Malaria Preparedness Plan, Greater Darfur Region, Sudan, 2005

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1 Meteosat Rainfall Estimation (RFE) imagery is an automated (computer-generated) product which uses Meteosat infrared data, rain gauge reports from the global telecommunications system, and microwave satellite observations within an algorithm to provide RFE in mm at an approximate horizontal resolution of 10 km (http://www.fews.net/imagery/?pageID=imageryRfe).
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1 Introduction

Malaria is the leading cause of morbidity and mortality in Sudan. It is assumed that symptomatic malaria accounts for 20-40% of outpatient clinic visits and approximately 30% of hospital admissions. Almost 90% of all malaria cases are caused by *falciparum* malaria which causes the most severe form of the disease and deaths attributable to malaria.

High seasonal rainfall, variation in temperature and humidity which is observed during the rainy season in Sudan can favour mosquito breeding, resulting in strong seasonal transmission.

General poverty, limited access to health care and displacements enforced by poverty and/or conflict may also favour high intensity transmission of malaria in Sudan. The potential for epidemics can increase due to the influx of non-immune populations moving from areas of no malaria/low transmission to highly endemic areas.

The situation in Greater Darfur, because of prolonged conflict, a weak health system, massive population displacement, and limited access to health care services, offers a particular challenge to the emergency health managers for prevention and control of malaria. Malaria endemicity and transmission increases from North to South and West of Darfur. While the state of North Darfur is characterized by low malaria transmission and consequently people living in North Darfur will have low immunity, the state of South Darfur is typically characterized by more recurrent transmission and consequently people in South Darfur are expected to have higher immunity. Therefore, people moving from areas of low transmission (including non-immune people) to areas of higher transmission in Darfur will be exposed to high malarial transmission when other favourable conditions for mosquito vector such as stagnant water, flooding and changes in environment and excessive rainfall are present. Conversely, movement from hyperendemic to lower endemic areas in Darfur will also heighten epidemic risk in the local communities during the malaria season. In addition, overcrowding conditions and temporary shelters in camps and temporary settlements of the internally displaced people (IDPs) in Darfur are also likely to promote the transmission cycle of malaria. Given the fact that all pre-cursors for an outbreak of malaria prevail in Darfur during the current season (June-November), it is of paramount importance to develop and put in place an epidemic preparedness and response plan for malaria to avoid all “preventable” deaths and reduce morbidity due to malaria in Greater Darfur.

2 Strategy of Outbreak Preparedness and Response plan

The main goal of this outbreak preparedness and response plan is to reduce malaria burden in Darfur, especially amongst the IDPs living in camps and other temporary settlements. This goal will, strategically, be achieved through:

- Early detection of an outbreak using an early warning and early detection system for malaria outbreaks in IDP camps and settlements in Greater Darfur;
- Early diagnosis and prompt treatment of all malaria cases;
- Planning and implementation of selective measures for transmission control like reduction of vector density towards prevention of outbreaks.

3 Objectives of the Plan

The objectives of this outbreak preparedness and response plan for malaria are to:

(i) Identify outbreak prone areas and populations at risk from malaria in Greater Darfur, to allow prediction and detection as well as forward planning of logistics for better targeting
response;
(ii) Prevent predicted malaria outbreaks by vector control measures;
(iii) Detect an outbreak at its early stage and bring it under control through rapid case management, and, where possible, vector control;
(iv) Streamline operational procedures for a coordinated response to a malaria outbreak;
(v) Conduct operational research for addressing critical knowledge gaps that may contribute to effective control and sustainable reduction of malaria transmission risk in crises situations;
(vi) Learn lessons of outbreak control and management in order to improve outbreak preparedness and response for future outbreaks of malaria in Greater Darfur.

4 Implementation

The National Malaria Control Programme (NMCP) of Sudan, in collaboration with the State Ministry of Health (SMoH) of the three Darfur states (North, South and West Darfur), will be operationally responsible for implementation of the plan, while WHO will provide technical oversight, advice and data management support for operationalization of the plan in Greater Darfur.

5 Components of the Plan

The malaria preparedness and response plan will have three major components, each with specific activities and sub-activities in order to accomplish the goal and objectives of the plan:
6 Early Detection and Forecasting of Outbreaks

An early warning system for malaria (Malaria Early Warning System-MEWS) and early detection system (EDS) for malaria outbreaks will be introduced throughout Greater Darfur during the high risk season (July to November) for identifying and measuring the build-up time towards an evolving outbreak. The overall goal is to enhance the surveillance system to direct the preventive and control measures to the specific camps/settlements for IDPs in Greater Darfur.

6.1 Malaria Early Warning Systems (MEWS)

The Malaria Early Warning System (MEWS) system would be based on monitoring of climatic indicators, like unusual increase in rainfall, in order to predict or detect those conditions suitable for an outbreak at any given time and place in Darfur. The combination of increased rainfall and higher temperature in desert-fringe areas would signal the beginning of an outbreak, while excessive rainfall beyond the historical seasonal average would signal the likelihood of an outbreak in arid and semi-arid areas of Greater Darfur.

Other population-vulnerability factors will also be studied closely, in conjunction with rainfall, to predict the potential severity of outbreaks (not the timing), including:

- The migration of non-immune populations into malaria risk areas;
- Prolonged drought;
- Poor nutritional status of the population;
- High incidence of other diseases that may compromise health status;
- Environmental changes that increase the risk of transmission, such as sudden increase in vectorial capacity (anopheles densities).

6.2 Early Detection System (EDS) for Malaria

6.2.1 Defining epidemic thresholds for Early Detection

The Early Detection System (EDS) aims to detect the beginning stages of an outbreak by measuring changes in the incidence of morbidity and mortality. The system is based on analysis of surveillance data on (i) clinical malaria cases, (ii) laboratory diagnosed malaria cases and (iii) malaria mortality. The existing epidemiological surveillance system (EWARS), functioning in the IDP camps of Greater Darfur, already provides weekly surveillance data for early detection of malaria outbreaks. Data are analyzed and reviewed on a weekly basis at the central level in terms of:

- Weekly attack rates (or incidence rates) by camps, broken down by age groups (where feasible);
- Case Fatality Rates (CFR) of clinically diagnosed malaria cases by camps and by age-groups;
- Deviation from the mean (average) of malaria cases, calculated over one year for the specific IDP camps to determine any unusual/seasonal increase of cases;
- % of parasitologically confirmed cases.

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2 Typically this would signal the timing of an increase in malaria transmission 2-4 months before a malaria epidemic occurs.
3 In the northern area of North Darfur state is nested in Sahara desert and is characterized by low rainfall. The state of West Darfur is characterized by short rains beginning from May, peaking in July-August and finishing in October and the average rainfall in this state varied between 250-500mm. The state of South Darfur is characterized by increased humidity in areas bordering Central African Republic with average rainfall in excess of 1000mm. Typically, the peak of malaria incidence occurs approximately 6 weeks after the peak of rainfall.
4 Early detection indicators from the health facilities may confirm the onset of an epidemic situation and predict the magnitude of the epidemic 3-4 weeks in advance.
6.2.2 Choice of indicators

Monitoring of unconfirmed malaria cases is notably prone to bias because it is subject to imprecise clinical case definitions and varying diagnostic practices. Field research studies have shown for different settings that a majority of clinically diagnosed malaria cases would not be confirmed through microscopy or careful clinical exclusion of alternative causes for fever. Attempts to produce more specific algorithms for the clinical diagnosis of malaria have not been successful so far. The major pitfall is the potential confusion between a genuine increase of malaria incidence and a seasonal peak of another febrile illness (mainly influenza and acute respiratory infections). Although this problem is particularly acute in low transmission areas (with a low proportion of malaria among fever cases), this can be partly solved by restricting surveillance to the relatively wet and hot season prone to malaria transmission during which most of other infections are usually not favored. Despite these important drawbacks, the number of unconfirmed malaria cases is the most suitable indicator to monitor in the context of resource-constrained settings where access to a reliable laboratory is rare. Compared to other indicators listed below, its most important advantage for time series analysis is a better stability simply due to higher frequencies (case loads). But other arguments are also critical for this choice, as follows below.

