility for work and economic pursuits- dam construction, mining, logging, forestry, road construction and maintenance
- populations living permanently in or near forest

The risk by age and sex varies in different regions with more adult males in areas of occupational migration to forests or forest fringes. Different strategies are needed for these two main groups.[654]

[5] Most of these are species complexes, and the behaviour of individual sibling species (morphologically identical separate species) shows some differences

Plasmodium vivax risk including biological masks in Myanmar



Biological masks: Biological masks were used to modify malaria risk defined by the medical intelligence layers. If temperature did not exceed the limit for successful sporogony of *P. vivax* in the local dominant *Anopheles* vector species, risk was downgraded to malaria free (Gething *et al.* (2011). in prep). If the area was hyper-arid (as defined by the bare area definition of the GLOBCOVER product (http://ionia1.esrin.esa.int/)) risk was downgraded from stable to unstable or from unstable to malaria free.

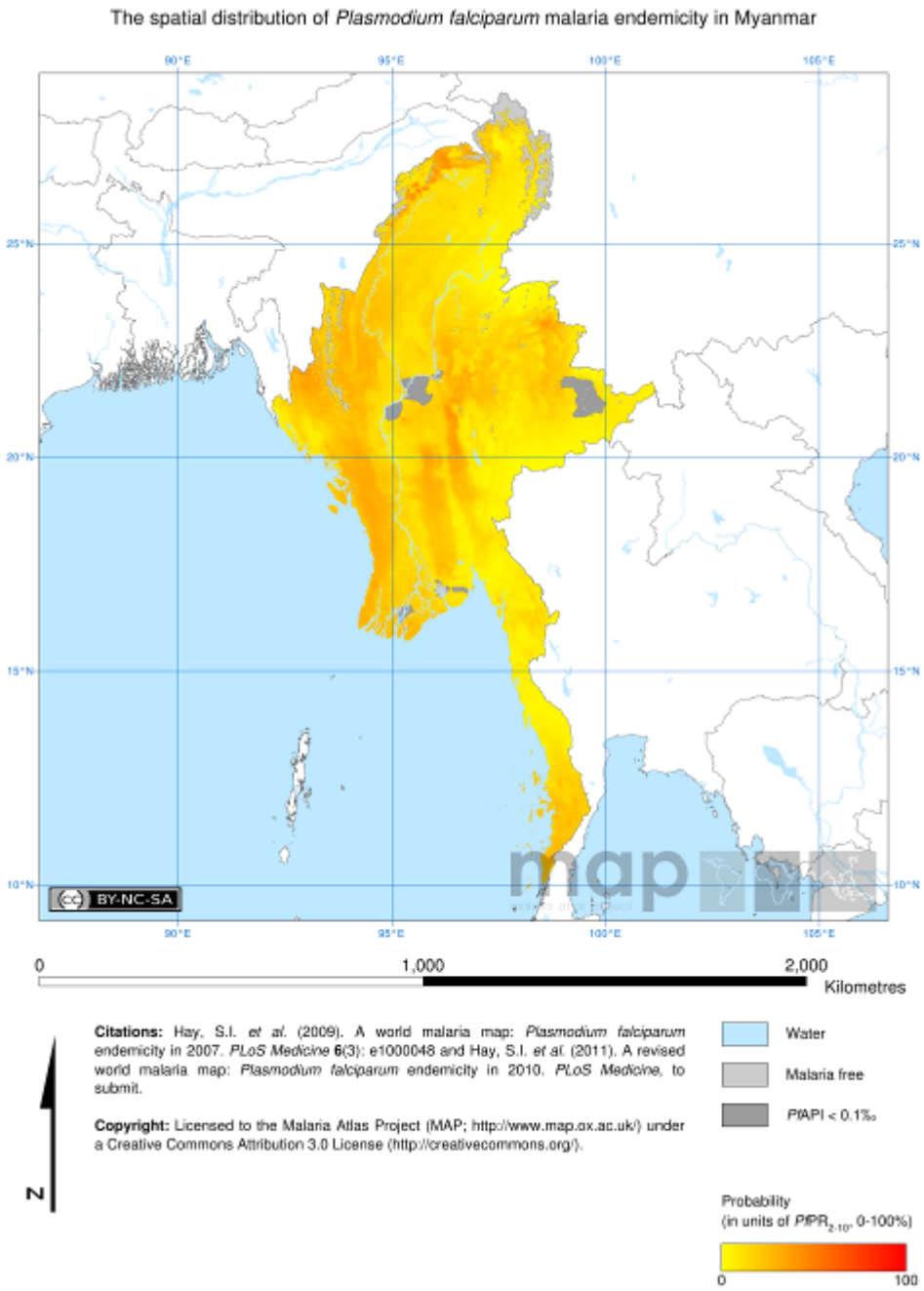
N

Water

Malaria free

*Pv*API < 0.1‰

*Pv*API ≥ 0.1‰



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Burma has a National Strategic Plan for Malaria Control for 2006-2010, which has recently been updated for 2011-2015.[655] The main points of this are:

- Scaling up the coverage and consistent use of long lasting insecticidal nets/insecticide-treated mosquito nets (LLINs/ITNs) and selective application of indoor residual spraying (IRS) and other preventive measures where appropriate
- Improving early access to quality assured diagnosis and effective treatment.
- Empowering communities at risk and strengthening multi-sector partnerships.
- Strengthening program management and technical support.

3.2 Prevention

Evidence of efficacy of ITNs and treated hammock nets in Southeast Asia is limited, but several published studies have shown at least some effect.[656,657,658] An estimated 8 million nets are in use in the country, but only 531,400 are teated with insecticide. As a result, only 5.65% of the population in medium and high-risk areas are protected by ITNs/LLINs.[659] ITN distribution and net treatment therefore currently form the primary aspects of preventive control in Burma, with the Vector Borne Disease Control (VBDC) unit hoping to achieve 100% coverage by 2014.[660] About 694,000 ITNs were distributed in 2008, 113,000 of which were LLINs; double the number distributed in 2007.[661] In addition IRS is used selectively in order to contain outbreaks, especially in development project sites and temporary settlement areas that are endemic.[662] 11,284 people were protected by IRS in 2008.[663] Intermittent Preventive Treatment (IPT) is not used in Asia due to very high levels of resistance to sulfadoxine-pyrimethamine (SP). The WHO only recommends IPT in Africa.[664]

3.3 Case Management

Increasing early diagnosis and treatment (EDAT) is an essential part of Burma's National Strategic Plan for Malaria Control. Malaria cases examined by microscopy increased from 120,029 in 2000 to 411,494 in 2008, associated with a 20% increase in the number of slides examined and an increase in the slide positivity rate, from 31% to 45%.[665] However, large improvements have been limited by lack of financial resources and therefore most reported cases of malaria continue to be unconfirmed.[666] The quantity of RDTs and microscopy supplies is inadequate, and of the 700 malaria microscopy centres only 60% are functional. Even then, the quality of the diagnosis is a concern.[667]

The national protocol for antimalarial drugs is to use artemisinin-based combination therapy (ACT) for *P. falciparum* (artemether-lumefantrine currently recommended) and chloroquine and primaquine for *P. vivax*. However, in 2009 only 25% of patients were treated according to National Treatment Guidelines, which the government hopes to increase to 60% by 2015.[668] Indiscriminate use of anti-malarials is rampant. Coverage with ACTs of an assured quality remains low in both the public and private sector, and monotherapy with artemisinin-based drugs of dubious quality is common. This may contribute to spread of drug resistant malarial parasites.[669]

3.4 Supporting Interventions

In support of the preventive and case management interventions discussed above, the VBDC is attempting to empower Burma's 40,000 community health workers to encourage ITN use and to carry out EDAT in isolated rural areas. However, many health care workers are yet to be trained or require retraining to deal with the changes in malaria control.[670] Behaviour change communication (BCC) is in use, but it is not adapted to fit the language and culture of at-risk ethnic minorities and migratory groups.[671] There are numerous NGOs operating in Burma, but their actions are not coordinated and they often do not share data with the Ministry of Health and VBDC. This makes planning, estimating the extent of the disease burden, monitoring programmes and evaluating the impact of interventions difficult.[672] Monitoring and evaluation at the township level is hindered by the weak managerial and technical capacities of the health system.[673] Burma has a history of carrying out high quality research into malaria, but the interested institutions lack resources.[674]

3.5 Delivery Systems

Malaria control is integrated into the general health services and is part of the National Health Plan. At national level, malaria control is part of the VBDC Programme, which is

responsible for technical guidance, planning and monitoring and evaluation. At the township level malaria control is integrated into the primary care health system (WHO 2005). While health care is technically universal and free, the lack of financial resources and trained staff, the poor state of infrastructure and equipment, the patchiness and inaccessibility of provision, and the regular lack of supplies mean that only 25-40% of people seek treatment in the public sector.[675]

Therefore people turn to the private sector for anti-malarial drugs, which are often of substandard quality and often taken without confirming diagnosis of malaria (the actual drivers of spread of resistance are difficult to confirm). This could lead to increased risk of spread of drug resistant parasites. The Food and Drug Administration (FDA) is weak and understaffed, hindering its ability to check the sale of false and substandard drugs in the private sector.[676]

4. Health System Issues

The biggest problem facing the health system in Burma is a lack of financial resources; government expenditure on healthcare was just $0.4 per capita in 2005-06.[677] The VBDC has 2,392 posts nationwide, but only 1,600 are filled because they cannot afford the training or the pay. Financial constraints hinder much-needed training and capacity building, leading to poor management at the township level; affecting supply, planning, implementation, monitoring and evaluation.[678] The lack of financial resources also limits the expansion of diagnostic and treatment services. The burden of health care therefore predominantly falls upon individuals, who are the source of 73.4% of national health expenditure, which hits the poorest and most vulnerable the hardest.[679] The availability and quality of care differs hugely across Burma, with the worst provision in the peripheral forested areas where malaria is most endemic, and where ongoing internal conflict hinders public health provision.[680] Burma's health information systems are very weak, with data collected at the local level being inconsistently consolidated. In particular data from partners are not incorporated into Burma's information systems.[681]

5. Current Funding and Technical Support

The 3Diseases Fund (3DF) was established by Australia, the Netherlands, European Commission (EC), Norway, Sweden and the United Kingdom in order to fill the gap left by the withdrawal of Global Fund support in 2005. A $100 million grant was provided to tackle HIV, TB and malaria for 2006-2011, and activities included programme planning and implementation and capacity strengthening of township health department and logistics.[682,683]

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM), satisfied by new government assurances, approved a $77,384,020 grant in Round 9 of its funding cycle for 2011-2015. The funded project builds on the progress made and lessons learnt with the 3DF, and follows Burma's National Strategic Plan for Malaria Control in scaling up ITN distribution, improving EDAT, empowering health care workers and building the management capacity of the national health system. The project will cover 14 of the country's 17 states, reaching 40.9 million people.[684]

The Global Alliance for Vaccines and Immunizations (GAVI) is providing a $33 million grant for health systems strengthening in order to improve services in 180 villages. The project aims to develop annual township health plans and budgets, and introduce innovative health financing schemes in order to strengthen township level health systems.[685]

WHO is a major source of technical support including monitoring of drug efficacy.

UNICEF is financing supply chain management officers at state and division level in order to improve the logistics of supply provision.

USAID's Mekong Malaria Project is strengthening the regional capacity of the FDA and revising the quality assurance system for microscopy.

6. Major Gaps

The possibility of artemisinin resistance developing in *P.falciparum* is a potentially catastrophic development that would seriously hinder global malaria control. It is crucial that evidence of artemsinin-resistant strains of malaria is collected, and if confirmed, acted upon to limit its spread. Research is therefore extremely important, but so is tackling likely causes of increasing resistance, such as the prevalence of unregulated treatment provision and poor quality drugs

Limited information on the current epidemiological patterns of malaria hampers planning and prioritisation of malaria control interventions, and access to populations at highest risk to provide adequate prevention, diagnosis and treatment needs to be improved.

Lack of financial resources has led to inadequate supplies and limited capacity, especially at township level, to plan and manage malaria control.

As neighbouring countries progress towards malaria elimination, a less extensive capacity to control malaria in Burma is likely to hinder their efforts, particularly with the levels of migration in the region.

Cambodia

Summary table: malaria an Cambodia

Parasites	*P. falciparum, P. vivax, P. malariae, P. ovale*
Vectors	*A. dirus, A. minimus, A. aconitus, A. maculatus, A. epiroticus*
% of people under ITNs and variation across the country	Overall figure of 10% of the population covered by ITNs is quoted (2008). However, the 2007 survey in malaria risk areas found 25.3% sleeping under an ITN the previous night (79.6% under a mosquito net) measured in peak transmission season, and many more ITNs have been distributed since (2010 survey in progress)
First-line drug for *P. falciparum* (unconfirmed)	AS+MQ
First-line drug for *P. falciparum* (confirmed)	AS+MQ
Second-line drug for *P. falciparum*	QN(7d)+T(7d)
Treatment of *P. vivax*	CQ
Evidence of insecticide &/or drug resistance	Artemisinin-resistant *P. falciparum* has been identified on the Thai-Cambodian border.
IRS use	Not in use, but focused trials are under way.
IPTi use	Not in use in Asia due to high SP resistance.
IPTp use	Not in use in Asia due to high SP resistance.
Evidence of diagnostics being used to direct antimalarial treatment	Microscopy or RDTs are only available at 58% of health facilities, but Village Malaria Workers also use RDTs.
	July 2011

1. Introduction

Cambodia is an extremely important country in the global fight against malaria due to the emergence of artemisinin resistant strains of the parasite on the Thai-Cambodian border. If this resistance were to spread it would be a devastating set back for recent successes in regional and global malaria control efforts. Strengthening the health system and reaching mobile and migrant populations, as well as more static populations in the northeast where transmission is highest, represent major challenges.

