

Mortality survey among  
Internally Displaced Persons and  
other affected populations in  
Greater Darfur, Sudan



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## Executive summary

### Introduction

The crisis in Darfur was described in 2004 as the worst humanitarian situation in the world. As of July 2005, around 3.3 million people -or 50% of the total population- have been estimated in need of humanitarian assistance. The international response, slow at the beginning of the crisis, gained momentum in 2004, when Darfur started drawing political attention, with increasing pledges of the donor community, growing numbers of humanitarian workers, and an overall good accessibility to humanitarian aid. Half of the health requirements were funded midway into 2005.

In spite of the improvements, the situation is considered precarious, in terms of bad agricultural perspectives for the next planting season and exhausted coping mechanisms of the population.

### Objectives and methods

This survey was commissioned by the UN Humanitarian Coordinator and jointly conducted by WHO, the FMoH and SMoH of the three states, in partnership with the UN agencies and NGOs. Funding was provided by USAID and DFID. The protocol of the study was submitted to an inclusive peer-review. CRED provided substantial support in data analysis and report writing.

The **main objective** of the survey was to estimate the mortality between November 2004 and end of May 2005 in the three States, among: IDPs living in accessible camps, IDP living outside of camps, and affected communities in accessible areas. More specifically, the survey aimed to:

- I) describe demographic characteristics of the study populations;
- II) estimate crude and under-five mortality during the recall period;
- III) analyse changes in mortality between the present and the previous survey;
- IV) analyse differences in mortality between the different groups;
- V) identify the major self-reported causes of death,
- VI) describe basic food, non-food aid and service availability, and
- VII) obtain baseline mortality estimates for calibrating the existing surveillance system.

The survey used a retrospective approach, based on two-stage cluster sampling. Three separate surveys were conducted in each State, each targeting one of the defined study populations. The clusters were randomly allocated from OCHA lists of aid beneficiaries in accessible areas. The second sampling stage used the standard WHO cluster methodology. A total of 90 clusters of 20 households each was included in North and West Darfur, while security prevented the completion of the survey in the South. Data were collected anonymously by teams of interviewers with the supervision of both national and international staff, using a structured pre-piloted questionnaire in Arabic. Data included deaths, births, migration in/out during the study period, demographic characteristics and availability of basic goods and services. Data were analysed separately for each State and study population, and jointly for the three groups in each state, after weighting for stratum population size. For South Darfur, only data referring to IDPs in the camps are presented.

### Main findings and recommendations

With the exception of U5 children in IDP camps in the South, mortality rates are all below the emergency thresholds (CMR: 1 per 10,000 per day; U5 MR: 2 per 10,000 day); however, several 95% confidence intervals of the rates include the emergency thresholds. The decrease in mortality among IDPs from the previous WHO-EPIET survey has been substantial. Even if a direct comparison cannot be established due to the different recall periods and some methodological differences, mortality declined by a factor of almost two in North Darfur and of around three in the West and the South, indicating a positive impact of humanitarian response. Injuries in the North and diarrhoea in the West represent the major self-reported causes of death. More detailed findings are presented in the following table and in the relevant chapter of the full report. The main conclusion of the report is that, while it is of comfort to register the improvement in mortality, there is still room for strengthening the

quality and coverage of PHC services, including water and sanitation interventions and keep up the international interest in funding and implementing relief programmes, in order to respond to the plea of Darfurians for better protection and improved livelihood.

**Table 1. Summary of main findings**

|   | North   | West  | South  |
|---|---|---|--|
| <b>Sampled populations</b>  |   |   |  |
| IDPs in camps   | <b>3,961</b>  | <b>3,597</b>  | <b>3,188</b>   |
| IDPs outside camps  | <b>3,570</b>  | <b>3,120</b>  | -  |
| Affected residents  | <b>5,024</b>  | <b>3,815</b>  | -  |
| <b>Mortality</b>  |   |   |  |
| <b>CMR per 10,000 per day (95% CI)</b>                                    |   |   |  |
| IDPs in camps   | <b>0.8</b><br><b>(0.5-1.0)</b>  | <b>0.8</b><br><b>(0.5-1.2)</b>  | <b>0.8</b><br><b>(0.6-1.2)</b>   |
| IDPs outside camps  | <b>0.9</b><br><b>(0.6-1.3)</b>  | <b>0.5</b><br><b>(0.3-0.8)</b>  | -  |
| Affected residents  | <b>0.8</b><br><b>(0.5-1.1)</b>  | <b>0.4</b><br><b>(0.3-0.6)</b>  | -  |
| Overall, three groups together  | <b>0.8</b><br><b>(0.6-1.0)</b>  | <b>0.6</b><br><b>(0.5-0.8)</b>  | -  |
| <b>U5 MR per 10,000 per day (95% CI)</b>                                  |   |   |  |
| IDPs in camps   | <b>1.5</b><br><b>(0.9-2.4)</b>  | <b>1.0</b><br><b>(0.5-1.7)</b>  | <b>2.6</b><br><b>(1.6-3.9)</b>   |
| IDPs outside camps  | <b>1.8</b><br><b>(0.8-3.4)</b>  | <b>0.8</b><br><b>(0.5-1.4)</b>  | -  |
| Affected residents  | <b>1.1</b><br><b>(0.7-1.7)</b>  | <b>0.7</b><br><b>(0.2-1.7)</b>  | -  |
| Overall, three groups together  | <b>1.5</b><br><b>(1.0-2.1)</b>  | <b>0.9</b><br><b>(0.6-1.3)</b>  | -  |
| <b>Three main self-reported causes of death<sup>1</sup>, all ages (%)</b> |   |   |  |
| IDPs in camps   | <b>Watery diarrhoea (25%)</b><br>Meningitis (16%)<br>Malaria (12%)                | <b>Bloody diarrhoea (27%)</b><br>Watery diarrhoea (20%)<br>Injuries (11%)       | <b>Watery diarrhoea (16%)</b><br>Injuries (14%)<br>Bloody diarrhoea (9%) |
| IDPs in camps   | <b>Watery diarrhoea, malnutrition (7%)</b>  | <b>Bloody diarrhoea (27%)</b><br>Watery diarrhoea (20%)<br>Meningitis, ARI (6%) | -  |
| IDPs outside camps  | <b>Injuries (55%)</b> Watery diarrhoea (9%) <b>Bloody diarrhoea, Malaria (5%)</b> | <b>Watery diarrhoea (19%)</b><br>Bloody diarrhoea (10%)<br>Meningitis (10%)     | -  |
| <b>Access to health care, main provider<sup>2</sup>, (%)</b>              |   |   |  |
| IDPs in camps   | <b>Public (100%)</b>  | <b>Public (94%)</b>   | <b>Public (99%)</b>  |
| IDPs outside camps  | <b>Public (68%)</b>   | <b>Public (99%)</b>   | -  |
| Affected residents  | <b>Public (52%)</b>   | <b>Public (90%)</b>   | -  |
| <b>Access to protected sources of water<sup>3</sup>, %</b>                |   |   |  |
| IDPs in camps   | <b>95%</b>  | <b>61%</b>  | <b>72%</b>   |
| IDPs outside camps  | <b>46%</b>  | <b>49%</b>  | -  |
| Affected residents  | <b>32%</b>  | <b>45%</b>  | -  |
| <b>Food aid, received<sup>4</sup>, %</b>                                  |   |   |  |
| IDPs in camps   | <b>81%</b>  | <b>86%</b>  | <b>71%</b>   |
| IDPs outside camps  | <b>64%</b>  | <b>52%</b>  | -  |
| Affected residents  | <b>47%</b>  | <b>73%</b>  | -  |

<sup>1</sup> excluding others

<sup>2</sup> Public: hospital, health unit, mobile clinic

<sup>3</sup> Protected: piped systems, bladder tanks and hand pumps

<sup>4</sup> During the month preceding the interview

## List of acronyms

|               |   |
|---------------|---|
| <b>CDC</b>    | Centre for Disease Control and Prevention                 |
| <b>CMR</b>    | Crude mortality rate                                      |
| <b>CRED</b>   | Centre for Research on the Epidemiology of Disasters      |
| <b>DE</b>     | Design Effect   |
| <b>EMRO</b>   | Eastern Mediterranean Regional Office                     |
| <b>EPIET</b>  | European Programme For Intervention Epidemiology Training |
| <b>FMOH</b>   | Federal Ministry of Health                                |
| <b>GoS</b>    | Government of Sudan                                       |
| <b>HAC</b>    | Health Action in Crisis                                   |
| <b>IDPs</b>   | Internally Displaced Persons                              |
| <b>ICRC</b>   | International Committee of the Red Cross                  |
| <b>MICS</b>   | Multiple Indicators Cluster Survey                        |
| <b>NGOs</b>   | Non Governmental Organizations                            |
| <b>OCHA</b>   | Office for Coordination of Humanitarian Affairs           |
| <b>PPS</b>    | Probability Proportional to Size                          |
| <b>SMOH</b>   | State Ministry of Health                                  |
| <b>UNFPA</b>  | United National Population Fund                           |
| <b>U5MR</b>   | Under five mortality rate                                 |
| <b>UNICEF</b> | United Nations Children's Fund                            |
| <b>UNDSS</b>  | United Nation Department of Safety and Security           |
| <b>WFP</b>    | World Food Programme                                      |
| <b>WHO</b>    | World Health Organization                                 |

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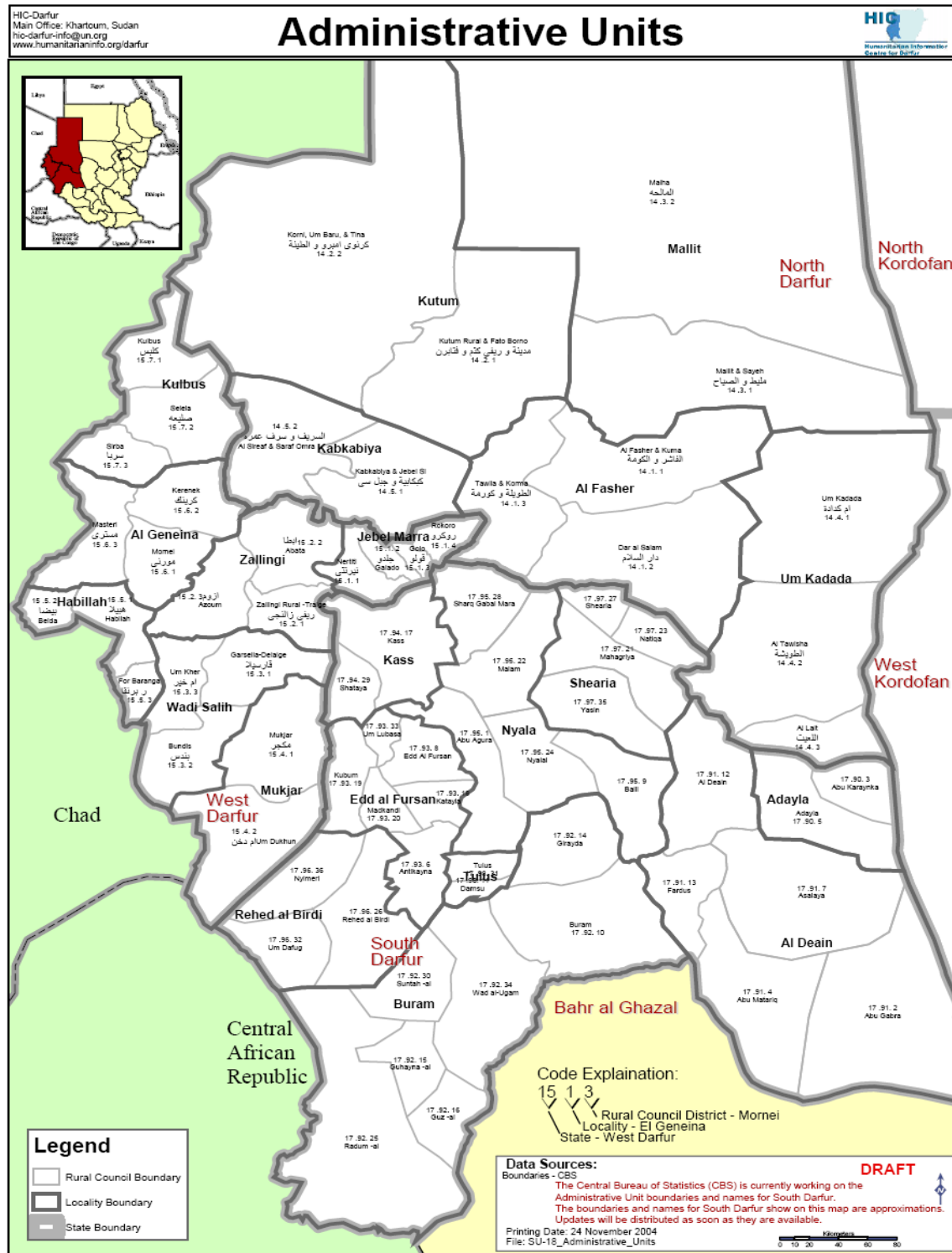
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# Map of Darfur



