

Draft Preliminary Report

Retrospective Mortality Survey

Among the Internally Displaced Population,

Greater Darfur, Sudan, August 2004

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1 Introduction

The Darfur region of Sudan covers 256,000 square kilometres. Divided into three administrative states, North, South, and West Darfur, it has an estimated population of between five and six million people (Figure 1).

In February 2003 the conflict in Darfur escalated, affecting about 2.2 million people. An estimated 1.2 million people were internally displaced, seeking refuge in towns and villages in Darfur and also across the border in Chad. In August 2004, 127 settlements for internally displaced populations (IDP) had been identified in Darfur (34 in the North, 45 in the South and 48 in the West) (Figure 1) and 15 refugee camps in Chad.

There has been increasing international concern over the health status of the internally displaced populations. To monitor morbidity and mortality in this population, WHO and MoH implemented an early warning surveillance system. Due to the difficulties in collecting data, information related to mortality remains sporadic and incomplete. To better assess the current health status of the internally displaced people in Darfur, WHO and the Sudanese Ministry of Health jointly conducted a retrospective mortality survey in August 2004. Data on mortality was collected as it provides the most fundamental measurable indicator of health status of an affected population.

Study Objectives

Primary objective

To estimate crude mortality rate in the 62 days from 15th June to 15th August 2004, among the Internally Displaced Population (IDP) present in the settlements at the time of the survey, in each of the three states of Greater Darfur (North, West and East) region.

Secondary objectives

To describe demographic characteristics of the study population

To identify the major causes of death (fever, respiratory infections, diarrhoea, injury/violence, and other)

To describe basic service availability for IDP populations

2 Methods

The study protocol is provided in Annex.

2.1 Study setting

The study population was defined as all IDPs living within accessible IDP settlements in North Darfur, West Darfur and South Darfur. The crude mortality rate was estimated for the 62-day period between June 15th and August 15th 2004.

2.2 Study design

We used a two-stage cluster sampling design. The sampling frame included IDP settlements identified by WFP or UNOCHA (in both government and non-government areas). Settlements that were not accessible due to poor road or security reasons were not included in the sampling frame. For each state, 50 clusters were randomly selected within IDP settlements based on the method described by Henderson and Sanderson (EPI)¹. We used IDP population estimates from WFP, UNOCHA or NGOs whichever was most recent. Within each cluster, 30 households were randomly selected.

2.3 Sample size calculation

Our study was designed to detect a crude mortality rate (CMR) of 1.5 deaths/10,000/days or higher (95% Confidence Interval 1.0 to 2.0) with a cluster effect of 2. The sample required is 7500 for each state. Assuming an average household size of five people, we calculated that the at least 1500 households (50 clusters of 30 households) had to be interviewed in each state.

2.4 Ethical approval

WHO guidelines do not require ethical review for mortality surveys during humanitarian emergencies. Oral consent from the head of household was obtained before the start of each interview. During the survey, only one household did not give consent.

2.5 Data collection

Data was collected using an English/Arabic questionnaire, which we piloted in a suburb of Khartoum amongst families originating from the Darfur region. The questionnaire collected information on:

- Availability of water and sanitation, non-food items (plastic sheeting, jerry cans, blankets, cooking pots and soap), food ration and access to medication
- Demographic composition of the household (age and sex of each household member)
- Status of the household members: alive, absent, disappeared or dead.
- Main cause of death: fever, diarrhoea, respiratory illness, violent death or other.

Field teams were composed of the WHO mortality survey team, staff from the State Ministry of Health, UN agencies and NGOs. All field teams received both theoretical training and field training before undertaking the survey. Members of IDP populations were also recruited at each settlement to facilitate the survey and provide translation into local languages. Sudanese staff were unable to travel to non-government areas. In such cases, local healthcare workers or health visitors were trained and accompanied by members of the expatriate survey team.

To establish whether a death had occurred during the study period, we developed calendar of significant events for each settlement such as vaccination campaigns. In addition to we asked about the occurrence of 'karama' (a remembrance of the dead which is observed during the first three days, after 15 days and after 40 days).

2.6 Analysis

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. The denominator was the average population over the study period. This included all family members recorded as alive. Individuals recorded as disappeared, absent or dead were assumed to be present for half the study period. For crude mortality, one death per 10,000 people per day was used as the threshold to define an emergency situation^{2 3}. For mortality amongst under five years old, we used a threshold value of 2 deaths per 10,000 persons per day^{2 3}. All analysis was conducted using Epiinfo 3.2.2 (Centers for Disease Control and Prevention 2004).

