Rapid Assessment Sampling in Emergency Situations

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Text: Peter K.Wingfield-Digby, UNICEF consultant

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UNICEF APSSC
19 Phra Atit Road
Bangkok 10200 Thailand
Tel: (66 2) 356 9499
Fax: (66 2) 280 5941
E-mail: apssc@unicef.org
Website: www.unicef.org

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Abbreviations

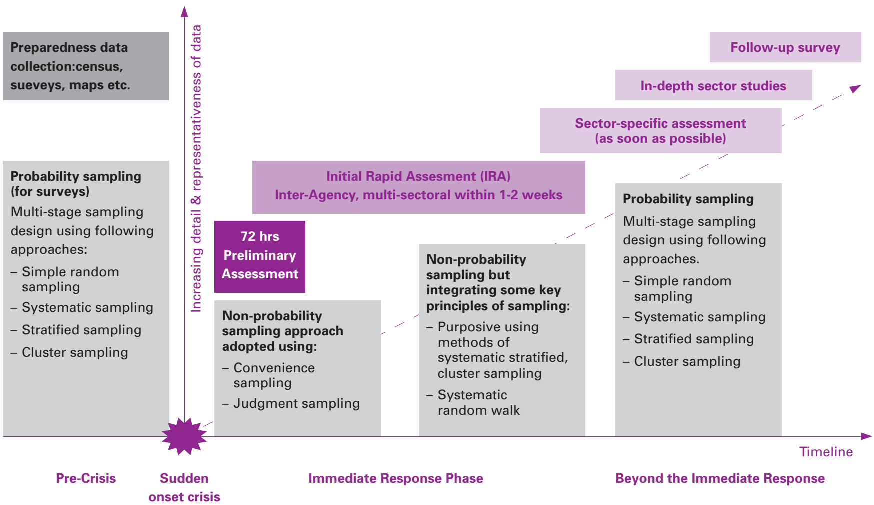
CIDA	Canadian International Development Agency
CRDR	Center for Refugee and Disaster Response, Johns Hopkins University
CWIQ	Core Welfare Indicators Questionnaire
deff	Design effect
EPI	Expanded Programme on Immunization
GPS	Global Positioning System
IASC	Inter-Agency Standing Committee
ICRC	International Committee of the Red Cross
IDP	Internally Displaced Person
IRA	Initial Rapid Assessment
LSMS	Living Standards Measurement Study
McRAM	Multi-Cluster Rapid Assessment Mechanism
MICS	Multiple Indicator Cluster Survey
MOS	Measure of Size
NGO	Non-Government Organization
NSO	National Statistical Office
NHSCP	National Household Survey Capability Programme
NSDS	National Strategy for the Development of Statistics
PPS	Probability Proportional to Size
PSU	Primary Sampling Unit
SMART	Standardized Monitoring and Assessment of Relief and Transitions
SRS	Simple Random Sampling
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WHS	World Health Survey

1. Background

The number and scale of humanitarian emergencies over the past decade has led to notable efforts to improve assessment tools used in emergency situations; rapid assessments have become one of these widely used tools. Rapid assessments are seen as an instrument for making data available quickly to provide information on the impact of an emergency on affected populations, so as to improve response planning and resource mobilization. **Macintyre (1999)** identifies four attributes that characterize a generic rapid assessment:

- low cost
- quick feedback of results
- smaller sample size than would be expected with traditional survey methods
- increasingly, computerized data capture and analysis

Following the onset of the emergency, during the immediate response phase, an initial (preferably inter-agency) rapid assessment should be conducted; this is usually done in the first two weeks following an emergency. Beyond the immediate response phase, more detailed in-depth sectoral assessments are typically carried out. These may also be considered rapid in nature as quick feedback of results is usually required for the ongoing response.



