

November 2006

DARFUR CRISIS

Death Estimates Demonstrate Severity of Crisis, but Their Accuracy and Credibility Could Be Enhanced



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Highlights

Highlights of [GAO-07-24](#), a report to congressional requesters

Why GAO Did This Study

In 2003, violent conflict in Darfur, Sudan, broke out between rebel groups and government troops and government-supported Arab militias. While few would dispute that many thousands of Darfur civilians have died, less consensus exists about the total number of deaths attributable to the crisis. Estimates by the Department of State (State) and other parties report death tolls up to about 400,000 for varying populations and periods of time between February 2003 and August 2005. Based on the views of experts convened by GAO and the National Academy of Sciences, interviews with estimate authors, and a review of relevant literature, this report (1) evaluates six Darfur death estimates, (2) identifies general challenges to estimating deaths in such crises, and (3) discusses measures to improve death estimates.

What GAO Recommends

To safeguard the U.S. government's credibility as a source of reliable death estimates, GAO recommends ensuring greater transparency regarding the data and methods used for such estimates. GAO also recommends that the U.S. government consider other measures suggested by the experts to help address gaps in data and improve the quality of any future death estimates. State and the U.S. Agency for International Development agreed with GAO's recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-07-24.

To view the full product, including the scope and methodology, click on the link above. For more information, contact David Gootnick at (202) 512-3190 or gootnickd@gao.gov.

DARFUR CRISIS

Death Estimates Demonstrate Severity of Crisis, but Their Accuracy and Credibility Could Be Enhanced

What GAO Found

The experts GAO consulted did not consistently rate any Darfur death estimate as having a high level of accuracy; moreover, they noted that all the studies had methodological strengths and shortcomings. Most of the experts had the highest overall confidence in estimates by the Centre for Research on the Epidemiology of Disasters (CRED) and had a slightly lower level of confidence in State's estimate. Many experts believed State's lower-end estimate was too low. Additionally, the published documents describing State's estimate lacked sufficient information about its data and methods to allow it to be replicated and verified by external parties.

Estimating deaths in a humanitarian crisis such as that in Darfur involves numerous challenges. For example, in Darfur, difficulties in collecting mortality data, such as lack of access to particular geographical regions, impacted the data's quality and led to data gaps. Because of such data gaps, some Darfur death estimates relied on potentially risky assumptions and limited contextual information. Further, limitations in estimates of Darfur's population before and during the crisis may have led to over- or underestimates of the death toll. Finally, varying use of baseline mortality rates—the rate of deaths that would have occurred without the crisis—may have led to overly high or low death estimates.

The experts proposed and rated a wide range of measures that U.S. agencies could take to improve the quality and reliability of death estimates for Darfur and future humanitarian crises. Among these measures, the most highly rated was ensuring that public documentation of the data and methods used contain sufficient information to enable external replication and verification of the estimates. Other very highly rated measures include collecting and maintaining data for specific periods of time and geographic areas and housing the responsibility for making estimates in a reputable independent body.

Darfur Village Burning



Source: United States Holocaust Museum. Photograph by Brian Steidle.

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Abbreviations

CDC	Centers for Disease Control and Prevention
CE-DAT	Complex Emergency Database
CIJ	Coalition for International Justice
CMR	crude mortality rate
CRED	Centre for Research on the Epidemiology of Disasters
IDP	internally displaced persons
JEM	Justice and Equality Movement
NGO	nongovernmental organization
SLM/A	Sudan Liberation Movement/Army
SMART	Standardized Monitoring and Assessment of Relief and Transitions
USAID	U.S. Agency for International Development
UN	United Nations
WHO	World Health Organization

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United States Government Accountability Office
Washington, DC 20548

November 9, 2006

The Honorable Tom Lantos
Ranking Minority Member
Committee on International Relations
House of Representatives

The Honorable Mike DeWine
The Honorable Richard J. Durbin
United States Senate

In 2003, violent conflict broke out in the Darfur region of western Sudan when rebel groups, believing that the region was marginalized by the Sudanese government, led attacks against the government. In response, the government armed and supported local Arab and tribal militias, commonly known as the Janjaweed, to defeat the rebels. Attacks on the civilian population by these militias, sometimes in conjunction with the Sudanese army, have resulted in widespread death and disruption. The crisis has affected an estimated 3.76 million people in Darfur, including approximately 1.85 million—“internally displaced persons” (IDPs)—who now live in camps. To aid these populations, the United States has provided more than \$1 billion in assistance for Darfur since fiscal year 2004, largely through the U.S. Agency for International Development (USAID).¹

While few would dispute that many civilians have died in Darfur owing to violence, disease, and malnutrition, less consensus exists about the total number of deaths during, or directly resulting from, the crisis. The U.S. Department of State (State) reported that a total of 98,000 to 181,000 people died between March 2003 and January 2005. Five other studies—conducted for varying purposes by international institutions, academics, and individual researchers—have produced estimates ranging up to about

¹Simultaneously with the release of this report, we are issuing a separate report on U.S. humanitarian assistance to relieve the crisis in Darfur; challenges that have affected the delivery of the assistance; the African Union’s efforts to fulfill a mandate to support peace in Darfur; and factors that have affected its implementation of this mandate. See GAO, *Darfur Crisis: Progress in Aid and Peace Monitoring Threatened by Ongoing Violence and Operational Challenges*, [GAO-07-9](#) (Washington, D.C.: Nov. 9, 2006).

400,000 deaths for various periods of time between February 2003 and August 2005.²

Because policymakers require an accurate estimate of the death toll in Darfur to understand the dimensions of the crisis and determine the U.S. response, we were asked to examine the estimates, the methods used to produce them, and their relative accuracy. This report (1) evaluates the relative accuracy and methodological strengths and shortcomings of the six death estimates for Darfur;³ (2) identifies general challenges to estimating the total death toll in Darfur and similar humanitarian crises; and (3) discusses measures that the U.S. government could take to improve its death estimates for Darfur and any similar, future crisis.

To evaluate the estimates, we reviewed and analyzed public information on the estimates and interviewed the estimate authors regarding their studies' data, methods, and objectives. We provided this information and summaries of the interviews to a group of 12 experts in epidemiology, demography, statistics, and the Darfur crisis convened in April 2006 in collaboration with the National Academy of Sciences.⁴ These experts discussed their review of this information and evaluation of the estimates during an all-day session and also assessed the estimates in a follow-up survey. State's Bureau of Intelligence and Research, which conducted the department's death estimate for Darfur, declined to speak with us or provide additional information, limiting the experts' ability to fully understand State's methods of analysis. However, despite this limitation, the experts were able to discuss State's estimate in detail and assess its accuracy and methodologies. To identify challenges of estimating total deaths in Darfur, we asked the group of experts to highlight key problems, and we reviewed literature related to death estimates and mortality data in crises such as the one in Darfur. To identify ways in which the U.S. government could improve death estimates for that and any future

²The five estimates that were publicly available in March 2006 were conducted by, respectively, (1) Jan Coebergh, a medical doctor who has worked in Darfur; (2) the Centre for Research on the Epidemiology of Disasters (CRED) in Brussels, Belgium; (3) John Hagan, Wynnona Rymond-Richmond, and Patricia Parker (released by the Coalition of International Justice); (4) Eric Reeves, an researcher and advocate for Sudan-related issues; and (5) the World Health Organization (WHO).

³This report's assessment of the estimates' methodological strengths and shortcomings is based on experts' opinions of the estimates' data, methods, objectivity, and sufficiency of reporting.

⁴Two additional experts participated by phone for parts of the day.

humanitarian crisis, we asked the experts to provide suggestions during their discussion, and we solicited further opinions on these suggestions in the follow-up survey. Additionally, to learn about current practices related to the experts' suggestions for improving death estimates, we spoke with officials from USAID, State, and the Centers for Disease Control and Prevention (CDC) in the U.S. Department of Health and Human Services. Appendix I provides additional details of our objectives, scope and methodology. We conducted our work from September 2005 to November 2006 in accordance with generally accepted government auditing standards.

Results in Brief

The experts we consulted did not consistently rate any of the death estimates as having a high level of accuracy and noted that all of the studies had methodological strengths and shortcomings. Most of the experts had the highest overall confidence in the estimates by the Centre for Research on the Epidemiology of Disasters (CRED), which relied primarily on a statistical analysis of about 30 mortality surveys, and they rated the CRED estimates' accuracy and methodological strengths highest among the six.⁵ The experts had a slightly lower level of confidence in the State estimate and gave it slightly lower ratings for accuracy and methodological strengths. Further, many experts believed that the lower end of State's estimate was too low and found that published documents describing State's estimate lacked sufficient information about its data and methods to allow it to be replicated and verified by external researchers. Most experts rated an estimate by the World Health Organization (WHO), which primarily extrapolated findings from its 2004 mortality survey, somewhat lower than the estimates by CRED and State. Finally, most of the experts expressed the least confidence in three estimates that reported the highest number of deaths. They cited several shortcomings in these estimates, such as a reliance on unrealistic assumptions regarding fixed levels of mortality for all populations and time periods included in the estimate.⁶

Estimating deaths in a humanitarian crisis such as that in Darfur involves numerous challenges. In Darfur, difficulties related to the collection of survey data, including a lack of access to particular geographical regions,

⁵CRED conducted two death estimates: one for the period of September 2003-January 2005 and another for the period of February-June 2005.

⁶The three highest estimates reviewed by the experts ranged from 253,573 to 396,563 deaths over varying periods of time.

challenging survey conditions, and limited resources and training for research staff, impacted the data's quality and resulted in data gaps. Because of the lack of complete mortality data, some of the estimates rely on potentially risky assumptions and limited contextual information. For example, some estimates assume that mortality rates in accessible areas can be applied to inaccessible areas, without accounting for differences between the two due to factors such as patterns of violence and humanitarian relief efforts. In addition, limitations in estimates of Darfur's population before and during the crisis may have led to over- or underestimations of the death toll. Finally, varying use of baseline mortality rates—the rate of deaths that would have occurred regardless of the crisis—may also have led to overly high or low death estimates.

The group of experts proposed and rated a wide range of measures that U.S. agencies could take, directly or by supporting other organizations, to improve the quality and reliability of death estimates and relevant data for Darfur and any future such humanitarian crises. The most highly rated measure was ensuring that publicly available documentation of U.S. government estimates contains sufficient information on data and methods, so that external researchers can replicate the estimates and verify their credibility and objectivity. Other very highly rated measures that the government could consider included collecting and maintaining temporal and spatial data (i.e., data covering specific periods of time and geographic areas); housing the responsibility for making estimates in a reputable independent body; improving the training of nongovernmental organization (NGO) staff who collect mortality survey data; and promoting an interdisciplinary approach to estimating mortality. Through various initiatives already under way, U.S. agencies are carrying out efforts that may address some of the experts' suggestions, for example, providing guidance on the design and implementation of survey instruments and supporting the collection and maintenance of temporal and spatial data.

To safeguard State's credibility as a source of accurate and reliable death estimates, we recommend that the Secretary of State provide, for this and any future estimates of mortality that State conducts, sufficiently detailed descriptions of its data and methodology to enable other parties to assess and replicate its findings.⁷ Additionally, to enhance the U.S. government's capacity to assess and respond to any future humanitarian crisis, we recommend that the Secretary of State and the Director of U.S. Foreign

⁷We recognize that when such estimates draw from classified data, external researchers reviewing these data would require appropriate levels of security clearance.

Assistance and USAID Administrator consider the experts' other suggestions to help address gaps in data and improve any future death estimates.

We provided a draft of this report to the Department of State and USAID. State and USAID responded with formal comments, agreeing with our recommendations, and State provided additional perspectives on reporting and documentation regarding its death estimate. Reproductions of these letters, as well as our responses to the letters, can be found in appendixes VI and VII. We also provided a draft to the CDC for technical review, and we received technical comments from both the CDC and State, which we incorporated in the report as appropriate. Finally, we provided the authors of the other five estimates the portions of the report pertaining to their individual estimates. They provided comments, which we incorporated in the report as appropriate. These authors' comments and our responses are summarized in appendix VIII.

Background

Sudan is the largest country in Africa, with a population estimated at about 40 million (see fig. 1). Darfur is in the western region of Sudan and comprises three states, with an estimated preconflict population of around 6 million.⁸

⁸Estimates for the preconflict population of Darfur range from about 4 million to close to 7 million. Experts we interviewed have noted uncertainty regarding the population estimate for Darfur due to the lack of a current census and the fact that migration in this region occurs even during nonconflict times.

Figure 1: Map of Sudan



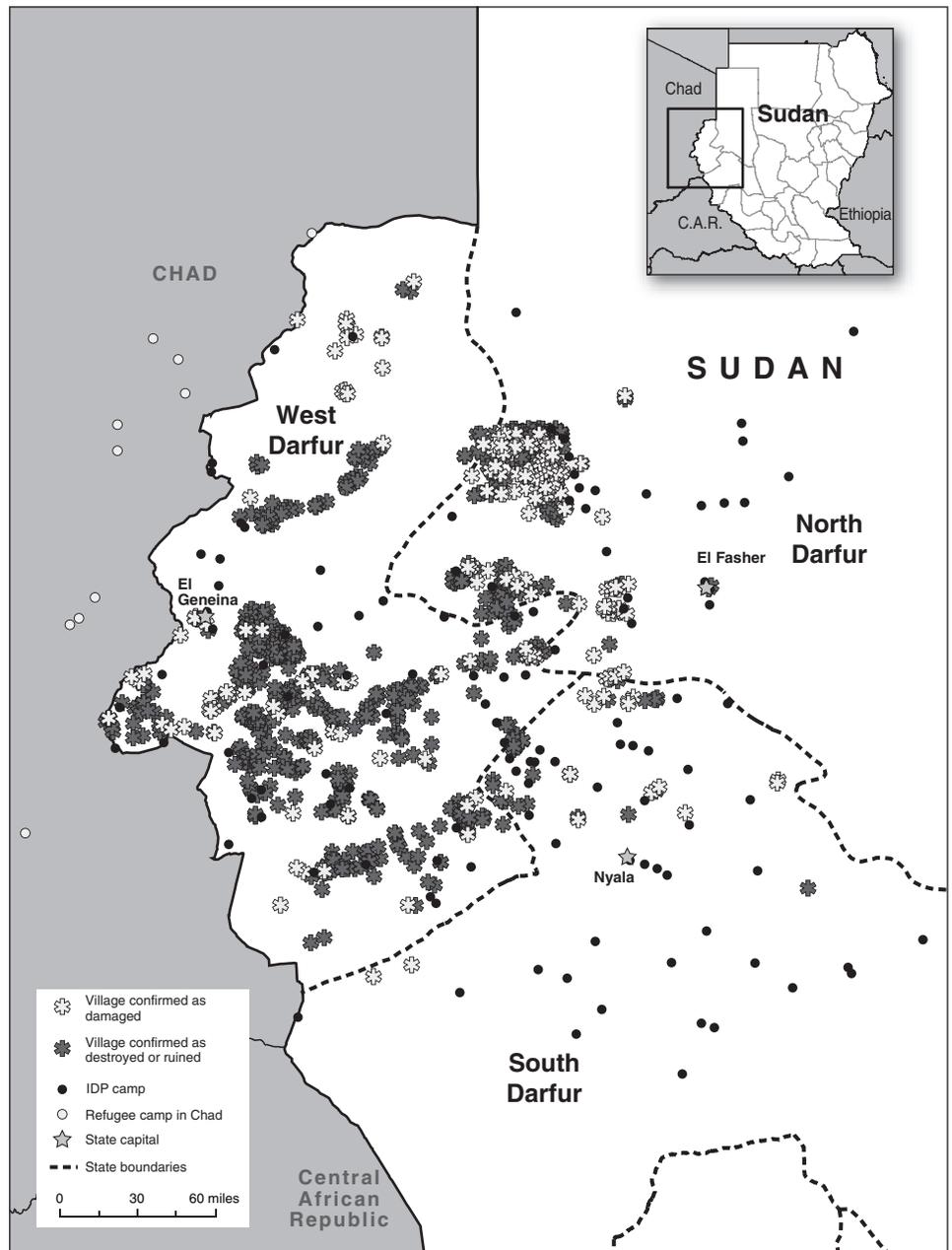
Source: GAO based on Map Resources (map).

