

**Republic of the Sudan**

**National Ministry of Health**

**National Malaria Control Programme**



**Five years Strategic Plan for the National  
Malaria Control Programme**

**Sudan**

**2011 – 2015**

**Khartoum, 2010**

## **List of Acronyms**

ACT	Artemisinin-based Combination Therapy
ANC	Antenatal Care
BCC	Behavioural Change Communication
CBO	Community Based Organization
COMBI	Communication for behavioural impact
CQ	Chloroquine
EPI	Extended Programme of Immunisation
GDP	Gross Domestic Product
GFATM	Global Fund to Fight AIDS, Tuberculosis & Malaria
HIS	Health Information System
HMM	Home Based Management of Malaria
IDP	Internally Displaced Persons
IEC	Information, Education and Communication
IMCI	Integrated Management of Childhood Illness
IMF	International Monetary Fund
IPT	Intermittent Preventive Treatment
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
IVM	Integrated Vector Management
LLINs	Long Lasting Insecticidal Net
NMCP	National Malaria Control Programme
SMCP	State Malaria Control Programme
M&E	Monitoring and Evaluation
MIS	Malaria indicator survey
MoH	Ministry of Health

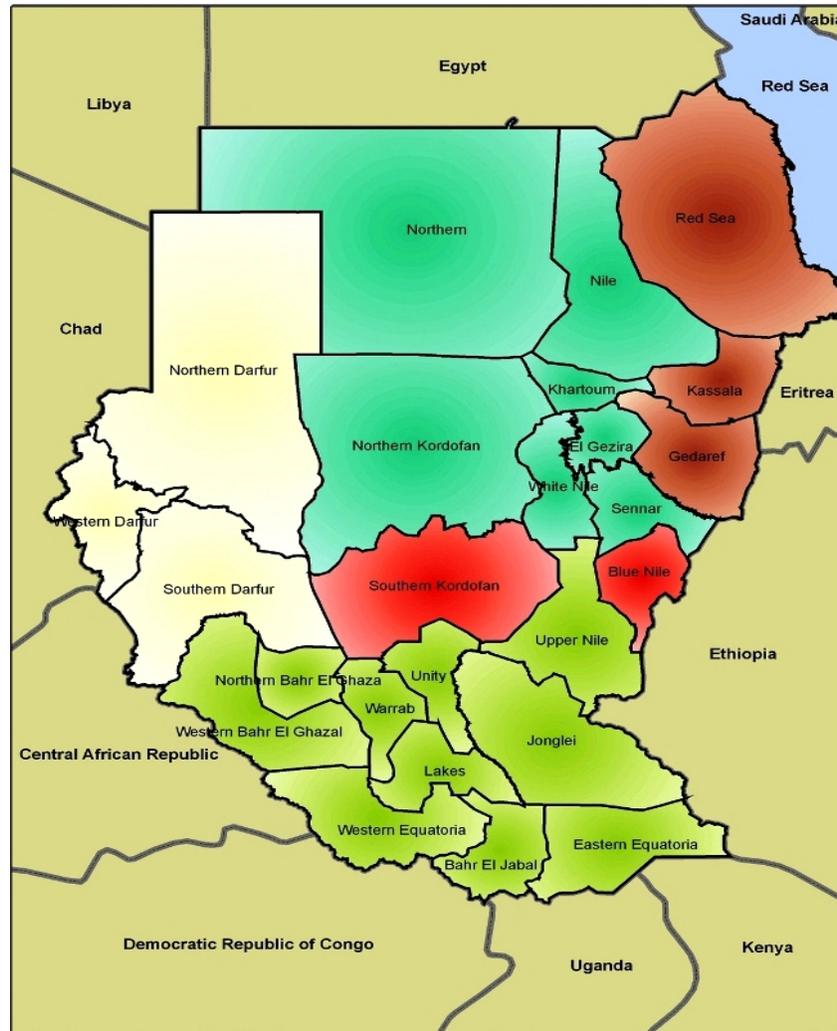
NGOs	Non Governmental Organizations
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
RH	Reproductive health
S&E	Supplies and Equipments
SP	Sulphadoxine-Pyrimethamine
SPR	Slide positivity rate
SUFI	Scaling up for impact
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WHOPES	WHO pesticide evaluation scheme

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# 1 Situation analysis

## 1.1 Country profile



Map no. 1: Map of Sudan

### 1.1.1 Geography and Climate

Sudan is situated in northern Africa, bordering the Red Sea and it has a coastline of 853km along the Red Sea. With an area of 2,505,810 square kilometres (967,499 sq mi), it is the largest country in the continent. It has borders with the following 9

countries: Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Libya and Uganda.

The terrain is generally flat plains, broken by several mountain ranges; in the west Jebel Marra is the highest range; in the south is the highest mountain Mount Kinyeti Imatong, near the border with Uganda; in the east are the Red Sea Hills. The Blue and White Niles meet in Khartoum to form the River Nile, which flows northwards through Egypt to the Mediterranean Sea. Blue Nile's course through Sudan is nearly 500 miles long and is joined by the rivers Dinder and Rahad between Sennar and Khartoum. The White Nile within Sudan has no significant tributaries.

The amount of rainfall increases towards the south. In the north there is the very dry Nubian desert; in the south there are swamps and rain forest. Sudan's rainy season lasts for about three months (July to September) in the north, and up to six months (June to November) in the south. The dry regions are plagued by sand storms, known as haboob.

### **1.1.2 Demography**

Based on the Sudan national census conducted on 2008, the estimated population is 39,154,490 of which 21% is in the southern states. Sudan is composed of 25 states; 15 in the north and the rest in the south. Khartoum, the capital, is situated at the convergence of the White and the Blue Niles.

In the northern and western semi-desert areas, people rely on the scant rainfall for basic agriculture and many are nomadic, traveling with their herds of sheep and camels. Along the River Nile there are well-irrigated farms growing cash crops.

Sudan has the greatest number of displaced persons (IDPs and Refugees) of any single country in the world, estimated at around 4.9 million as per UNDP 2009. The situation in regards to the refugees is as well affected, specially the eastern part of the country. In general, the population of both IDPs and refugees is not stable over time and subject to change according to the situations affecting them.

### **1.1.3 Economic and General Development**

Despite new economic policies and infrastructure investments, Sudan still faces formidable economic problems. Since 1997 Sudan has been implementing the macroeconomic reforms recommended by the International Monetary Fund (IMF). In 1999, Sudan began exporting crude oil and in the last quarter of 1999 recorded its first trade surplus. Increased oil production revived light industry, and expanded export processing zones helped sustain GDP growth. These gains, along with improvements in monetary policy, have stabilized the exchange rate. Agriculture production remains Sudan's most important sector, employing 80% of the work force and contributing to 39% of GDP, but most farms remain rain-fed and susceptible to drought.