Laboratory confirmed cases are certainly the best indicator to use for detection of epidemics, although unavailable in most peripheral health facilities. However, several other major constraints are restricting the use of it. The first is that laboratory data are distorted by selection bias; generally, only a small portion of febrile patients is tested and those who are tested are unlikely to be representative. Secondly, selection criteria vary over time according to laboratory workload, availability of reagents and drugs and/or diagnostic practice of different staff. Thirdly, quality of results might be variable and questionable because malaria slides are relatively difficult to read and highly dependant on operator and material. The same limitations apply to the derived proportion of positive slides or Slide Positivity Rate (SPR) to be used for epidemic detection.

In health centers and hospitals with In-Patients Departments (IPDs), other attractive indicators (more specific for malaria) to be considered are the absolute numbers or proportions of malaria related admissions or deaths. Use of blood transfusions has been used as a proxy measure for incidence of severe malaria. In areas where seasonal migration of workers is significant, pediatric admissions are more likely to give an accurate picture of the local malaria transmission than adult admission; in such situations children are less likely to have functional immunity or to have traveled and acquired the disease elsewhere. Here again, field observations reveal poor respect of recommended case definitions and diagnosis practice: severe malaria is often over-diagnosed after exclusion of other severe diseases even without parasitological confirmation and ignoring more specific clinical criteria.

6.2.3 Attendance as major confounding factor

Typically, long-term facility-based data are difficult to interpret without taking into account how the population may have changed in number and care-seeking practice over time. Population growth can be considered as the simplest explanation for consistently rising malaria case counts. But many other factors can impact attendance rates more dramatically: prices and cost recovery schemes, availability of drugs, quality and number of staff, geographical partition of care delivery units and, of course, population displacements. Having so frequently “false” epidemic alerts makes the application of such techniques questionable. In contrast, for a clinic, any abrupt loss of attraction or served population would lead to epidemic thresholds lacking sensitivity.

6.2.4 Use of incidence thresholds for alert

Either of the following two indicators will be used to raise an alert to trigger public health action for IDP camps/settlements in Greater Darfur:

- **Relative values**: When the average case load of the most recent four weeks is at least 1.5 times higher, compared to the average of a similar four-week period in the
previous year;
- **Statistical cut-offs**: When the most recent case load is above the weekly mean, averaged over the past one year, plus two standard deviations of historical value.

### 6.3 Rapid Field Investigation for Outbreak Verification

As soon as the surveillance system raises an alert in any of the IDP camps/settlement in Darfur, a field investigation will be carried out by the Rapid Response Team (RRT) of the SMoH in order to verify the existence of an outbreak. A standardized case investigation procedure will be followed by the RRT to collect data on malaria cases from the community as well from the health centres. A retrospective analysis of the data will then determine whether an outbreak is imminent.

The data and the medical records will be reviewed and analysed in terms of:
- **Time**: the moment the first case occurred. An outbreak curve could be drawn with the increases in the number of cases;
- **Place**: where the first cases/cluster occurred. By geographically mapping the cases, the spreading of the outbreak to other areas could be visualised;
- **Person**: representing the age distribution of cases (percentage of cases by age group). In a table the most affected age groups (attack rates by age group), and the age group with the highest case fatality ratio could be presented.

Broadly, three indicators will be used to determine impending outbreaks:
- Comparison of monthly reported cases of present year with last year;
- Comparison of confirmed malaria cases and proportion of suspected cases diagnosed by broad age classification (under 5 and over 5 years age group) over the past 8 weeks;
- Comparing the case fatality rate for the past 8 weeks (by age grouping).

### 6.4 Classifying the Types of Malaria Outbreak Patterns

Once an outbreak/outbreak has been confirmed, the prevailing trend of the malaria transmission needs to be further analysed in order to determine the types of malaria outbreak patterns:

1. **True outbreaks**: Infrequent/cyclical outbreaks in relatively non-immune populations related to climatic anomalies (mainly arid and semi-arid zones in Darfur) with little or no seasonal fluctuations where infection is normally rare;
2. **Strong seasonal transmission**: Variable but relatively predictable transmission influenced by variations in normal climatology;
3. **Combination of both true outbreaks and strong seasonal transmission**: Malaria transmission aggravated by massive population movement resulting in the appearance of features of both true outbreak and strong seasonal transmission;
4. **Yearly increase towards endemicity**: A general upward trend in endemicity and transmission in areas where malaria has reemerged due to neglected control activities.

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5 The considerable increase in cases (clearly beyond what is normal for the area) in the reporting month over the year before is suspicious of a malaria epidemic
6 If the proportion of fever cases that are confirmed as malaria is increasing considerably in the past two weeks, this can signal an impending epidemics
7 An increasing trend of case fatality rates over past weeks could be significant. Excessive case fatality rate in falciparum malaria (> 1% in all cases and > 20% for severe cases fulfilling malaria case definitions are features of an epidemic)
7 Epidemic Preparedness

7.1 Identification of epidemic prone areas (IDP camps, settlements) and populations at risk

Using the past historical epidemiological data on clinically diagnosed malaria derived from the Early Warning and Alert Response (EWARS) surveillance system, the epidemic prone areas and populations at risk for malaria in Greater Darfur will be stratified. Based on the cumulative incidence rate for malaria in 2004, all the IDP camps in Greater Darfur will be categorized into high risk, middle risk and low risk camps. In accordance with this risk scale, the number and proportion of populations at-risk in each of the IDP camp is estimated8.

7.2 Epidemic risk and resource mapping

Using GIS or HealthMapper, outbreak risk maps will be prepared and updated on a monthly basis using the weekly surveillance data for malaria from EWARS. The currently available resources (money, material and human resources available for outbreak control and response) of NGOs working in the outbreak-prone IDP camps and settlements are to be mapped for efficient utilization and management, as well as to identify potential gaps in response. The resource map will periodically be updated throughout the high risk season (July to November) for malaria.

7.3 Epidemiological surveillance

A sentinel surveillance system will be established during the high risk season for malaria (July to November) and will function as an adjunct to the EWARS system for outbreak prone diseases in Darfur. The sentinel surveillance system is established to gather quality data on malaria cases in a timely manner and to be better able to estimate the trend.

All health centres run by the NGOs and the SMoH as well as all the public hospitals which are within the geographic catchment areas of the high risk and middle risk IDP camps and settlements and amongst those which have minimal diagnostic facilities for parasitological confirmation (Rapid Diagnostic Test Kits (RDTs) or Light Microscopy) are selected as sentinel sites for malaria surveillance.

The sentinel surveillance system gathers data on a weekly basis and the data are analyzed both at the state level as well as at federal level using the following indicators:

- Number of deaths reported due to malaria;
- Proportion of positive RDT results or positive blood smears/total suspected;
- Proportion of malaria cases/total number of consultations;
- Proportion of uncomplicated/severe cases of malaria;
- Proportion of <5 malaria cases/total number of malaria cases;
- Increase in malaria incidence rate.

