Beyond crude mortality rates: what can small-scale surveys tell us about age-specific mortality in humanitarian emergencies?

Peter Heudtlass¹, Bruno Masquelier², Debarati Guha-Sapir¹

Draft paper for the Chaire Quetelet 2012 Conference in Louvain-La-Neuve

1. Introduction

In complex humanitarian emergencies, mortality rates play an important role for advocacy, priority setting and evaluation of relief efforts (Checchi and Roberts 2008). In the spirit of the humanitarian principles, emergency response is needs-based and programs have to be tailored to prevent deaths in the most vulnerable populations. This vulnerability is assumed to differ between age groups. However, in many emergency settings, demographic and epidemiological data are incomplete and therefore estimating age-specific risk is extremely difficult. This is mainly due to collapse or nonexistence of routine registration of deaths. Here, we assess whether small-scale surveys from health service providers in humanitarian emergencies (mainly UN agencies and international NGOs) can fill in this gap. The methods of these have been standardized over the last years, most notably through the SMART initiative, and many surveys are now being externally validated and results are publicly accessible. Yet, standardization efforts have mainly concerned approaches to estimating crude mortality rates, and the data collection has been largely focused on deaths among children under 5 or the overall population, irrespective of age and sex.

This being said, there is evidence in the literature that the relative increase in emergency related mortality risk is higher in other age groups than the under 5s (Davis 1996). Therefore, we will assess scope and level of detail of mortality indicators and the extent to which these data are informative on the situation of adults.

Our study is based on the Complex Emergency Database (CEDAT), maintained by the Centre for Research on the Epidemiology of Disasters (CRED), at Louvain University (Degomme and Guha-Sapir 2007). The database is hosting the results of small-scale surveys from humanitarian emergencies³.

¹ Peter Heudtlass is a PhD candidate and Debarati Guha-Sapir professor at the School of Public Health, Louvain University, and director of the Centre for Research on the Epidemiology of Disasters (CRED), Brussels
² Louvain University and FNRS
³ Complex emergencies are defined as follows in this database: All crises characterized by extreme vulnerability that display a combination of the following features: (1) The government is unwilling or incapable to effectively respond, resulting in a need for external assistance; (2) political oppression or armed conflict; (3) displacement; (4) increased mortality (http://www.cedat.be/glossary). The authors are grateful to the UK Department for International Development (DFID) and the Canadian Agency for International Development (CIDA) for funding the database; to Action Contre La Faim International (ACFIN), UNICEF, Save the Children UK, Tearfund, CARE, the Ministry of Health of Sudan, the Central Bureau of Statistics of Sudan, World Relief, World Vision, MSF Holland, Sudanese Red Crescent, Sudan AID, the US Office for Foreign Disaster Assistance, GOAL, MSF Belgium, MSF Switzerland, Epicentre, the World Health Organization, the American Refugee Committee, the World Food Program, the EU Commission DG ECHO and all other institutions who
We focus on surveys carried out since 1998 in the territory of South Sudan, which became an independent state on July 2011. We opted for South Sudan as a case study for two reasons. First, the Sudanese civil conflict, that lasted between 1983 and 2005 translated into a substantial excess death toll in South Sudan. Second, the demographic and epidemiological data on conflict affected populations in South Sudan remain incomplete, although this country and the corresponding Sudanese regions prior to independence are among the regions that are best covered in the CEDAT.

2. Data and methods

Set up in 2004, the Complex Emergency Database now comprises the results of about 3000 nutrition and mortality surveys from 51 countries, obtained either directly from the web or through UN agencies or agreements with international NGOs (e.g. MSF, IRC, ACF, and Goal) and major humanitarian donors such as the Canadian and UK departments for international development CIDA and DFID.

About 70% of surveys are conducted by NGOs, which typically cover lower administrative entities (mainly districts and cities) than surveys carried out by UN agencies and governments (Degomme and Guha-Sapir 2007). Some surveys are focused on specific sub-populations such as internally displaced people (IDP) or refugees in camps.

The main objectives of these surveys are needs assessment, monitoring/evaluation of humanitarian interventions and advocacy. Anthropometric data is collected to estimate the prevalence of malnutrition and mortality is assessed using retrospective household surveys. Often, the assessments are complemented by information on the immunization status of children and background information on households such as income or access to food, water and sanitation.

A series of indicators are extracted from the survey reports and entered in the database after performing consistency checks. However, the database generally includes only a fraction of the information that is available in the survey reports. Regarding mortality, only Under Five Mortality Rate (U5MR) and Crude Mortality Rate (CMR) are routinely entered.

For the purpose of this article, we searched both the (publicly accessible) electronic database and the survey report archive located at CRED. We retained a list of 234 mortality surveys carried out in South Sudan since 1998. For each survey, we checked whether the corresponding report is available in the archive and searched available reports for indicators of age-, sex- and cause-specific mortality.