2. The Burden of Disease

Of Cambodia's 13.4 million people an estimated 2.65 million are at risk of contracting malaria, and 1.6 million of these live in high transmission areas within 1 km of a forest.[686] Malaria is the seventh most common cause of outpatient attendance (accounting for 0.6% of outpatients in 2008), the sixth most common health problem among inpatients (accounting for 3.53% of inpatients in 2008) and the fifth most common cause of hospital mortality (accounting for 3.53% of all hospital deaths in 2008).[687] Between 2001 and 2008 the number of report cases fell from 121,612 to 80,644, and malaria-related deaths decreased from 476 to 209.[688]

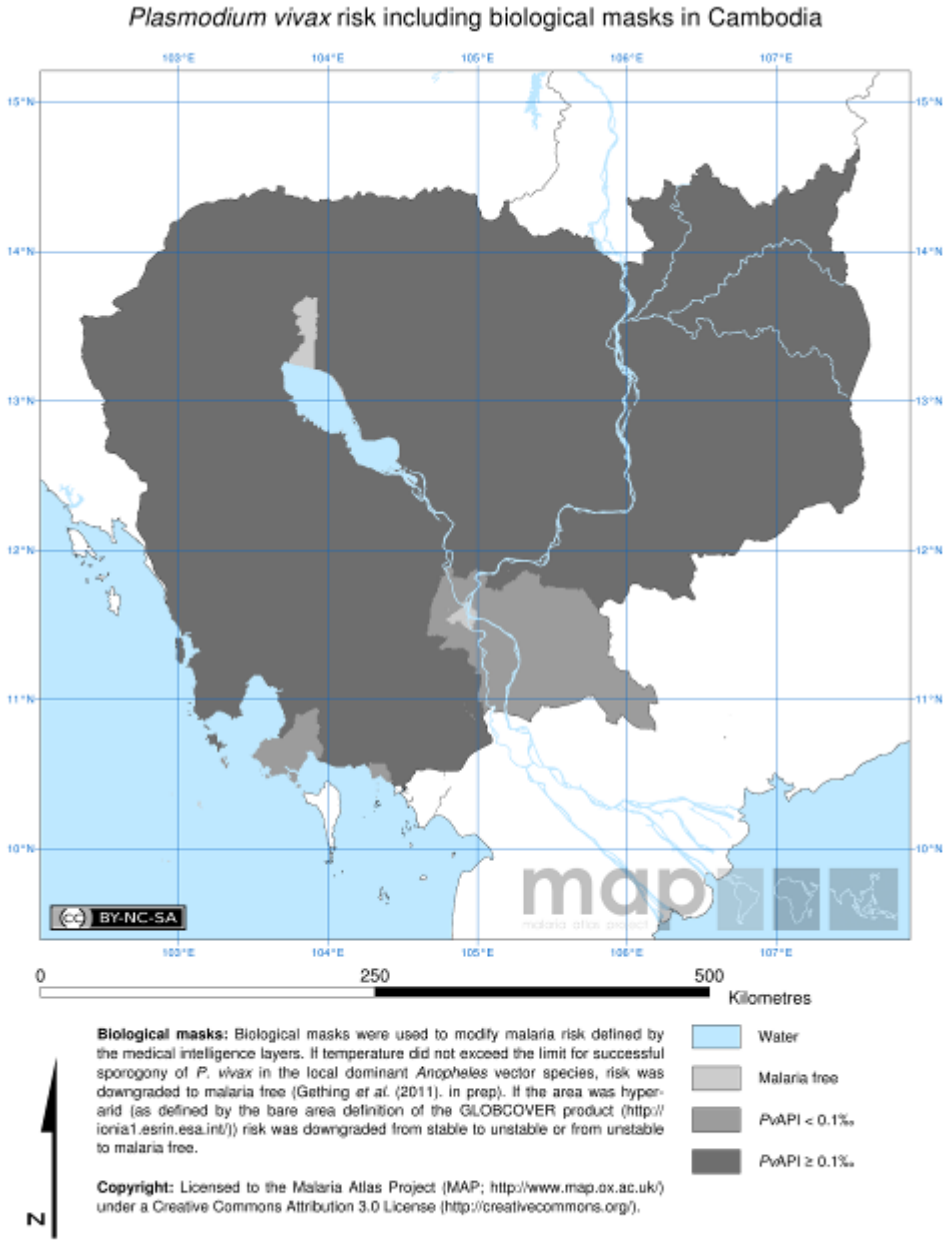
The principal vectors in Cambodia are *Anopheles dirus* and *A. minimus*, but the latter is thought to be of lesser significance*. A. aconitus* and *A. maculatus* are considered as secondary vectors, and *A. epiroticus* (previously known as *A. sundaicus)* is a vector prevalent in coastal areas only. Recent studies by the National Centre for Parasitology, Entomology, and Malaria Control (CNM) and the Institute of Tropical Medicine (ITM) Antwerp reveal that vectors in Cambodia are changing their biting habits, and that secondary vectors are becoming increasingly involved in malaria transmission.[689] In Cambodia, 74% of malaria cases are caused by *Plasmodium falciparum,* 23% are caused by *P. vivax,* and 3% are mixed infections*. P. malariae* and *P. ovale* are rare*,* although Pasteur Institute of Cambodia identified a few examples during a recent cross-sectional survey.[690] Multi-drug resistant strains of *P. falciparum* are common, particularly in the western parts of the country bordering Thailand. Of biggest concern is early evidence of artemisinin-resistant *P. falciparum* detected along the Thai-Cambodian border in 2006-2007.[691]

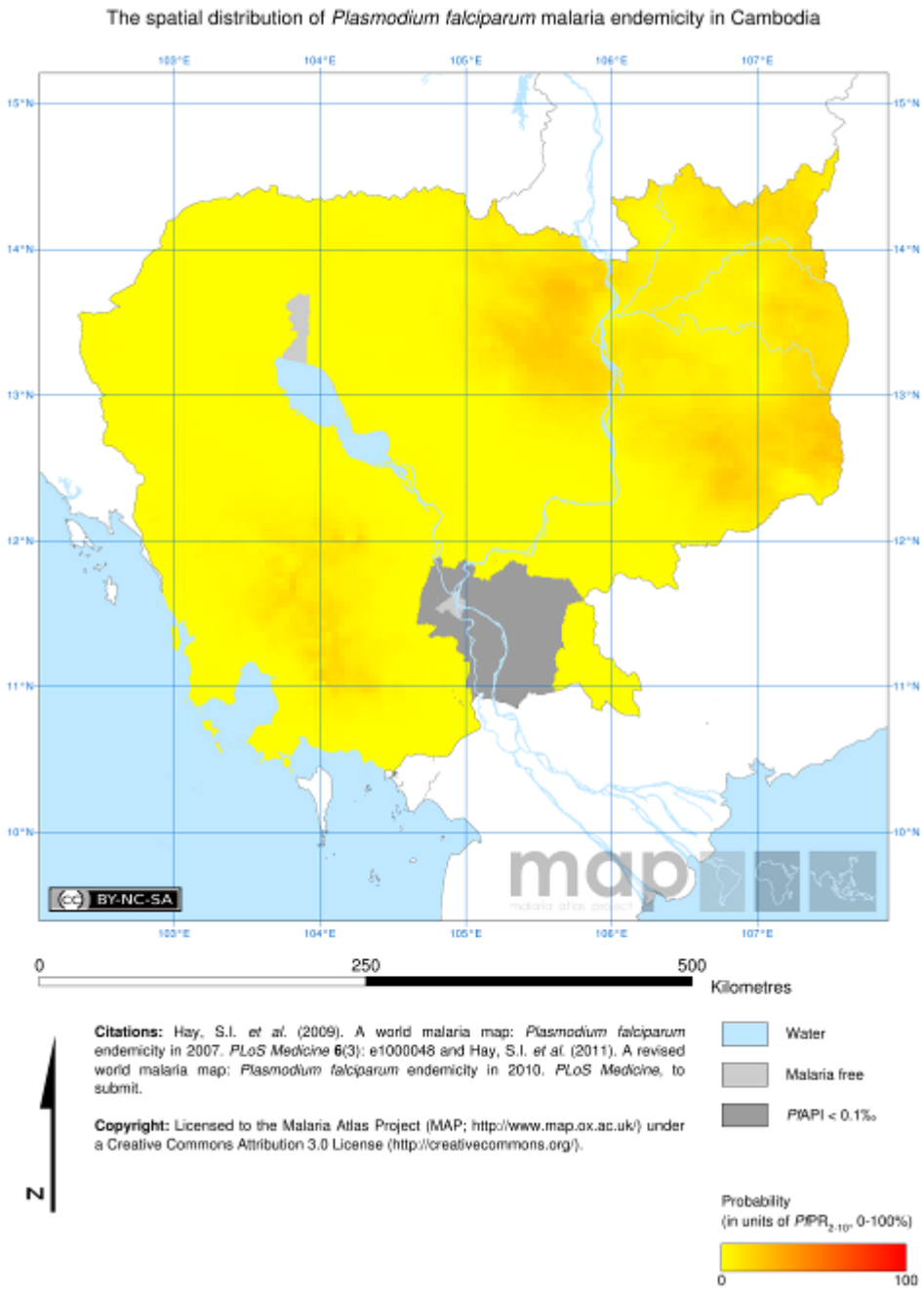
It is reported that 62% of the country is covered in thick forests and jungle, which provides ideal breeding grounds for the most significant vector in Cambodia, *A. dirus*.[692] However, forest cover is rapidly diminishing, but the process of deforestation brings various populations into close proximity with forest fringe. These remote areas also have the lowest access to the public health system. Transmission in Cambodia is high and seasonal, related to the monsoon season, and is geographically located in the forest areas of the north, west and north east, and the rubber plantations of the east and north east. Transmission is low or non-existent in the rice-growing areas of the south and central regions, and low in intensity in coastal areas. The worst affected sectors of society are ethnic minority groups in the northeast, forest fringe inhabitants including security personnel, temporary migrants especially in the northwest, refugees and new forest settlers.[693]

Vector[6]	**Breeding places**	**Biting habits**	**Resting habits**
A. dirus	Small water collections, footprints of animals, wheel-tracks, burrow-pits, usually in thick forest or forest fringe with heavy shade and high humidity	Exophagic (bites outdoors), highly anthropophilic	Exophilic (rests outdoors after feeding)
A.minimus	Edges of flowing waters such as foothill streams, and springs. Prefer shaded areas of sunlit habitats.	Endophagic (bites indoors) as well as exophagic (bites outdoors), and anthropophilic, but frequently show zoophily) found to bite cattle more frequently than *A.dirus*	Mainly exophilic (rests outdoors after feeding)
A. aconitus	Rice fields, swamps, irrigation ditches, pools and streams with vegetation and prefer sunlit habitats.	Exophagic and endophagic, anthropophilic and zoophilic	Exophilic and endophilic
A. maculatus	In or near hilly areas, in seepage waters, edges of ponds, ditches, rice fields, and prefers sunlight.	Exophagic and endophagic, equally zoophilic and anthropophilic	Exophilic and endophilic
A. epiroticus	Salt and brackish waters, lagoons, marshes, pools and	Exophagic as well as endophagic. More	Exophilic and endophilic

[6] Most of these are species complexes, and the behaviour of individual sibling species (morphologically identical separate species) shows some differences

	seepages.	anthropophilic than zoophilic.	





3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Cambodia's National Malaria Control Programme Strategy (2009 – 2015) aims to reduce malaria-related mortality and morbidity by 50% and 30% respectively by 2014, and to make considerable progress moving towards the pre-elimination of *P. falciparum* malaria.[694]

General Objectives

- To improve preventive measures with a focus on complete coverage for long lasting insecticidal net distribution & application of other vector control measures in targeted malaria endemic areas.

- To increase access to and utilization of early diagnosis and treatment (EDAT) for malaria for all the people in the country & halt the development and prevent the spread of antimalarial drug resistance including artemisinin resistance.
- To increase awareness and care-taking practices on malaria prevention and proper health seeking behaviour in malaria endemic areas in Cambodia.
- To strengthen the institutional capacity of the national malaria control programme at central, provincial, operational district and commune levels.

3.2 Prevention

The prevention package involves the distribution of Insecticide-Treated Nets and Long-Lasting Insecticide-treated Nets (ITNs/LLINs) and Long Lasting Insecticide Treated Hammock Nets (LLIHNs) to reduce malaria transmission, and Behaviour Change Communication (BCC) support activities to change behaviour and improve peoples' knowledge about malaria and malaria prevention.[695] By increasing the coverage of preventive measures, it is envisioned that malaria transmission and the pressure on the use of antimalarial drugs will be reduced.[696] ITN distribution is highly integrated into other health interventions such as immunisations, anaemia prophylaxis and even the distribution of food aid. CNM has established a centralised procurement and distribution system, with trained Village Health Volunteers (VHV) coordinating local malaria control, including ITN distribution, BCC, health education and resource mobilisation. ITNs are also distributed through antenatal care and non- governmental organisation (NGO) partners who have greater access to remote areas.[697] Routine re-treatment and replacement of ITNs during the dry season three years after initial distribution will ensure maximum prevention is sustained.[698] The need for net retreatment is expected to decline, as the proportion of LLINs increases, but currently there remain many untreated nets and conventional ITNs.

Reduction in malaria morbidity in recent years has in part been the result of the decentralisation and extension of all key malaria control activities, which has allowed greater provision of malaria services to remote, at-risk areas. However, while the level of coverage of ITNs/LLINs realised in Cambodia has been impressive (with 742,000 ITNs distributed in 2008) reaching the most remote and highest risk areas remains a challenge.[699] Tackling this is of particular importance because of the potential for cross-border migrant workers to contribute to the spread of artemisinin-resistant strains of malaria. These populations within 2 km of forests are being targeted with free LLINs and LLIHNs and BCC to protect these vulnerable populations against malaria.[700]

Indoor Residual Spraying (IRS) is not part of the general national malaria control strategy, as its effectiveness is debated due to the behaviour of both people and vectors. It was not seen as a priority in earlier years, when infrastructure limitations would have made it extremely difficult to carry out. However, the need for maximum protection in order to eliminate resistant parasites has encouraged the malaria programme to investigate its introduction on a limited scale. Focal IRS began in 2010, and provided that early studies demonstrate its feasibility, the use of targeted IRS is likely to be expanded.[701] Intermittent Preventive Treatment (IPT) is generally not used in Asia due to the region's lower malaria transmission intensity and high levels of resistance to sulfadoxine-pyrimethamine rendering it ineffective. WHO generally recommends IPT only in Africa.[702]

3.3 Case Management

The case management strategy in Cambodia is to promote early diagnosis and treatment (EDAT). The Cambodia Malaria Baseline Survey (CMBS) revealed that parasitological diagnosis using microscopy or Rapid Diagnostic Test (RDT) was only available at 58% of the 24 public health facilities surveyed, 54% of the staff received training on clinical diagnosis

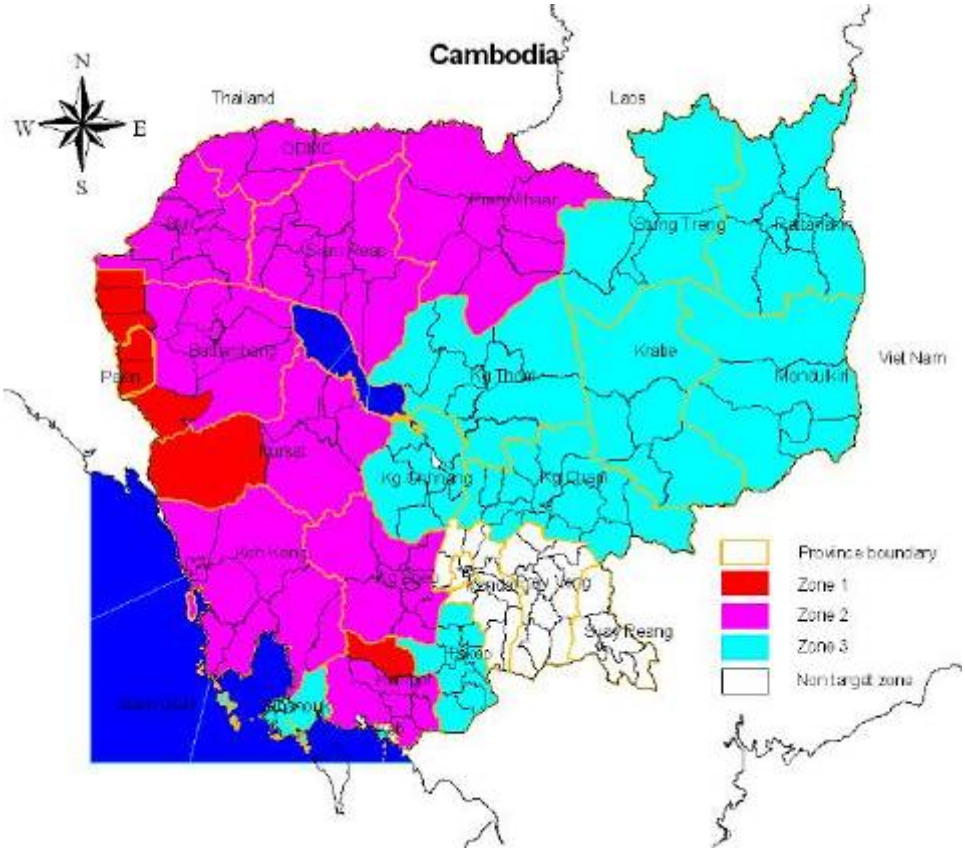
and microscopy while only 29% were trained on clinical microscopy and RDT.[703] Furthermore, the survey revealed that almost 60% of these health facilities faced regular stock-outs of RDTs or antimalarials.

The EDAT package therefore aims to improve diagnosis of malaria through the use of microscopy or RDT, and effective treatment with Artemisinin-based Combination Therapy (ACT), through the provision of free diagnosis and treatment through the public sector and community-based volunteers, and subsidised diagnosis and treatment through the private sector.[704] It is also promoting the use of ACTs through BCC, improved public-private cooperation, and removing artemisinin monotherapies (AMTs) and substandard and counterfeit drugs by the means of a strengthened anti-malarial drug quality assurance system. Recognising the importance of reducing this drug selection pressure to stem the emergence and spread of artemisinin resistance, the Ministry of Health in Cambodia banned the sale of AMTs in 2008, and has taken active measures to enforce the ban.