7.4 Designation of primary treatment centres and referral hospitals for malaria case management

While all health centres in Darfur (whether run by NGOs or SMoH) are responsible for treating

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8 In accordance with an estimate made by WHO/AFRO in the 1990s as part of the program for accelerating the implementation of Regional Malaria Control Strategy in Africa, the estimated proportion of population at risk in Sudan was thought to be 50% which was determined by expert national opinion based on historical malaria incidence data and knowledge of risk factors. Using this value as reference, the population at risk of epidemics in these IDP camps was calculated for each IDP camp by multiplying its total population by the proportion thought to be at risk.
malaria cases, those health outposts which are located within the geographic catchments of high risk and middle risk IDP camps are designated as primary treatment centres for management of malaria cases during an outbreak. Sufficient quantities of anti-malarial drugs for first-line and second-line of treatment for uncomplicated malaria will be stockpiled at each of the primary treatment centres. All health care providers working in the primary treatment centres will be trained on standardized case management of uncomplicated malaria as per the National Guideline for Treatment of Malaria in Sudan. All primary treatment centres will have the proper diagnostic facilities for parasitological confirmation of malaria cases (either by RDTs or Light Microscopy).

Nyala Teaching Hospital in South Darfur, El Fasher Teaching Hospital in North Darfur and El Geneina Hospital in West Darfur will act as referral hospital for treating severe malaria cases. Sufficient quantities of anti-malarial drugs and emergency medical supplies for in-patient management of at-least 500 severe malaria cases, at any given point in time, are to be stockpiled at each of these designated referral hospitals. All medical doctors working in the hospitals will be trained on standardized case management of severe malaria as per the National Guideline for Treatment of Malaria in Sudan. All the referral hospitals will have the facilities for light microscopic examination of blood smear in order to track the progress of high-risk cases of severe malaria.

7.5 Stockpile

An adequate stockpile of anti-malarial drugs, RDTs and other basic laboratory supplies and insecticides and necessary equipment for vector control will be maintained for preparedness and response.

7.5.1 Anti-malarial drugs

The anti-malarial drugs for the first-line and second line of treatment as approved by the National Malaria Control Programme (NMCP) of the Government of Sudan, will be stockpiled in all the primary treatment centres while antimalarial drugs for case management of severe malaria cases will be stockpiled in the referral hospitals. Based on data from previous years, an expected case load of clinically diagnosed malaria cases will be projected for each of the high risk camps and the requirement of drugs for first line and second line treatment as well as drugs requirement for treatment of severe malaria cases will be estimated based on this projected case load. Between 30-40% of the estimated requirements of drugs will be actively stockpiled (to prevent expiration of the drugs) throughout the high risk season.

7.5.2 Rapid Diagnostic Kits (RDTs) and other basic laboratory supplies

Rapid Diagnostic Test Kits (RDTs) as well as other essential laboratory supplies and equipment (preferably Light Microscope, where feasible) will be stockpiled in all the primary treatment centres in order to facilitate laboratory confirmation of malaria cases. Light Microscopes will be distributed to all the referral hospitals as well as to those health centres run by the NGOs where the minimal laboratory diagnostic facilities exist.

7.5.3 Insecticides and equipment for vector control

Sufficient quantities of insecticides, hand sprayer pumps, protective clothing and other necessary supplies for Indoor Residual Spraying (IRS) will also be stockpiled at the warehouses of SMoH in Darfur for responding to an outbreak.
7.6 Vector Control

Vector control remains the mainstay for preventing and reducing malaria transmission in Darfur through curbing densities and infectivity of malaria vectors. In order to have a rapid and large-scale impact on vector populations and to ensure effective protection to all individuals within a community, indoor residual spraying (IRS) is the preferred method of malaria vector control in Darfur. IRS aims on (i) reduction or interruption of transmission of disease, (ii) preventing gradual build-up of transmission, or (iii) targeting camps/settlements where an outbreak is forecasted/predicted through the early warning system.

7.6.1 Indoor Residual Spraying (IRS)

The current strategy for control of vector mosquitoes through IRS principally focuses on:

- Targeting the IDPs living in all the high risk as well as the middle risk IDP camps and settlements in Darfur with blanket IRS;
- Spraying twice (first cycle in late July and the second cycle in early October) during the malaria transmission season;
- Achieving a high coverage (proportion of houses and rooms sprayed in IDP camps/settlements) of more than 85% in every IDP camp/settlement in Darfur to ensure “mass effect” and tangible impact on transmission;
- Using Deltamethrin 2.5% SC formulation, because of the type of human dwellings in the IDP camps and settlements in Darfur.

7.6.2 Insecticide Treated Nets (ITNs)

Although the vector control in Darfur does not lie on mass distribution of ITNs. However, as long as ITNs (specially LLINS) are distributed/deployed achieving high coverage and used fairly rapidly, could be an important strategy for outbreak control, specially where house structures do not allow IRS and where population have stabilized. NGOs and other UN agencies are encouraged to distribute the ITNs as well as long lasting Insecticide Treated Nets (LLINs) free to IDPs and to encourage their use. Priority should be given to the pregnant women and to children under 5 years of age.

7.7 Standardization of Case Management

The use of the “National Guideline for Treatment of Malaria” developed and approved by the National Malaria Control Programme of the Federal Ministry of Health (FMoH) in Sudan will be extensively promoted to standardize case management of both “uncomplicated malaria”, “treatment failure malaria” as well as “severe malaria” at all health facilities in Darfur.

7.8 Training for competency and skills building for treatment

During the high risk season (July to November), health care providers as well as community health workers working with NGOs as well as with the public sector will be trained in standardized case management, laboratory diagnostics, vector control and home management of malaria cases in accordance with the National Guidelines for Treatment of Malaria in Sudan.

7.8.1 Training on case management

All health care providers working at the designated primary treatment centres of high risk and middle risk IDP camps and settlements will be trained in case management of uncomplicated malaria while all medical doctors working at the referral hospitals will be
trained on management of severe malaria cases in accordance with the National Guideline for Treatment of Malaria.

7.8.2 Training on laboratory diagnostics

Laboratory personnel working at the designated referral hospitals as well as the primary treatment centres of the high risk and middle risk IDP camps and settlements which have diagnostic facilities will be trained or re-trained on the use of RDTs for parasitological confirmation as well as microscopic confirmation of blood smear.

7.8.3 Training on field investigation

The Rapid Response Team (RRT) of each of the three states in Darfur will be trained in order to build core competency in protocolized procedure for field assessment, case investigation and outbreak detection using a standardized protocol and questionnaire. An outbreak investigation kit will be pre-positioned for use by the RRT in each state in Darfur.

7.8.4 Training of Home visitors and Community Health Workers

Appropriate training will be provided to home visitors and community health workers of primary treatment centres of high risk and middle risk IDP camps and settlements in improved recognition of malaria illness during home visits, and referral of active cases to health facilities for treatment.

7.9 Coordination of Outbreak Response

A Malaria Outbreak Task Force comprising members from SMoH, NGOs, WHO and other UN organizations will be formed in each of the three states in Darfur. The task force will be responsible for the coordination of the emergency response to any outbreak of malaria in Darfur. The team will be chaired by the Director General of the SMoH.

