efforts to control malaria in Sudan—case study of the national malaria control programme, 2001–2005

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Efforts to Control Malaria in Sudan - case study of the National Malaria Control Programme, 2001-2005


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Abstract - Malaria endemicity in Sudan varies from hypo-endemic in the north to holo-endemic in the south with the majority of the population living in epidemic-prone areas. Plasmodium falciparum is the main parasite and Anopheles arabiensis is the primary vector. The country Roll Back Malaria strategic plan was developed in 2002 with main 4 strategic directions: i) early diagnosis and prompt treatment; ii) multiple prevention; iii) forecasting, early detection and containment of epidemic; iv) and capacity building. Sudan has shifted from chloroquine to artesisinin-based combination therapy (ACT) in 2004. Taxes and tariff on Insecticide Treated Nets (ITNs) has been deleted. Weekly-based notification system from 16 epidemic-prone states has been established with regular feedback from national to states. The programme gives more attention to build the state capability and to build partnership with national and international organizations. Recent surveys showed that coverage with mosquito nets was increased in 2005 compared to 2000 from 23.1% to 57.0% and with ITNs from 0.4% to 21.1%. Treatment of malaria still relies on chloroquine (65.6%) with limited tendency for the use of sulfadoxine-pyrimethamine (9.2%) or ACTs (10.5%). The main challenges for the programme are sustaining the success through reduction of staff turnover, increasing regular financial resources, availing Long Lasting Insecticide Treated Nets (LLINs) particularly to rural population and increasing access to ACTs through implementation of malaria home management.

Controllo della malaria in Sudan: valutazione del Programma Nazionale di Controllo della malaria, 20012005
Riassunto - In Sudan, il livello di endemia malarica varia dal tipo ipoendemico nel nord a quello oloendemico nel sud. La maggioranza della popolazione vive in aree soggette a manifestazioni epidermiche. Plasmodium falciparum è il parassita principale e Anopheles arabiensis è il vettore dominante. L’iniziativa “Roll Back Malaria” è stata introdotta nel paese all’inizio di questa decade e il piano strategico è stato sviluppato nel 2002 con 4 direzioni principali: a) diagnosi precoce e trattamento immediato, b) prevenzione multiplica; c) previsione, primo riconoscimento e contenimento delle epidermiche; e d) formazione delle risorse umane. Nel 2004, il Sudan ha cambiato le modalità di trattamento della malaria, passando dalla monoterapia con cloroquina, alla terapia di combinazione di farmaci antimalarici con artesiminina (ACT), e sono state abolite tasse e tariffe doganali su zanzarrie impregnate con insetticida (ITNs). È stato introdotto un sistema settimanale di notifica dei casi di malaria in 16 stati soggetti a epidemie. Il programma nazionale di lotta alla malaria riserva più attenzione alla creazione di collaborazioni con organizzazioni nazionali e internazionali. Le recenti indagini hanno messo in evidenza una maggiore utilizzazione della zanzarrie nel 2005 rispetto al 2000, passando dallo 0.4% al 21.1%. Il trattamento della malaria è ancora largamente basato sull’uso della cloroquina (65.6% dei casi), con una lieve tendenza verso l’uso della sulfadoxina-pirimetamina (9.2%) o ACT (10.5%). Le sfide principali per il programma di lotta alla malaria consistono nella riduzione della rotazione del personale incaricato, nell’aumento delle risorse finanziarie, nella utilizzazione di zanzarrie a lunga azione residua (LLIN), particolarmente in zona rurale, e nell’accesso ai farmaci antimalarici basati sulla combinazione con artesiminina (ACT) per la gestione della cura della malaria a domicilio.

Key words: Sudan, malaria, malaria control, Anopheles arabiensis, Plasmodium falciparum

INTRODUCTION

Malaria is a major public health problem in Sudan. The main malaria vector all over the Sudan is Anopheles arabiensis with An. gambiae s.s. and An. funestus mainly in the southern part of the country. Plasmodium falciparum is the agent in more than 95% of cases with few scattered cases of P. vivax, P. malariae and P. ovale.