Conflict in Darfur

In early 2003, Darfur rebels attacked Sudanese police stations and the airport in El Fasher, the capital of North Darfur. In El Fasher, the rebels destroyed numerous military aircraft, killed many Sudanese soldiers, and kidnapped a Sudanese general. In response, the government armed and supported the local tribal and Arab militias (the Janjaweed). Fighting between the principal rebel groups—the Sudan Liberation Movement/Army (SLM/A) and the Justice and Equality Movement (JEM)—and the Sudan military and Janjaweed intensified during late 2003. In addition to displacing approximately 1.85 million Darfurians in the region, attacks on civilians by the Sudan military and Janjaweed have forced an estimated 220,000 Darfur refugees to take shelter in Chad⁹ and so affected approximately 1.91 million additional Darfur residents that they require humanitarian assistance. (Fig. 2 shows the locations of Darfur villages destroyed or damaged in the conflict.)

⁹U.S. law considers any person who is outside the country of such person's nationality and who is unable or unwilling to return to, and is unable or unwilling to avail himself or herself of the protection of, that country because of persecution or a well-founded fear of persecution on account of race, religion, nationality, membership in a particular social group, or political opinion to be a refugee. 8 U.S.C. § 1101 (a) (42)A.

Figure 2: Map of Destroyed and Damaged Darfur Villages, as of February 2005



Source: GAO based on a map from State's Humanitarian Information Unit and Map Resources (map).

Peace negotiations under the mediation of the Chad government in 2003 led to a September 2003 cease-fire agreement between the SLM/A and the Sudan government; however, the agreement collapsed in December of that year. A second cease-fire agreement was signed by the Sudanese government, the SLM/A, and the JEM in April 2004.¹⁰ At this point, the African Union was brought in to monitor compliance with the cease-fire agreement between the three parties, and peace negotiations continued under African Union auspices with Chadian participation.¹¹ After a relatively calm 2005, cease-fire violations and violent incidents reportedly began to increase in the final months of the year and into 2006.

On May 5, 2006, the government of Sudan and one faction of the SLM/A signed the Darfur Peace Agreement, which establishes agreements in key areas such as power sharing, wealth sharing, and security arrangements.¹² The U.S. government and other parties support a transition of peacekeeping responsibilities from the African Union to the UN. In August 2006, the UN Security Council adopted a resolution expanding the mandate of the UN Mission in the Sudan and calling for the mission's deployment to Darfur.¹³ As of October 2006, the Sudanese president had rejected a UN transition but expressed support for a September offer by the UN Secretary-General to assist the African Union Mission in Sudan by providing equipment and dedicated personnel. Meanwhile, the environment in Darfur remained insecure, with attacks and displacement continuing and, during some periods, worsening over time.

¹⁰“Agreement on Humanitarian Ceasefire on the Conflict in Darfur,” signed on April 8, 2004, in N’Djamena, Chad.

¹¹Additional interim agreements were also reached, including the July 5, 2005, “Declaration of Principles for the Resolution of the Sudanese Conflict in Darfur” signed by the Sudanese government, the SLM/A, and the JEM. This declaration contains 17 principles to guide future deliberations, such as respect for the diversity of the people of the Sudan, democracy, a federal system of government, effective representation in all national government institutions, and equitable distribution of national wealth.

¹²“Darfur Peace Agreement” signed on May 5, 2006, at Abuja, Nigeria.

¹³UN Security Council Resolution 1706, adopted August 31, 2006. The expanded UN Mission in the Sudan mandate includes, among other things, supporting the implementation of the 2006 Darfur Peace Agreement and the 2004 Humanitarian Ceasefire Agreement.

U.S. Response to Darfur Crisis

The U.S. government has been active in addressing the conflict. On July 22, 2004, the U.S. House and the Senate each passed separate resolutions citing events in Darfur as acts of genocide.¹⁴ Further, on September 9, 2004, in testimony before the Senate Foreign Relations Committee, the U.S. Secretary of State announced that genocide had been committed in Darfur and that the Sudanese government had supported the Janjaweed, directly and indirectly, as they carried out a “scorched earth” policy toward the rebels and the African civilian population in Darfur.¹⁵

According to State officials, the administration’s declaration of genocide was influenced by findings from interviews with 1,136 Darfur refugees in eastern Chad in July and August 2004, which demonstrated a pattern of abuse against members of Darfur’s non-Arab communities. The interviews were conducted by an “Atrocities Documentation Team” assembled by State and consisting of officials from State and USAID, as well as members of the Coalition for International Justice¹⁶ and the American Bar Association. State reported that 61 percent of those interviewed said that they had directly witnessed the killing of a family member in addition to other crimes.¹⁷

For fiscal years 2004 through 2006, the United States obligated \$996 million in humanitarian assistance for Darfur.¹⁸ Although more than 68

¹⁴H. Con. Res. 467, 108th Cong. (2004); S. Con. Res. 133, 108th Cong. (2004).

¹⁵The Convention on the Prevention and Punishment of the Crime of Genocide of 1948 defines genocide as any of the following acts committed with intent to destroy, in whole or in part, a national, ethnical, racial or religious group, as such: (a) killing members of the group, (b) causing serious bodily or mental harm to members of the group, (c) deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part, (d) imposing measures intended to prevent births within the group, or (e) forcibly transferring children of the group to another group. The U.S. government ratified the convention in 1988. According to a State official, the key factor in the U.S. government’s genocide determination was the intent of the Sudanese government regarding its actions in Darfur (i.e., its intent to destroy, in whole or in part, a specific group of people); the number of deaths attributable to the crisis was not a critical factor.

¹⁶The Coalition for International Justice (CIJ) was an international, nonprofit organization that supported international war crimes tribunals and justice initiatives. It closed its operations in March 2006.

¹⁷Department of State, *Documenting Atrocities in Darfur*, Publication 11182 (Washington, D.C.: Bureau of Democracy, Human Rights, and Labor and the Bureau of Intelligence and Research, September 2004). Available at <http://www.state.gov/g/drl/rls/36028.htm>.

¹⁸In addition to the U.S. assistance provided for Darfur, an additional \$197 million has supported Darfur refugees located in Eastern Chad for fiscal years 2004 through 2006.

percent of this assistance has consisted of food aid, U.S. assistance to Darfur has also supported other vital needs, such as water and sanitation, shelter, and primary health care services. Partly as a result of U.S. assistance, NGOs and UN agencies have made significant progress in increasing the number of internally displaced persons and affected residents receiving aid. The number of international and national humanitarian aid workers in Darfur expanded from 202 in April 2004 to 13,500 staff members of 84 NGOs and 13 UN agencies in July 2006. In 2005 and early 2006, malnutrition and mortality rates in Darfur had dropped since 2004, a trend that U.S. and other officials attribute in part to international humanitarian assistance efforts. Further, according to State sources, the U.S. government, via private contractors, provided about \$280 million, between June 2004 through September 2006, primarily to build and maintain facilities throughout Darfur to house African Union troops assigned to monitor compliance with the April 2004 cease-fire agreement.¹⁹

Data Sources and Methods for Darfur Death Estimates

A key data source for the Darfur death estimates is health, nutrition, and mortality surveys conducted in the field by NGOs delivering humanitarian services (e.g., Médecins Sans Frontières, known in English as Doctors without Borders, and Save the Children)²⁰ as well as by UN or governmental agencies (e.g., the WHO, the World Food Program, and the CDC). These surveys are discrete data collection exercises carried out at a specific time with a particular sample of the affected population, such as people in a certain IDP camp.

Surveys that ask about mortality are often combined with those collecting health and nutrition data. “Retrospective” mortality data are collected by asking a sample of respondents to recall the number of deaths that occurred in their household during an earlier defined period of time.²¹ Interviewers may also ask respondents questions that allow them to categorize the cause of death (e.g., deaths due to violence, disease, or malnutrition). Households surveyed may be located in a single area (e.g., displacement camp) or multiple areas (e.g., multiple camps or sites within a region.) Because an absolute number of deaths is difficult to interpret,

¹⁹See [GAO-07-9](#).

²⁰ The estimates by Coebergh, Hagan, and Reeves used the Atrocities Documentation Team’s survey of Chad refugees as an additional key source of data.

²¹ Respondents are also asked to report the number of births and the numbers of people in their household during the recall period.

organizations conducting surveys calculate mortality rates for the population sampled and for the time included in the “recall period.” These mortality rates allow for comparison among different population groups and with different time periods, such as when no humanitarian crisis is occurring. In acute emergencies, when mortality may change significantly during a short time interval, mortality rates are often expressed as the number of deaths per 10,000 people per day. Typically, a crude mortality rate—that is, the rate of death for the entire population, including both sexes and all ages²²—is reported, as well as mortality rates for specific groups (such as those younger than 5 years or of a specific sex). Data from CRED’s Complex Emergency Database (CE-DAT) show that at least 68 surveys conducted with IDPs and affected residents reporting crude mortality rates were conducted in Darfur between 2004 and 2006.²³ Two retrospective mortality studies used in most Darfur death estimates were conducted, respectively, by Médecins Sans Frontières and the WHO.

- *Médecins Sans Frontières Mortality Surveys in West Darfur.* The organization conducted retrospective mortality surveys with 3,175

²²According to the Sphere Project, the crude mortality rate can be expressed with different standard population denominators and for different time periods; however, the daily crude mortality rate is the most specific and useful health indicator to monitor in a disaster situation. [See The Sphere Project, *Humanitarian Charter and Minimum Standards in Disaster Response* (Geneva: Switzerland, 2004); also known as the *Sphere Handbook*.] Sphere, launched in 1997 by a group of humanitarian NGOs and the Red Cross, developed minimum standards to be attained in disaster assistance in five sectors: water supply and sanitation, nutrition, food aid, shelter, and health services. The *Sphere Handbook* reports that a doubling of the baseline crude mortality rate indicates a significant public health emergency, requiring an immediate response. If the baseline rate is unknown, health agencies should aim to maintain the crude mortality rate at below 1.0 per 10,000 per day. According to data from the U.S. National Center for Health Statistics, the normal crude mortality rate for 2003 in the United States is about 0.23 deaths per 10,000 per day.

²³CE-DAT is a searchable database of complex emergencies that includes information on health and mortality indicators. The database which receives funds from the State’s Bureau of Population, Refugees, and Migration, is housed in CRED, a WHO Collaborating Center located within the School of Public Health of the Université Catholique de Louvain in Brussels. (See <http://www.cred.be/cedat/index.htm>.) According to CRED, the database contains 1,155 surveys covering 36 countries; half of these surveys are drawn from original reports, and the other half are drawn from secondary sources. Research staff from CE-DAT we interviewed have told us that, because they rely on voluntary reporting from organizations conducting surveys to populate their database, not all surveys that have been conducted in Darfur may be included in their database.

households in four sites in West Darfur.²⁴ The surveys, conducted between April and June 2004, asked respondents about the number and cause of deaths in their household up to 6 months earlier,²⁵ before they fled their villages, as well as after they arrived at their IDP camps or settlements. Médecins Sans Frontières reported crude mortality rates ranging from 5.9 to 9.5 deaths per 10,000 per day during the period when respondents were in their villages and in flight and rates ranging from 1.2 to 5.6 deaths per 10,000 per day during the camp period. Médecins Sans Frontières also reported that violence caused 68 to 93 percent of deaths during the village and flight periods.

- *2004 World Health Organization Retrospective Mortality Survey.* The WHO surveyed 3,140 households in accessible IDP settlements in the three regions of Darfur to determine mortality rates between June and August of 2004.²⁶ The organization reported crude mortality rates of 1.5 per 10,000 per day for North Darfur; 2.9 per 10,000 per day in West Darfur; and 3.8 per 10,000 per day for Kalma camp in South Darfur for the defined recall period. Diarrhea accounted for most of the reported deaths in all three regions, while violence or injury accounted for a smaller percentage of deaths, ranging from 10 to 21 percent.

Researchers estimating death tolls in humanitarian crises such as that in Darfur generally extrapolate mortality surveys' various mortality rates to longer time periods and larger populations. In addition, to estimate an "excess" number of deaths directly attributable to the conflict, some researchers subtract a baseline mortality rate—that is, an expected

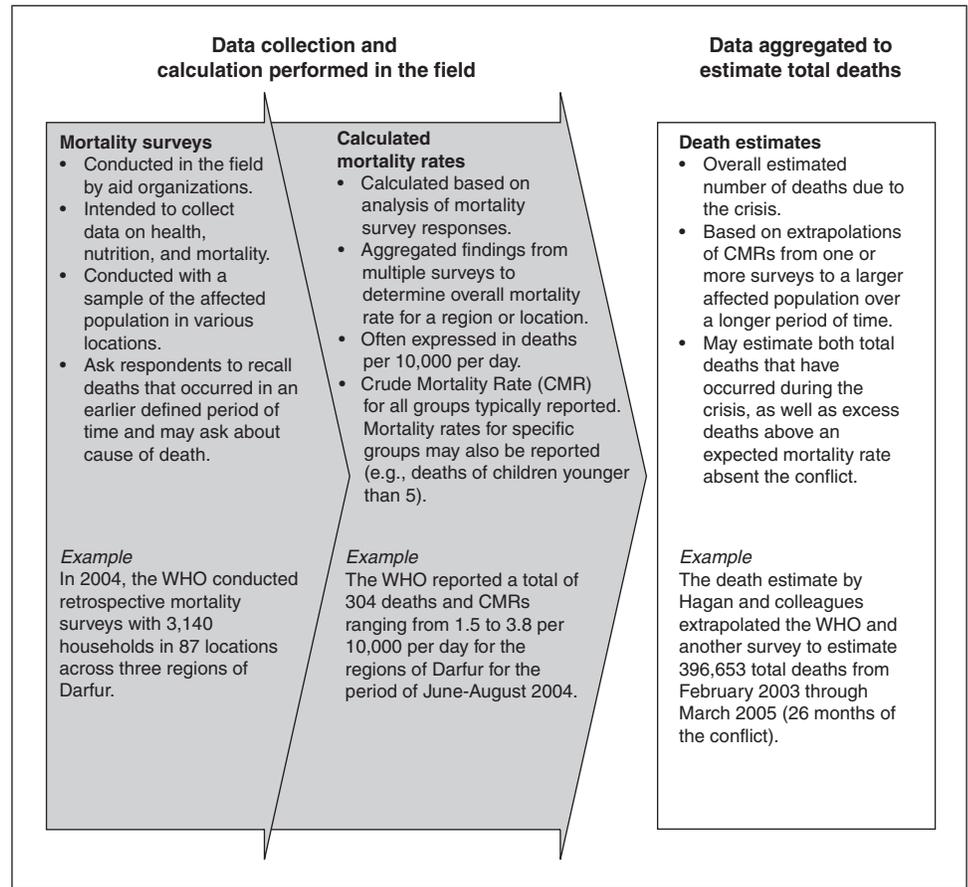
²⁴Across the four sites, Médecins Sans Frontières surveyed 3,175 households representing a total of about 17,500 people and drawn from an estimated IDP population of 215,400. See Depoortere, Evelyn et al. "Violence and Mortality in West Darfur, Sudan (2003-2004): Epidemiological Evidence from Four Surveys." *Lancet*, 364 (2004): 1,315-1,320. Médecins Sans Frontières produced this study in collaboration with Epicentre, a nonprofit organization created in 1987 by Médecins Sans Frontières, which groups health professionals specialized in public health and epidemiology. (See <http://www.epicentre.msf.org/>.)

²⁵The recall period varied in the surveys conducted across the four sites. The longest was 183 days for the survey conducted at Zalingei, and the shortest was 39 days for the survey at El Geneina. Médecins Sans Frontières reported using a calendar of locally important events to facilitate recall.

²⁶The WHO reported surveying a total of 3,140 households representing about 21,000 people. The WHO surveyed IDPs from 43 locations in North Darfur and 43 locations in West Darfur, but due to security problems surveyed only IDPs residing in Kalma camp in South Darfur. See World Health Organization. *Retrospective Mortality Survey among the Internally Displaced Population Greater Darfur, Sudan 2004*, 2004. www.who.int/disasters/repo/14656.pdf

number of deaths that would have occurred absent the conflict—from the total number of deaths estimated for the time period and population. (Fig. 3 illustrates the generation of a death estimate.)

Figure 3: Example of Generation of a Death Estimate



Source: GAO.

The death estimates that we and the group of experts reviewed were produced for varying purposes, according to their authors.

