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High mortality and violence among refugees and returnees from West Darfur, Sudan arriving in Chad, 2023: results from three retrospective mortality surveys

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ABSTRACT

Introduction Fighting erupted on 15 April 2023 in Sudan between the army and the paramilitary Rapid Support Forces. By September 2023, more than 420 000 people had fled to Chad. To assess the impact of the conflict on the displaced populations, several surveys were conducted. We aimed to describe retrospective crude and under-5 mortality rates, reported causes of death and the frequency and type of violent events experienced by populations displaced to camps in eastern Chad.

Methods Cross-sectional surveys were carried out in August and September 2023 among displaced populations in Toumtouma, Ourang and Arkoum camps. Each survey included retrospective mortality and frequency and type of violent events experienced. All surveys considered precrisis and crisis phases.

Results In all sites, the crude mortality rate (CMR) was significantly higher in the crisis phase than in the precrisis phase. The CMR was particularly elevated among populations in Ourang camp (CMR: 2.25 deaths/10 000 persons/day (95% CI 1.77 to 2.74) in crisis phase versus CMR: 0.11 deaths/10 000 persons/day (95% CI 0.02 to 0.20) in precrisis phase). Violence was the leading reported cause of death in all sites. Among households in Ourang, more than 90% came from El Geneina (Sudan) and more than one in 10 of all men aged 30 and over died of violent causes. In Toumtouma, Ourang and Arkoum camps, the overall frequency of violence among households was 3.3%, 11.7% and 4.4%, respectively, with beatings and shooting most frequently cited.

Conclusions In the three camps investigated, excess mortality was observed among households during the crisis phase attributed largely to deaths caused by violence among men. The population in Ourang camp, largely from El Geneina, were particularly affected by the violence, with the CMR 20 times higher than in the precrisis period and mortality rates exceeding the standard emergency threshold (1 death/10 000 persons/day).

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Since the start of the Sudan conflict in 2023, mortality estimates have been wide-ranging with the source often unclear, and no mortality estimates based on field surveys have been published.

WHAT THIS STUDY ADDS

⇒ These surveys are the first that provide epidemiological evidence of the high rates of mortality and violence experienced among displaced populations since the start of the conflict. In a series of cross-sectional surveys, we demonstrated significantly higher mortality rates during the conflict period compared with a preconflict period among households in three different camps in eastern Chad, mainly due to violent deaths among men.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These surveys add to the documentation of the Sudan conflict and describe the violence that the population experienced, particularly in El Geneina. Regular epidemiological surveys, together with documentation of village destruction and population displacements and other methodologies, are essential to document the conflict's impact on the civilian population.

INTRODUCTION

After Sudanese President Omar al-Bashir was ousted in April 2019, a transitional government was put in place with a series of economic and social reforms and effectively dissolved in 2021 following a military coup. The delicate power arrangement that developed between the Sudan Armed Forces (SAF) under General Abdelfattah al-Burhan and the paramilitary Rapid Support Forces (RSF) commanded by General Mohamed Hamdan Daglo, known as Hemetti, was marked

by internal fighting and erupted into a civil war between the SAF and the RSF on 15 April 2023, creating a major crisis in Sudan. Violent fighting broke out all over the country, including Darfur, considerably exacerbating already existing intercommunity tensions and causing successive waves of internal and external population displacement, including towards Chad. While the earlier Darfur conflict that began in 2003 was largely localised to the Darfur region and involved rebel groups fighting against the Sudanese government, the current conflict affects all of Sudan and involves multiple factions, including the SAF, the RSF and various militias and former rebel groups.[1 2]

