Documentation of Khartoum and Gezira Malaria Free Initiative

Prepared by

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Executive summary

Sudan's health infrastructure has been severely affected by 20 years of conflict. This has resulted in increased incidence of infectious disease, increased maternal mortality, high infant mortality and increased reliance on unregulated private sector health care providers.

Recent figures from the Ministry of Health suggest that there are approximately 7.5M cases of malaria in Sudan each year, more than 90% of which are caused by the potentially lethal *Plasmodium falciparum.* Malaria accounts for 20-40% of outpatients and about 30% of inpatients. It is thought to be responsible for 35,000 deaths annually (that is 70% of the deaths attributed to malaria in the Eastern Mediterranean Region).

The Malaria Free Initiative (MFI) of Khartoum and Gezira States was established in order to demonstrate the potential of modern malaria control measures. While the goal was to reduce morbidity and mortality due to malaria, the overall aim was to develop a strong political commitment to malaria control nationally and to attract funding for the expansion of the MFI to cover more endemic areas of the country in future, thus reversing the deterioration that has occurred over the last 20 years.

Khartoum and Gezira States were chosen as the ideal sites for this initiative: The recent influx of people displaced from hyperendemic and holoendemic regions in the south of the country meant that the epidemic risk in this area of unstable seasonal malaria transmission was unusually high; Khartoum was formerly malaria free and malaria was once firmly under control in Gezira suggesting that the goals set by the MFI were likely to be achievable; The high population density (more than 35% of the population in just 2 out of Sudan's 26 States) meant that the intervention was likely to be very cost effective; and, Khartoum is the Capital City and has considerable potential as a tourist venue. Health interventions here were therefore considered likely to initiate strong political support.

The approach that was adopted was in line with plans developed under the Roll Back Malaria (RBM) movement. It involved the application of proven malaria control strategies based on three strategic priorities:

- diagnosis & treatment
- prevention
- epidemic surveillance

And a fourth conditional priority (upon which all the other priorities depended):

- strengthening staff capacity.

Community participation, intersectoral collaboration and monitoring & evaluation were all crucial underlying principles for the plan.

The MFI was launched in 2002. Although the initiative is only in its second year of implementation, already major achievements are apparent. These are

particularly evident in the case of programme management: Dedicated offices have been established at central and peripheral levels, target staffing levels have been achieved and essential equipment and supplies have been procured. In addition, activities have been decentralized to localities and sub-localities according to plan. Quality training has been provided to staff at all levels and staff morale and staff commitment have both been massively increased (with staff turnover reduced from annual to near zero).

At the same time strong political support has developed both at State and at Federal level. A strong public relations effort on the part of MFI managers has already raised the profile of the National Malaria Control Programme to a very high level.

The MFI has resulted in formerly unprecedented levels of inter-sectoral collaboration with a number of Ministries and government departments playing active and crucial roles in the initiative.

Although the MFI was only recently launched and the development of appropriate epidemiological indicators is still underway, early indications suggest that the programme is having a positive impact on the malaria situation in target areas.

Unfortunately WHO's global budget for RBM has recently been slashed by almost 75%, throwing the future of the MFI into question (despite strong high-level support from within WHO-EMRO).

The government of Sudan has allocated $5.1m and WHO has allocated $3.6m to support the initiative for the next four years, but this still leaves a shortfall of nearly $3.5m. Funds are needed immediately in order to prevent this innovative and promising initiative from folding before its full benefits can be felt.

This funding gap offers a rare opportunity for new donors to support a well established pilot project which already seems set to act as a pathfinder for similar projects throughout Africa and EMR.

Malaria and its control in Sudan

Overview of current situation

Sudan is the largest country in Africa with an area of 2.7 million km^2. The country is a Federal Republic made up of 26 States. These are divided into 112 Provinces which are further divided into 614 Localities.

The population was estimated to be 31.9 million in 2001 (based on the 1993 census) and is unevenly distributed with the highest density along and between the great rivers (the Blue Nile, White Nile and Main Nile) and in the riverine irrigated areas. 35% of Sudanese live in Khartoum and Gezira States which lie at the confluence of the three rivers, in central Sudan.

The annual growth rate of the population is estimated at 2.7%. Children under the age of five years comprise 16% and children aged 0-14 years comprise 44% of the total population. Women of childbearing age make up 28% of the population. Total fertility rate is 6.05 children. The infant mortality rate is 108 per 1,000 live births and the under-5 mortality rate is 157 per 1,000 live births. The maternal mortality rate is 365 per 100,000 births. Life expectancy (1998) is 56.1 years. The literacy rate is 53% (males 66%, females 41%).

Land use in Sudan is classified (according to rainfall and proximity to the rivers) into desert (34%), semi-desert (20%), forest (35%), agricultural land (7%) and wetland (1%).
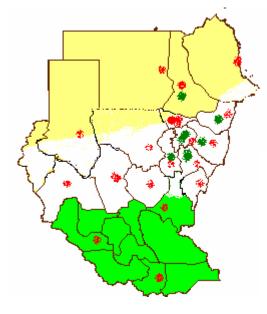
The effects of twenty years' war, compounded by drought and famine, have had a profound impact on all aspects of development in Sudan, not least health. Over the 1990s the health infrastructure crumbled leading to an upsurge in communicable diseases including malaria.
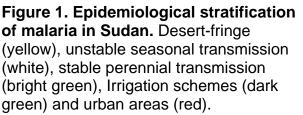
Major population movements have been an important feature of the troubles. Recent migration from rural southern states to urban areas in central Sudan has resulted in15% growth in many towns. Large poorly planned settlements with very limited services now surround many larger cities. This development is of particular concern in relation to malaria as it has meant an influx of people from sparsely populated hyperendemic or holoendemic areas in the south to highly populated epidemic prone hypoendemic or mesoendemic areas in central regions.