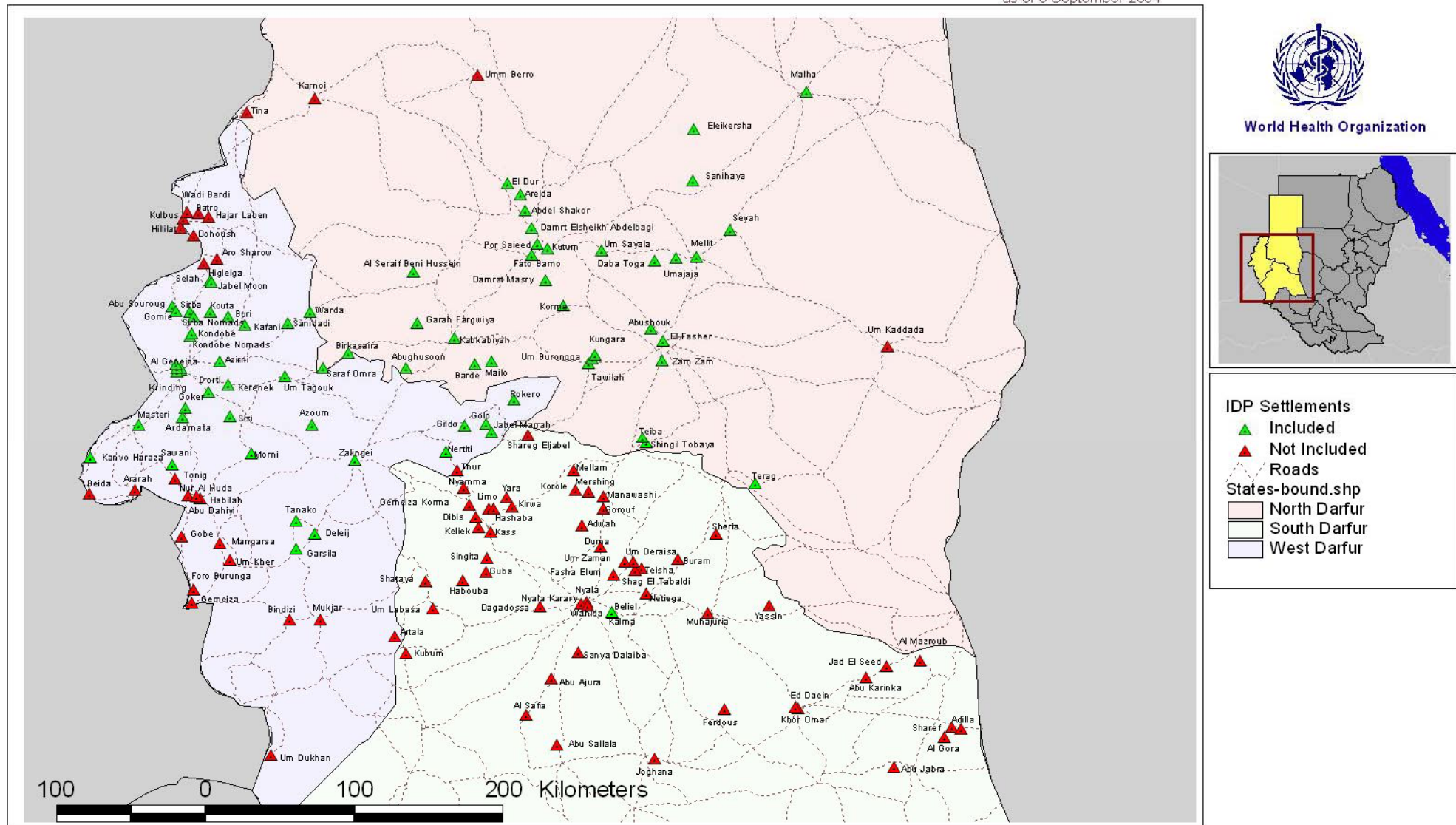
3 Results

Forty three clusters were completed in North Darfur and 43 clusters in the West Darfur. Field work was suspended on September 2nd due to the worsening security situation Figure 1. In South Darfur, the movement of field teams was limited because United Nations vehicles were not available. Therefore, only clusters selected for Kalma camp were completed. Although United Nations vehicles were made available at the end beginning of September, fieldwork was suspended due to a serious security incident involving the survey team. This meant that in South Darfur the survey was only conducted in Kalma camp. It is hoped that the survey in the South can be completed in the future by the Ministry of Health and WHO.

In this report we present the results of the survey achieved by the survey team before the fieldwork was suspended. Results are given separately for West Darfur, North Darfur and Kalma Camp.

Figure 1: Included and excluded IDP study populations

as of 9 September 2004



Disclaimer: The presentation of material on the maps contained herein does not imply the expression of any opinion on the part of the World Health Organization concerning the legal status of any country, territory, city or areas or its authorities of its frontiers or boundaries.

3.1 North Darfur

In North Darfur the number of IDPs was estimated to be 382,626 (Source WFP, 5th August 2004). We conducted interviews with a sample of 1,290 households representing a total of 9,274 internally displaced people at the beginning of the study period. Eighty two deaths were reported during the study period, 26 people were reported as having disappeared and 312 people were absent. At the end of the study period the population alive (excluding deaths, absent and disappeared individuals) was 8,854. The average number of persons per household was seven. Only one household did not consent to the interview. On average, two randomly selected households per cluster could not be included due to the absence all household members. These were replaced by other households randomly chosen from the same cluster. One individual had no sex recorded, 12 individuals had no age recorded and no cause was given for one death.

3.1.1 Demographic characteristics of the sample population

Among the individuals in the IDP sample population alive at the end of the study period (15^h of August) 47 % were male and 53% were female. There were more females than males in the 0 to 4 year and 15 to 49 year age groups (Table 1).

Table 1: Age specific sex ratio among the sample population, North Darfur Sudan, 15th of August 2004

Age group	Number of Males	Number of Females	Sex ratio (M/F)
0 to 4 years	671	779	0.86
5 to 14 years	1583	1517	1.04
15 to 49 years	1529	2044	0.74
50+ years	374	346	1.08
All ages	4157	4686	0.89

Note: One individual had no sex recorded and four males and six females had no age recorded

Over half of the sample population were under 14 years old (Table 2). Children under 5 years represented 16.4 % (95% CI [15.2 - 17.6]) of the sample population (1450/8844). The distribution of the sample population by age groups varied according to sex (Table 2).

Table 2: IDP sample population by age and sex, North Darfur Sudan, 15th of August 2004

Age group	Male			Female			Total population		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
0 to 4 years	671	16.1	[14.8-17.5]	779	16.6	[15.3 - 18.0]	1450	16.4	[15.2 - 17.6]
5 to 14 years	1583	38.1	[35.8 - 40.4]	1517	32.4	[30.7 - 34.1]	3101	35.1	[33.5 - 36.7]
15 to 49 years	1529	36.8	[34.4 - 39.2]	2044	43.6	[42.0 - 45.2]	3573	40.4	[38.8 - 42.0]
50+ years	374	9.0	[8.0 - 10.0]	346	7.4	[6.4 - 8.4]	720	8.1	[7.3 - 9.0]
Total	4157	100	—	4686	100	—	8844	100	—

Note: One individual had no sex recorded and four males and six females had no age recorded

The age distribution among the sample of IDP's is shown in Figure 2. Children under four years old are under represented, especially among males. There were fewer males than females between the ages of 15 to 40. Comparative figures from the last census in Sudan in 1993 (Figure 3) suggest that males and females are usually represented equally [2].

Figure 2: Age distribution among the sample of IDP's, North Darfur Sudan, 15th of August 2004