In mid-May 2023, the volatile security situation at the border prompted local Chadian authorities to prohibit the formation of camps within 40 km of the border to prevent any flare-ups. The refugee camps in Ouaddaï province were overcrowded and struggling to cope with the various health challenges, despite ongoing expansion and new camps were opened. By mid-August, more than 44 000 people from Adré had been settled in the recently created Ourang camp and nearly 26 000 people from Borota and Goungour camps in the new Arkoum camp. According to the Office of the United Nations High Commissioner for Refugees, more than 420 000 people fled to Chad, including almost 327 000 in Ouaddaï province, by September 2023 and more than 722 000 by March 2025.[3 4]

To describe the impact of the conflict on the displaced populations in camps in Eastern Chad, surveys were carried out in August and September 2023. Toumtouma camp was regarded as a camp of returnees, or Chadian refugees who had returned to Chad from Sudan. Arkoum camp was one of the first new camps set up in Chad after the start of the conflict, and Ourang camp was a destination for populations arriving from El Geneina. All three camps were comprised of populations newly arrived since the start of the conflict. We aimed to describe retrospective crude and under-5 mortality rates, causes of death and the frequency and type of violent events experienced by refugee and displaced populations in Toumtouma, Ourang and Arkoum camps in eastern Chad.

METHODS

Cross-sectional surveys were completed in Toumtouma, Ourang and Arkoum camps. The recall period was from 1 January 2023 to the day of each survey, with phases from 1 January to 14 April 2023 (precrisis) and from 15 April to the date of the survey considered for the sample size calculation. For each site, based on an expected crude mortality rate (CMR) of 1 death/10 000 persons/day, a precision of ±0.3 with 95% CI (alpha error=0.05), a recall period of 104 and 106 days in the two phases, an average of five members per household and an expected 20% non-response, a minimum of 1026 households was to be sampled in each camp.

Survey procedures

The population was sampled using systematic random sampling in Toumtouma camp and cluster spatial sampling in Ourang and Arkoum camps using a preparatory stage to define the area of interest for both camps with a georeferenced polygon based on a recent satellite image. In Ourang and Arkoum, 108 random coordinates were generated within the polygon, regardless of their distance from a household/shelter, including five backup coordinates. The coordinates were found using a global positioning system (GPS) device or the OsMand application. The interviewers then selected the 10 nearest households/shelters within 20 metres of the coordinates. If a selected household was not available after two attempts to visit or if the household did not wish to respond, the household was not replaced.

Survey teams conducted face-to-face interviews based on a standardised questionnaire with household heads or their representatives. The teams consisted of mixed teams of Chadians who resided in the host localities and were identified in collaboration with local health authorities. Further details about the research partnerships are described in the author reflexivity statement (online supplemental material 2). A head of the household was defined as a member of the household aged 18 years or older who defined themselves as head of the household and was considered as such by other household members, could provide accurate information on demographic information and mortality in his/her household during the recall period and had been present in the household during the entire recall period. Information on the sex and age of the household members and dates for new arrivals, births, departures and disappearances were noted, in addition to the geographical location of the household prior to arriving in the camp, the date the household left their previous household and the date the household arrived in the current camp. To assess mortality, the household head was asked if any member of their household died during the recall period, and further information, including sex and age and reported date, cause and place of death, were collected for each deceased individual. Violence episodes and the type of violence (beating, sexual, shooting, stabbing, detainment/kidnapping or other) were also recorded for all household members.

Data analysis

CMRs and under-5 mortality rates (U5MRs), expressed as deaths per 10 000 persons per day, and 95% CI were calculated using the total person-time for all household members. For the CMR, the total number of deaths and person-time of the entire population were used. For the U5MR, only deaths and person-time of this specific age group were used. The recall period was from 1 January to the day of the survey. Two phases were considered according to the context: (1) the precrisis phase (Toumtouma: 1 January to 14 March 2023/Ourang and Arkoum: 1 January to 14 April 2023) and (2) the crisis phase (Toumtouma: 15 March to the day of the survey/Ourang and Arkoum: 15 April to the day of the survey). Among households in Toumtouma camp, the crisis phase

was modified to reflect the intercommunity tensions that erupted earlier at the end of March in West Darfur and drove important population displacements towards Chad. Two-sided exact tests were used to assess differences between the two periods, and p values (p) were also presented. The estimates in Ourang and Arkoum were adjusted to account for the sampling method. Disappearance rate was calculated in the same manner as mortality rates, expressed as disappearances/10 000 persons/day. Proportions were calculated for self-reported causes of death and violent episodes. Data analysis was conducted using Stata (StataCorp, College Station, Texas, USA, https://www.stata.com).