Malaria Burden

Malaria is the leading cause of morbidity and mortality in Sudan. The annual number of malaria cases is estimated at 7.5 million accounting for 20-40% of the total outpatient attendance as well as approximately 30% of the in-patient attendance at hospitals. The annual number of deaths from malaria is estimated at 35 000, representing about 70% of malaria deaths recorded in the Eastern Mediterranean Region. *Plasmodium falciparum* accounts for approximately 90% of clinical malaria incidence and practically all mortality.

Virtually the whole population of Sudan is considered to be at risk of malaria although the epidemiology of the disease varies markedly according to location: In northern and most of the central States of Sudan, including the States of Khartoum and Gezira, malaria is hypo- or mesoendemic. In these areas the

Figure 1. Epidemiological stratification of malaria in Sudan. Desert-fringe (yellow), unstable seasonal transmission (white), stable perennial transmission (bright green), Irrigation schemes (dark green) and urban areas (red).

malaria situation is unstable and epidemic outbreaks are common. In the States of Southern Darfur, Western Kordofan and Southern Kordofan, malaria is predominantly mesoendemic but there are hyperendemic areas along their southern fringes. In most of these areas malaria incidence follows a seasonal pattern, with the peak during the later part of the rains. In the Red Sea State an additional peak towards the end of the year is usual. In Gezira State another peak associated with seasonal irrigation occurs early in the year. In the nine southern States malaria is hyper- or holoendemic and transmission is perennial. The dominant malaria vector in hypo- and mesoendemic areas is *Anopheles arabiensis* whilst in hyper- and holoendemic areas *A.gambiae* sensu stricto (rainy season) and *A.funestus* (dry season) are generally responsible for transmission.

Table 1. Epidemiological strata by endemicity, population, vector and intervention of choice.

Strata	Endemicity	Population	Vector	Selected Interventions
desert fringe	hypoendemic	2,000,000	*Anopheles arabiensis*	Case management, ITMs, source reduction where appropriate (with community involvement), IRHS during emergency
unstable seasonal transmission	hypoendemic mesoendemic	15,000,000	*Anopheles arabiensis*	Case management, ITMs, IRHS during emergency
stable perennial transmission	hyperendemic	4,000,000	*Anopheles gambiae Anopheles funestus*	Case management, ITMs and IPTs.
irrigation schemes	usually in mesoendemic zones	2,000,000	*Anopheles arabiensis*	Case management, ITMs, targeted IRHS, IPTs, source reduction where appropriate (with community involvement) during emergency
urban malaria	hypoendemic mesoendemic	8,000,000	*Anopheles arabiensis*	Case management, ITMs, source reduction where appropriate (with community involvement), larviciding, IRHS during emergency

History of malaria control in Sudan
Malaria control in the Sudan has a relatively long history. Early in the 20th Century, shortly after Ross discovered of the vectorial role of anophelines in the transmission of malaria, environmental sanitation and management were introduced for the protection of larger urban centres throughout the country. At the same time a growing health infrastructure brought treatment within reach for an increasing number of people. Environmental management was also the main tool of malaria control when agricultural irrigation was introduced on an internationally unprecedented scale in 1928 (Sennar Dam and Gezira Irrigated Area). Larviciding with diesel oil in the lake area and sensitive spots in the canal and irrigation areas, as well as strict adherence to irrigation cycles and immediate attention to leakages were the mainstay of very effective mosquito control. After the Second World War, insecticides were introduced that permitted both crop protection and malaria control, the latter in the form of house spraying.

In 1954 an attempt at malaria eradication was initiated. The project relied on combined curative and preventive measures including the extensive use of DDT. Initial results were encouraging at least in meso-endemic areas but by 1964 managerial, technical and financial constraints were having a bad impact on eradication efforts. Insecticide resistance was first noted in 1966 and by the early

1970s there were frequent malaria epidemics. Following political and financial instability and the global change in the priority status of malaria prevention from eradication to control in the 1970s, malaria incidence in the country started to rise, reaching a peak in 1984 and maintaining from then on a substantial malaria profile significantly above earlier levels.

In central Sudan this deterioration led to a public outcry and in 1978 the Blue Nile Health Project was established with support from WHO, WB and the governments of Kuwait, Japan and the USA. Malaria was successfully controlled in the project area for 10 years before funding was withdrawn in 1989. The project had placed little emphasis on sustainability and the gains of the 1980s were soon lost, culminating in a major epidemic in 1993-4.

It was only in 1998/1999, after the launching of the Roll Back Malaria Initiative, that malaria control regained the priority status that it clearly warrants in Sudan.
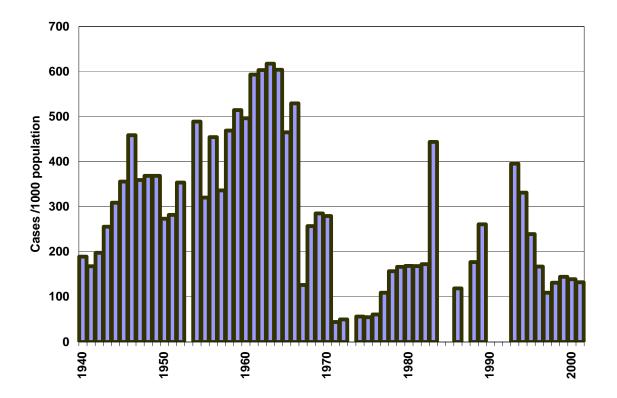
Figure 2. Incidence of malaria in Sudan: 1940-2001.

Note: Zero values indicate missing data.