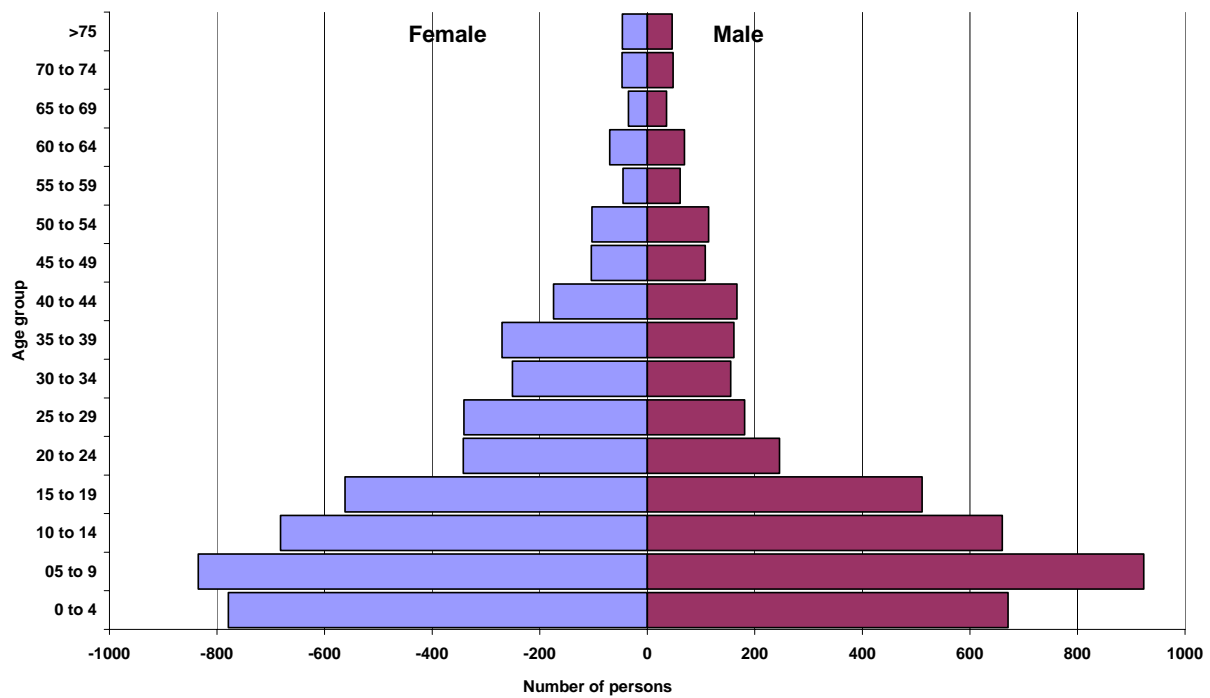
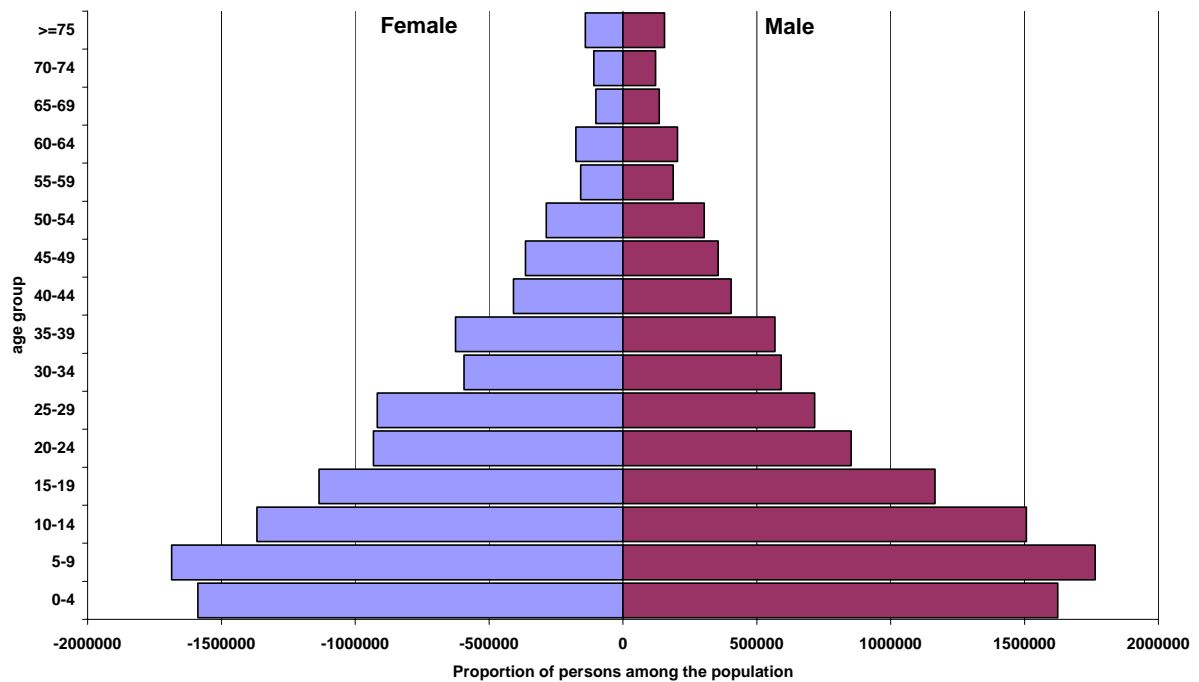
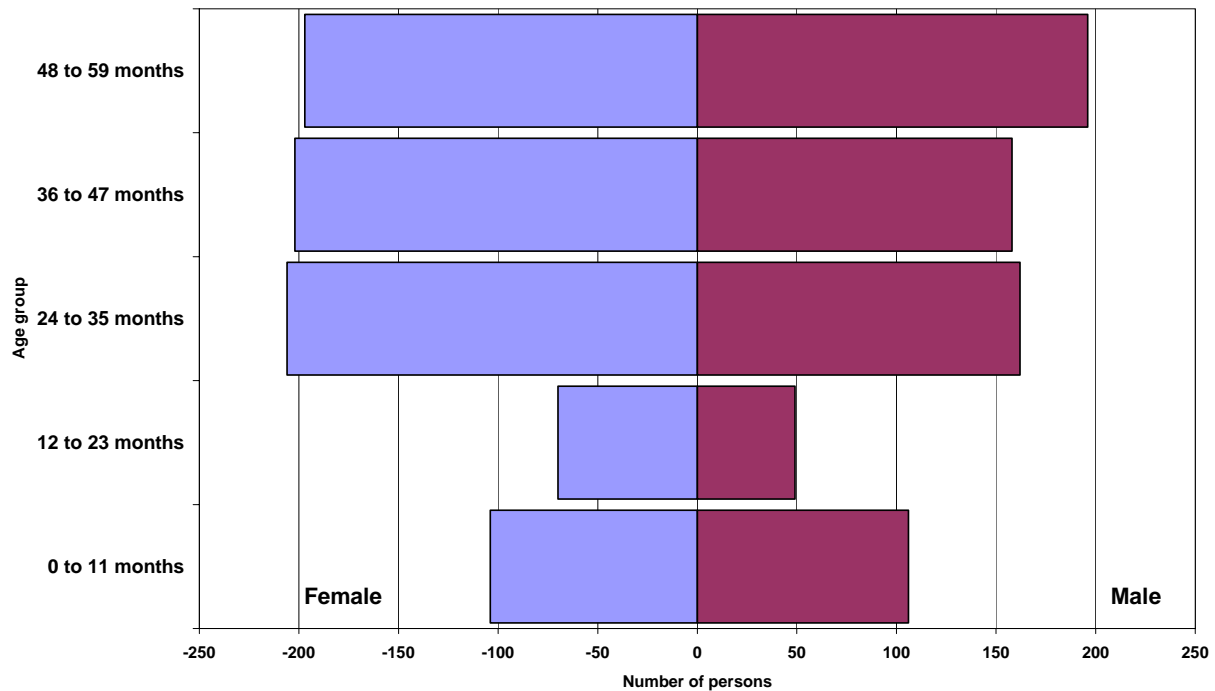


Figure 3: Age distribution, Northern States of Sudan, 1993 (Census data)



The distribution of children under 5 years old in the sample population is shown in Figure 3. Under normal conditions, age groups are similar. Among the sample population, children under 23 months are underrepresented.

Figure 4: Age distribution among the sample of IDP's under 5 years of age, North Darfur Sudan, 15th of August 2004



3.1.2 Retrospective mortality in the sample of internally displaced persons, North Darfur, 15 June to 15 August 2004

Among 9,274 persons included in the sample, 82 deaths were reported during the study period, including 23 deaths among the children under five years of age and 13 deaths among children under one year of age.

The crude mortality rate in the IDP sample population in North Darfur between June 15th and August 15th was **1.5 /10,000 persons / day** (95% CI [1.1 - 1.9]). For the same period, the mortality rate for children under 5 years of age was **2.5 / 10,000 children under five years / day** (95% CI [1.6 - 3.9]) (Table 3).

Table 3: Mortality rates in the IDP sample population, North Darfur Sudan, 15th June to 15th August 2004

	Number of deaths	Mid period population	Deaths / 10,000 population / day	95% Confidence Interval	Design Effect
All ages	82	9064	1.5	1.1 - 1.9	1.39
Under 5 years old	23	1467	2.5	1.6 - 3.9	1.04

Note: For all ages the threshold for a health emergency is 1.0 /10,000/ day and for under 5 years old is 2.0/10,000/day²³

For all ages, diarrhoea was reported as the main cause of death in almost a quarter of deaths, a fifth was reported as due to injury or violence, 17% (14/81) due to fever and 10% (8/81) due to respiratory disease (Table 4). Other causes were reported for about a third of all deaths.