The disease affects almost all the residents with a variable degree of endemicity; the highest reported in the South. Five malaria strata can be identified: high perennial transmission (South Sudan), seasonal transmission (Central Sudan), desert-fringe...
(Northern part), irrigated (where there is permanent irrigation) and urban malaria (state capital). Accordingly, the risk of malaria transmission varies from 1% to 74% based on climatic condition. Estimated proportions of population at risk of malaria epidemic (expressed as percentage of population) range between 25% (www.mara.org, 2002) to 50% (WHO, 2004). Nation wide epidemics (unlikely to occur) would affect 7.6-15.9 million individuals (WHO, 2004). The disease accounted for 37.2% of all maternal deaths at hospital level (Dafalla SE et.al, 2003). It is documented also that in Sudan those affected with malaria were unable to work for 22% of the time during the course of the year (WHO, 1996).

The old estimate “7.5 million cases and 35,000 deaths annually” is over-utilized. It is dated back to early 1990s. In view of the “malaria indicator survey” (MIS survey) and other surveys conducted recently, this estimate seems to be high. This argument is also supported by the fact that reported annual malaria cases and deaths is reducing from around 4 million (139.4 cases/1000 population) to around 2 million (71.9 cases/1000 population) in 2005 (Fig 1).

**Figure 1 - The total reported malaria cases and the rate per 1000 population in Sudan, 2000-2005**

According to MIS survey (unpublished document), the prevalence of malaria among 2-10 years old children ranged between 0.7 to 31.7%. The states reported high prevalence rate include: Bahr Elgabal (31.7%), Bahr Elgazal (23.3%), South Kordofan (20.9%) and West Darfour (7.9%). The rate is significantly higher in rural compared to urban population. The fever prevalence at time of the survey (among 2-10 years old) ranged between 3.5 to 28.1% and the fever treated as malaria, in the 2 weeks prior to the survey ranged between 23.6% (North Kordofan) to 50.8% (West Darfour).

Malaria control programme in Sudan is the oldest in the tropic. It was started early in the last century. Andria Baflour (1904) initiated a campaign (larval control using retained oil) and he succeeded to eradicate malaria in Khartoum area. The control efforts continued in many areas in Sudan. Among the most important landmarks we have to mention:

- Sinnar pilot project during the eradication era with noticeable success by the end of the project in 1960s.
- Blue Nile Health Project which was a product of partnership between government of the Sudan, World Health Organization (WHO), World Bank, Kuwait, Japan, USA and others. The project succeeded to decrease the malaria prevalence from over 20% to less than 1% and could sustain that for more than 10 years. The cessation of the project caused a severe epidemics in early 1990s in Gezira area (Fig 2).

**Figure 2 - The prevalence of malaria in Gezira irrigated area, 1975-2006**

Roll Back Malaria (RBM) initiative: Sudan is one of the first countries to meet the requirement of the initiative.

Abuja declaration: the country incorporated the Abuja targets in developing its RBM strategic plan and other sub-strategic plans.

This paper aims to document the ongoing efforts to control malaria in Sudan.

**METHODOLOGY**

The data and information presented here were collected through a retrospective desk review and a mini-survey. The desk analysis target the annual reports (2003-2005), activities reports (2001-2005), strategic plans and annual plans reports, review reports and researches and surveys which are relevant to the programme.

The mini-survey was carried out to confirm the contribution of partners. The National Malaria Control Programme has data about the contribution of various partners (still some partners may provide support through NGOs or directly to communities). A special form was develop for this purpose and distributed to 22 non-governmental organizations (NGOs) and private sector. The response rate was 81.8%.
Operational background
The malaria control activity is lead in conjunction by the National Malaria Control Programme (NMCP) and the States malaria control programmes (SMCPs). The NMCP is leading malaria control all over the country. The programme is integrated with the general health system, and provides the general strategic planning, development of guidelines, raising and allocation of resources, building states capacities and evaluation of the states work. The SMCPs are responsible for local planning, implementation and monitoring. Early in 2001, the NMCP has reviewed the SMCPs status. The review revealed, that although there is a focal person for malaria control in 16 out of 26 States at that time, the programme is well established in only 3 of them (18.8%).