Following a serious aggravation of the malaria situation in the early and mid-1990s, the Government of Sudan decided that malaria control must be a priority and the country joined the "Roll Back Malaria" initiative.

In 1998/1999 the foundations were laid for the creation of a functional malaria control body at the federal level and several State level units were established. From 2000 onwards, efforts were initiated to develop a comprehensive malaria control programme in three priority States including Khartoum and Gezira. In other States efforts were made to improve surveillance and to strengthen technical capacity.

The current National Malaria Control Programme is under the directorship of the Director General of the Malaria, Schistosomiasis and Leishmaniasis Control Programme. The Federal Office of the National Malaria Control Programme has a professional staff of 42 and eight departments which cover vector biology and control, control of epidemics, quality assurance, treatment and drugs, training and research, multiple prevention, State affairs, and administration and finance.

Modern Health services in Sudan
The curative part of the health care system of Sudan is composed of 274 hospitals with 22,656 beds (18 of these hospitals are under federal and 256 under State management). There are 693 health centres (most of them now with a medical officer), as well as 1,468 dispensaries, 1,442 dressing stations, and 2,729 primary health care units. The staff of the curative health services comprises 4,992 medical doctors, 306 pharmacists and 6,193 medical assistants. The staff of the environmental health services includes 365 public health inspectors and officers, 917 sanitary, overseers, and 1,473 assistant sanitary overseers. Moreover, there are 2,433 technical staff in curative and environmental health services (mostly laboratory technicians and microscopists in 1,755 laboratories).

The Sudan has 7 Medical Schools, the largest of which are located in Khartoum and Wad Medani (Gezira State). Training of Medical Assistants is Federal- and State-based.

The private health care sector consists almost exclusively of doctors and medical assistants who are Government employees and run private clinics in their spare-time. Private hospitals are rare and practically restricted to Khartoum State.

Current Malaria Control Measures in Sudan
Current malaria control efforts in Sudan are based on the principles developed under the *Roll Back Malaria* Initiative:

Diagnosis:
In the majority of public health facilities the diagnosis of malaria is still based on clinical signs. Only in the three priority areas of Khartoum, Gezira and White Nile States is the principle of treatment based on microscopic diagnosis being broadly

applied and in these areas a quality control system based on cross-checking slides at a central reference laboratory is under development.

In other areas microscopic diagnosis of malaria is still largely confined to hospitals and major health centres. Microscopic diagnosis in public health facilities is based on Giemsa staining whereas in the private sector the far less reliable Field's stain is the norm.

Treatment:
Treatment in the public health services generally follows the "National Protocol for Treatment of Malaria" (a booklet is available in all facilities). At present the public system still uses chloroquine as the first line, and sulfadoxine-pyrimethamine as the second line drug for uncomplicated falciparum malaria. However new treatment guidelines have recently been developed and the firstline treatment is to change to a combination of artesunate and sulphadoxine-pyrimethamine. Patients with severe or complicated falciparum malaria are referred to hospital, where the treatment consists of quinine by the parenteral route, followed later by oral quinine when the patient is able to swallow and retain the drug. Due to the cost of infusion fluids, the drug is often given by the intramuscular route.

Malaria diagnosis and treatment are paid by the patient (according to the cost-sharing doctrine). This discourages people from seeking care at government health facilities and encourages self-treatment which is often inappropriate or under dosed.

Vector control:
Vector control operations in the priority areas are largely based on the use of focal spraying of residual deltamethrin or permethrin in houses. Guidance for the deployment of these measures will be derived increasingly from the early warning system currently under development by the federal and State malaria control services. Breeding place abatement by environmental sanitation is expanding slowly. The irrigation ordinance of Sudan stipulates intermittent irrigation in all Government and private irrigation schemes. This ordinance is generally followed meticulously.

ITNS:
The use of insecticide treated nets (ITN) is still quite restricted, but active steps are being taken to identify suppliers of suitable low-cost nets. In an effort to promote uptake the Government has accorded tax-exemption for the importation of nets.

Rationale behind the Malaria Free Initiative

The Malaria Free Initiative (MFI) of Khartoum and Gezira States was established in order to demonstrate the potential of modern malaria control measures. While the goal was to reduce morbidity and mortality due to malaria, the overall aim was to develop a strong political commitment to malaria control nationally and to attract funding for the expansion of the MFI to cover more endemic areas of the country in future, thus reversing the deterioration that has occurred over the last 20 years.

Targeting

Khartoum and Gezira States were chosen for a number of reasons: The recent influx of people displaced from hyperendemic and holoendemic regions in the south of the country meant that the epidemic risk in this area of unstable seasonal malaria transmission was unusually high; Khartoum was formerly malaria free and malaria was once firmly under control in Gezira suggesting that the goals set by the MFI were likely to be achievable; Their high population density (more than 35% of the population in just 2 out of Sudan's 26 States) meant that the intervention was likely to be cost effective; and, Khartoum is the Capital City and has considerable potential as a tourist venue. Health interventions here were therefore considered likely to initiate strong political support.

Approach

The approach that was adopted was in line with plans developed under the Roll Back Malaria (RBM) movement. It involved the application of proven malaria control strategies based on three strategic priorities: diagnosis & treatment, prevention and epidemic surveillance. A fourth conditional priority on which all the other priorities depend was the strengthening of staff capacity. Community participation, intersectoral collaboration and monitoring & evaluation all formed crucial underlying principles for the plan.

Diagnosis
Improvements in diagnosis have been based on upgrading the existing microscopy network through the provision of equipment and supplies and on training and close supportive supervision of microscopists through a refurbished central reference laboratory.