Source: UNICEF – APSSC

Diagram 1: Sampling methods for data collection in emergencies

The nature of an emergency heightens all the usual challenges associated with data collection. Uncertainty over population figures and demographic information constitutes one of the main barriers to conducting accurate assessments. Standard approaches to data collection particularly with regard to sampling are typically not well adapted to volatile settings, and data collection in a humanitarian response can often lack technical credibility and statistical robustness. It is important to recognize that while good information does not guarantee a good programme, poor information almost certainly guarantees a bad one.

It is not within the scope of this paper to discuss the different types of tools that can be used in a rapid assessment, nor is this paper intended to make expert sampling statisticians of its readers. The aim is to give the reader some ideas about the key points and principles related to sampling that need to be considered when carrying out a rapid assessment in an emergency situation.

At the outset, it should be said that sampling can be a perplexing subject. In a sense, it is very simple and, provided basic principles are followed, it is unlikely that the user can go seriously wrong. On the other hand, there is a danger in thinking that the subject is too easy. Sampling concepts are vitally important to any data collection operation, and users are advised to sharpen their skills in this area, well before any emergency arises.

What can be done before the onset of an emergency with regard to sampling will first be discussed before looking at sampling approaches that should be deployed in the immediate response phase and then beyond that phase. Reference is frequently made to other sources where more detailed information can be found, particularly in section 7.

Box 1: Earthquakes and tsunamis – Rapid assessments in the Pacific

Essential requirements after a disaster are that the assessment is carried out as soon as possible and the results are made available speedily. This does not always happen. An evaluation of what happened after the 2007 earthquake and tsunami in the Solomon Islands is a good illustration of the problem. Because of the multitude of actors involved, UNICEF decided not to conduct any initial surveys and depended on the assessments of others.

Their own later evaluation, however, found that the initial assessment data generated by a variety of organizations (government and non-government) were painfully slow in materializing, and often contained conflicting or confusing information. Those conducting the evaluation said that government and humanitarian agencies working across the Pacific must make stringent efforts to harmonize emergency data collection tools and streamline information management systems in declared emergencies.

Source: UNICEF (2008)

2. Sampling terminology

One of the difficulties in talking about sampling is that it involves a large number of technical terms, and it is important to know what the sampling professional means by these terms, so that the terms can be used correctly. Table 1 provides a brief description of the most important terms. Most of these terms are used specifically in relation to probability sampling; those that apply to non-probability sampling have been clearly flagged (see definitions in glossary below).

Table 1: Glossary of key sampling terms

Term	Usage
Cluster sampling	Sampling in which next-to-last stage involves a geographically defined unit such as a census enumeration area (EA)
Cluster size	(Average) number of sampling units – persons or households – in cluster
Complex sample design	Refers to use of multiple stages, clustering and stratification in household survey samples, as opposed to simple random sampling
Confidence level	Describes degree of statistical confidence with which precision or margin of error around the survey estimate is obtained, 95 percent generally being regarded as the standard
Convenience sampling	A method of non-probability sampling where sample elements (e.g. schools) are purposively chosen because of their easy accessibility or known willingness to cooperate.
Design effect (*deff*)	Ratio of variance from complex sample design to that of simple random sample of same sample size; sometimes referred to as clustering effect, though *deff* includes effects of stratification as well as clustering
Domain	Geographical unit for which separate estimates are to be provided
Implicit stratification	Means of stratifying through geographical sorting of sample frame, coupled with systematic sampling with probability proportional to size
Intra-class correlation	The coefficient of intra-class correlation measures the homogeneity of elements within clusters
Judgement sampling	A method of non-probability sampling that relies upon so-called ‘experts’ to purposively choose the sample elements.