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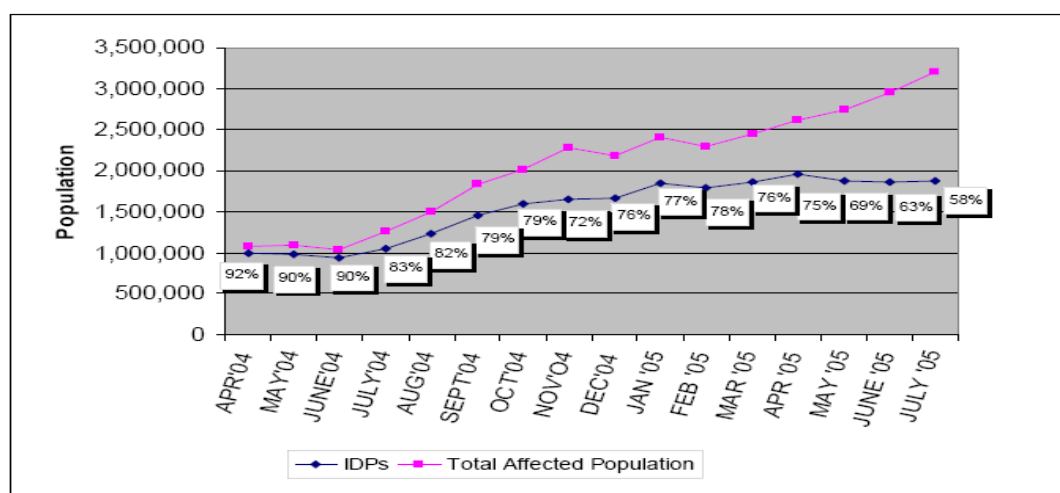
## 1. Introduction

### 1.1 The crisis in Darfur

The recent crisis in Darfur started after decades of clashes among groups competing for scarce and diminishing resources, when two rebel movements -Sudan Liberation Army/Movement (SLA) and Justice and Equality Movement (JEM)- took arms against the government in February 2003. Recurrent droughts, insufficient investment in one of the most underdeveloped region of the country and spill-over repercussions from other regional conflicts have exacerbated the already precarious situation, fuelling the grievance of opposition groups. All these factors have been acknowledged to be at the origin of the recent phase of the conflict (Polloni 2004, Pantuliano 2004, de Waal 2004 and 2005), which has been characterized over the last two years and half by unprecedented levels of violence.

Darfur was widely labelled as the worst humanitarian crisis throughout most of 2004. The high level of violence and insecurity has resulted in a huge internal displacement and in the flight of around 200,000 refugees to the neighbouring Chad. The crisis has progressively affected non-displaced communities, whose already stretched resources and services have suffered from increasing pressures and overall economic breakdown. As of July 2005, around 3.2 million people, or 50 % of the total population in Darfur have been estimated in need of humanitarian assistance<sup>5</sup>.

Figure 1 Estimated number of IDPs and the total affected population (OCHA, 2005,1)

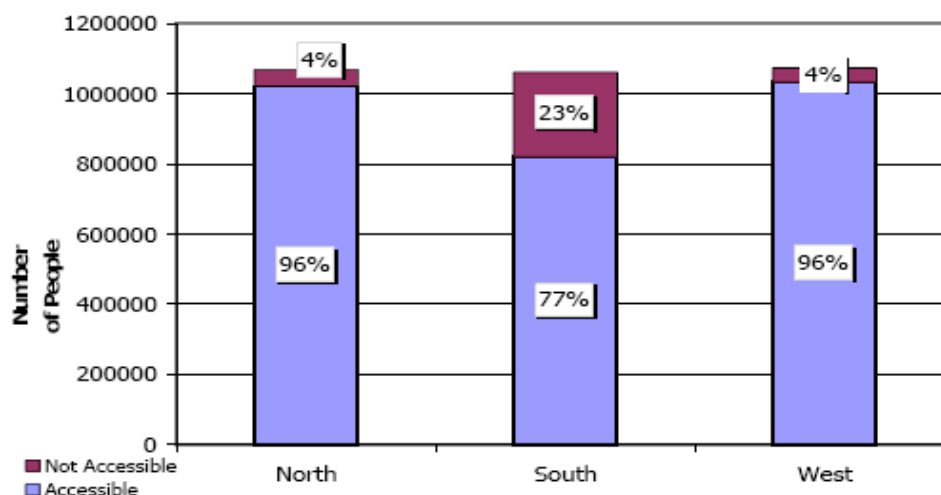


The international response, acknowledged to have been too slow at the beginning of the crisis, gained momentum since the first months of 2004, when Darfur started drawing political and media attention (Singh, 2004). Important developments have slowly started to make an impact on the political and military situation in Darfur and the deployment of AU forces, in combination with a ceasefire agreement and heightened international engagement, has brought about a change in the nature of the conflict. In 2004, the international response to the crisis changed gear: the number of humanitarian workers has increased from 228 in April 2004 to around 12,500 (national and international) one year later, with 81 NGOs and 13 UN agencies active in the region (Office of the UN Resident and Humanitarian Coordinator for the Sudan, July 2005, 2).

As of June 2005, overall accessibility to UN humanitarian aid was estimated at 90%, being only 77% in the South, the most populous state of the region (ibidem).

<sup>5</sup> According to UNFPA & Government estimates of 1999, the pre-conflict Darfur population amounted to approximately 6.4 million people

Figure 2 Affected population accessible to UN humanitarian aid (ibidem)



Between December 2003 and January 2005, US\$ 1.3 billion have been pledged towards the crisis, with the health sector receiving 6% of total funding (Office of the UN Resident and Humanitarian Coordinator for the Sudan 2005,3). Health sector activities included in the 2005 UN Work Plan were 53 percent funded midway into the year. Health requirements represent 4% of the total humanitarian needs (OCHA, 2005).

In spite of all these improvements, the situation is considered very precarious, with the failure of the 2004/5 harvest season<sup>6</sup>, alarming perspectives for the present agricultural season and with the coping mechanisms of the population at large almost exhausted.

## 1.2 Rationale and objectives of the study

Mortality, together with malnutrition, is the most commonly used indicator for assessing the severity of a crisis, the magnitude of the needs and for monitoring the adequacy of the humanitarian response. Comparison of the crude mortality rate (CMR) at different time intervals provides, when complemented by other contextual information, a measure of the impact of the response to the crisis (Hofmann et al, ODI, 2004).

Several retrospective mortality surveys have been carried out in Darfur since 2003 (CRED, 2005). Most of the surveys showed mortality rates above the emergency threshold of 1 death/10,000 per day. With few exceptions (WHO, 2004, CDC/WFP, 2004), however, these surveys had a narrow geographical focus. Further, even if the findings are consistent in showing broad spatial and time trends, they cannot be directly compared or combined in a meta-analysis due to differences in the study populations or methods utilized.

The survey that is the object of this report was requested by the Office of the UN Humanitarian/Resident Coordinator and by the Government of Sudan to provide information on the health status and health determinants (access to water, sanitation, health care) in order to evaluate and better target humanitarian interventions.

<sup>6</sup> The cereal output has been estimated by ICRC to be only 25% of a normal season

The **main objective** of the survey was, therefore, to estimate the mortality between November 2004 and end of May 2005<sup>7</sup> among the following crisis-affected populations in each of the three states of Greater Darfur Region (North, West and South):

1. IDPs living in accessible well-defined camps,
2. IDP living in accessible settlements, outside of camps, and
3. Affected communities living in accessible areas.

More specifically, the survey aimed to:

- I. describe demographic characteristics of the study populations;
- II. estimate crude and under-five mortality rates during the above specified recall period;
- III. analyse changes in mortality between the present study period and June-August 2004<sup>8</sup>;
- IV. analyse differences in mortality between the different groups included in the study;
- V. identify the major self-reported causes of death,
- VI. describe basic food, non-food aid and service availability, and
- VII. obtain baseline mortality estimates that can be used for calibrating and strengthening the existing surveillance system.

The study was designed, organized and conducted jointly by Ministry of Health of Sudan and WHO<sup>9</sup>, with technical and logistic support from other UN agencies (OCHA, UNICEF, WFP, UNFPA, UNJLC), NGOs and other institutions<sup>10</sup>. Funding was provided by USAID and DFID. The protocol of the study was submitted to an inclusive peer-review. CRED, the Centre for Research on the Epidemiology of Disasters provided support in the phase of data analysis and report writing.

## 2 Methods

### 2.1 Study design

The survey design was a retrospective study, based on two-stage cluster sampling. Mortality information for the defined period was collected using a modified version of the past household census method<sup>11</sup>. A summary probing question was asked at the end of the interview on any deaths reported during the defined period. The self-reported cause of each death was classified into 11 categories (all types of injury, measles, neonatal tetanus, bloody diarrhoea, other diarrhoea, meningitis, ARI, malnutrition, malaria, maternal mortality and other) using a standardized algorithm, based on local language terms for designating these conditions.

The other information collected included the duration of displacement and origin of the family and the availability of **basic** goods/services (see the attached questionnaire).

The start of the recall period was defined as the end of Ramadan (Eid el Fitr), religious holiday that is well remembered by all Muslim people, and fell on 15 November 2004. The end was defined as the median day of the survey implementation in each state. A local calendar of events was used to determine the age of household members and the dates of death, birth or migration.

### 2.2 Study populations

To allow for multiple comparisons with previous surveys that included one or two study populations (e.g. IDPs in and outside camps), three separate surveys were undertaken in each State, each targeting a different population group. Findings are presented in the relevant section both separately for each population and, whenever relevant, as weighted aggregates.

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<sup>7</sup> The recall period defined for this survey

<sup>8</sup> The recall period of the previous WHO-EPIET survey

<sup>9</sup> Country, Regional Office and HQ

<sup>10</sup> see the section on acknowledgements for a list of contributors

<sup>11</sup> The method consisted of performing two separate censuses of the household as at the day before the survey and at the beginning of the recall period, and reconstruct demographic changes occurred in the household since the start of the period: deaths, migration out, births and migration in, asking for the month in which the event occurred.

The following definitions were used:

- IDP: a person not living in his/her permanent residence;
- Accessible area: defined according to the current UN security criteria
- Affected communities: for the purpose of this study they include beneficiaries of food aid, living in their permanent residence.