7.10 Operational research

A number of operational research activities will be conducted during the course of the implementation of the plan, to address critical knowledge gaps in the prevention and control of malaria. The research findings will be used to improve early detection, case management and field diagnostics practice for malaria prevention and control. Research will focus on:

- Use of weekly malaria case surveillance data for setting incidence thresholds and cut-offs for outbreak alert and malaria outbreaks in displaced and dynamic population settings;
- Evaluation of the Rapid Diagnostic Test kits on its predicted sensitivity for true parasitological confirmation of malarial illness in unstable field situations like Darfur;
- Effectiveness of the anti-malarial drug distribution system and preferences for, and barriers to the choice of malaria health care.
- Comparison between ITNS and IRS for malaria outbreak prevention and control.
8 Epidemic Response

8.1 Early Diagnosis and Prompt Treatment

During an outbreak a diagnosis of malaria always precedes treatment with anti-malarial drugs. A diagnosis will be made based on a clinical suspicion of the disease due to fever and other signs and symptoms.

8.1.1 Diagnosis

During an outbreak, all cases of malaria need initially to be clinically diagnosed using the standardized case definition. When possible, Rapid diagnostic tests need to be carried out together with the clinical diagnosis, for parasitological confirmation of uncomplicated malaria (in order to detect the parasite-specific antigen). The parasite based diagnosis is essential to:

- Diagnose the cause of an outbreak of febrile illness;
- Confirm the end of an outbreak;
- Follow the progress in high risk cases, e.g. severe malaria.

Light microscopic examination of blood smear will be carried out routinely in each referral hospital to track the progress of high-risk cases of severe malaria.

8.1.2 Treatment

Once malaria has been confirmed as the cause of an outbreak, treatment would be solely based on clinical presentation and each patient will be treated early with a full course of anti-malarial drugs as per the National Guideline for Treatment of Malaria in Sudan. Accordingly, at all health facilities, the standardized case management protocol for uncomplicated, treatment failure and severe malaria will be followed. In practice, all patients attending health facilities will be triaged to ensure that the sickest patients are seen and treated first.

(i) Management of Uncomplicated Malaria

All cases of uncomplicated malaria will be treated with first line treatment as mentioned in National Malaria Treatment Protocol for Sudan. In the case of treatment failure the patient will be put on second line of treatment.

(ii) Management of Severe Malaria

As soon as the signs and symptoms of severe malaria are recognized, the patient needs to be immediately referred to a higher level of emergency care. While referring the patient to a higher level of care and while at the higher level of care, all cases of severe malaria need to be provided with (pre-) referral treatment in accordance with the protocol.

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9 Rapid Diagnostic Tests should not be relied on as the sole basis of treatment and a negative test result should not preclude treatment during an on-going epidemic. When parasite-based diagnosis is essential, rapid diagnostic tests (RDTs) offer the advantage of simplicity and speed over light microscopy, particularly in situations when the normal laboratory services are non-existent or overworked. Published sensitivity for *P. falciparum* range from comparable to good filed microscopy (> 90% at 100-500 parasite/µl) to very poor (40-50% for some widely used products).

10 The goal should be to treat every patient of either clinically or parasitologically diagnosed case with full course of anti-malarial drugs within 24 hours of onset of symptoms. This is because delay in treatment of uncomplicated malaria especially in non-immune patient could result in progression to severe disease which is associated with a high case fatality rate.

11 A negative RDT result should not automatically preclude treatment especially in severe clinical diseases.
(iii) Management of pregnant women with malaria

All pregnant women with malaria need to be treated at the health facilities in Darfur as per the National Guideline for Treatment of Malaria.

8.2 Active case finding

When an outbreak has been confirmed in an IDP camp/settlement, the home visitors/community health workers\(^\text{12}\) of primary treatment centres will be visiting home to home in the camp, to find out active cases (based on clinical presentation) and refer them to the treatment centre in order to ensure they receive treatment with full course of anti-malarial drugs within 24 hours of onset of illness. During the period when the outbreak is ongoing, the home visitors will also follow-up on the old cases (to ensure treatment compliance and recovery) and report to the treatment centres about any death due to malaria at home.

8.3 Transmission control

As soon as an outbreak has been confirmed in a camp/settlement, the affected camp/settlement will be targeted for rapid containment of transmission through indoor residual spraying at the very beginning of the outbreak or during outbreak acceleration. A high coverage (>85%) needs to be achieved for IRS to ensure a “mass effect” of the IRS for reducing vector density as well as control of vector transmission in the affected camp/settlement.

8.4 Quick access to care

During an on-going outbreak in an IDP camp/settlement, the primary treatment centres within the geographic catchment area of the affected camp is primarily responsible for treating all cases of uncomplicated malaria. All treatment should be “free” without any user fee (whether run by the SMoH or NGOs). In the following circumstances, mobile clinics or additional temporary fixed treatment units may be opened up as a time-limited measure in order to reinforce the local health centres:

- When the number of malaria cases are extraordinarily high to the extent that the existing fixed centre is unable to cope with the huge influx and there is a need to quickly deploy treatment facilities for a large number of malaria cases;
- When malaria cases are being reported from certain areas of the camps/settlement which remain inaccessible due to geographic terrain, insecurity or other physical constraints;
- Malaria cases are being reported from areas/camps wherein no facilities for treatment of malaria cases exist nearby.

All mobile clinics/temporary fixed treatment units will be capable of parasitological diagnosis, including managing of both uncomplicated and severe malaria cases.

8.5 Coordination for Outbreak Response

During an on-going outbreak, all response efforts will be coordinated at the state level by the Malaria Outbreak Task Force set up at the state level with technical backstopping from the National Malaria Control Programme (NMCP) of Sudan. WHO will closely collaborate with the NMCP and the SMoH of the affected state for technical supervision and monitoring of the interventions targeted for outbreak control and management.

\(^{12}\) One (1) Home Visitor/Community Health Worker will be assigned for every 1,000 population in the camp/settlement for active case finding.
8.6 Community involvement and social mobilization

Constant contact between health authorities and the population at-risk will be pursued for successful outbreak response efforts. In order to reach out to all the affected population, communities will be informed by regular visit of home visitors and community health workers of the primary treatment centres in to the affected areas, on the following:

- The risk of malaria outbreaks and how to avoid them;
- What to do if family members become ill;
- What, where and why control measures are carried out;
- What the communities can do to combat the outbreak.

8.7 Post-outbreak evaluation

After the outbreak is over, an evaluation will be carried out on the following:

- Epidemiological characteristics of the outbreak;
- Evaluation of surveillance indicators (Sensitivity and predictive value) used for early detection and predicting an outbreak;
- Quality of surveillance for outbreak forecasting;
- Assessment of the timeliness from onset to outbreak detection;
- Assessment of the timeliness from outbreak detection to response;
- Management of the outbreak response;
- Assessment of logistics and budgetary matters.

8.7.1 Indicators for monitoring and evaluating the response to the outbreak

The following indicators are used to monitor and evaluate the response to the outbreak:

(i) Process indicators

**Access to health care** During each week of the outbreak:
- All camps/settlements within the outbreak area within 2 hours travel of skilled and adequately equipped health care;
- Mobile clinics set up and running according to planned schedule;
- Arrangements for referral implemented for 90% of cases;
- No rupture of stock of drugs designated for use in the outbreak;
- Malaria diagnosis and treatment free of charge.

**Vector control**
- Planned IRS activities achieved within the time frame (i.e. while outbreak curve is still rising);
- Planned distribution/re-impregnation of insecticide-treated nets (ITNs) achieved within the time frame (i.e. during the onset of the outbreak).

(ii) Outcome indicators

**Indicators of good case management**
- Time from onset of symptoms to presentation for treatment < 24 hours;
- Percentage of patients developing severe disease shows a downward trend;
- Hospital CFR for all admitted cases < 1%;
- CFR for severe falciparum malaria < 20%.