Measure of size (MOS)	In multistage sampling, a count or estimate of the size (for example, number of persons) of each unit at a given stage
Non-probability sampling	Sampling methods not guided by statistical theory. Examples are: quota sampling, judgmental sampling, purposive sampling, convenience sampling, random walk sampling
Non-sampling error	Bias in survey estimate arising from errors in design and implementation; refers to accuracy or validity of an estimate as opposed to its reliability or precision
Primary sampling unit (PSU)	Geographically-defined administrative unit selected at first stage of sampling
Probability sampling	Selection methodology whereby each population unit (person, household, etc.) has known, non-zero chance of inclusion in the sample
Quota sampling	A non-probability technique, in which interviewers are given quotas of certain types of persons to be interviewed.
Random sampling	Sampling procedure in which each unit has a known and specified probability of selection.
Random walk	A type of non-probability sampling in which interviewers begin the interview process at some random but well defined geographic point, and then follow a specified path of travel, systematically selecting households to be interviewed.
Relative standard error (coefficient of variation)	Standard error as percentage of survey estimate; in other words, standard error divided by estimate
Reliability (precision, margin of error)	Refers to degree of sampling error associated with a given survey estimate
Sample frame	Set of materials from which sample is actually selected, such as a list or set of areas; thus a collection of population units
Sample size	Number of households or persons selected
Sampling error (standard error)	Random error in survey estimate due to the fact that a sample rather than the entire population is surveyed; square root of sampling variance
Sampling fraction	The ratio of sample size to total number of population units
Sampling variance	Square of standard error or sampling error

Sampling with probability proportional to size (PPS)	Selection of first (second, etc.) stage units in which each is chosen with probability proportionate to its measure of size
Segment	A delineated, mapped subdivision of a larger cluster
Self-weighting	Sample design where all cases have the same survey weight
SRS	Simple random sample. Each element of the population has an equal chance or probability of selection (rarely used in household surveys)
Stratified sampling	Technique of organizing a sample frame into subgroups that are internally homogeneous and externally heterogeneous to ensure that sample selection is "spread" properly across important population subgroups
Systematic sampling	Selection from a list, using a random start and predetermined selection interval, successively applied
Target population	Definition of population intended to be covered by survey
Weight	Inverse of probability of selection; inflation factor applied to raw data

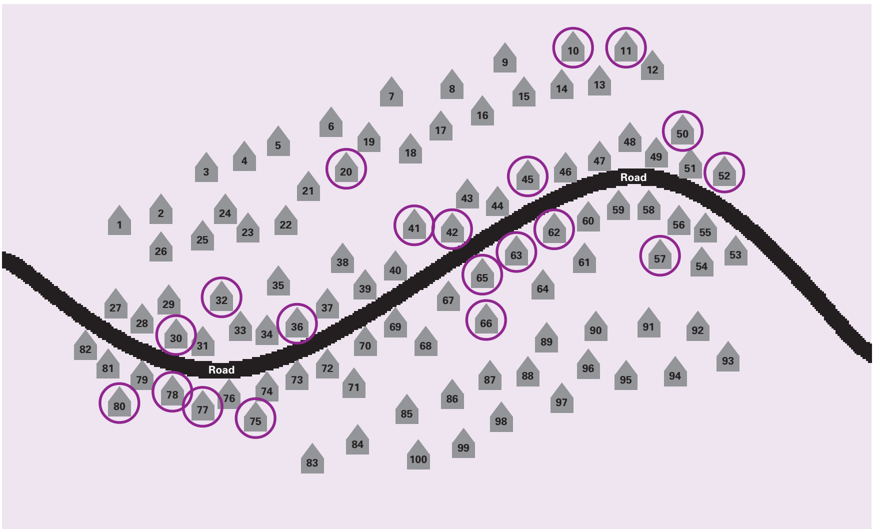
Based on Table 3.1 and text in United Nations (2008)

The use of some of the terms found in the glossary can be illustrated by means of simple examples. These examples are typically associated with probability sampling; however the basic principles which underpin these examples are those which can also be incorporated into non-probability sampling approaches. As will be discussed later, during a rapid assessment there is rarely the opportunity to undertake a statistical probability sampling approach to data collection, however understanding some fundamental statistical sampling concepts and procedures that can be integrated into the data collection during a rapid assessment may lead to improved representativeness and reliability of data.