In addition to lack of accessibility, the following exclusion criteria were used:

- IDPs and resident communities living in the three Darfur capitals, and
- Nomadic populations.

### 2.3 Sampling design

The two-stage cluster sampling standard methodology (WHO, 2004) was used, with household as the basic sampling unit and clusters randomly selected with probability proportional to size (PPS). For the first stage of sampling - the allocation of clusters - a lists of all IDP camps, settlements of IDPs not living in camps and affected resident communities in each state were obtained from OCHA. Locations declared non accessible due to lack of security by UN Department of Safety and Security (UNDSS) were excluded.

For the second sampling stage, households were randomly selected within each selected cluster according to the standard immunization coverage cluster survey methodology (*ibidem*). A household was defined as a group of people living together (sharing the same meals and or sleeping under the same roof). If no one was at home at a selected house, a neighbour was consulted concerning the whereabouts of members of the household. If the members had departed permanently or were not expected to return before the survey team has to leave the village, the household was skipped and replaced by the nearest one. If household members were expected to return, the survey team revisited the house at least two more times before declaring the household missing and replacing it.

For clusters that had become not accessible during the survey due to the deterioration of the security situation or for which the target population could not be found, an alternative cluster was selected in the next location listed on the sampling frame after the one containing the inaccessible cluster (*ibidem*). The security situation was checked regularly at State level with UNDSS.

### 2.4 Sample size

The sample size was calculated for each study population based on the estimation of the CMR, and on the basis of different hypotheses/assumptions below. The sample sizes were calculated using Epi-Info 6.04, Statcalc (CDC and WHO, 2001).

Among IDPs living in camps it was assumed that the mortality had declined since the last WHO-EPIET survey, due to the improved humanitarian response. Therefore the lowest CMR estimated in the previous survey (1.5/10,000/day in North Darfur) was used for the calculation of sample size. In order to estimate in each state a CMR of 1.5 deaths/10,000 persons/day, with a precision of 0.5 (95% Confidence Limits of 1.0 to 2.0 deaths/10,000 persons/day), with a design effect of 2 and a recall period of 180 days, the required sample size was of 2,500 persons or 417 households (estimating a mean household size of 6).

For the other two populations, the same design effect, average household size and recall period were used. For IDPs living outside of the camps, the CMR was assumed to be 2/10,000 per day, with a precision of 0.5 (95% Confidence Limits of 1.5 to 2.5 deaths/10,000 persons/day), which resulted in a required sample size is of 3,285 persons or 548 households.

For the affected residents, it was assumed that the mortality was the same as that estimated in the CDC/WFP survey of September 2004 (WFP and CDC, 2004). In order to estimate a CMR of 0.7/10,000 day with a precision of 0.3 (95% Confidence Limits of 0.4 to 1.0 deaths/10,000/day),

with a design effect of 2 and a recall period of 180 days, the required sample size was of 3,270 persons or 545 households (estimating a mean household size of 6).

Given the uncertainties in the above parameters (expected mortality, design effect, mean household size, etc) it was decided to standardize the number of households to be included in each cluster. Conservatively, the smaller sample size was aligned to the larger one, in order to increase the precision of the estimates. In conclusion we aimed to select a total of 600 households (30 clusters of 20 households each) for each study population in each state.

## 2.5 Survey planning and data collection

A questionnaire was developed in consultation with national and international organizations providing health services in Darfur. The entire form was translated from English into Arabic and then back-translated into English by a second translator. The survey questionnaires were pre-tested in one IDP camp in West Darfur and revisions were made based on this pilot.

Data were collected by teams consisting of locally recruited interviewers under the supervision of one FMOH staff and one international Arabic speaking consultant recruited by WHO. In North Darfur more than one third of clusters were in SLA-controlled areas, where MoH staff were not allowed to work. It was decided, therefore, that international WHO staff would select and train local interviewers and ensure the overall supervision of the field work. One international staff and one FMOH officer ensured the overall coordination of the field work in each of the 3 States, with the support of the SMOH, the WHO sub-offices, UN agencies and NGOs. Around 80 staff (drivers, interviewers, supervisors, and coordinators) were involved in the field work during 2-3 weeks.

Field workers (interviewers and supervisors) were submitted to standardized training including a) job duties for each category of survey team worker, b) instructions for the second sampling stage, c) definition of study period and study population, and d) questionnaire and interview techniques.

Interviews were conducted anonymously. Respondents were informed about the objectives of the study and on the fact that the data collection was not part of registration or food/other aid distribution. Oral, informed consent was obtained from all respondents before the start of the interview. NGOs active in camps carried out sensitization campaigns- on the objectives of the survey.

## 2.6 Data entry, validation and analysis

To ensure data quality, regular meetings were held among field workers and supervisors to review the data collection process, to check data completeness and to resolve any logistic or methodological issues.

Data were entered by the State Coordinators. EPI-INFO 3.3.2 (CDC, 2005) was used to create entry forms with quality checks to minimize data entry errors. Data validation for completeness and quality was performed before the analysis through ad hoc programs performing range and consistency checks. A number of double entry checks were also performed, checking a random sample of questionnaires.

The analysis was conducted using EPI-INFO 3.3.2 and SPSS, while Microsoft Excel and Access were used for data management.

The mortality rate was calculated as the number of deaths per 10,000 persons per day. The numerator included all deaths recorded during the study period. For the calculation of denominator, it was assumed that all persons died, born or migrated contributed to half of the recall period, as in the previous WHO-EPIET survey. For crude mortality, 1 death per 10,000 people per day was used as the threshold to define an emergency situation (Noji, 1997). For mortality among children under 5 years old, 2 deaths per 10,000 people were used as benchmark (MSF, 1995). Ninety-five per cent confidence limits were calculated for each mortality estimate, using the respective cluster design effect.

### 3. Results

The survey was conducted in the three Darfur states and covered 207 clusters: 90 in North Darfur, 90 in West Darfur and 27 in South Darfur<sup>12</sup>. Table 1 shows the number of people interviewed by state and study population.

**Table 1: Number of people interviewed by state and study population**

|              | IDPs living inside camps | IDPs living outside camps | Resident population | Total  |
|--------------|--------------------------|---------------------------|---------------------|--------|
| North Darfur | 3,961                    | 3,570                     | 5,024               | 12,555 |
| West Darfur  | 3,597                    | 3,120                     | 3,815               | 10,532 |
| South Darfur | 3,188                    |                           |                     | 3,188  |

Due to security problems, the survey in South Darfur was only conducted in camps.

#### 3.1 North Darfur

##### 3.1.1 Survey sample

In North Darfur the number of affected people was estimated to be 431,477 IDPs and 266,537 affected residents<sup>13</sup>. We conducted interviews on 1,779 households: 598 inside camps, 525 outside camps and 656 households among the resident population. The median day of the survey was June 5<sup>th</sup>, 2005, which means that the recall period covered 202 days.

The study population on November 15<sup>th</sup>, 2004 was 11,904 and at the time of the survey 11,927. (Table 2 shows show the population dynamics during the recall period.) The mid-period population, calculated as the average of the population at the start of the recall period and the population at the end, was 11,915.5.

**Table 2: Summarized population dynamics, North Darfur, May-June 2005**

|                  | IDPs in camps | IDPs outside camps | Residents | Total |
|------------------|---------------|--------------------|-----------|-------|
| Total deaths     | 57            | 60                 | 75        | 192   |
| Total births     | 57            | 64                 | 119       | 240   |
| Total departures | 130           | 114                | 138       | 382   |
| Total arrivals   | 155           | 122                | 55        | 332   |

*NB: The categories in this table are not mutually exclusive.*

The average number of persons per household was 6.7 for the entire population. For IDPs inside camps the average number was 6.2, IDPs outside camps 6.4 and for the residents 7.3.

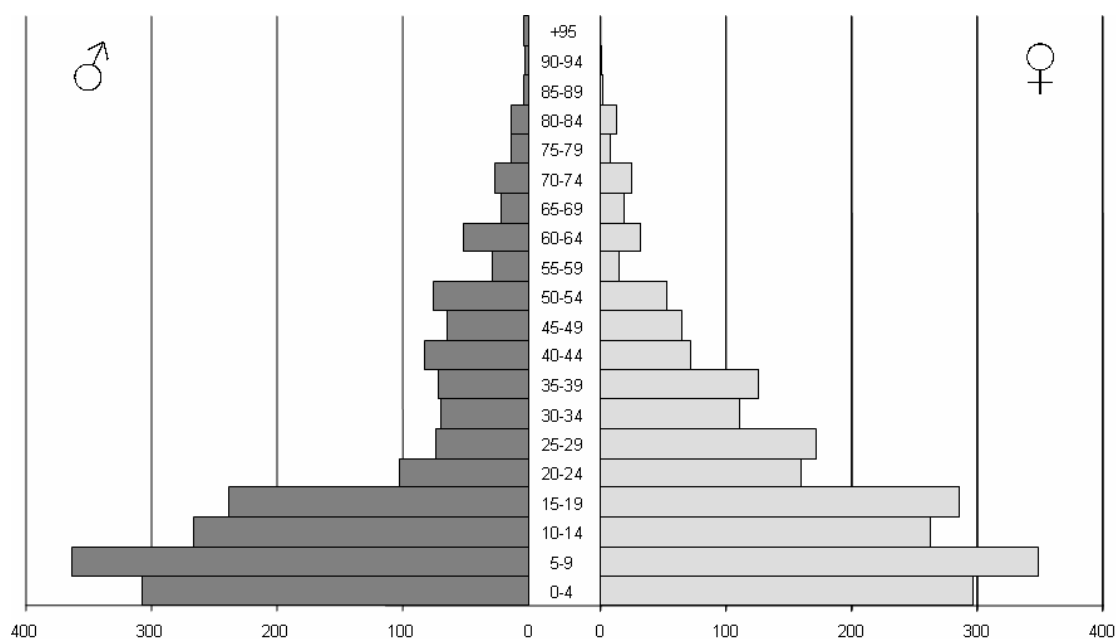
<sup>12</sup> The remaining clusters could not be surveyed in this region due to the deteriorated security situation

<sup>13</sup> OCHA, May, 2005

**Table 3: Distribution of IDPs inside camps by age and gender, North Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 308   | 16%  | 297     | 14%  | 605              | 1.0       |
| 5-14 years  | 630   | 33%  | 612     | 30%  | 1242             | 1.0       |
| 15-49 years | 706   | 37%  | 993     | 48%  | 1699             | 0.7       |
| 50+ years   | 245   | 13%  | 170     | 8%   | 415              | 1.4       |
| All ages    | 1889  | 100% | 2072    | 100% | 3961             | 0.9       |