Crash training programme: Efforts to strengthen the state capacity initiated with objective training. This was started with the replication of the WHO course “Planning malaria control programmes”. It is a 2-months course. The course was carried out in Gezira University at the Blue Nile Research and Training Institute (BNRTI). The training was facilitated by an international expert in malariaology. All states programmes coordinators, in addition to national staff, have attended the course. By the end of the course, 16 states were lead by these trainees. This course was paving the road for the future as it leads to common understanding about malaria and how to approach it.

Stopping the brain drain: In collaboration with WHO and UNICEF, the NMCP has continued training in the BNRTI with the aim of having at least 20 participants every year (Picture 1). These participants were working with malaria, were nominated by states malaria programmes and were agreed to work after graduation in their respective states. If they complied, the NMCP responsibility then is to avail higher training (MSc or advanced short courses) for them. If they did not comply, the NMCP will not provide the Higher Diploma certificate for them. This clear carrier pathway and arrangements stop the brain drain (almost 70% of those who were trained before this have crossed the Red Sea to work in Gulf States) and provide motivation (people were encouraged to stay at rural areas). By the end of 2005, 88% of states were lead by at least one trained personnel. The attrition rate is minimal (1-2 from each batch) and has been reported in conflict areas.

Keep it hot: To keep these trainees updated, the NMCP came out with the idea of “reading one book together”. Copies from WHO publication in the field of malaria sent every 3-4 months to all states coordinators with questions (mostly multiple choice questions) to foster reading. Another important tool is to keep the line of contact with lower level staff hot. For this purpose states coordinators expected a monthly phone conversation from the national coordinator or from his deputy. This after covering the work issues extends even to social dimension. Review meetings regularly carried out every 3-4 months since 2001. The majority of meeting were carried outside Khartoum. Each time one of the states hosted the meeting with its accommodation expenses. The role adopted to meet these expenses is to mobilize the partners and local communities. These meetings were used also as a tool for developing team spirit, sharing experiences and advocacy for malaria control in the respective state in particular.

Partnership: in 2001 the main programme partners at the national level are WHO, UNICEF, Government of Egypt (Gambia Control Project) and Saving and Social Development Bank (SSDB). These were kept as partners but the programme succeeded to involve more other partners. Among them are NGOs, private companies, neighbouring countries, public-private mix schemes, media and press.

NGOs Forum: The NGOs (a total of 40 national and international NGOs) that give contribution in malaria control programme were gather together forming “NGOs Forum” which was lead by “NMCP-NGOs committee. The Forum activities were maintained for the last 4 years through the support from “GSK/Plan Sudan/NMCP” partnership. Private companies showed an increasing interest in malaria control. This was organized in a form of joint programmes at national and state levels. Partners at state level come mainly from cotton growing schemes (Gezira) and sugar factories sector (Kenana, Ginaed and New Halfa). Their support usually came in kind (insecticides and pump machines) but sometimes they support also the cost of operation.
**Temporary partners:** The NMCP and SMCPs also created temporary partners-partners that have limited support that when combined together become tangible. These were used for celebration of Africa malaria day, covering some expenses of meetings and ad hoc activities. Recognizing this, starting from 2005, the programme listed the partners year by year on a board and put that in front of the NMCP so that every one coming across can read. This year the programme decided to show the list through newspapers.

