

Within this setting, the International Rescue Committee has been working in South Kivu, DRC, since 1996. Most of the IRC's activities have been related to supporting the fledgling health care system, improving infrastructure through construction projects, and preventing disease outbreaks through vaccination campaigns, water source improvements and improving sanitary conditions. In February 1999, the IRC conducted a mortality survey in Katana Health Zone which revealed a measles outbreak that had killed 1,400 children. The survey results instigated a rapid allocation of funds by OFDA (the U.S. Office for Foreign Disaster Assistance) and enabled the IRC to conduct a vaccination campaign with the Ministry of Health. This year, IRC Bukavu sought to conduct similar surveys in three health zones, two where IRC is presently working and a third where it intends to begin work soon. The results will hopefully be used to guide health policy. In an attempt to obtain insight into the mortality conditions throughout eastern DRC, two additional populations were surveyed in locations where IRC has no immediate plans to work. The results of these five surveys are contained herein.

## Methods

Two approaches were employed for selecting households for inclusion in the surveys. When the approximate population size and location were known, a systematic sample proportional to population was employed. When the size and location of the population were not well known, a systematic spatial sampling regime was employed.

### Systematic Sample Proportional to Population, Two-Stage Cluster (for Kisangani, Kabare, Moba)

a) A sample size was selected to enable the detection of a doubling of mortality above the baseline rate over a one-year period. Baseline mortality was assumed to be 1.5/1,000 pop./mo. This calculation made the assumption that visiting clusters of five households each would have the effect of reducing the statistical power of the sample (the "design effect") by 50%. For example, including 20 clusters of five houses (100 households) was assumed to result in a sample with equal statistical power to a random sample of 50 households.

b) Clusters of five houses were assigned to specific clinic areas by a systematic assignment technique, which allocated a number of clusters proportional to the population of each clinic area. A list of the clinic area populations was constructed with a cumulative total listed beside each entry on the list. The total population to be surveyed was divided by the number of clusters sought in order to define the sampling interval. A random number was selected between 1 and the sampling interval. Where that number fell in the cumulative list was assigned a cluster. The sampling interval was repeatedly added to that number, and the clinic areas corresponding to the cumulative sums were assigned clusters (as with the WHO, EPI methodology). The population figures were provided by local authorities or from the IRC's experience in the area.

c) Within each clinic area, a crude map was made, usually by measuring the distance across the clinic area with a GPS (global positioning system) unit. An imaginary grid system was superimposed on the map. Random numbers were selected, which corresponded to a location on the imaginary grid. For example, if an area was 1.00 km north-south by 1.00 km east-west, and the reference point (0,0) was the south-west corner, two numbers between 001 and 100 would be chosen. The first number would correspond to how many tens of meters north interviewers would go from the reference point, and the second number would correspond to how many tens of meters east they would move to the starting point. The distance and magnetic heading to that location were calculated, and a GPS unit was used to guide investigators to that point ( $\pm 10$  meters). The five households closest to the chosen location were visited.



d) If no one was home or if a household refused to be interviewed, that house was skipped and the next was visited. The age and gender of each household member was recorded. If there was a question about whether someone was part of a family, only those who had slept in that household on the preceding night were included. Interviewees were asked if anyone in their household had died since Christmas 1999 or during the year 1999. The age of the decedent at the time of death, month of death and cause as reported by the family were recorded. If someone did not know the age of an individual or the exact month of a death, the interviewee was asked to give a best estimate.

#### Spatial Sampling (for Katana)

- 1) A random starting location was chosen on the main north-south road within the southernmost 7 km of the health zone.
- 2) At that location on the road, investigators chose a random number between 1 and 1,000 and went east that many meters. That spot will be referred to as the first sampling point.
- 3) The five households closest to that point were interviewed. Houses were asked the same questions as in d) above. The distance from the fifth (farthest) hut to the first sampling point was estimated. This distance will be referred to as the radius of the sampling point. Thus, the radius defines the size of a circle that would need to be placed around the sampling point in order to include five households. This was done to ensure during the analysis that the oversampling of rural populations, as commonly occurs with spatial sampling, was not creating a systematic bias.
- 4) Using a GPS unit, the second sampling point was identified 1.00 km east of the first sampling point. Steps 3 and 4 were repeated. This process of moving 1.00 km east and interviewing five households was repeated until interviewers reached the shores of Lake Kivu.
- 5) Interviewers returned to the first sampling point and began to move in increments of 1.00 km to the west, interviewing five households and measuring the radius of the sampling point at each location. This process continued until security constraints prevented further westward movement. A line of sampling points will be referred to as an east-west transect.
- 6) Steps 2 through 6 were repeated at increments of 7 km north and south up and down the road. This resulted in east-west transects running parallel across the study area. A spacing of 7 km was initially chosen in an attempt to have a sample size of 1,600 individuals.