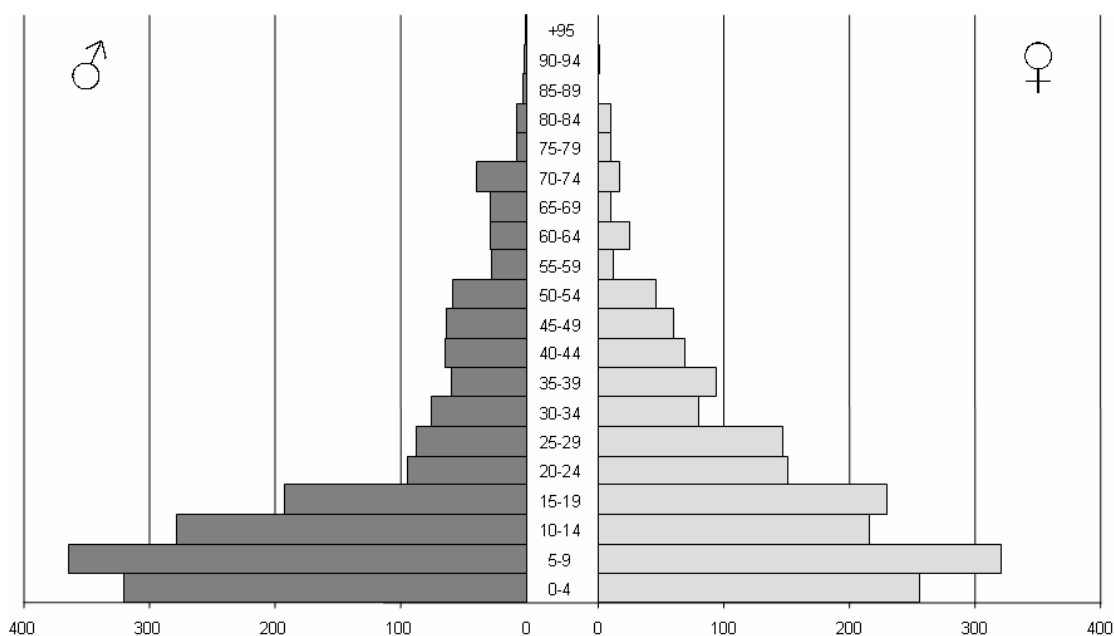
Age missing: 2

**Figure 3: Age pyramid for IDPs inside camps, North Darfur, May-June 2005**

The sex distribution for the IDPs inside camps show that 48% were male and 52% female ( $p=0.004$ ). A statistically significant deficit can be observed among the males in the 15-49 years age group ( $p<0.001$ ) and females above 50 years ( $p<0.001$ ). 15% was younger than 5 years which is less than the proportion of this age group reported by MICS 2 (17.9%)

**Table 4: Distribution of IDPs outside camps by Age and Gender, North Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 320   | 18%  | 256     | 15%  | 576              | 1.3       |
| 5-14 years  | 642   | 35%  | 537     | 30%  | 1179             | 1.2       |
| 15-49 years | 640   | 35%  | 834     | 47%  | 1474             | 0.8       |
| 50+ years   | 207   | 11%  | 134     | 8%   | 341              | 1.5       |
| All ages    | 1809  | 100% | 1761    | 100% | 3570             | 1.0       |

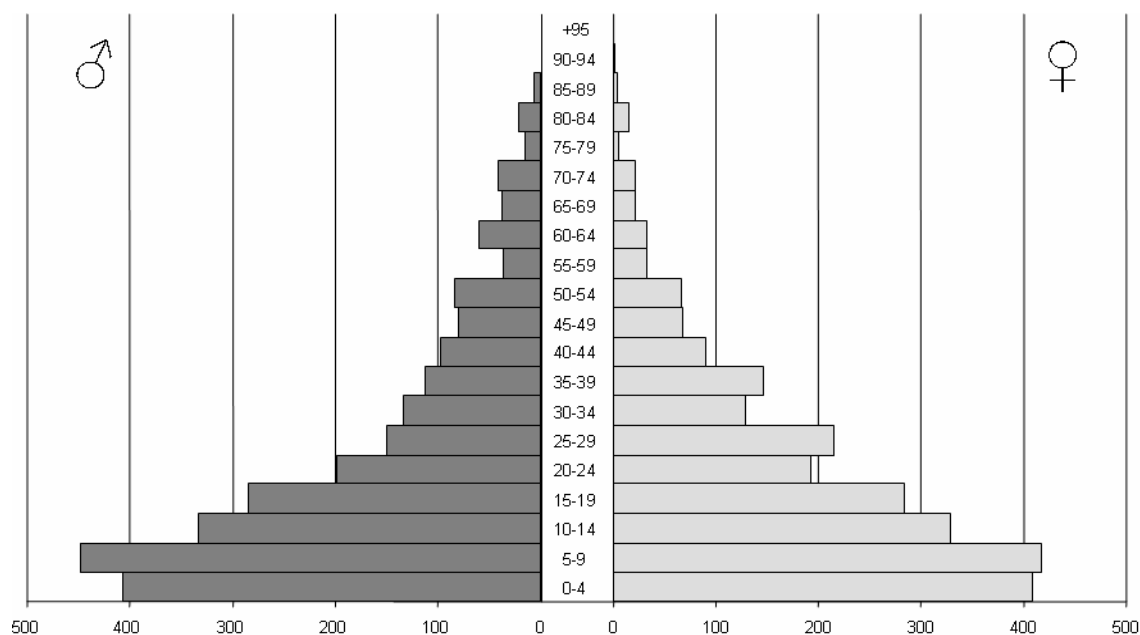
*Figure 4: Age pyramid for IDPs outside camps, North Darfur, May-June 2005*

Among the IDPs outside camps there was a non significant majority of males (51% male versus 49% female). However, there is again a shortfall among the males in the 15-49 years age group ( $p < 0.001$ ) but also a significant deficit among the girls younger than 15 years ( $p < 0.01$ ) and women above 50 years ( $p < 0.001$ ).

**Table 5: Distribution of resident population by Age and Gender, North Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 407   | 16%  | 408     | 16%  | 815              | 1.0       |
| 5-14 years  | 782   | 31%  | 747     | 30%  | 1529             | 1.0       |
| 15-49 years | 1055  | 41%  | 1122    | 45%  | 2177             | 0.9       |
| 50+ years   | 301   | 12%  | 202     | 8%   | 503              | 1.5       |
| All ages    | 2545  | 100% | 2479    | 100% | 5024             | 1.0       |

Age missing: 12

*Figure 5: Age pyramid for resident population, North Darfur, May-June 2005*

The sex ratio amongst residents is comparable to the ratio from the IDPs outside camps, i.e. 1.0 (51% male, 49% female). Similarly to the two other groups, a deficit in the less than five years group and a significant gap of older women ( $p < 0.001$ ) can be noticed. However, the shortfall in males in the 15-49 years category is not significant in this population.

### 3.1.2 Retrospective mortality

#### *IDPs inside camps*

Out of an average population size of 3,726 persons, 57 deaths were reported during the study period.

$$\text{Crude Mortality Rate (CMR)} = \frac{\left( \frac{57 \text{ deaths}}{3,726 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{0.8/10,000/day}$$

The design effect (DE) was calculated to be 1.6 and the 95% confidence interval (95% CI) [0.5; 1.0].

The under five years old category consisted of an average of 553 children, of which 17 died.

$$\text{Under Five Mortality Rate (U5MR)} = \frac{\left( \frac{17 \text{ deaths}}{553 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{1.5/10,000/day}$$

DE was 1.0 and 95%CI [0.9; 2.4]

The deaths younger than 5 years of age represent 30% of the total deaths.

The main causes of death were watery diarrhoea (25%), meningitis (16%) and malaria (12%). Among under five years old, the 3 main causes remain the same with respectively 53%, 12% and 18%. (see Table 6)

#### *IDPs outside camps*

The average population size for this sample was 3,382.5 persons. Between Eid El Fir and the survey, 60 people died.

$$\text{CMR} = \frac{\left( \frac{60 \text{ deaths}}{3,382.5 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{0.9/10,000/day} \quad \mathbf{95\%CI[0.6;1.3]}$$

The DE is 2.4.

The average number of under five years old was 519. 19 deaths were reported.

$$\text{U5MR} = \frac{\left( \frac{19 \text{ deaths}}{519 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{1.8/10,000/day} \quad \mathbf{95\%CI[0.8;3.4]}$$

Design effect = 2.6

The deaths younger than 5 years of age represent 32% of the total deaths.

The main causes of death in the total sample were injuries (34%) and malaria (10%). However, no injury-related death was reported amongst the under five years old. In this group the main causes were ARI (21%), malnutrition (16%), watery diarrhoea (16%) and malaria (11%). (see Table 6).

**Residents**

The average population size of the affected residents tier was 4,807. 75 people died during the recall period.

$$\text{CMR} = \frac{\left( \frac{75 \text{ deaths}}{4,807 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{0.8/10,000/day} \quad \mathbf{95\%CI[0.5;1.1]}$$

The design effect was 2.5.

The average number of under five years old was 746.5 in which 17 deaths were reported.

$$\text{U5MR} = \frac{\left( \frac{17 \text{ deaths}}{746.5 \text{ people}} \right)}{202 \text{ days}} * 10,000 = \mathbf{1.1/10,000/day} \quad \mathbf{95\%CI[0.7;1.7]}$$

The design effect was 0.7

The deaths younger than 5 years of age represent 23% of the total deaths.

The main causes of death in the total sample were by far injuries (55%). Among the under five years old watery diarrhoea (24%), malaria (18%) and malnutrition (18%) were the 3 main causes of death. (see Table 6)

**Table 6: Cause specific mortality, North Darfur, May-June 2005**

|                    | IDPs in camps |         | IDPs outside camps |         | Residents |         |
|--------------------|---------------|---------|--------------------|---------|-----------|---------|
|                    | 0-4years      | Overall | 0-4years           | Overall | 0-4years  | Overall |
| Injuries           | 0%            | 9%      | 0%                 | 34%     | 6%        | 55%     |
| Measles            | 6%            | 2%      | 0%                 | 0%      | 6%        | 1%      |
| Tetanus            | 0%            | 0%      | 0%                 | 0%      | 6%        | 1%      |
| Watery diarrhoea   | 53%           | 25%     | 16%                | 5%      | 24%       | 9%      |
| Bloody diarrhoea   | 6%            | 5%      | 5%                 | 7%      | 6%        | 5%      |
| Meningitis         | 12%           | 16%     | 0%                 | 2%      | 0%        | 0%      |
| ARI                | 0%            | 0%      | 21%                | 7%      | 0%        | 7%      |
| Malaria            | 18%           | 12%     | 11%                | 10%     | 18%       | 5%      |
| Malnutrition       | 0%            | 2%      | 16%                | 7%      | 18%       | 4%      |
| Maternal Mortality | 0%            | 0%      | 0%                 | 2%      | 0%        | 1%      |
| Others             | 6%            | 30%     | 31%                | 26%     | 18%       | 11%     |
|                    | 100%          | 100%    | 100%               | 100%    | 100%      | 100%    |

**Aggregated mortality rates**

The distribution for the tree surveyed groups in North Darfur is 22% IDPs inside camps, 41% IDPs outside camps and 37% affected residents (OCHA, 2005). In order to obtain the overall CMR for North Darfur, a weighted average of the specific mortality rates of each group has been calculated using the proportion of each group. The obtained CMR for North Darfur is **0.8/10,000/day** (95%CI [0.6; 1.0]; DE 2.5) and the U5MR **1.5/10,000/day** (95%CI [1.0; 2.1]; DE 1.9).

The aggregated CMR for both IDP groups in North Darfur is 0.8/10,000/day (95%CI [0.7; 1.0], DE 1.0) and U5MR is 1.7/10,000/day (95%CI [1.2; 2.3], DE 1.0).

### 3.1.3 Access to health care, water and food aid

All IDPs inside camps (100%) had access to health system infrastructure (hospital, health unit, mobile clinic). Among the IDPs outside camps this proportion falls to 68%, with another 25% consulting traditional healers. Among residents, only half of the population makes use of the health infrastructure, with almost as many others going to traditional healers or seeking care somewhere else. (see Table 7)

**Table 7: Sources of health care, North Darfur, May-June 2005**

|                   | IDPs in camps | IDPs outside camps | Residents |
|-------------------|---------------|--------------------|-----------|
| Public health     | 100%          | 68%                | 52%       |
| Non public health | 0%            | 25%                | 35%       |
| Other             | 0%            | 5%                 | 13%       |
| Don't go          | 0%            | 2%                 | 0%        |

Sources of water differed considerably too. Among IDPs inside camps, hand pumps (59%) were by far the main source of water access. They are still one of the two major sources for IDPs outside camps with 37% percent, almost as much as the open well (38%). The latter is undoubtedly the most important source for residents (52%). (see Table 8)

**Table 8: Sources of water, North Darfur, May-June 2005**

|                       | IDPs in camps | IDPs outside camps | Residents |
|-----------------------|---------------|--------------------|-----------|
| Protected sources     | 95%           | 46%                | 32%       |
| Non protected sources | 5%            | 51%                | 68%       |
| Other                 | 0%            | 3%                 | 0%        |

In IDP camps, 81% of the population had received food aid during the month preceding the interview. Among IDPs outside camps this proportion was 64% and among residents 47%.