The Merowe High Dam, also known as Merowe Multi-Purpose Hydro Project or Hamdab Dam, is a large construction project in northern Sudan, about 350 km north of the capital Khartoum. The main purpose of the dam is the generation of electricity. Its dimensions make it the largest contemporary hydro power project in Africa. Finishing the construction of the dam had served the stability and expansion in electricity supply

The following are important health expenditure and coverage indicators (*years: 2006 & 2007*)

GDP per capita (US\$ exchange rate): 1199

Per capita total expenditure on health (average US\$ exchange rate): 39

Per capita governmental expenditure on health (average US\$ exchange rate): 12

Total expenditure on health as % of GDP: 3.3

General governmental expenditure on health as % of total health expenditure: 29.8

Out-of-pocket expenditure as % of total health expenditure: 70.2

General government expenditure on health as % of total government expenditure: 4.3

Ministry of Health budget as % of government budget: 3

Antenatal care coverage (%): 70 (2006)

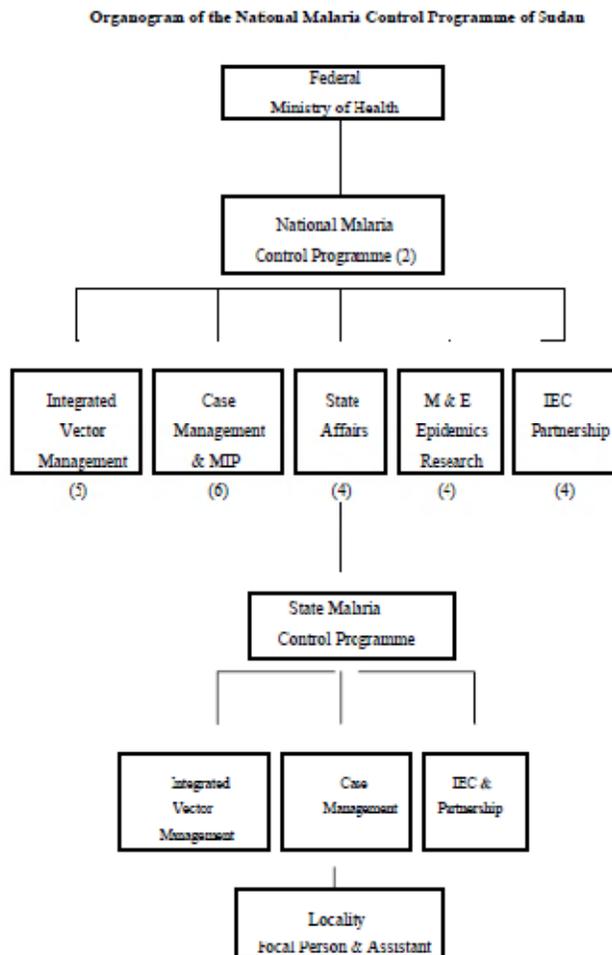
*(Reference: Demographic, Social and Health Indicators for Countries of the Eastern Mediterranean, 2009 by WHO)*

### **1.1.4 Health System and Health Status**

A decentralization process since the mid-1990s has devolved much responsibility for government health system financing and management to the States and localities. The

Federal Ministry of Health (FMOH) is joined by 26 State Ministries of Health (15 of which are in the geographic north of the country). The Federal Ministry of Health is responsible for setting national policies and legislation, intersectoral collaboration, overall supervision and evaluation of the health system, international relations, management of skilled cadres, and quarantine and control of epidemics that is beyond the capacity of state or is of a federal threat. In each state a State Ministry is responsible for administration and financing of the health system and management of higher-level facilities (health centers and hospitals). Within each State there is a number of localities where Health Area Systems are responsible for management of lower-level facilities. Local councils are also responsible for water and sanitation services. In addition to the Ministry of Health structure, some hospitals are managed by the Ministry of Higher Education and the military. Outside the governmental system are privately-run clinics and hospitals.

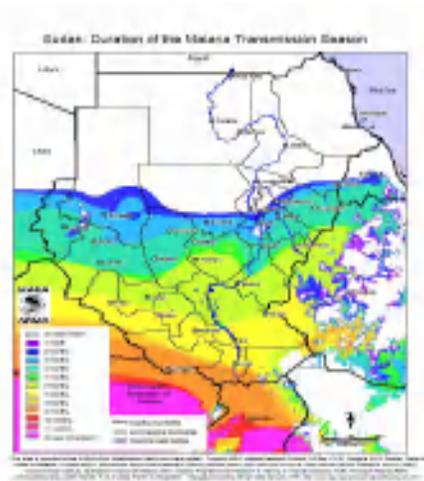
The following organograms show the structure at the NMOH and the NMCP structure at the national and state levels.



There are 5,736 public health facilities managed by the Federal Ministry of Health in northern states of Sudan. Of which, there are 365 general hospitals, 1,573 health centres and 3,778 basic health units (BHU) including dispensaries. The numbers of care providers are 2,716 medical doctors, 1,507 medical assistance and 945 nurses.

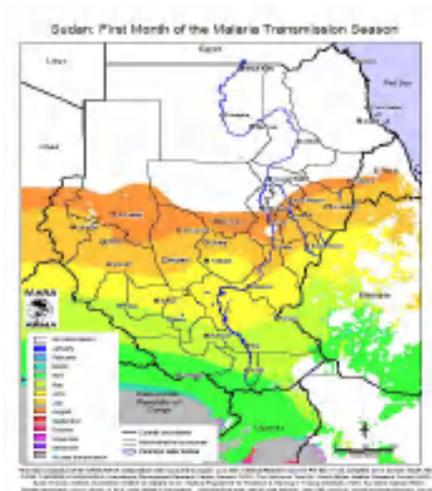
## 1.2 Malaria Situation

### 1.2.1 Epidemiology



Based on climate models, it is estimated that 75% of the population (37 millions) are at risk of endemic malaria, while 25% are at risk of epidemic malaria. Most of the country below north latitude 15° is endemic zone with relatively high transmission in southern states, while parts of the north are exposed to epidemics following the heavy rains or floods from River Nile.