Improving the coverage and quality of malaria diagnosis and treatment is key to tackling widespread self-diagnosis and unnecessary use of antimalarials, which may contribute to the emergence of antimalarial drug resistance (Figure 1). By promoting the correct use, and increasing the availability of effective ACTs, the quality of malaria treatment will be improved and the undermining effect of AMT and fake drug use reduced.[705]

Cambodia is the recipient of a Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) grant for piloting the Affordable Medicine Facility – Malaria (AMFm), an innovative financing mechanism designed to expand access to effective ACTs. It does this by significantly reducing the cost of ACTs in the public and private sector, thereby making them more affordable.[706]

Figure 1: Artemisinin resistance in Cambodia
Zone 1 represents areas where artemisinin resistance has already been detected and which are priority target areas. Buffering Zone 1, Zone 2 is at risk of spread of resistant strains due to proximity to Zone 1. Zone 3 is being targeted but is considered to be a lower priority.[707]



3.4 Supporting Interventions

BCC is an integral part of Cambodia's NMCP strategy, especially through the preventive package. The preventive package involves focusing on the training and education of Village Health Volunteers (VHVs), Village Health Support Groups (VHSGs), health centre feedback committee members, school teachers, pupils and out of school children, community leaders (such as provincial and district governors), and mass media representatives. BCC is also being targeted at private sector buyers and sellers of antimalarial drugs, in order to educate them about which drugs are acceptable to use. CNM aims to design culturally appropriate BCC materials in order to inform incoming and outgoing migrant populations about the malaria risk, available preventive measures and diagnosis and treatment services. This will be achieved through peer education and targeted BCC campaigns at source communities and through employers and agents at work sites.[708] To address the need for a more gender-sensitive approach, partners such as Women's Media Center (WMC) and the Ministry of Women's Affairs (MOWA) are active partners in the BCC strategy.[709]

The Research and Surveillance package consists of malaria surveillance, monitoring and evaluation, efforts to improve the quality of the health information system (HIS) and targeted operational research. As malaria incidence continues to decline and Cambodia prepares to move toward pre-elimination malaria status, surveillance and research will become an increasingly important part of its strategy. Monitoring and evaluation (M&E) have been strengthened through increased supervision of Village Malaria Workers (VMWs), monthly VMW meetings, implementation of nationwide household, outlet and health facility surveys (2004 and 2007) and the development of a National Monitoring and Evaluation Plan (2009 – 2014). CNM is working on improving the HIS to include relevant data from communities as well as the private sector, particularly regarding the sale of RDTs and antimalarials. There is an urgent need to integrate data collected from the private sector into the routine HIS in order to help the national programme monitor malaria case management, to establish provider knowledge and practices, and to improve patient adherence to new treatment policies. There are also planned and ongoing efforts to improve data management and the quality of epidemiological data generated at different levels in order to better target populations at risk, generate evidence-driven malaria strategic plans, and measure progress against targets over time more accurately.[710]

Finally, a Management package is being implemented which includes improved planning, resource management and overall coordination of the programme to support decentralisation and integration within the health sector.

3.5 Delivery Systems

Efforts are being made to improve the quality of, and confidence of the population in, public provision of malaria diagnosis and treatment. It is estimated that more than 70% of individuals seek treatment from the private sectors.[711] Furthermore, population surveys in remote malaria endemic areas have shown that fake anti-malarials were present in 70-80% of private drug outlets in 1999.[712] Currently, synergy between the public and private sectors is poor. By both improving the quality of public sector diagnosis and treatment and encouraging people to seek treatment within the national health system, while at the same time improving the regulation of the drugs available through the private sector, more rational, accurate and effective treatment of malaria can be realised. CNM is also pursuing a Public-Private Mix (PPM) strategy, with the aim of facilitating greater cooperation and coordination with the private sector. A system of accredited private providers is being established, the capacity of regulatory enforcers to monitor drug quality improved, and private provision made use of in order to increase diagnosis and treatment coverage.[713]

4. Health System Issues

The public health system has improved in recent years, but overall utilisation of its services remains low. This is due to low public perceptions and the passive nature of the system which is not designed to reach out to remote populations. Motivation is low due to low wages and the slow pace of decentralisation. Diagnosis by microscopy or RDT has improved but remains low, especially in remote areas of high risk. Health service centres have often reported stock outs of diagnosis and treatment supplies. Both cooperation with and regulation of the private sector is poor, although measures are being taken to improve this situation.[714] There are major gaps in HIS, as although there is a functioning routine HIS stemming from the lowest health facility level up to the national level, with standardization of reporting forms and integration of public facility data systems, a number of gaps in data availability (particularly from the private sector) and quality still remain that affect all disease groups. Furthermore, data collection is fragmented, lead to gaps in information on key affected populations.

5. Current Funding and Technical Support

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) approved a $102,033,561 grant in Round 9 of its funding cycle for 2011-2015. The goal is to 'contain artemisinin-resistant *Plasmodium falciparum* parasites by removing selection pressure and to move towards pre-elimination status. The medium-term strategy supported by this grant is to ensure that by 2015 no artemisinin resistant malaria parasites are detected in Cambodia and that the country moves toward reaching pre-elimination status for all species of malaria'.[715]

The Containment Project, funded by the Bill & Melinda Gates Foundation, offered $9.5 million to Cambodia for January 2009 – December 2010.[716] A no-cost extension through Oct 2011 has recently been approved for this project. This was only half of the required $21 million however, and was frontloaded in year one. Additional funding was therefore urgently required in order to sustain and extend the project's impact, which was the rationale for the successful GFATM round 9 application.[717]

Rolling Continuation Channel (RCC) grant of $41 million began in May 2009 to 'further scale-up proven malaria control interventions towards pre-elimination of malaria in Cambodia.' It aims to strengthen and scale up the most successful activities from Round 2 and to consolidate the other two ongoing GFATM grants (Round 4 and Round 6) into a single funding stream by the end of 2012. The RCC, AMFm, and GFATM Round 9 grants were consolidated into a single funding stream.

DFID granted $276,660 in 2008 for a **Health Sector Support Project** to fund operational research projects, capacity building activities and to support technical assistance.[718]

USAID funds the CNM through the WHO with an average annual allocation of $500,000, which mainly supports therapeutic efficacy studies in sentinel sites to update national antimalarial policy and to provide technical assistants.[719]

6. Major Gaps

Key gaps where further strategy development and resources are needed include:

- Working effectively with the private sector
- Reaching at-risk remote populations and mobile migrant workers
- Strengthening surveillance systems
- Addressing uneven coverage of diagnosis and treatment

India

Summary table: malaria in India

Parasites	*P. falciparum, P. vivax*
Vectors	*A. culicifacies, A. stephensi, A. dirus, A. fluviatilis, A. minimus and A. epiroticus, A. annularis, A. varuna, A. jeyporiensis and A. philippinensis*
% of people under ITNs and variation across the country	By 2008 36% of the population were covered by a mosquito net (not necessarily an ITN).
First-line drug for *P. falciparum* (unconfirmed)	CQ+PQ
First-line drug for *P. falciparum* (confirmed)	AS+SP
Treatment of *P. vivax*	CQ+PQ(14d)
Evidence of insecticide &/or drug resistance	Resistance to DDT and malathion is common in *A. culicifacies* and *A. stephensi* in peninsular India. CQ resistance in malaria parasites is on the rise.
IRS use	IRS is the main preventive measure in India, protecting 54 million people.
IPTi use	Not in use.
IPTp use	Not in use.
Evidence of diagnostics being used to direct antimalarial treatment	RDTs have been introduced but are currently insufficient in number. Most cases of malaria are clinically diagnosed.
	July 2011

1. Introduction

With the rapid economic development India is experiencing, a more intensive response to the poor health of the nation has recently become a priority. The healthcare system is being reformed and expanded and greater financial resources are being directed towards vector control. The halving of the number of malaria cases in India in 13 years is a testament to a limited degree of success. However, preventive and case management interventions must be further scaled up, with a particular focus on net distribution, accurate diagnosis, and prompt, effective treatment.

2. The Burden of Disease

India accounts for approximately two thirds of the confirmed cases reported in the South-East Asia Region. In 2008, 96 million slides were examined, from which 1.5 million cases were confirmed. The number of cases has fallen from more than 2 million confirmed in 2000 to 1.5 million cases in 2008, representing a minor increase on 2007.[720] *Plasmodium falciparum* has increased as a percentage of total cases from 39% in 1995 to nearly 50% in 2008, partly due to migration from endemic to non-endemic areas, but also due to rising resistance to chloroquine (CQ).[721] The other 50% of malaria is caused by *P. vivax*.[722]

Table 1. Countrywide malaria surveillance data (1995 – 2008)

Year	Population (in thousands)	Total Malaria Cases (in millions)	*P.falciparum* cases (in millions)	*Pf %*	Annual Parasite Incidence API	Slide Positivity Rate SPR	Deaths due to malaria
1995	888,143	2.93	1.14	38.84	3.29	3.51	1,151
1996	872,906	3.04	1.18	38.86	3.48	3.32	1,010
1997	884,719	2.66	1.01	37.87	3.01	2.97	879
1998	910,884	2.22	1.03	46.35	2.44	2.49	664
1999	948,656	2.28	1.14	49.96	2.41	2.59	1,048
2000	982,413	2.03	1.04	51.05	2.07	2.34	932
2001	984,579	2.09	1.01	48.20	2.12	2.31	1,005
2002	1,025,563	1.84	0.90	48.72	1.80	2.01	973
2003	1,027,157	1.87	0.86	45.85	1.82	1.89	1,006
2004	1,040,939	1.92	0.89	46.47	1.84	1.97	949
2005	1,082,882	1.82	0.81	44.32	1.68	1.88	963
2006	1,084,067	1.79	0.84	47.08	1.65	1.67	1,707
2007	1,087,571	1.51	0.74	49.11	1.39	1.56	1,310
2008	1,089,795	1.52	0.76	49.56	1.40	1.60	924

With regards to the geographical variation of malaria, five states account for 60% of cases: Orissa, Chhattisgarh, Madhya Pradesh, Jharkhand and West Bengal. Orissa alone accounts for 20% of India's malaria burden. Other highly endemic states include Arunachal Pradesh, Assam, Meghalaya and Tripura.[723] These are predominantly under-developed areas with difficult terrain, poor communication facilities and inadequate health infrastructure. They are hilly, forest-fringed and forested areas with a large number of breeding sites and efficient malaria vectors. Border regions with Burma, Bangladesh, Bhutan and Nepal in the East have particularly high transmission. Across India malaria transmission is unstable but perennial, with seasonal increases in the monsoon and post-monsoon seasons.[724,725] Malaria outbreaks occur frequently in various parts of the country. The reasons for such outbreaks have been identified as improper surveillance and inadequate residual spray activities in rural areas, and inadequate anti-larval measures in urban areas. Due to the low and unstable transmission dynamics, most of the population has no or little immunity toward malaria.[726]

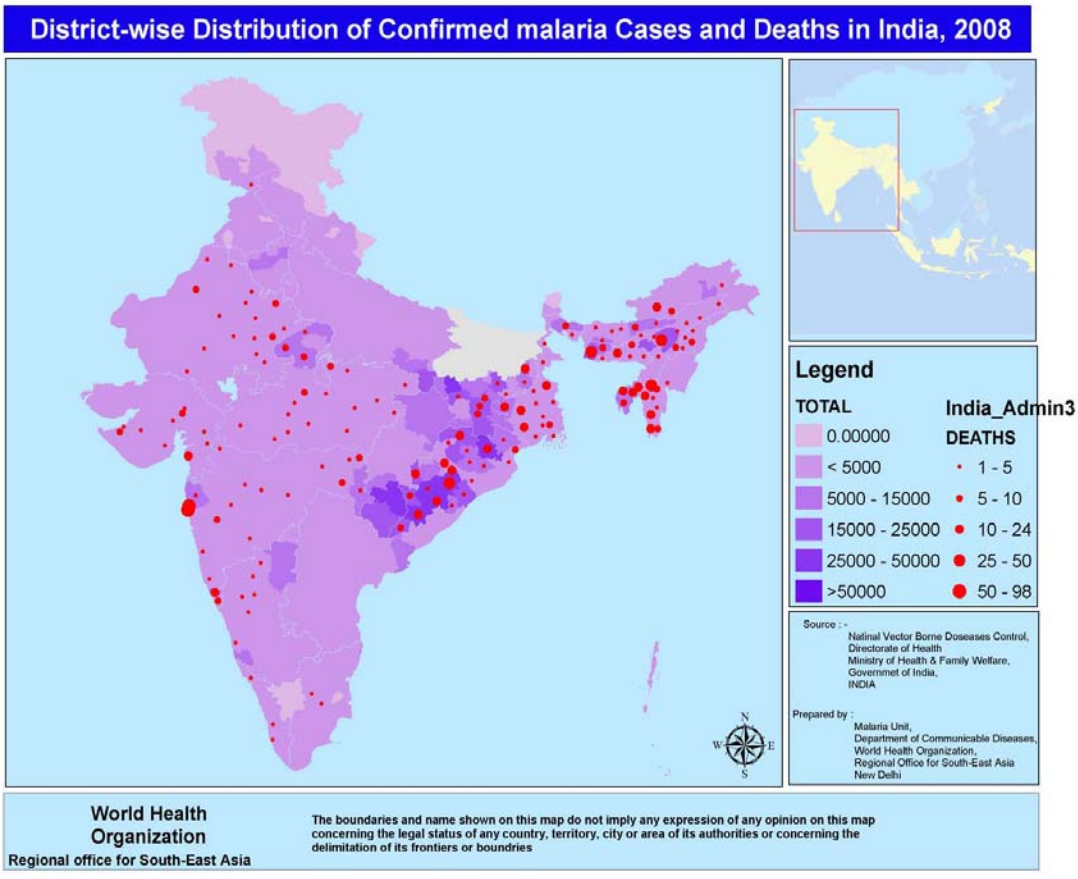
The transmission of malaria is governed by local factors leading to vector abundance under favourable conditions. There are six primary vectors of malaria in India: *Anopheles culicifacies, A. stephensi, A. dirus, A. fluviatilis, A. minimus* and *A. sundaicus*. The secondary vectors are *A. annularis*, *A. varuna*, *A. jeyporiensis* and *A. philippinensis*.[727]

- *A. culicifacies* is the main vector of rural and peri-urban areas and is widespread in peninsular India. It is found in a variety of natural and man-made breeding sites. It is highly zoophilic (prefers feeding on animals other than humans) and therefore a high density of cattle limits its vectorial capacity. *A. culicifacies* is a complex of 5 sibling species designated as A, B, C, D and E. Species A has a relatively higher degree of anthropophagy as compared with species B. Species A is an established vector of *P. vivax* and *P. falciparum*, whereas species B is completely refractory to *P. vivax* and partially refractory to *P. falciparum*. It has been demonstrated that species B, however, may play a role as a vector of *P. falciparum* in areas where the cattle population is very low or absent.
- *A. stephensi* is responsible for malaria in urban and industrial areas. *A. stephensi* is a complex of 3 variants, i.e. type form, intermediate form and *mysorensis* form. The type

form is found in urban areas; intermediate form in urban and semi-urban localities and *mysorensis* form is present in rural areas. Both type form and intermediate form act as vectors whereas the *mysorensis* form is not a vector. Malaria has become an important problem in some of the cities in peninsular India. It has also become a potential problem in rural areas which are undergoing a change to urbanized lifestyle with use of coolers.