Malaria diagnosis in the health services of Khartoum and Gezira is increasingly based on microscopic diagnosis. Laboratories exist at all hospitals and health centres and at many of the dispensaries. Thick and thin blood films and Giemsa staining are used routinely. There is extensive quality assurance (re-checking of slides) at the Federal and the State Laboratory levels. In principle, all positive slides and 10% of (declared) negative slides are re-checked by the State level

laboratory. There is an additional re-checking level at the federal laboratory. Recent results of rechecking slides from the State reference laboratories at the federal laboratory revealed a frequency of 1.2 % false positives and 0.8 % false negatives for Khartoum State and 23.8 % false positives and 0.0 % false negatives for Gezira State.

Treatment

Between 1997 and 2001, the *in vivo* response of *P.falciparum* to chloroquine was assessed in 21 sites in 14 States. In 13 sites including Khartoum and Gezira the failure rates were greater than 25%. Based on these results the national antimalarial drug policy has recently been updated introducing artesunate based combination therapy (ACT) (in this case artesunate and sulphadoxine-pyrimethamine) as the first line treatment of choice for uncomplicated falciparum malaria in Sudan. Introduction of the new regimen is expected in 2004.

Strong emphasis has been placed on the training of medical staff in clinical diagnosis and in the management of simple, severe and complicated malaria.

At present malaria diagnosis and treatment are paid by the patient. There is an adequate supply of first- and second-line drugs for the treatment of uncomplicated malaria available at all levels of the health services. Similarly, there is an adequate supply of drugs for the management of severe and complicated malaria available at all hospitals. The national protocol for the treatment of malaria has been provided in the form of a wall chart algorithm to all health facilities covered by the MFI.

Prevention

The use of insecticide treated bednets (ITN) gives effective protection against malaria to the user, to others sleeping in the same room as a user and, if coverage is sufficiently high, to the community as a whole. In rural areas of Gezira state MFI aims to sell sufficient ITNs to cover a target population of 160,000 by 2008. The ITNs will be sold at a subsidized rate. The scheme will target the most vulnerable groups: children and pregnant women living in low income highly endemic zones.

Government taxes on ITN imports were recently lifted making ITNs more affordable for all. MFI will promote private sector involvement in bednet sales both in Khartoum and in Gezira.

"Source reduction" through the use of mechanical, chemical and biological methods for preventing vectors from breeding in urban and irrigated areas is an important part of malaria control in central Sudan and has been since efforts began in the early 1900s. This aspect of MFI is particularly dependent on community mobilization and inter-sectoral collaboration - the public and various government Ministries (Education, Water Corporations & Agriculture) all play active and vital roles in source reduction. Prevention of mosquito breeding in Government-run and private irrigation schemes relies on water management

(intermittent irrigation of crops). Leakages from irrigation canals are also a major source of breeding. The MFI has successfully involved the Ministries of Irrigation and Agriculture in repair operations.

Vector control through the use of indoor residual spraying (IRS) is an effective option for IDP camps in highly endemic irrigated areas. Cost is however high and so the use of IRS is generally restricted to dealing with outbreaks. The technique may well be phased out as ITN coverage increases.

Space spraying is used in areas of high population density during outbreaks and is an important measure for maintaining public relations.

Surveillance
An epidemic early warning system has been established by MFI: Analysis of epidemiological indicators collected from 198 clinical and 31 entomological sentinel sites scattered throughout Khartoum and Gezira intervention zones is carried out every week. Weekly incidence of malaria cases in the sentinel stations and monthly records of malaria incidence, malaria admissions to hospitals, deaths from malaria, and slide positivity rates are reviewed regularly. The weekly incidence reports from the sentinel stations are usually received by EMS, fax or e-mail within a few days after the week on record. Reporting is regular and processing tends to be up-to-date. This system forms the backbone of anti-epidemic action.

Evidence of any outbreak is communicated immediately to treatment and control groups initiating emergency response measures

Capacity building
Training forms a crucial component of this initiative improving the skills and boosting the morale of workers at all levels.

Formal training is augmented by regular supportive supervision which forms an important part of the strong M&E component of the MFI.

Achievements

The MFI was launched in 2002. Although the initiative is only in its second year of implementation, already major achievements are apparent. These are particularly evident in the case of programme management:

Dedicated offices have been established at central and peripheral levels, target staffing levels have been achieved and essential equipment and supplies have been procured. In addition, activities have been decentralized to localities and sub-localities according to plan. Quality training has been provided to staff at all levels and as a direct result staff morale and commitment has been massively increased (with staff turnover reduced from annual to near zero).

Table 2. Summary of training carried out since the start of the MFI initiative.

Staff category	Number trained	% coverage
Medical officers	131	65
Medical assistants	108	43
Laboratory assistants	325	100
Public health inspectors	50	100
Sanitary overseers	28	100
Assistant sanitary overseers	50	100
Mosquito men	200	80

At the same time, strong political support has developed both at State and at Federal level. A solid public relations effort on the part of MFI managers has already raised the profile of the National Malaria Control Programme to a very high level. Considerable efforts have been made to inform the public of the purposes and activities of the MFI. Information leaflets have been distributed through schools to most of the households in Khartoum State, radio broadcasts are regularly scheduled, and there is rarely a week that programme activities are not reported in the press or on television. Also other forms of publicity are being actively applied through the programme and through cooperating NGOs. There is a mechanism in place for evaluating the impact of public information that has so far shown a rise of public awareness of MFI.

Geographical reconnaissance has been carried out and potential and actual vector breeding sites have been mapped. Epidemiological stratification has been completed and on the basis of this work, four strata have been identified: urban, peri-urban, rural riverine, and rural non-riverine (pastoral). Control measures are now efficiently targeted according to this new stratification.

An epidemiological early warning system with weekly monitoring has been established, and the number of sentinel stations recently expanded to cover virtually all parts of Khartoum and Gezira.