**Innovative partnership:** A brilliant partnership with the private was that with the SSDB in 2000. The theme of this partnership is to avail ITNs with affordable price. The bank, supported technically by the NMCP, procured and distributed through the SMCPs and other distribution outlet a total of 100 000 nets. In the year 2004, the idea well appreciated was further developed. The NMCP approached the Financial Investment Bank (FIB) and requested their involvement. The FIB Bank then created an “ITN Portfolio Fund”, in collaboration with the Bank of Sudan, the SSDB Bank, the Development Foundation of Sudan, the Health Insurance Fund and enlisted the involvement of individuals as shareholders. The NMCP manager served as the technical adviser to the Portfolio manager. The Portfolio Fund initially raised about US$ 460 000 and was able to procure 300 000 factory-treated conventional nets from Siam Dutch in Thailand in the first year. These nets were enough to cover a population of between 800 000–900 000 people. The nets have been sold to local traders - usually targeting the urban market, for which the NMCP is not currently involved in the distribution of ITNs. Also nets have sold to NGOs and UN agencies. In addition to providing ITNs as a commercial supplier, the involvement of the Financial Investment Bank not only helped raise its image countrywide (with more people buying shares and opening new accounts in 2005), but also saw it operate at a profit of about 54% (CDC newsletter, 2005). Up-to-now a total of one million US$ was used to procure 460 000 ITNs through private sector. In 2006 the SSDB served as an outlet for the distribution of nets in 9 States.

**Cross-borders partners:** Collaboration with the neighbouring countries was also attempted. A continuous support for the programme, although directed to limited area, comes from the Arabic Republic of Egypt as part of a Joint programme “Gambia Control Project”. The programme has two main objectives: provision of support to northern state to control malaria and as part keeping identified area malaria free “Anopheline-Free Zone”. The programme was initiated early in 1970s following the construction of High Dam in Aswan area and bearing in mind the nasty experience of the malaria epidemic occurred in south Egypt in 1940s. Each year the programme provides insecticides for indoor residual spraying and chemical larviciding in addition to spraying machines and transport facilities. The programme recently was extended to cover other areas in north and east part of Sudan. Collaboration with Ethiopia was arranged by the “Horn of Africa Initiative” as cross-border activities. The collaboration was also extended to Chad. The NMCP shoulder the cost of training in malariology for one year in BNRTI for three candidates.

**Financing:** the support came from the government of Sudan at the start of this period was limited to payment of salaries and may extend to procurement of insecticides in certain states. The programme other activities depends on the support coming from WHO, UNICEF and other national and international non-governmental agencies. Starting from 2001 the allocated fund for the programme is increasing (Fig.3).

![Figure 3 Received budget at all level and from all sources except the GFATM, 2001-2005](image)

The proportion of government contribution at federal, states and local levels is also increasing compared to other sources from almost negligible (paying for staff salaries and pressing things) in 2000 to more than 50% in 2005. Every year following the strengthening of the SMCPs, the contribution of the local level is growing.

**Global Fund to fight AIDS, TB and malaria (GFATM):** The programme proposal for Round 2 was accepted late in 2002. The total approved amount for 5 years is US$ 33 million, with an approved grant amount of US$ 14 million for the first 2 years. In year one US$ 8 million of this phase I grant amount was disbursed. However, the first instalment (US$ 8 million for the first year) was disbursed in 2005 through UNDP (as a principal Recipient) and WHO as executing agency. The disbursement of Round 2 was affected by re-programming in order to address a drug policy change and the change from treatable to LLINs.
The fund covered 10 states out of the country 25 states and is mainly for availing ACTs and LLINs. The programme applied for round 5 to fill the gap. Unfortunately the Round 5 application was rejected on the grounds that the earlier grant was still being finalized and due to problems related to the gap analysis. Again the programme applied for Round 6. The proposal requests US$ 64 million over 5 years to build upon the Round 2 grant and to expand into new sites. Referring to a number of weaknesses, the TRP of the GFATM rejected the approval of the proposal in its present form but encouraged to resubmit following major revision.

**Technical intervention:** as mentioned malaria control programme in the Sudan is established early in the last century. Through out, vector control is leading malaria activities. By the beginning of this century many efforts were directed to enforce case management and hence a comprehensive approach to malaria control. Since 2002, however, technical interventions are guided by the strategic plan. Interventions per each stratum were summarized in table 1.

**Malaria diagnosis and treatment:** Currently malaria diagnosis is based on performing blood slide examination or rapid diagnostic test (at public or private sector) in the urban areas while in rural areas diagnosis is presumptive.