RESULTS

The surveys took place from August to September 2023 in Toumtouma, Ourang and Arkoum camps. A total of 1032 households (6372 people) of 1033 visited took part in the survey in Toumtouma camp, 1032 households (6301 people) of 1040 households visited in Ourang camp and 1029 households (5324 people) of 1050 households visited in Arkoum camp. The average household size at the time of survey was 5.9 in Toumtouma, 5.8 in Ourang, and 4.9 in Arkoum, with an average male-to-female sex ratio of 0.8 across the camps. Refugees accounted for 59%, 99% and 98% of household in Toumtouma, Ourang and Arkoum, respectively. In Toumtouma, 37% of households were returnees, Chadian refugees who have returned from Sudan to Chad, and 4% internally displaced.

Children under the age of 5 accounted for around 17% of the population and those under 15 between 49% and 53%. The median age of household members at the time of survey was 13 (IQR: 6–28) in both Toumtouma and Arkoum and 15 (IQR: 7–28) in Ourang. We observed an under-representation of men in the 15–29 age group, with a sex ratio of 0.6–0.7 on average for each camp, and in the 30–44 age group, with a sex ratio of 0.4, 0.7, and 0.8 in Toumtouma, Arkoum and Ourang camps, respectively. This undrepresentation persisted, albeit to a lesser degree, among older age groups (online supplemental figure S1).

Almost all households were from West Darfur. In Toumtouma camp, the majority came from Umm Dam (48%), Tendelti (26%) and El Geneina (13%). In Ourang camp, 91% of households were from the town of El Geneina, while in Arkoum camp, 53% and 34% were from Kongo Haraza and Misterei, respectively (figure 1).

In all three sites, the CMR was significantly higher in phase 2 than in phase 1. The CMR was particularly