**Indicators of interruption of transmission**
- The incidence curve flattens or falls;
- The slide/test positivity rate flattens or falls.
(iii) Indicators of outbreak preparedness and response

- Emergency preparedness plan of action available and reviewed within 24 hours of alert;
- Outbreak investigation initiated within 48 hours of alert;
- Plans made and extra resources requested within 48 hours of completion of outbreak investigation;
- Necessary resources (including additional requested resources) deployed within 2 weeks of outbreak alert;
- Emergency meetings with partners to coordinate response.
## 9 Budget

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<td><strong>TOTAL COST (IN USD)</strong></td>
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Annex: Vector control proposal

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1 Introduction

Darfur is an area of low and seasonal malaria transmission, with a peak in cases expected just after the rains, usually in August-October. Transmission increases from north to south. People have little immunity to malaria. Severe disease and death due to malaria can occur at all ages. Young children, pregnant women, malnourished people and patients with concurrent infections (including HIV) are most vulnerable.

Current predictions are that the rains in 2004 will be low to normal. Mosquito density and malaria transmission should not be excessive compared to normal years. However, local epidemics with high mortality may occur among vulnerable displaced populations because of the concentration of people, the lack of adequate housing and preventive measures resulting in increased exposure to mosquito bites, and reduced access to effective treatment. People located near permanent water bodies are at risk year-round.

The first priority in an epidemic is prompt and effective diagnosis and treatment of malaria with artemisinin-based combination therapy (ACT). Reference is made to the information note on the current introduction of ACT in Sudan. Vector control can significantly contribute to reducing the risk of infection and saving lives provided that it is well planned, targeted and timely. Anti-vector measures for epidemic prevention and control can be implemented effectively only if they are supported by an infrastructure of well-trained personnel, adequate supplies and equipment, supervision and evaluation.

Implementation of vector control is most cost-effective when used for prevention before an epidemic, or for control at the very start of an epidemic. It should aim at high (> 85%) coverage to achieve “mass effect” and impact on transmission. Vector control can be used to prevent a seasonal transmission surge, targeted at communities where an epidemic is expected soon. In Darfur it should be implemented at no cost to the end-user.

Indoor residual spraying (IRS) is the preferred method since it is especially well adapted to epidemic prevention and control. For Darfur, any synthetic pyrethroid insecticide can be used, provided WHOPES specifications are met and the requisite safety precautions for its use and disposal are taken. Synthetic pyrethroids have a residual action of 2–6 months, are safer to apply than most other insecticides and still face relatively limited resistance. For straw and mud walls, WP (wettable powder) formulations are suitable. EC (emulsion concentrate) is not suitable. IRS is recommended to protect populations living in huts and other walled structures that will still be upright after the rains when malaria transmission reaches its peak. Shelters made of plastic sheeting and tents can also be treated, preferably using a specific formulation (deltamethrin SC 5% (other concentrations also suitable), Suspension Concentrate). For plastic sheeting, the amount of solution per surface area should be reduced compared to spraying on walls13.

There is limited documented evidence on the impact of insecticide-treated mosquito nets (ITNs) in epidemic prevention and control. Community use of ITNs in Darfur is limited, like in many other epidemic-prone areas. Thus, the effectiveness of ITNs would depend on behavioural change: people should actually sleep under the nets. The approach would be suitable to protect populations where (i) ITNs and support structures for hanging them (huts of over 1½ meters high; sticks or ropes for outside use) are readily available and there are staff experienced in implementing ITN programmes, (ii) where a high coverage with untreated nets already exists and a functioning infrastructure can ensure timely treatment with insecticide (unless long lasting insecticidal nets are used), and (iii) in scattered populations where implementation of IRS is impractical or exorbitantly expensive. ITNs provide personal protection even when coverage is low. Due to their market value, ITNs may be liable to selling and theft14.

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14 Instructions for the implementation of ITN programs are available on the WHO Roll Back Malaria website (http://www.rbm.who.int, for instance Insecticide treated mosquito net interventions: a manual for national control program managers (WHO/ CDS/ RBM/ 2002.41) and Instructions for treatment and use of ITN (WHO/CDS/ WHOPES/GCDPP/2002.4).
Larval control, usually with temephos (Abate), may be useful for epidemic prevention in exceptional circumstances where breeding sites are few, permanent, identifiable and accessible. The intervention only reduces vector density, not longevity, so that its impact on malaria transmission in rural areas with multiple breeding sites will be limited and should considered only as complement of other vector control measures above indicated. There is no evidence to support the use of ULV space spraying (fogging) as a means of epidemic prevention and control.

2 Objectives

2.1 General Objective

To reduce the incidence of both malaria and bloody diarrhea caused by mosquitoes and houseflies, respectively, in IDP camps and settlements in the Greater Darfur area through the control of adult resting flies using indoor and outdoor residual insecticide spraying of human dwellings and insecticide treated mosquito nets (ITNs) and through the control of immature stages of the vectors by either modifying their breeding sites or by larviciding.

2.2 Specific Objectives

1- To identify the breeding sites of malaria mosquitoes in and around the IDP camps;  
2- To reduce the density of malaria vectors and other disease carriers through sanitation and insecticide treatment of breeding and resting sites;  
3- To sustain a system of vector control through regular spraying of breeding and resting sites and distribution of treated mosquito nets; and  
4- To increase the population’s awareness of vector-borne diseases and stimulate the population to participate in disease prevention and control.

2.3 Activities

1- Vector surveillance through regular checks of mosquito in the IDP camps;  
2- Outdoor and indoor residual insecticide spraying of mosquitoes;  
3- Health education for community participation in vector control;  
4- Training of MOH and NGO staff for vector control activities; and  
5- Operational research for monitoring vector susceptibility and/or resistance to insecticides in use.

3 Rationale

Because of the importance of vector borne diseases among displaced populations living in camps in Darfur, there is need to carry out vector control activities in order to curtail infections and reduce both morbidity and mortality caused by these diseases. Between 22 May 2004 and 1 July 2005, a total of 254,947 clinically diagnosed Malaria cases, including 397 deaths (CFR 0.16%) were reported from the Greater Darfur Region through the Early Warning and response System EWARS. The weekly distribution of reported clinically diagnosed Malaria cases by state is shown in figure 1.
4 Methodology

4.1 Interventions

An integrated approach will be adopted for the control of disease vectors in all selected IDP camps. This approach will consist of: (1) using a residual insecticide to control adult mosquitoes; (2) improving environmental sanitation through the collection of refuse and the covering of man made holes and open burrows (made by brick makers); (3) larviciding by spraying a less toxic chemical (e.g. Temephos) on water collections to kill mosquito immature stages (larvae and pupae); and (4) community mobilization through public health education. In addition, there is a need to advocate the use of insecticide treated mosquito nets (ITNs) for prevention of malaria mosquito bites and other vector-borne diseases.

4.2 Selection of IDP camps

The selection of IDP camps for vector control activities will be based on the incidence of Reported Clinically Diagnosed Malaria Cases. The following IDP camps have been selected for vector control: Abou Shouk, Zam Zam, Kabkabiya, Kutum, Kassab and Fataborno in North Darfur State; Mornei, Kulbus, Habila, Mukjar, Um Kher and Um Dukhum in West Darfur State and Kalma, Kass, Ottash, Bulbul, Shereia and Mereshing in South Darfur State. There is a population of 690,469 inhabitants in the 18 selected camps representing 47.9% of internally displaced persons (IDPs).