Proportional mortality varied by age group, although the numbers were small. Among children under five years old, the most frequently reported cause of death was diarrhoea (44%, 10/23).

Among individuals aged five to 14 years old, there was one death reported due to each cause except fever for which no deaths were reported. Injury or violence was reported in 45% (12/27) of all deaths among individuals aged 15 to 49 years. The largest proportion of deaths among individuals aged 50 years and older was reported as due to other causes (44%, 12/27), with similar numbers of death reported for fever, respiratory disease, diarrhoea and injury or violence.

Table 4: Distribution of reported cause of death by age group, in a sample of IDPs, North Darfur Sudan, 15th June to 15th August 2004

Reported cause of death	Proportional Mortality				
	n % [95% CI]				
	0 to 4 years	5 to 14 years	15 to 49 years	50+ years	All ages
Fever	5	0	5	4	14
	22 %	0 %	19 %	15 %	17 %
	[3 - 41]	—	[0 - 39]	[0 - 31]	[8 - 27]
Respiratory disease	1	1	2	4	8
	4 %	25 %	7 %	15 %	10 %
	[0 - 14]	[0 - 100%]	[0 - 22]	[3 - 27]	[3 - 17]
Diarrhoea	10	1	5	3	19
	44 %	25 %	19 %	11 %	24 %
	[23 - 64]	[0 - 100%]	[0 - 39]	[0 - 24]	[11 - 36]
Injury or Violence	0	1	12	4	17*
	0 %	25 %	44 %	15 %	21 %
	—	[0 - 100%]	[15 - 74]	[2 - 28]	[6 - 36]
Other	7	1	3	12	23
	30 %	25 %	11 %	44 %	28 %
	[6.0 - 55]	[0 - 100%]	[0 - 25]	[24 - 65]	[16 - 41]
Total	23	4	27	27	81**
	100%	100%	100%	100%	100%

* One death due to injury or violence had no age recorded but is included in all ages.

** The total number of deaths in the table is 81 instead of 82 because cause of death was not recorded for one death.

3.1.3 Basic access to services among households in a sample of IDPs, North Darfur, 2004.

Almost a quarter of households in the sample reported that their main source of drinking water was either from an unprotected well or whadi (river) (Table 5). Over one third of households did not have access to a latrine. About 45% of households reported that they did not have soap. A third of household reported that they had not received a food ration in the last month. Ninety percent of households sought medication from either a hospital or health centre.

Table 5: Access to basic items and services in a sample of IDP households, North Darfur Sudan, August 2004

	Number of households	Proportion of households	95 % CI
Main source of drinking water			
Household standpipe	28	2.2 %	0 - 5.1
Bladder tank	281	21.8 %	12.5 - 31.1
Hand pump	510	39.6 %	27.6 - 51.5
Protected well	69	5.4 %	0.7 - 10.0
Unprotected well	71	5.5 %	0.8 - 10.2
Whadi (river)	231	17.9 %	8.6 - 27.2
Water seller	51	3.9 %	0 - 8.7
Others	48	3.7 %	0.2 - 7.3
Total	1289	100 %	--
Access to latrine			
Yes we use	778	60.5 %	50.0 - 71.0
Yes but we do not use	27	2.1 %	0.4 - 3.8
Latrine not available	481	37.4 %	26.6 - 48.2
Total	1286	100%	--
Presence of basic non food items in the households			
Plastic sheeting	815 / 1288	63.3 %	53.0 - 73.5
Jerry cans	926 / 1286	72.0 %	63.9 - 80.0
Blankets	715 / 1283	55.7 %	45.7 - 65.7
Cooking pots	964 / 1284	75.0 %	67.4 - 82.8
Soap	565 / 1278	44.2 %	35.4 - 53.0
Access to food distribution			
Received a ration during the last month	841 / 1273	66.0 %	55.7 - 76.4
Main Source of medication			
Hospital	366	29.1 %	18.0 - 40.2
Health Centre	763	60.7 %	48.3 - 73.1
Mobile clinic	59	4.7 %	0 - 10.1
Traditional healer	63	5.0 %	0 - 10.2
Other	6	0.5 %	0 - 0.9
Total population	1257	100 %	--

3.2

West Darfur

In West Darfur, the number of IDPs was estimated to be 498,528 (source WFP, August 5th 2004). We conducted interviews with a sample of 1,292 households representing a total of 7,995 internally displaced people at the beginning of the study period. One hundred and forty two deaths were reported during the study period, seven people were reported as having disappeared and 187 people were absent. The sample population alive at the end of the study period (excluding deaths, absent and disappeared individuals) was 7,659. The average number of persons per household was 6. On average, two randomly selected households per cluster could not be included due to the absence of the family members. These households were replaced by other households chosen randomly in the same cluster. One individual had no sex recorded, six had no age recorded and no cause was given for one death.

3.2.1 Demographic characteristics of the sample population

Among the individuals in the IDP sample population alive at the end of the study period (15^h of August) 47 % were male and 53% were female. There were more females than males in the sample among 15 to 49 years and fifty years and older age groups (Table 6).

Table 6: Age specific sex ratio among the sample population of IDP's, West Darfur Sudan, 15th of August 2004

Age group	Number of Males	Number of Females	Sex ratio
0 to 4 years	665	605	1.1
5 to 14 years	1330	1257	1.1
15 to 49 years	1251	1775	0.7
50+ years	359	409	0.9
All ages	3605	4046	0.9

Note: One individual had no sex recorded, three males and three females had no age recorded

Over half of the sample population were under 14 years old (Table 7). Children under 5 years represented 16.6 % (95% CI [15.7 - 17.5]) of the sample population (1270/7651). The distribution of the sample population by age groups varied according to sex.

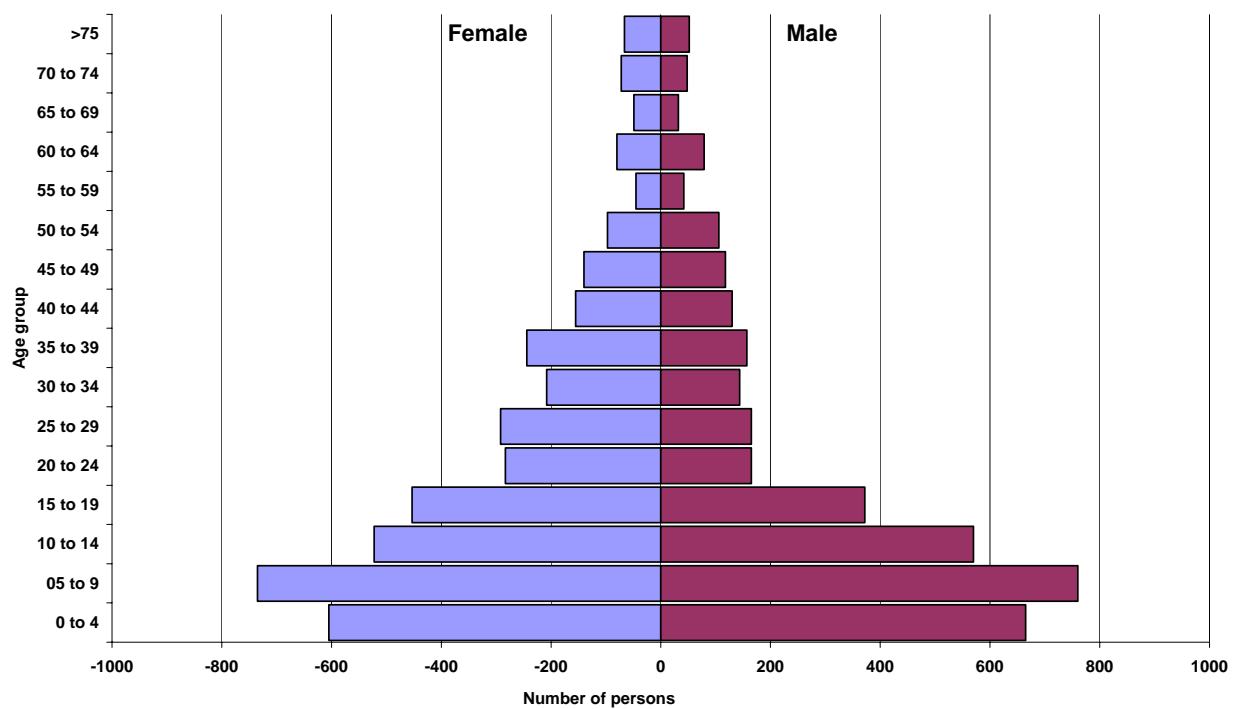
Table 7: IDP sample population by age and sex, West Darfur Sudan, 15th of August 2004