- *A. fluviatilis* is the main vector in hilly areas, forests and forest fringes in many states, especially in the east. *A. fluviatilis* is a complex of 4 sibling species designated as S, T, U and V, of which species S is highly anthropophagic and an efficient vector of malaria.
- *A. minimus* is the vector in the foothills of North-Eastern states.
- *A. dirus* is an important forest vector in the North-East, well known for its exophilic behaviour.
- *A. sundaicus sp. D*, a brackish-water breeder, is now in India restricted to the Andaman and Nicobar Islands.[728]

Resistance to DDT and malathion is common in *A. culicifacies* and *A. stephensi* in peninsular India. Insecticide resistance in other vectors is thought to be patchier, and information on this aspect is planned to be collected by a large number of studies in various parts of the country from 2009 to 2014.[729]



3. Malaria Control Programme

3.1 Policies, Strategies and Plans

Malaria control in India is coordinated by the Directorate of National Vector Borne Diseases Control Programme (NVBDCP), which falls under the Ministry of Health and Family Welfare. There is a Strategic Action Plan for Malaria Control (SAPMC) 2007 – 2012 that guides

malaria control, the goal of which is to reduce malaria-related mortality by 50% by 2010 and 75% by 2015. The objectives of the SAPMC are to achieve:

- at least 50% reduction in mortality due to malaria by the year 2010
- at least 80% of those suffering from malaria get correct, affordable and appropriate treatment within 24 hours of reporting to the health system by the year 2012
- at least 80% of those at high risk of malaria get protected by effective preventive measures by 2012.

The strategies being used to achieve the above are:

i. Surveillance and case management
- Case detection (passive and active)
- Early Diagnosis and Complete Treatment
- Sentinel surveillance

ii. Integrated Vector Management (IVM)
- Indoor Residual Spray (IRS)
- Insecticide Treated Nets (ITNs) / Long Lasting Insecticidal Nets (LLINs)
- Anti-larval measures including source reduction

iii. Epidemic preparedness and early response

iv. Supportive Interventions
- Capacity building
- Behaviour Change Communication (BCC)
- Inter-sectoral collaboration
- Monitoring and Evaluation (M&E)
- Operational research and applied field research.[730]

3.2 Prevention

The main form of preventive malaria control in India is Indoor Residual Spraying (IRS), which has a long history of use in the country and currently protects roughly 54 million people at risk.[731] However, while IRS coverage in target areas is reported to be 69-99%, a recent report has found that in reality it is often in the region of 17-43%.[732] The WHO claims that 85% coverage is required for IRS to be effective, and therefore this low level of coverage is hampering malaria control efforts. The reasons for low coverage included negligent spraying teams, the refusal of villagers (based on mistrust of DDT) and inaccessible properties. The motivation, technical understanding and training of those doing the spraying is low, and the attitudes of villagers uninformed and hostile.[733] Information, Education and Communcation (IEC) and Behaviour Change Communication (BCC) are needed in support of IRS.

Insecticide Treated Nets (ITNs), including Long Lasting Insecticidal Nets (LLINs), are also used in India, but play a smaller role than in many malaria endemic countries. A demographic and household survey carried out in 2005–2006 found that 36% of households owned a mosquito net, and 7.2 million ITNs were distributed in 2008.[734] The WHO estimates that over 39 million people are protected by ITNs in India, but there remains extensive scope for scaling up net distribution and use, as the NVBDCP has calculated that over 38 million more ITNs are required to achieve universal coverage of the at-risk population.[735,736]

Intermittent Preventive Treatment for pregnant women (IPTp) is not currently used in India, but the NVBDCP plans to carry out a controlled trial in order to assess the utility of IPTp in India.[737]

3.3 Case Management

India has been slow to react to rising *P. falciparum* resistance to CQ, which has had a direct impact on the increasing prevalence of *P. falciparum* across the country. Recently, however, CQ has been abandoned as the first-line antimalarial and parasitological diagnosis and Artemisinin-based Combination Therapy (ACT) adopted. 600,000 courses of ACT were delivered in 2008 and artemisinin mono-therapies were recently banned.[738] This is being combined with accurate diagnosis by microscopy and Rapid Diagnostic Kits (RDKs) in remote areas in order to treat only confirmed cases and reduce the wasting of expensive drugs and the increase in resistance this could cause.[739] However, a recent study has shown that RDTs are being used indiscriminately by untrained people, therefore drastically reducing the cost effectiveness of the government's attempt to increase diagnostic coverage. There is also insufficient coverage of RDTs, especially in remote rural areas where they are most needed.[740]

3.4 Supporting Interventions

IEC and BCC support interventions are not being implemented sufficiently. Preventive measures and effective case management cannot be realised unless public understanding of malaria and acceptance of malaria control interventions is improved.[741] Surveillance of malaria transmission is often badly executed, with 71% of villagers surveyed reporting unsatisfactory performance by saying that the surveillance worker generally prepared blood smears sitting at one place in the village instead of house-to-house visit, and even during the peak transmission season their visits remained highly irregular.[742]

The Health Management Information System (HMIS) is well established in India, but is not without problems. The manual process includes long and complex forms, and the electronic transmission of reports via the web-based HMIS is not widely or consistently used. Therefore, the programme has to rely heavily on data generated through the manual system. This severely delays the transmission and receipt of reports, hindering the planning and implementation of malaria control interventions. Furthermore, only data from public health facilities are collected. Considering the extent of treatment provided through the private sector, this leads to incomplete data that may under-estimate the true malaria burden.[743]

3.5 Delivery Systems

It is estimated that 75% of patients with malaria-like symptoms seek some kind of private healthcare. To a very small extent, the public sector is now starting to supply diagnostics and antimalarials through private providers, predominantly at the district level. Except for a few companies (mining especially), the private sector is not very involved in malaria control; its only contribution is medical care, usually paid by the patient out of pocket (Personal Communication). This is very widespread, and likely to account for the majority of treatments.

4. Health System Issues

The Indian government has been making a concerted effort to improve the public health system over recent years, characterised by the National Rural Health Mission (NRHM), which was launched in 2005 with the aim of improving the health of the rural population. Actions under the NRHM include improving hospital care, the decentralization of programme management to district level and the establishment of Accredited Social Health Activists (ASHAs). The ASHAs provide a vital extension of primary healthcare to the most vulnerable communities, specialising in maternal and child health and disease control. The NRHM has

already had tangible results; the number of government hospitals had increased from 4,751 in 2000 to 7,663 in 2006, and ASHAs have been scaled up in malaria endemic and tribal areas. There are now a total of 481,308 ASHAs.[744]

However, the public health system still has problems. The health infrastructure remains under-equipped, under-staffed and under-financed to cope with the challenge of providing universal access to healthcare and carrying out malaria control interventions. There are inadequate human resources at the district and provincial levels, and procurement problems are hindering effective malaria control.[745] The ASHA and Fever Treatment Depots (FTDs), which are at the centre of the NVBDCP's extension of diagnosis and treatment services, were found to be ineffective in a recent study. Not one of the 22 ASHA's surveyed were active in malaria control, and only one of the 14 FTDs surveyed was functioning.[746]

5. Current Funding and Technical Support

Funding for malaria programmes in India increased from $54 million in 2001 to $110 million in 2008, of which $74 million (65%) came from the government.[747]

Through Round 4 the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) has granted $63,544,954 to India for malaria control for the period 2005 – 2010.[748] This funding has supported the Intensified Malaria Control Project, implemented in the 7 North-Eastern states along with parts of Orissa, Jharkhand and West Bengal, covering a population of about 100 million.[749] $13,863,557 was provided in 2008.[750]

The World Bank is another major source of financial support, providing $28,619,974 in 2008 alone and $140 million since 2001.[751] Support for 2008 – 2013 is largely coming from the World Bank's National Vector Borne Disease Control and Polio Eradication Support Project for India, which is envisaging coverage of a population of 185 million, in 93 districts of 8 states (Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Orissa and Karnataka).[752]

Partnerships have been established as follows:

WHO has provided regular technical assistance for malaria control since the 1950s. Currently, the country office has one national professional officer and four consultants assisting the programme, funded by GFATM grant.

Collaboration with neighbouring countries is undertaken through arrangements made by WHO South-East Asian Regional Office (SEARO).

Continuing partnership exists with the National Institute of Malaria Research (NIMR) for conducting research on various aspects of malaria control including drug and insecticide resistance and also operational research studies.

There is collaboration with a few NGOs in some endemic districts, as local partners for malaria control activities. A mechanism for “public-private-partnership” allows state and district level malaria control programmes to establish local partnerships with NGOs, particularly for BCC.

UNICEF and Janani Suraksha Yojana (JSY) contribute to malaria control by providing ITNs or LLINs to pregnant women in certain districts.[753]

6. Major Gaps

Gaps in the current malaria control programme are:[754]

- RDT coverage needs to be expanded to all endemic villages.
- Delays in conducting microscopic examination of smears collected at community level must be rectified.
- ACTs need to be used for all *P. falciparum* cases in the country.
- The effectiveness of IRS needs to be improved.
- There needs to be a total shift from retreatment of plain nets to the distribution of LLINs.
- Distributing ITNs to remote areas with limited access is difficult.
- Human resources at all levels of the health system, from national to block level, are inadequate.
- Procurement and supply constraints.

Pakistan

Summary table: malaria in Pakistan

Parasites	*P. falciparum, P. vivax*
Vectors	*A. culicifacies, A. stephensi, A. fluviatilis, A. annularis*
% of people under ITNs and variation across the country	Nationally only 4.3% of households have an ITN and 10.7% have a non-treated mosquito net. This varies by province, with Sindh having no ITNs in any household and Balochistan having 20% household coverage (2009).
First-line drug for *P. falciparum* (unconfirmed)	AS+SP
First-line drug for *P. falciparum* (confirmed)	AS+SP
Second-line drug for *P. falciparum*	QN
Treatment of *P. vivax*	CQ+PQ(5d)
Evidence of insecticide &/or drug resistance	Resistance to CQ and AQ has been identified (83% failure rate), leading to a change in first-line treatment to AS+SP as policy.
IRS use	Used selectively, covering 600,000 households and protecting 4.9 million people in 2008.
IPTi use	Not in use.
IPTp use	Not in use.
Evidence of diagnostics being used to direct antimalarial treatment	Approximately 30% of malaria cases are diagnosed by microscopy or RDT prior to treatment.
	July 2011

1. Introduction

Malaria was almost eliminated in Pakistan in the 1960s, but financial and administrative constraints led to an explosive resurgence of the disease, reaching epidemic proportions in the 1970s. Current efforts are focused on reducing mortality rates in the 30 highly endemic districts, and moving towards an elimination strategy in Punjab province.[755] The recent floods in Pakistan have had a drastic impact on malaria transmission; 20 million people in 62 districts are now at risk from a malaria epidemic, and the WHO expect 2 million cases over the next six months. This is likely to put further pressure on the already over-stretched malaria control resources unless the international community increase their financial support (Personal Communication).

2. The Burden of Disease

95 million of Pakistan's 161 million people are at risk from malaria, which resulted in a suspected 4.5 million cases of the disease in 2008 Only 59,284 of these cases were confirmed however, and due to the lack of effective monitoring and evaluation systems, it is unknown how many deaths are linked to malaria.[756] Some estimates claim the true disease burden could be magnitudes larger, with between 500,000 and 1.6 million cases a year.[757] The disease is estimated to account for 6% of all outpatient attendances and 18% of admissions.[758]

Malaria transmission follows an unstable pattern in Pakistan, with unpredictable epidemics every 6 to 10 years, but with seasonal annual peaks that differ depending on the parasite. Balochistan, NWFP and Sindh province are particularly susceptible to large outbreaks. *Plasmodium falciparum* and *P. vivax* are the only widely distributed species of parasite in Pakistan, with the former accounting for roughly 20% of cases. *P. vivax* peaks in the Summer (June – September) and *P. falciparum* peaks in late Summer and Winter (August-December). Furthermore, because *P. vivax* forms a latent liver stage (the hypnozoite), there is a peak of relapse episodes seen in the early summer (April-June) due to transmission in the previous year.[759] The predominant vectors are *Anopheles culicifacies* and *A. stephensi,* but recently two new species, *A. fluviatilis* and *A. annularis,* have been reported in Balochistan.[760] [761] Out of 136 administrative districts, 30 share the highest malaria burden. The majority of these highly endemic districts are situated along the border with Afghanistan and Iran, as seen in the map below. Seasonal transmission variations, drought, extensive agricultural practices, vast irrigation systems, hydrological changes and the high number of displaced people all contribute to the high endemicity of these districts. Poor access of the population to early diagnosis, effective treatment and effective prevention measures have further aggravated the situation.[762]

Recent *P.falciparum* drug efficacy surveys indicated high failure rates (83%) in Chloroquine (CQ) and Amodiaquine (AQ) treated patients after 28 days of follow up. This may have been exacerbated by the over- and unnecessary use of malaria drugs. Based on these results the national treatment policy in Pakistan has been revised, with artemisinin combination therapy (ACT) (AS+SP) being adopted for first line treatment of *P. falciparum*.[763]

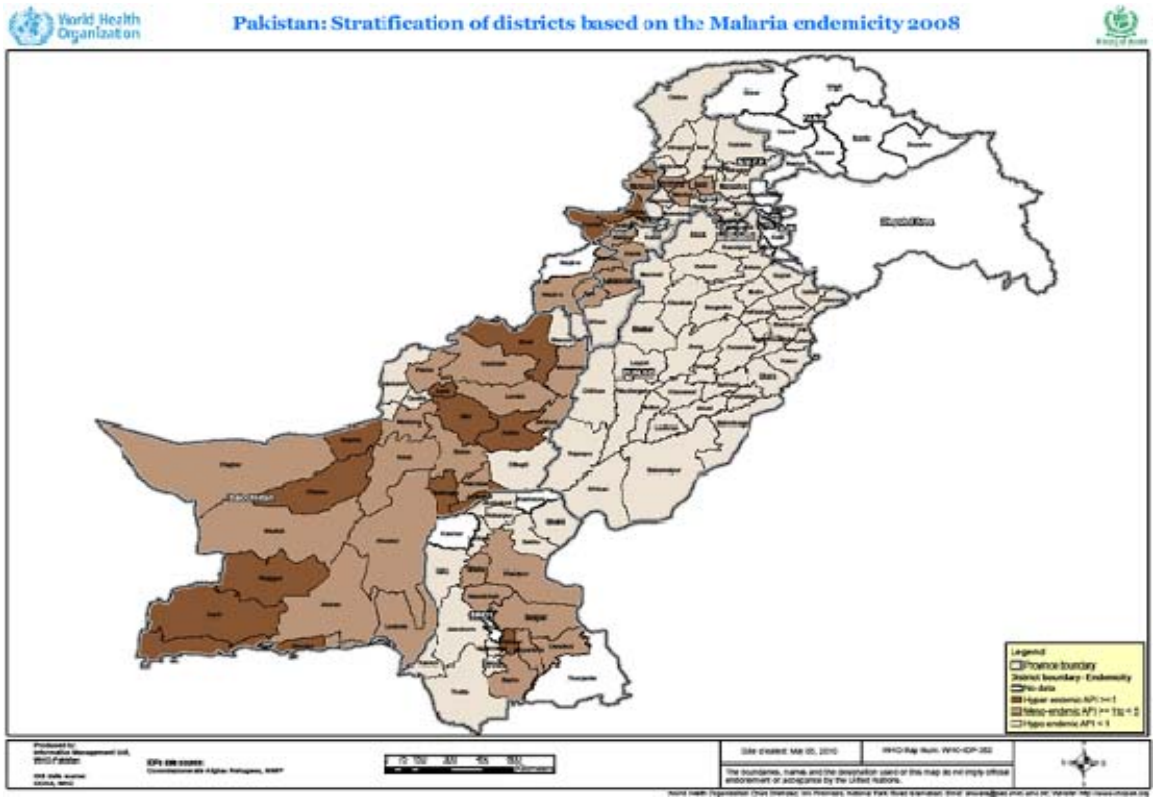


Figure 1: Pakistan malaria endemicity, by district in 2008.[764]

3. Malaria Control Programme

3.1 Policies, Strategies and Plans

The goal of the National Malaria Control Programme (NMCP) is to improve the health status of the population by effectively controlling malaria through implementation of the Roll Back Malaria (RBM) strategies. The five year National Strategic Plan (NSP) 2010 – 2015 aims to meet the RBM targets of reducing the malaria burden in Pakistan by 75% by 2015.