**Malaria microscopy:** The serial reviews carried out by national and international experts showed that microscopic diagnosis of malaria is still lagging behind in terms of quality as well as coverage. Microscopic diagnosis covered only one third of the available health facilities in Sudan and clearly concentrated in urban areas. Problems related to premises, supply system and doctors’ confidence with the laboratory results were reported. The curricula of undergraduate studies in medical laboratory sciences university faculties (reviewed in a workshop arranged by the NMCP with representatives from the all faculties, 2004) lack adequate contact hours and uniform content. A review done by the NMCP staff in two big cities in central Sudan has documented that, 20% of microscopes in use were not functioning at the time of the survey. Some of these are found in the private and voluntary sector. In Khartoum, despite the ongoing efforts which involve the private sector also, almost 50% of the slides assigned as positive for *P. falciparum* were found to be negative. On the other hand, the use of Giemsa is documented in more than 90% of laboratories. A consultant was recruited by the WHO/EMRO region in 2004 to design with the national the solution. A task force to design, implement and monitor a National Quality Assurance programme (QA) convened many meetings thereafter and coming out with a national guidelines for improvement. Accordingly, trials to build quality assurance programme were made but the ongoing system is limited in capacity and place particularly at states level. The problem is mainly attributed to failure to recruit or to sustain senior staff for quality assurance at state level.

**A promising idea for improving microscopy:** A 3-prongs system suggested by the NMCP was tried. According to the system all efforts to improvement suppose to follow 3 steps, each lead to other. The first step to be done by the QA focal person at district/ state level is conduction of situation analysis and based of this laboratories classified into 3

<table>
<thead>
<tr>
<th>Strata</th>
<th>States</th>
<th>Selected Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desert Fringe (Hypoendemic with 2,000,000 population)</td>
<td>Northern, River Nile and Red Sea except states capital</td>
<td>Case management, ITNs, source reduction, IRS during emergency</td>
</tr>
<tr>
<td>Seasonal malaria (Hypo-Mesoendemic, with 15,000,000 population)</td>
<td>Rural areas in Greater Darfour, Kordofan, Blue Nile, White Nile, Sinnar, Gezira, Gedaref, Kassala and Khartoum</td>
<td>Case management, ITNs, IRS during emergency</td>
</tr>
<tr>
<td>Stable perennial transmission (Hyperendemic with 4,000,000 population)</td>
<td>Southern Sudan</td>
<td>Case management, ITNs and IPT</td>
</tr>
<tr>
<td>Urban malaria (Hypo-Mesoendemic, with 8,000,000 population)</td>
<td>Khartoum and all large cities e.g. Port Sudan, Medani</td>
<td>Case management, ITNs, source reduction, larviciding, IRS during emergency</td>
</tr>
<tr>
<td>Irrigated Schemes (mostly in the mesoendemic zones, with 2,000,000 population)</td>
<td>All large-scale irrigated schemes (Gezira, Elrahad, Kinana, Asalia, West Sinnar, New Halafa and Elzidab)</td>
<td>Case management, ITNs, targeted IRS, IPTs, source reduction</td>
</tr>
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</table>
levels: A, B and C. Class A having good performance and should be congratulated and visited next year, class B has some problems and should be corrected and visited every 3 months and class C: laboratories which needs major correction, should corrected and visited very 1-2 months. The classification (giving green, yellow and red colours for class A, B and C respectively) then reflected on the area map and to be hanging in front of the director, this should be updated every year. The second step is to adopt necessary interventions and to be followed as scheduled. The 3rd step is to use the collected data through the year for reclassification. The system was started in 3 states but the implementation was affected by the staff turnover.

**Malaria rapid diagnostic tests:** Rapid diagnostic tests (RDTs) are registered for use in Sudan early in 2000. However, the use of rapid diagnostic tests for a long time is limited to private sector. The use in public sector is left for each health facilities interest. The procurement of RDTs is not part of the public system. The cost of diagnosing malaria with RDTs nowadays may reach up to US$4.