3. Results

3.1 Description of the surveys and mortality levels

For 185 of the surveys, a full report was available in the archive. These surveys were kept for further analysis. They were predominantly carried out with residents (44%), during the period 2003 to 2008. The majority of them were conducted in three regions: North Bahr-El-Ghazal, Jonglei and Upper Nile. 78% of the surveys used cluster sampling methods, the remaining were mostly exhaustive, with actual samples for the mortality assessment varying from 34 to 6948 individuals. Recall periods vary between 30 days and a year with a 90-day period used in most surveys.

shared reports of surveys conducted in South Sudan with CEDAT; finally to the database manager David Hargitt for collecting, validating, cleaning and entering survey results over the last years.
The two mortality indicators available in survey reports and routinely entered in the database are the daily crude mortality rate (CMR) and the under-5 mortality rate (U5MR). The CMR is computed as the total number of deaths occurring during the recall period over the population at risk of dying at the mid-point of the recall period, irrespective of age and sex. This is what demographers refer to as the crude death rate and express as a number of deaths per 1000 population. In the case of humanitarian emergencies, it is expressed as the number of deaths per day per 10 000 persons. The Sphere Project (2011) has established a set of regional standards for baseline mortality. In Sub-Saharan Africa, this standard is set at 0.41/10 000/day for CMR and at 1.07/10 000/day for U5MR. Emergencies are defined as situations where mortality is higher than twice this threshold. Using these standard thresholds, however, can be problematic because the baseline mortality varies significantly from one country to another or from one region to another. For example, within regions of Sub-Saharan Africa, the Population Division of the United Nations estimated that the crude mortality rate in the period 2005-2010 ranged from 0.32/day/10000 in Eastern Africa to 0.45/day/10000 in Central Africa (United Nations 2011). There may also be substantial changes over time; in the former Sudan, the estimated crude mortality rate declined from 0.42/day/10000 in the period 1980-5 to 0.26 in the period 2005-10, mainly thanks to a decline in child mortality.

<table>
<thead>
<tr>
<th>Population Status</th>
<th>Regional distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDP</td>
<td>Abyei Administrative Area 1 %</td>
</tr>
<tr>
<td>Mixed populations</td>
<td>Central Equatoria 3 %</td>
</tr>
<tr>
<td>Residents</td>
<td>East Equatoria 2 %</td>
</tr>
<tr>
<td>Unspecified Period</td>
<td>Jonglei 22 %</td>
</tr>
<tr>
<td></td>
<td>Lakes 1 %</td>
</tr>
<tr>
<td>2000-2002</td>
<td>North Bahr El-Ghazal 20 %</td>
</tr>
<tr>
<td>2003-2005</td>
<td>Unity 11 %</td>
</tr>
<tr>
<td>2006-2009</td>
<td>Upper Nile 16 %</td>
</tr>
<tr>
<td>2009-2012</td>
<td>Warab 8 %</td>
</tr>
<tr>
<td>Sample design</td>
<td>West Bahr El-Ghazal 10 %</td>
</tr>
<tr>
<td>Cluster</td>
<td>West Equatoria 1 %</td>
</tr>
<tr>
<td>Exhaustive</td>
<td>16 %</td>
</tr>
<tr>
<td>Systematic random</td>
<td>2 %</td>
</tr>
<tr>
<td>Unspecified</td>
<td>4 %</td>
</tr>
<tr>
<td>Mean sample size</td>
<td>2876.6</td>
</tr>
<tr>
<td>Min sample size</td>
<td>34</td>
</tr>
<tr>
<td>Max sample size</td>
<td>6948</td>
</tr>
</tbody>
</table>

Table 1. Descriptive characteristics of surveys carried out in South Sudan and included in the CEDAT

The U5MR is the second mortality indicator, which is computed similarly, but only among the population of children aged less than 5. It is therefore different from the under-five mortality rate used by demographers (5q0, sometimes also denoted U5MR, which adds to the confusion). The latter refers to the probability that a child will die before reaching age 5 if the mortality conditions prevailing during the year were kept constant. It is not possible to directly compare the U5MR and
the 5q0 because they refer to different populations and their calculation is based on different assumptions. Surveys such as DHS and MICS or indirect methods based on census data usually yield values of the probability 5q0. Estimates are mostly derived from mothers’ reports about their children who did not necessarily live in the same household. One way to obtain a country-specific value of U5MR to serve as baseline mortality is to resort to the United Nations estimates, which provide deaths by age and by five-year period as well as the population by age. In Sudan, an estimated 687,000 deaths under age 5 occurred in the period 2005-2010 and the corresponding population at mid-period can be estimated at 619,600 (United Nations 2011). Therefore, the daily U5MR can be estimated at 0.61. The same calculation over age 5 yields an over-5 crude mortality rate of 0.19 deaths per day per 10,000 persons.