Simple random sampling

Suppose a village consists of 100 households, and we want to interview 20 of them. We would do the following:

1. A listing of these 100 households, or a map showing the location of these 100 households, would constitute a *sample frame* (see glossary of terms in Table 1). In this example the *sample size* is 20, and the *sampling fraction* is 1 in 5.
2. To select a simple random sample (SRS), we could give each household a different number, prepare a slip of paper for each household with its number on it, and put all these slips of paper into a hat.
3. We would then shake the hat well, and draw out 20 pieces of paper. Alternatively, as is done most of the time, a random number generator would be used. Both of these approaches involve SRS, because the selection of any one household does not affect the probability of selection of any other household.



Source: UNICEF – APSSC

Diagram 2: Simple random sampling

SRS is the simplest example of *probability sampling*. The great merit of using SRS is that we are able to evaluate the *reliability* or precision of any estimate obtained from the survey. This is done by calculating the *sampling error*. If we were to repeat the sampling exercise, drawing many samples of 20 from the 100, and replacing each sample of 20 after it is drawn, we would get many different estimates of our variable of interest (say percentage of households with access to safe water). If the values of all these estimates were plotted on a graph, it would take a bell-shaped form (the normal distribution) and statistical theory allows us to estimate the probability of getting any particular value of the estimate.

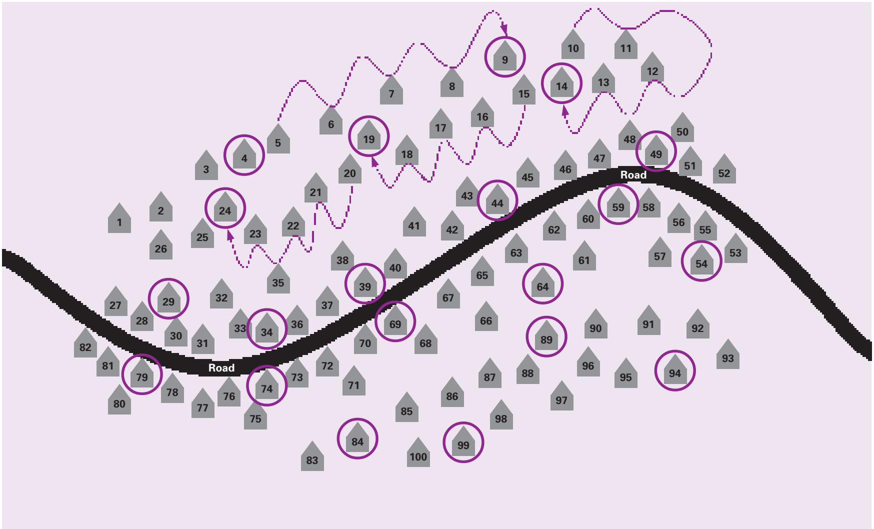
For instance, we can say that we are 95 percent confident that the true (unknown) value of our variable of interest lies within two *standard errors* (on either side) of the value obtained from our single sample. Diagram 2, however, gives an illustration of where this confidence would be misplaced, since we have by chance selected a sample where many of the households fall close to the road.

Systematic sampling

To overcome the problem with the use of SRS which may by chance result in having a sample that is not very representative of the population, an alternative, and better, approach is to use *systematic sampling* whereby:

1. A numbered listing of all the 100 households is created, and an appropriate sampling interval (100/20=5) is worked out.
2. An initial household is selected at random within the first sampling interval (let us suppose we selected the fourth household), and then the sampling interval is added to identify the remaining households: 4, 9, 14, 19, etc.

If the order of listing of the 100 households is entirely random, this use of systematic sampling will give results that are no better than SRS. The trick is to put the households in a meaningful order. Thus, if geographic location is important, it would be good to have the list running in a logical geographic order, from one end of the village to the other. On the other hand, if ownership of assets were an important consideration, it might be more suitable to list according to this aspect, putting those with most assets at the top of the list, and those with very few at the bottom.