The objectives of the NMCP are:

- Proportion of malaria cases that are diagnosed and provided correct treatment within 24 hours of the onset of symptoms (at facility or community) will be raised to 60%.
- Malaria morbidity will be reduced by 75% during the planned period.
- *P. falciparum* will be kept to less than 15% of all malaria infections in the country.
- Achieve universal household coverage of insecticide treated nets (ITNs) through free distribution in high risk districts in the country.
- All districts will have the capacity to detect, report and respond appropriately to malaria epidemics.
- The management and technical capacity of federal, provincial and district level programmes to plan, implement and monitor malaria control initiatives will be improved.[765]

3.2 Prevention

The preventive measures in Pakistan's NMSP are predominantly Long-Lasting Insecticidal Net (LLIN) distribution and Indoor Residual Spraying (IRS). Pregnant women and children under the age of five are being targeted in particular, as they represent the most at-risk groups. Between 2006 and 2008 300,000 LLINs were distributed in Pakistan, which is far fewer than the number required to protect the at-risk population and short of the NMCP target by 70%.[766] [767] The Malariometric Survey 2009 showed that only 4.3% of households surveyed had an ITN and 10.7% had a non-treated mosquito net.[768] This varied by province, with Sindh having no ITNs in any household and Balochistan having 20% household coverage. However, 85% of households that did possess an ITN were using it regularly. This suggests that once distribution has occurred, usage rates will be sufficiently high, and therefore justifies making this intervention a cornerstone of malaria control in Pakistan.[769]

Aside from ITN distribution, IRS has been deployed as part of an Integrated Vector Management (IVM) strategy. IRS is currently being used selectively, covering about 600,000 households and protecting 4.9 million people in 2008.[770] Again, this is below the stated NSP target. Intermittent Preventive Treatment (IPT) for the protection of pregnant women has not been adopted in Pakistan for two reasons: firstly, because the incidence of disease is not sufficient to merit it, and secondly, because *P. vivax* is the predominant form of the disease, and SP is not effective against *P. vivax*.[771] Preventive measures need to be drastically scaled up if the malaria burden in Pakistan is to be reduced.

3.3 Case Management

The NMCP is striving to improve the coverage and accuracy of malaria diagnosis and treatment. They aim to examine all cases of malaria by microscopy or Rapid Diagnostic Test (RDT) in order to reduce the erroneous use of antimalarials which can promote increased

drug resistance. RDTs are being introduced as a main supportive diagnostic tool, particularly for areas where microscopy is not available or inaccessible. This includes are large proportion of the country, as public diagnostic facilities are able to examine no more than 30% of reported cases. However, the number of reported malaria cases being examined by either microscopy or RDT has remained stable since 2005 at around 2 million.[772] The Malariometric Survey 2009 showed that 20.5% of clinics surveyed had malaria microscopy (which varied by province) and only 8.2% had an RDT available.[773] Because of the lack of diagnostic services in many areas, presumptive treatment of fever which presents with malaria like symptoms is given routinely. A substantial proportion of fever is not caused by malaria, so this results in over treatment of malaria and under treatment of non-malarial causes of fever. Targeting of treatment therefore depends on accurate diagnosis at all levels of the health system. Furthermore, these results suggest that access to early diagnosis and prompt treatment has not been increased in line with the NMCP goal of expanding primary healthcare to 80% of the population in the 19 most endemic districts.[774]

ACTs have been adopted for first line treatment of *P. falciparum* malaria, and the NMCP can confirm that 6.8 million doses of some form of antimalarial medicine was delivered in 2008.[775] However, the Malariometric Survey reveals the lack of ACT availability and the extent to which other drugs continue to be prescribed.[776] Of those who had recently had fever (in the 2 weeks prior to the survey), the majority took chloroquine alone. For those who have *falciparum* malaria (either confirmed or unconfirmed) this is likely to lead to treatment failure, since this species is mostly resistant to the drug (>90% resistance). Only 12.5% took SP. Few (8.5%) had access to ACTs, but it is not clear how many of these cases actually had malaria. The survey also revealed that of the health facilities visited, 80% had chloroquine, but just 14% had ACTs in stock. 16% had no antimalarial drugs at all.[777]

3.4 Supporting Interventions

To support the preventive and case management measures being implemented in Pakistan, the NMCP is carrying out Information, Education and Communication (IEC) and Behaviour Change Communication (BCC) in order to improve the population's knowledge, opinions and behaviour in regards to malaria. IEC/BCC is being delivered through 5 methodologies: interpersonal communication (health workers, religious and community leaders); primary and secondary education (malaria incorporated into vector borne disease control module); mass media (electronic and print); special events (malaria day); and, advocacy.[778]

Broad awareness campaigns are planned through multi-channel media using messages that have been pre-tested and approved. Additional campaigns will specifically target individuals at risk (for example, children, pregnant women and groups of humanitarian importance). Each campaign will have specific aims for changing behaviour, and evaluated at the output level (to measure actual effectiveness in behaviour change).

Specific focus will be given to:

- Ensuring prompt presentation for febrile illness.
- Use of ITNs and other preventative measures.
- Increasing confidence in the use of the public sector.
- Awareness of the role and quality assurance of the private sector.[779]

Attempts are also being made to establish more effective surveillance, research and monitoring and evaluation (M&E) systems, in order to better analyse, plan and implement malaria control interventions in Pakistan. The testing of antimalarial drugs efficacy and insecticide susceptibility will be carried out at 4 selected sentinel sites in the country. M&E

systems established under the GFATM Round 2 grant will be strengthened, at both the central and local level.[780]

3.5 Delivery Systems

An estimated 80% of curative primary healthcare is provided by the private sector in Pakistan, although this varies across provinces.[781] Despite this, little is known about the actions of the private sector and the quality and extent of their diagnosis and treatment services. A recent pilot evaluation showed that a training and accreditation system for private sector practitioners resulted in high rates of diagnostic and treatment tool usage. The pilot project was conducted in 4 districts and showed a high uptake of interventions (RDT and treatment) and with training programmes being accepted by private practitioners. The informal sector includes pharmacies, small shops, traditional healers, herbal or homeopathic medicine practitioners and other non-licensed practitioners. It is not known how widespread the use of these are for provision of diagnosis and treatment, although pharmacies play a role in dispensing drugs. Efforts to include the informal sector in malaria control are required.[782]

Public health care is inequitably spread across the country, and is generally inefficiently utilised. The public health system is supported by Non-Governmental Organisations (NGOs). Government spending on health increased in 2006 by 40% compared to 2005, and the funding of malaria control has remained at about $1 million annually since 2002.[783] [784] Coordination with the private sector is ongoing, with RDTs and ACTs being provided to commercial health facilities in order to utilise their capacity for reaching a high coverage rate.[785]

4. Health System Issues

The public health care system has a well defined pyramidal structure, with Basic Health Units (BHUs) at the base with an approximate catchment of 15-20,000 people; Rural Health Centres (RHCs) forming the core of primary health care with a catchment population of approximately 80-100,000 people; Tehsil Headquarters (THQ) hospitals providing in-patient services at the secondary level; followed by District HQ providing an upper-secondary level of hospital services. There are also major teaching hospitals and specialist centres, provided by a mixture of public and private sectors. The system is supported by Government financing, Civil Society Organisations, and bilateral donors such as USAID, DFID, World Bank, Asian Development Bank and Islamic Development Bank. There were 948 hospitals in 2008, with over 133,956 registered physicians and over 65,387 registered nurses, 9,012 dentists and approximately 100,000 Lady Health Workers. The population to facilities ratio for a doctor is 1 per 1,212 persons; a dentist 1 per 18010 persons, a hospital bed is 1 per 1,575 persons.[786]

There is considerable inequity in access to healthcare services between rural and urban areas. Health service providers are concentrated in urban areas, while nearly 65% of the population is rural. Thus the government is the main provider of rural health services and also the only substantial provider of preventive care throughout the country. The primary health care infrastructure in the border areas, where malaria is most prevalent, is particularly weak, with low coverage by community based health workers. Awareness of malaria and use of preventive intervention such as LLIN is poor and access to early malaria diagnosis and effective, quality treatment is limited. There is a huge unregulated private sector, providing over the counter anti-malaria drugs of unknown quality with potential for propagating drug resistance on both sides of the border. Furthermore, due to the remote nature of the border districts, there are inadequate numbers of skilled health workers, with poor supervision and support. The institutional malaria training centres and the annual refresher training courses for the few available health workers are inadequate. None of the

high burden districts in the border areas and agencies have dedicated district malaria control officers, lab technicians for malaria microscopy, entomology technicians, or malaria health promoters.[787]

The District Health Management Information System (HMIS) contains information on the number of malaria cases reported from health centres within the district, including the number of suspected cases and confirmed cases. This information feeds into provincial and federal level reporting. However, the system is neither efficient, active nor accurate. Those cases that are reported are not disaggregated to show the proportion of cases in pregnancy or by gender or age group. The system does not report in a timely manner and is not fit for epidemic detection. Under the GFATM Round 7 programme, a system of HMIS specifically for malaria has been developed. This system contains all the relevant information required for monitoring and is being deployed in the 19 target districts.[788]

5. Current Funding and Technical Support

The National Government provides roughly $1 million a year for malaria control, and has done since 2002.[789]

The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) has provided disbursements between 2003 and 2008 totalling US$ 12 million.[790] The areas of focus for this grant include improving case management, preventive measures amongst pregnant women and children (through ITN distribution), community awareness and outbreak detection and control. The project focuses on 19 districts in KPK, FATA, Baluchistan, Sindh and Punjab, and will run until 2013.[791]

WHO has been providing financial and technical support on a biennial basis. WHO provided US$ 0.127 million support between 2006 and 2007.[792]

DFID provides budgetary support to the health sector through the National Health Facility (NHF), where the funds are pooled for all the disease control programmes and released on performance basis.[793]

6. Major Gaps

The lack of financial resources is one of the major factors hindering malaria control; even more so in the context of the devastating floods earlier this year. The total financial gap for case management, vector control and outbreak response has been calculated to be $14 million (Personal Communication).

The health care system in Pakistan is under-funded, under-staffed and unequally distributed between rural and urban areas. Border districts, where malaria is most prevalent, in particular lack primary healthcare, diagnostic and treatment facilities, trained staff and monitoring & evaluation systems.

ITN distribution is still far off from achieving universal coverage, and a sustainable system for replacing worn nets is yet to be established across the country. BCC/IEC is needed to increase net utilisation.

Diagnostic and treatment services are poor, particularly in rural areas. There are problems regarding the lack of microscopy and RDT and ACT stock-outs.

The unregulated private sector continues to sell inappropriate anti-malarials and monotherapies that risk increasing parasite resistance.

Acronyms

3DF	3 Diseases Fund	M&E	Monitoring and Evaluation
ACT	Artemisinin-based Combination Therapy	MACEPA	Malaria Control and Evaluation Partnership in Africa
ADDO	Accredited Drug Dispensing Outlet	MCH	Mother and Child Health
AFM	Africa Fighting Malaria	MCSP	Malaria Control Strategic Plan
AGA	AngloGold Ashanti	MDG	Millennium Development Goal
AL	Artemether-lumefantrine	MEEDS	Malaria Early Epidemic Detection System
AM	Artesunate-mefloquine	MEN	Monitoring and Evaluation Newsletter
AMFm	Affordable Medicines Facility-Malaria	MICS	Multiple Indicator Cluster Survey
AMT	Artemisinin Monotherapy	MIP	Malaria in Pregnancy
ANC	Antenatal Care	MIS	Malaria Indicator Survey
APE	Agente Polivalente Elementare (community health worker)	MOH	Ministry of Health
AQ	Amodiaquine	MOHSW	Ministry of Health and Social Welfare
AS	Artesunate	MOPH	Public Ministry of Health
AS/AQ	Artesunate and Amodiaquine	MOWA	Ministry of Women's Affairs
ASHA	Accredited Social Health Activist	MQ	Mefloquine
BCC	Behaviour Change Communication	MSD	Medical Stores Department
BHC	Basic Health Centres	MTEF	Medium Term Expenditure Framework
BHU	Basic Health Unit	MVU	Mobile-Video-Unit
BPHS	Basic Package of Health Services	NBS	National Bureau of Statistics
CCM	Country Coordinating Mechanism	NDA	National Drug Authority
CHAM	Christian Health Association of Malawi	NGO	Non-Governmental Organisation
CHAZ	Churches Health Association of Zambia	NHF	National health Facility
CHC	Comprehensive Health Centre	NHS	National Health Service
CHEW	Community Health Extension Worker	NHSSP II	National Health Sector Strategic Plan II
CHPS	Community Health Planning and Services	NIMR	National Institute of Malaria Research
CHW	Community Heath Workers	NMCC	National Malaria Control entre

CIDA	Canadian International Development Agency	NMCP	National Malaria Control Programme
CM	Community Mobilisers	NMIA	National Malaria Indicators Assessment
CMD	Community Medicine Distributors	NMMTSP	National Malaria Medium Term Strategic Plan
CMS	Central Medical Stores	NMS	National Medical Stores
CNM	National Centre for Parasitology, Entomology, and Malaria Control	NMSP	National Malaria Strategic Plan
COMMIT	Communication and Malaria Initiative in Tanzania	NSP	National Strategic Plan
CQ	Chloroquine	NVBDCP	National Vector Borne Diseases Control Programme
CSZ	Central South Zone	PCIME-C	Program for Integrated management of Childhood Illnesses in the Community
DEWS	Disease Early Warning System	PESS	Plano Estratégico do Sector de Saúde (health sector strategic plan)
DFID	United Kingdom Department for International Development	PfAPI	Plasmodium falciparum annual parasite incidence
DHAP	Dihydroartemisinin-Piperaquine	PfPR	Plasmodium falciparum parasite rate
DHA-PPQ	Dihydroartemisinin-piperaquine	PHA	Public Health Account
DHS	Demographic and Health Survey	PHSDP	Primary Health Services Development Programme
DLDB	Duka La Dawa Baridi	PHU	Peripheral Health Units
DOMC	Division of Malaria Control	PLMP	Pharmaceutical Logistics Master Plan
DRC	Democratic Republic of Congo	PMI	President's Malaria Initiative
EDAT	Early Diagnosis and Treatment	PNAM	National Essential Medicines Supply System
EHP	Essential Health Package	PNCM	Programme for National Communication and Mobilisation
EPHS	Essential Package of Health Services	PPM	Public-Private Mix
EPI	Extended Programme of Immunisation	PQ	Primaquine
EPR	Epidemic Preparedness and Response	PSI	Population Services International
ESR	Epidemic Surveillance and Response	PSM	Procurement and Supply Management
FANC	Focused Antenatal Care	QA	Quality Assurance
FBO	Faith-based Organisations	QAC	Quality Assurance Centre
FDA	Food and Drug Administration	QC	Quality Control
FDC	Fixed Dose Combination	QN	Quinine
FMOH	Federal Ministry of Health	RBM	Roll Back Malaria

FSNAU	Food Security and Nutrition Analysis Unit	RCC	Rolling Continuation Channel
FTD	Fever Treatment Depot	RDK	Rapid Diagnostic Kit
GAVI	Global Alliance for Vaccination and Immunizations	RDT	Rapid Diagnostic Test
GFATM	Global Fund to fight Aids, Tuberculosis and Malaria	RHC	Rural Health Centre
GMP	Gates Malaria Partnership	RHTM	Regional Health Management Team
GoT	Government of Tanzania	RMIFP	Regional Malaria and IMCI Focal Person
GSCP	Ghana Sustainable Change Project	RTI	Research Triangle Institute
GTZ	German Development Agency	SAPMC	Strategic Action Plan for Malaria Control
HAS	Health Surveillance Assistant	SEARO	South-East Asian Regional Office
HBMF	Home-Based Management of Fever	SMI	Scaling-up Malaria Interventions
HC	Health Centre	SP	Sulfadoxine Pyrimethamine
HEP	Health Extension Programme	SPS	Strengthening Pharmaceutical Systems
HEW	Health Extension Worker	SUFI	Scale Up For Impact
HIS	Health Information System	SuNMaP	Support to National Malaria Programme
HMIS	Health Management Information System	SWAp	Sector Wide Approach
HMM	Home Management of Malaria	T	Tetracycline
HMN	Health Metrics Network	TA	Technical Assistance
HP	Health Post	TAG	Technical Advisory Group
HSDP	Health Service Development Programme	THMIS	Tanzanian HIV/AIDS and Malaria Indicator Survey
HSS	Health System Strengthening	THQ	Tehsil Headquarter
ICCM	Integrated Community Case Management	TNVS	Tanzania National Voucher Scheme
ICON-CS	Lambda Cyhalothrin	UCC	Universal Coverage Campaign
IEC	Information, Education and Communication	UMSP	Ugandan Malaria Surveillance Project
IHP	International Health Partnership	UNICEF	United Nations Children's Fund
ILS	Integrated Logistics System	USAID	United States Agency for International Development
IMCI	Integrated Management of Childhood Illness	USG	United States Government
IPT	Intermittent Preventive Treatment	VBDC	Vector Borne Disease Control
IPTp	Intermittent Preventive Treatment for pregnant women	VHSG	Village Health Support Group
IRS	Indoor Residual Spraying	VHT	Village Health Teams

ITN	Insecticide-Treated Net	VHV	Village Health Volunteer
IVM	Integrated Vector Management	VMW	Village Malaria Worker
JICA	Japanese International Cooperation Agency	WB	World Bank
JSY	Janani Suraksha Yojana	WHO	World health Organization
KNMS	Kenyan National Malaria Strategy	WMC	Women's Media Centre
LLIHN	Long Lasting Insecticide Treated Hammock/Net	ZMCP	Zanzibar Malaria Control Programme
LLIN	Long-Lasting Insecticidal Net	ZMSP	Zanzibar Malaria Strategic Plan

References

1 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

2 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

3 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.