Microscopic diagnosis of malaria has been strengthened and public and private sector health care personnel have received refresher training in diagnosis and treatment. 21 seminars addressing malaria mortality reduction have been held.

Larviciding of permanent mosquito breeding sites has been regularly carried out where necessary and a very high level of coverage is reported. However every effort has been made to minimize the use of this chemical approach by concentrating efforts on physical source reduction.

House spraying of residual insecticides has not been conducted in Khartoum as part of the MFI since there has been no epidemic outbreak of malaria in the State since start-up. Historically, indoor residual spraying (IRS) has formed the mainstay of malaria vector control in Gezira and still it plays an important but

diminishing role. IRS has been carried out in a number of epidemic prone IDP camps and villages since the start of the MFI and reported coverage in these areas has been high. Large scale distribution of subsidized insecticide treated bednets (ITN) aimed at pregnant women and children has also been carried out in Gezira and coverage has already reached nearly 30% of the target population (figure 3). The use of ITNs for personal protection is expected to supercede IRS as coverage increases. In Khartoum the epidemiological situation does not warrant the distribution of subsidized ITNs at this stage. Instead efforts are underway to involve the private sector in ITN sales. Progress has been slow so far, but it is expected that the recent lifting of government import tax on ITNs may facilitate uptake.
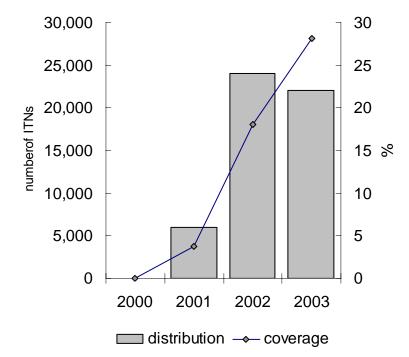
Figure 3. Distribution and ITNs in Gezira state and proportion of target coverage achieved (factoring in 20% loss each year due to wear and tear).

Health education is an ongoing, intensive activity both within schools and in the general community. A state wide competition involving 612 schools was held on Khartoum State Malaria Day. 4,263 children took part in the competition submitting a wide range of prize winning entries including paintings, songs, plays, stories and poems. Results of impact studies are expected soon.

As well as school malaria committees, malaria control committees and RBM societies have been established as part of MFI's community mobilization efforts. In addition village focus group discussions and numerous public meetings have been held in an effort to promote empowerment and community ownership of the scheme.

The level of cooperation between MFI and relevant sectors of the health care and public health system is truly impressive. This is especially evident in vector breeding source reduction activities. 3,818 metres of water pipe have been replaced and 6,104 broken water pipes that had resulted in major breeding sites have been repaired as a direct consequence of the active collaboration between MFI and the Public Works Department (PWD). MFI has been responsible for surveillance, notification and transportation while the PWD has provided engineers and equipment.

The Farmers Union and the Ministry of Agriculture also play key and active roles in malaria prevention by supporting a programme of intermittent irrigation. In central Sudan's hot dry climate regular complete drying of irrigated fields has a dramatic impact on the breeding potential of vectors. Strict penalties have been imposed on farmers who fail to cooperate and compliance with this scheme is now almost complete.

Weekly cabinet briefings are held on the malaria situation in Khartoum and political support for the MFI is extremely strong, both at State and at Federal levels. This is a reflection of the considerable achievements of the MFI team.

Although the MFI was only recently launched and the development of appropriate epidemiological indicators is still underway, early indications suggest that the programme is having a positive impact on the malaria situation in target areas[1].

For example, the proportion of inpatient deaths attributed to malaria in Khartoum fell by 62% from 2000 to 2003 (from 10.5% down to 4.0%). The number of health facilities surveyed during this period increased from 75 to 125 and it may be that many of the new facilities included were at the periphery of the health service and therefore saw fewer deaths. This would result in some *dilution* of the death rate but would not account for the discrepancy between the overall death rate and the malaria death rate.

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[1] Reported incidence has not been used as an indicator as it is considered very misleading because the number of facilities reporting and the size of their catchment populations have both fluctuated considerably and without record over recent years. In addition, microscopy is thought to be weak in many facilities: Although cross checking results from the central reference laboratory suggest that the standard of microscopy in Sudan is extraordinarily high, a recent study demonstrates that even in two major paediatric hospitals in Khartoum malaria is heavily over-diagnosed. In one hospital surveyed only 25% of slides classified as positive were actually positive on reexamination (N=186). In the second hospital this value rose to just over 60% (N=49). The quality assurance methodology in use at the central reference laboratory is currently under review.

Table 3. Mortality rate amongst health facility admissions in Khartoum State (percentages are shown in italics).
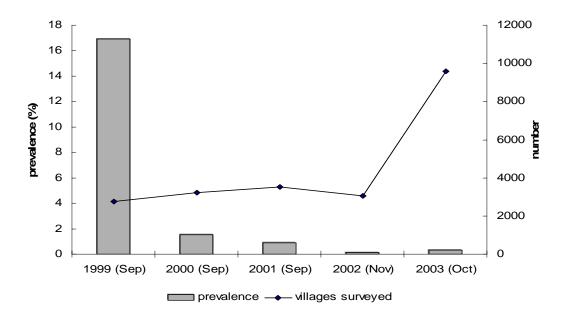
	2000	**2001**	**2002**	**2003**
Number of facilities surveyed	75		?	125
All causes	*8.5*		*7.9*	*6.9*
Overall drop				***18.8***
Attributed to malaria	*0.9*		*0.5*	*0.3*
Overall drop				***69.2***

As in Khartoum, in Gezira there was a marked reduction in the proportion of inpatient deaths attributed to malaria, falling by 72% from 2001 to 2003 (from 29% down to 8%).