## 3.2 West Darfur

### 3.2.1 Survey sample

The number of affected people in West Darfur was estimated to be 689,045 IDPs and 230,515 affected residents<sup>14</sup>. Interviews were conducted on 1,780 households: 596 inside camps, 566 outside camps and 618 households among the resident population. The median day of the survey was June 9<sup>th</sup>, 2005, which means that the recall period covered 206 days.

The study population on November 15<sup>th</sup>, 2004 was 9,987. At the time of the survey it was 10,057. (Table 9 show the population dynamics during the recall period.) The mid-period population, calculated as the average of the population at the start of the recall period and the population at the end, was 10,022.

**Table 9: Summarized population dynamics, West Darfur, May-June 2005**

|                  | IDPs in camps | IDPs outside camps | Residents | Total |
|------------------|---------------|--------------------|-----------|-------|
| Total deaths     | 55            | 32                 | 31        | 118   |
| Total births     | 53            | 61                 | 66        | 180   |
| Total departures | 103           | 93                 | 155       | 351   |
| Total arrivals   | 45            | 144                | 171       | 360   |

*NB: The categories in this table are not mutually exclusive.*

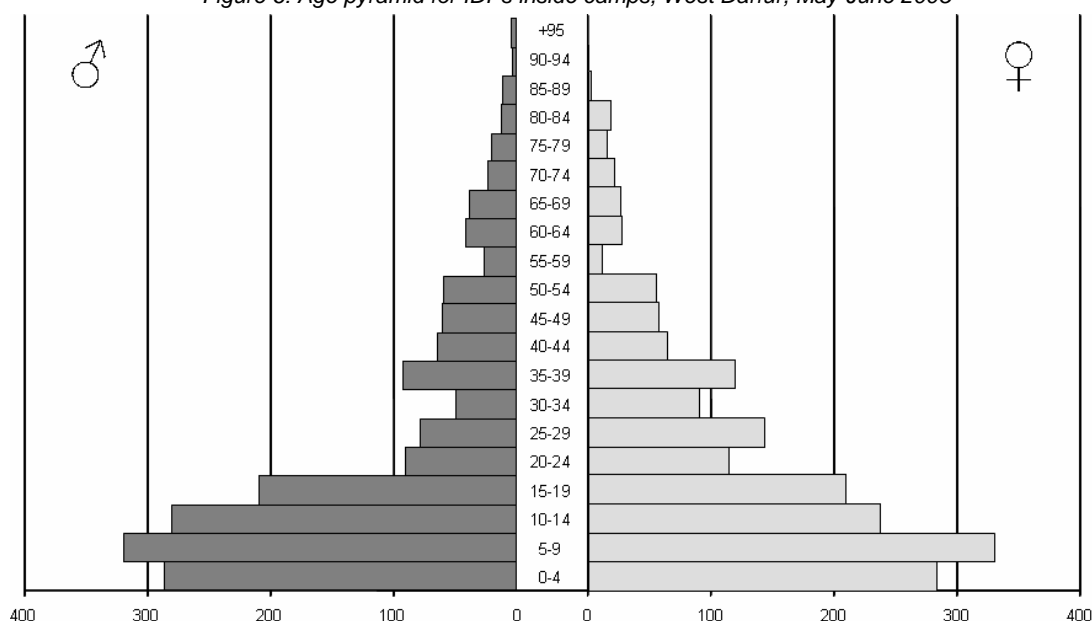
The average number of persons per household was 5.6 for the total sample. For IDPs inside camps it was 5.8, IDPs outside camps 5.6 and for the residents 5.5.

<sup>14</sup> OCHA, May, 2005

**Table 10: Distribution of IDPs inside camps by Age and Gender, West Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 285   | 16%  | 284     | 15%  | 569              | 1,0       |
| 5-14 years  | 600   | 34%  | 569     | 31%  | 1169             | 1,1       |
| 15-49 years | 643   | 36%  | 802     | 44%  | 1445             | 0,8       |
| 50+ years   | 236   | 13%  | 178     | 10%  | 414              | 1,3       |
| All ages    | 1764  | 100% | 1833    | 100% | 3597             | 1,0       |

Age missing: 1

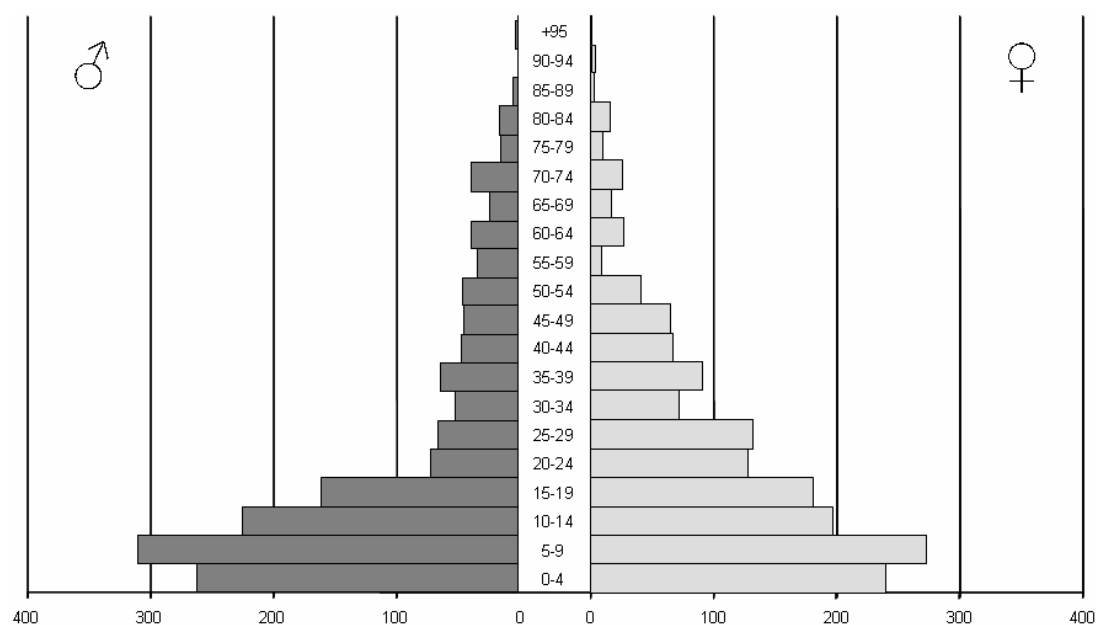
**Figure 6: Age pyramid for IDPs inside camps, West Darfur, May-June 2005**

The male/female sex ratio was 1.0. There are, however, significant discrepancies in the age groups 15-49 years and 50+ years. The former has a significant deficit of males ( $p < 0.001$ ), the latter shows a deficit of females ( $p = 0.004$ ). The proportion under five years old (16% boys, 15% girls) is similar to what might be expected based on the 2000 MICS (16.3% for West Darfur). The 5-14 years (34% males, 31% females) are however overrepresented when compared to the estimations for Sudan for 2005 from the US Census Bureau (27.3%).

**Table 11: Distribution of IDPs outside camps by Age and Gender, West Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 262   | 17%  | 241     | 15%  | 503              | 1,1       |
| 5-14 years  | 535   | 35%  | 472     | 29%  | 1007             | 1,1       |
| 15-49 years | 503   | 33%  | 737     | 46%  | 1240             | 0,7       |
| 50+ years   | 216   | 14%  | 154     | 10%  | 370              | 1,4       |
| All ages    | 1516  | 100% | 1604    | 100% | 3120             | 0,9       |

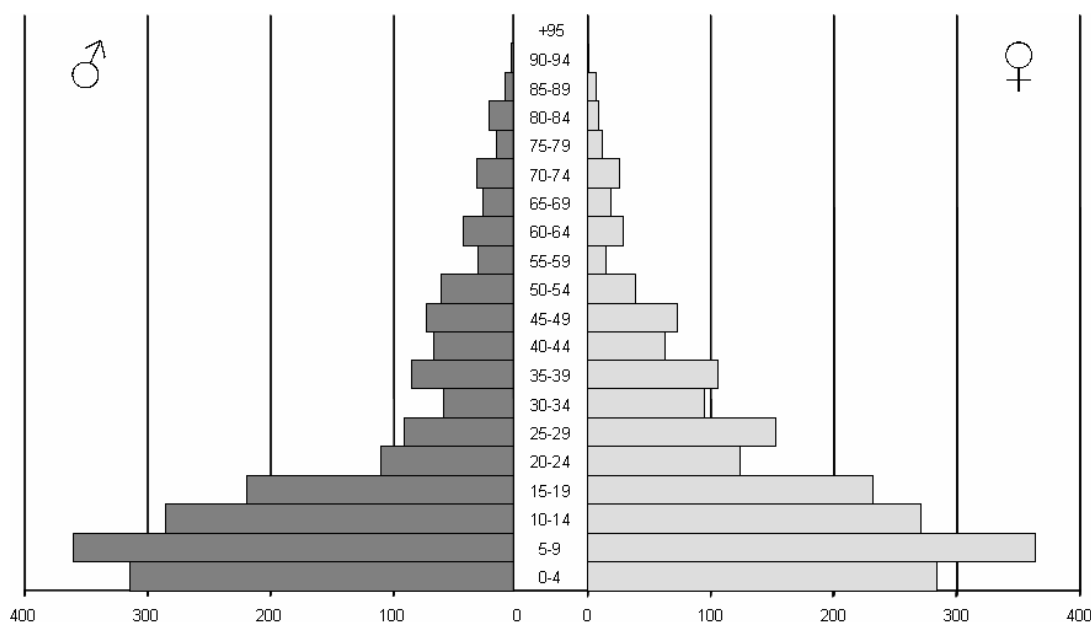
Age missing: 4

**Figure 7: Age pyramid for IDPs outside camps, West Darfur, May-June 2005**

The sex ratio is 0.9, corresponding to a non significant majority of females (51% vs. 49%). Similarly to the IDPS inside camps there are significant discrepancies in the 15-49 years and the 50+ years groups. A deficit of adult males ( $p < 0.001$ ) and older females ( $p = 0.001$ ). The under five years old group is again comparable to MICS2000. The proportion of 5-14 year old boys is bigger than expected according to US Census Bureau. This may explain the relative shortage of girls in the same age group (sex ratio 1.1;  $p = 0.047$ ).

**Table 12: Distribution of resident population by Age and Gender, West Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 315   | 17%  | 285     | 15%  | 600              | 1,1       |
| 5-14 years  | 647   | 34%  | 636     | 33%  | 1283             | 1,0       |
| 15-49 years | 697   | 37%  | 849     | 44%  | 1546             | 0,8       |
| 50+ years   | 229   | 12%  | 157     | 8%   | 386              | 1,5       |
| All ages    | 1888  | 100% | 1927    | 100% | 3815             | 1,0       |

*Figure 8: Age pyramid for resident population, West Darfur, May-June 2005*

There is no significant difference between the proportion of males and females. The sex ratio in 50+ years however is 1.5, which is even higher than in the IDP populations. This suggests again a significant deficit of older women ( $p < 0.001$ ). There is also a significant shortage of adult males ( $p < 0.001$ ), similar to the IDPs. Again there is a higher proportion in the 5-14 years old than can be expected (see above).