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- The authors of the CRED estimates²⁷ said that their aim in conducting their estimate was to develop a method that, rather than extrapolating mortality from a single survey to the entire region and conflict period, took into account variations over time and space.
 - Dr. Coebergh²⁸ noted that his estimate was intended as a political statement to increase public awareness of the crisis. He also stated that the estimate was produced as a response to earlier total death tolls quoted in the media, which he believed were too low and did not adequately capture violent deaths.
 - According to Dr. Hagan,²⁹ his estimate in the spring of 2005 responded to earlier total death figures, quoted in the media, that he believed were too low and did not adequately capture violent deaths. He stated that one of his goals was to provide greater transparency about the available estimates.
 - Dr. Reeves³⁰ said that he produced his first estimate of the Darfur death toll, in June 2004, because he believed that the figures being quoted by the UN significantly understated the Darfur death toll and were not supported by the data.
 - According to State, its purpose was to provide information for internal policymakers.

²⁷CRED is a nonprofit research institution and a World Health Organization Collaborating Centre based in the School of Public Health of the Université Catholique de Louvain in Brussels.

²⁸Jan Coebergh is a medical doctor in the Netherlands who has worked in Darfur.

²⁹John Hagan, a professor of sociology at Northwestern University, conducted his estimate with his colleagues, Wynnona Rymond-Richmond and Patricia Parker; the estimate was released by the Coalition of International Justice. Dr. Hagan stated that the 2005 estimate used an assumption of constant levels of mortality over time, because he believed other estimates had relied on that assumption. He also noted that he subsequently modified his assumptions and estimating methods in his estimate with Alberto Palloni. [See John Hagan and Alberto Palloni, "Social Science: Death in Darfur," *Science*, vol. 313 (2006): 1,578-1,579.]

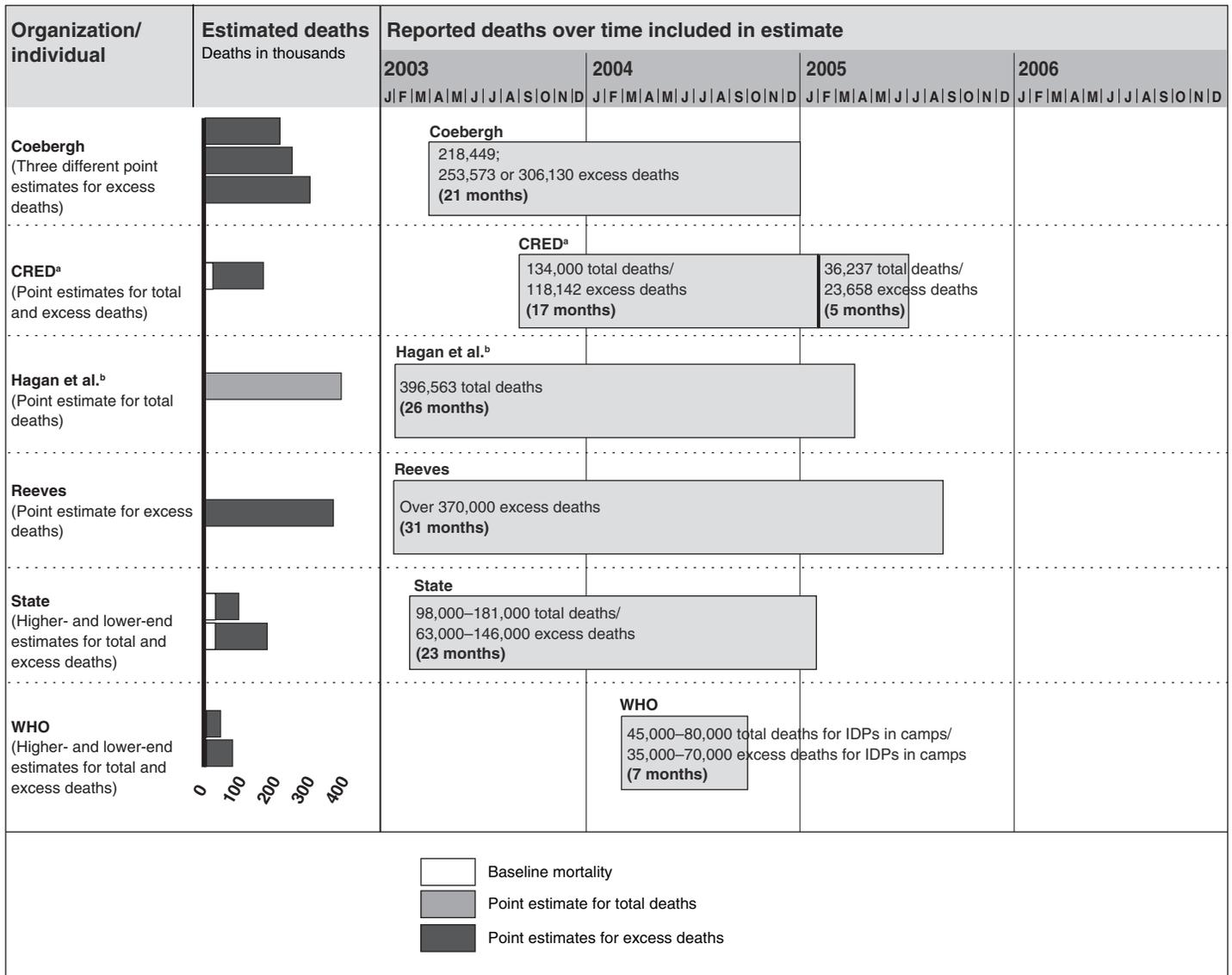
³⁰Eric Reeves is a professor of English language and literature at Smith College and has spent the past 7 years working full-time on research and advocacy issues related to Sudan. When the experts convened in April 2006, they reviewed and discussed Reeves's latest available estimate of 375,000 through August 2005. At the end of April 2006, he reported that total excess mortality in Darfur was greater than 450,000 deaths.

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- A WHO³¹ official told us that the organization sought to assess the order of magnitude of deaths in Darfur to assist it in planning humanitarian relief for IDPs in camps.

The estimates that we and the experts reviewed vary quantitatively and in the time that they cover—from 35,000 excess deaths or 45,000 total deaths for IDPs in camps over 7 months of the conflict, to almost 400,000 total deaths for Darfur over 26 months of the conflict. (See fig. 4 for a summary description of the estimates and their findings, and see app. IV for more details.)

³¹The WHO estimate was presented by David Nabarro, a senior WHO official.

Figure 4: Death Estimates Based on Reported Figures and Time Included



Source: GAO analysis of estimates from above organizations.

^aCRED conducted two death estimates: one for the period of September 2003-January 2005 and another for the period of February-June 2005. The bar on the left for “estimated deaths” is the combined total of these two estimates.

^bThis estimate was conducted by John Hagan and colleagues and released by the CIJ.

We and the group of experts also reviewed a preliminary version of a death estimate for West Darfur by John Hagan and Alberto Palloni; however, this estimate is not discussed in our report, because the version that the experts reviewed was preliminary and not publicly available when they convened in April 2006. In the estimate's final version, which became publicly available in September 2006, Hagan and Palloni estimated that a range of 57,506 to 85,346 deaths had occurred in West Darfur over 31 months. Using the same ratio of deaths to displacement, they estimated a range of 170,000 to 255,000 deaths in all three states of Darfur over the same time period.³²

In addition, the estimates differ methodologically, incorporating varying source data, mortality rates and causes of death, assumptions regarding variable or fixed mortality rates, estimates of the affected population, consideration of baseline mortality rates, and reporting methods. (See app. IV for more information.)

- *Source data.* The estimates' respective sources of data range from about 30 mortality surveys to a single mortality survey. The estimates also use nonsurvey or contextual information, such as the retrospective reporting of attacks or displacement patterns, to varying degrees. In addition, the amount of source data used varies according to the availability of such data when the estimates were conducted. For example, fewer data were available for estimates conducted in 2004³³ than for those conducted in 2005.
- *Mortality rates and cause of death.* The estimates differ in whether they applied mortality rates that include all causes of death or calculated and applied mortality rates due to violence and nonviolence separately.

³²See John Hagan and Alberto Palloni, "Social Science: Death in Darfur," *Science*, vol. 313 (2006): 1578-1579. In addition, the experts did not review a study of the Darfur conflict by Bloodhound, a Danish advocacy group, because it was published after the experts met in April 2006. The study estimates that deaths in Darfur ranged from 57,000 to 128,000 deaths between April 2003 and September 2005 due to attacks on villages throughout the region. [See Andreas Höfer Petersen and Lise-Lotte Tullin, *The Scorched Earth of Darfur: Patterns in Death and Destruction Reported by the People of Darfur. January 2001-September 2005* (Copenhagen: Bloodhound, 2006). Available at http://www.bloodhound.se/rap_uk.html.]

³³The WHO conducted an initial estimate in July 2004 and a subsequent estimate in October 2004. Eric Reeves began his estimates in June 2004 and has reported ongoing "mortality updates" since that time. As of October 2006, his last update was conducted at the end of April 2006.

However, most of the estimates, as well as the mortality surveys we reviewed, express mortality rates in deaths per 10,000 people per day.

- *Assumptions of variable or fixed mortality rates.* The estimates include different assumptions regarding whether mortality rates varied over the period of the conflict or according to the affected region or remained constant for all populations in all areas over the entire period of conflict.
- *Affected population estimates.* The estimates rely primarily on information from the UN Humanitarian Profiles in determining the total affected population, but they differ in their assumptions about whether the affected population changed over time or remained constant. Additionally, one estimate also includes only IDPs in camps and excludes affected residents in Darfur and refugees in Chad.
- *Baseline mortality rates.* The estimates varied in their use of a baseline mortality rate—that is, the number of expected deaths absent the conflict—from using no baseline to using a baseline of 0.5 deaths per 10,000 per day.
- *Reporting methods.* Some estimates report a range of possible total deaths, others report point estimates — that is, single numbers. Additionally, some estimates are precise figures, such as 396,563, while others are rounded to fewer significant digits, such as 134,000.

Some Death Estimates Judged More Accurate and Methodologically Stronger, Despite Shortcomings

Although none of the death estimates was consistently considered accurate or methodologically strong, the experts we consulted rated some of the estimates more highly than others. Overall, the experts expressed the highest level of confidence in CRED's estimates and slightly lower levels of confidence in State's and the WHO's estimates. They expressed the lowest level of confidence in the three estimates that report the highest number of deaths, citing multiple shortcomings, such as a reliance on unrealistic assumptions about populations' level of risk over periods of time.

No Estimate Consistently Considered Accurate

Although the experts clearly had greater confidence in some estimates than in others, they did not consistently express a high level of confidence in any of the estimates or consistently rate any of them as accurate.³⁴

The experts expressed a slightly higher level of confidence in the CRED estimates than the State estimate. However, only 2 of the 12 experts expressed a high level of confidence, and most had a moderate level of confidence, in the CRED estimates. Experts had a moderate to low level of confidence in the WHO estimate. Almost all experts expressed a low level of confidence in the estimates by Coebergh, Hagan, and Reeves.³⁵ (See app. V for additional survey results.)

Similarly, the experts did not consistently rate any of the estimates as accurate; the majority of experts rated almost all of the reported figures as either too high or too low. Only CRED’s second estimate—36,000 total deaths for February-June 2005—was viewed by half of the experts as “about right.” (See table 1.)

Table 1: Accuracy of Darfur Death Estimates Rated by Experts

Estimate (number of months in estimate)	Too high	About right	Too low
Coebergh			
218,449 excess deaths (21)	7	1	2
253,573 excess deaths (21)	8	0	2
306,130 excess deaths (21)	8	1	1
CRED’s two estimates			
Sept. 2003-Jan. 2005: 134,000 total deaths (17)	1	3	6
Feb. 2005–July 2005: 36,237 total deaths (5)	2	5	2
Hagan et al.			
396,563 total deaths (26)	10	0	0
Reeves			
Over 370,000 excess deaths (31)	10	0	0
State’s lower- and higher-end estimates			

³⁴Although they questioned the accuracy of the estimates and had differing views about the actual number of deaths that have occurred in Darfur, the experts did not question the severity of the crisis. In discussing the importance of the estimates’ accuracy, several experts noted that estimates can be used in war crime proceedings, and one stated that it was important to account for all those who died so that this could become part of the historical record.

³⁵One expert rated having a moderate level of confidence in the estimate by Hagan.

Estimate (number of months in estimate)	Too high	About right	Too low
Lower-end estimate: 98,000 total deaths (23)	0	1	9
Higher-end estimate: 181,000 total deaths (23)	4	4	2
WHO's lower- and higher-end estimates			
Lower-end estimate: 45,000 total deaths (7)	1	2	7
Higher-end estimate: 80,000 total deaths (7)	3	1	6

Source: GAO.

Note: We asked experts to rate the accuracy of total deaths when these were reported in the estimate. Coebergh and Reeves reported excess deaths only. Additionally, in responding to this question, one expert said that there was no basis to judge or that he or she was not sure about the accuracy of the estimates; one expert chose not to respond to this question; another expert chose two responses for the second CRED estimate, and his or her responses are excluded.

In some cases, experts tended to agree as to whether the reported figures were too high or too low; in other cases, there was less agreement. For example, 9 of 10 experts rated the lower-end of State's estimate as too low, and the majority of the experts viewed the estimates by Coebergh, Hagan, and Reeves as too high. In contrast, experts did not agree as to whether State's higher estimate was too high, too low, or about right. For example, a few experts believed the higher end of State's estimate was likely to be closer to a reasonable midrange estimate. These experts also thought that the mortality surveys State used for the estimate may have been conducted at places with higher levels of aid and subsequently lower levels of mortality, or that disease outbreaks may have been missed. However, one expert believed that State may have overestimated mortality by applying elevated mortality rates for too many months of the crisis.

Experts Found Methodological Shortcomings in Each Estimate

CRED Estimates

The experts' overall assessment of the estimates' methodological strengths in terms of their data, methods, objectivity, and reporting did not produce any consistently high ratings, and experts noted shortcomings in each estimate.³⁶

Overall, the experts rated CRED's estimates most highly in terms of data, methods, objectivity, and reporting of limitations. However, several

³⁶In evaluating each estimate's methodological strength, the experts rated the *source data* and whether such data were methodologically sound; the *methods*, including whether extrapolations were appropriate, assumptions were reasonable, and shortcomings that could result in over- or underestimation were sufficiently described; the *level of objectivity*, based on whether a particular bias appears to be part of the estimating procedure; and the *sufficiency of reporting* and information contained in published documents describing the estimate.

experts found shortcomings in the CRED estimates' data and methods and thought that CRED could have provided more information and clarity in its reporting.

- *Source data.* Most experts said that the data CRED used for its two estimates (drawing from a total of about 30 mortality surveys in Darfur and Chad³⁷) were generally sound.³⁸ CRED reported checking the reliability and validity of the surveys included in its estimates, which experts found to be a strength. However, several experts cited some shortcomings in CRED's data sources. For example, some said that CRED could have better articulated the criteria used to select the survey data or weighted the surveys it used by sample size. A few experts also thought that CRED should have considered other sources besides mortality surveys, such as surveillance data on morbidity or nutrition.
- *Methods used, including extrapolations and assumptions.* Some experts found CRED's method of using disparate data sources to estimate total deaths to be innovative and logical.³⁹ Additionally, more than half of the experts rated CRED's assumptions and extrapolations as somewhat appropriate or reasonable.⁴⁰ For example, several experts found the Sudan baseline mortality rate that CRED used more accurate than the baseline mortality rates derived from a larger region of sub-Saharan Africa used in some of the other estimates. However, some assumptions and extrapolations were questioned. For example, several experts thought that CRED's assumption regarding a generally stable rate for nonviolent mortality during much of 2004 may have been inaccurate, owing to

³⁷CRED selected or excluded surveys for reasons such as whether findings from a regional survey differed statistically from findings for statewide surveys or whether a survey's findings were viewed as outliers. CRED used the selected surveys to analyze violent or nonviolent mortality rates depending on, for example, whether the surveys reported the proportion of deaths due to violence. Although CRED primarily relied on mortality survey data, it also used contextual information to refine its estimates and make some assumptions.

³⁸Nine experts rated the data CRED used as generally sound, two rated the data as equally sound and unsound, and two rated the data as generally unsound.

³⁹CRED analyzed findings from the mortality surveys mentioned above to separately estimate nonviolent and violent mortality rates and combined these to get overall mortality rates for different regions and periods of the conflict.