Source: UNICEF – APSSC

Diagram 3: Systematic sampling

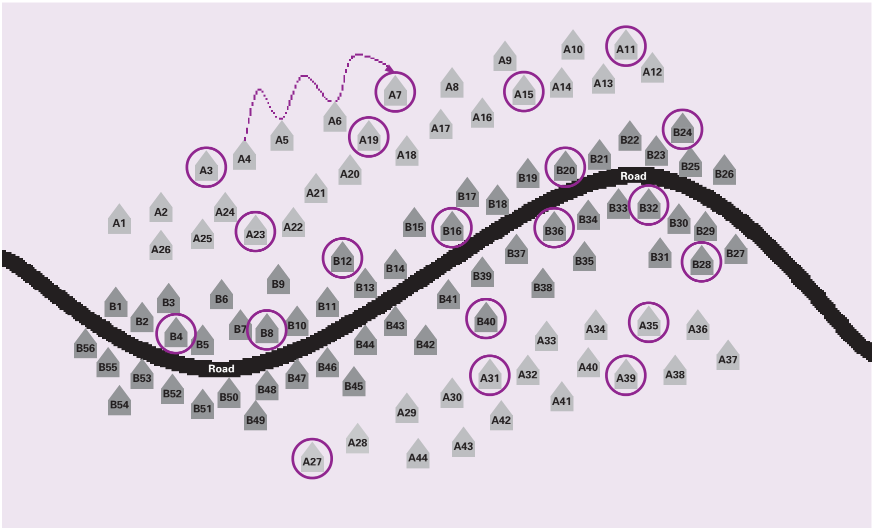
However, although systematic sampling is usually a perfectly acceptable form of sampling, it is not in fact (strictly speaking) a form of simple random sampling. This is because, once we have made the first selection, the rest of the selections are predetermined, while those not selected had no chance of being picked. In our example above, once household 4 had been selected, household 9 was selected with certainty, while household 8 had zero probability of selection. What this means is that we cannot apply the sampling error calculation that we used for SRS. What we can say, though, is that the sampling errors obtained through the use of systematic sampling are nearly always lower than those achieved using SRS.

Stratified sampling

Quite often systematic sampling is combined with other methods of sampling. For example, suppose we were interested in the situation of households that are close to a main road and those that are far from the road, and we knew that villages or houses in the affected area could be divided between those with easy access to the road and those that have to travel quite far to access the main road. We might then choose to use *stratified sampling*. This would involve:

1. Creating two sampling strata, one containing the houses in a predefined distance from the road and the other with the households that are further away,
2. Selecting the samples separately within each stratum.

We might still use systematic sampling for the final selection within each stratum, but stratification would allow us to use different *sampling fractions* in the two strata. If the situation of people living in houses far from the road was of more interest to us, we could oversample that stratum, which would make for a more efficient use of our limited resources.



Source: UNICEF – APSSC

Diagram 4: Stratified sampling

Complex sample designs

These ideas could be extended to the regional or national level, but now we would be dealing with many villages. We can imagine the *sampling frame* as consisting of all the villages, and our interest might be in selecting a sample of households across these villages. But rather than go to every village, which would be very expensive, we might prefer to select a sample of villages, and then interview a *cluster* of households within the selected villages. This involves a more *complex sample design*, where:

1. The villages might be grouped into strata according to their region. These villages form the *primary sampling units (PSUs)*, and can be placed in a logical geographic order, which would provide an element of *implicit stratification*. A common approach is to begin by listing the villages along with some *measure of size (MOS)* (e.g. number of households in them).
2. Within a region, a certain number of villages are then selected systematically with probability proportional to this MOS, and within the selected villages a fixed number of households are selected.

The main advantages of this approach are that the sample is *self-weighting* within a region (since the probabilities of selection at the two stages balance out) and that the method provides a fixed workload for field staff at the final stage. Much more detail on methods of probability sampling can be found in the references given in Section 7.2.