Transmission of malaria in north Sudan south to Khartoum is seasonal and depends on rainfall except in urban cities and irrigated schemes. Sudan's rainy season lasts for about three months (July to September) in the north, and up to six months (June to November) in the south. Hence, the duration of transmission varies from 3-6 months with an average of 4 months, while a longer season is noticed in the southern areas. The transmission season may last from July/August to November/December, with an earlier beginning in June in the southern areas (e.g., Kadugli, El Damazin) and later start in August in northern areas (Wad Medai, Kosti, Kassala, El Obeid) (see the map)



Longer transmission up to 9 months takes place in certain agriculture schemes areas, while the urban cities may have another transmission during winter (December- February ) due to broken water pipes; a clear cut example of man-made malaria

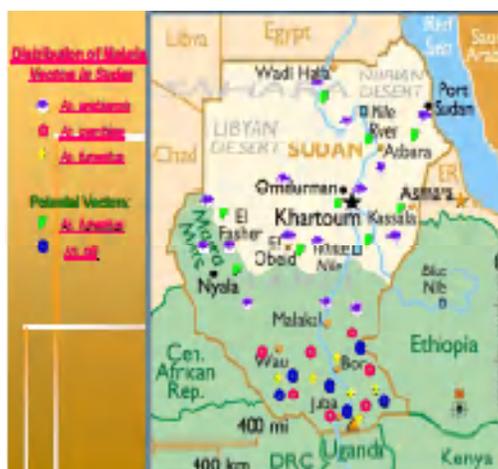
*Plasmodium falciparum* is responsible for more than 95% of malaria cases in Sudan. However, an increase in *P. Vivax* cases has been noticed in the last years. .

*Anopheles arabiensis* is the principal vector all over Sudan besides *An.gambiae*, *An.funestus* which mainly distributed in the south part of Sudan.

## Distribution of major malaria vectors in Sudan:

Over successive decades malaria used to be a major cause of an enormous burden in North Sudan. In north Sudan, malaria used to represent around 21% of the outpatient consultations and around 30% of inpatient admissions.

The remarkable progress achieved over the last decade in general and during the last few years in particular can be demonstrated by comparing the figures of 2001 and those of 2009 as per the next table.



	2001	2009
Reported cases	3,987,702	2,491,376
Reported deaths	2,252	1,142
Estimated cases	7.5 million	3.3 million
Estimated deaths	35,000	9,788

The overall malaria parasite prevalence dropped from 5.4% as per the MIS 2005 to 1.8% in MIS 2009.

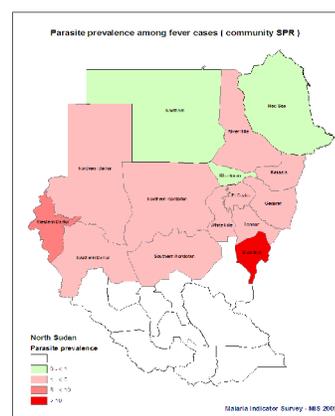
Whereas malaria continues to be a priority health problem in north Sudan, a dramatic change in the disease burden has taken place in recent years as a result of a decade of intensified malaria control efforts. The remarkable success of the 'Khartoum Malaria Free Initiative' which started as a pilot project in 2002 has prompted the expansion of the same strategy to other 3 states e.i. Gezira, River Nile and White Nile. Malaria control efforts in the other states has also been intensified. It is envisaged that almost all the states in north Sudan are expected to approach the pre-elimination stage in the next few years. The significant success in Khartoum state is very encouraging, e.g. the % of malaria cases among the attendants of health facilities has dropped from 20% in

2001 to just 3.3% in 2008 and the parasitological prevalence has dropped from 91 to just 4 per 10,000 population

The results of the recent Malaria Indicator Survey (MIS) – 2009, the a survey that covered all northern 15 states of Sudan, showed that there has been a significant change in the prevalence of malaria. This can be attributed to a lot of factors, e.g. high level of political commitment, setting up and successfully implementing a comprehensive and consistent evidence-based strategy, human resource development in the different fields of malariology in addition to the efficient coordination and cooperation with the different key partners and stakeholders, at national, regional and international levels.

The cooperation with the World Health Organization (WHO), United Nations Development Programme (UNDP), UNICEF, etc, is a clear example. Besides, the remarkable efforts in resource mobilization and fund raising whose prominent the example is the cooperation with the Islamic Development Bank and Global Fund to Fight AIDS, TB and Malaria (GFATM).

The recent MIS in north Sudan showed that the malaria parasite prevalence, determined through community slide positivity rate (SPR) by examining the peripheral blood of 21,988 individuals for malaria parasites, was in the category of (0 - <1) in Khartoum, Red Sea and Northern states, (1 - <5) in River Nile, Kasala, Gedaref, El Gezira, Sennar, White Nile, Northern Kordofan, Southern Kordofan, Northern Darfur and Southern Darfur, (5 - <10) in Western Darfur and lastly (<10) in Blue Nile. None of the clusters in the Northern desert state reported a case of malaria infection. Refer to the next map.



**Map no. 7: Parasite prevalence among fever cases (community SPR)**

### **Reasons for updating the national strategy in 2010:**

Although the current national strategic plan for National Malaria Control Programme in Sudan was set for the period 2007 to 2012, there was a need for updating this plan in the year 2010 upon studying the results of the recent MIS conducted in 2009 and to take the appropriate action based on the new information presented to simply apply the golden principle of ‘information for action’.

The NMCP in north Sudan and taking into account the promising result of the recent Malaria Indicator Survey (MIS) conducted in the 15 northern states in 2009 compared to those results of 2005 MIS (in the 8 states covered by both surveys), decided to review the strategic directions and to take the appropriate decision accordingly. E.g. the great success achieved in most of the states, as proved by the results of this MIS, shed the light on the importance of key strategies namely surveillance, quality assurance, home based management of malaria, scaling up the coverage of some interventions into universal coverage, etc. Annex 1 shows the

comparison between the results of 2009 MIS and those of 2005 MIS in the 8 states included in both surveys.

A task force was formed to review the current strategic plan 2007-2012 and a decision was taken to update this strategy to cope with the recent evidences and information and to step forward in the different strata towards intensive control or pre-elimination according to the epidemiological situation and feasibility of interventions in each stratum.

Updating the national strategy for the period 2011-2015 will definitely contribute to the successful attainment of the millennium development goals (MDGs) in north Sudan by the year 2015.

### **1.2.2 Malaria Control Program**

Sudan has a long history of malaria control activities, dating as far back as the beginning of the 20th century, when very successful interventions based on trained volunteers (the “mosquito men”) and simple vector control strategies led to the near elimination of malaria from many parts of northern Sudan. In contrast, the attempt at malaria eradication in the 1950-60s had very limited success due to managerial, technical and financial constraints. In 1998, Sudan endorsed the international Roll Back Malaria initiative as the organizing principle for its own activities, placing more attention on early diagnosis and prompt treatment and multiple prevention measures.

The National Malaria Control Programme is under the directorate general of Primary Health Care in the organogram of the NMOH and it consists of five main departments headed by the National malaria control programme coordinator. The NMCP has developed state malaria control programme (SMCP) in each of the 15 states and each SMCP consists of three departments (see organogram)

The responsibilities of the national programme are as follows:

- Setting national policies, strategies, and plans for malaria control
- Setting standards, establishing technical guidelines , and quality assurance protocols and systems
- Establishing states’ malaria control units
- Conduct human resource needs assessment and develop capacity building plans for all levels
- Overall supervision & monitoring and evaluating malaria control activities and preparation of national reports .