4.3 Duration and frequency of spraying in IDP camps

To maintain mosquito density at lower levels, the spraying of residual insecticide will be carried out during both the dry season and the wet season. Spraying will be carried out in human dwellings, latrines, animal sheds, animal slaughter places, and refuse dumps, which are all breeding and resting places of disease vectors.

It is envisioned that every selected IDP camp and settlement will be sprayed for at least ten days the first month followed by with another ten days spraying in subsequent months (second
and third months). Insecticide spraying will be done once a day during morning hours (6 to 10 am). Because fly behavior in the IDP camps and settlements is not well understood, it is proposed that both indoor and outdoor insecticide spraying be carried out so that endophylic and exophylic resting mosquitoes and houseflies will be reached.

4.4 Type of insecticide

Residual insecticides such as permethrin (25% SC\textsuperscript{16} or 25% EC\textsuperscript{16}), a synthetic pyrethroid insecticide, will be sprayed in selected camps to control adult mosquitoes and houseflies. Temephos (or Abate) will be used to control mosquito larvae in identified water collections (man-made stagnant water pools).

4.5 Distribution of treated mosquito nets (LLINs)

Because of their effectiveness on disease vectors, their long residual effect, and to avoid the use of untreated nets, long lasting insecticide treated nets (LLINs) will be purchased and distributed to IDP camps and settlements in each state. From field experience, it is known that long lasting insecticide treated nets are effective even after twenty (20) washes.

Due to high temperatures prevailing in Darfur at night (above 40 degrees Celsius at times), it is believed that many camp residents will use mosquito nets even when sleeping outside to protect themselves from mosquito bites, thus preventing against malaria. There will be a mass mobilization campaign in each camp to sensitize community members of the usefulness of mosquito nets in disease prevention.

Therefore, there is need for 55,055 long lasting mosquito nets (LLINs) to cover a population of 137,637 people living in selected IDP camps located in North Darfur, South Darfur and West Darfur States. Pregnant women and children under five years old will be targeted for LLINs in all the three states. Altogether, in North Darfur, 46,254 people will be targeted, 62,324 in South Darfur and 29,059 in West Darfur. Table 2 shows the distribution of LLINs and the population in need per state. The total cost of long lasting treated nets (LLINs) will be US $192,693.

Table 1. Distribution of long lasting insecticide treated nets (LLINs) by state, Darfur, Sudan.

<table>
<thead>
<tr>
<th></th>
<th>North Darfur</th>
<th>South Darfur</th>
<th>West Darfur</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Under 5 years old</td>
<td>11,210 (28,026)*</td>
<td>15,105 (37,763)</td>
<td>7,043 (17,607)</td>
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<tr>
<td>Pregnant women</td>
<td>7,291 (18,228)</td>
<td>9,824 (24,561)</td>
<td>4,581 (11,452)</td>
<td>21,696 (54,241)</td>
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<tr>
<td>Total</td>
<td>18,502 (46,254)</td>
<td>24,930 (62,324)</td>
<td>11,624 (290,59)</td>
<td>55,055 (137,637)</td>
</tr>
</tbody>
</table>

* Population at risk

5 Requirements

5.1 Equipment

To cover spray activities in the selected IDP camps and settlements in ten days, sufficient equipment is needed. A total of three hundred (300) Hudson Xpert spraying pumps are needed to accommodate spraying activities in the three states.

\textsuperscript{15} SC = suspension concentrate (advised for spraying tents made from polythene sheeting)

\textsuperscript{16} EC = emulsifiable concentrate
To ensure safety precautions against chemicals, there will be need for every spray operator to have his/her own protective clothing. Items such as overalls, goggles, masks, gloves, and shoes will be worn during spraying. In addition, operators will be instructed to wash hands with soap after spraying and to dispose of any remaining chemicals by pouring it into a pit latrine or a dug hole in the ground. Insecticide containers should be buried and shall not be recycled for further use.

5.2 Transport: Fuel and vehicles

Vehicles are needed for transporting spraying teams, insecticide, and equipment (e.g. spraying equipment). Vehicles will be hired locally for the duration coinciding to the spraying period. The total working period in each IDP camp/settlement will be at least 10 days per month. To facilitate smooth operations during spraying, one vehicle per sector is needed.

5.3 Protective clothing

During spraying activities, all spray operators and mixers will wear protective clothes. The protective clothing will include overalls, masks, shoes, hat, goggles and gloves.

5.4 Capacity building

For efficiency and cost-effectiveness of vector control activities, the training of MOH and NGO staff involved in program implementation is needed. In addition, training is needed for all teams involved in spraying dwellings and the resting places of disease vectors. Approximately three hundred (300) spray operators will be trained including mixers, enumerators, and supervisors from across the three states of Darfur. All malaria program coordinators and environmental health supervisors from the MoH and all water and sanitation program coordinators from NGO partners will be trained in proper implementation of vector control activities.

For sustainability of vector control activities, there is need for each IDP camp and settlement to have its own trained staff that is well equipped, adequate amounts of insecticide, and enough funds to pay allowances to spray operators.

6 Monitoring and Evaluation

6.1 Baseline data

To measure accurately the impact of vector control on mosquito population densities, and their subsequent effect on malaria transmission, there is a need to collect baseline data on both vectors and their transmitted diseases. For the entomological data collection, a random selection of sentinel sites will be carried out in each camp. Adult and larval densities of Anopheles mosquitoes and their susceptibility tests to insecticide in use will also be carried out. Baseline data on incidence of malaria will be recorded from health facilities (clinics, dispensaries) located in the IDP camps and settlements. These health facilities currently serve as reporting units for the health information system in place for notifiable diseases.

It is important that the collection of entomological and epidemiological baseline data be done at the start of vector control activities and that the collection of such data be done by trained MoH staff (i.e., malaria control program coordinators and environmental health supervisors) after receiving brief training in vector bionomics, bioassay tests, and health information. The baseline data will help to determine whether the vector control activities have an effect on both Anopheles mosquitoes and houseflies and their transmitted diseases. Routinely collected data will be compared with baseline data.
6.2 Monitoring of vector control activities

Vector control activities will be monitored to ensure efficiency and effectiveness of control measures and to make sure that activities are carried out as planned. Monitoring will help detect problems and constraints encountered during the program implementation and provide information for re-planning of vector control activities, if the need arises, and proper use of resources. There is a need to train personnel in vector control activities in order to attain the expected outcome. Training of supervisors, enumerators, mixers, and spray operators on vector control techniques (hands-on training) will be carried out in each state at the start of spraying activities. A recently published WHO training manual on spraying techniques and spraying supervision will be used. In addition, only WHO approved insecticides and equipment will be recommended for use.

Relevant, easy to collect, simple, and measurable indicators will be considered for both entomological and epidemiological situations. The entomological indicators will focus on monitoring mosquitoes and houseflies, while the epidemiological indicators will focus on monitoring the malaria and bloody diarrhea incidence.

6.2.1 Entomological monitoring

To assess the effect of vector control on mosquito densities, routine sampling will be carried out in the selected camps and settlements two weeks after either spraying, after distributing insecticide treated mosquito nets, or after covering the majority of breeding places. Variables such as: (1) human biting rates (for mosquitoes); (2) larval density (3) bioassay tests for susceptibility or resistance of disease vectors; and (4) the proportion of dwellings or houses sprayed with residual insecticide in each camp will be monitored.

Mosquito larval breeding places will be monitored and adult Anopheles mosquitoes resting inside human dwellings will be collected using sucking tubes or CDC light traps.

Some sub-samples of the adult mosquito collection will be subjected for parity dissections and possibly ELISA/PCR detection of infection.