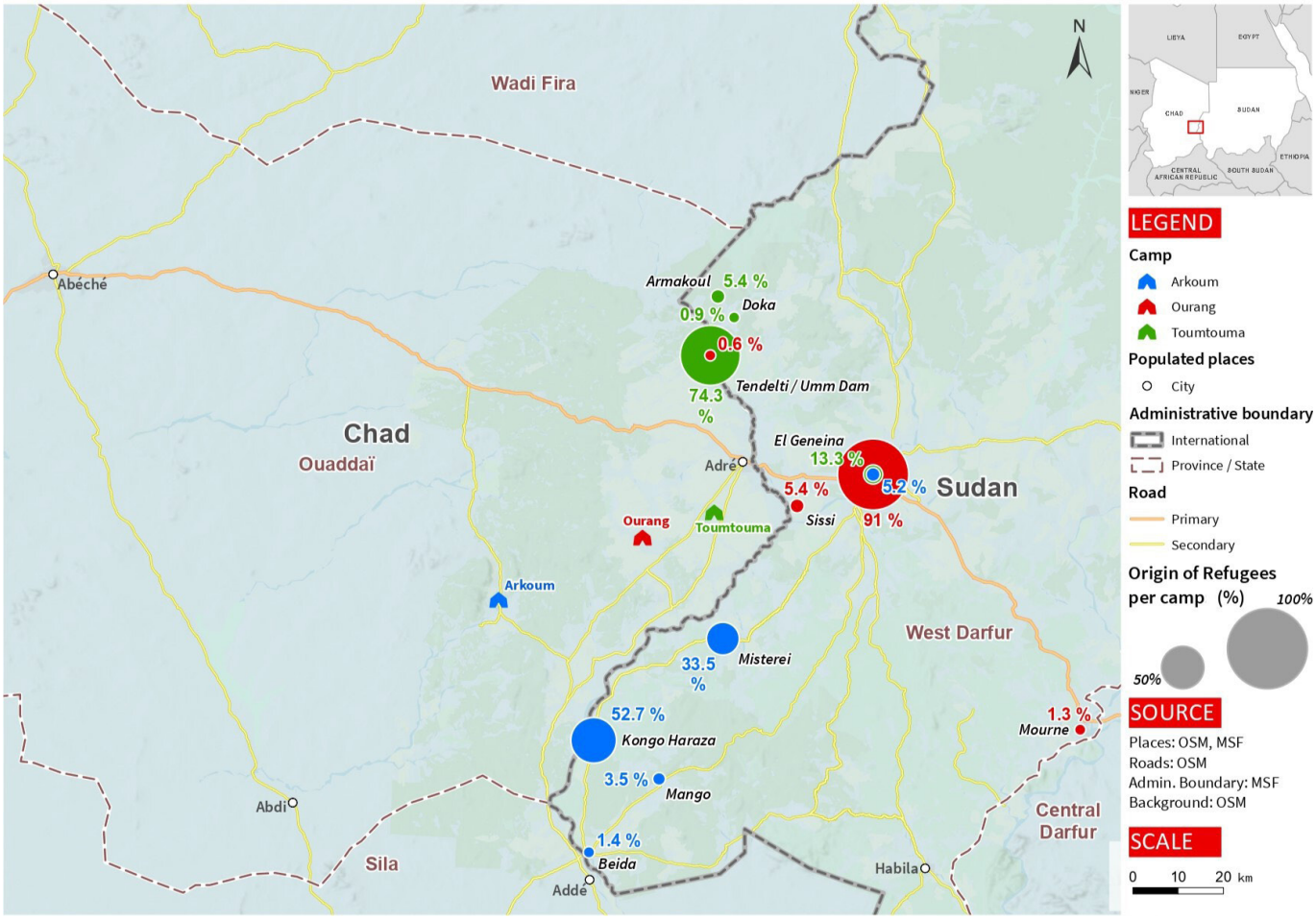

Figure 1 Household origins, Toumtouma, Ourang and Arkoum camps (Amdam, Chad not displayed on map).

Table 1 Crude and specific mortality rates and disappearance rates during phases 1 and 2, Toumtouma, Ourang and Arkoum camps

	Phase 1 (before the crisis)		Phase 2 (during the crisis)		
Mortality/10 000 persons/day	**Rate**	**(95% CI)**	**Rate**	**(95% CI)**	**P value**
Toumtouma					
CMR	0.20	0.07 to 0.32	0.58	0.43 to 0.74	<0.01
U5MR	0.27	0.00 to 0.64	0.07	0.00 to 0.19	–
Women	0.04	0.00 to 0.12	0.12	0.02 to 0.21	–
Men	0.38	0.12 to 0.64	1.15	0.82 to 1.49	<0.01
Disappearance			0.94	0.74 to 1.14	
Ourang					
CMR	0.11	0.02 to 0.20	2.25	1.77 to 2.74	<0.01
U5MR	0.00	0.00 to 0.00	2.23	1.27 to 3.19	<0.01
Women	0.06	0.00 to 0.15	0.75	0.44 to 1.07	<0.01
Men	0.16	0.02 to 0.30	3.88	3.01 to 4.76	<0.01
Disappearance			1.06	0.73 to 1.39	
Arkoum					
CMR	0.15	0.03 to 0.26	0.67	0.46 to 0.89	<0.01
U5MR	0.33	0.00 to 0.70	1.10	0.50 to 1.69	–
Women	0.07	0.00 to 0.17	0.28	0.08 to 0.49	–
Men	0.24	0.02 to 0.46	1.14	0.72 to 1.55	<0.01
Disappearance			0.50	0.29 to 0.72	

