

Alternative Sampling Designs for Emergency Settings

1. The Need for Alternative Sampling Approaches in Emergencies

Appropriate response to an emergency requires reliable and timely data about the health and nutrition status of the affected population. The assessment method traditionally used in emergency settings is a 30x30 cluster survey. This method provides statistically reliable results if implemented correctly, but with a sample size requirement of 900, it can be time-consuming and expensive to carry out.

The nature of an emergency exacerbates all the usual challenges associated with data collection while intensifying the urgency with which reliable data on the affected population is needed. Emergencies can affect vast populations and dispersed geographical areas; they may occur in areas of relative insecurity, and can have a rapid on-set. In an emergency, certain geographic areas will often need to be assessed repeatedly over relatively short time periods, in order to determine when and what type of aid may be required.

Humanitarian agencies and decision makers need tools for rapid and effective prioritization of areas in greatest need and practical and reliable methods for on-going monitoring of the situation. There has long been demand for a statistically reliable emergency assessment tool that is less time and resource intensive than a conventional 30x30 cluster survey. Until recently, however, appropriate data collection alternatives were not available.

2. The Potential of Lot Quality Assurance Sampling (LQAS)

LQAS is a sampling method and analysis tool which originated in industry as a quality assurance method, and is now increasingly applied in international health programs by USAID and its partners. The method uses the statistical properties of cumulative binomial distributions to perform hypothesis tests to predict binary outcomes (yes/no, pass/fail, whether a certain threshold is attained or not, etc). The key benefit of LQAS is its parsimony: the prediction of a dichotomous outcome using an LQAS hypothesis test often requires a much smaller sample size than would usually be the case for obtaining a point estimate for that outcome. The small sample size required by LQAS can translate into relatively rapid and low cost data collection, which makes the method attractive to public health professionals. In the last 20 years, international public health program managers have frequently used LQAS to monitor program performance--for instance, to assess whether a pre-defined immunization coverage is achieved in a given intervention area, or whether the quality of services offered by health staff reaches a desired threshold.

One possible limitation of LQAS is its reduced capacity to estimate the distributional properties (means, etc.) of an indicator. This, however, is mainly an effect of the reduced sample size; thus where a minimum sample size is met, LQAS data can be used to calculate point estimates (means) and confidence intervals, thus overcoming this limitation.

3. LQAS Applied to Emergency Settings

In 2003, USAID/Food and Nutrition Technical Assistance (FANTA) Project, Catholic Relief Services (CRS) and Ohio State University (OSU) teamed together to explore whether LQAS methods could be used to assess the prevalence of acute malnutrition in emergency settings. Until that time, while LQAS had demonstrated utility for monitoring program performance, it had been less frequently applied to assess health outcomes such as nutritional status. This is, in part, due to the higher level of statistical precision required for measuring these indicators.

The results of computer simulations led the FANTA/CRS/OSU team to develop two LQAS designs (a **33x6** design: 33 clusters, 6 observations per cluster, and a **67x3** design: 67 clusters, 3 observations per cluster). Although the validity of LQAS inference generally requires that data be collected using a simple random sample (as opposed to cluster sampling), the simulation results demonstrated that 33x6 and 67x3 cluster designs would allow for valid LQAS hypothesis testing about the level of acute malnutrition in the population.

Three threshold levels of acute malnutrition were identified as necessary to detect: 10%, 15%, and 20%. These thresholds correspond to those used by the World Health Organization and many national governments when categorizing the severity of an emergency. The 33x6 and 67x3 LQAS designs offer the advantage of a substantially smaller sample size compared to that of a 30x30 cluster survey (≈ 200 vs. 900). Yet, the LQAS sample sizes are still large enough to allow for point estimates to be generated with the data collected.

4. Field Validations of the 33x6 and 67x3 Sampling Designs in Ethiopia and Sudan

FANTA and CRS field tested the 33x6 and 67x3 sampling designs in the Siraro woreda of Ethiopia in June 2003. The two designs were implemented alongside a conventional 30x30 cluster survey so that the results across the various sampling designs could be compared. The field test showed promising results with respect to the statistical reliability and potential time savings offered by the alternative sampling designs.

In September 2005, FANTA and Save the Children US (SC US) followed up with a field validation study of the 33x6 and 67x3 sampling designs in two Administrative Units (AUs) of West Darfur, Sudan. The study used rigorous sampling, data collection and analysis methods to compare child- and household-level results across the three sampling designs administered within each AU. The study validated the findings from the Ethiopia field test: Not only did the 33x6 and 67x3 designs provide comparable results for child-level indicators tested, but the household-level indicator point estimates and 95% confidence intervals were comparable to the 30x30 cluster results as well. Moreover, the study provided further evidence that data collection

for the 33x6 and 67x3 designs requires a fraction of the time and cost as that required for the 30x30 cluster survey.

5. Development of Guidance on Using the 33x6 and 67x3 Designs and Dissemination of Related Studies

To provide guidance on using the 33x6 and 67x3 designs for rapid assessments in emergency settings, FANTA will develop a field manual, *Using Alternative Sampling Designs in Emergency Settings: An Implementation Guide for Practitioners*. FANTA will work closely with Office of Foreign Disaster Assistance (OFDA) and implementing organizations to ensure the materials produced are as practical and useful as possible. Once the materials are available in April 2008, FANTA will coordinate with OFDA to have these new sampling approaches incorporated into the OFDA guidelines for collecting and reporting data on the nutritional status of a population in emergency situations.

Together the simulation and field validation work have provided solid evidence that the 33x6 and 67x3 designs offer rapid, economical and appropriate alternatives for conducting statistically reliable assessments in emergencies. Since 2005, FANTA has made presentations of this sample design work to a variety of audiences, including OFDA, USAID PVO partners, and the Emergency Working Group at the UN Standing Committee on Nutrition.

In June 2007, FANTA presented the work at the international conference hosted by the Center for Research on the Epidemiology of Disasters and the London School of Public Health and Hygiene, "New Methods for Assessing Health in Complex Situations."

6. Publications and Manuscripts in Preparation

Deitchler M, Valadez JJ, Egge K, Fernandez S, Hennigan M. A field test of three LQAS designs to assess the prevalence of acute malnutrition. *International Journal of Epidemiology* 2007; doi: 10.1093/ije/dym092. Available on line at: <http://ije.oxfordjournals.org/papbyrecent.dtl>

Morris S. Learning to love LQAS. *International Journal of Epidemiology* 2007; doi: 10.1093/ije/dym120. Available on line at: <http://ije.oxfordjournals.org/papbyrecent.dtl>

Deitchler M, Deconinck H, Bergeron G. Precision, time, and cost: a comparison of three sampling designs in an emergency setting. Submitted to *Emerging Themes in Epidemiology*. July 2007.

Olives C, Pagano M, Deitchler M, Hedt B, Egge K, Valadez JJ. Cluster & SRS designs to assess the prevalence of acute malnutrition by LQAS: A computer simulation study. To be submitted to *Survey Methodology*. October 2007.