⁴⁰Eight experts rated CRED's extrapolations as very or somewhat appropriate, two experts rated them about as appropriate as inappropriate, one expert rated them as somewhat inappropriate, and one expert found no basis to judge or was not sure. Additionally, 10 experts rated CRED's assumptions as very or somewhat reasonable, and two experts rated them as somewhat or very unreasonable.

possible changes in the affected population, camp formations, the level of aid, and the outbreak of disease. Additionally, some experts considered the method that CRED used to estimate deaths among refugees in Chad to be somewhat unsystematic.

- *Level of objectivity.* Overall, experts viewed CRED's death estimates as having the highest level of objectivity.⁴¹ Two authors of other estimates also concluded that the CRED estimates were likely to be more reliable and more scientific than other Darfur death estimates, including their own.
- *Sufficiency of reporting.* Experts noted that, among the estimates they evaluated, CRED most sufficiently reported the limitations and potential sources of over- or underestimation in its estimates. However, several experts believed that better descriptions of the methods used, including information on specific formulas and calculations, could have been provided. An author of another estimate also noted that the mortality surveys used in CRED's estimates lacked complete citation information. In our review of CRED's first estimate, we were able to replicate it to some degree only after the authors provided a substantial amount of information, such as specific mortality rates and formulas used and citations for source studies, in addition to the information in the published document.

State Estimate

In assessing State's estimate, the experts identified methodological strengths related to each of the four elements but also noted some shortcomings. Strengths included its use of multiple types of information, including contextual data from other sources besides surveys, such as reporting of attacks. Many experts also believed the estimate had a high level of objectivity. However, the experts, as well as authors of other estimates, cited several shortcomings in State's estimate. For example, many believed that the lower end of the estimate was too low, owing to several factors including the use of some data that underestimated mortality rates. Additionally, experts and other authors thought that the published documents containing the estimate lacked sufficient information, such as a clear description of the mortality rates used for all populations and time periods included in the estimate.

- *Source data.* Many experts cited as one strength the estimate's use of different types of data, including mortality survey data and contextual information, to triangulate findings and estimate mortality, and one expert

⁴¹Ten experts rated CRED's level of objectivity as very high or high, one expert rated it as moderate, and one expert indicated that he or she had no basis to judge or was not sure.

deemed this approach a “pioneering attempt” in the field of death estimates in humanitarian crises.⁴² However, just over half of the experts thought that the data used were methodologically sound.⁴³ Some experts said that several of the mortality surveys used in State’s estimate may have had methodological limitations in areas such as survey design, implementation, or accessibility to insecure regions, resulting in unrealistically low mortality rates. These experts believed that such limitations in source data, in addition to other problems—for example, the estimate’s lack of clarity regarding how missing populations are accounted for and use of a relatively higher baseline mortality rate—may have pulled down State’s estimate, in particular, its lower end.

- *Methods used, including extrapolations and assumptions.* About half of the experts felt that State’s estimate applied somewhat appropriate extrapolations, and a similar proportion thought that it made reasonable assumptions. A few experts thought that its depiction of varying levels of mortality over time and affected regions was appropriate to estimate total deaths throughout the Darfur crisis. However, several experts thought that the assumptions used, in some cases, were based on insufficient rationale and evidence and that additional sensitivity analysis could have been conducted. For example, the State estimate assumes that mortality rates in Darfur are 20 percent lower for affected residents than for IDPs, an assumption that some experts believed lacked sufficient rationale.
- *Level of objectivity.* Nine of the 12 experts rated the State estimate’s level of objectivity as high.⁴⁴ Several experts generally believed that the estimate represented a “good faith effort” to use available evidence in an unbiased way.
- *Sufficiency of reporting.* Many of the experts found that the published documents containing State’s estimate lacked sufficient information to allow them to replicate the estimate and verify the accuracy and reliability

⁴²State reports using various sources of information from sources other than surveys, such as displacement patterns, village destruction, and retrospective reporting of attacks to, among other things, fill in data gaps and determine whether mortality rates derived from existing surveys could be applied as an overall rate to a broader population or if higher or lower rates were warranted.

⁴³Seven of the 12 experts rated the State’s data as generally methodologically sound, 2 rated the data as equally sound and unsound, 2 rated the data as generally not sound, and 1 indicated that he or she was not sure or had no basis to judge.

⁴⁴Two experts rated the objectivity as moderate, and one said that he or she had no basis to judge or was not sure.

of the data and methods. For example, some experts noted that the data used were not sufficiently described and that more specific citations, as well as a description of the criteria applied to select the data, would have been useful. Additionally, some experts felt that they did not have a good sense of the reliability and validity of the contextual data used in the estimate and the application of these data to determine mortality rates or total deaths. Moreover, several experts said that State should have included the specific formulas or mortality rates used for all populations, time periods, and regions. Similar comments were made by several authors of other estimates. Our review of the State estimate also showed that it could not be replicated with the information contained in the report. Further, one expert noted that the published document available on State's Web site particularly lacked sufficient description of the estimate's methods, data, and potential limitations.

WHO Estimate

Several experts found strengths in the data and level of objectivity of the WHO's estimate, which it presented in a short briefing in October 2004. However, several experts observed shortcomings in the WHO's reporting of its estimate.

- *Source data.* The WHO estimate of IDP deaths in Darfur for 7 months in 2004 relied primarily on findings from the organization's 2004 mortality survey. Several experts noted that this survey followed standard methods and was generally reliable. However, a few experts and estimate authors said that the 2004 WHO survey may have underestimated mortality, owing to local government restrictions that prevented researchers from asking respondents detailed questions about mortality.
- *Methods used, including extrapolations and assumptions.* Experts provided mixed ratings on the appropriateness of the extrapolations and the reasonableness of the assumptions used in the WHO estimate. For example, one expert believed that because the methodology of the organization's 2004 survey was appropriate to gauge levels of mortality among a limited IDP population for 2 months, but not aggregate mortality, the survey findings should not have been extrapolated to generate a death estimate for the total IDP population for 7 months.
- *Level of objectivity.* Half of the experts rated the level of objectivity of the WHO estimate as high, three rated it as moderate, and two rated it as low.⁴⁵ About half of the experts thought that the WHO estimate's level of objectivity was equal to CRED's and State's.

⁴⁵One indicated no basis to judge or not sure.

Three Other Estimates

- *Sufficiency of reporting.* Several experts thought that the WHO’s reporting of its estimate had several shortcomings. For example, they thought that the briefing document describing the death estimate did not make it sufficiently clear that the estimate included deaths of IDPs from all causes—both violent and nonviolent—but excluded deaths of affected residents in Darfur and refugees in Chad. The experts found that the lack of a clear description of such issues allowed for misinterpretation by readers, including the media and academia.

The experts cited several methodological shortcomings in the Coebergh, Hagan, and Reeves estimates, including the use of problematic data and application of unrealistic assumptions about the levels of mortality over time and affected populations.

- *Source data.* Many experts found shortcomings in each of the three estimates’ use of certain survey data.⁴⁶ A number of experts noted problems in the design, sampling, and data collection in the Atrocities Documentation Team’s survey of Chad refugees on which all three estimates based, at least in part, their numbers of violent deaths. Experts also pointed out that, because the survey’s intended purpose was to document levels and types of victimization, the estimates by Dr. Coebergh, Dr. Hagan, and Dr. Reeves should not have extrapolated the survey findings to a broader population or time period in order to estimate total deaths. In addition, many experts observed that the estimates by Coebergh and Hagan inappropriately used findings from the 2004 WHO survey to calculate only nonviolent deaths without taking into account the fact that some deaths reported by the WHO were due to violence or injury.⁴⁷
- *Methods used, including extrapolations and assumptions.* Most experts found that the Coebergh, Hagan, and Reeves estimates used unrealistic extrapolations and assumptions to fill information gaps and estimate total deaths. For example, many experts thought that each of the three estimates relied on too few data points extrapolated to an excessive degree. As a result of this type of extrapolation, the experts observed, a

⁴⁶Each of the three estimates based, at least in part, its numbers of violent deaths on the “Atrocities Documentation Team’s” survey of Chad refugees and its numbers of nonviolent deaths on the 2004 WHO survey. The Coebergh and Reeves estimates also used additional data sources.

⁴⁷The 2004 WHO survey reported that violence or injury accounted for 10 to 21 percent of deaths in North and West Darfur and Kalma camp in South Darfur for a 2-month recall period in the summer of 2004. Jan Coebergh and John Hagan told us they knew that the WHO survey reported a percentage of deaths due to violence but believed the survey did not sufficiently capture violent deaths, particularly during the period prior to camp arrival.

sensitivity analysis changing one or two assumptions could swing the total number of deaths from 100,000 to half a million, making the estimates unreliable. Moreover, several experts believed that some of the authors had inappropriately assumed constant rates of mortality for different population groups in Darfur at different periods in the conflict.⁴⁸ Two of the estimates (Coebergh's and Hagan's) also used "fixed" estimates of the affected population over time, a method that some experts thought was inappropriate because the affected population grew over the course of the conflict. Additionally, the three estimates involve assumptions that some experts viewed as questionable, such as using unsupported numbers to estimate the number of deaths among populations inaccessible to aid or assuming all missing persons were likely to be dead.

- *Level of objectivity.* Most experts rated the level of objectivity of the three estimates as low, particularly those by Drs. Coebergh and Reeves. The experts thought that the estimates were more characteristic of advocacy or journalistic material than of objective analysis.
- *Sufficiency of reporting.* One expert noted that the estimate by Dr. Hagan was very straightforward and one could follow the logic of the data and methods applied. However, most of the experts found that the three estimates did not sufficiently describe limitations that may have resulted in under- or overestimation of total deaths. In reviewing the estimates, we found we were able to replicate Dr. Hagan's entire estimate based on its description in public documents. We were also generally able to replicate Reeves' estimate after receiving additional information about, among other things, his calculation of some numbers and the sources of his data. We had more difficulty in replicating Dr. Coebergh's estimate based on the information in the published article and were able to do so only after the author provided, at our request, details about the specific data, methods, and formulas that were used.

Estimating Deaths in Humanitarian Crises Involves Many Challenges

Estimating the total deaths in a humanitarian crisis such as that in Darfur involves a number of challenges, most notably related to collecting data in the field and extrapolating from limited data. Difficulties in collecting sound, consistent survey data—including lack of access to particular geographical regions, the conditions under which the surveys are conducted, and limited resources and training for field staff conducting surveys—affect the quality of the data collected and result in data gaps. Because of such limitations, as well as the unavailability of data from

⁴⁸Reeves's estimate assumes some change in mortality levels over time.

other sources, the death estimates that we reviewed rely on potentially risky assumptions and limited contextual information. Limitations in estimates of Darfur's population before and during the crisis also impacted the quality of the death estimates. Additionally, varying approaches to the use of baseline mortality rates may have somewhat affected their accuracy.

Challenges in Collecting Source Data Affected Data Quality and Led to Data Gaps

Difficulties in conducting health, nutrition, and mortality surveys in a crisis such as Darfur's can affect survey data's quality and completeness and, thus, the soundness of death estimates based on the data. In Darfur, these difficulties include lack of access to certain geographical regions, difficult survey conditions, researchers' limited resources and training, and lack of consensus over sampling methods. In addition, the findings from the surveys in Darfur are not always publicly available, and few other reliable sources of mortality data exist in Darfur.

- *Lack of access to some geographical regions.* Researchers' lack of access to some geographic areas in Darfur raises concerns about the completeness of the data collected. Because of security problems, humanitarian aid organizations that typically conduct the surveys, such as Médecins Sans Frontières, and other researchers found it difficult to access all areas of Darfur, particularly South Darfur, according to several experts. In one instance, a survey conducted by the WHO in 2005 in South Darfur was suspended because of security concerns. Other surveys were also curtailed because of security concerns or attacks on NGO staff. In general, surveys were conducted primarily in camps where humanitarian relief was being provided, which could lead to underestimates of actual mortality. For example, the WHO and World Food Program note in their respective reports that their 2004 surveys may underestimate mortality, owing to their samples' exclusion of people in inaccessible areas. Additionally, one expert reported that the Sudanese government at times placed restrictions on the relief organizations collecting data and limited their access to particular camps and regions.
- *Challenging survey conditions.* Challenges in conducting household-based mortality surveys during and after humanitarian crises such as that in Darfur can affect the data's accuracy, consistency, and completeness and lead to over- or underreporting of mortality. Such challenges include linguistic and other cultural factors, difficulties resulting from the surveys' conflict or postconflict environment, and issues of recall and precision.
 - Accurate translation of surveys into foreign languages can be difficult.

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- Surveys might not be conducted in all local languages.⁴⁹
 - Definitions of a household vary.⁵⁰
 - Some people are reluctant to talk about death.
 - Some cultures will not report the deaths of infants.⁵¹
 - If all household members die, none remain to be surveyed.⁵²
 - The presence of government employees or parties to the conflict can lead to over- or underreporting.
 - A reluctance to forgo food rations may lead to underreporting of deaths in the household.
 - Dating deaths that occurred months prior to survey can be difficult.⁵³
 - The length of the survey's recall period may lead to under- or overreporting of deaths and affect the precision of estimated mortality rates.⁵⁴

⁴⁹In Darfur, for example, some surveys were conducted in Arabic and not in other local languages.

⁵⁰One expert stated that in Darfur, a household was defined as everyone who ate at the same table the previous night. This definition is important because household size is a factor in calculating crude mortality rates.

⁵¹One expert noted that certain cultures do not report the deaths of unnamed infants and, in some of these cultures, naming does not occur until an infant has lived for 40 days. Because the first 40 days of life present the highest risk of mortality, unreported infant deaths could compromise mortality estimates.

⁵²Known as "survivor bias" in the research literature. For example, see World Health Organization, "Module 4: Studying Health Status and Health Needs." (Available at http://www.who.int/hac/techguidance/tools/disrupted_sectors/module_04/en/index2.html p.3)

⁵³Known as "recall bias" in the research literature. For example, see World Health Organization, "Module 4: Studying Health Status and Health Needs." (Available at http://www.who.int/hac/techguidance/tools/disrupted_sectors/module_04/en/index2.html p.3.)

⁵⁴For example, a survey conducted by the World Food Program in the fall of 2004 had a recall period of 7 months. However, because the average length of displacement was 7.5 months, it is likely that the survey did not capture all mortality that occurred prior to displacement, some of which could have been due to violence.

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- Identifying some causes of death can be difficult.⁵⁵
 - *Insufficient training and resources among research staff.* Difficulties in training staff and assembling resources may also have affected the quality of the surveys conducted. Mortality surveys require staff who are proficient in matters such as designing questionnaires, selecting samples of the local population,⁵⁶ and conducting interviews in local languages. Although larger organizations that routinely conduct surveys generally have staff that are experienced in designing and implementing surveys, other groups may not have as much knowledge and experience in collecting data, according to experts and the research literature. Although the NGOs provide some training, high turnover rates make it difficult to retain the levels of knowledge and skill that are required.
 - *Challenges related to sampling methods.* The research literature notes that samples drawn in IDP or refugee camps may not provide an accurate count of deaths that occurred in attacks on villages and when IDPs were fleeing to the camps.⁵⁷ However, although it recognizes the difficulty of selecting and implementing an appropriate sampling method to measure violent deaths outside camps, the literature does not offer any definitive solutions.

In addition, the NGOs that conduct mortality surveys in Darfur do so primarily to monitor conditions in the camps they serve, and they generally do not disseminate the survey results. To address this problem, CE-DAT was established in 2003, under the Standardized Monitoring and

⁵⁵For example, identifying death from particular illnesses and diseases can be difficult for respondents.

⁵⁶The research literature also questions whether appropriate guidance and training in sampling are routinely provided to field staff and whether guidance is always followed when provided. See Paul B. Spiegel, Peter Salama, Susan Maloney, and Albertine van der Veen, "Quality of Malnutrition Assessment Surveys Conducted During Famine in Ethiopia," *JAMA*, vol. 292, no. 5 (2004).

⁵⁷See Jennifer Leaning and Michael VanRooyen, "An Assessment of Mortality Studies in Darfur, 2004-2005," *Humanitarian*, vol. 30 (June 2005). Also see Michel Thieren, "Health Information Systems in Humanitarian Emergencies," *Bulletin of the World Health Organization*, vol. 83, no. 8 (2005). For a discussion of possible approaches to sampling in these situations, see Holly Reed (Rapporteur), "Demographic Assessment Techniques in Complex Humanitarian Emergencies," *Summary of a Workshop* (Washington, D.C.: National Academy Press, 2002).