4 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

5 Ministry of Health. National Malaria Strategic Plan 2007 – 2011. MoH; 2007.

6 Ibid.

7 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

8 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.

9 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

10 Ibid.

11 Ibid.

12 Ibid.

13 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.

14 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

15 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

16 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.

17 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

18 Ibid.

19 Ibid.

20 Ibid.

21 Ibid.

22 Ministry Of Health. Annuaire données sanitaire 2006 [2006 directory of health data]; MoH; 2006.

23 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

24 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

25 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

26 Ibid.

27 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

28 Ibid.

29 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Democratic Republic of Congo. London: Malaria Consortium; 2008.

30 Ibid.

31 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.

32 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.

33 The Global Fund. Round 8 Funding Application: The Democratic Republic of Congo; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/ZAR?lang=en#.
34 Ibid.
35 Ibid.
36 Ibid.
37 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
38 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
39 World Health Organization. World Malaria Report 2008. Geneva: World Health Organization; 2008.
40 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.
41 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
42 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
43 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008.
44 Ibid.
45 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
46 Ibid.
47 Ministry Of Health, National Five-Year Strategic Plan for Malaria Prevention & Control in Ethiopia 2006 – 2010. Addis Ababa: MoH; 2006.
48 Ibid.
49 Ibid.
50 The Global Fund. Round 8 Funding Application: Ethiopia. Available at: http://portfolio.theglobalfund.org/Grant/Index/ETH-809-G10-M?lang=en.
51 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
52 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.
53 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
54 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
55 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008..
56 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
57 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
58 Ibid.
59 World Health Organisation. World Malaria Report 2009. Geneva: World Health Organization; 2009.
60 Ibid.
61 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008.
62 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
63 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
64 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
65 The Global Fund. Round 8 Funding Application: Ethiopia. Available at: http://portfolio.theglobalfund.org/Grant/Index/ETH-809-G10-M?lang=en.
66 Ibid.
67 Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, et al. Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. Malaria Journal, 2010; 9:58.
68 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008.
69 Ministry of Health. National Five-Year Strategic Plan for Malaria Prevention & Control in Ethiopia 2010 – 2015. Addis Ababa: MoH; 2010.

70 Ibid.
71 The Global Fund. Round 8 Funding Application: Ethiopia. Available at: http://portfolio.theglobalfund.org/Grant/Index/ETH-809-G10-M?lang=en.
72 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008.
73 Ministry of Health. Health Sector Strategic Plan 2005/6 – 2009/10. Addis Ababa: MoH; 2005.
74 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
75 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ethiopia Report. London: Malaria Consortium; 2008.
76 President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia FY 2010. Washington: PMI; 2010.
77 The Global Fund. Round 8 Funding Application: Ethiopia. Available at: http://portfolio.theglobalfund.org/Grant/Index/ETH-809-G10-M?lang=en.
78 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
79 World Health Organisation. World Malaria Report 2009. Geneva: World health Organization; 2009.
80 Ibid.
81 Ministry of Health. National Malaria Strategic Plan 2008 – 2015. MoH; 2008. Available at: http://www.ghanahealthservice.org/malaria_control_publications.php.
82 Ibid.
83 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
84 Ministry of Health. National Malaria Strategic Plan 2008 – 2015. MoH; 2008. Available at: http://www.ghanahealthservice.org/malaria_control_publications.php.
85 Ibid.
86 Ibid.
87 World Health Organisation. World Malaria Report 2009. Geneva: World health Organization; 2009.
88 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
89 Ibid.
90 Ibid.
91 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
92 World Health Organisation. World Malaria Report 2009. Geneva: World health Organization; 2009.
93 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
94 Ibid.
95 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
96 Ministry of Health. National Malaria Strategic Plan 2008 – 2015. MoH; 2008. Available at: http://www.ghanahealthservice.org/malaria_control_publications.php.
97 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
98 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
99 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
100 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
101 Ibid.
102 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
103 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
104 Ibid.
105 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
106 Ministry of Health. National Malaria Strategic Plan 2008 – 2015. MoH; 2008. Available at: http://www.ghanahealthservice.org/malaria_control_publications.php.
107 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
108 Ministry of Health. National Malaria Control Monitoring and Evaluation Plan 2008-2015. MoH; 2009. Available at: http://www.ghanahealthservice.org/malaria_control_publications.php.
109 The Global Fund. Round 8 Funding Application: Ghana; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/GHN?lang=en#.
110 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.

111 Ibid.
112 Ibid.
113 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
114 Ibid.
115 The Global Fund. Round 8 Funding Application: Ghana; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/GHN?lang=en#.
116 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
117 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Ghana Report. London: Malaria Consortium; 2008.
118 World Health Organisation. World Malaria Report 2009. Geneva: World health Organization; 2009.
119 The Global Fund. Round 8 Funding Application: Ghana; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/GHN?lang=en#.
120 Ibid.
121 Ibid.
122 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Ghana FY 2010. Washington: PMI; 2010.
123 World Bank [internet]. Nutrition and Malaria Control for Child Survival Project. Available at: http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P105092.
124 The Global Fund. Round 8 Funding Application: Ghana; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/GHN?lang=en#.
125 Njagi K [Internet]. Scale Up Of IRS/LLIN And Challenges For Matching With Vector Surveillance'; 2008. Available at : http://www.rollbackmalaria.org/partnership/wg/wg_itn/ppt/5winwgSession3-7.pdf.
126 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
127 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
128 Ibid.
129 National Malaria Control Programme [internet]. Malaria in Kenya: epidemiology of malaria in Kenya. Available at: http://www.nmcp.or.ke/section.asp?ID=3.
130 Kamau L, Agai D, Matoke D, Wachira L, Gikandi G, Vulule JM.. Status of insecticide susceptibility in Anopheles gambiae sensu lato and Anopheles funestus mosquitoes from Western Kenya. Journal of Insect Science, 2006; 8:1 – 7.
131 National Malaria Control Programme [internet. National Malaria Control Programme Home. Available at: http://www.nmcp.or.ke/.
132 Division of Malaria Control. Kenyan National Malaria Strategy 2009 – 2017. Nairobi: MoH; 2009.
133 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
134 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
135 Ibid.
136 Ibid.
137 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
138 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
139 Ibid.
140 Ibid.
141 Ibid.
142 Division of Malaria Control. Kenya Malaria Indicator Survey. Nairobi: Division of Malaria Control; Kenya. 2009.
143 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
144 Ibid.
145 Gates Malaria Partnership. Gates Malaria Partnership Report 2001 – 2006. London: London School of Hygiene & Tropical Medicine; 2006.
146 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
147 Division of Malaria Control. Kenya Malaria Indicator Survey. Nairobi: Division of Malaria Control; Kenya. 2009.
148 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
149 Ibid.

150 Ibid.
151 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
152 The Global Fund. Round 4 Funding Application: Kenya.; 2004. Available at:
http://portfolio.theglobalfund.org/Grant/Index/KEN-405-G06-M?lang=en.
153 President's Malaria Initiative. Malaria Operational Plan (MOP) Kenya FY 2010. Washington: PMI; 2009.
154 World Bank [internet]. World Bank Booster Program: Kenya. Available at:
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/EXTAFRBOOPRO/0,,contentMDK:20898970~pagePK:64168445~piPK:64168309~theSitePK:2128617,00.html.
155 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
156 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
157 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
158 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
159 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
160 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
161 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
162 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
163 Ministry of Health. National Malaria Strategic Plan 2005 – 2010: Scaling up Malaria Control Interventions. Lilongwe: Government of Malawi; 2005.
164 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
165 UNICEF, (2006) Malawi Multiple Indicator Cluster Survey 2006.
166 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
167 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
168 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
169 Ibid.
170 Ibid.
171 Ibid.
172 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
173 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
174 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
175 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
176 Ministry of Health. National Malaria Strategic Plan 2005 – 2010: Scaling up Malaria Control Interventions. Lilongwe: Government of Malawi; 2005.
177 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
178 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
179 Ibid.
180 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
181 Ibid.
182 Ministry of Health. National Malaria Strategic Plan 2005 – 2010: Scaling up Malaria Control Interventions. Lilongwe: Government of Malawi; 2005.
183 The Global Fund. Round 7 Funding Application: Malawi; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/MLW-708-G05-M?lang=en.
184 World Health Organization. World Malaria Report 2009. Geneva: WHO.

185 President's Malaria Initiative. Malaria Operational Plan (MOP) Malawi FY 2010. Washington: PMI; 2010.
186 Ibid.
187 Ibid.
188 INE [internet]. População. Available at: www.ine.gov.mz.
189 United Nations Development Program. Human Development Report 2007/2008: Fighting climate change: Human solidarity in a divided world. New York: United Nations Development Program; 2008.
190 Republic of Mozambique. Report on the Millennium Development Goals. Maputo: Government of Mozambique and UNDP; 2005.
191 INE & Macro International Inc. Moçambique: Inquérito Demográfico e de Saúde 1997. Maputo: Moçambique, Instituto Nacional de Estatística; Macro International Inc; 1998.
192 INE, MISAU & USAID. Moçambique: Inquérito Demográfico e de Saúde 2003. Maputo: Moçambique, Instituto Nacional de Estatística, Ministério da Saúde e USAID com Assessoria da MEASURE DHS+/ORC Macro; 2005.
193 INE, MISAU & UNICEF. Resultados do Inquérito sobre Indicadores Múltiplos (MICS) 2008. Maputo: Instituto Nacional de Estatística; 2009.
194 INE & Macro International Inc. Moçambique: Inquérito Demográfico e de Saúde 1997. Maputo: Moçambique, Instituto Nacional de Estatística; Macro International Inc; 1998.
195 INE. Inquérito Demográfico e de Saúde 2003. Maputo: Instituto Nacional de Estatística, Direcção de Estatísticas Demográficas, Vitais e Sociais, Macro International Inc.-DHS Program (USA); 2004.
196 UNICEF. Count down to 2015 Maternal, Newborn and Child Survival. New york: UNICEF; 2008.
197 Ministério da Saúde. Plano Estratégico do Sector da Saúde 2007-2012. Maputo: Ministério da Saúde; 2007.
198 World Health Organisation. Stock taking Report for Mozambique. International Health Partnership and related initiatives (IHP+). Harmonization for Health in Africa (HHA). Inter-Regional Country Health Sector Teams' Meeting. Lusaka, Zambia; 2008.
199 INE. Mortalidade em Moçambique: Inquérito Nacional Sobre Causas de Mortalidade, 2007/8. Relatório Preliminar. Maputo: Instituto Nacional de Estatística; 2009.
200 MISAU-PNCM. Inquérito Nacional sobre Indicadores de Malária em Mocambique (IIM-2007). Maputo, Ministério da Saúde, Direccão Nacional de Saúde Pública, Programa Nacional de Controlo da Malária; 2009.
201 Ibid.
202 MOH-NMCP. Malaria Indicator Survey, Mozambique 2007 preliminary report. Maputo: National Malaria Control Program, Ministry of Health; 2008.
203 MISAU-PNCM. Inquérito Nacional sobre Indicadores de Malária em Mocambique (IIM-2007). Maputo: Ministério da Saúde, Direccão Nacional de Saúde Pública, Programa Nacional de Controlo da Malária; 2009.
204 Malaria Consortium. Briefing Document – Lessons Learned from LLIN Universal Coverage Campaigns in Cabo Delgado and Manica Provinces. London: Malaria Consortium; 2008.
205 MISAU-PNCM. Inquérito Nacional sobre Indicadores de Malária em Mocambique (IIM-2007). Maputo: Ministério da Saúde, Direccão Nacional de Saúde Pública, Programa Nacional de Controlo da Malária; 2009.
206 Ibid.
207 Ibid.
208 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
209 MOH-NMCP. National Plan for Malaria Prevention and Control in Mozambique 2010 – 2014 (Semi-final version). Maputo: Mozambique, Ministry of Health; 2009.
210 Mozambican Country Coordinating Committee. Malaria Prevention and Control in Mozambique: scaling up for universal access with community involvement. Maputo: Prepared to GFATM; 2009.
211 MISAU-PNCM. Inquérito Nacional sobre Indicadores de Malária em Mocambique (IIM-2007). Maputo: Ministério da Saúde, Direccão Nacional de Saúde Pública, Programa Nacional de Controlo da Malária; 2009.
212 Ibid.
213 MOH-NMCP. National Malaria Prevention and Control Monitoring and Evaluation Plan 2010-2014. Maputo: National Malaria Control Programme, Ministry of Health; 2009.

214 Mozambican Country Coordinating Committee. Malaria Prevention and Control in Mozambique: scaling up for universal access with community involvement. Maputo: Prepared to GFATM; 2009.
215 Ibid.
216 Ibid.
217 World Health Organisation. Stock taking Report for Mozambique. International Health Partnership and related initiatives (IHP+). Harmonization for Health in Africa (HHA). Inter-Regional Country Health Sector Teams' Meeting. Lusaka, Zambia; 2008.
218 The Global Fund. Round 9 Funding Application: Mozambique; 2009. Available at: http://portfolio.theglobalfund.org/Country/Index/MOZ?lang=en#.
219 MOH-NDHR. National Plan for Health Human Resources Development (NPHHRD) 2008 - 2015. Maputo: Ministry of Health; 2008.
220 Ministério da Saúde. Plano Estratégico do Sector da Saúde 2007-2012. Maputo: Ministério da Saúde; 2007.
221 MISAU-PNCM. Inquérito Nacional sobre Indicadores de Malária em Mocambique (IIM-2007). Maputo: Ministério da Saúde, Direccão Nacional de Saúde Pública, Programa Nacional de Controlo da Malária; 2009.
222 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
223 Chilundo B, Mavimbe J, Muquingue H, Cossa M, Gonçalo A, Augusto O, Beda V. Multi-Country Evaluation Study Health Impact of the Scale-up to Fight AIDS, TB and Malaria with special reference to the Global Fund: Final Country Impact Evaluation Report - MOZAMBIQUE. Maputo, Faculty of Medicine. University Eduardo Mondlane. Commissioned by Macro International Inc. In partnership with: World Health Organization. Johns Hopkins Bloomberg School of Public Health. Harvard University School of Public. African Population and Health Research Center; 2008.
224 The Global Fund. Round 9 Funding Application: Mozambique; 2009. Available at: http://portfolio.theglobalfund.org/Country/Index/MOZ?lang=en#.
225 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
226 National Malaria Control Program. National Malaria Indicator Survey Mozambique 2007. Maputo: National Malaria Control Program, Ministry of Health; 2009.
227 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
228 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
229 Ibid
230 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
231 Federal Ministry of Health. National Policy on Malaria Diagnosis and Treatment. Abuja: Federal Ministry of Health; 2009.
232 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Nigeria Report. London: Malaria Consortium; 2008.
233 Ibid
234 Federal Ministry of Health. National Policy on Malaria Diagnosis and Treatment. Abuja: Federal Ministry of Health; 2009.
235 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
236 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
237 National Malaria Control Program. LLIN Distribution in 2010: Current Progress. Abuja: Federal Ministry of Health; 2010.
238 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
239 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
240 Ibid
241 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
242 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
243 SuNMaP. SuNMaP Updated Programme Strategy. Abuja: SuNMaP; 2010.