- Resource mobilization, building partnership and intersectoral and intrasectoral collaboration
- Support control of epidemics of national threats
- Develop, implement and guide applied research activities
- Advocate for malaria control strategies and activities at different levels

The responsibilities of the state programme are as follows:

- Setting plan for malaria control at state level
- Establishing localities malaria control units and strengthen malaria control capacity building at state and localities
- Supervise, monitoring and evaluating malaria control activities at state and localities.
- Strengthen malaria partnership, intersectoral collaboration, and community involvement at state and locality levels
- Advocate and raise awareness in regards to malaria control strategies and activities at state, locality and community levels

Following the adoption of the Regional Committee Resolution (EMRC52/R6) by Member States, integrated vector management (IVM) was endorsed as the strategic approach for the prevention and control of vector-borne diseases. This is a rational decision-making process for optimal use of resources for vector control. One of the recommendations to countries among others was to establish vector control units that will deal with all vector-borne diseases. After a comprehensive vector control needs assessment, Sudan recommended the establishment of an IVM unit within the NMCP to deal with other vector-borne diseases as well. Therefore the structure at the central level is replicated in all the other administrative levels. A national IVM strategic plan was developed as an outcome of the needs assessment. Implementation of malaria vector control interventions is broadly linked to this strategy – among others as a way of using available resources optimally and cost-effectively. Current malaria control interventions

### **1.2.3.1 Malaria vector control and prevention**

Malaria vector control in Sudan has a long history. The main vector control interventions include indoor residual spraying (IRS), the use of long lasting insecticide-treated nets (LLINs), chemical larviciding, environmental management and limited biological control. In recent years, some of these interventions and where they should be applied have been challenged due to reports of vector resistance to certain insecticides. For example the local vector – *An. arabiensis* is highly resistant to pyrethroids in central parts of Sudan. Resistance to pyrethroids has become a challenge for LLINs use in this area as it is the only class of insecticides that can be used for LLINs treatment. The same is for IRS but alternative (bendiocarb for central Sudan) are there with considerable higher cost.

As part of a vector resistance management strategy, bendiocarb was recommended for IRS in central Sudan (Gezira and Sennar states). Due to lack of evidence on the impact of combining IRS (bendiocarb) with LLINs, the strategy deliberately remained silent on the use of LLINs in areas where the vectors were reported resistant to pyrethroids. A study is underway to come up with answers to such questions. On the other hand, implementing the vector resistance management strategy.

#### **1.2.3.1.1 Indoor residual spraying (IRS)**

This intervention is implemented in the following areas of Sudan (Gezira, Elrahad, New Halfa, Suki, Zeidab, and Sugar cane projects) for both malaria control in irrigated schemes and as a protection/response to malaria epidemics. Although this strategy has been in place for many years, the need for regular training/re-training of spray teams and the need for improved supervision are necessary to improve/assure quality.

#### **1.2.3.1.2 Long lasting insecticidal nets (LLINs):**

Implementation of LLINs in Sudan is based on the premise of universal access to all people living in malaria-risk areas. Ideally targetting all those areas of high malaria intensity and then to other areas as resources become available. The aim is to reach the universal coverage (one net for every two persons) goal. Moreover, due to the mandate of the IVM department within the NMCP to address other vector-borne diseases, the presence of malaria is not the only criteria. Where there is evidence that other vector-borne diseases could benefit from this intervention, LLINs have to be introduced and implemented.

As the main vector control intervention, the distribution system is by the MCP staff and their partners through house to house campaigns using communication towards behavioral impact (COMBI) methodology. Attempts to try different methods of LLIN distribution – especially combining with vaccination campaigns has not been successful as a channel for distribution in Sudan. Instead, LLINs could be distributed through routine ANC in collaboration with reproductive health department for pregnant women to maintain/complement regular routine channel. The 2005 MIS showed that 10.2% of the surveyed house holds possess at least one LLIN while only 7.6% of the under five years children were sleeping under LLIN. The most recent 2009 MIS showed that 40.3% of household possessed at least one LLIN and that 34.3% of under-fives were sleeping under any net and 25.3% were sleeping under LLINs. The policy is to replace any LLIN the life of which exceeds 3 years to have it technically functioning.

#### **1.2.3.1.3 Larval control**

The main method of larval control is the use of chemicals – usually Temephos EC 50%. Areas targeted are mostly in urban settings in the big cities and riverine areas, as appropriate. Environmental management is limited to agricultural irrigated schemes through drainage as well as intermittent irrigation. Biological control using larvivorous fish is also implemented on a small scale in the irrigated agricultural areas and constant stagnant big ponds.

#### **1.2.3.1.4 Fogging**

Fogging is not a priority method for malaria vector control. In Sudan, however, this method is being used in urban areas (biting nuisance), in complex emergency areas and during vector-borne disease outbreaks. These include dengue, yellow fever, and Rift valley fever.

#### **1.2.3.1.5 Entomological surveillance**

Since a lot of the vector control interventions rely on the use of insecticides, entomological monitoring – including monitoring for insecticide resistance and residual efficacy (the latter using susceptible laboratory strains) is important. Over years, vector resistance has been monitored in several states with evidence of resistance to organophosphates, DDT and recently to pyrethroids. A combination of entomological inoculation rates (EIR – the product of biting rates and sporozoite infections) and parity determination of parity rates crudely, could serve as a good measure of impact of the interventions. Where this is feasible, it is recommended that it is done routinely. As part of operational research, the biting and resting behaviour should also be monitored – to detect change in behaviour that could compromise the vector control interventions.

### **1.2.3.2 Case Management**

#### **1.2.3.2.1 Malaria diagnosis**

Currently in the main urban centers there are many laboratories performing blood slide examination, while in rural areas diagnosis is presumptive (syndromic approach). There is ongoing functional quality assurance program using 3x3 method. This 3x3 methodology entails three steps assessment, training and supervision. Each steps is composed of other three components e.i. assessment and supervision includes set up, SOPs, and accuracy of the laboratory where training involves basic, refresher and on site training during the visit. Then any laboratory is going to be classified into: A; good, B; accepted, and C; poor. A bachege of solusion is followed based on the assessment result where the supervision aims to check for improvement). However, over the last 3-4 years more than 90% of laboratories use Giemsa- stained thick smears for malaria

diagnosis. Almost all laboratories use the semi-quantitative method (the plus system) to quantify parasitaemia. However training of laboratory technologists, technicians and microscopists on the quantitative method to count the number of asexual stages falciparum malaria parasites per microlitre is indispensable especially in hospitals and health centres to ensure proper monitoring and management of severe and complicated malaria cases. As a result of long and continued efforts, the quality of laboratory service and diagnosis had improved to some extent. Rapid diagnostic tests (RDTs) used to be available only in big cities (by the private sector) and conflict areas (by NGOs). In general their sensitivity and specificity are above 95%. Local study results in Sudan showed that it is stable in field conditions. A reasonable increase in use of RDTs has been noticed with the support from the IDB and the GFATM especially at BHUs level.