Age group	Male			Female			Total population		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
0 to 4 years	665	18.4	[17.1 - 19.8]	605	15.0	[14.0 - 16.0]	1270	16.6	[15.7 - 17.5]
5 to 14 years	1330	36.9	[35.1 - 38.7]	1257	31.1	[29.9 - 32.3]	2587	33.8	[32.8 - 34.8]
15 to 49 years	1251	34.7	[32.7 - 36.7]	1775	43.9	[42.6 - 45.1]	3026	39.6	[38.4 - 40.7]
50+ years	359	10.0	[8.9 - 11.0]	409	10.1	[9.1 - 11.1]	769	10.1	[9.2 - 10.9]
Total	3605	100		4046	100		7652	100	

Note: One individual had no sex recorded, three males and three females had no age recorded

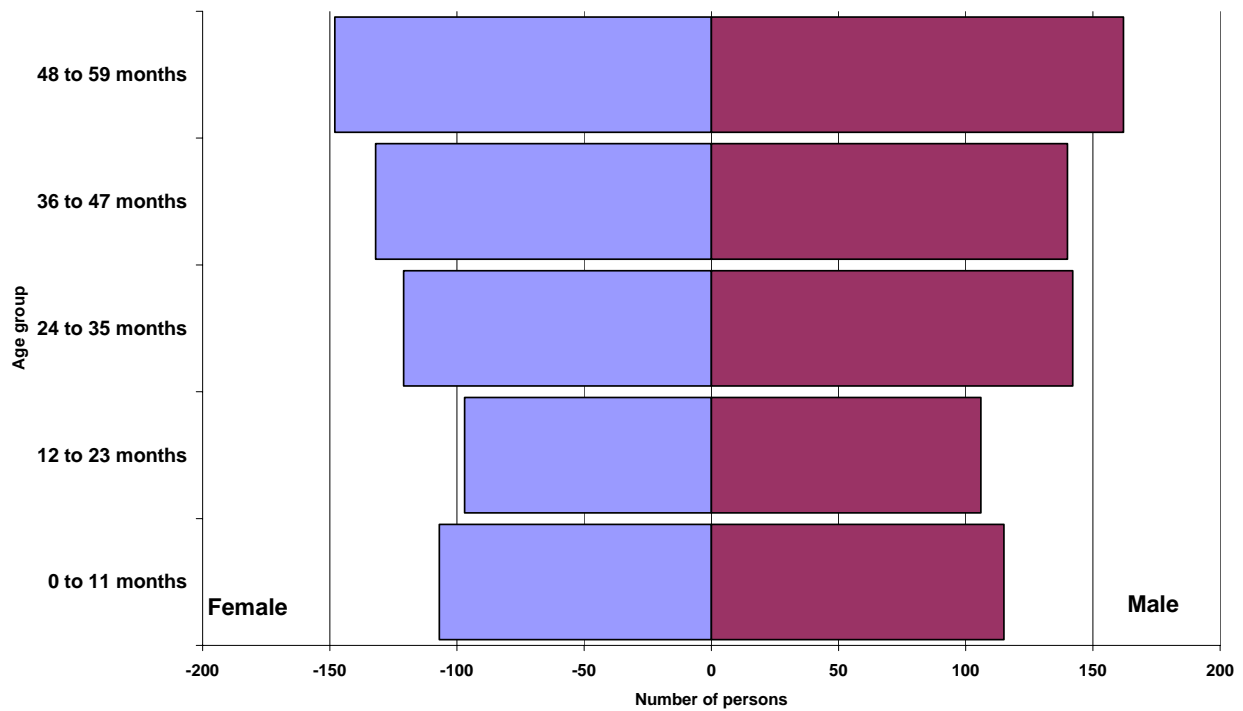
The age distribution among the sample of IDP's is shown in Figure 5. Children under four years old are under represented. There were fewer males than females between the ages of 15 to 40 years. Comparative figures from the last census in Sudan in 1993 (Figure 3) suggest that males and females are usually represented equally.

Figure 5: Age distribution among the sample of IDP's, West Darfur Sudan, 15th of August 2004



The distribution of children under 5 years old in the sample population is shown in Figure 6. Under normal conditions, age groups are similar. Among the sample population, younger children are underrepresented.

Figure 6: Age distribution among the sample of IDP's, West Darfur Sudan, 15th of August 2004



3.2.2 Retrospective mortality in the sample of internally displaced persons, West Darfur, 15 June to 15 August 2004

Among the 7,996 persons included in the sample, 142 deaths were reported during the study period, including 25 deaths among the children under 5 years of age and 7 deaths among children less than 1 year of age.

The crude mortality rate in the sample of IDP in West Darfur between June 15th and August 15th was **2.9 deaths / 10,000 persons / day** (95% CI [2.4 - 3.6]). For the same period, the under 5 years of age mortality was **3.1 deaths / 10,000 children under 5 / day** (95% CI [2.1 - 4.7])

Table 8).

Table 8: Mortality rates by age, in a sample of IDPs, West Darfur Sudan, 15 June – 15 August 2004

West Darfur	Number of deaths	Mid period population	Deaths / 10000 population / day	95% Confidence Interval	Design Effect
All ages	142	7827	2.9	[2.4 – 3.6]	1.58
Under 5 years old	25	1286	3.1	[2.1 – 4.7]	1

Note: For all ages the threshold for a health emergency is 1.0 /10,000/ day and for under 5 years old is 2.0/10,000/day²³

For all ages, diarrhoea was reported as the main cause of death in almost a third of deaths, 21% (29/141) due to fever, 12% (17/141) was reported as due to injury or violence, and 9.2% (13/141) due to respiratory disease (Table 9). Other causes were reported for about a fifth of all deaths. Proportional mortality varied by age group, although the numbers were small. Among children under five years old, the most frequently reported cause of death was diarrhoea (76%, 19/25). Among individuals aged five to 14 years old, half the reported deaths were reported due each fever (54%, 7/13). Injury or violence was reported in 41% (13/32) of all deaths among individuals aged 15 to 49 years. The largest proportion of deaths among individuals aged 50 years and older was reported as due to diarrhoea (37%, 26/71).