CMR, crude mortality rate; U5MR, under-5 mortality rate.

elevated in Ourang camp (CMR: 2.25 deaths/10 000 persons/day (95% CI 1.77 to 2.74) in phase 2 vs CMR: 0.11 deaths/10 000 persons/day (95% CI 0.02 to 0.20) in phase 1). Among households in Toumtouma, most deaths were reported to have occurred in March and April in Sudan, while in Ourang, more than 100 of the 179 reported deaths occurred in June, and in Arkoum, deaths were more evenly spread from April to June. Additionally, several household members were identified as missing in each of the three sites, with disappearances/10 000 persons/day in phase 2 ranging between 0.50 (95% CI 0.29 to 0.72) among households in Arkoum and 1.06 (95% CI 0.73 to 1.39) among households in Ourang (table 1).

Violence, and more specifically shootings, was the leading cause of death in all three sites. Diarrhoea was the second leading cause of death among households in Toumtouma and Arkoum, while measles was the second leading cause in Ourang (table 2). Most deaths occurred in the village of origin or during displacement, with few deaths reported after arrival in the camps. Among households in Toumtouma, El Geneina (43.8%) and Tendelti (35.4%) were the villages of origin for the majority of violent deaths. The grand majority (95.9%) of deaths linked to violence among households in Ourang were from El Geneina and, in Arkoum camp, mostly coming from Misterei (60.7%). Overall, 2.4% of household members from El Geneina across the three camps died from violent causes, almost five times what was observed among households across all other origins (0.5%) (table 3).

Like the overall mortality rate, the mortality rate among men was significantly higher in phase 2 than in phase 1 among households across all sites, with a particularly elevated male-specific mortality in Ourang (3.88; 95% CI 3.01 to 4.76). Among households in Ourang, more than one in 10 of all men aged 30 and over died of violent causes, and 4.9% of men aged 15–44 were reported missing during the recall period. Among households in Toumtouma, over 4% of all men aged 30 and over died of violent causes, and in Arkoum, almost 4% of all men aged 30–44 died of violent causes, and 5.2% of men aged 15–44 were reported missing during the recall period (table 4).

While there was no significant difference observed in U5MR among households in Toumtouma and Arkoum, the U5MR was significantly higher in phase 2 (U5MR: 2.23 deaths/10 000 persons/day (95% CI 1.27 to 3.19)) versus no deaths reported in the first phase among households in Ourang. Measles was the main reported cause of death, followed by violence. Similar trends were observed among women, with an increase in mortality observed among households in Ourang in phase 2 and no significant differences observed in Toumtouma and Arkoum.

Table 2 Causes of death by age (phase 1 and 2), Toumtouma, Ourang and Arkoum camps

	Toumtouma			Ourang			Arkoum		
	<5 years	5+ years	Total	<5 years	5+ years	Total	<5 years	5+ years	Total
Causes of death	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
ARI	0 (0.0)	3 (5.1)	3 (4.8)	0 (0.0)	2 (1.3)	2 (1.1)	1 (5.9)	0 (0.0)	1 (1.8)
Diarrhoea	3 (100)	1 (1.7)	4 (6.5)	3 (11.1)	0 (0.0)	3 (1.7)	8 (47.1)	1 (2.6)	9 (16.1)
Malaria/fever	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.4)	2 (1.3)	4 (2.2)	4 (23.5)	2 (5.1)	6 (10.7)
Malnutrition	0 (0.0)	0 (0.0)	0 (0.0)	3 (11.1)	0 (0.0)	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)
Measles	0 (0.0)	0 (0.0)	0 (0.0)	9 (33.3)	0 (0.0)	9 (5.0)	0 (0.0)	1 (2.6)	1 (1.8)
Trauma/accident	0 (0.0)	2 (3.4)	2 (3.2)	0 (0.0)	5 (3.3)	5 (2.8)	0 (0.0)	1 (2.6)	1 (1.8)
Violence	0 (0.0)	48 (81.4)	48 (77.4)	8 (29.6)	139 (91.4)	147 (82.1)	1 (5.9)	27 (69.2)	28 (50.0)
Don't know	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.4)	1 (0.7)	3 (1.7)	2 (11.8)	6 (15.4)	8 (14.3)
Other	0 (0.0)	5 (8.5)	5 (8.1)	0 (0.0)	3 (2.0)	3 (1.7)	1 (5.9)	1 (2.6)	2 (3.6)
Total	**3 (100)**	**59 (100)**	**62 (100)**	**27 (100)**	**152 (100)**	**179 (100)**	**17 (100)**	**39 (100)**	**56 (100)**