In general, 23.1% of the fever cases are seen at private sector while 29.6% of the urban population with fever do so. There is a number of private laboratories that participate in the quality assurance program (3x3 method). None the less, investment towards improving the quality of microscopy and assurance of both microscopy and RDT is a mandate.

#### **1.2.3.2.2 Treatment**

The national drug policy for uncomplicated falciparum malaria was changed in 2004 from mono-therapy to Artemisinin-based Combination Therapy (ACT). This change was based on evidence as studies showed >43% CQ resistance, and high efficacy of ACTs (AS+SP and artemether-lumifantrine).

In 2005 MIS, a few months after the actual implementation of the ACT-based treatment protocol, results showed that ACTs used by 10.5% of the population and still chloroquine (CQ) was used by 65.6% of the population. In the 2009 MIS the use of ACTs was increased to 43.9% but CQ and SP was still being used (13.4%). Recently, ACTs have been availed through GFR2 and UNICEF covering all the

**Table showing the result of drug efficacy studies**

<b>Drug tested</b>	<b>Year</b>	<b>Region</b>	<b>Total failure rate</b>
<b>CQ</b>			
	1978	Central	00.8%
	1989	Eastern	43.0%
	1979-01	Central	49.0%
	2001	Southern	11.5%
	2002-03	All over	32.0-70.0%
<b>AQ</b>			
	2001	Southern	05.9%
	2001	Southern	25.2%
<b>AS+AQ</b>			
	2003	Western	07.3%
	2003	Southern	01.0%
	2003	Western	07.3%
<b>AS+SP</b>			
	2003-04	central	00.0%
	2003	Western	08.8%
	2003	Southern	00.9%
	2004	Eastern	00.0%
	2004	All over	0.0% -0.7%
	2005	All over	0.0% - 5.4%
	2007	B. Nile state	1.5%
	2008	W. Nile and Sennar states	3.9% - 4.0%
<b>ART+LUM</b>			
	2004	Central	00.0%
	2004	<b>Southern</b>	00.0%
	2005	<b>W. Nile state</b>	00.0%
	2006	<b>Gezira and B. Nile states</b>	4.5% - 00.0%
	2007	<b>Kassal state</b>	00.0%
	2008	<b>W. Nile state</b>	9.6%

15 northern states. Besides, the drugs for severe malaria had been distributed free of charge in more than 64 hospitals covering all the patients with severe malaria.

A sentinel surveillance system has been established since 2002 with WHO support involving 6 sites in different parts of the northern states of Sudan for continuous monitoring of the efficacy of anti-malaria drugs.

Home-based management of malaria has been implemented as a policy in areas with relatively high malaria transmission, low coverage of health facilities, poor access to health services, and where other obstacles become a barrier for seeking/accessing health services. Now there are over 425 villages involved in the HMM system for delivering curative and preventive/promotional services all over the country. Situation analysis, KAP survey and pilot projects to assess the feasibility and acceptability of the policy has guided the policy implementation.

#### **1.2.3.2.3 Malaria in Pregnancy:**

Two interventions are recommended for controlling malaria in pregnancy: appropriate case management and LLINs. Pregnant women are treated as part of the general health system (PHC units) according to the "National Protocol for Treatment of Malaria". The strategy is to provide LLIN for any pregnant women in the targeted areas. IPT for pregnant women was used as a policy in areas where risk of malaria is relatively high and prolonged. Recently and with the success in reducing malaria prevalence and incidence this policy became of a lower effect for at the community level.

#### **1.2.3.3 Malaria epidemics**

Most areas of north Sudan are prone to malaria epidemics. During the recent decades, epidemics were reported in Khartoum, Gazira, Sinnar, White Nile, Blue Nile, Al-Gadarif, kassala, Red sea, Northern, River Nile, N. Darfour, W. Darfour, and N. Kordfan states. The main determinants of epidemics are: climatic factors, rains, floods, drought and famine, spread of resistance of *P. falciparum* to

antimalarials e.i. chloroquine, increasing resistance of vectors to insecticides, migration of population from low to high endemic areas, instability in the bordering countries and refugees influx, and establishment of large agricultural projects. Serious malaria epidemics affected Gazira area in 1974 -1975 in the central region. The out cry of the epidemics lead to establishment of the Blue Nile Health Project (BNHP) in 1975 with contribution from Sudan government, WHO, World Bank, Kuwait, Japan and USA. The project includes malaria control as one of its main component. Malaria was successfully controlled for 10 years. The prevalence of the disease was reduce from 25% to < 1% but due to discontinuation of the external funds, control operations were stopped in 1989. Abrupt cessation of control interventions led to malaria epidemic due to reduction of local population immunity, the incidence of the disease built up to appear in dramatic epidemic in 1993 - 1994.

Urban epidemics are well documented in Khartoum State in the years 1981, 1988, 1994 and 1998. A number of factors played role: increased rainfall, spread of irrigated agriculture within the city limits, construction of new urban colonies without proper facilities for drainage, influx of refugees and IDPs, and insufficient supply of drugs.

In Al- Gedarif State epidemic years followed heavy seasonal rains in 1993 and 1998 was reported. An epidemic occurred in 1978 in this state following the war in Ethiopia and the influx of refugees across the border to Kassala and Al -Gedarif states. Epidemics in River Nile State coincided with the heavy floods in 1974, 1988, 1989 and 1994. In the western part of the country and N. Kordofan two epidemics were reported in 1999 due to poor storage of water.

#### **1.2.3.4 RBM Partnership, Coordination and Management**

Sudan, as one of the first countries adopted RBM initiative through the NMCP, has given much attention to partnership. The NMCP has already lined up with an impressive array of partners. As the scale of RBM activities grows, RBM partners will need to be differentiated into distinct partner communities, which are led and

co-ordinated through a top level board or task force coordinated by NMCP. The list of RBM partners includes:

- **UN agencies:** WHO, UNICEF, UNDP
- **NGOs:** over 40 NGOs were part of a forum (Malaria NGOs forum) to coordinate and communicate malaria control issues. Plan Sudan, Goal, and Development Action Now, are good examples.
- **Private sector:** Saving and Development Bank initiated investment in ITNs early. The idea was carried over by the Financial and Investment Bank. Recently Canar, a telecommunication company, contributed considerably in malaria control based on a two years action plan . Other private sectors include: DETASI, Coca Cola, Kenana Sugar Co., Gazera Scheme Board and others..
- **Academic and research institutes:** Blue Nile Research and Training Institutes (Gezira University), Tropical Medicine Institute (Ministry of Science and Technology), Endemic Disease Institute (University of Khartoum), Public Health Institute, Continuous Professional Development centre, and other medical schools, and other related health institutes and schools are well collaborating with the NMCP.
- **Bilateral and cross-border collaboration: the government of Egypt** as part of Gambia Control Project that involves both south of Egypt and north of Sudan is a good example.