Whether these reductions were due to improved diagnosis or improved treatment of severe cases is not clear from the available data.

Results from prevalence surveys also suggest that malaria has been well controlled under the MFI. In Khartoum, autumn prevalence now appears to be well below the level seen in 1999 (figure 4) (unfortunately the timing of the surveys and the number of villages involved was not consistent and so these data must be interpreted with a degree of caution).

Figure 4. Prevalence of falciparum malaria in 7 Provinces of Khartoum State (all age groups).

Similar prevalence surveys conducted in schools in Gezira also suggest that malaria has been well controlled under the MFI (figure 5) (although in this case the timing of the surveys was consistent, the number of villages involved was not and so once again these data must be interpreted with some caution).

Figure 5. January prevalence of falciparum malaria in children aged 2-9 years in rural Gezira.

Funding shortfall and request for support.

Unfortunately WHO's global budget for the *Roll Back Malaria* Initiative has recently been slashed by almost 75% (from $5m for 2002-2003 to just $1.3m for 2004-2005). The planned financial contribution from WHO to MFI therefore looks set to crash, despite strong high-level support from within WHO-EMRO. The future of the Malaria Free Initiative is therefore in question.

The government of Sudan has allocated $5.1m and WHO has allocated $3.6m to support the initiative from 2004-2008 but this still leaves a shortfall of almost $3.5m.

Funds are needed immediately in order to prevent this innovative and promising programme for change from folding before its full benefits can be felt.

This funding gap offers a rare opportunity for new donors to support a well established pilot project which already seems set to act as a pathfinder for similar projects throughout Africa and EMR.

Your support is urgently requested.

Annexes

Annex 1. Budget

	Four year total	Allocation by donor				Funding gap
		Federal	State	WHO	Other	
Year						
Quarter						
Objective 1 Populations in target States have better access to diagnosis and appropriate treatment for malaria and use them more promptly on developing fever.						
Total for objective 1:	6,165,000	616,500	1,849,500	1,726,200	308,250	1,664,550
Objective 2 People in target States are protected by appropriate malaria prevention measures.						
Total for objective 2:	4,045,000	404,500	1,213,500	1,132,600	202,250	978000
Objective 3 Epidemics prevented.						
Total for objective 3:	415,000	41,500	124,500	116,200	20,750	112,050
Objective 4 Management capacity of malaria control programme optimized						
Total for objective 4:	2,235,000	223,500	670,500	625,800	111,750	603,450
TOTAL:	**12,860,000**	**1,286,000**	**3,858,000**	**3,600,800**	**643,000**	**3,472,200**

Annex 2. Project Planning Matrix

Overall goal:	Impact indicators:
Malaria in target States is rolled back creating a climate of optimism for expansion of NMCP.	By 2008, the reported incidence of falciparum malaria (confirmed and suspected) in the 2 target States of Khartoum and Gezira will be reduced by at least 80% compared to 2002.
	By 2008, the reported incidence of confirmed falciparum malaria will be reduced to less than 0.5 cases per 1,000.
	Malaria epidemics will be effectively prevented[2].

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[2] Weekly incidence in outbreak zone reduced by 90% within 4 weeks of implementation.

Objective 1:	Coverage indicators:
Populations in target States have better access to diagnosis and appropriate treatment for malaria and use them more promptly on developing fever.	Proportion of fever cases examined and treated according to National guidelines.
	Proportion of people with suspected malaria using public health services.
	Changes in treatment seeking behaviour (Proportion of people with fever seeking treatment within 24 hours of onset of fever and level of compliance with prescribed treatment regimen).
Activities:	Process indicators:
Refurbish and revitalize malaria reference laboratory.	Malaria reference laboratory collecting representative sample of slides from every health facility in target States every six months. Cross checking 100% of positive slides and 10% of negative slides and providing detailed feedback reports.
Upgrade public sector diagnostic facilities. .	Proportion of public sector diagnostic facilities functioning properly (fully equipped and have adequate supplies throughout the year).
Train public sector and private sector microscopists. .	Proportion of microscopists identified as "in need" by malaria reference laboratory attending training/refresher training.
	Sensitivity and specificity of diagnosis and proportion of false positive cases.
Procure drugs required for artemisinin based combination therapy (ACT) and distribute to health facilities.	Proportion of projected ACT drugs procured
	Proportion of health facilities experiencing a stock-out of ACT lasting for 2 weeks or more during the last 3 months
Train public sector and private sector doctors. .	Proportion of targeted doctors and private sector health providers attending training courses.
Develop and implement a communication programme based on COMBI methodology for people living in target states.	Proportion of target groups reached by communication programme and proportion of group members able to recall at least 3 key malaria messages.

Objective 2:	Coverage indicators:
People in target States are protected by appropriate malaria prevention measures.	Number of outbreaks.
	Bednet sales figures.
Activities:	**Process indicators:**
Source reduction through physical, chemical and biological measures as appropriate (involving major community mobilization and intersectoral collaboration initiatives). .	Speed with which broken water pipes are repaired, proportion of potential peri-urban breeding sites wet and proportion vector positive, proportion of irrigated fields dried on a weekly basis and proportion of permanent breeding sites effectively seeded with mosquito eating fish.
	Number and type of community mobilization efforts.
Pre-transmission season indoor residual spraying conducted in IDP camps in highly endemic irrigated areas.	Proportion of target communities sprayed, quality of spray (based on cone bioassays) and coverage within sprayed communities (based on proportion of houses mosquito free 1 month post spray).
Private sector encouraged to develop market for insecticide treated bednets (ITN).	Number and capacity of private sector ITN outlets established. .
Vector control provided during epidemics through space spraying of insecticides.	Proportion of outbreaks dealt with by spray teams.