244 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
245 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
246 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
247 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
248 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
249 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Nigeria Report. London: Malaria Consortium; 2008.
250 Ibid
251 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
252 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
253 The Global Fund. Report of the Affordable Medicines Facility – Malaria Ad Hoc Committee; 2008.
254 SuNMaP. SuNMaP Updated Programme Strategy. Abuja: SuNMaP; 2010.
255 Federal Ministry of Health. Advocacy, Communication, and Social Mobilisation Strategic Framework and Implementation Plan. Federal Ministry of Health; 2010.
256 SuNMaP. SuNMaP Programme Capacity Building Strategy. Abuja: SuNMaP; 2009.
257 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
258 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Nigeria Report. London: Malaria Consortium; 2008.
259 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
260 SuNMaP. Monitoring Changes in Malaria Epidemiology in Nigeria. Abuja: SuNMaP; 2010.
261 Federal Ministry of Health. National Malaria Control Program Strategic Plan 2009 – 2013. Abuja: Federal Ministry of Health; 2009.
262 Ibid
263 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
264 SuNMaP. SuNMaP Updated Programme Strategy. Abuja: SuNMaP; 2010.
265 The Global Fund. Round 8 Funding Application: Nigeria; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/NGA?lang=en#.
266 Ibid
267 Ibid
268 Ibid
269 Ibid
270 SuNMaP. SuNMaP Updated Programme Strategy. Abuja: SuNMaP; 2010.
271 Ibid
272 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
273 Ministry of Health. 11th EARN Annual Review and Planning Meeting Presentations, October 2010, Kigali.
274 Chen T. [Internet] Where The Fight Against Malaria Is Being Won; 2010.[Available at: http://humanrights.change.org/blog/view/where_the_fight_against_malaria_is_being_won]
275 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at: http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
276 Ibid.
277 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
278 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at: http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.

279 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
280 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
281 World health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
282 Ministry of Health. National Malaria Strategic Plan 2008 – 2012. Kigali: Ministry of Health; 2008.
283 Ministry of Health. National Malaria Indicator Survey; 2007. Kigali: Ministry of Health; 2009.
284 Ministry of Health, National Institute of Statistics of Rwanda (NISR), and ICF Macro. Rwanda Interim Demographic and Health Survey 2007-08. Calverton, Maryland, U.S.A.: MOH, NISR, and ICF Macro.; 2009.
285 Ibid.
286 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
287 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
288 Ibid.
289 Ministry of Health. National Malaria Indicator Survey; 2007. Kigali: Ministry of Health; 2009.
290 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
291 Ibid.
292 Ibid.
293 Ministry of Health. 11th EARN Annual Review and Planning Meeting Presentations, October 2010, Kigali.
294 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
295 Ministry of Health. National Malaria Indicator Survey; 2007. Kigali: Ministry of Health; 2009.
296 Ministry of Health. 11th EARN Annual Review and Planning Meeting Presentations, October 2010, Kigali.
297 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
298 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
299 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
300 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
301 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
302 Ibid.
303 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
304 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
305 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
306 Ministry of Health. National Malaria Indicator Survey; 2007. Kigali: Ministry of Health; 2009.
307 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
308 Ibid.
309 Ministry of Health. 11th EARN Annual Review and Planning Meeting Presentations, October 2010, Kigali.
310 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
311 The Global Fund. Round 8 Funding Application: Rwanda; 2008. Available at:
http://portfolio.theglobalfund.org/Grant/Index/RWN-809-G10-M?lang=en.
312 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Rwanda FY 2010. Washington: PMI; 2009.
313 Ibid.
314 Ministry of Health. 11th EARN Annual Review and Planning Meeting Presentations, October 2010, Kigali.
315 Ibid.
316 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at:
http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.

317 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
318 World Health Organization. World Malaria Report 2009. Geneva: World health Organization.
319 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
320 World Health Organization. Country Cooperation Strategy 2008 – 2011: Sierra Leone. Brazzaville: WHO regional Office for Africa; 2008.
321 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
322 Ibid.
323 Ministry of health and Sanitation. Strategic Plan on Malaria Control and Prevention 2009 – 2015; 2009.
324 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
325 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
326 Roll Back Malaria [internet]. Sierra Leone: Roadmap to Achieve 2010 RBM Targets. Available at: http://www.rbm.who.int/countryaction/sierraLeone_roadmap.html.
327 Ministry of health and Sanitation. Strategic Plan on Malaria Control and Prevention 2009 – 2015; 2009.
328 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
329 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
330 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
331 World Health Organization. Country Cooperation Strategy 2008 – 2011: Sierra Leone. Brazzaville: WHO regional Office for Africa; 2008.
332 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
333 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
334 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
335 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
336 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
337 Ibid.
338 Ibid.
339 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.
340 Gbomor SE. Pharmacovigilance in Serra Leone. Presentation given by Sahr Emmanuel Gbomor of Drug Information and Pharmacovigilance Department, Pharmacy Board of Sierra Leone; 2009.
341 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
342 Ibid.
343 Ibid.
344 World Health Organization/UNICEF [internet]. Accelerated Malaria Control towards Elimination in Sierra Leone. Available at: http://www.whosierraleone.org/Accelerating%20Malaria%20Control_branded_3.htm.

345 Aidspan – an independent watchdog of the Global Fund and publisher of the Global Fund Observer. Available at: http://www.aidspan.org/index.php?page=home.
346 The Global fund. Round 7 Funding Application: Sierra Leone; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/SLE-708-G05-M?lang=en.
347 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
348 Ibid.
349 Alegana VA, Okiro EA, Gething PW, Patil P, Tatem AJ, Linard C, et al. Estimating the Plasmodium falciparum morbidity and mortality burden 2005 and 2009 in Somalia: Combining models of population distribution, time-space changes in malaria infection risk and the epidemiology of malaria disease burden. Report prepared for UNICEF-Somalia; 2010.
350 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
351 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
352 WHO Eastern Mediterranean Regional Office [internet]. Somalia. Available at: http://www.emro.who.int/rbm/CountryProfiles-som.htm.
353 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
354 Ministry of Health. National Malaria Strategic Plan 2005 – 2010; 2005. Available at: www.rollbackmalaria.org/countryaction/nsp/somalia2005-2010.pdf.
355 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
356 Ibid.
357 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
358 Ibid.
359 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
360 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
361 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
362 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
363 Ibid.
364 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
365 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
366 Ministry of Health. National Malaria Prevention and Control Monitoring and Evaluation Plan 2011 – 2015. Available at: http://www.emro.who.int/somalia/CollaborativeProgrammes-rbm.htm.
367 Noor AM, Clements ACA, Gething PW, Moloney G, Borle M, Shewchuk T, et al. Spatial prediction of Plasmodium falciparum prevalence in Somalia. Malaria Journal, 2008; 7:159.
368 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
369 Ministry of Health. National Malaria Strategic Plan 2011 – 2015.
370 Ibid.
371 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.
372 The Global Fund. Round 8 Funding Application: Somalia (HIV/Aids); 2008. Available at: http://portfolio.theglobalfund.org/Grant/Index/SOM-809-G06-H?lang=en.
373 Aidspan [internet]. Aidspan – an independent watchdog of the Global Fund and publisher of the Global Fund Observer. Available at: http://www.aidspan.org/index.php?page=home
374 The Global Fund. Round 10 Funding Application: Somalia; 2010. Available at: http://portfolio.theglobalfund.org/Country/Index/SOM?lang=en#.

375 World Health Organization. Country Cooperation Strategy for WHO and Sudan 2008 – 2013. Geneva: World Health Organization; 2009.
376 The Global Fund. Round 7 Funding Application: Southern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G09-M?lang=en.
377 World Health Organization. Country Cooperation Strategy for WHO and Sudan 2008 – 2013. Geneva: World Health Organization; 2009.
378 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
379 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
380 South Sudanese Ministry of Health. National Malaria Control Program 2006 – 2011; 2007. Available from: www.rollbackmalaria.org/countryaction/nsp/sudanS.pdf.
381 South Sudanese Ministry of Health. National Malaria Control Program 2006 – 2011; 2007. Available from: www.rollbackmalaria.org/countryaction/nsp/sudanS.pdf.
382 South Sudanese Ministry of Health. National Malaria Control Program 2006 – 2011; 2007. Available from: www.rollbackmalaria.org/countryaction/nsp/sudanS.pdf.
383 Roll Back Malaria [Internet]. Sudan: Country Facts. Available from: http://www.rbm.who.int/countryaction/sudanSouthern_roadmap.html.
384 Roll Back Malaria [Internet]. Sudan: Country Facts. Available from: http://www.rbm.who.int/countryaction/sudanSouthern_roadmap.html.
385 The Global Fund. Round 7 Funding Application: Southern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G09-M?lang=en.
386 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
387 South Sudanese Ministry of Health. National Malaria Control Program 2006 – 2011; 2007. Available from: www.rollbackmalaria.org/countryaction/nsp/sudanS.pdf.
388 The Global Fund. Round 7 Funding Application: Southern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G09-M?lang=en.
389 Ibid.
390 Ibid.
391 South Sudanese Ministry of Health. National Malaria Control Program 2006 – 2011; 2007. Available from: www.rollbackmalaria.org/countryaction/nsp/sudanS.pdf.
392 The Global Fund. Round 7 Funding Application: Southern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G09-M?lang=en.
393 World Health Organization. Country Cooperation Strategy for WHO and Sudan 2008 – 2013. Geneva: World Health Organization; 2009.
394 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
395 World Health Organization. Country Cooperation Strategy for WHO and Sudan 2008 – 2013. Geneva: World Health Organization; 2009.
396 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
397 Ibid.
398 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
399 Ibid.
400 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
401 Ranson H, Abdallah H, Badolo A, Guelbeogo WM, Kerah-Hinzoumbé C, Yangalbé-Kalnoné E, et al. Insecticide resistance in Anopheles gambiae: data from the first year of a multi-country study highlight the extent of the problem. Malaria Journal, 2009; 8:299.
402 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
403 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.

404 Roll Back Malaria [Internet]. Sudan: Country Facts. Available from: http://www.rbm.who.int/countryaction/sudanSouthern_roadmap.html.
405 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
406 Ministry of Environment and Physical Development. National Implementation Plan for the Stockholm Convention on POPs; 2007. Available from: http://chm.pops.int/Countries/National%20Implementation/tabid/253/language/en-GB/Default.aspx.
407 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
408 Ibid.
409 Ibid.
410 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
411 Ibid.
412The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
413 Ibid.
414 Ibid.
415 Ibid.
416 The Global Fund. Round 7 Funding Application: Northern Sudan; 2007. Available from: http://portfolio.theglobalfund.org/Grant/Index/SUD-708-G10-M?lang=en.
417 Ministry of Environment and Physical Development. National Implementation Plan for the Stockholm Convention on POPs; 2007. Available from: http://chm.pops.int/Countries/National%20Implementation/tabid/253/language/en-GB/Default.aspx.
418 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
419 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
420 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
421 Malaria Consortium. Tanzania Roll Back Malaria Consultative Mission: Essential Actions To Support The Attainment Of The Abuja Targets. London: Malaria Consortium; 2004.
422 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
423 Ministry of Health and Social Welfare. National Malaria Medium Term Strategic Plan 2008-2013. Dar es Salaam: Ministry of Health and Social Welfare; 2008.
424 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
425 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
426 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
427 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
428 Ibid.
429 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
430 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
431 Ibid.
432 The Global Fund. Round 7 Funding Application: Tanzania; 2007. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
433 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
434 GFATM The Global Fund. Round 9 Funding Application: Tanzania; 2009. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
435 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
436 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
437 Ibid.

438 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
439 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
440 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
441 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
442 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
443 Ibid.
444 Ibid.
445 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
446 Ibid.
447 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
448 Aidspan – an independent watchdog of the Global Fund and publisher of the Global Fund Observer. Available at: http://www.aidspan.org/index.php?page=home.
449 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
450 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
451 GFATM The Global Fund. Round 8 Funding Application: Tanzania; 2008. Available at: http://portfolio.theglobalfund.org/Country/Index/TNZ?lang=en.
452 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
453 World Health Organization. World Malaria Report 2008. Geneva: World Health Organization; 2008.
454 President's Malaria Initiative. Country Profile: Uganda. Washington: PMI; 2010.
455 Ibid
456 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
457 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
458 Ugandan Ministry of Health. National Malaria Control Program 2005 – 2010; 2005.
459 Ibid
460 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
461 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
462 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
463 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
464 Ibid
465 Ibid
466 Ugandan Ministry of Health. National Malaria Control Program 2020 – 2015; 2010.
467 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
468 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
469 The Global Fund. Round 10 Funding Application: Uganda. Available at: http://portfolio.theglobalfund.org/Country/Index/UGD?lang=en.
470 Malaria Consortium. The Clover Project: Improving Health Systems – working together with malaria as an entry point. London: Malaria Consortium; 2010.

471 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
472 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
473 Ibid
474 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
475 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
476 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
477 UDHS Uganda Bureau of Statistics (UBOS) and Macro International Inc. Uganda Demographic and Health Survey 2006. Calverton, Maryland, USA: UBOS and Macro International Inc; 2007.
478 Ugandan Ministry of Health. National Malaria Control Program 2020 – 2015; 2010.
479 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
480 Kyabayinze DJ, Asiimwe C, Nakanjako D, Nabakooza J, Counihan H, Tibenderana JK. Use of RDTs to improve malaria diagnosis and fever case management at primary health care facilities in Uganda. Malaria Journal, 2010. 9:200.
481 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
482 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
483 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
484 UMIS Uganda Bureau of Statistics (UBOS) and ICF Macro. 2010. Uganda Malaria Indicator Survey 2009. Calverton, Maryland, USA: UBOS and ICF Macro; 2009.
485 Ugandan Ministry of Health. National Malaria Control Program 2005 – 2010; 2005.
486 The Global Fund. Round 10 Funding Application: Uganda. Available at: http://portfolio.theglobalfund.org/Country/Index/UGD?lang=en.
487 Ibid
488 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
489 The Global Fund. Round 10 Funding Application: Uganda. Available at: http://portfolio.theglobalfund.org/Country/Index/UGD?lang=en.
490 Malaria Consortium. The Clover Project: Improving Health Systems – working together with malaria as an entry point. London: Malaria Consortium; 2010.
491 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
492 Ugandan Ministry of Health. National Malaria Control Program 2005 – 2010; 2005.
493 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
494 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
495 Malaria Consortium. The Clover Project: Improving Health Systems – working together with malaria as an entry point. London: Malaria Consortium; 2010.
496 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
497 The Global Fund. Round 10 Funding Application: Uganda. Available at: http://portfolio.theglobalfund.org/Country/Index/UGD?lang=en.
498 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.