Table 9: Distribution of reported cause of death by age group, in a sample of IDPs, West Darfur, Sudan, 15 June – 15 August 2004

Reported cause of death	Proportional Mortality				
	n %				
	[95% CI]				
	0 to 4 years	5 to 14 years	15 – 49 years	50+ years	All ages
Fever	3	7	7	12	29
	12 %	54 %	22 %	17 %	21 %
	[0 – 25]	[26 – 82]	[4.1 – 39.7]	[8 – 26]	[13 – 28]
Respiratory disease	0	0	2	11	13
	0 %	0 %	6 %	16 %	9 %
	—	—	[0 – 16]	[5 – 26]	[3 – 15]
Diarrhoea	19	2	5	26	52
	76 %	15 %	16 %	37 %	37 %
	[59 – 93]	[0 – 38]	[3 – 29]	[23 – 50]	[27 – 47]
Injury or Violence	0	1	13	3	17
	0 %	8 %	41 %	4 %	12 %
	—	[0 – 26]	[19 – 63]	[0 – 9]	[5 – 19]
Other	3	3	5	19	30
	12 %	23 %	16 %	27 %	21 %
	[0 – 26]	[0 – 54]	[3 – 29]	[16 – 38]	[14 – 29]
Total	25	13	32	71	141
	100%	100%	100%	100%	100%

Note: The total number of deaths in the table is 141 instead of 142 because cause of death was not recorded for one death.

3.2.3 Basic access to services among households in a sample of IDPs, West Darfur, 2004.

Almost a quarter of households in the sample reported that their main source of drinking water was either from an unprotected well or Whadi (river) (Table 10). Almost one third of households did not have access to a latrine. Over 50% of households reported that they did not have soap. About a third of household reported that they had not received a food ration in the last month. The majority (88%) of households sought medication a health centre.

Table 10: Access to basic items and services in a sample of IDP's household, West Darfur Sudan, August 2004

	Number of households	Proportion of households	95 % CI
Main source of drinking water			
Household standpipe	48	3.7 %	0 - 8.8
Bladder tank	583	45.2 %	32.7 - 57.8
Hand pump	291	22.6 %	12.2 - 33.0
Protected well	66	5.1 %	0.7 - 9.6
Unprotected well	56	4.3 %	0 - 9.1
Whadi (river)	245	19.0 %	8.8 - 29.2
Water seller	0	0 %	--
Others	0	0 %	--
Total	1289	100 %	--
Access to latrine			
Yes we use	455	35.3 %	25.9 - 44.7
Yes but we do not use	72	5.6 %	2.6 - 8.6
Latrine not available	762	59.1 %	48.8 - 69.4
Total	1289	100 %	--
Presence of basic non food items in the households			
Plastic sheeting	899	69.7 %	60.9 - 78.6
Jerry cans	689	53.6 %	44.9 - 62.3
Blankets	724	56.3 %	47.9 - 64.8
Cooking pots	534	41.5 %	31.2 - 51.8
Soap	691	54.0 %	45.1 - 63.1
Access to food distribution			
Received a ration during the last month	723	56.9 %	45.8 - 67.9
Main Source of medication			
Hospital	68	5.4 %	1.0 - 9.8
Health Centre	1105	87.7 %	79.9 - 95.5
Mobile clinic	60	4.8 %	0 - 11.35
Traditional healer	27	2.1 %	0.5 - 3.8
Other	0	0 %	--
Total population	1260	100 %	--

4 Discussion

4.1 Summary of results

Monitoring population health status is a priority in complex emergencies. The crude mortality rate is a robust and simple indicator of population health³. Despite the implementation of a WHO/MoH early warning surveillance system for communicable disease outbreaks and mortality in health facilities, no reliable community level mortality data has been available in Great Darfur. Our study was designed to estimate baseline mortality data from 15th June to 15th August 2004 for the internally displaced people in Great Darfur.

The main results of our survey suggest that despite the relief efforts throughout Greater Darfur, the mortality in the IDP population is not yet controlled; the crude mortality rate in North Darfur, West Darfur and Kalama camp in South Darfur are all above the emergency threshold (1 death /10,000/day). The main cause of death reported during the survey was diarrhoea, particularly affecting children under five years old. The age distribution among children suggests an important deficit in children under two years old. Among adults, injuries and violence were the main causes of death.

A large proportion of IDP households had access to basic services, food and non-food items. However, about a third of IDP households still lack access to water and sanitation.

4.2 Validity of results

We used a two-stage cluster sampling design for the survey. Although this type of study design increases the required sample size, a cluster design was the most practical way of sampling the population in the current context; systematic sampling was not appropriate in the IDP settlements and the absence of nominative lists of IDPs did not allow random sampling. Our study was designed with a large sample size to increase the precision of the results. Although we only completed 43 clusters in North and West Darfur, we exceeded the number of individuals required for our survey, achieving the required precision. In addition, the cluster design effect is below that expected, indicating a similar situation in all clusters. The area covered by our survey still represents the majority of the IDP population.

To estimate the current mortality, we used a two-month recall period. Field teams were specifically trained to avoid including deaths that occurred before the study period. For this we used event calendars created for each settlements based on significant events such as vaccination campaigns. In addition, we also enquired about 'karama', a remembrance of the dead that is observed during the first three days, after 15 days and 40 days after death.

Interviewers were trained and accompanied during the interview by WHO or MoH team members. Absent households were re-visited several times during the same day and where possible visited on subsequent trips to the settlement. Regular debriefing with the field teams was conducted to check the quality of data collected.

4.3 Possible limitations

Not all IDP settlements were included in the survey. It is possible that mortality in these populations is higher as they have less access to humanitarian aid. Therefore, we cannot exclude the possibility that the mortality rates estimated for the accessible areas in our survey are lower than that for the whole state. In addition, our survey did not include households from which all members died. This may underestimate the mortality rate. As food distribution is related to the size of the family, we cannot exclude that in some cases, the interviewee exaggerated the number of individuals in the household and underreported the number of deaths. This would also have led to an underestimation of mortality rates.

Conversely, if for any reason interviewees over reported the number of deaths, this would have increased the mortality estimate. However, our results suggest that prevarication is unlikely to have occurred or was limited since our data show high consistency between death rates (even with small numbers when analysed by cause), abnormal age distribution and cause of death in the three surveys.

4.4 Kalma Camp

In the South the survey was interrupted and limited to Kalma camp. The 19 clusters from Kalma camp included 3,506 persons. This allows inference about mortality rates in the camp with good precision. The results, however, cannot be generalised to other settlements in South Darfur. The lower confidence level of the crude mortality rate in Kalma camp is 2.9 /10,000/day. This does not allow us to rule out a severe situation in Kalma camp.

4.5

Interpretation of results

Mortality is not yet controlled in North Darfur, West Darfur and Kalma camp in South Darfur. In North Darfur, our estimate of the crude mortality rate is about three times the expected rates under normal conditions in Africa⁶ (0.5 deaths /10,000/day). In West Darfur, our estimates suggest that the crude mortality rate is six times the expected level for Africa. In Kalma camp the estimated mortality rate was over seven times the expected level for Africa. These estimates suggest that the humanitarian situation is still in the emergency phase.

Children under five years old are more likely to die from communicable disease. Deaths due to fever is likely to reflect death by malaria. Deaths due to diarrhoea are likely to reflect poor environmental sanitation. This is supported by the proportion of IDPs with access to water and latrines in our survey as well as observation by the survey teams of the conditions in IDP settlements.