**Moving to ACTs:** Sudan NMCP has decided, on the basis of scientific evidence, to change national anti-malarial drug policy from monotherapy to ACTs. Artesunate-sulfadoxine/pyrimethamine (AS/SP) has replaced chloroquine as the first-line treatment, and lumefantrine-artemether (Coartem) has replaced SP as the second-line treatment. Quinine and artemether are recommended treatment choices for severe *falciparum* malaria. The process of change has been described in details elsewhere (Malik et al, 2006). Efforts to make ACTs available free or with affordable price, to increase the coverage and to train health personnel are continuing. Smooth landing from chloroquine now has been insured and the chance for sustainability is increasing as every day new partners offered help. The issue now is part of plans prepared by governmental authorities, GFATM, WHO, UNICEF, private sector, academic and research institutes, expertise on personal basis and some NGOs (Malaria Consortium, Plan Sudan,).

**Malaria home management:** Access to treatment, particularly at rural areas is of concern. A Pilot project (supported by TDR, Italian Fund and GFATM, Malaria Consortium) to adopt malaria home management is still going on. However, the programme manages to go hand by hand with the district health system in its efforts to rehabilitate the dispensaries (the basic health unit in Sudan). Two districts, so far, were covered and the ACTs made available in all dispensaries after training of the health cadre.

**Multiple prevention:** *Conventional vector control measures* were forming the backbone of the programme at all level. At the district level vector control is the only activity in most of the situation. Communities at different level very much appreciated seeing malaria cars or sprayer men moving from door to door for fogging or indoor residual spraying. Larval control using chemical larviciding (temephos) or environmental management is going as a routine in urban settings but with variable coverage and efficiency. Attempts to scale up the use of larvivorous fish (which was introduced in pilot areas during the Blue Nile Health Project in 1980s) were tried in 5 areas. In Khartoum, it replaces the use of chemical larviciding by 70% in an irrigated scheme. In Gezira, an irrigated area, the trial is going on and tries to answer questions such as the self-sustainability, the effects of various seasons and spraying with pesticide used widely there. This work is done in collaboration with the University of Gezira, Faculty of Environmental Health.

Susceptibility of vectors to insecticide usually conducted regularly with support from WHO. Unfortunately evidence of resistance to pyrethroids group is reported in two sites. A workshop arranged by the NMCP and WHO and attended by national and international experts decided to tackle the problem using rotation strategy.

Community participation and intersectoral collaboration are involved in the conventional vector control activities. Communities, private or public-private mix companies contribute in man and kind. Examples of regular intersectoral support are the support from Gezira Scheme Board, Kinnana Sugar Cane and New Halafa Sugar Cane. Communities and community-based organization were very much involved in Khartoum, Gazera, Kassala and Gadafir States.

**Insecticide treated nets:** mosquito nets have a long history of use in the country. ITNs as a tool for personal protection and vector control in Sudan was assessed in a pilot project early in 1990s (Abd ElNur O, 2003). The intervention nowadays is very popular. With reference to Abuja Declaration, taxes and tariff on ITNs has been deleted completely. This reduces the price by 60%. The treated nets (both conventional and long lasting ones) commonly imported to country through WHO, UNICEF, private, and NGOs. The distribution usually convened through NMCP, SMCP, community-based organization, NGOs and private. With the introduction of LLINs into the country, the NMCP developed a policy for distribution. The policy aims to concentrate the distribution in certain areas rather than to go for thin distribution as occurs before. Also the policy calls for distribution in rural areas as mosquito nets is the only tangible and suitable vector control measures in rural areas. Accordingly, the distribution was centred into 5 states and
even in these states the distribution moved from area to another after reaching coverage with at least one LLIN per household. The distribution is from house-to-house with a communication programme based on communication for behavioural impact (COMBI) methodology. Each household was ask to pay an equivalent to 1 US$ to cover the cost of the distribution and to support the SMCP and/or community facilities such as dispensaries, schools or any other facility. Poorer families were exempted. This policy is used also to distribute freely the LLINs coming as part of the GFATM (i.e. no money taken from households). In Blue Nile state as an example, the distribution started in 2003 using LLINs (Olyset™) donated by Japanese through UNICEF. In the first round, they started the distribution of 5000 LLINs in the first villages around the capital city in the state and then they moved around. In the subsequent rounds they build on the first distribution. Even before GFATM, a total of 92000 LLINs have been distributed in rural areas with overall coverage of 70% in this state. Some argued that rural people will sell these nets to people living in the city and hence they suggested starting with the city and then moving to villages. In contrary to their expectation the tracking surveys carried out by NMCP jointly with WHO showed that people are still keeping and using their nets after 2 years of the distribution. Overall, the estimated need for LLN is 7 million. So far a total of 965000 LLINs (including the 250 000 from GFATM) were distributed. What is important here, the NMCP and the SMCPs knows the details of the distribution to extent that they can tell the name of the family so the subsequent distribution will build on this.