Of the survey reports that we have reviewed, 67% of reports provided values for both the CMR and the U5MR, 9% only provided a value of the CMR and 16% only provided a value of the U5MR. Some surveys did not provide any information on mortality. In 103 surveys, a breakdown of deaths was provided for under-5 and over-5 mortality. In combination with the U5MR and CMR, we can therefore compute a mortality rate for people over age 5.

Figure 1 compares the mortality rates irrespective of age, under age 5 and over age 5 by periods, along with daily mortality rates derived from the United Nations estimates for the whole Sudan. In emergency settings, there is a continuous decline in mortality rates among children; the median value of U5MR drops from 2.2/day/10,000 in the period 2000-2002 to about 0.9 in 2009 and after, with emergency related mortality close to the baseline. Mortality rates above age 5 are on average lower, and they also experienced a notable decrease since 2006. Nevertheless, even in the relatively peaceful periods 2006-2009 and 2009-2012, about 75% of the surveys were above the baseline.

Figure 1. Trends in the U5MR and CMR by time period, as reported in survey reports from South Sudan

---

4 Questions on recent household deaths in censuses and surveys could be used to compute a U5MR comparable to the one obtained in small-scale surveys, but it would then be necessary to have data on births that occurred in the household, and data on children who left the household during the reference period.
3.2 Information on adult mortality

Only one survey provided in the report a disaggregation of the household population by age (5-12yrs, 12-18yrs, adults and elderly), but it did not provide this breakdown for deaths. Another survey provided a breakdown of deaths but not of the population at risk. Therefore, nothing can be learned from these surveys on the distribution of deaths by age among adults.

Interestingly, although there is a shortage of data on the number and age distribution of adult deaths in survey reports, several reports provide information on the number of deaths by broad cause. This information is obtained through verbal autopsies. In verbal autopsies, respondents are asked about the circumstances of reported deaths and pre-mortal symptoms and are then classified by broad categories. Sensitivity and specificity of this tool is generally low, also because the data is often collected by interviewers without medical background. However, it is widely used to assess the burden of mortality in settings where no routine system of registration of deaths is available. In all surveys that report verbal autopsies, the results are disaggregated by under age 5 and age 5 and older; none of them offers a further age breakdown.

According to the verbal autopsies, by far the most deaths in both age groups are related to diarrheal diseases. Interestingly, the pattern for the infectious diseases that are most commonly associated with mortality and morbidity in complex humanitarian emergencies – diarrheal diseases, malaria, respiratory tract infections and measles (Brennan and Nandy, 2011) – seem to be comparable in both groups.

Figure 2. Distribution of deaths under age 5 and among adults by broad category of causes, as reported in survey reports from South Sudan

A significant number of 5+ deaths do not fit into one of the categories, suggesting that verbal autopsies are better suited for investigating common causes of death in under 5 populations.
4. Discussion

Estimating age-specific mortality in settings where good demographic and epidemiological data is chronically scarce is challenging. For demographers, South Sudan is a fortunate exception among the Sub-Saharan states affected by complex emergencies because relatively recent census data is available. This data needs careful interpretation, as the census has been conducted in the midst of South Sudan’s struggle for independence, with ongoing violence and civil conflict in many parts of the country, and access to some populations might have been restricted. In addition to that, an efficient country-wide system of routine birth and death registration – crucial for the estimation of age-specific mortality is not yet in place.

What can small-scale surveys tell us about age-specific mortality in South Sudan? Surveys compiled in CEDAT provide valuable insights in the development of emergency related mortality over the recent years. More importantly, data covers population groups that are arguably most at risk and by definition difficult to reach.

Reviewed surveys focused mainly on the nutritional and health status of children. However, there is also routinely data collected on household composition and recent mortality experience. This data is used by the survey authors to estimate U5MR and/or CMR. Our analysis has shown that further disaggregation by age is practically non-existent. Nonetheless, some surveys allowed us calculating a death rate for the 5 and above population. Against widespread belief but in agreement with earlier findings in literature (Davis 1996), these groups experienced an emergency related increase in mortality (excess mortality) that has been at least as important as among children under five.

Data on broad causes of mortality, obtained through verbal autopsies and reported in a considerable share of reviewed surveys suggest that similar conditions are responsible for emergency related mortality in both age groups, with mortality related to diarrheal diseases being by far the most important.

Looking at individual surveys, sample sizes were too small and recall periods too short to obtain further age or sex breakdowns. Much larger sample sizes though are illusionary in most of today’s complex emergencies. Researchers and decision-makers should resort to meta-analysis and triangulation from small-scale surveys and other existing sources. Data from local authorities should be complemented with data from humanitarian agencies, such as UN agencies and international NGOs. Furthermore, research should be conducted on innovative methods to deal with the specific challenges of obtaining demographic and epidemiologic information in complex humanitarian emergencies, such as Bayesian methods that allow incorporating historical data from multiple sources and decrease sample sizes of emergency assessments.

5 The census has been conducted in 2008 and about 15% of its microdata can be obtained from http://www.ipums.org/
References