The age structure of the IDPs in our study samples is similar in all three samples. It reflect an absence of children under five years old, especially among children under 2 year of age. This means that these children disappeared during the last 2 years, reflecting the difficult living conditions of the population. Children under 2 year of age are the most vulnerable and as such are the first group to adversely affected during humanitarian emergencies. The age structure also reflects an absence of adult men, an observation also made in previous conflict situations.

5 Recommendations

1. Existing humanitarian intervention should be intensified to reduce overall mortality
2. Additional efforts are needed to improve the environmental sanitation (access to clean water and latrines)
3. The early warning system needs to be enhanced for prospective mortality surveillance. This may be done through a combination of activities such as 24 hour surveillance of cemeteries, active mortality reporting at the community level by health visitors (one per 200 families) and monitoring through free provision of burial shrouds.

6 References

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7 Annex 1: Survey Protocol

8 Annex 2 : Kalma Camp

In Kalma camp the number of IDPs was estimated to be 73,658 (source WFP, August 5th 2004). We conducted interviews in a sample of 558 households (19 clusters) representing a total of 3,506 internally displaced people at the beginning of the study period. Eighty deaths were reported during the study period, four people were reported as having disappeared and 154 people were absent. The population alive at the end of the study period (excluding deaths, absent and disappeared individuals) was 3,267. The average number of persons per household was 6. On average, two randomly selected households per cluster could not be included due to the absence of the family members. These households were replaced by other households chosen randomly in the same cluster. One individual had no age recorded, one individual had no vital status recorded and no cause was given for three deaths.

8.1.1 Demographic characteristics of the sample population

Among the individuals in the IDP sample population alive at the end of the study period (15^h of August) 45 % were male and 55% were female. There were more females than males all age groups except 5 to 14 years (Table 11).

Table 11: Age specific sex ratio among the sample population of IDP, Kalma camp Darfur Sudan, 15th of August 2004

Age group	Number of Male	Number of Female	Sex ratio
0 to 4 years	261	291	0.89
5 to 14 years	592	581	1.01
15 to 49 years	470	735	0.63
50+ years	146	191	0.76
All ages	1469	1798	0.81

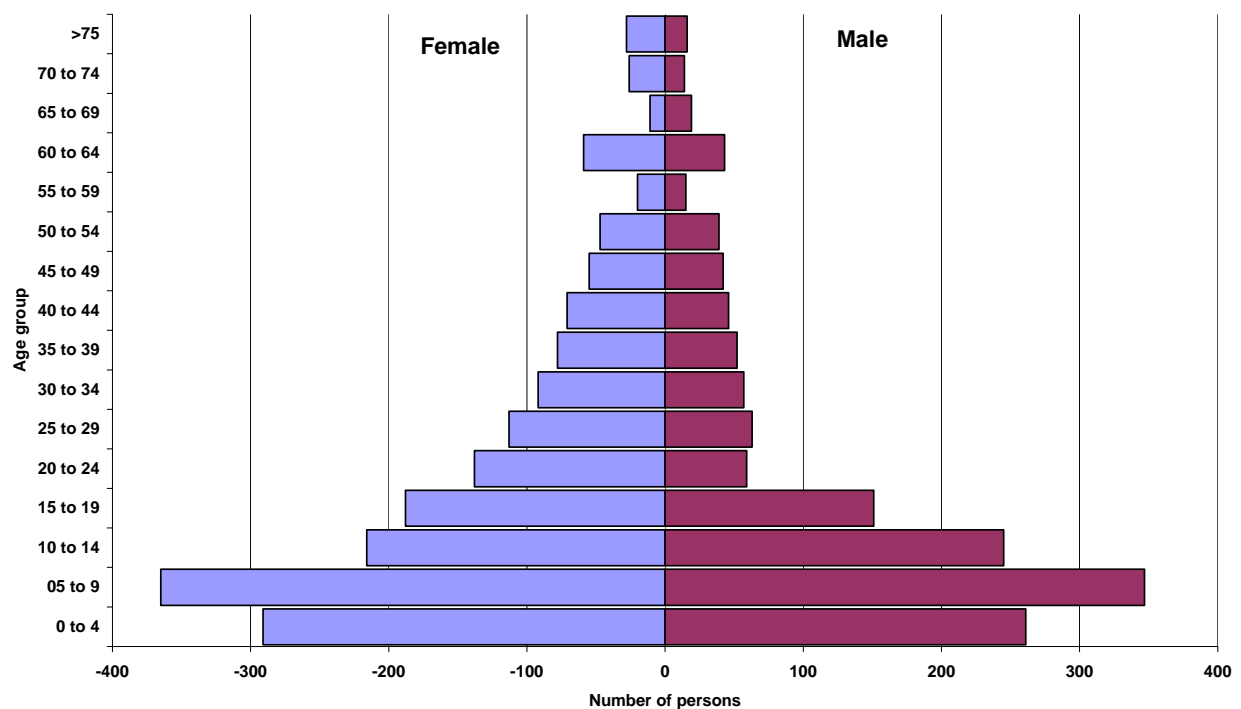
Over half of the sample population was under 14 years old (Table 12). Children under 5 years represented 16.9 % (95% CI [15.9 - 17.9]) of the sample population (552/3267). The distribution of the sample population by age group varied according to sex (Table 12).

Table 12: IDP sample population by age and sex, Kalma camp, South Darfur Sudan, the 15th of August 2004

Age group	Male			Female			Total population		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
0 to 4 years	261	17.8	[15.2 - 20.3]	291	16.2	[14.0 - 18.3]	552	16.9	[15.9 - 17.9]
5 to 14 years	592	40.3	[37.7 - 42.9]	581	32.3	[29.3 - 35.3]	1173	35.9	[34.2 - 37.6]
15 to 49 years	470	32.0	[29.9 - 34.0]	735	40.9	[38.3 - 43.4]	1205	36.9	[35.2 - 38.5]
50+ years	146	9.9	[8.6 - 11.3]	191	10.6	[8.3 - 13.0]	337	10.3	[8.9 - 11.7]
Total	1469	100	—	1798	100	—	3267	100	—