**Malaria Free Initiative:** Recognizing the efforts carried out in Khartoum and Gazera States, FMOH and WHO supported the idea of making Khartoum and Gezira malaria free areas ie malaria will not be a public health problem by the end of 2005. Plans were developed and technical and financial support was provided by WHO, federal and the States ministry of health.

**Khartoum Malaria Free Initiative:** The initiative was based mainly on vector control focusing on larval control. Case management with emphasis on early diagnosis and appropriate treatment was also considered. The initiative relied very much on the efforts of related sectors. A functioning partnership is well established with the Urban Water Corporation and Ministry of Agriculture to deal with breeding resulted from broken water pipes (more than 9000 at the beginning of the project) and irrigation in farms and small schemes. Data provided so far showed a real reduction in the prevalence and hence the number of cases and deaths. The community and health care providers perceived the efforts positively. The Italian Fund supported a consultant to develop with national the plan for the second phase.

**Gezira Malaria Free Initiative:** Gezira has a long history of controlling malaria by using indoor residual house spraying. The success story in 1980s as part of the Blue Nile Health Project encouraged WHO to include Gezira in the malaria free project initiatives. The initiative started with WHO support and builds on the support provided by the Gezira Irrigation Scheme Board on annual basis. Data provided so far showed reduction in the number of cases and deaths (Fig 4).

![Figure 4 - The prevalence of malaria in Khartoum State, 1998-2006](image)

**Communication and advocacy:** With the assistance of consultants from WHO HQ and WHO/EMR, the NMCP became oriented and exposed to communication for behavioural impact (CMOBI) The NMCP celebrated the Africa Malaria Day (AMD) 25th April 2002-2006. Many activities to improve community awareness were carried out through Radios at National and State levels. In collaboration with the National Radio (almost free broadcasting), 10 messages covered case management and use of ITNs were broadcasted continuously. The messages were in Arabic and Arabi Juba, common in the southern states. Communication through the media and in particular the National Radio is going on nowadays as part of the partnership developed with Canar Telecommunication Company.

**Epidemic detection:** a weekly-based notification system from 16 epidemic-prone states has been developed with regular feedback from national to states very early in 2002. The system builds on the ongoing communicable diseases surveillance system. The SMCP coordinator in each state identified 4-7 sentinel sites from many sites that send reports to surveillance department regularly. He looks into the data, compiles them and sends a copy to the NMCP. This practice by time strengthened the
states coordinator with regards to early detection and response to epidemic. The “surveillance system for early detection and forecasting for malaria” project supported by WHO/HQ/Geneva covered 5 states and improved the capacity of using data at local level to develop an epidemic threshold so that malaria epidemic can be detected and dealt with locally. It is worth mentioning here, during the period, no major malaria epidemic occurs and the minor ones were contained quickly.

Monitoring and evaluation: day-to-day monitoring of the programme is going on through monthly and annual reports from the states and the NMCP departments, review meetings and supportive supervision. In 2004 the NMCP with WHO developed a comprehensive plan for monitoring and evaluation. The 2005 data was considered the base-line data as it covers the majority of the States.

Operational research: there is a research department at national level. The department facilitates the collaboration with research institutes and researchers in addition to monitoring of the researches carried out by the NMCP staff. During the period 2001-2005, 20 operational researches were carried out by the NMCP staff. Seven of these were published in local, regional and international journals. The results of these researches were utilized for improvement of the ongoing practice. The best example is the use of the efficacy studies (Chloroquine, sulfadoxine/pyrethramethine, ACTs...) to move from chloroquine to ACTs which has been recognized by COHRED (www.cohred).