#### **1.2.3.5 M&E and research**

A comprehensive malaria survey to assess the impact of selected interventions and to identify the missing base-line data was conducted in 2005 as well as 2009. M&E focal point appointed at federal and states level and trained locally and at the regional level. Reporting forms and charts were revised, simplified, standardized and distributed to the selected sentinel sites and the training on database was planned.

There is a research department at national level. The department facilitates the collaboration with research institutes and researchers in addition to monitoring of the research studies carried out by the NMCP staff. During the period 2001-2009, more than 35 operational researches were conducted by the NMCP staff. The results of these studies were utilized for the improvement of the ongoing practice, e.g. changing the drug policy to ACTs .

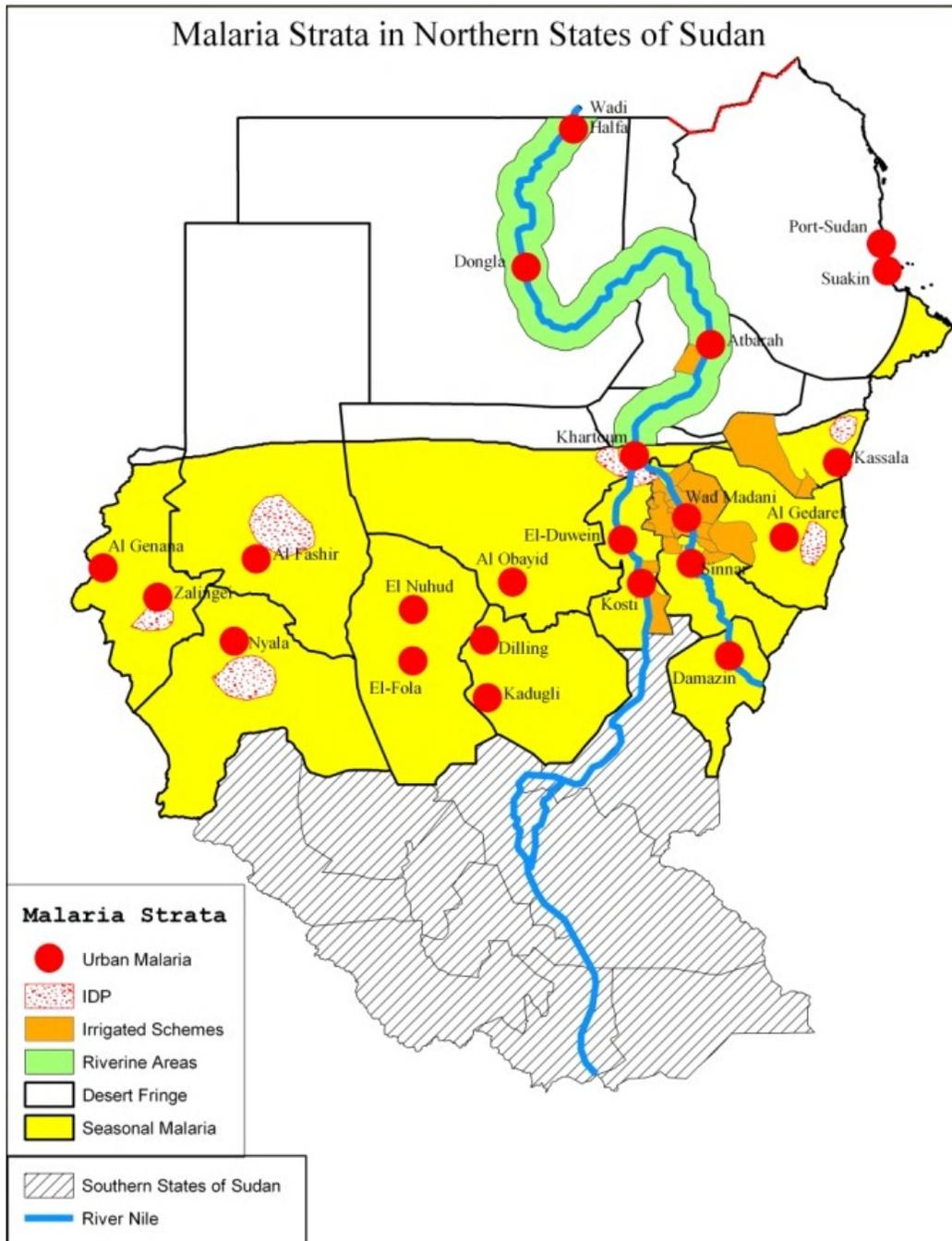
## 2 Stratification

Operation stratification of malaria in northern Sudan was based on climatic condition (mainly rainfall), Hydrologic condition related to River Nile, Population displacement, movement and activity. Based on that 6 Strata were identified in the northern states.

Endemicity, population, states and the suitable interventions for each of the 6 main strata are seen in the table below:

Strata	Transmission/ Risk	Population	Areas	Main Technical Interventions
Desert fringe	No transmission, malaria free	654,923	Desert fringe area in the north above Latitude 15 <sup>0</sup> <b>except</b> cities, Riverine areas, irrigated scheme in River Nile State and delta Tokar in Red Sea	Case management, entomological/ parasitological surveillance
Riverine areas of north Khartoum	Epidemic prone seasonal unstable related to floods , dams	1,576,860	Area about 20 Km on both sides of River Nile above Latitude of 15 <sup>0</sup>	Epidemic Early warning, early detection and rapid response. Case management, entomological monitoring, Larviciding as appropriate
Seasonal malaria	Seasonal , low to moderate risk	14,590,161	Rural areas other than irrigated schemes in Greater Darfour, Kordofan, Blue Nile, White Nile, Sinnar, Gezira, Gedarif, Kassala and Khartoum	Case management, LLINs, Epidemic Early warning, early detection and rapid response
Urban malaria	Seasonal transmission with low risk	9,461,161	Khartoum and all large cities e.g. Port Sudan, Wad Medani....	Case management, environmental management, Larviciding and Epidemic Early warning, early detection and rapid response .
Irrigated Schemes	Seasonal transmission	3,679,340	All large- scale irrigated schemes (Gezira, Elrahad, Kinana, Asalia, West	Case management, IRS, LLINs, Epidemic Early warning, early detection and rapid response

	from 6-9 months with low to moderate risk		Sinnar, New Halafa and Elzidab, Suki, Khashm Elgerba)	
Emergency and complex situation	Epidemic prone or seasonal transmission	3,153,720	IDP and refugees (the number is as per 2007 and is subject to change)	Case management, LLINs, Epidemic Early warning, early detection and rapid response



### **3 Malaria control strategies**

The National Malaria Strategic Plan( 2011-2015 ) is aiming to provide a common platform and description of interventions for all NMCP partners. It also encourages all partners to be engaged in malaria control with common strategies and objectives, i.e. one plan, one implementation and coordination mechanism and one M&E plan.