Objective 3:	Coverage indicators:
Epidemics prevented.	Proportion of outbreaks where incidence reduced by 90% within 4 weeks of implementation of control measures.

Activities:	Process indicators:
Bi-weekly monitoring of epidemiological indicators collected at sentinel sites throughout Khartoum and Gezira.	Complete bi-weekly reports of surveillance activities prepared at central level.
Evidence of outbreak communicated immediately to treatment and prevention groups.	Time delay between diagnosis of cases and outbreak notification and between outbreak notification and outbreak response.
Objective 4:	**Coverage indicators:**
Management capacity of malaria control programme optimized.	Increase in the proportion of reports from locality level received at State level on time.
	Regular monitoring and supervision activities in the target provinces according to schedule
	Required malaria information for management is available in due time.
	Staff turnover minimized.
	Reports from external evaluation regarding overall quality of programme and level of political/community support.

Activities	Process indicators:
Establish offices at state and locality level.	Proportion of planned offices established at each level.
Recruit staff at state and peripheral level.	Proportion of planned staff recruited at each level.
Provide necessary supplies and equipment including appropriate means of transportation for state and locality levels.	Proportion of state and locality level malaria control centers that have a minimum package of equipment, supplies and transportation.
Provide training to improve management capacities at all levels.	Proportion of targeted staff receiving training at various levels.
Carry out regular supportive supervision at all levels.	Proportion of implementation units providing monthly data.
Strengthen epidemiological and entomological surveillance and improve malaria information system.	Adequate supplies of necessary equipment available every year.
Provide specialized training for technical staff in various disciplines.	Number of technical staff who attend a technical training course every 2 years.
Organize visits for technical and managerial staff to other countries in order to facilitate exchange of ideas.	Number of technical or managerial staff taking part in exchange visits to other countries.
Strengthen national research capacities and carry out operationally important research.	Number of operational research reports produced and proportion published/presented internationally each year.
Carry out internal and external project evaluation.	Internal and external project evaluations organized in 2005 and 2008.
Monitor and combat fake antimalarials in private sector.	Evidence of cooperation with other sectors to combat fake drugs established.

Annex 3. Indicators

		Base line		Achieved	Target			
		year	value	Q1 2004	Q1 2005	Q1 2006	Q1 2007	Q1 2008
Overall goal:								
Malaria in target States is rolled back creating a climate of optimism for expansion of the malaria free initiative.								
Impact indicators:								
By 2008, the reported incidence of falciparum malaria (confirmed and suspected) in the 2 target States of Khartoum and Gezira will be reduced by at least 80% compared to 2002.		2002	<mark>108/1000 (921992/ 8538000)</mark>	<mark>46% 58/1000 (527045/ 9044000)</mark>	30%	50%	65%	80%
By 2008, the reported incidence of confirmed falciparum malaria will be reduced to less than 0.5 cases per 1,000.		2002	248409	57623 (5/1000)	3/1000	2/1000	1/1000	0.5/1000
Malaria epidemics will be effectively prevented (weekly incidence in outbreak zone reduced by 90% within 4 weeks of implementation).		2002	No outbreak	no outbreak	No outbreak	No outbreak	No outbreak	No outbreak
Objective 1:								
Populations in target States have better access to diagnosis and appropriate treatment for malaria and use them more promptly on developing fever.								

Coverage indicators:							
Proportion of fever cases examined and treated according to National guidelines.		2002	30%	45%	60%	75%	75%	80%
Proportion of people with suspected malaria using public health services.		2002	50%	60%	70%	75%	75%	80%
Changes in treatment seeking behaviour (Proportion of people with fever seeking treatment within 24 hours of onset of fever and level of compliance with prescribed treatment regimen).			??	??	40%	60%	75%	80%
Activities and process indicators:								
Refurbish and revitalize malaria reference laboratory.								
Proportion of health facilities receiving detailed feedback reports from malaria reference laboratory.		2002	0% (0/1130)	10%	60%	70%	80%	90%
Proportion of health facilities involved in QA system every three months.		2002	10% (113/1130)	25% (283/1130)	50%	75%	90%	90%
Upgrade public sector diagnostic facilities.								
Proportion of public sector diagnostic facilities functioning properly (fully equipped and have adequate supplies throughout the year).		2002	30% (339/1130)	42%	50%	75%	85%	90%
Train public sector and private sector microscopists.								
Proportion of microscopists identified as "in need" by malaria reference laboratory attending training/ refresher training.		2002	40% (/1,441)	19% (/425)	60%	80%	100%	100%
Proportion of positive slides found to be negative on cross-check.		NA	NA	36% (3,198/8,839)	20%	10%	10%	5%

Train public sector and private sector doctors.								
Number of doctors and private sector health providers attending training courses.	Public Private	NA	NA	156 3	308 125	308 125	308 125	308 125
Proportion of reported malaria cases that are slide positive (sentinel sites).		NA	NA	49% (248,600/ 502,460)	65%	80%	85%	90%
Develop and implement a communication programme based on COMBI methodology for people living in target states.								
Proportion of target groups reached by communication programme.		NA	NA	50%	70%	85%	100%	100%
Proportion of group members able to recall at least 3 key malaria messages.		NA	NA	27% (353/1,263)	50%	75%	80%	80%
Objective 2:								
People in target States are protected by appropriate malaria prevention measures.								
Coverage indicators:								
Number of outbreaks[3].		2003	3	0	0	0	0	0
Bednet sales figures.		2003	27000	27000	250000	400000	700000	1320000
Activities and process indicators:								

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[3] Increase in reported cases/deaths from a peripheral reporting unit in excess of the mean value plus 2 standard deviations for the corresponding two week period in the preceding 5 years.