Assessment of Relief and Transitions (SMART) initiative,⁵⁸ to provide quick access to accurate and reliable data needed by humanitarian decision makers. However, the usefulness of the database is limited, because NGOs are not reporting the survey results systematically and because the quality of many of the reported surveys is problematic.

Moreover, mortality data from other sources, such as prospective or ongoing surveillance systems⁵⁹ that systematically record deaths, are generally unavailable in Darfur. The research literature notes that existing systems for registering or reporting deaths generally collapse when crises occur and that prospective surveillance systems established in crisis situations have limitations.⁶⁰ However, the literature also notes that data from graveyard counts and regular reporting and surveillance systems have been used in some crises, despite such limitations, in conjunction with survey-based data to estimate mortality in crisis situations.⁶¹ In Darfur, data from surveillance systems were generally not available, although one expert reported that systems had been set up in some of the larger camps by the middle of 2004. However, the expert also reported that these systems were capturing data in ways that would allow them to be used only qualitatively, rather than quantitatively, for death toll estimates.

⁵⁸SMART coordinated by USAID, involves experts from U.S. government agencies, multilateral organizations, universities, and nongovernmental organizations. SMART has issued guidance on how to measure mortality, nutrition, and food security in crisis situations. CE-DAT serves as SMART's primary data source for trend analysis and monitoring and reporting.

⁵⁹Mortality surveillance systems require teams of trained home visitors to record deaths in the population as they occur. The home visitors are assigned a specific sector of the camp or village and instructed to visit their assigned areas regularly. During their visits, they record the population size of the area and all deaths that have occurred.

⁶⁰See World Health Organization, pp. 2-3, and Bradley Woodruff, "Violence and Mortality in West Darfur," *The Lancet*, vol. 364 (2004), p. 1,290.

⁶¹See Bradley Woodruff. "Interpreting mortality data in humanitarian emergencies," *The Lancet*, vol. 367 (2006), p. 9. Also see Romesh Silva and Patrick Ball, "The Demography of Conflict-Related Mortality in Timor-Leste (1974-1999): Empirical Quantitative Measurement of Civilian Killings, Disappearances and Famine-related Deaths," in *Human Rights and Statistical Objectivity*, J. Asher, D. Banks, F. Schueren, eds. New York: Springer (forthcoming). Also see Francesco Checchi and Les Roberts, *Interpreting and Using Mortality Data in Humanitarian Emergencies: A Primer for Non-Epidemiologists*, Network Paper no. 52 (London: Humanitarian Practice Network, 2005).

Gaps in Data Leads to Reliance on Assumptions and Limited Information

Gaps in data on mortality can lead to reliance on extrapolations based on potentially risky assumptions and limited contextual information. Because the available data for Darfur cover certain geographic areas and time periods, the estimates that we examined assume that mortality rates for surveyed locations and specific periods can apply to unsurveyed locations and longer periods. Most of the experts we consulted voiced concerns about such extrapolations. Some experts noted that factors such as patterns of attack and displacement, humanitarian relief efforts, and the incidence of disease might cause mortality rates in the surveyed areas to differ from rates in the unsurveyed areas. One expert stated that he could only speculate on conditions and mortality rates in the areas that had not been surveyed. In addition, several experts expressed concern about extrapolations from limited time periods to longer periods, noting that mortality rates can change rapidly.

Some of the estimates' assumptions are informed by contextual information in the absence of data; however, this information also had limitations. For example, some estimates relied on anecdotal reports of conditions in Darfur, satellite imagery on attacks of villages, and information about weather conditions to determine appropriate mortality rates. While the experts generally approved of the use of contextual information, they did not believe that the information used could compensate for the gaps in the data.

Limitations in Population Data Affect Reliability of Death Estimates

Limitations in the population data before and during a crisis such as Darfur's can also impact researchers' ability to produce reliable death estimates. No definitive estimate of Darfur's pre-crisis population exists, and estimates of the current population vary considerably, from around 4 to 7 million. The difficulty of estimating the region's population is compounded by the fact that migration was widespread in Darfur before the crisis, making it difficult to get accurate counts. Because the death estimates essentially extrapolate the mortality rates from the surveys to the entire population affected by the crisis, an estimate of the affected population that is too high or too low will lead to an over- or underestimate of the death toll. The estimates we reviewed generally used data for the affected population that were reported in the UN Humanitarian Profiles; however, the collection and reliability of the profile

data had limitations.⁶² For example, the profiles estimated a population of more than 160,000 IDPs in Kalma camp, the largest in Darfur, prior to October 2005. Yet, a subsequent count by a relief agency in October 2005 reported only 87,000 IDPs in the camp. An expert also noted that figures based on registration can be unreliable and depend greatly on the agency responsible for registration. He stated that sources of bias include poor coverage by the agency (underestimation), as well as problems with populations' being "double-counted" to increase the amount of aid delivered (overestimation).

Varying Use of Baseline Mortality Rates Can Affect Estimates' Accuracy

Varying approaches to the selection of a baseline for normal mortality can raise or lower death estimates, possibly making the totals overly high or low. All but one of the Darfur death estimates that we examined subtract baselines for normal or expected mortality from the total deaths, based on the assumption that some deaths from disease, old age, or malnutrition would have occurred without the crisis. For example, CRED's use of a baseline mortality rate of 0.3 subtracted about 16,000 deaths from the total estimate of 134,000, resulting in 118,000 "excess" deaths. If CRED had used a baseline of 0.5, it would likely have subtracted about 26,000 deaths, obtaining a somewhat lower estimate of deaths from the crisis.⁶³

The experts we convened proposed various baseline mortality rates, ranging from 0.3 to 0.75 deaths per 10,000 affected persons per day.⁶⁴ One reason for the difference in the suggested rates is the range of methods that the experts used to select them—for example, a rate that prevailed in the country before the crisis, a standard based on prior humanitarian crises, or a rate from a comparable country in the region. However, each

⁶²Estimates of the affected population reported in the UN Humanitarian Profiles are based on data provided by international humanitarian agencies and their implementing partners; the majority of information comes from the UN World Food Program food registration. These estimates do not include residents in the three state capitals of Darfur, Nyala, El Fasher, and Geneina because their number is relatively large compared with the IDP population they are hosting. Officials from the UN Office for the Coordination of Humanitarian Affairs told us that they had had difficulty verifying the reliability of data reported and insuring the uniformity of such data.

⁶³The Darfur death estimates used different baseline mortality rates. For example, CRED used a baseline of 0.3 because UNICEF reported that as a national average prior to the conflict. State used 0.5 because that was the WHO baseline mortality rate for sub-Saharan Africa.

⁶⁴In addition, some experts felt that it was appropriate to use two rates, one for the "normal" period and one for the "emergency" period of the crisis. For example, one expert proposed 0.3 for the normal period and 0.6 for the emergency period.

of these methods has acknowledged limitations that could result in inaccurate estimates of expected rates and, therefore, in over- or underestimations of mortality due to the crisis.

In addition, the experts debated whether a baseline of any sort was justified for a humanitarian crisis such as Darfur, arguing ethical and philosophical, rather than technical, considerations. About half of the experts said that deaths that would have occurred regardless of the crisis should be subtracted from the death toll attributed to the crisis. However, two experts took a contrary position, arguing that the concept of expected or normal levels of mortality was not appropriate in the presence of genocide or ethnic cleansing because the perpetrators of those crimes against humanity should be considered culpable for all deaths that resulted from the crises they instigated.⁶⁵ Using a baseline to estimate mortality would lead to a somewhat smaller excess death toll than not using a baseline. For example, State's estimate of total deaths ranged from 98,000 to 181,000, minus 35,000 expected deaths; thus, State estimated 63,000 to 146,000 excess deaths directly resulting from the crisis.

Wide Range of Measures Could Improve Death Estimates for Darfur and Future Humanitarian Crises

The group of experts proposed and rated a wide range of measures that U.S. agencies could take directly, or support other entities in taking, to improve the quality and reliability of death estimates and relevant data for Darfur and future humanitarian crises. The measure rated most likely to produce the most improvements was ensuring sufficient public documentation of estimates' data and methods to allow replication of the methods, verification of the findings, and confirmation of the estimates' credibility and objectivity. Other highly rated measures included collecting and maintaining temporal and spatial data, housing responsibility for making the estimates in a reputable independent body, improving the training of nongovernmental organizations' staff who collect survey mortality data, and promoting an interdisciplinary approach to estimating mortality. U.S. agencies are engaged in several initiatives that address some of these measures.

⁶⁵The remaining experts either presented views for or against or did not comment on this issue. An expert who made this argument also noted that the countries with higher rates of normal mortality would attribute relatively more deaths to "normal" factors than in countries with lower mortality rates.

Proposed Measures Cover Wide Range of Activities

The experts suggested a series of measures covering a broad range of activities that U.S. agencies or other, U.S.-funded or -supported entities could take to improve death estimates for future humanitarian crises.⁶⁶ (See table 2.) Although the experts acknowledged the importance and necessity of estimating mortality—for example, to help hold perpetrators accountable and to have a complete historical record—they generally believed that death estimates should be conducted with caution. To assist in this endeavor, the experts proposed and rated 19 measures as likely to produce some improvements in data collection and mortality estimation. Some experts differed as to whether government agencies or other entities would be best placed to implement particular suggestions.

Table 2: Measures Rated by Experts as Likely to Greatly Improve Death Estimates for Future Crises, in Order of Ranking and Number of Endorsements

Measure	Number of endorsements
Ensure that publicly available documents on U.S. government estimates provide sufficient information on methods, data, assumptions, and limitations.	11
Support the collection and maintenance of temporal and spatial data.	10
House responsibility for mortality estimates in a reputable, independent body or group.	9
Improve training of NGO staff who collect mortality survey data.	9
Promote an interdisciplinary approach to estimating mortality (include epidemiologists and demographers).	9
Create technical teams, under the auspices of an international body, that can conduct mortality estimates as needed.	8
Report mortality and morbidity information more routinely and systematically to provide an ongoing sense of the situation.	8
Promote data collection by NGOs on the ground at routine service points in addition to periodic assessments.	7
Promote the use of other measures of a conflict's severity (e.g., displaced persons, number of attacks) in addition to mortality estimates.	7
Improve existing surveying techniques (e.g., cluster sampling) by incorporating spatial or temporal information.	7
Provide guidance (minimum standards) on how to design and implement survey instruments in the affected region (e.g., pretesting or translation techniques).	6
Provide guidance on amalgamating existing mortality/morbidity surveys.	5
Define criteria for selecting and using data.	4

⁶⁶The experts suggested that the U.S. agencies best able to implement these suggestions are the CDC, USAID, and State. Other, nongovernment entities include academic institutions, such as the Johns Hopkins University; multilateral organizations, such as the WHO; and NGOs such as Médecins Sans Frontières.

Measure	Number of endorsements
Make satellite tapes and imagery available to researchers.	3
Provide guidance on triangulating different types of data.	3
Provide assistance to local statistical agencies to improve data collection.	3
Develop algorithms to track population change over time.	3
Create a statistical unit under appropriate agency (possibly under auspices of the Committee on National Statistics) to be responsible for these types of estimates.	3
Tap other resources, such as pro bono groups of statisticians, that could provide assistance.	1

Source: GAO.

Note: The table is based on analysis of 12 experts in epidemiology, demography, statistics, and the Darfur crisis. Numbers shown under “Number of endorsements” represent the number of experts who rated the measure as likely to “very greatly” or “greatly” to improve the estimates. In several instances, one or two experts noted problems with suggestions that had been highly rated by others. The experts rated an additional measure for the Darfur crisis, namely, whether an independent agency should conduct a retroactive assessment.

Majorities of the experts rated 10 of the 19 measures, and 9 of the 12 experts rated 5 of the measures, as likely to “very greatly” or “greatly” improve the estimates for future crises.⁶⁷ Following are the 10 most highly rated measures:

- *Ensure that publicly available documents on the U.S. government estimates provide sufficient information on methodology.* Sufficient documentation and transparency of data and methods are needed to allow independent researchers to verify the reliability and validity of estimates. Although this suggestion would not improve the estimates per se, experts felt that it was important for establishing the credibility of the estimates.
- *Support the collection and maintenance of temporal and spatial data.* Temporal and spatial databases would allow researchers to track mortality over time and across regions and could improve researchers’ ability to estimate mortality. Experts suggested that temporal and spatial data could be collected in a number of ways, including through the use of satellite imagery.
- *House responsibility for mortality estimates in a reputable, independent entity or group.* Experts indicated that an independent entity could be perceived as free of bias, political goals, or both. However, such an entity would need adequate funding, and experts had differing views as to where it should be housed. One expert felt it could be placed under a U.S.

⁶⁷Experts rated the measures using the following 5-point scale: “Very greatly improve,” “Greatly improve,” “Moderately Improve,” “Somewhat Improve,” and “Not improve.”

organization such as the CDC, while another felt it should be under an international organization such as the WHO.

- *Improve training of NGO staff who collect mortality survey data.* Because NGO staff conduct most of the surveys, improving their training would help improve the quality of data collected. Several experts reported the existence of initiatives to improve and standardize NGOs' data collection in emergencies, such as the SMART initiative, and of guidance on the topic from the World Food Program and the WHO. Some experts suggested expanding these efforts with additional U.S. government support.
- *Promote an interdisciplinary approach to estimating mortality (include epidemiologists and demographers).* Because epidemiologists and demographers bring different expertise and perspectives to mortality estimation, collaboration between the disciplines could lead to greater understanding of each other's approaches and, ultimately, to more integrated methodologies for death estimates.
- *Create technical teams, under the auspices of an international body, that can conduct mortality estimates as needed.* Technical teams, assembled as needed and operating under independent organizations, could—rather than a single, permanent independent entity—be responsible for conducting death estimates. Such teams might be perceived as free of bias and political goals, which would increase the credibility of their findings. However, some experts reported that such technical teams already exist, citing as examples the WHO, the International Rescue Committee, and Médecins Sans Frontières, among others.⁶⁸
- *Report mortality and morbidity information more routinely and systematically to provide an ongoing sense of the situation.* This suggestion is intended to allow researchers and governments to monitor crises as they develop. Although this suggestion was relatively highly rated, experts had some questions about who would do the reporting, how the data would be gathered, and how the estimates would be made. One expert noted that groups like CRED are currently reporting such mortality and morbidity information somewhat routinely and systematically.

⁶⁸One expert felt that it would be preferable for the U.S. government to support the existing technical teams.

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- *Promote data collection by NGOs on the ground at routine service points, in addition to periodic assessments.* Proponents stated that humanitarian relief organizations could collect data on famine-related deaths and that human rights organizations could collect narrative testimonies about political violence and conflict-related displacement. Some experts believed that the NGOs could collect these data with little additional time or expense and that the data collection could help create an early warning system for famine and diseases. However, several experts were concerned that data collected at routine service points would provide biased estimates because certain segments of the affected population would not be likely to pass through these points.
 - *Promote the use of other measures of a conflict's severity (e.g., displaced persons, number of attacks) in addition to mortality estimates.* Such alternative estimates could provide insights into crises and help check the accuracy of the mortality data. These estimates could include conflict-related displacement, property destruction, property looting, exposure to violence as a marker for psychological trauma, incidence of sexual and gender-based violence, forced displacement, and data from security incidence reports. One expert indicated that some of these data are probably being collected by various human rights agencies and organizations and suggested creating a body to collate and report their data.
 - *Improve existing surveying techniques (e.g., cluster sampling) by incorporating spatial or temporal information.* A few experts felt that improvements in surveying techniques were needed because of limitations in certain aspects of cluster sampling, the most commonly used technique; however, another expert stated that cluster sampling⁶⁹ was extremely useful. One expert argued that existing surveying techniques should take into account the spatial and temporal distribution of the affected population.

⁶⁹Cluster sampling is a simple method that can be used to draw a representative sample even where there is no listing, or known total number, of households (that is, no individual household sampling frame) and where households are arranged in a chaotic pattern, as if often the case in IDP camps. See Francesco Checchi and Les Roberts, *Interpreting and Using Mortality Data in Humanitarian Emergencies: A Primer for Non-Epidemiologists*, Network Paper no. 52 (London: Humanitarian Practice Network, 2005).