6.2.2 Disease monitoring

To assess the effect of mosquito control on the incidence of malaria, a number of indicators will be considered. To monitor malaria incidence, the following indicators will be used: (1) the number of malaria cases (probable and confirmed); (2) the malaria case fatality rate (CFR) among the IDP populations; (3) the proportion of children under five years of age with severe or uncomplicated malaria; and (4) the proportion of pregnant women with malaria cases (confirmed or unconfirmed cases).

At health facilities, patients with malaria will be asked whether their dwellings or houses and their surroundings were sprayed with insecticide.

6.3 Evaluation of vector control activities and its impact on disease transmission

It is expected that after the third round of spraying activities, there will be a reduction in mosquito densities by 70%. In order to attain this proportion, there is a need to reach between 85 to 90% spraying coverage of all dwellings and breeding sites found in the selected IDP camps and settlements. This will reduce the contact between man and vectors, thus reducing disease transmission in the camps. A low contact between man and the vectors will definitely reduce the disease prevalence in IDP populations, making them healthier and productive. Reduction in houseflies and mosquitoes is expected to lead to a reduction in bloody diarrhea, acute jaundice syndrome, and malaria in IDP camps which will reduce the frequent usage of insecticide and treatment of cases longer term.
To determine the program outcome, two indicators will be considered for malaria: (1) the percentage reduction in disease incidence or disease morbidity; and (2) the percentage reduction in disease mortality in each camp.

6.4 Role of WHO in the control of vectors of communicable diseases

It is noteworthy to indicate that routine monitoring of vector control through insecticide spraying, distribution of treated mosquito nets, and larviciding in selected IDP camps and settlements will be carried out by trained MOH staff. Program evaluation will be done by WHO and MoH staff. Interested NGO partners will be invited to join the evaluation team. Reports of vector control activities will be shared among stakeholders and disseminated to all partners involved in the control of communicable diseases. WHO will coordinate a joint planning of vector control interventions and ensure participation of partners providing health services at State level.

From time to time susceptibility tests of malaria mosquitoes will be carried out to determine their physiological status to the insecticides in use. Tests will be carried out by a WHO vector control specialist together with staff from MOH (malaria control program and environmental health program) using WHO test kits.

7 Cost

A total of US $ 538,328 will be needed for vector control activities in the Greater Darfur area of which US $ 345,635.00 will be needed for a one round spraying activities in IDP camps and settlements, most affected by malaria diseases in North, South and West Darfur states and US $ 192,693 to purchase long lasting insecticide treated nets (LLINs). This budget comprises US $ 177,266 for North Darfur state, US $ 236,731 for South Darfur state and US $ 124,334 for West Darfur state. Below is the budget’s breakdown per state.

It is also noted that the cost of synthetic pyrethroid insecticide (permethrin 25% EC or SC) and hand spray pumps (Hudson Xpert spray pumps) is respectively 32 % and 15 respectively from the total budget, while the daily survival allowances (so-called incentives paid to spray operators) and the training of spray persons is 3% and 0.5% respectively.

| Table 2. Budget summary of vector control in IDP camps and settlements, Greater Darfur, Sudan. |
|--------------------------------|------|------|------|----------------|------|
| Description of Items           | North| South| West | Total Expenses | % Total budget |
| Insecticide                    | 55,500 | 79,275 | 38,100 | 172,875 | 32.11 |
| Hand spray pump                | 27,440 | 30,800 | 20,160 | 78,400 | 14.56 |
| Daily survival allowances      | 4,591 | 6,546 | 3,060 | 14,197 | 2.63 |
| Training                       | 919  | 1,310 | 663  | 2,892 | 0.53 |
| Other expenses                 | 24,059 | 31,545 | 21,667 | 77,271 | 14.35 |
| Expenses for spraying activities| 112,509 | 149,476 | 83,650 | 345,635 | - |
| Treated mosquito nets          | 64,757 | 87,255 | 40,684 | 192,693 | 35.79 |
| TOTAL                          | 177,266 | 236,731 | 124,334 | 538,328 | 100.00 |
8 Work Plan

Activities will be carried out as planned during the course of this work (July to October 2005). Planned activities are mainly, training, spraying (of human dwellings, shops, restaurants and animal sheds), larval control, net distribution, operational research and monitoring and evaluation. The below standing tables indicate the months where each planned activity will be carried out.

**Budget for vector control activities in selected IDP camps in North Darfur**

<table>
<thead>
<tr>
<th>Description</th>
<th>Abushouk</th>
<th>Zam Zam</th>
<th>Kabkabiya</th>
<th>Saraf Omra</th>
<th>Kassab</th>
<th>Fataborno</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>80,492</td>
<td>18,787</td>
<td>77,500</td>
<td>29,689</td>
<td>12,977</td>
<td>2,572</td>
<td>222,017</td>
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<tr>
<td>insecticide (litres)</td>
<td>1,342</td>
<td>350</td>
<td>1,300</td>
<td>450</td>
<td>220</td>
<td>50</td>
<td>3,700</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost of insecticide</th>
<th>Daily allowances(^18)</th>
<th>Training(^19)</th>
<th>Protective clothing</th>
<th>Hand spray pump</th>
<th>Transport(^20)</th>
<th>M&amp;E</th>
<th>Contingency 10%</th>
<th>TOTAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abushouk</td>
<td>20,123</td>
<td>1,615 (38)</td>
<td>323</td>
<td>1,748</td>
<td>9,240</td>
<td>1,200</td>
<td>230</td>
<td>3,520</td>
<td>38,719</td>
</tr>
<tr>
<td>Zam Zam</td>
<td>5,250</td>
<td>425 (10)</td>
<td>85</td>
<td>460</td>
<td>1,400</td>
<td>800</td>
<td>150</td>
<td>905</td>
<td>9,955</td>
</tr>
<tr>
<td>Kabkabiya</td>
<td>19,500</td>
<td>1,573 (37)</td>
<td>315</td>
<td>1,702</td>
<td>10,360</td>
<td>1,200</td>
<td>210</td>
<td>3,558</td>
<td>39,138</td>
</tr>
<tr>
<td>Saraf Omra</td>
<td>6,750</td>
<td>595 (14)</td>
<td>119</td>
<td>644</td>
<td>3,920</td>
<td>800</td>
<td>170</td>
<td>1,348</td>
<td>14,826</td>
</tr>
<tr>
<td>Kassab</td>
<td>3,300</td>
<td>255 (6)</td>
<td>51</td>
<td>276</td>
<td>1,680</td>
<td>400</td>
<td>150</td>
<td>635</td>
<td>6,987</td>
</tr>
<tr>
<td>Fataborno</td>
<td>750</td>
<td>128 (3)</td>
<td>26</td>
<td>138</td>
<td>840</td>
<td>400</td>
<td>100</td>
<td>262</td>
<td>2,884</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55,500</strong></td>
<td><strong>4,591 (108)</strong></td>
<td><strong>919</strong></td>
<td><strong>4,968</strong></td>
<td><strong>27,440</strong></td>
<td><strong>4,800</strong></td>
<td><strong>1,010</strong></td>
<td><strong>10,228</strong></td>
<td><strong>112,509</strong></td>
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</table>

\(^17\) Estimation cost for Round 1 spraying (10 days spraying)  
\(^18\) Number of spray operators in brackets  
\(^19\) Training of spraying team at a cost of US $4.25 per spray operator/day for 2 days  
\(^20\) Vehicles will be hired at the market rate
Budget for vector control activities in selected IDP camps in South Darfur