499 The Global Fund. Round 10 Funding Application: Uganda. Available at: http://portfolio.theglobalfund.org/Country/Index/UGD?lang=en.
500 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
501 President's Malaria Initiative. Country Profile: Uganda. Washington: PMI; 2010.
502 President's Malaria Initiative. President's Malaria Initiative: Uganda – Malaria Operational Plan for FY 2010. Washington: PMI; 2009.
503 Ministry of Health. National Malaria Strategic Plan 2006 – 2010. MoH: 2006.
504 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
505 Ibid.
506 Ministry of Health. National Malaria Strategic Plan 2006 – 2010. MoH: 2006
507 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
508 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
509 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
510 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
511 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
512 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
513 Ministry of Health. National Malaria Strategic Plan 2006 – 2010. MoH: 2006
514 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
515 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
516 Ministry of Health. Zambia National Malaria Indicator Survey 2008. MoH: 2008.
517 Chizema-Kawesha E, Miller JM, Steketee RW, Mukonka VM, Mukuka C, Mohamed AD, et al. Scaling Up Malaria Control in Zambia: Progress and Impact 2005–2008. The American Journal of Tropical Medicine and Hygiene, 2010; 83(3):480 – 488.
518 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
519 Ministry of Health. Zambia National Malaria Indicator Survey 2008. MoH: 2008.
520 Chizema-Kawesha E, Miller JM, Steketee RW, Mukonka VM, Mukuka C, Mohamed AD, et al. Scaling Up Malaria Control in Zambia: Progress and Impact 2005–2008. The American Journal of Tropical Medicne and Hygiene, 2010; 83(3):480 – 488.
521 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
522 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
523 Ministry of Health. Zambia National Malaria Indicator Survey 2008. MoH: 2008.
524 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
525 Ministry of Health. National Malaria Strategic Plan 2006 – 2010. MoH: 2006
526 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
527 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
528 Chizema-Kawesha E, Miller JM, Steketee RW, Mukonka VM, Mukuka C, Mohamed AD, et al. Scaling Up Malaria Control in Zambia: Progress and Impact 2005–2008. The American Journal of Tropical Medicine and Hygiene, 2010; 83(3):480 – 488.
529 Ibid.
530 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
531 Malaria Consortium. Health Systems Strengthening roundtable: CLOVER Country report: Zambia. London: Malaria Consortium. 2010.
532 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
533 Ministry of Health. Zambia National Malaria Indicator Survey 2008. MoH: 2008.
534 Ibid.
535 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.

536 Ibid.
537 National Malaria Control Centre. Monitoring and Evaluation Newsletter: Issue 1, Third Quarter 2009. NMCC: 2009a.
538 National Malaria Control Centre. Monitoring and Evaluation Newsletter: Issue 2, Fourth Quarter 2009. NMCC: 2009b.
539 National Malaria Control Centre. Monitoring and Evaluation Newsletter: Issue 3, First Quarter 2010. NMCC: 2010.
540 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
541 Ibid.
542 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
543 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
544 Ibid.
545 Chizema-Kawesha E, Miller JM, Steketee RW, Mukonka VM, Mukuka C, Mohamed AD, et al. Scaling Up Malaria Control in Zambia: Progress and Impact 2005–2008. The American Journal of Tropical Medicine and Hygiene, 2010; 83(3):480 – 488.
546 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
547 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
548 The Global Fund. Round 7 Funding Application: Zambia; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/ZAM?lang=en#.
549 Malaria Consortium. Health Systems Strengthening roundtable: CLOVER Country report: Zambia. London: Malaria Consortium. 2010.
550 President's Malaria Initiative. Malaria Operational Plan (MOP) Zambia FY 2010. Washington: PMI; 2010.
551 Ibid.
552 Ibid.
553 Ibid.
554 Ibid.
555 Ibid.
556 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
557 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
558 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
559 Ibid.
560 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
561 Ministry of Health and Social Welfare. Zanzibar Malaria Strategic Plan 2008 – 2012; 2008.
562 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
563 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
564 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
565 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
566 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
567 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
568 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
569 Ibid.
570 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
571 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
572 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.

573 Ibid.
574 Ibid.
575 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
576 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
577 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
578 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
579 Ibid.
580 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
581 Ibid.
582 National Bureau of Statistics. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam: NBS; 2008.
583 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
584 Ibid.
585 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
586 Ibid..
587 Ibid..
588 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
589 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Zanzibar. London: Malaria Consortium; 2008.
590 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
591 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
592 Aidspan [internet]. Aidspan – an independent watchdog of the Global Fund and publisher of the Global Fund Observer. Available at: http://www.aidspan.org/index.php?page=home.
593 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
594 Presidents Malaria Initiative. Malaria Operational Plan (MOP) Tanzania FY 2010. Washington: PMI; 2009.
595 Africa Fighting Malaria. Keeping Malaria Out of Zanzibar: Africa Fighting Malaria Occasional Paper. Washington: AFM; 2008.
596 The Global Fund. Round 8 Funding Application: Zanzibar; 2008. Available from: http://portfolio.theglobalfund.org/Grant/Index/ZAN-809-G07-M?lang=en.
597 Malaria Consortium. Roll Back Malaria: Country Needs Assessment, Zanzibar. London: Malaria Consortium; 2008.
598 Safi, N. Editorial. Afghanistan Annual Malaria Journal. 2009; 1: 6 – 7.
599 Ibid.
600 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
601 Safi, N. Editorial. Afghanistan Annual Malaria Journal. 2009; 1:6 – 7.
602 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1:15 – 29.
603 Ibid.
604 Youssef R, Safi N, Hemeed H, Sediqi W, Nasser J, Butt W. National Malaria Indicators Assessment, 2008. Afghanistan Annual Malaria Journal, 2008; 1: 37 – 49.
605 Ministry of Public Health. National Malaria Strategic Plan 2008 – 2013. MOPH: 2008.
606 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1:15 – 29.
607 Ministry of Public Health. National Malaria Strategic Plan 2008 – 2013. MOPH: 2008.

608 Ibid.
609 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
610 Ministry of Public Health. National Malaria Strategic Plan 2008 – 2013. MOPH: 2008.
611 Ibid.
612 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1:15 – 29.
613 Youssef R, Safi N, Hemeed H, Sediqi W, Nasser J, Butt W. National Malaria Indicators Assessment, 2008. Afghanistan Annual Malaria Journal, 2008; 1:37 – 49.
614 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
615 Ibid.
616 Ministry of Public Health. National Malaria Strategic Plan 2008 – 2013. MOPH: 2008.
617 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
618 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1: 15 – 29.
619 Safi N, Hameed H, Sediqi W, Himmat E. NMLCP Annual Report, 2008. Afghanistan Annual Malaria Journal, 2008; 1: 8 – 14.
620 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
621 Ibid.
622 Youssef R, Safi N, Hemeed H, Sediqi W, Nasser J, Butt W. National Malaria Indicators Assessment, 2008. Afghanistan Annual Malaria Journal, 2008; 1:37 – 49.
623 Howard, N, Shafi, A., Jones, C., & Rowland, M. Malaria control under the Taliban regime: insecticide-treated net purchasing, coverage, and usage among men and women in eastern Afghanistan. Malaria Journal, 2010; 9:7.
624 Ibid.
625 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1:15 – 29.
626 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
627 Youssef R, Safi N, Hemeed H, Sediqi W, Nasser J, Butt W. National Malaria Indicators Assessment, 2008. Afghanistan Annual Malaria Journal, 2008; 1:37 – 49.
628 Safi N, Leslie T, Rowland M. Progress and Challenges to Malaria Control in Afghanistan. Afghanistan Annual Malaria Journal, 2008; 1:15 – 29.
629 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
630 Ibid.
631 Ibid.
632 Ibid.
633 Ministry of Public Health. National Malaria Strategic Plan 2008 – 2013. MOPH: 2008.
634 Safi N, Hameed H, Sediqi W, Himmat E. NMLCP Annual Report, 2008. Afghanistan Annual Malaria Journal, 2008; 1:8 – 14.
635 Ibid.
636 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
637 Safi N, Hameed H, Sediqi W, Himmat E. NMLCP Annual Report, 2008. Afghanistan Annual Malaria Journal, 2008; 1:8 – 14.

638 The Global Fund. Round 8 Funding Application: Afghanistan; 2008. Available from: http://portfolio.theglobalfund.org/Country/Index/AFG?lang=en.
639 Ibid.
640 Ibid.
641 World Health Organization. WHO Country Cooperation Strategy 2008-2011: Myanmar; WHO Country Office for Myanmar: WHO; 2008.
642 Beyrer C, Suwanvanichkij V, Mullany LC, Richards AK, Franck N, Samuels A, et al. Responding to AIDS, TB, Malaria and Emerging Infectious Diseases in Burma: Dilemmas of Policy and Practice. PLoS Med, 2006; 3:10.
643 World Health Organization. WHO Country Cooperation Strategy 2008-2011: Myanmar; WHO Country Office for Myanmar: WHO; 2008.
644 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
645 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
646 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
647 Ibid.
648 World health Organization. Highlights of the work of the WHO in the South-East Asia region: report of the regional director. WHO Regional Office for South-East Asia. New Delhi: World Health Organization; 2009.
649 Beyrer C, Suwanvanichkij V, Mullany LC, Richards AK, Franck N, Samuels A, et al. Responding to AIDS, TB, Malaria and Emerging Infectious Diseases in Burma: Dilemmas of Policy and Practice. PLoS Med, 2006; 3:10.
650 Ibid.
651 World Health Organization. Myanmar Country Profile. Geneva: World Health Organization; 2005.
652 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
653 Beyrer C, Suwanvanichkij V, Mullany LC, Richards AK, Franck N, Samuels A, et al. Responding to AIDS, TB, Malaria and Emerging Infectious Diseases in Burma: Dilemmas of Policy and Practice. PLoS Med, 2006; 3:10.
654 World Health Organization. External Review: National Malaria Control Programme, Myanmar, 18-28 October. Available from: http://www.searo.who.int/en/Section10/Section21/Section1979_10763.htm.
655 Ministry of Health. National Strategic Plan for Malaria Control in Myanmar 2010-15; 2009.
656 Lengeler C. Insecticide-treated bed nets and curtains for preventing malaria. Cochrane Database of Systematic Reviews 2004, Issue 2.
657 Luxemburger C, Perea W, Delmas G, Pruja C, Pecou B, Moren A. Permethrin – impregnated bed nets for prevention of malaria in schoolchildren on the Thai- Burmese border Transactions of the Royal Society of Tropical Medicine and Hygiene, 2004; 88:155-159.
658 Thang ND, Erhart A, Speybroeck N, Xa NX, Thanh N, Ky P, Hung LX, Thuan LK, Coosemans M, D'Alessandro U. Long-Lasting Insecticidal Hammocks for Controlling Forest Malaria: A Community – Based Trial in a Rural Area of Central Vietnam. PloS ONE, 2009; 4(10):736.
659 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
660 Ibid.
661 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
662 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
663 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
664 World Health Organization. WHO Policy Brief: Global Malaria Programme; Geneva: World health Organization; 2010.
665 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
666 Ibid.
667 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
668 Ibid.

669 Ibid.
670 Ibid.
671 Ibid.
672 Ibid.
673 Ibid.
674 World Health Organization. External Review: National Malaria Control Programme, Myanmar, 18-28 October. Available from: http://www.searo.who.int/en/Section10/Section21/Section1979_10763.htm.
675 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
676 Ibid.
677 Ibid.
678 Ibid.
679 Ibid.
680 Ibid.
681 Ibid.
682 World Health Organization. WHO Country Cooperation Strategy 2008-2011: Myanmar; WHO Country Office for Myanmar: WHO; 2008.
683 The Global Fund. Round 9 Funding Application: Myanmar; 2009. Available from: http://portfolio.theglobalfund.org/Country/Index/MYN?lang=en#.
684 Ibid.
685 Ibid.
686 Cambodian Ministry of Health. National Malaria Control Program Annual Report. Phnom Penh: MoH; 2009.
687 Ibid.
688 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
689 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
690 Ibid.
691 World health Organization. Highlights of the work of the WHO in the South-East Asia region: report of the regional director. WHO Regional Office for South-East Asia. New Delhi: World Health Organization; 2009.
692 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
693 Ibid..
694 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
695 Ibid.
The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
697 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
698 Ibid.
699 World Health Organisation. World Malaria Report 2009. Geneva: WHO; 2009.
700 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
701 Ibid.
702 World Health Organization. WHO Policy Brief: Global Malaria Programme; Geneva: World health Organization; 2010.
703 National Centre of Parasitology, Entomology and Malaria Control. Malaria baseline survey 2004. Phnom Penh: Ministry of Health of Cambodia; 2004.
704 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
705 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
706 The Global Fund. AMFm Phase 1: Cambodia; 2009. See: http://www.theglobalfund.org/en/amfm/funding/?lang=en.
707 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.

708 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
709 Ibid.
710 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
711 National Centre of Parasitology, Entomology and Malaria Control. Malaria baseline survey 2004. Phnom Penh: Ministry of Health of Cambodia; 2004.
712 Cambodian Ministry of Health. National Malaria Control Program 2009 – 2015. Phnom Penh: MoH; 2009.
713 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
714 Ibid.
715 Ibid.
716 World Health Organisation and Partners, A strategy to contain artemisinin resistant malaria parasites in Southeast Asia; 2009. See: http://www.malariaconsortium.org/resistance/the_containment_project.htm.
717 The Global Fund. Round 9 Funding Application: Cambodia; 2009. Available from: http://portfolio.theglobalfund.org/Grant/Index/CAM-S10-G14-M?lang=en.
718 Ibid.
719 Ibid.
720 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
721 National Vector Borne Disease Control Programme. National Drug Policy on Malaria 2008. New Delhi: Ministry of health and Family Welfare; 2008.
722 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
723 Ibid.
724 Ibid.
725 WHO India. Malaria Country Profile India 1995 – 2007; 2007. Available at: http://whoindia.org/LinkFiles/Malaria_Country_Profile-Malaria.pdf.
726 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
727 Ibid.
728 Ibid.
729 Ibid.
730 Ibid.
731 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
732 Prasad H. Evaluation of malaria control programme in three selected districts of Assam, India. Journal of Vector Borne Disease, 2009; 46: 280–287.
733 Ibid.
734 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
735 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
736 WHO [Internet]. WHO South-East Asia Region (SEAR): India. Available at: http://www.searo.who.int/EN/Section10/Section21/Section340_4021.htm.
737 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
738 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
739 Sharma VP. Battling the malaria iceberg with chloroquine in India. Malaria Journal, 2007; 6:105.
740 Prasad H. Evaluation of malaria control programme in three selected districts of Assam, India. Journal of Vector Borne Disease, 2009; 46: 280–287.
741 Ibid.
742 Ibid.

743 WHO India. Malaria Country Profile India 1995 – 2007; 2007. Available at: http://whoindia.org/LinkFiles/Malaria_Country_Profile-Malaria.pdf.
744 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
745 Ibid.
746 Prasad H. Evaluation of malaria control programme in three selected districts of Assam, India. Journal of Vector Borne Disease, 2009; 46: 280–287.
747 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
748 The Global Fund. Round 4 Funding Application: India; 2004. Available at: http://portfolio.theglobalfund.org/Grant/Index/IDA-405-G07-M?lang=en.
749 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
750 World Health Organization. World Malaria Report 2009. Geneva: World Health Organization; 2009.
751 Ibid.
752 National Vector Borne Disease Control Programme . Strategic Action Plan for Malaria Control in India 2007 – 2012; New Delhi: Ministry of health and Family Welfare; 2007.
753 Ibid.
754 Ibid.
755 WHO [internet]. WHO Eastern Mediterranean Regional Office (EMRO). Available at: http://www.emro.who.int/rbm/CountryProfiles-pak.htm.
756 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
757 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
758 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
759 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
760 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
761 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.
762 Ibid.
763 Ibid.
764 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
765 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
766 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
767 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.
768 SoSec Consulting Services. 19 districts Pakistan (draft final report). Islamabad: SoSec Consulting; 2009.
769 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
770 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
771 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
772 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
773 SoSec Consulting Services. 19 districts Pakistan (draft final report). Islamabad: SoSec Consulting; 2009.
774 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.
775 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.
776 SoSec Consulting Services. 19 districts Pakistan (draft final report). Islamabad: SoSec Consulting; 2009.
777 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.
778 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.
779 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.

780 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.

781 Ibid.

782 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.

783 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.

784 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.

785 Ibid.

786 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.

787 Ibid.

788 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolo.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.

789 Ibid.

790 World health Organization. World Malaria Report 2009. Geneva: World Health Organization.

791 Ministry of Health. Pakistan National Strategic Plan for Malaria Control 2010 – 2015; 2010.

792 The Global Fund. Round 7 Funding Application: Pakistan; 2007. Available at: http://portfolio.theglobalfund.org/Grant/Index/PKS-708-G08-M?lang=en.

793 Ibid.