Existing U.S. Initiatives May Improve Some Aspects of Data and Death Estimates

Several current U.S. initiatives may enhance the availability and quality of mortality data and produce more accurate death estimates for Darfur and other similar crises in the future. These initiatives embody several of the measures rated by the group of experts as likely to improve death estimates; however, several of the experts, as well as U.S. officials knowledgeable about the initiatives, whom we spoke with indicated that more can be done.

- *CE-DAT* may improve death estimates through its promotion of more routine reporting of mortality and morbidity information and defining some criteria based on methodological requirements for assessing the quality of data. In addition, CE-DAT includes a cartographical database to link indicators to maps, which aligns with the experts' recommendation for collecting and maintaining spatial and temporal data. CE-DAT staff discussed some limitations, with respect to the data in the database, including the fact that information is not provided to CE-DAT routinely and CE-DAT is not widely known. CE-DAT staff also said that there is currently no systematic means of verifying data reliability and validity of data and making data publicly available in a timely manner.
- *SMART*, an interagency initiative coordinated by USAID, may improve death estimates through its promotion of a standard methodology to design and implement survey instruments that measure crude mortality, as well as other indicators of need.⁷⁰ According to a USAID official, SMART is also intended to help build the technical capacity of NGO field workers and host government partners to collect and report more reliable data. To this end, the SMART initiative aligns with some of the recommendations made by our group of experts, including, improving the training of NGO staff that collect mortality data and reporting mortality and morbidity data more routinely and systematically. Experts and officials whom we spoke with generally agreed that the idea behind SMART represents positive steps toward improving mortality data collection. However, they also discussed various limitations of the initiative. For example, an official involved with the effort noted that that funding has been at times sporadic and that limited resources have stymied outreach efforts. Others stated that some of SMART's methodological principles need further research and testing in the field and that no consensus currently exists regarding some of these principles. Officials from USAID indicated that SMART's major components, including mortality, nutrition, and food security, have been piloted in several countries and that the SMART methodology is

⁷⁰SMART initiative is aimed at improving the monitoring, reporting, and evaluation of humanitarian assistance interventions. (See www.smartindicators.org.)

meant to be iterative with continuous upgrading based on further research and best practices.

- *The Humanitarian Information Unit*, housed in State's Bureau of Intelligence and Research, may enhance the quality and availability of spatial and temporal information used in future death estimates through its current efforts to develop maps and other visual images of humanitarian crises. For example, for the Darfur crisis, it has developed a series of maps showing the number of destroyed villages or reported attacks in the region at different points in time based on data from satellite imagery or reports from on the ground organizations such as the African Union, the UN, and USAID. The unit's work also addresses two additional suggested measures—promoting the use of other measures of conflict and improving existing surveying techniques by incorporating spatial and temporal data. However, the Humanitarian Information Unit, in some cases, has had difficulty obtaining standardized, reliable, or complete data. Additionally, the unit does not consistently and systematically collect data, such as preconflict population estimates, in part because the unit performs its work upon request.
- *The International Emergency and Refugee Health Branch of the CDC* may improve death estimates and the collection of mortality data through its provision of technical assistance to UN and U.S. agencies collecting data in complex emergencies and its support of the collection of spatial and temporal data.⁷¹ However, officials from the International Emergency and Refugee Health Branch stated that because it often works as a consultative body and its resources are constrained, the scope of its work is limited.

Several international initiatives also address problems with data collection and analysis. The WHO plans to implement a Health and Nutrition Tracking Service that would routinely monitor mortality and malnutrition during major crises and provide a central help desk, remotely located, for field staff conducting surveys. Additionally, the World Food Program has created a manual on survey techniques to measure health and nutrition indicators, including crude mortality.

The group of experts we convened were generally aware of, or involved, with these U.S. government and international initiatives, as well as some

⁷¹For example, members from the International Emergency and Refugee Health Branch provided technical training on data collection to the World Food Program for two mortality surveys conducted in Darfur.

NGO initiatives, that addressed certain aspects of their suggestions. For example, three experts assisted in the development of the SMART guidelines, and two of the three were also technical advisors for the CE-DAT initiative. Some experts felt that certain suggestions could be met by investing more in these existing initiatives rather than by creating new ones. U.S. officials responsible or aware of these initiatives also acknowledged limitations with several of these or thought that more could be done with respect to the measures suggested by the experts.

Conclusions

Despite variance among the death estimates we reviewed, each of the estimates shows, tragically and unquestionably, that many thousands of civilians died in Darfur between February 2003 and August 2005. Given the continuing conflict, insecurity, and displacement in the region, many more have undoubtedly died since the estimates were conducted, as a direct result of violence or because of increased vulnerability to disease and malnutrition. However, despite the importance of the death estimates in showing the severity of the crisis, none of the estimates consistently received high ratings in terms of accuracy or methodological strengths from the experts we convened. Some of the shortcomings in the estimates' source data, methods, and objectivity may be attributed to challenges in mortality data collection and extrapolation, characteristic of a humanitarian crisis such as Darfur. However, in certain cases, a lack of transparent reporting of an estimate's data, methods, assumptions, or limitations hindered the experts from replicating it and thus verifying its accuracy and credibility. In particular, many experts noted the unavailability of these published details—and the resulting lack of transparency—for State's estimate.

Several ongoing U.S. initiatives may produce enhancements that align with the experts' suggested measures for addressing gaps in data and improving death estimates conducted for Darfur and any similar humanitarian crises in the future. For example, the SMART initiative and CE-DAT, respectively, provide guidance on how to design and implement surveys and promote more routine reporting of mortality and morbidity data. However, experts and U.S. government officials observed that gaps in these areas still exist. Among the measures that have not been addressed, the one that the experts rated most highly—ensuring the public availability of information on estimate methods, data, assumptions, and limitations—is essential to protect the credibility of U.S. government death estimates for Darfur and any future humanitarian crises.

Recommendations for Executive Action

To safeguard the Department of State's credibility as a source of accurate and reliable death estimates, we recommend that the Secretary of State promote greater transparency in any of its future death estimates for Darfur or other humanitarian crises by ensuring that publicly available documents contain sufficient detail on the estimates' data, methods, assumptions, and limitations to allow external researchers to replicate and verify the estimates.

Additionally, to enhance the U.S. government's capacity to assess the dimensions of, and respond appropriately to, any future humanitarian crises, we recommend that the Secretary of State and the Director of U.S. Foreign Assistance and USAID Administrator consider the experts' other suggested measures to help address gaps in data and improve the quality and reliability of any future death estimates.

Agency Comments and Our Evaluation

We provided a draft of this report to the Department of State and USAID. State and USAID responded with formal comments, agreeing with our recommendations, and State provided additional perspectives on reporting and documentation regarding its death estimate. Reproductions of these letters, as well as our responses to the letters, can be found in appendixes VI and VII. We also provided a draft to the CDC for technical review, and we received technical comments from both the CDC and State, which we incorporated in the report as appropriate.

We provided the authors of the other five estimates the portions of the report pertaining to their individual estimates. The authors of the CRED estimates agreed with the experts' evaluation. Jan Coebergh did not provide any major comments regarding the relevant portion of the report and indicated that he was aware of the limitations of his estimate. John Hagan expressed concerns regarding the experts' relatively positive evaluation of the estimates by CRED and State and believed we should have included the estimate he did with Alberto Palloni in our evaluation. David Nabarro from the WHO disagreed with our inclusion of his estimate with the others in the report and said that we had not clearly conveyed the estimate's purpose. Eric Reeves disagreed with the experts' criticism of the Atrocities Documentation Team's survey of Chad refugees, stating that the survey was well conducted and a critical source of data to estimate violent deaths, particularly early on in the conflict when little data was available. More details on the authors' comments and our responses can be found in appendix VIII.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the

report date. At that time, we will send copies of this report to the Secretary of State, the Director of U.S. Foreign Assistance and USAID Administrator, the Director of the CDC, relevant congressional committees, and other interested parties. We will also make copies available to others on request. In addition, the report will be available on GAO's Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact either David Gootnick at (202) 512-3149 or gootnickd@gao.gov, or Nancy Kingsbury at (202) 512-2700 or kingsburyn@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors are listed in appendix IX.



David Gootnick, Director
International Affairs and Trade



Nancy Kingsbury, Managing Director
Applied Research and Methods

Appendix I: Objectives, Scope, and Methodology

This report (1) evaluates the relative accuracy and methodological strengths and shortcomings of six death estimates for Darfur, including one by the Department of State (State); (2) identifies general challenges to estimating the total death toll in Darfur and similar humanitarian crises; and (3) discusses measures that the U.S. government could take to improve its death estimates for Darfur and any similar, future crises.

To evaluate the relative accuracy and methodological strengths and shortcomings of the Darfur death estimates, we selected estimates that had been made public prior to March 2006. We imposed this cutoff point so that we could interview the authors, prepare materials for the experts, and give the experts time to review the materials. Because our cutoff point was March 2006, the convening experts' discussion was of death estimates that spanned various time periods between February 2003 and August 2005. Our findings do not, therefore, discuss any estimates that were made after March 2006.

Additionally, to address these objectives, we convened, in collaboration with the National Academy of Sciences, 12 experts for an all-day meeting on April 7, 2006, in Washington, D.C., to discuss the six death estimates. (Two additional experts also participated by phone for parts of the day.) The academy proposed lists of experts, and we approved their final selection. The selected experts had extensive knowledge of estimating mortality rates and death totals in conflict and postconflict situations or other types of humanitarian crises and were familiar with the sorts of data and estimates that have been produced for the Darfur crisis or other such crises in Africa. Additionally, the selected experts represented a range of professional experiences and backgrounds, including epidemiologists, demographers, statisticians, and directors of aid programs currently in Darfur. They were affiliated with various organizations, including universities, U.S. government and United Nations (UN) agencies, and humanitarian aid and nonprofit organizations based in the United States, as well as overseas. All of the experts signed a form from the National Academy of Sciences certifying that they had no conflicts of interest that could compromise their ability to assess the death estimates objectively. Some experts reported they had had professional contact with several of the authors.

During the meeting, the experts discussed their evaluation of each of the Darfur death estimates, as well as challenges to estimating total deaths for Darfur and similar crises and measures to improve such estimates. The meeting was recorded and transcribed to ensure that we accurately captured the experts' statements, and we reviewed the transcripts as a

source of evidence. (See app. II for a list of the experts' names and affiliations and a summary of the meeting agenda and discussion questions.)

In addition, prior to the meeting, we reviewed and analyzed public information on the estimates, including documents describing the estimates and source data for the estimates and provided this information to the experts.¹ The source data documents that we reviewed included 15 reports of health, nutrition, and mortality surveys; State publication describing the July-August 2004 survey with refugees in Chad; and volumes of the UN Nutrition Information in Crisis Situations containing descriptions of additional health, nutrition, and mortality surveys of which we were unable to obtain full reports. (See app. III for a complete list of published documents that were provided to the experts.) We also provided the experts supplemental information on the design, sampling and implementation of the Atrocities Documentation Team's survey of Chad refugees and a copy of the survey instrument, which we obtained from representatives of the Coalition of International Justice. Additionally, we interviewed the estimates' authors regarding the data, methods, and objectives of their work and replicated their estimates when we had sufficient information. We provided summaries of these interviews to the experts, as well as replications of the estimates, reviewed and approved by the authors, in advance of the meeting. We spoke with all of the estimate authors except State's Bureau of Intelligence and Research, which declined to speak with us or provide additional information. Although this limited the ability of our experts to fully understand State's methods of analysis as noted during their discussion, the experts were able to discuss State's estimate in detail and provide assessments of its data, methods, objectivity, limitations, and accuracy.

Following the meeting, we also asked the experts to answer additional questions on each estimate, as well as questions on suggested measures to improve estimates through a follow-up data collection instrument. We developed the instrument with the help of survey specialists and based the questions in the instrument on the meeting agenda and points that arose during the meeting deliberations. We pretested the instrument with two

¹As noted in the report, we and the group of experts also reviewed a preliminary death estimate for West Darfur by John Hagan and Alberto Palloni, but we do not discuss the estimate in this report because the estimate had not been published. The authors told us that the version of the estimate they gave us was preliminary and that they were working on a more refined version of the estimate using different methods.

experts and made changes based on their input. We administered the instrument via e-mail and received responses from all 12 of the experts who attended the meeting in Washington, D.C. In some instances, we contacted the respondents by e-mail or phone to obtain greater clarity or details regarding their answers.

Further, to identify challenges involved in estimating total deaths in humanitarian crises, such as that in Darfur, we asked the group of experts to highlight key challenges during their discussion, and we reviewed literature related to death estimates and mortality data for humanitarian crises. We summarized the parts of the experts' discussion that most directly addressed challenges, and we identified themes that were raised by the experts. The literature we reviewed included articles that we identified through databases, such as ProQuest, Lexis Nexis, and Medline, using various search terms, such as *mortality estimates*, *death estimates*, *humanitarian crisis(es)*, *conflict(s)*, or *(complex) emergency/emergencies*. We also reviewed literature cited in these articles and on Web sites related to humanitarian assistance or data analysis in humanitarian crises, as well as literature recommended by the group of experts² and the authors of the estimates. In total, we reviewed about 20 articles. We organized the individual challenges identified by the experts and in the literature according to the two overarching themes we identified from the experts' discussion and from the literature: (1) challenges affecting the source data used for the death estimates and (2) challenges affecting the generation of the death estimates. We also provided portions of the draft pertaining to the challenges to conducting death estimates as well as the background regarding mortality surveys to several of the experts we convened and incorporated their technical comments into the final version of the report.

Finally, to identify measures that the U.S. government could take to improve death estimates for Darfur and in future humanitarian crises, we asked the experts to provide suggestions during the meeting and solicited further opinions on these suggestions in the follow-up instrument. The instrument listed 19 measures that the experts had suggested as likely to improve death estimates for Darfur and such crises that may occur in the future and asked the experts to rate them with a five-point scale, ranging

²Over half of our experts were also authors or coauthors on some of the articles we reviewed.

from “Very greatly improve” to “Not improve.”³ We ranked the measures according to the numbers of respondents that rated them “Very greatly improve” and “Greatly improve.” The instrument also asked for experts’ comments on each of the suggested measures, and we followed-up with some experts to get additional information regarding comments on suggested measures, particularly with respect to current efforts. Additionally, we spoke with officials from the U.S. Agency for International Development, State, and the Department of Health and Human Services’ Centers for Disease Control and Prevention to learn of any current U.S. government initiatives related to the suggested measures. We also reviewed public information and documents provided by the officials and available on the Internet that describe efforts by the U.S. government, as well as other international initiatives.

We conducted our work in San Francisco and Washington, D.C., from September 2005 to November 2006 in accordance with generally accepted government auditing standards.

³The experts also rated an additional measure for the Darfur crisis regarding whether an independent agency should conduct a retrospective assessment.

Appendix II: List of Experts and Meeting Agenda

This appendix provides the names and affiliation of the experts participating in the meeting held on April 7, 2006, in Washington, D.C., and a summary of the day's discussion questions.

List of Experts

The following experts attended the meeting:

- Jana Asher, American Association for the Advancement of Science
- Richard Brennan, Health Unit, International Rescue Committee
- Francesco Checchi, London School of Hygiene and Tropical Medicine
- Allan Hill, Harvard School of Public Health, Harvard University
- Arif Husain, Vulnerability Analysis and Mapping Unit, United Nations World Food Program
- Mark Myatt, University College of London
- W. Courtland Robinson, Bloomberg School of Public Health, Johns Hopkins University
- William Seltzer, Department of Sociology and Anthropology, Fordham University
- Romesh Silva, Human Rights Data Analysis Group, The Benetech Initiative
- Michael VanRooyen, Program on Humanitarian Crises and Human Rights, Harvard University
- Ronald Waldman, Mailman School of Public Health, Columbia University
- Bradley Woodruff, Maternal and Child Nutrition Branch, U.S. Centers for Disease Control and Prevention

The following experts participated in the meeting by phone for parts of the day:

- Bushra Gamar Hussein, Darfur Region, Sudan Social Development Organization
- Jennifer Leaning, Harvard School of Public Health, Harvard University

Summary of Meeting
Discussion Questions

Darfur Death Estimates

- Are the source data used in each of the estimates sufficiently representative and reliable?
- To what extent do the methods used in each of the estimates follow principles that are generally accepted in the field?
- Do the key assumptions made in the estimates seem reasonable?
- How accurate or inaccurate do you think each of these estimates are in terms of representing the actual number of deaths that occurred in Darfur during the time period and regions under consideration?
- For each of the estimates, is sufficient information presented in the reports to adequately assess the strengths and weaknesses and/or the reasonableness of the estimates? Do you understand the processes by which the estimates were derived?
- What are the major strengths and limitations of each of these estimates for Darfur?