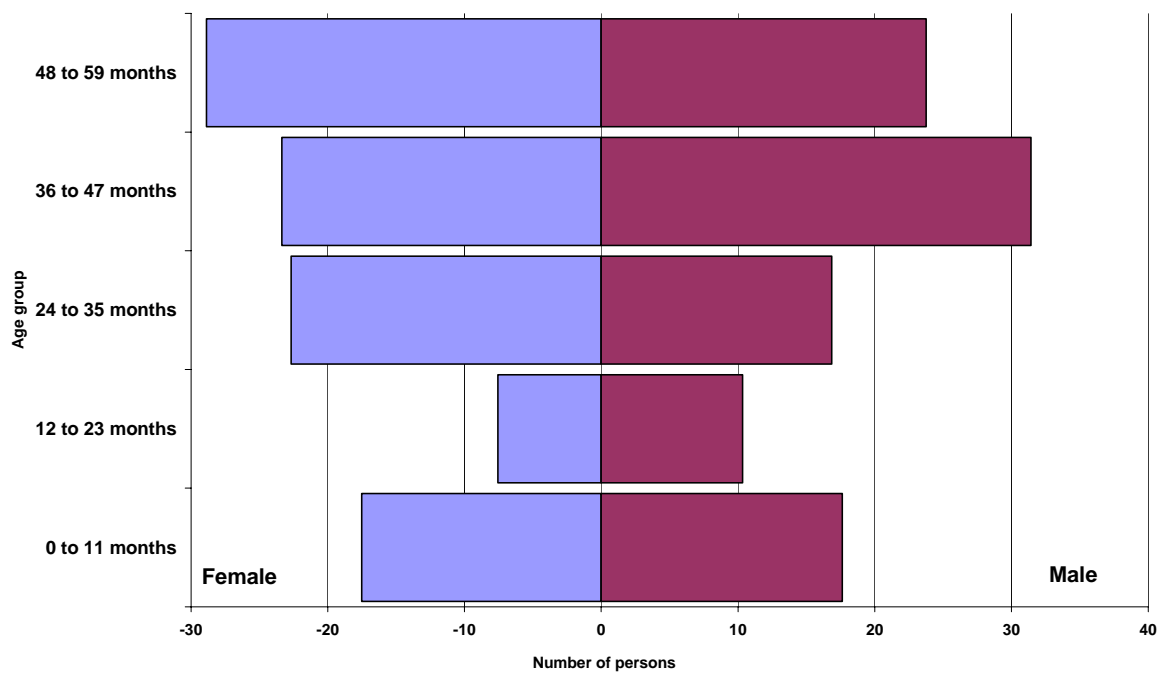
The age distribution among the sample of IDP's is shown in Figure 7. Children under four years old are under represented. There were fewer males than females between the ages of 15 to 49 years. Comparative figures from the last census in Sudan in 1993 (Figure 3) suggest that males and females are usually represented equally [2].

Figure 7: Age distribution among the sample of IDP's, Kalma Darfur, Sudan, 15th of August 2004



The distribution of children under 5 years old in the sample population is shown in Figure 3. Under normal conditions, age groups are similar. There were fewer males than females aged 48 to 59 months. Conversely, there were more males than females aged 36 to 47 months. Males aged 24 to 35 months were underrepresented as were all infants under 24 months old.

Figure 8: Age distribution among the sample of IDP's, Kalma camp, South Darfur Sudan, 15th of August 2004



8.1.2 Retrospective mortality in the sample of internally displaced persons, Kalma camp, South Darfur, 15 June to 15 August 2004

Among the 3,506 persons included in the sample, 80 deaths were reported from 15th June to 15th August, including 42 deaths among the children under 5 years of age and 15 deaths among children less than 1 year of age.

The crude mortality rate in the sample of IDPs in Kalma Darfur between June 15th and August 15th was 3.8 /10,000/day, 95% CI [2.9 - 5.0]. For the same period, the under 5 year mortality was 11.7 /10,000/day, 95% CI [7.4 - 18.1] (Table 13).

Table 13: Mortality rates by age, in a sample of IDPs, Kalma, South Darfur, Sudan, 15 June – 15 August 2004

Kalma	Number of deaths	Mid period population	Deaths / 10000 population / day	95% Confidence Interval	Design Effect
All ages	80	3387	3.8	2.9 – 5.0	1.57
Under 5 years old	42	580	11.7	7.4 – 18.1	2.16

Note: For all ages the threshold for a health emergency is 1.0 /10,000/ day and for under 5 years old is 2.0/10,000/day^{2,3}

For all ages, diarrhoea was reported as the main cause of death in about 40% of deaths, 17% (13/77) due to fever and respiratory disease and 10% (8/81) due to injury or violence (Table 14). Other causes were reported for 14% (11/77) all deaths. Proportional mortality varied by age group, although the numbers were small. Diarrhoea was the most frequently reported cause of death for children under five years (52%, 22/42) and aged five to 14 years old (57%, 4/7). Injury or violence was reported in 63% (5/8) of all deaths among individuals aged 15 to 49 years. The largest proportion of deaths among individuals aged 50 years and older was reported as due to diarrhoea (30%, 6/20).

Table 14: Distribution of reported cause of death by age group, in a sample of IDPs, Kalma, South Darfur, Sudan, 15 June – 15 August 2004

Reported cause of death	Proportional Mortality				
	n % [95%CI]				
	0 to 4 years	5 to 14 years	15 – 49 years	50+ years	All ages
Fever	7	0	2	4	13
	17 %	0 %	25 %	20 %	17 %
	[0 – 34]	—	[0 – 73]	[0 – 40]	[7.4 – 26.4]
Respiratory disease	7	2	0	4	13
	17 %	29 %	0 %	20 %	17 %
	[3 – 31]	[0 - 69]	—	[4 – 36]	[8 – 26]
Diarrhoea	22	4	0	6	32
	52 %	57 %	0 %	30 %	42 %
	[33 – 72]	[13 - 100]	—	[0 – 66.7]	[30 – 53]
Injuries or Violence	1	0	5	2	8
	2 %	0%	63 %	10 %	10 %
	[0 – 8]	—	[0 – 47]	[0 – 23]	[0 – 22]
Other	5	1	1	4	11
	12 %	14	13	20 %	14 %
	[0 - 29]	[0 – 52]	[0 – 47]	[2 – 38]	[3 – 25]
Total	42	7	8	20	77
	100%	100%	100%	100%	100%

Note: The total number of deaths in the table is 77 instead of 80 because cause of death was not recorded for three deaths

8.1.3 Basic access to services among households in a sample of IDPs, Kalma Darfur, 2004

Only 11% of households in the sample reported that their main source of drinking water was the Whadi (river), the majority receiving their water from bladder tanks and handpumps (Table 5). About half the households did not have access to a latrine. About a quarter of households reported that they did not have soap. A quarter of household reported that they had not received a food ration in the last month. Almost all households sought medication from a health centre.

Table 15: Access to basic items and services in a sample of IDP's household, Kalma Darfur, Sudan, August 2004

	Number of households	Proportion of households	95 % CI
Main source of drinking water			
Household standpipe	0	0 %	--
Bladder tank	277	49.6 %	29.3 - 69.8
Hand pump	220	39.4 %	20.3 - 68.4
Protected well	0	0 %	--
Unprotected well	0	0 %	--
Whadi (river)	62	11.1 %	0 - 23.4
Water seller	0	0 %	--
Others	0	0 %	--
Total	559	100 %	--
Access to latrine			
Yes we use	261	46.8 %	30.7 - 62.9
Yes but we do not use	21	3.8 %	0 - 8.1
Latrine not available	276	49.5 %	33.4 - 65.6
Total	558	100 %	--
Presence of basic non food items in the households			
Plastic sheeting	481 / 558	86.2 %	75.1 - 97.3
Jerry cans	493 / 558	88.4 %	83.0 - 93.6
Blankets	433 / 558	77.6 %	66.7 - 88.5
Cooking pots	462 / 558	82.8 %	75.7 - 89.4
Soap	424 / 558	75.9 %	65.3 - 86.6
Access to food distribution			
Received a ration during the last month	410 / 550	74.5 %	60.9 - 88.1
Main Source of medication			
Hospital	1	0.2 %	0 - 0.5
Health Centre	550	99 %	98 - 100
Mobile clinic	2	0.4 %	0 - 1.1
Traditional healer	1	0.2 %	0 - 0.5
Other	1	0.2 %	0 - 0.5
Total population	555	100 %	--