Source reduction through physical, chemical and biological measures as appropriate (involving major community mobilization and intersectoral collaboration initiatives).								
Proportion of identified broken water pipes repaired annually.		2000	8% (1,248/ 15,201)	71% (2,607/ 3,637)	80%	85%	90%	90%
Proportion of peri-urban breeding sites vector positive.		2000	18% (5,316/ 29,932)	6% (11,114/ 166,868)	4%	3%	3%	2%
Proportion of irrigated fields dried on a weekly basis.		2000	90% (?)	96% (?)	97%	98%	98%	98%
Number of people participating in malaria related community mobilization events on regular basis.	Public School		865 3,000	2,570 9,210	5,000 15,000	7,000 20,000	10,000 40,000	12,000 50,000
Number of groups participating in malaria related community mobilization events	Gov't Private NGO		4 0 10	12 3 10	20 7 12	20 10 15	20 15 15	20 15 15
Pre-transmission season indoor residual spraying conducted in IDP camps in highly endemic irrigated areas.								
Proportion of target communities sprayed.		NA	NA	100% (3,066/ 3,066)	100%	100%	100%	100%
Proportion of rooms in target communities actually sprayed (based on proportion of houses mosquito free 1 month post spray).		NA	NA	Baseline surveys 2004	?	?	?	?
Proportion of sprayed rooms in target communities sprayed completely (based on cone bioassays).		NA	NA	Baseline surveys 2004	?	?	?	?
Subsidized insecticide treated bednets (ITN) distributed to target groups in high risk areas by public								

sector.								
Proportion of target population protected.		2000	0%	28%[4] (52,000/ 160,000)	41% (82,000/ 160,000)	58% (122,000/ 160,000)	77% (172,000/ 160,000)	100% (232,000/ 160,000)
Private sector encouraged to develop market for insecticide treated bednets (ITN).								
Number and capacity of private sector ITN outlets operating. .	1000 10000	2000	0%	1 nil	10 1	20 1	30 2	40 2
Vector control provided during epidemics through space spraying of insecticides.								
Proportion units at locality level fully prepared and equipped to deal with outbreaks.		2000	0% (0/59)	24% (14/59)	50%	75%	100%	100%
Objective 3:								
Epidemics prevented.								
Coverage indicators:								
Proportion of outbreaks where incidence reduced by 90% within 4 weeks of implementation of control measures.		NA	NA	100%	100%	100%	100%	100%
Activities and process indicators:								

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[4] Factoring in 20% loss per annum due to wear and tear.

Indicator								
Bi-weekly monitoring of epidemiological indicators collected at sentinel sites throughout Khartoum and Gezira.								
Proportion of complete bi-weekly reports of surveillance activities prepared at local level.		2000	0%	100% (14/14)	100% (30/30)	100% (45/45)	100% (59/59)	100% (59/59)
Evidence of outbreak communicated immediately to treatment and prevention groups.								
Time delay between diagnosis of cases and outbreak notification and between outbreak notification and outbreak response.		2000	no outbreak	no outbreak	2 weeks 1 day	2 weeks 1 day	2 weeks 1 day	2 weeks 1 day
Objective 4:								
Management capacity of malaria control programme optimized.								
Coverage indicators:								
Increase in the proportion of reports (with the required quality) from locality level received at State level on time.		2002	0	0	80%	100%	100%	100%
Regular monitoring and supervision activities in the target areas according to schedule		2002	40%	50%	60%	75%	80%	80%
Required malaria information for management is available in due time.		2002	10%	30%	50%	75%	80%	100%
Staff turnover minimized.			NA		60%	75%	75%	80%
Reports from external evaluation regarding overall quality of programme and level of political/community support.					report			report

Activities and process indicators:								
Establish offices at state and locality level.								
Proportion of planned offices established at each level.	State Locality Unit	NA	NA	100% (2/2) 100% (14/14) 0% (0/59)	50%(30/59)	75%(45/59)	100%(59/59)	100%(59/59)
Recruit staff at state and peripheral level.								
Proportion of planned staff recruited at each level.	State Locality Unit	NA	NA	100% (70) 100% (121) 100% (1,340)				
Provide necessary supplies and equipment including appropriate means of transportation for state and locality levels.								
Proportion of state and locality level malaria control centers that have a minimum package of equipment, supplies and transportation.	State Locality			100% (2) 100% (14)				
Provide training to improve management capacities at all levels.								
Proportion of staff receiving annual training at various levels.	Management Mid level Workers	2000	25%(16/64) 15%(60/400) 5%(45/900)	88%(57/64) 50%(200/400) 25%(225/900)				
Carry out regular supportive supervision at all levels.								
Proportion of implementation units providing monthly data.		2000	0%	100%	100%	100%	100%	100%
Strengthen epidemiological and entomological surveillance and improve malaria information system.								
Adequate supplies of necessary equipment available every year. .		2000	0%	50%	75%	85%	100%	100%

Provide specialized training for technical staff in various disciplines.								
Number of technical staff who attend a technical training course every 2 years.		2000	0%	10%	50%	75%	90%	90%
Organize visits for technical and managerial staff to other countries in order to facilitate exchange of ideas.								
Number of technical or managerial staff taking part in exchange visits to other countries.		2000	0%	10%	50%	60%	80%	100%
Strengthen national research capacities and carry out operationally important research.								
Number of operational research reports produced and proportion published/presented internationally each year.		2000	0	0	2	2	2	2
Carry out internal and external project evaluation.								
Internal and external project evaluations organized in 2005 and 2008.	Internal external				1 1			1 1
Monitor and combat fake antimalarials.								
Report on assessment of drug quality in private sector outlets.		NA	NA	0	1			