Challenges to Estimating Total Deaths for Darfur and Similar Crises

- In your opinion, what sources of data for what time periods and locations would be necessary to produce reasonably precise estimates of death totals for Darfur?
- What general observations do you have concerning the challenges of estimating total deaths in Darfur?

Implications for the U.S. Government: Ways to Improve Death Estimates for Darfur and Future Crises

- In your view, are there any lessons learned about conducting death estimates in Darfur for the U.S. government? If so, what are these?
- Are there measures the U.S. government could take or promote to improve estimates for Darfur or similar crises in the future?

Appendix III: List of Death Estimates and Mortality Surveys Provided to Experts and Additional Bibliographical References

Death Estimates¹

Estimate by the U.S. Department of State

- State Department's Fact Sheet, "Sudan: Death Toll in Darfur," March 25, 2005. www.state.gov/s/inr/rls/fs/2005/45105.htm (Viewed, August 24, 2006)
- M. Phelan in D. Guha-Sapir and O. Degomme, "Darfur: Counting the Deaths" (Method 2). Centre for Research on the Epidemiology of Disasters (CRED). Brussels: May 26, 2005. www.cred.be/docs/cedat/DarfurCountingTheDeaths-withClarifications.pdf (Viewed October 23, 2006)

Estimate by the Centre for Research on the Epidemiology of Disasters: Debarati Guha-Sapir and Olivier DeGomme

- Guha-Sapir, D., O. Degomme, and M. Phelan, "Darfur: Counting the Deaths" (Method 1). Centre for Research on the Epidemiology of Disasters (CRED). Brussels: May 26, 2005. www.cred.be/docs/cedat/DarfurCountingTheDeaths-withClarifications.pdf (Viewed October 23, 2006)
- Guha-Sapir, D. and O. Degomme, "Darfur: Counting the Deaths (2): What are the trends?" Centre for Research on the Epidemiology of Disasters (CRED). Brussels: December 15, 2005. www.cred.be/docs/cedat/DarfurCountingTheDeaths2.pdf (Viewed October 23, 2006)

Estimate by Jan Coebergh

- Coebergh, J. "Sudan: genocide has killed more than the tsunami." *Parliamentary Brief*, vol. 9, no. 7, pp. 5-6 (February 2005). www.thepolitician.org/ (Viewed, August 24, 2006)

Estimate by John Hagan, Wenona Rymond-Richmond, and Patricia Parker and announced by the Coalition for International Justice

- Coalition for International Justice Press Release, "New Analysis Claims Darfur Deaths Near 400,000." April 21, 2005.

¹As noted in the report, the experts reviewed a death estimate of West Darfur by John Hagan and Alberto Palloni, but this estimate is not discussed in this report because it was not publicly available.

- Hagan, J., W. Rymond-Richmond, and P. Parker, "The Criminology of Genocide: The Death and Rape of Darfur," *Criminology*, vol. 43, no. 3, pp. 525-561 (July 2005).

Estimate by Eric Reeves

- Portions of mortality updates from www.sudanreeves.org. (Reviewed by author.) Dr. Reeves began reporting his mortality updates in June 11, 2004. The most recent update reviewed by the experts was from August 31, 2005.

Estimate by the World Health Organization

- Nabarro, D. "Mortality Projections for Darfur," World Health Organization Briefing presented October 15, 2004. www.who.int/mediacentre/news/briefings/2004/en (Viewed, August 24, 2006)

Surveys Used in Estimates as Data Sources

State or regionwide estimates

- U.S. Centers for Disease Control and Prevention and UN World Food Program, "Emergency Nutrition Assessment of Crisis Affected Populations Darfur Region, Sudan, August-September 2004." www.reliefweb.int/library/documents/2004/wfp-sdn-26ocr.pdf. (Viewed, August 24, 2006)
- UN World Food Program, "Emergency Food Security and Nutrition Assessment in Darfur, Sudan." (Rome, Italy: World Food Program, October 2004). www.wfp.org/country_brief/africa/sudan/assessments/041025_food_assessment.pdf (Viewed, August 24, 2006)
- World Health Organization, "Retrospective Mortality Survey Among the Internally Displaced Population Greater Darfur, Sudan 2004." September 15, 2004. www.reliefweb.int/library/documents/2004/who-sdn-15sep.pdf (Viewed, August 24, 2006)
- World Health Organization, "Mortality Survey among Internally Displaced Persons and Other Affected Populations in Greater Darfur, Sudan." September 2005. www.emro.who.int/sudan/pdf/CMS%20Darfur%202005%20final%20report_11%2010%2005.pdf (Viewed, August 24, 2006)

North Darfur

- Dubray, C., “Health assessment in emergencies: Serif Umra, North Darfur, Sudan.” Epicentre and Medecins Sans Frontiers. November 2004.
- Sibson, V., “Findings of a nutrition survey of Kutum town, Kasab camp and Fata Borno, North Darfur.” GOAL. May 2005.²

West Darfur

- Abadallah, S., “Report of rapid baseline survey Azirni, Sanidadi and Um Tagouk.” Center for International Emergency, Refugee and Disaster Studies, Johns Hopkins University and World Relief. October 12, 2004.
- Deconinck, H. and O. Karouri, “Nutrition assessment; Fur Baranga, Administrative Unit, Habila Locality, West Darfur, Sudan.” Save the Children, USA. January 14-17, 2005.
www.humanitarianinfo.org/darfur/uploads/assessments/fb%20nutrition%20survey%20report%20jan%2005.doc (Viewed, August 24, 2006)
- Depoortere, E., F. Checchi, F. Broillet, S. Gerstl, A. Minettia, O. Gayraud et al., “Violence and mortality in West Darfur, Sudan (2003-2004): epidemiological evidence from four surveys” *Lancet*, vol. 364, no. 9442, pp. 1,315-1,320 (2004). www.msf.fr/documents/base/2004-10-01-Depoortere.pdf (Viewed, August 24, 2006)
- Depoortere, E., “Health assessment in emergencies: Murnei and Zalingei, West Darfur, Sudan.” Epicentre and Médecins Sans Frontières. (Paris, France: Médecins Sans Frontières, June 2004).
www.doctorswithoutborders.org/publications/reports/2004/epicentre_report_darfur_05-2004.pdf (Viewed, August 24, 2006)
- Hearn, A. and A. Agar, “Nutritional Survey, Mornei Camp, January-February 2005.” Concern Worldwide in collaboration with State Ministry of Health and UNICEF.

²Survey included in CRED December 2005 update. Note: the report included here was only publicly available in HTML format. Therefore, some of the appendixes and formatting did not come through.

- Rio, D., “Nutrition and Food Security Assessment, Wade Saleh and Mukjar Provinces, West Darfur, North-Sudan.” Médecins Sans Frontières Holland. April 2004.
- West Darfur State, Ministry of Health in collaboration with UNICEF, Concern and Save the Children-US. “Nutrition and Mortality Survey in Ardamat, Dorti, Riyadh and Abu-zar IDP camps.” June 14-18, 2005.

South Darfur

- Grandesso, F., F. Sanderson, J. Kruijtit, T. Koene, and V. Brown, “Mortality and Malnutrition among Populations Living in South Darfur, Sudan.” *JAMA*, vol. 293, no. 12, pp. 1,490-1,494 (March 2005). <http://jama.ama-assn.org/cgi/content/abstract/293/12/1490> (Viewed, August 24, 2006)

Chad

- United Nations High Commissioner for Refugees et al., “Emergency Nutrition and Mortality Surveys Conducted among Sudanese Refugees and Chadian Villagers, Northeast Chad, June 2004.” http://www.cdc.gov/nceh/ierh/ResearchandSurvey/Chad_report04.pdf (Viewed, August 24, 2006)

Other Information Provided

- UN Nutrition Information in Crisis Situations, volumes 3, 4, 6, 7 from 2004 and 2005. <http://www.unsystem.org/scn/publications/RNIS/countries/sudan.htm> (Viewed, August 24, 2006)
- Bureau of Democracy, Human Rights and Labor and Bureau of Intelligence and Research, Department of State, “Documenting Atrocities in Darfur,” Publication 11182 (Washington, D.C.: Bureau of Democracy, Human Rights, and Labor and the Bureau of Intelligence and Research, September 2004). <http://www.state.gov/g/drl/rls/36028.htm> (Viewed, August 24, 2006)

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**Appendix III: List of Death Estimates and
Mortality Surveys Provided to Experts and
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Appendix IV: Summary Description of Death Estimates Reviewed

Estimate by Jan Coebergh

Reported figures	<ul style="list-style-type: none"> • Three possible point estimates for excess deaths: 218,449; 253,573; or 306,130 represent a range of death estimates all above 200,000.
Time period covered	<ul style="list-style-type: none"> • April 2003 through December 2004.
Total number of months	<ul style="list-style-type: none"> • 21
Data sources	<ul style="list-style-type: none"> • Uses varied sources including Atrocities Documentation Team's survey of Chad refugees based on number of people who reported seeing family member killed, 2004 mortality surveys by World Health Organization (WHO) and Médecins Sans Frontiers and estimates by WHO officials. • Does not use any contextual or nonsurvey information.
Mortality rates applied and cause of death	<ul style="list-style-type: none"> • Calculates violent and nonviolent deaths separately. • <i>306,130</i>: Includes nonviolent and violent deaths. About 170,000 from violence, 108,000 from health causes, and 25,000 in inaccessible areas. • <i>218,449</i>: Includes nonviolent and violent deaths. About 73,700 from violence and 126,000 from health causes • <i>253,573</i>: Includes nonviolent and violent deaths. About 111,000 from health causes and about 143,000 from violence • Applies some daily mortality rates; other mortality rates are monthly or for longer periods of time.
Mortality changes over time and/or region	<ul style="list-style-type: none"> • Assumes the same mortality levels over time and per region.
Baseline crude mortality rate assumed	<ul style="list-style-type: none"> • 0.5
Affected population included in estimate	<ul style="list-style-type: none"> • Uses one "fixed" population estimate of 400,000 which is the average of an assumed starting point of 0 in February 2003 and 800,000 in April 2004. (Affected population does not change over time.) • Estimate includes affected population from all regions in Darfur and refugees in Chad.

**Appendix IV: Summary Description of Death
Estimates Reviewed**

Centre for Research on the Epidemiology of Disasters (CRED): Two Estimates

Reported figures	<ul style="list-style-type: none"> 134,000 total deaths. 118,142 excess deaths. 	<ul style="list-style-type: none"> 36,237 total deaths. 23,658 excess deaths.
Time period covered	<ul style="list-style-type: none"> September 2003 through January 2005. 	<ul style="list-style-type: none"> February 2005 through June 2005.
Number of months	<ul style="list-style-type: none"> 17 	<ul style="list-style-type: none"> 5
Data sources	<ul style="list-style-type: none"> Examines data from about 20 mortality surveys. About half of these were used to estimate nonviolent mortality rates, and half were used to analyze the proportion due to violence. (Surveys used depended on what surveys reported the proportion of deaths due to violence.) Some steps were taken to examine the reliability of methods used in the surveys and exclude outliers. 	<ul style="list-style-type: none"> Examines about 10 surveys conducted between January and August 2005; however, primarily uses findings from the 2005 statewide WHO survey because these results did not differ with other smaller surveys that covered the same period.
	<ul style="list-style-type: none"> Relies mainly on mortality survey findings and uses other sources of contextual or nonsurvey information to refine both estimates. 	
Mortality rates applied and cause of death	<ul style="list-style-type: none"> Estimates nonviolent and violent deaths separately. Total crude mortality is nonviolence crude mortality divided by (1 minus the proportion due to violence). Nonviolent mortality is generally assumed stable except for the hunger (or rainy season) during June through August 2004. Proportion due to violence is based on a regression analysis of survey data. 	<ul style="list-style-type: none"> 2005 WHO survey findings include crude mortality rates and proportion of deaths due to violence or injury.
Mortality changes over time and/or region	<ul style="list-style-type: none"> Nonviolent mortality rate is assumed stable at 1.1 for all regions except June through August 2004 for which rates are higher due to impact of rainy season. (Rates used are based on results from the 2004 WHO survey for each region.) Based on regression analysis, proportion of violence generally decreases over time beginning December 2003 to January 2005. Prior to December 2003, assumes steady rate of violence. Assumes some difference in violence between regions. 	<ul style="list-style-type: none"> Assumes different mortality levels per region but no difference over time from February to June 2005. Shows increase in violence for North Darfur from last estimate.
Baseline crude mortality rate assumed	<ul style="list-style-type: none"> 0.3 based on national average from the United Nations Children's Fund (UNICEF). 	
Affected population included in estimate	<ul style="list-style-type: none"> Assumes different monthly estimates of the affected population based on information from the United Nations Humanitarian Profiles for each Darfur state from September 2003 till January 2005. Excludes deaths from isolated areas with high violence rates in South Darfur after September 2004. Adds additional 200,000 for Chad refugees; their deaths estimated as 10% of the total excess deaths estimated. 	<ul style="list-style-type: none"> Assumes different monthly estimates separated by internally displaced persons (IDP) and affected residents based on information from the United Nations Humanitarian Profiles. Includes all regions in Darfur. Applies different mortality rates to groups of affected residents, IDPs in camps, IDPs outside camps (did not do this in first estimate).

**Appendix IV: Summary Description of Death
Estimates Reviewed**

Estimate by John Hagan and Others and Released by the Coalition for International Justice

Reported figures	<ul style="list-style-type: none">• 396,563 total deaths.
Time period covered	<ul style="list-style-type: none">• February 2003 through March 2005.
Total number of months	<ul style="list-style-type: none">• 26
Data sources	<ul style="list-style-type: none">• Uses Atrocities Documentation Team's survey of Chad refugees to estimate violent deaths based on number of people who reported seeing a family member killed.• Uses 2004 WHO mortality survey findings for North and West Darfur to estimate nonviolent deaths.• Does not use any contextual or nonsurvey information.
Mortality rates applied and cause of death	<ul style="list-style-type: none">• Nonviolent mortality rate is on a combination of findings from North and West Darfur WHO survey.• Violent mortality rate is calculated based on survey of Chad refugees and assumptions include that all missing persons have died and that the average family size is five.
Mortality changes over time and/or region	<ul style="list-style-type: none">• Assumes the same mortality levels over time and per region.
Baseline crude mortality rate assumed	<ul style="list-style-type: none">• 0 (Did not apply a baseline mortality rate because believed it was not appropriate.)
Affected population included in estimate	<ul style="list-style-type: none">• Uses a single estimate of 1.5 million, as of April 2005, to include IDP population from all regions in Darfur and refugees in Chad. 1.5 million is the midpoint between 1.2 and 1.8 million. (1.2 comes from State's Documenting Atrocities Report, and 1.8 was stated as widely cited as the affected population in early 2005.)

**Appendix IV: Summary Description of Death
Estimates Reviewed**

Estimate by Eric Reeves

Reported figures	<ul style="list-style-type: none"> Over 370,000 excess deaths.¹
Time period covered	<ul style="list-style-type: none"> February 2003 through August 2005.
Number of months	<ul style="list-style-type: none"> 31
Data sources	<ul style="list-style-type: none"> Uses varied sources such as the Atrocities Documentation Team's survey of refugees in Chad, the 2005 WHO mortality survey, communication from David Nabarro, and projections from the Department of U.S. Agency for International Development. Uses contextual or nonsurvey data in various calculations, such as mortality rates for inaccessible populations.
Mortality rates applied and cause of death	<ul style="list-style-type: none"> Generally estimates nonviolent and violent deaths separately. Survey of Chad refugees to estimate violent deaths based on number of people who reported seeing family member killed. Estimates some mortality rates per day; estimates other rates per month or longer periods of time.
Mortality changes over time and/or region	<ul style="list-style-type: none"> Assumes some changes in mortality over time. Generally does not assume different mortality rates per region except for populations in inaccessible areas.
Baseline crude mortality rates	<ul style="list-style-type: none"> 0.3 based on UNICEF.
Affected population included in estimate	<ul style="list-style-type: none"> Assumes affected population changes somewhat over time, although not on a monthly basis. Uses information from UN profiles, as well as other sources. For example, in some cases, assumes some groups are excluded from UN profiles and increases numbers accordingly. Includes affected population from all regions in Darfur and Chad refugees.