ARI, acute respiratory infection.

In Toumtouma, Ourang and Arkoum camps, the overall frequency of violence during the recall period was 3.3%, 11.7% and 4.4%, respectively. The main types of violence were beatings (2.3% in Toumtouma, 8.3% in Ourang and 3.5% in Arkoum) and shootings (0.9% in Toumtouma, 4.1% in Ourang and 0.7% in Arkoum). No cases of sexual violence were reported in Toumtouma and Arkoum, while five cases were reported in Ourang (online supplemental table S1).

DISCUSSION

The three surveys described here are representative of the populations living in Toumtouma, Ourang and Arkoum

Table 3 Deaths by town/village of origin, Toumtouma, Ourang and Arkoum camps

Town/village of origin	Household members	Deaths	%	Deaths caused by violence	%
Toumtouma					
Umm Dam	3157	10	0.3	7	0.2
Tendelti	1525	22	1.4	17	1.1
El Geneina	863	25	2.9	21	2.4
Armakoul	351	3	0.9	2	0.6
Amdam (Chad)	265	1	0.4	1	0.4
Other	211	1	0.5	0	0.0
Total	**6372**	**62**	**1.0**	**48**	**0.8**
Ourang					
El Geneina	5782	172	3.0	141	2.4
Sissi	289	3	1.0	2	0.7
Mourne	77	1	1.3	1	1.3
Other	153	3	2.0	3	2.0
Total	**6301**	**179**	**2.8**	**147**	**2.3**
Arkoum					
Kongo Haraza	2825	20	0.7	6	0.2
Misterei	1778	30	1.7	17	1.0
El Geneina	273	6	2.2	5	1.8
Other	448	0	0.0	0	0.0
Total	**5324**	**56**	**1.1**	**28**	**0.5**

The bold hightlights the total of the value presented (for each of three camps), but has no statistical significance.

Table 4 Violence-related mortality by age group and sex, Toumtouma, Ourang and Arkoum camps

	Toumtouma			Ourang			Arkoum		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Age group	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
0–14 years	1 (0.1)	1 (0.1)	2 (0.1)	6 (0.4)	11 (0.7)	17 (0.6)	1 (0.1)	2 (0.2)	3 (0.1)
15–29 years old	0 (0.0)	8 (1.3)	8 (0.6)	6 (0.6)	21 (2.8)	27 (1.6)	1 (0.1)	7 (1.4)	8 (0.6)
30–44 years old	3 (0.6)	11 (4.3)	14 (1.9)	5 (1.1)	54 (11.7)	59 (6.4)	0 (0.0)	13 (3.7)	13 (1.7)
≥45 years	2 (0.4)	22 (4.7)	24 (2.5)	4 (1.2)	40 (11.5)	44 (6.4)	0 (0.0)	4 (1.3)	4 (0.7)
Total	**6 (0.2)**	**42 (1.4)**	**48 (0.8)**	**21 (0.7)**	**126 (4.1)**	**147 (2.3)**	**2 (0.1)**	**26 (1.0)**	**28 (0.5)**

The bold hightlights the total for all of the age groups, but has no statistical significance.

camps. Most of these populations fled the violent fighting that took place throughout Darfur, Sudan, starting in March and April 2023, with a peak in the violence in West Darfur's capital El Geneina in June 2023.[2] In all three camps, excess mortality linked to deaths from violence among men was observed in the crisis phase; the mortality rate among households in Ourang, mostly coming from El Geneina, was twenty times higher than before the crisis and more than doubled and tripled among households in Toumtouma and Arkoum camps, respectively.