#### ***3.1 Vision:***

The vision of NMCP is the reduction of malaria–related morbidity and mortality in a way that Malaria is no longer a public health problem that hinders the socio-economic development in the country. This will contribute to the attainment of the MDGs by the year 2015.

#### ***3.2 Mission:***

The mission of the NMCP is to sustain the strong political commitment and partnerships at all levels that will all together ensure the scale up of delivery and use of evidence based and cost effective malaria control interventions within the context of scaling up for impact (SUFI).

#### ***3.3 Goal:***

To contribute to the improvement of the health status in northern part of Sudan through reduction and prevention of morbidity and mortality associated with malaria

#### ***3.4 Objective:***

The objective of NMCP Strategic Plan 2011-2015 is ***to reduce the morbidity and mortality of malaria by 50% by 2015 all over the northern Sudan (compared to reported cases in 2009).***

Due to the success story in Khartoum this updated Strategic Plan envisages certain areas (Northern, Red Sea, River Nile, Gezira, White Nile) aiming malaria free

status where the overall commitment, financing and health system potential indicate higher potential for significant reduction of local malaria transmission with ultimate goal of malaria elimination: the objective for such selected areas will be:

***By 2015 reported malaria incidence, with 100% laboratory confirmation of malaria diagnosis, will be reduced by at least 80% as compared to 2009 and will reach the level of 10 cases per 1 000***

### ***3.5 Strategic Directions***

#### **3.5.1 Prompt and reliable diagnosis and effective treatment:**

Prompt and effective treatment of malaria remains a key intervention in reducing the burden of disease and death from malaria. The challenge to providing adequate treatment is weak health systems that are unable to deliver timely diagnosis and treatment, especially to remote and underserved populations.

Sudan will ensure the availability of quality artemisinin-based combination antimalarial therapies as well as the effective antimalarial drugs for severe and complicated cases in public health care facilities. The NMCP will work with public and private practitioners to ensure that they comply with national treatment policies and guidelines.

Sudan is a member of Horn of Africa Network for Monitoring Antimalarial Treatment (HANMAT). The country will maintain the sentinel surveillance system to monitor parasite resistance to first-line and second-line drugs as well as testing potential new malaria treatments, using in-vivo methods , and will introduce the use of other methods as relevant ( in-vitro and molecular markers )

Home-based management of malaria (HMM) is now being implemented as a policy to improve the practice at home and community by training and providing medicines.

Confirmation of malaria diagnosis will be expanded by improving coverage and quality of both microscopy and RDT use at all levels, putting no chance for clinical malaria diagnosis at least at health facility level. . All efforts will be made to increase access to laboratory-based diagnosis. Rapid diagnostic tests will be deployed basically at BHUs and at community level (for HMM) where microscopy may not be cost effective and for outbreak investigation. Quality assurance of both microscopy and RDTs will be promoted at all levels of the health sector.

**Outcome targets:**

- By 2015, 95% of malaria patients in all the northern states will receive prompt and effective treatment as per the national treatment policy
- By 2015, 90%–of patients with uncomplicated malaria will be correctly managed at health facilities
- By 2015, 90% patients hospitalized with a diagnosis of severe malaria will be managed according to the national treatment policy

**Output targets:**

- By 2015 , 90% of laboratories functioning according to national guideline
- By 2015, 80% of health facilities able to confirm malaria diagnosis according to the national policy (microscopy, rapid diagnostic test)
- By 2015, Quality Assurance system for malaria microscopy will be implemented in all states' reference laboratories
- By 2015 95% of health facilities will report no stock outs of recommended anti-malarial drugs continuously for one week during the last 3 months
- By 2015, 95% of health facilities will provide free antimalarial drugs according to national treatment policy

- By 2015, at least 65% of population targeted by HMM will have access to quality anti-malaria drugs through this strategy

### **3.5.2 Effective prevention measures within the framework of IVM**

The strategy will focus on universal access to the main vector control interventions within the IVM framework. In areas targeted for indoor residual spraying the emphasis will be to make sure that spraying teams are well trained. Supervision will also be strengthened for record keeping and reporting as well as to ensure high level of coverage and quality. The implementation of LLINs, on the other hand, will aim at population coverage of targeted areas for community-wide protection. The MOH will also provide an enabling environment for private sector involvement in distributing LLINs especially in urban areas. Where it is feasible, larval control using chemicals (Temephos), environmental management and biological control agents will be promoted. Entomological surveillance – including monitoring of insecticide resistance will form part of the monitoring and evaluation.

#### **Outcomes targets:**

- To provide appropriate prevention measures for at least 90 % of targeted population in at risk areas by 2015
- By 2015, 90% of the population in at risk areas will report having slept under an LLIN the previous night

#### **Output targets:**

- By 2015, 90% of the population in at risk areas will have access to LLINs

- By 2015, malaria control programme will be able to provide quality IRS with at least 85% coverage for at least –85% of targeted localities
- By 2015, all states will have at least one trained and well-equipped team for entomological surveillance
- By 2015, 85 % of targeted breeding sites for larval control will be managed with appropriate intervention

### **3.5.3 Detection and control of malaria epidemics**

The NMCP established a unit for malaria surveillance, epidemics prevention and control at central level. A contingency plan for epidemic preparedness, forecasting and rapid response is set and the relevant trained teams are formed in each state. The teams include staff from all relevant sectors. The activities for epidemic prevention and control include the following: intersectoral coordination to reduce major water collections through mechanical interventions (source reduction), ~~and~~ raise community awareness for immediate support and participation, sentinel surveillance sites for early detection and preparedness to monitor relevant indicators on weekly basis (number of malaria cases, deaths, rise in fever cases especially in areas lacking adequate laboratory services and meteorological indicators or climatic changes), availing adequate buffer stocks of drugs, laboratory supplies; including RDTs; insecticides, LLINs and vector control needs, as well as improving malaria diagnosis and treatment services.