¹This figure is from an August 2005 estimate that was the latest available at the time the group of experts convened, and this was reviewed. At the end of April 2006, Eric Reeves provided a new estimate of over 450,000 people have died from violence, disease, and malnutrition.

**Appendix IV: Summary Description of Death
Estimates Reviewed**

Department of State Estimate

Reported figures	<ul style="list-style-type: none"> • 98,000 to 181,000 total deaths. • 63,000 to 146,000 excess deaths.
Time period covered	<ul style="list-style-type: none"> • March 2003 through January 2005.
Total number of months	<ul style="list-style-type: none"> • 23
Data sources	<ul style="list-style-type: none"> • Uses data deemed sound from available mortality surveys in the Complex Emergency Database at that time for Darfur and refugees in Chad (refers to list of about 20 surveys included in report). • Provides some information regarding which surveys and contextual data sources were used and why. • Applies contextual information to fill in data gaps and determine if existing mortality rates should be applied to a broader population within that region or if a higher or lower rate was warranted. Refers to information such as displacement patterns, fire mapping remote sensing data, reporting of attacks, historical trends on humanitarian intervention, and disease outbreaks.
Mortality rates applied and cause of death	<ul style="list-style-type: none"> • Estimates high and low mortality rates that are assumed to include mortality due to all causes (nonviolent and violent). • Reports that some mortality rates were adjusted based on contextual information (e.g., report of attacks). For example, reports using West Darfur survey data as a basis for estimating mortality in North Darfur are based on nonsurvey data showing similar patterns of conflict in 2003 and early 2004, but estimates of higher total deaths in North Darfur are due to larger displaced population and more incidents of fighting.
Mortality changes over time and/or region	<ul style="list-style-type: none"> • Assumes differences in mortality over time and per region. • Divides conflict into four time periods: (1) the initial outbreak of violence (March through September 2003), (2) the breakdown of cease-fire/escalation of conflict (October 2003 through March 2004), (3) the second cease-fire (April through June 2004) and (4) increased international humanitarian response (July 2004 through January 2005). • Reports that highest mortality and level of violence occurred during December 2003 to February 2004. Mortality began falling in March 2004.
Baseline crude mortality rate assumed	<ul style="list-style-type: none"> • Uses 0.5 deaths per 10,000 per based on estimates from the WHO of sub-Saharan African populations.
Affected population included in estimate	<ul style="list-style-type: none"> • Assumes different monthly estimates (separated by displaced and affected populations) based on UN profiles for each Darfur state from September 2003 until January 2005. • Assumes an incremental increase prior to September 2003 because no source of reliable information was available. Uses data from the United Nations High Commissioner for Refugees (UNHCR) on spontaneous settlements and camps to estimate Chad population. • Assumes affected residents experienced mortality rates that were 20% lower than displaced populations.

**Appendix IV: Summary Description of Death
Estimates Reviewed**

WHO Estimate

Reported figures	<ul style="list-style-type: none">• 45,000 to 80,000 total deaths.• 35,000 to 70,000 excess deaths.
Time period covered	<ul style="list-style-type: none">• March 2004 through September 2004.
Total number of months	<ul style="list-style-type: none">• 7
Data sources	<ul style="list-style-type: none">• Primarily uses findings from 2004 WHO mortality survey, although looked at other surveys conducted.• Uses contextual information, such as the occurrence of disease outbreaks and the level of humanitarian assistance, to help refine estimates and define best and worst case scenarios.
Mortality rates applied and cause of death	<ul style="list-style-type: none">• Estimates mortality rates include all causes of death (violent and nonviolent).
Mortality changes over time and/or region	<ul style="list-style-type: none">• Estimates an average mortality rate for the entire region of Darfur. Does not assume different mortality rates over time or per region.
Baseline crude mortality rate assumed	<ul style="list-style-type: none">• 0.5
Affected population included in estimate	<ul style="list-style-type: none">• Assumes different monthly estimates of IDPs based on UN profile reports.• Estimate includes only IDPs in camps and excludes affected residents from all Darfur regions and refugees in Chad.

Source: GAO analysis based on published documents of estimates and interviews with estimate authors.

Note: The summaries of these estimates are based on the published information, as well as interviews with and additional information provided by estimate authors with the exception of State who declined to speak with us. Additionally, mortality rates discussed in table are crude mortality rates per 10,000 per day.

Appendix V: Additional Follow-Up Survey Results

This is a summary of responses to additional questions from our follow-up survey from the 12 experts we convened with the National Academy of Sciences in April 2006.

(1) In your view, are the mortality estimates by the listed authors based on methodologically sound source data? (Mark only one response in each row.)

Authors/estimates	Definitely yes	Generally yes	Based as much on sound as unsound data	Generally no	Definitely no	No basis to judge/ not sure
• Coebergh	0	1	4	5	2	0
• CRED (Guha-Sapir and Degomme)	0	9	2	1	0	0
• Hagan, Rymond-Richmond, and Parker	0	0	2	7	2	0
• Reeves	0	0	2	7	3	0
• U.S. Department of State (Phelan)	0	7	2	1	1	1
• WHO (Nabarro)	1	6	3	0	2	0

(2) In your view, do the authors make appropriate or inappropriate extrapolations from the source data to the affected population? (Mark only one response in each row.)

Authors/estimates	Very appropriate	Somewhat appropriate	About as appropriate as inappropriate	Somewhat inappropriate	Very inappropriate	No basis to judge/ not sure
• Coebergh	0	0	1	5	5	1
• CRED (Guha-Sapir and Degomme)	1	7	2	1	0	1
• Hagan, Rymond-Richmond, and Parker	0	0	1	5	6	0
• Reeves	0	0	0	5	7	0
• U.S. Department of State (Phelan)	0	5	3	2	0	2
• WHO (Nabarro)	0	4	3	2	2	1

(3) In your view, are the assumptions made by the authors reasonable or unreasonable? (Mark only one response in each row.)

Authors/estimates	Very reasonable	Somewhat reasonable	As many reasonable as unreasonable assumptions	Somewhat unreasonable	Very unreasonable	No basis to judge/ not sure
• Coebergh	0	0	2	4	5	1
• CRED (Guha-Sapir and Degomme)	1	9	0	1	1	0
• Hagan, Rymond-Richmond, and Parker	0	2	0	4	6	0
• Reeves	0	0	1	4	7	0
• U.S. Department of State (Phelan)	1	6	1	2	0	2
• WHO (Nabarro)	0	5	3	2	1	1

Appendix V: Additional Follow-Up Survey Results

(4) In your view, do the authors sufficiently or insufficiently describe appropriate limitations, including sources of possible over or under estimation? (Mark only one response in each row.)

Authors/estimates	Very sufficiently	Somewhat sufficiently	As sufficiently as insufficiently	Somewhat insufficiently	Very insufficiently	No basis to judge/ not sure
• Coebergh	0	3	0	3	6	0
• CRED (Guha-Sapir and Degomme)	2	6	2	2	0	0
• Hagan, Rymond-Richmond, and Parker	0	0	3	1	8	0
• Reeves	0	1	0	4	7	0
• U.S. Department of State (Phelan)	1	4	2	4	0	1
• WHO (Nabarro)	0	7	1	2	2	0

(5) In your view, how high or low would you rate the level of objectivity in the authors' mortality estimates? (Mark only one response in each row.)

Authors/estimates	Very high	High	Moderate	Low	Very low	No basis to judge/ not sure
• Coebergh	0	0	2	8	2	0
• CRED (Guha-Sapir and Degomme)	2	8	1	0	0	1
• Hagan, Rymond-Richmond, and Parker	1	0	5	3	2	1
• Reeves	0	0	0	8	4	0
• U.S. Department of State (Phelan)	0	9	2	0	0	1
• WHO (Nabarro)	0	6	3	1	1	1

(6) Overall, what is your level of confidence in the estimates made by each of the authors? (Mark only one response in each row.)

Authors/estimates	Very high	High	Moderate	Low	Very low	No basis to judge/ not sure
• Coebergh	0	0	0	7	5	0
• CRED (Guha-Sapir and Degomme)	0	2	9	1	0	0
• Hagan, Rymond-Richmond, and Parker	0	0	1	3	8	0
• Reeves	0	0	0	4	8	0
• U.S. Department of State (Phelan)	0	2	7	2	1	0
• WHO (Nabarro)	0	0	7	3	1	1

Appendix VI: Comments from the Department of State

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



United States Department of State

*Assistant Secretary for Resource Management
and Chief Financial Officer*

Washington, D.C. 20520

OCT 4 2006

Ms. Jacquelyn Williams-Bridgers
Managing Director
International Affairs and Trade
Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548-0001

Dear Ms. Williams-Bridgers:

We appreciate the opportunity to review your draft report, "DARFUR CRISIS: Death Estimates Show Crisis Severity, but Their Accuracy and Credibility Could Be Enhanced," GAO Job Code 320420.

The enclosed Department of State comments are provided for incorporation with this letter as an appendix to the final report.

If you have any questions concerning this response, please contact Jim Gray, Congressional Liaison, Bureau of Intelligence and Research, at (202) 647-2921.

Sincerely,

A handwritten signature in black ink, appearing to read "Bradford R. Higgins".

Bradford R. Higgins

cc: GAO – Leslie Holen
INR – Randall M. Fort
State/OIG – Mark Duda

Department of State Comments on GAO Draft Report

DARFUR CRISIS: Death Estimates Show Crisis Severity, but Their
Accuracy and Credibility Could be Enhanced
(GAO-7-24, GAO Code 320420)

Thank you for allowing the Department of State the opportunity to comment on the draft report *Darfur Crisis: Death Estimates Show Crisis Severity, but Their Accuracy and Credibility Could be Enhanced*.

GAO Recommendations

To safeguard the Department of State's credibility as a source of accurate and reliable death estimates, we recommend that the Secretary of State promote greater transparency in any of its future death estimates for Darfur or other humanitarian crises by ensuring that publicly available documents contain sufficient detail on the estimates' data, methods, assumptions, and limitations to allow external researchers to replicate and verify the estimates.

Additionally, to enhance the U.S. government's capacity to assess the dimensions of, and respond appropriately to, any future humanitarian crises, we recommend that the Secretary of State and the Director of U.S. Foreign Assistance and USAID Administrator consider the experts' other suggested measures to help address gaps in data and improve the quality and reliability of any future death estimates.

Department of State Comment

The Department of State endorses these recommendations and supports efforts to increase transparency, address gaps in data, and improve the quality of future death estimates. As the GAO points out, humanitarian crises present difficult challenges in collecting and presenting mortality data.

In the case of the Darfur Mortality Estimate, the State Department declassified an internal assessment of the Bureau of Intelligence and Research (INR) originally intended for use by Department policymakers. INR's source documentation and description of methodology were provided to the Centre for Research on the Epidemiology of Disasters (CRED) for use

See comment 1.

See comment 2.

in compiling the CREED study titled *Darfur: Counting the Deaths*, a source for this GAO report.

Following are GAO's comments on the Department of State's letter dated
October 4, 2006.

GAO Comments

1. State asserts that its death estimate was intended for internal purposes. We maintain that because State's estimate was publicly available and discussed by State officials, sufficient detail on this and any future such estimates is necessary to safeguard State's credibility as a source of accurate and reliable death estimates, particularly where such a serious topic is concerned.
2. When asked, the CRED authors indicated that State provided them with the text on the methodology as included in the published report, but did not provide source information on the data used in State's estimate.

Appendix VII: Comments from the U.S. Agency for International Development



USAID
FROM THE AMERICAN PEOPLE

OCT 17 2006

David Gootnick
Director
International Affairs and Trade
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Gootnick:

I am pleased to provide the U.S. Agency for International Development's (USAID) formal response on the draft GAO report entitled *Darfur Crises: Death Estimates Show Crisis Severity, but Their Accuracy and Credibility Could Be Enhanced* (GAO-07-24).

Thank you for the opportunity to respond to the GAO draft report and for the courtesies extended by your staff in the conduct of this review. We appreciate GAO's comprehensive efforts in addressing this important subject and we support your recommendation that the U.S. Government should work to ensure greater transparency regarding the data and methods used for death estimates. USAID also concurs with your second recommendation that the Secretary of State and the Director of U.S. Foreign Assistance and USAID Administrator consider the experts' other suggested measures to help address gaps in data and improve the quality and reliability of future death estimates.

USAID looks forward to working to help address gaps in data and improve the quality of future death estimates. Thank you again for the opportunity to comment.

Sincerely,

A handwritten signature in black ink, appearing to read "Mosina H. Jordan". The signature is fluid and cursive, written over a horizontal line.

Mosina H. Jordan
Counselor to the Agency

Appendix VIII: Summary of Authors' Comments

To the five other estimate authors, we provided portions of the report pertaining to their individual estimates. We summarize their comments and our responses below.

- The authors of the Centre for Research on the Epidemiology of Disasters (CRED) estimates agreed with the experts' evaluation.
- Jan Coebergh did not provide any major comments regarding the relevant portion of the report and indicated that he was aware of the limitations of his estimate.
- John Hagan expressed concern regarding the experts' relatively positive evaluations of the estimates by CRED and the Department of State (State), stating that the respective estimates' published documentation does not provide sufficient information on the data and methodologies used. As discussed in the report, the experts noted limitations in the sufficiency of reporting for both these estimates, but they were able to discuss these estimates in detail and assess their respective levels of accuracy and methodological strengths and shortcomings. In addition to providing the experts the published reports containing the estimates, we provided them information regarding the source mortality surveys used in the estimates, as listed in appendix III. For the CRED estimate, we also provided the experts with additional details about the methodology based on our interviews with the authors. Dr. Hagan also believed that we should have included in our evaluation the estimate he did with Alberto Palloni published in the September 2006 issue of *Science*. We added information on the key findings of this estimate to the report, but as we note in the report, it does not include an analysis of the estimate because a final publicly available version was not available when the experts convened in April 2006.
- Eric Reeves disagreed with the experts' criticism of the Atrocities Documentation Team's survey of Chad refugees. He stated this survey was well conducted and a critical source of data to estimate violent deaths especially early in the conflict when little information was available. In the report, we note that the literature acknowledges difficulties in capturing deaths due to violence. Nevertheless, some of the estimates reviewed by the experts used other techniques to account for violent deaths, such as statistical analysis or contextual information. Moreover, many experts felt that Atrocities Documentation Team's survey was not a reliable or appropriate source of data to estimate violent deaths for a cumulative death estimate on

Darfur, based on public documentation on the survey, as well as supplemental information on the survey's design, implementation, and sampling we obtained from representatives at the Coalition for International Justice. In addition, Dr. Reeves also expressed a concern regarding the 2004 survey by WHO and believed it did not sufficiently capture violent mortality in areas outside camps. To address this concern, we added information regarding the issue of accessibility as a potential source for underestimation of mortality and specifically discuss this survey. Dr. Reeves also stated that in a draft version of the report, we had incorrectly characterized his estimate's use of the 2004 WHO survey to account for only nonviolent deaths and, accordingly, we removed this characterization from the report.

- Regarding the WHO estimate, David Nabarro emphasized in his comments that the estimate was undertaken to provide a rough order of magnitude of deaths in order to facilitate humanitarian relief efforts. He also pointed out that it applied to a shorter time period than the other estimates and was restricted to IDPs located in camps, without attempting to account for deaths in the larger population. We provided additional clarification in the report to emphasize the more restricted scope and coverage of the WHO estimate. Further, we stated that the purpose of the WHO estimate was to provide an order of magnitude estimate to assist in humanitarian relief planning.

Appendix IX: GAO Contacts and Staff Acknowledgments

GAO Contacts

David Gootnick, (202) 512-3149, gootnickd@gao.gov
Nancy Kingsbury, (202) 512-2700, kingsburyn@gao.gov

Staff Acknowledgments

In addition to the individuals named above, Emil Friberg, Assistant Director; Jim Ashley; Martin de Alteriis; Etana Finkler; Leslie Holen; Theresa Lo; Reid Lowe; Grace Lui; John F. Miller; and Chhandasi Pandya made key contributions to this report.

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