Empty households that did not appear abandoned at the time of the visit were assumed to be of the same household size as the others in the sampling radius and were included in the estimated population within the radius.

#### Spatial Sampling (Kalonge Displaced)

The exact location of IDPs (internally displaced persons) within Katana, Kabare and Bukavu is not known. Moreover, indications from the Red Cross and IRC local staff were that many of those registered as displaced to receive food rations were actually local residents. The issue became so problematic at the time of the survey that after receiving death threats, the Red Cross ceased all distributions to the displaced in Bukavu. Interviewers felt that because of the unique dialect of Mashi spoken by the residents of Kalonge they were able to confirm the true residents through interviews in lieu of identifying the displaced through official registration lists.

The method by which the displaced were sought was different in Bukavu City than it was in the rural settings of Katana and Kabare. In Bukavu, more than 90% of the displaced were reported by the Red Cross to be in two large neighborhoods. Interview teams went to the geographic centers

*OK, but just  
how was this  
built into the  
analysis?*



of those neighborhoods, as defined by our local driver, and walked on a compass heading until the edge of the neighborhoods. The direction was usually chosen to be perpendicular to the road on which the car had arrived. As the teams proceeded, they inquired about the presence of the displaced from Kalonge. When an individual or family was identified, the interviewers engaged them in informal conversation about their home village, how long they had been in Bukavu, etc. When the interviewers were convinced that the family was truly from Kalonge, they explained why the IRC was there and asked if family members would be willing to respond to a few questions. Interviewers walked two opposite directions in the slum of Kadutu and three directions in Ibanda. Thus, the sample size was not fixed and was determined by the chance direction chosen. There was no attempt to re-interview the few displaced who were not at home at the time of the visit.

When encountered, the displaced in Katana and Kabare were identified in those locations where residents were interviewed for the ongoing mortality surveys. In Katana, this means that the displaced were sought in small areas (approximately a 400-meter radius) in a systematic spatial sample. Among residents of Katana, there had been a dramatic gradient in mortality rates during the IRC's 1999 mortality survey, with the northernmost latitudes experiencing more than twice the mortality of the southernmost reaches. The displaced were sought out until a quota was achieved for each range of latitude in proportion to the Red Cross estimates of the Kalonge displaced in each area. In Kabare, the same process of visiting the displaced in the vicinity of resident household clusters was followed, except that the resident clusters were identified using the WHO, EPI survey methodology (systematic, proportional to population). Never were more than 10 displaced households visited within the same 400-meter radius and usually fewer than three were in the same location. IDPs were asked the same three questions as described in d) above.

Mortality rates were reported for both the Bukavu displaced and the Kabare and Katana displaced in combination. Overall mortality estimates were weighted according to the estimated displaced in the urban versus rural areas as estimated at a meeting of the NGO community. The best estimate was that the Bukavu estimate comprised 31% of the weighed estimate. As no displaced in Walungu were interviewed, it was assumed that their mortality experiences were similar to those displaced in Katana and Kabare.

Cause of death data and age breakdown data were not weighted according to whether the displaced are presently living in Bukavu versus Katana and Kabare. This is because i) the causes of death appeared to be generally similar between zones, and ii) the numbers of deaths from any given cause were small.

Confidence intervals were calculated assuming that the design effect of the cluster sampling was two. Because the sample of displaced persons from Bukavu represented 45% of the households interviewed but only 31% of the Kalonge displaced, the mortality among the Bukavu displaced was weighted to contribute only 31% to the overall mortality estimates. Likewise, the number interviewed in Bukavu was reduced by 45% ( $45\% \text{ of sample} / 31\% \text{ of true population} = 1.45$ ). Both of these assumptions for the creation of confidence intervals are believed to be conservative and to credit the sample with less power than it really possesses.

Reasonable

Wtg by  
pop<sup>n</sup> size.  
OK

### Analysis

Crude mortality rate (CMR) was defined as [the number of deaths/the number of living + dead people in the population during the recall period – those not born at the midpoint of the recall period] X 1,000/the recall period. Mortality in this report is expressed as deaths/1,000