3. Emergency preparedness

The preparedness phase – which precedes an emergency onset – is the most critical phase for planning a comprehensive and more predictable emergency response, including for sampling.

With regard to collecting statistical information, there is much that international agencies can do to prepare for possible emergencies, and UN country teams have actually an obligation as part of the Resident Coordinator (RC)/Human Coordinator (HC) accountability to engage with all parties (in particular in complex emergencies) in an effort to strengthen such statistical capacities. Pre-crisis risk analysis offers a critical element in such a strategy and requires national institutions involved in primary data collection to appreciate the data needs of humanitarian response teams. Many national statistical offices (NSOs) have in place a National Strategy for the Development of Statistics (NSDS). Within the framework of the NSDS, a programme of regular censuses and surveys on a broad range of topics – population, health, education, poverty, etc. – will have been established which will further strengthen the links between NSOs and humanitarian agencies.

A well-conducted initial rapid assessment relies on well-documented statistical and qualitative baseline data about the affected region(s) of a country and its population. Initially, basic demographic data will serve as invaluable input to the estimation of affected populations in combination with rapid assessment data collected from various sites of the emergency. Before a crisis such data should be easily available from most NSOs. Secondary data should also include basic health-related data such as immunization coverage as well as livelihood and poverty-related data. Steps should be taken by the UN country team to consolidate relevant baseline data for disaster-prone regions of a country as part of a UN Emergency Response Plan and to make this available in easily accessible electronic format to all humanitarian stakeholders in the onset of an emergency through relevant national institutions and/or the UN RC/HC Office.

The NSDS provides the framework for the conduct of all national social and economic surveys. There is a well-developed body of knowledge on how such surveys should be conducted, and the relevant sampling literature is referenced in Section 7.2. The survey reports produced initially by the statistics office immediately after the survey are usually fairly descriptive, presenting results for the general reader in the form of tables and graphs, along with an associated commentary. With the enormous developments in computer power in recent years, there is tremendous scope for analysts working in the local offices of these international agencies (or even their counterparts at their regional offices) to carry out further analysis of the data that has already been collected.

Agencies should maintain a complete set of detailed maps of the areas where they are working. Instead of collecting data themselves, it may often be adequate to make use of secondary data. They should maintain proper documentation of relevant surveys and data, and should obtain copies of survey datasets (where available). They should also maintain the necessary metadata about these surveys (questionnaires, coding manuals, etc.) so that they can make full use of the data. Much of the relevant data can now be found on relevant international websites or on the sites of the NSOs, but there is sometimes a time-lag in the relevant information being posted.

In addition to the use of national surveys, another approach that is often used, especially in the health field, is what is known as "sentinel" surveillance. This method involves selecting a number of sites around the country. The topic of interest is then monitored on a regular basis, and can provide a useful early warning system, to detect signs of particular problems at specific sites. While this method is very useful in highlighting specific problems at specific sites, it does have the disadvantage that it is difficult to generalize the results from the level of the individual sites to a regional or national level. There is also the risk that the sample may suffer from what is known as the Hawthorne Effect, in that research subjects tend to change their behaviour over time simply because they know they are being studied.

In summary, the main points to consider in the preparedness phase are to build up and analyse baseline data. This can be achieved through:

- Maintaining good detailed maps of the country
- Identifying pre-crisis population vulnerabilities
- Keeping detailed reports of relevant surveys, including their metadata
- Becoming familiarised with the key statistical indicators of the country
- Identifying enabling and limiting factors (policies, laws)
- Maintaining close working relations with the national statistics office
- Identifying national capacities for emergency response – organizational, human or material
- Building and strengthening data collection system databases, including sampling frames
- Building and strengthening analytical capacity

4. Sampling during the immediate response phase

It is recognised that, in the immediate aftermath of an emergency, it may not be possible to carry out a strict probability sample survey. This may be because of access/mobility issues, time/resource factors and/or because there is an absence of good population data to create a suitable sample frame. In such situations some form of non-probabilistic sampling is often necessary. However, particular attention should be given to issues of bias which are discussed in section 5 below.