### 3.2.2 Retrospective mortality

#### *IDPs inside camps*

The average population size during the recall period was 3,469.5 persons. 55 deaths were reported.

$$\text{CMR} = \frac{\left( \frac{55 \text{ deaths}}{3,469.5 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{0.8/10,000/day} \quad \mathbf{95\%CI[0.5;1.2]}$$

The design effect was 2.8.

The average population of under five years was 529 children. Eleven of them died.

$$U5MR = \frac{\left( \frac{11 \text{ deaths}}{529 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{1.0/10,000/day} \quad \mathbf{95\%CI[0.5;1.7]}$$

DE was 1.0.

The deaths younger than 5 years of age represent 20% of the total deaths.

The main causes of death were diarrhoea both bloody (27%) and watery (20%). Among under five years old they were bloody diarrhoea (27%), watery diarrhoea (18%), measles (18%) and acute respiratory infections (18%). (see Table 13)

### ***IDPs outside camps***

The average population size was 2,958 persons. 32 people died between Eid El Fitr and the survey.

$$CMR = \frac{\left( \frac{32 \text{ deaths}}{2,958 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{0.5/10,000/day} \quad \mathbf{95\%CI[0.3;0.8]}$$

The DE was 1.3.

The average number of under five years old was 462. 8 deaths were reported.

$$U5MR = \frac{\left( \frac{8 \text{ deaths}}{462 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{0.8/10,000/day} \quad \mathbf{95\%CI[0.5;1.4]}$$

The design effect was 0.6

The deaths younger than 5 years of age represent 25% of the total deaths.

The main causes of death were again bloody and watery diarrhoea (35% and 26%). For the under fives measles, watery and bloody diarrhoea were all three the cause of death in 29% followed by malaria with 14%. (see Table 13)

### ***Residents***

The average population size of the affected residents was 3,594.5. 31 people died during the recall period.

$$CMR = \frac{\left( \frac{31 \text{ deaths}}{3,594.5 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{0.4/10,000/day} \quad \mathbf{95\%CI[0.3;0.6]}$$

with a design effect is 0.7.

The average number of under five years old was 547.5 in which 8 deaths were reported.

$$U5MR = \frac{\left( \frac{8 \text{ deaths}}{547.5 \text{ people}} \right)}{206 \text{ days}} * 10,000 = \mathbf{0.7/10,000/day} \quad \mathbf{95\%CI[0.2;1.7]}$$

The design effect is 2.1.

The deaths younger than 5 years of age represent 26% of the total deaths.

The main causes of death in the total sample were similarly to the IDPs diarrhoea (watery 19%; bloody 10%), but also meningitis (10%). Among under fives there was no predominant cause. (see Table 13)

**Table 13: Cause specific mortality, West Darfur, May-June 2005**

|                    | IDPs in camps |         | IDPs outside camps |         | Residents |         |
|--------------------|---------------|---------|--------------------|---------|-----------|---------|
|                    | 0-4years      | Overall | 0-4years           | Overall | 0-4years  | Overall |
| Injuries           | 0%            | 11%     | 0%                 | 0%      | 0%        | 6%      |
| Measles            | 18%           | 4%      | 29%                | 6%      | 0%        | 0%      |
| Tetanus            | 9%            | 2%      | 0%                 | 0%      | 0%        | 0%      |
| Watery diarrhoea   | 18%           | 20%     | 29%                | 26%     | 13%       | 19%     |
| Bloody diarrhoea   | 27%           | 27%     | 29%                | 35%     | 13%       | 10%     |
| Meningitis         | 0%            | 4%      | 0%                 | 6%      | 13%       | 10%     |
| ARI                | 18%           | 7%      | 0%                 | 6%      | 13%       | 3%      |
| Malaria            | 0%            | 5%      | 14%                | 3%      | 13%       | 6%      |
| Malnutrition       | 0%            | 0%      | 0%                 | 0%      | 0%        | 0%      |
| Maternal Mortality | 0%            | 2%      | 0%                 | 3%      | 0%        | 3%      |
| Others             | 9%            | 18%     | 0%                 | 13%     | 38%       | 42%     |
|                    | 100%          | 100%    | 100%               | 100%    | 100%      | 100%    |

### **Aggregated mortality rates**

The proportions of the West Darfur population were respectively 47% IDPs inside camps, 33% IDPs outside camps and 20% residents. Taking this distribution into account, the overall CMR for West Darfur is **0.6/10,000/day** (95%CI [0.5; 0.8]; DE 2.3) and the U5MR **0.9/10,000/day** (95%CI [0.6; 1.3]; DE 1.1).

The aggregated CMR for both IDP groups in West Darfur is **0.7/10,000/day** (95%CI [0.5; 0.9], DE 1.4) and U5MR is **0.9/10,000/day** (95%CI [0.7; 1.3], DE 0.6).

### **3.2.3 Access to health care, water and food aid**

Almost the entire population sought health care throughout the health care infrastructure (hospital, health unit and mobile clinic). (see Table 14)

**Table 14: Sources of health care, West Darfur, May-June 2005**

|                   | IDPs in camps | IDPs outside camps | Residents |
|-------------------|---------------|--------------------|-----------|
| Public health     | 94%           | 99%                | 90%       |
| Non public health | 1%            | 0%                 | 3%        |
| Other             | 4%            | 0%                 | 3%        |
| Don't go          | 1%            | 0%                 | 0%        |

The main sources of water were hand pumps and open wells. IDPs inside camps also highly relied on bladder tanks. (see Table 15)

**Table 15: Sources of water, West Darfur, May-June 2005**

|                       | IDPs in camps | IDPs outside camps | Residents |
|-----------------------|---------------|--------------------|-----------|
| Protected sources     | 61%           | 49%                | 45%       |
| Non protected sources | 34%           | 51%                | 51%       |
| Other                 | 5%            | 0%                 | 4%        |

In IDP camps, 86% of the population had received food aid during the month preceding the interview. Among IDPs outside camps this proportion was 52% and among residents 73%.

### 3.3 South Darfur

#### 3.3.1 Survey sample

The number of IDPs inside camps in South Darfur was estimated to be 585,875<sup>15</sup>. Interviews were conducted on 540 households inside camps. The median day of the survey was June 7<sup>th</sup>, 2005, which means that the recall period covered 204 days.

The study population on November 15<sup>th</sup>, 2004 was 2,385. At the time of the survey it was 3,089. (Table 16 show the population dynamics during the recall period.) The mid-period population, calculated as the average of the population at the start of the recall period and the population at the end, was 2737.

**Table 16: Summarized population dynamics, South Darfur, May-June 2005**

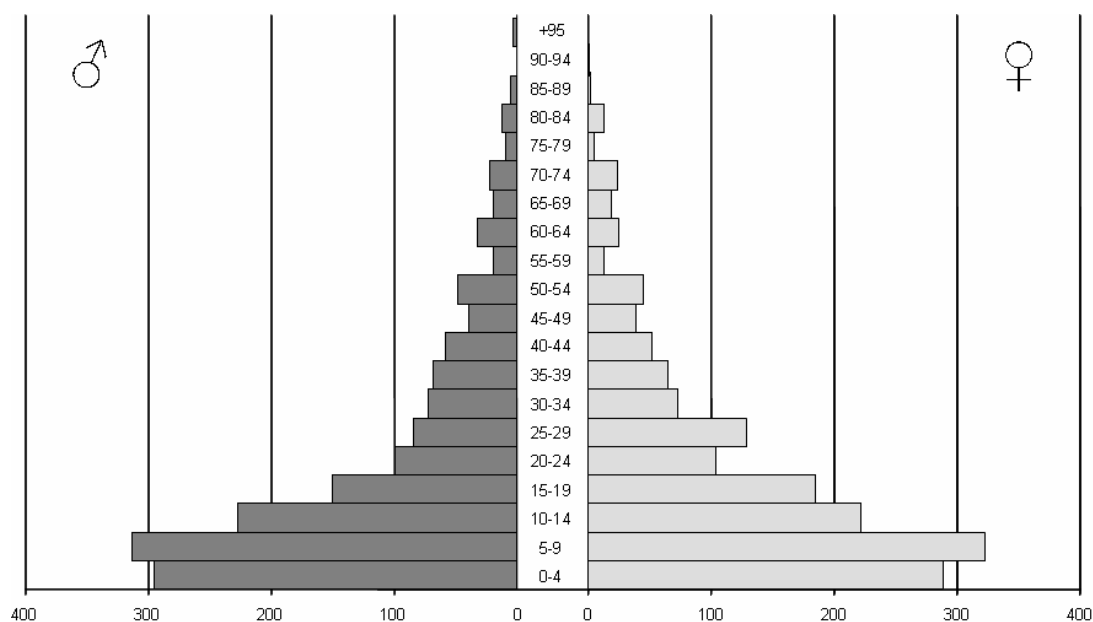
|                  | <b>IDPs in camps</b> |
|------------------|----------------------|
| Total deaths     | <b>47</b>            |
| Total births     | <b>50</b>            |
| Total departures | <b>50</b>            |
| Total arrivals   | <b>753</b>           |

The average number of persons per household was 4.6.

<sup>15</sup> OCHA, May, 2005

**Table 17: Distribution of IDPs inside camps by Age and Gender, South Darfur, May-June 2005**

| Age Groups  | Males |      | Females |      | Total population |           |
|-------------|-------|------|---------|------|------------------|-----------|
|             | n     | %    | n       | %    | n                | Sex Ratio |
| 0-4 years   | 296   | 19%  | 286     | 18%  | 582              | 1,0       |
| 5-14 years  | 540   | 34%  | 539     | 33%  | 1,079            | 1,0       |
| 15-49 years | 570   | 36%  | 642     | 40%  | 1,212            | 0,9       |
| 50+ years   | 168   | 11%  | 147     | 9%   | 315              | 1,1       |
| All ages    | 1,574 | 100% | 1,614   | 100% | 3,188            | 1,0       |

*Figure 9: Age pyramid for IDPs inside camps, South Darfur, May-June 2005*

The male/female sex ratio was 1.0. There is a significant ( $p=0.039$ ) deficit of males in the 15-49 years old group. The gender differences in the other age groups are not significant. According to the MICS 2000 the proportion of under five years old was 17.7% which is comparable to the data of this survey.

### 3.3.2 Retrospective mortality of the IDPs inside camps

The average population size during the recall period was 2737 persons. During this period, 47 people died.

$$\text{CMR} = \frac{\left( \frac{47 \text{ deaths}}{2737 \text{ people}} \right)}{204 \text{ days}} * 10,000 = \mathbf{0.8/10,000/day} \quad \mathbf{95\%CI[0.6;1.2]}$$

The design effect was 1.7.

The average population of under five years was 479.5 children, of which 25 died.

$$U5MR = \frac{\left( \frac{25 \text{ deaths}}{479.5 \text{ people}} \right)}{204 \text{ days}} * 10,000 = \mathbf{2.6/10,000/day} \quad \mathbf{95\%CI[1.6;3.9]}$$

DE was 1.5.

The deaths younger than 5 years of age represent 53% of the total deaths.