In Toumtouma camp, 60% of the population surveyed were refugees and 36% were returnees and came mainly from Umm Dam (48%), Tendelti (26%), El Geneina (13%) and small villages around these three West Darfur localities. These first arrivals were ethnic Zaghawa people living in localities just outside the border. The population of Ourang camp was 99% Sudanese refugees. Most of them were Masalit; they arrived in Pessa camp (Adré, Chad) in mid-April and were then transferred to Ourang camp. Over 90% of these households came from El Geneina and the surrounding area. The population of Arkoum camp was 98% refugees. The vast majority were ethnic Masalit people from the villages of Kongo Haraza (53%) and Misterei (34%) in West Darfur.

Considering our findings at the household level, 4%, 11% and 3% of households in Toumtouma, Ourang and Arkoum, respectively, experienced one or more violence-related deaths, and 11%, 42% and 13% had been exposed to one or more episodes of violence. Most reported violent episodes, including deaths, were beatings or shootings. Few cases of sexual violence were reported, which may have been linked to stigmatisation. In addition to violence-related deaths, disappearances were also common and mostly affected men. This explains in part the skewed nature of the age/sex pyramids with males aged 15–44 years under-represented in all three camps. The high proportion of deaths attributed to violence (from 50%–82%) observed in the current surveys, mostly among populations fleeing West Darfur, is similar to those in the early phases (2003–04) of the prior conflict in Darfur, with in both cases, violence-related mortality rates particularly elevated among men. In the Darfur conflict, mortality rates declined over time, which has been attributed in part to an increase in humanitarian response. Our findings describe the early dynamics of violence experienced by populations who fled in the first months of the conflict. Surveys in later stages of the Darfur conflict as well as other conflicts have demonstrated that deaths not caused directly by violence but indirectly linked to the conflict emerged as the principal cause of death over time.[5–8]

Early in the conflict, the discrepancies between national figures and West Darfur estimates, the latter quickly exceeding the national counts, demonstrated the challenge to properly monitor mortality figures.[9–11] Deaths in West Darfur and possibly other provinces appeared to have been excluded from national figures, raising suspicions that the figures mainly included deaths occurring in Khartoum, and protracting the pattern of marginalisation of the peripheries by the central elite, showing that who counts matters as much as who is counted. A 2024 report by the United Nations Panel of Experts, mandated with assisting the Sudan sanctions committee created in 2005, estimated 10 000 to 15 000 deaths in El Geneina alone, while other sources estimated 12 000 deaths across Sudan as of November 2023.[12 13] The figures for El Geneina roughly correspond to our findings, with analysis of photographs and satellite imagery also demonstrating village destruction in El Geneina.[14 15] However, the Panel described the estimate as from 'intelligence sources', without specifying if the sources were SAF, RSF or non-Sudanese, which in any case suggests that the findings should be interpreted with caution.

Some results and patterns evoke the most intense period of the war in Darfur in 2003–2004, although with important differences. The targeting of the Masalit, West Darfur's historically dominant non-Arab community, and specifically of Masalit men, systematically accused by Arab attackers of being enemy combatants, is similar to the targeting of the same community, and specifically of men, in 2003–2004. This pattern extended to other non-Arab communities across Darfur and was clearly orchestrated by the central government.[2] The widespread displacement of the civilian population is comparable to the war 20 years ago, although no longer limited to Darfur and rather encompasses the whole of Sudan; the

fighting between the RSF and the SAF has effectively split the country.