#### **Outcome target:**

- By 2015, 80 % malaria epidemics will be detected and properly responded to within 2 weeks of onset

#### **Output target:**

- By 2015, all states will have updated epidemics control plan and epidemics stocks

- By 2015 all epidemic detection sentinel sites will have trained staff for detection, reporting and control of epidemics
- By 2015, 100 % of sentinel sites will have epidemics detection charts and weekly reporting during transmission season

### **3.5.5 Strengthening of the malaria control programme**

#### **Objectives:**

The main objective of this section is to build the capacity of the programme at all levels (national, state, locality, and the community) to enable it tackling the leading role in the malaria control efforts both technically and logistically. This involves human resources capacity building, establishing/strengthening administrative and supply systems, provision and maintaining a well addressed assets, and communication and transportation facilities that enhance good job performance, productivity and satisfaction

#### **Output target:**

- By 2015, 100% of the annually allocated budget for malaria control will be received by NMCP and SMCP
- By 2015, -each of the State Malaria Control Programmes will have at least 4 personnel trained
- By 2015, all malaria programmes at locality level will have at least 4 trained staff on different aspects of malaria control
- By 2015, all localities will have adequate warehouses with appropriate storage condition for malaria commodities

- By 2015, all MCPs at state and locality levels will be capacitated to the level that could maintain the administrative and communication network running on
- By 2015, local communities will have a great role and participation in implementing as well as advocating for malaria interventions

### **3.5.6 Malaria surveillance, M&E and Operational research**

Special priority will be given to strengthening the malaria information system, as part of integrated disease surveillance to provide the information necessary for planning and management of control activities. Sentinel surveillance systems will be supported for monitoring resistance of malaria parasites to antimalarial drugs, resistance of malaria vectors to various insecticides, and of course sentinel sites for epidemic detection. Design of a national malaria database with geo-referenced information using simple GIS application is foreseen.

Monitoring and evaluation system will be strengthened to measure availability and distribution of antimalarial medicines and LLINs, scaling up the coverage of key interventions for malaria prevention and management as well as measuring the trends in malaria morbidity and mortality. Periodic prevalence and coverage surveys will be conducted for measuring outcome indicators and estimating impact, and health facility surveys for measuring output and process indicators for malaria services delivered at health facility level. Research priority will be ranked towards policy and health system research as well as the applied research. The MCP staff at all levels will positively contribute to researches in the field of malaria, communicable and Vector borne diseases control.

#### **Output target:**

- By 2015, 100% of localities will provide monthly quality reports and feedback using standardized system
- By 2015, national malaria database will be implemented in all states and at least 85% of localities

- By 2015, all states will have a functional M&E unit with an updated M&E plan
- By 2015 information on malaria burden and coverage of interventions will be updated using a national malaria parasite prevalence and coverage indicator surveys
- As per the past experience, the national malaria control programme will use the evidence from research to guide the programme policy and activity implementation

### **3.5.7 Partnership and private sector**

The NMCP will strengthen and develop innovative mechanisms to ensure intersectoral and intrasectoral coordination, and community participation. The NMCP will increasingly emphasize cooperation with other health programmes such as EPI, IMCI, antenatal care services, laboratory services, epidemiology and surveillance services, and health information systems. The programme will maintain its partnership and strengthen its cooperation with all national and international partners such as United Nations agencies, nongovernmental organizations, research and training institutes, and other technical and implementation partners. Maintaining cross-border coordination and expansion of similar coordination mechanisms to other neighbouring countries is crucial. Partnerships between the public and private sectors will be emphasized as an important vehicle for achieving the stated malaria goal and objectives. Media and schools always have an important role to play in rolling back malaria in Sudan.

- By 2012, the MCE (malaria control and elimination) network at national level will be fully functioning at the national level.
- By 2015, the MCE network members other than public sector will be implementing at least 35% of malaria control activities

## 4 Programme management

### *4.1 Creation of awareness, demand and appropriate use:*

Advocacy efforts are needed at national, state and locality levels to ensure:

- Financial and programmatic support for malaria control interventions
- Appropriate treatment seeking behaviours
- Demands for services and products
- Utilization of services

The advocacy activities will be part of any intervention. There is a need to develop advocacy products and messages. The delivery methods also need to be considered carefully. A suitable methodology needs to be selected from the following: communication for behavioral impact (COMBI), behavioral change communication (BCC), conventional IEC, Radio, inclusion of consumer-good packaging, ....ect.

### *4.2 Delivery system:*

The NMCP will work through the state malaria control programmes (SMCP) to deliver services to beneficiaries. So delivery of services will be solely the responsibility of the state level down to the level of the localities.

The case management related activities are and will continue to be part and parcel of the primary health care. Drugs will be distributed through the ongoing system. This is based on the Central Medical Drug Supply and the Revolving Drug Fund with full coordination and responsibility of the procurement and supply system (PSM) unit at the general directorate of pharmacy. Quality will be ensured and assured. Chargeable drugs will be availed and distributed through and to the private sector.

Vector control activities will be delivered as part of the integrated control of vector-born diseases diseases which is part of the district health system. Mosquito nets for free distribution will be distributed mainly through campaigns at locality level directly to the end benefeciaries/communities. Other distribution outlets include distribution through the expanded programme of immunization (EPI) & reproductive health (RH) services' channels.

There is a need always for the advocacy activities to be community-based through the involvement of community-based organizations, school children, NGOs, religious/community leaders, community health volunteers, etc...

### ***4.3 Financing:***

The NMCP will work to mobilize adequate financing for malaria control and pre-elimination. Sustainable financing requires guaranteed funds from all sources combining domestic and external funds which include those provided by the Sudanese government, GFATM, World Bank, Bilateral agencies, UN agencies, NGOs, private companies, Islamic Development Bank ... etc

The over all estimated budget for this strategic plan is US\$ 514,516,195. This budget is expected to be covered by different partners .

Plus the government contribution

The Table below provides crude estimation per intervention area in US\$ for the whole period 2011-2015

<b>Strategic intervention</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>Total</b>
<b>Effective case management</b>	22,883,638	24,781,271	24,211,530	23,186,612	21,284,047	116,347,098
<b>Integrated vector management</b>	68,441,819	70,390,635	70,376,914	70,361,092	71,711,375	351,281,835
<b>Epidemic preparedness &amp; response</b>	3,511,202	3,223,631	3,271,336	3,361,947	3,394,337	16,762,453
<b>Capacity building</b>	3,815,953	4,798,891	4,358,216	4,290,810	4,126,181	21,390,051
<b>Home based management of malaria</b>	378,204	475,205	476,508	556,831	522,227	2,408,975
<b>Developing the quality assurance and control system</b>	726,327	823,302	824,502	878,391	573,261	3,825,783
<b>Surveys</b>	900,000	0	700000	0	900,000	2,500,000
<b>Total</b>	<b>100,657,143</b>	<b>104,492,935</b>	<b>104,219,006</b>	<b>102,635,683</b>	<b>102,511,428</b>	<b>514,516,195</b>