The main causes of death were watery diarrhoea (16%) and injuries (14%). Among under five years old they were watery diarrhoea (22%) and acute respiratory infections (13%). (see Table 18)

**Table 18: Cause specific mortality, South Darfur, May-June 2005**

|                    | IDPs in camps |         |
|--------------------|---------------|---------|
|                    | 0-4years      | Overall |
| Injuries           | 0%            | 14%     |
| Measles            | 4%            | 2%      |
| Tetanus            | 9%            | 5%      |
| Watery diarrhoea   | 22%           | 16%     |
| Bloody diarrhoea   | 9%            | 9%      |
| Meningitis         | 4%            | 2%      |
| ARI                | 13%           | 7%      |
| Malaria            | 4%            | 5%      |
| Malnutrition       | 9%            | 5%      |
| Maternal Mortality | 4%            | 2%      |
| Others             | 22%           | 33%     |
|                    | 100%          | 100%    |

### 3.3.3 Access to health care, water and food aid

Almost the entire population sought health care throughout the health care infrastructure (hospital, health unit and mobile clinic). (see Table 19)

**Table 19: Sources of health care, South Darfur, May-June 2005**

|                   | IDPs in camps |
|-------------------|---------------|
| Public health     | 99%           |
| Non public health | 0%            |
| Other             | 1%            |
| Don't go          | 0%            |

The main sources of water were hand pumps and open wells. IDPs inside camps also highly relied on bladder tanks. (see Table 20)

**Table 20: Sources of water, South Darfur, May-June 2005**

|                       | IDPs in camps |
|-----------------------|---------------|
| Protected sources     | 72%           |
| Non protected sources | 28%           |

Sixty percent of the IDPs in the camps had received food aid during the month preceding the interview.

## 4. Discussion

### 4.1 Limitations

Mortality in Darfur has been an issue of great debate since the beginning of the hostilities in 2003. Both political and methodological reasons explain this "statistical anarchy" (Washington Post, 2005).

Limitations in survey design and implementation are the rule, not the exception in field epidemiology, mainly in complex emergencies. However, a balanced review of how these limitations have affected the results is key to the interpretation of results and to the choice of the most appropriate actions.

Several surveys on mortality and nutrition have been conducted, most estimating values that were widely divergent. Much of this variation was due to the difficulties in estimating mortality among transient populations and insecure conditions. Denominators are particularly difficult to establish among rapidly moving populations.

This being said, obtaining data on death, disease or malnutrition rates in conflict situations is far from simple. **First**, death rates will differ according to who gets surveyed. This clearly applies to the different population groups in Darfur. Internally displaced populations live in appalling conditions and typically have death rates far above any emergency threshold. Residents who have not had to move, on the other hand, are usually better off. Moreover, the rate at which refugees die depends on their condition when they arrive in a given camp. As a result, using rates from a specific group (the most disadvantaged) to extrapolate deaths for the whole population can seriously distort the real picture.

**Second**, estimates will differ according to the timing of surveys. There are months in the year where deaths are frequent because of temporary escalation of violence, seasonal disease outbreaks or breakdowns in food supply. If data is collected right after or during one of these periods, the estimated death toll will be high. Applying this death rate to the entire region for the entire year will be grossly misleading.

**Third**, estimations of mortality have to be considered in the light of the counter-factual, i.e. how many people would have died, if the conflict had not occurred? It is very difficult to estimate the excess deaths without knowing the baseline mortality, which is the number of those who would have died anyway without the conflict.

**Fourth**, stereotypes of conflict-related mortality frequently dominate the debate and distort clear decision making processes. Outright violence is rarely the main cause among populations affected by conflict. The IRC mortality study in eastern Democratic Republic of Congo shows that deaths due to violence represent less than 20% of all causes (IRC, 2001). Data suggest, however, that there is a correlation between violence and infectious diseases and malnutrition, which suggests that "*people in those areas with the most violence suffer the most displacement*" and therefore have a higher probability of dying from the latter causes.

A good indicator of whether violence is a major cause of death is when death rates for adults are higher than those among children under 5 years, or the usual 1: 2 ratio increases. But studies from different countries show that this is rare.

More specifically, this survey was conducted in extremely difficult circumstances, within an uncertain and fluid security situation, need for frequent cross-line movements and enormous logistic challenges to transport simultaneously an average of 6 teams per state to scattered locations, in respect of UN security norms.

Security was problematic in South Darfur, where only 66 clusters -out of the planned 90- could be surveyed. Only findings for IDPs in the camps in the South<sup>16</sup> are presented in this report. In West Darfur, the deteriorated security was the reason for the replacement of 10 clusters (11% of the total), while in North Darfur only 4 clusters (4.5%) had to be replaced

For the selection of clusters, we relied on figures released by OCHA, complemented, whenever relevant, with updates from WFP registration in IDPs camps or from ICRC data. OCHA data are collected from different sources and methods: their validity and precision are variable. Further, the update cut-off for OCHA figures was 1<sup>st</sup> April 2005: in the two months before the survey was conducted, the situation can have changed in some locations, both in terms of numbers and/or category of population<sup>17</sup>.

The recall period of this survey, more than 6 months, was longer than the previous WHO-EPIET survey. In general, the longer the study, the more susceptible to biases it is, such under-reporting of deaths further back in the past; this could in theory limit the validity of the comparison with the previous survey. However, since the event that characterizes the start of the recall period is an important event<sup>18</sup>, well known by all respondents, such bias should not have heavily influenced the results and their comparison. Additionally, interviewers and supervisors were instructed to cross check the answers given by the respondents, to assess whether the recorded death had indeed happened in the mentioned period of time. To limit recall bias, a local calendar of events was used to assist in the definition of precise month of death.

In order to collect such a wealth of information in a short period, the survey was particularly labour intensive, with some 80 people directly involved in the field work. An effort was made to standardize methods and techniques through an intensive training and a strong supervision of interviewers, so as to improve reliability of findings; however, some residual variation cannot be excluded. Additionally, our internal inspection of data did not reveal any apparent patterns in questionnaire responses (measurement bias) according either to interviewer team or surveyed population type, a proxy affirmation that there were no major differences in the data collection process among interviewers and/or surveyed.

An information bias, such as providing inaccurate death data or information on the size of the household or on the availability of food or non-food aid, so as to justify more aid, cannot be completely ruled out. This bias would probably be towards under-reporting mortality. However, at the beginning of the interview, the respondents were informed that all the information provided was anonymous and that the study was not part of a registration process for the distribution of aid.

The Darfur crisis has had political connotations from the beginning, and manipulation of information, like mortality, has been instrumental to opposite political ends. The possibility of political biases affecting the survey, that is both under and over-reporting mortality for political purposes in order to minimize or conversely exaggerate the effects of the crisis has been carefully considered. The following measures were taken to reduce the influence of this bias: a close supervision of interviewers by a large number of international, politically neutral supervisors and coordinators, discussions with other UN agencies experts for the validation of preliminary results and internal comparisons of findings.

With regards to the causes of death, which is always a difficult information to collect, we relied on respondents' reports. For non-injuries related deaths, the self-reported cause may be influenced by prevailing local perceptions/ definitions of illness or may suggest the explanation given by the local health worker.

When the randomly selected household was empty, we asked the neighbours on the whereabouts of the family members, usually obtaining an indication on whether they were

<sup>16</sup> 27 out of the 30 planned clusters were completed

<sup>17</sup> This could be the reason for the relatively high number (10) of replacements not related to worsened security in west Darfur.

<sup>18</sup> It marks the end of the Ramadan

temporarily or definitively absent. We cannot exclude completely the possibility that in some households all members had disappeared because of death. Theoretically, such a bias, when and where present, will lead to the underestimation of mortality<sup>19</sup>. However, empirical evidence has shown that this phenomenon is more pronounced in communities with markedly high mortality rates and where killings are targeted and clustered, but no evident mortality clustering was detected in our survey.

## 4.2 Mortality

The aggregate crude mortality rate was 0.8/10,000/day in North and 0.6/10,000/day in the West. Neither IDPs (in or out of camps) nor residents in either State presented crude mortality or under five mortality rates higher than the emergency thresholds.<sup>20</sup> However, this finding should be viewed with some caution since the upper limits of the confidence intervals for the both crude and U5 mortality rates for the displaced were in several instances beyond the emergency threshold. In the North, the displaced outside camps were worse off compared to IDPs in camps and residents. Conversely, the upper limits of the interval for CMR in the West for the IDPs in the camps were higher than the emergency threshold. This could be explained by the lower availability of safe water in the West (only 61% used safe sources in the camps compared to 95% in the North Darfur camps). The findings above indicate that while food distribution and access of health care seem adequate in West Darfur, safe water supply requires improvement.

The Darfur situation had generated much speculation on the extent of violent deaths due to the conflict. In the current conditions, it was not possible to specifically identify deaths due to conflict related violence. Injuries were the most important cause of death in North Darfur, accounting for a third of all deaths, followed by diarrhoea and malaria. In West Darfur, only 7% of the deaths were due to injuries and by far the greatest number, nearly 50%, were due to diarrhoea. This wide difference between the share of injuries in North compared to the West also points to a specific nature of the mortality profile in the North. During the period of the survey, open and widespread hostilities were not reported in the North Darfur in areas of high levels of injury related deaths. However, according to some sources<sup>21</sup>, these areas served as active recruiting grounds for combatants who were sent to fight on the North / South border. This could also explain, in addition to the lack of resources, why many of the respondents who reported a death in their household did not organize a funeral.

A previous review (CRED, 2005) analysed data from 24 surveys in Darfur during the period September 2003 – January 2005. The authors concluded that direct violence was not a major cause of death and estimated a total of slightly over a hundred thousand excess deaths due to conflict in a 16 month period.

The mortality rates in North and West Darfur among IDPs and residents have reduced substantially since November 2004, in comparison to mortality reported in previous surveys including the one by WHO. Rapid and targeted humanitarian aid, coupled with an overall improved security situation in the region, has contributed to a drop in mortality to levels which are now comparable to other sub-Saharan countries. However, pockets of violence persist in specific areas and civil population living in these areas require protection and increased aid.

As mentioned earlier in this report, insecurity and logistical difficulties during the rainy season prevented the completion of the survey in South Darfur. The results presented in the earlier section refers therefore only to IDPs in the camps. The most important operational finding is that the mortality of children under five years remains well above the emergency threshold levels. The diarrhoeal disease remains the most important cause of death among these children, accounting for about a third followed by acute respiratory infections. Both of these are the classic causes of death among children in any poor developing nation and have cheap and effective treatment options for most cases. Injuries account for 14% of the deaths among the other age-groups and, occurring in organized camps, reveal a level of insecurity that invades what would otherwise be

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<sup>19</sup> survival bias

<sup>20</sup> In 5 of the 12 estimates, the design effects were greater than two indicating clustering bias.

<sup>21</sup> OCHA and WFP, personal communication, Khartoum June 2005

safe territory. While there are few options other than political ones for controlling general civil insecurity, the high mortality among IDP camp children requires urgent humanitarian intervention for improving coverage and quality of primary health care services.

### 4.3 Age and sex distribution

The age-sex distribution provides insights into the differential mortality between ages and between men and women. Some patterns also reflect the impact of conflict related deaths by deficits among males in combat ready ages.

The age-sex distribution of the survey population in North and West Darfur raises questions regarding the patterns of death now or in the past in these populations (Figs. 3 – 8). Overall, the patterns in both States are similar, displaying significant deficits among women in older age groups and among men between 15 – 49 years. The deficit among males in 15 – 49 might be due to recruitment in combat forces and due to migration for earning a livelihood elsewhere. A similar deficit is observed when population data from the Multiple Indicator Cluster Survey (UNICEF, 2000) is analysed, indicating that this pattern dates from several years and is not necessarily the result of the current conflict.

On the other hand, fewer women in older ages are an unusual pattern. In Sudan, however, the proportion of women in older age-groups has been observed to be smaller than men for over two decades (Alex De Waal, *Famine that kills*, Clarendon, Oxford Press, Oxford, 1989 pp 175; US Census Bureau, [www.census.gov](http://www.census.gov)). Typically, in developing as well as in industrialized countries, once girls have survived their 5th birthday, they present a life span greater than that of men. In Darfur, where severe insecurity has generated sudden displacement of families, older women may not have been able to follow the families or were left behind to protect the assets. Furthermore, mortality could have been higher in these ages due to lower entitlements to already scarce food in households. Finally, older women may have died earlier, before the survey began and were therefore not captured in these data.