In the earlier conflict, local mortality surveys and death rates were used, and sometimes misused, to extrapolate figures of the number of people killed in the whole of Darfur and over longer periods, with such discrepancies in terms of methodology and results that, as noted by scholar Alex de Waal in a recent testimony to the International Criminal Court, 'no definitive figures for the numbers of people who died as a result of the war are available'.[16] The author also notes that those 'estimates for numbers of dead are derived from various sources, including (most reliably) health and nutrition surveys undertaken by humanitarian agencies' and that 'the most comprehensive assessment of the available data was undertaken by the U.S. General Accountability Office (GAO)',[17] which itself 'found that the most robust [earlier] review of data was the work of the Centre for Research on the Epidemiology of Disasters (CRED), published in two reports in May and December 2005'.[6] CRED estimated 170 000 excess deaths between September 2003 and July 2005, but particularly intense largely unreported violence had already occurred between April and September 2003. Other, often higher, figures were criticised not due to the mortality surveys they were based on (mostly by WHO and the Coalition for International Justice, the latter at the request of the US Department of State), but because WHO and then other UN agencies extrapolated the estimated mortality rates from those surveys (2.6 deaths/10.000/day) across the entire Darfur displaced population and additionally an average of 10 000 deaths per month between March and September 2004, equating to 70 000 deaths over the entire period. That figure continued to be multiplied over time, reaching 180 000 deaths over 18 months and an estimated total of 300 000 deaths over a longer period.[18] Similar extrapolations took place in 2013 at the beginning of the war in South Sudan, when an estimate of 10 000 deaths was announced, then later multiplied by five, prior to any mortality surveys.[19]

Critics may dismiss mortality survey results as inaccurate while others may fail to acknowledge the inherent bias that accompanies mortality estimates. While limitations for the interpretation and utilisation of these results should be addressed, mortality estimates are necessary for humanitarian action in near real-time to guide actions and human rights advocacy for increased protection of civilians and may help identify gaps in response, increase visibility of the crisis and financial contributions to the humanitarian response and eventually contribute to the legal characterisation of the conflict.[20 21] In the current context, in lieu of relying on extrapolations, diverse methodologies are necessary to provide reliable mortality estimates across the country. Regular epidemiological surveys, together with documentation of village destruction, population displacements and other methodologies, are essential to document the conflict's impact on the population and the associated dynamics across Sudan.

Certain limitations are likely to have influenced the results of the current surveys. The recall period of more than 7 months may have led to recall bias, particularly for deaths occurring at the start of the recall period, including in Ourang, where no deaths were reported among children <5 years old in the period before the crisis. This was mitigated in part by developing a calendar of key events, but further studies could use baseline mortality rates established by earlier surveys. The causes of death must also be interpreted with caution, as they were reported by family members based on symptoms and observations. Social desirability bias, stigmatisation and lack of confidentiality may also have led to underreporting of experiences of sexual violence and other forms of violence, including domestic violence. Households that disappeared completely before arriving at the camp or when surviving members joined other households were not represented in the sampled population (known as survivorship bias). Additionally, the mortality rates observed here, as well as earlier surveys, are likely underestimated, given the high number of household members who were reported to have disappeared during the recall period, underscoring the importance of documenting disappearances in addition to deaths in similar contexts. Finally, these surveys were not representative of all households who fled Sudan, only those in the three camps included during the period covered by the survey. The experiences of those having fled to other countries than Chad or those remaining in Sudan are not described in these findings.

CONCLUSIONS

The results of these surveys highlight the scale of the conflict and the violence suffered by these populations at the outset of this crisis. Excess mortality was mainly due to violent deaths among men. Households in Ourang, mostly coming from El Geneina, were particularly affected, with a mortality rate twenty times higher than before the crisis in Sudan.

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