**DISCUSSION**

With reference to Abuja Declaration (WHO/CDS/RBM), the MICS survey (UNICEF 2000) and MIS survey (unpublished document), great achievements have been made in certain interventions while in others the gap between the desired and the actual is big. Coverage with at least one mosquito net (any net) has been increased from 21.0% to 57.0% and with ITNs/LLINs from 0.4% to 21.7% in 2000 and 2005 respectively. Sleeping under any mosquito nets and under ITNs/LLINs the night prior to the survey was reported by 35.1% and 11.2% of the surveyed population in 2005 compared with 23.1% and 0.4% in 2000. Indoor residual spraying in the targeted areas was conducted regularly. Intermittent preventive treatment with sulfadoxine-pyrimethamine as a recommended strategy to control malaria in pregnancy was only practiced by 1.8% among women who reported pregnancy in the 2 years prior to the survey that ended in a live birth.

The use of ACTs was reported by only 10.5% of those who get fever during the last 2 weeks prior the survey. The majority of patients used chloroquine (65.6%) and sulfadoxine-pyremethamine (9.2%). With increasing procurement of ACTs through the GFATM, UNICEF, WHO and private sector (Malik et al., 2006), the use of ACTs is expected to increase. Efforts thus should be directed to improve treatment-seeking behaviour as late consultation was a feature in many parts of Sudan. It has been shown, that mothers in rural areas usually start care at home and, within an average of three days, they shift to health workers if there was no response (Malik et al., 2006). Among the barriers, the cost of services was of the greatest concern (Malik et al., 2005). With the official declaration of the “free consultation at primary health care level”, free ACTs, wide-scale implementation of malaria home management strategy and with the ongoing education campaign more patients expected to come early for consultation.

The achievements mentioned above can be attributed to combination of technical and administrative interventions. It also proved the additive role of integration, decentralization, community mobilization and partnership in malaria control. The efforts carried out by the NMCP to strengthen the SMCPs go in parallel with the decentralization policy adopted all over the country. The value of decentralized planning and mobilizing of resources for malaria control is well recognized. However, decentralization will not work without national leadership (Garfield R, 1999) and without commitment from political as well as technical staff. According to decentralization policy in Sudan, states and districts were responsible about local planning and implementation for malaria control. This transfer, as shown by Colombia experience (Kroeger A et al., 2002) requires capacity building, communication and management skills in addition to guidance from the national level. Countries that made significant advances towards malaria control had based this on human and organizational resources (Mabaso MLH et al., 2004). Infrastructure and human capacity building in clinical, public health and environmental disciplines should be the priority (Killeen GF et al, 2004).

A management and partnership consultant recruited by the Malaria Consortium recently stated that (unpublished document), the leadership of NMCP has achieved a great deal in developing technical capacity and partnership. The role of NMCP should become that of the leader and co-ordinator of a much wider partnership operating under the umbrella of RBM that will have far greater access to resources in the coming future. Thus he recommended, the management of partnerships must be adequately resourced and systematised. He also recommended the continuation of integration with leishmaniasis and extension of this to other vector
borne diseases such as lymphatic filariasis, trypanosomiasis, yellow fever, dengue fever...ect. The last recommendation now is on the ground.

CONCLUSION AND RECOMMENDATIONS
The current malaria control programme is organized according to the RBM strategic plan requirements. The programme relies very much on developing state capacity to be able to lead the control activities and partnership. It also recognizes the importance of adopting evidence-based and cost-effective interventions. The programme gives more attention to the role of partners. The main challenges are sustaining the success through reduction of staff turnover, increasing regular financial resources, availing LLINs particularly to rural population and increasing access to ACTs through implementation of malaria home management. The NMCP in the new era should view its role as the leader and co-ordinator of Roll Back Malaria in Sudan, thinking of RBM as a social enterprise rather than NMCP as a public service.

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