In addition to these above deficits, there is a gap amongst young girls (5 – 14 years) in the IDP populations living outside the camps both in North and West Darfur. Recent literature on conflicts has repeatedly raised the importance of sex slavery related to local military activity. While we cannot corroborate this hypothesis with evidence, we cannot exclude such practice as an explanation. However, reviewing demographic history of this region, a similar deficit in 5-14 year old girls was noted after the famine of 1984 – 5 (de Waal), indicating that such gaps in young girls may be associated to major disasters such as famines and civil war.

The household size in North Darfur was substantially higher than West Darfur, numbering on average at least one more member. The largest households by far were those among affected resident households in North Darfur that averaged nearly 8 persons per family. The smallest family units (5.5 per household) were the displaced in West who remained outside camps.

A family size of around 7 is also observed among other displaced populations in Sudan and is probably not unusual for this population<sup>22</sup>. Compared to other Sub-Saharan countries, Sudan has a large family size averaging at 6.3 for the whole country. In Darfur where the size is even larger than the national average, it could reflect highly traditional lifestyles of the population inhabiting this region. Much of the population in North Darfur are of nomadic origins, who tend to have large families.

### 4.4 Food, water and health care

As may be expected, access to food inside camps was adequate with more than 90% receiving food aid. Contrary to the low coverage of clean water supply in West Darfur, food aid and its distribution seemed to be better than in the North, where only about half of the affected residents

<sup>22</sup> <http://www.db.idpproject.org/Sites/IdpProjectDb/idpSurvey.nsf/wViewCountries/29F253D20A3959EFC125683F004B7647>

received assistance during the last month, as compared to nearly 73 % of those affected in the West.

By and large, with the exception of the residents in North Darfur, food aid covered the majority of affected populations in both States. Remoteness and inhospitable terrain in that region, together with the scattered population settlements can pose major barriers to sustained and equitable distribution of food and could explain the lower levels among the North Darfur residents.

Availability of clean water, a key input to control morbidity and mortality, deserves attention. Although camps generally provide clean water to their residents, this was true in North Darfur but not in the West. While more than 90% of the IDPs in camp in North Darfur drew their water from hand pumps, bladder tanks or piped sources, only 60% of the West Darfur camp residents had access to safe water. Not unsurprisingly, diarrhoea accounted for nearly half the deaths in the survey period compared to North Darfur, where little over 18 % died of diarrhoea.

Overall, the water sources for the affected residents in both North and West were unsafe for over 40% of the population. In the North, this proportion reached almost 70% of the residents who did not have access to safe and clean water for drinking or cooking.

The low proportion of affected persons in the West, whether in camps or outside, who have access to safe water is a matter of concern from public health perspectives. Child mortality in the west may possibly be associated to this.

Camps in both North and West Darfur provided health services to almost all population, covering over 90% of the camp residents. Displaced in West Darfur, whether in or out of camps, were significantly better served with organized health care than the communities in the North. Use of traditional healers was higher in North Darfur, accounting for almost a third of the total affected residents. Distance and nomadic lifestyles may be factors promoting the more frequent use of traditional healers compared to the communities living in West Darfur. The sources of organized care included health units, hospitals and mobile clinics. Of these, the latter appear to have not been used at all by any population, raising questions regarding their cost effectiveness.

Over 50 % deaths in West Darfur for all IDPs were due to diarrhoeal diseases. This could be a consequence of the inadequacy of safe water supply for the displaced. This is applicable mainly to those living within camps, where nearly 40% did not have access to safe water. On the other hand, West Darfur had much better coverage of health care which should have had greater protective effect on the children.

## 5. Conclusions and recommendations

The survey shows a dramatic improvement in the mortality experience of IDPs since last year. Mortality declined by a factor of almost two in North Darfur and of around three in the West and the South. Under 5 mortality in displaced children in the South is the only value above the emergency threshold, and with one third of the deaths attributable to diarrhoea -a condition easy to treat- points to the need for improved quality and coverage of basic health services.

This survey was carried out before the rainy season, when the transmission of malaria peaks, food and non-food distribution becomes more difficult and the hunger season starts. The previous WHO-EPIET study instead collected information during the period July-August 2004, coinciding with the rainy season. For this reason, it would be incorrect to attribute the decline of mortality only to humanitarian assistance: other factors can have played a role. On the other side, the change is so dramatic and consistent across the different study populations and regions that we can confidently state that the impact of the strengthened humanitarian response has contributed, probably to a large extent, to saving a high number of lives.

In spite of mortality rates being lower than in 2004, and below the emergency threshold<sup>23</sup>, they are, overall, still in excess in relation to the available reference baselines of 0.3 per 10,000 per day for Sudan (UNICEF, 2005) and to the Sphere standards of 0.44 per 10,000 per day for Sub-Saharan Africa (Sphere project, 2004). Reducing this excess mortality must be the target of all humanitarian actors in Darfur.

Injuries, probably as a result of violence, have overall declined, but in North Darfur, where they still represented 34% of all causes of death for the three populations combined. The presence of violence underlines the fact that humanitarian assistance alone cannot reduce the predicament and suffering in Darfur and only political actions is necessary for ensuring reinforced protection of the civil population and respect of humanitarian law. In this context, signs of shifting attention of political partners to the Darfur crisis, such as the recently reported shortfall by the African Union to fund its operation in Darfur are of extreme concern.

As discussed in previous sections of the report, nothing can be said on mortality in areas that could not be included in the survey, because of lack of accessibility, particularly in the South. The UN criterion of accessibility for the survey was the same as applied for the delivery of humanitarian assistance.

This study shows that, in spite of the tremendous efforts of the humanitarian response in Darfur, probably the biggest ongoing relief operation, immediate needs persist and gaps in the response still need to be filled. For example, in West Darfur, diarrhoea represented about half of the causes of death, indicating that increased efforts must be put into improving water and sanitation services, and, secondarily, in increasing access to primary health care. This is also applicable to water and sanitation programmes and PHC services in South Darfur IDP camps, where the estimated under 5 mortality rates were above the emergency threshold. In spite of all efforts that humanitarian actors have put into coordination, the survey shows that there are differentials and gaps in service provision that require improved targeting.

With regards to the adequacy of public health services made available to the affected population, the study shows that mobile health clinics are substantially under-utilized. While mobile clinics are useful at the beginning of a crisis, to expand the coverage of essential services, it is recommended that this approach is reviewed against the map of existing fixed public health services, in order to ensure the most effective and efficient use of resources.

The data generated by the study, and in particular mortality data, need to be analysed together with those produced by the early warning system, with the objective of better interpreting the survey's results and validating the coverage and quality of the surveillance system.

Since 2003, more than twenty mortality surveys have been carried out in Darfur. They have generated a wealth of information, which has proved useful for programming and targeting relief interventions, as well as for advocacy purposes. There is room for improvement, however, in the coordination and standardization of surveys so that their findings can be more effectively compared and consolidated, and their costs reduced. This concern is clearly emerging in the ongoing debate around the reform of the humanitarian response system, and in particular on the value of using humanitarian outcomes, such as mortality, for better monitoring the crises and informing the planning of humanitarian response.

Prospective mortality surveillance is also being advocated, since it enables real-time monitoring of the crisis and, therefore, a prompter response. On the other hand, the requirements for sustaining quality surveillance through supervision are high. Additionally, population movements need to be minimal for a surveillance system to produce good mortality data. Thirdly, surveillance systems have a limited coverage, usually limited to camps, and cannot inform about vast areas, as surveys can. In conclusion, as a recent review points out (Cecchi and Roberts, 2005), surveys and surveillance should not be seen as mutually exclusive, but rather as complementary.

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<sup>23</sup> Several rates have, however, an upper confidence limit that is above the relevant emergency threshold

Finally, the findings of this survey need to be circulated widely among humanitarian actors and donors in order to put political pressure for solving the ongoing humanitarian crises in Darfur, increase humanitarian access and to maintain and enhance funding for protection and promotion of sustainable health as the health systems in Darfur recovers from the crises.

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## Annex 1: Questionnaire (English translation)

### Mortality Survey, Greater Darfur Sudan, 2005

State \_\_\_\_\_ Camp/settlement/village: Name \_\_\_\_\_ Code \_\_\_\_\_

Cluster number: \_\_\_\_\_ Household number: \_\_\_\_\_

Date \_\_\_\_ / \_\_\_\_ / 2005 Interviewer: \_\_\_\_\_ Supervisor \_\_\_\_\_

#### HOUSEHOLD DATA

1) Have you and your household members left your original place of residence? Yes / No / Unk

1a) If YES, Where did you live before?

Village \_\_\_\_\_ Administrative unit \_\_\_\_\_ Locality \_\_\_\_\_

State \_\_\_\_\_

1b) Since how long has you been living here? \_\_\_\_\_ months/years. Does not remember

1c) Did you live in another camp(s) since EID EL FATER ..... Yes / No / Unk

2) What is your **main** source of drinking water? (Tick one)

Central piped system       Household Standpipe       Bladder Tank

Open Well       Hand pump       Water Seller

Wadi       other

3) Do your household members currently use a latrine?  ALMOST Always  Sometimes

Never

IF sometimes or Never, Why (tick one):  Not Available       Dirty       Not Enough

Other

4) Did you ever receive **food aid**?  Yes       No       Unk

If yes, when was last time?  Within 1 Month       More than 1 Month

5) Did your household receive the following? (Circle one for every item) OBSERVE if possible?

Plastic Sheetting ..... Yes / No / Unk

Mosquito Net ..... Yes / No / Unk

Jerry Can ..... Yes / No / Unk

Blankets ..... Yes / No / Unk

Cooking Pots ..... Yes / No / Unk

Soap ..... Yes / No / Unk

6) If you are sick where do you go for medical care? (Circle one)

Hospital       Heath Unit       Mobile Clinic       Traditional Healer       Other       Don't go.



## VERBAL AUTOPSY TO DETERMINE CAUSE OF DEATH

- 1) Died from car accident, fall, drowning,  
poisoning, burn, bite, sting, bullet, bomb,  
mine or other violence or injury? If YES **STOP. Record Code 1**  
If NO Go to next question
- 2) Had Habouba (measles)? If YES **STOP. Record Code 2**  
If NO Go to next question
- 3) Had neonatal tetanus (Tetanus)? If YES **STOP. Record Code 3**  
If NO Go to next question
- 4) Had Eshal (diarrhoea)? If YES **Go to question 5**  
If NO Go to question 7
- 5) Had watery Diarrhoea? If YES **STOP. Record Code 4**  
If NO Go to question 6
- 6) Had Eshal Damawy  
(blood in the stool)? If YES **STOP. Record Code 5**  
If NO Go to question 7
- 7) Had Houma (fever OR hot body)? If YES **Go to question 8**  
If NO Skip to question #11
- 8) Had Sohaye (meningitis)? If YES **STOP. Record Code 6**  
If NO Go to next question
- 9) Had Kohaa  
(cough OR difficulty breathing)? If YES **STOP. Record Code 7**  
If NO Go to next question
- 10) Had Malaria (Malaria)? If YES **STOP. Record Code 8**  
If NO Go to next question
- 11) Had sook takhzeah (Malnutrition)? If YES **STOP. Report Code 9**  
If NO Go to next question
- 12) Mother died within 6 weeks  
from termination of pregnancy? If YES **STOP. Report Code 10**  
If NO Go to next question
- 13) Other causes If YES **STOP. Report Code 1**