<table>
<thead>
<tr>
<th>Description</th>
<th>Kalma</th>
<th>Ottash</th>
<th>Kass</th>
<th>Bulbul</th>
<th>Shereia</th>
<th>Mereshing</th>
<th>Total21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>147,083</td>
<td>19,415</td>
<td>52,423</td>
<td>35,000</td>
<td>23,673</td>
<td>39,482</td>
<td>317,076</td>
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<tr>
<td>insecticide (litres)</td>
<td>2,452</td>
<td>325</td>
<td>874</td>
<td>585</td>
<td>395</td>
<td>658</td>
<td>5,285</td>
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</table>

Costs of Items

<table>
<thead>
<tr>
<th>Costs of Items</th>
<th>Kalma</th>
<th>Ottash</th>
<th>Kass</th>
<th>Bulbul</th>
<th>Shereia</th>
<th>Mereshing</th>
<th>Total21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of insecticide</td>
<td>36,780</td>
<td>4,875</td>
<td>13,110</td>
<td>8,775</td>
<td>5,925</td>
<td>9,871</td>
<td>79,275</td>
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<tr>
<td>allowances22</td>
<td>2,975 (70)</td>
<td>425 (10)</td>
<td>1,063 (25)</td>
<td>723 (17)</td>
<td>510 (12)</td>
<td>850 (20)</td>
<td>6,546 (154)</td>
</tr>
<tr>
<td>Training</td>
<td>595</td>
<td>85</td>
<td>213</td>
<td>145</td>
<td>102</td>
<td>170</td>
<td>1,310</td>
</tr>
<tr>
<td>Protective clothing</td>
<td>3,220</td>
<td>460</td>
<td>1,150</td>
<td>782</td>
<td>552</td>
<td>920</td>
<td>7,084</td>
</tr>
<tr>
<td>Hand spray pump</td>
<td>7,280</td>
<td>2,800</td>
<td>7,000</td>
<td>4,760</td>
<td>3,360</td>
<td>5,600</td>
<td>30,800</td>
</tr>
<tr>
<td>Transport: Fuel</td>
<td>1,600</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>560</td>
<td>5,600</td>
</tr>
<tr>
<td>Transport: Fuel</td>
<td>960</td>
<td>480</td>
<td>480</td>
<td>480</td>
<td>480</td>
<td>1,840</td>
<td>3,360</td>
</tr>
<tr>
<td>Protective clothing</td>
<td>3,220</td>
<td>460</td>
<td>1,150</td>
<td>782</td>
<td>552</td>
<td>920</td>
<td>7,084</td>
</tr>
<tr>
<td>Hand spray pump</td>
<td>7,280</td>
<td>2,800</td>
<td>7,000</td>
<td>4,760</td>
<td>3,360</td>
<td>5,600</td>
<td>30,800</td>
</tr>
<tr>
<td>Transport: Fuel</td>
<td>1,600</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>560</td>
<td>5,600</td>
</tr>
<tr>
<td>M&amp;E</td>
<td>560</td>
<td>240</td>
<td>320</td>
<td>240</td>
<td>240</td>
<td>1,840</td>
<td>3,360</td>
</tr>
<tr>
<td>Contingency 10%</td>
<td>5,397</td>
<td>1,017</td>
<td>2,414</td>
<td>1,671</td>
<td>1,197</td>
<td>1,893</td>
<td>13,589</td>
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<tr>
<td>TOTAL COST</td>
<td>59,367</td>
<td>11,182</td>
<td>26,550</td>
<td>18,376</td>
<td>13,166</td>
<td>20,824</td>
<td>149,476</td>
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</table>

Budget for vector control activities in selected IDP camps in West Darfur

<table>
<thead>
<tr>
<th>Description</th>
<th>Kulbus</th>
<th>Habila</th>
<th>Mukjar</th>
<th>Um Kher</th>
<th>Mornei</th>
<th>Um Dukhum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>14,773</td>
<td>29,665</td>
<td>13,184</td>
<td>13,312</td>
<td>66,960</td>
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<td>500</td>
<td>220</td>
<td>225</td>
<td>1120</td>
<td>225</td>
<td>2,540</td>
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</table>

Costs of Items

<table>
<thead>
<tr>
<th>Costs of Items</th>
<th>Kulbus</th>
<th>Habila</th>
<th>Mukjar</th>
<th>Um Kher</th>
<th>Mornei</th>
<th>Um Dukhum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of insecticide</td>
<td>3,750</td>
<td>7,500</td>
<td>3,300</td>
<td>3,375</td>
<td>16,800</td>
<td>3,375</td>
<td>38,100</td>
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<tr>
<td>allowances22</td>
<td>298 (7)</td>
<td>595 (14)</td>
<td>255 (6)</td>
<td>255 (6)</td>
<td>1,360 (32)</td>
<td>255 (6)</td>
<td>3,060 (72)</td>
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<td>Training</td>
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<td>130</td>
<td>56</td>
<td>56</td>
<td>296</td>
<td>56</td>
<td>663</td>
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<tr>
<td>Protective clothing</td>
<td>322</td>
<td>644</td>
<td>276</td>
<td>276</td>
<td>1,472</td>
<td>276</td>
<td>3,312</td>
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<tr>
<td>Hand spray pump</td>
<td>1,960</td>
<td>3,920</td>
<td>1,680</td>
<td>1,680</td>
<td>8,960</td>
<td>1,680</td>
<td>20,160</td>
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<tr>
<td>Transport: Fuel</td>
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<td>800</td>
<td>400</td>
<td>400</td>
<td>1,200</td>
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<td>3,600</td>
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<tr>
<td>M&amp;E</td>
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<td>200</td>
<td>200</td>
<td>200</td>
<td>250</td>
<td>200</td>
<td>1,250</td>
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<tr>
<td>Contingency 10%</td>
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<td>1,427</td>
<td>641</td>
<td>648</td>
<td>3,106</td>
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<td>7,605</td>
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<tr>
<td>TOTAL COST</td>
<td>12,483</td>
<td>15,696</td>
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<td>7,130</td>
<td>34,163</td>
<td>7,130</td>
<td>83,650</td>
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21 Estimation cost for Round 1 spraying (10 days spraying)
22 Number of spray operators in brackets
## Work plan for vector control activities in selected IDP camps and settlements in the Greater Darfur (Year 2005)

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>Zam Zam</td>
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<tr>
<td>Kassab</td>
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<td>Saraf Omra</td>
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<td>Kabkabiya</td>
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<td>WEST DARFUR</td>
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<tr>
<td>Kulbus</td>
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<td>Um Kher</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Um Dukhum</td>
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</tr>
</tbody>
</table>

23 To prevent mosquitoes and houseflies from transmitting and/or spreading diseases, all human dwellings, shops, restaurants, animal shades will be sprayed with the chemical insecticide.

24 Spraying of mosquito breeding sites with Temephos.
<table>
<thead>
<tr>
<th>IDP camp</th>
<th>Training</th>
<th>Spraying activities</th>
<th>Larval control</th>
<th>Net distribution</th>
<th>Operational Research</th>
<th>Monitoring &amp; Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jul</td>
<td>Jul</td>
<td>Aug</td>
<td>Jul</td>
<td>Jul</td>
<td>Oct</td>
</tr>
<tr>
<td>SOUTH DARFUR</td>
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<tr>
<td>Kalma</td>
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<td>Kass</td>
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<td>Ottash</td>
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</tr>
<tr>
<td>Bulbul</td>
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</tr>
<tr>
<td>Shereia</td>
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</tr>
<tr>
<td>Mereshing</td>
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</tbody>
</table>