There are several key points about sampling that should be considered when preparing to carry out any assessment. At the risk of oversimplification, one can state these as:

- **Coverage:** Identify and define your target population. Aim to cover as wide a cross-section of the relevant population and geographical area as possible. Do not omit key sections. Try to avoid including just easy-to-reach elements.
- **Sample frame:** Establish clearly what your sample frame is. It might be a list of people, villages or a map.
- **Sampling methods:** Use probability sampling if at all possible. If non-probability sampling is used, do not pretend that it is probability sampling! Be honest in reporting your results. Describe clearly what you have done, and why.
- **Sample size:** Go for as large a sample as you can manage within your resources. *Where there is a choice, it is generally better to visit more locations and interview less people in each, than vice versa*.
- **Secondary data:** Make full use of secondary data, i.e. data collected before an emergency (census, surveys etc.) and information provided during the emergency by the media, the Government and other national and international actors. It is not always necessary to collect your own primary data. Even if you do, you can still incorporate the findings of secondary data into your final report, so as to give a more rounded picture of the situation.

Even when it comes to non-probability sampling, the process of selecting sites, households or individuals should still address the points outlined above. While there is often a tendency for people to believe that only convenience sampling can be used in a rapid assessment, there are other non-probability approaches which make more effort to increase the representativeness of the data. For example, Box 2 highlights an example of how a rapid assessment in Somalia was undertaken to ensure representation of all the Internally Displaced Person (IDP) camps that made up the sampling frame.

Box 2: IDP settlements in Somalia – Rapid population assessment

Occasionally, it is just not realistic to carry out a proper sample survey. For instance, among affected populations in an emergency situation in Mogadishu, the survey team simply approached three separate authority figures in each of 17 IDP settlements, and asked them basic questions about the population of the settlement. The responses were triangulated to arrive at a single response for each settlement.

Source: SAACID (2007)

Judgement sampling

One type of non-probability sampling is *judgement sampling*, where so-called "experts" select the sample. The argument here is that by making the selection themselves, they can avoid any possible risk of getting an unrepresentative sample, as might arise if all the areas chosen at random happened to fall in one part of a region. However, this argument does not take account of the variety of sampling methods that can be used with probability sampling. In fact, simple random sampling is very rarely used as a method of probability sampling. Instead, some kind of multistage sampling is normally used, often involving stratification and the use of systematic sampling, both of which greatly reduce the risk of getting an unrepresentative sample.

Judgement sampling is usually an extension of convenience sampling. For example, the expert may decide to draw the entire sample from one "representative" village, even though the target population includes many villages. When using this method, the researcher must be confident that the chosen sample is truly representative of the entire population. The expert would have to be extremely familiar with all villages to have this confidence. In reality, it is quite unlikely that the selected villages or households would be representative of all villages or households.

Purposive sampling

Rather than doing a simple convenience or judgement sampling, it is much better to select sites based on whatever data is available at the time. Choices must be made to include sites that will enable the person to understand the situation in the affected area as a whole, including but not limited to the worst-affected sites and population groups. Selecting priority areas for assessment entails some form of purposive sampling.

Purposive sampling is usually the best choice of sampling in the immediate aftermath of an emergency when it is not possible to apply probability sampling. Within this approach, selection of the sample is done according to specified criteria to represent certain cases, e.g. the extremes or the norm. The criteria for site selection (**IASC, 2009**) will generally be:

a) Urgent need: At the height of the crisis, data collection will be limited to a first fast exercise. Very practical criteria clearly linked to programme responses will guide site selection. First priority will be to assess areas in greatest need. Consider factors of vulnerability, including population size, density and influx, availability of water and food, reported epidemics or malnutrition.

b) Accessibility: Where overall needs are urgent, widespread and unmet, it is justifiable to focus on accessible areas. However, where inaccessibility is a widespread problem or coincides with very urgent needs, the extreme rapid assessment – a two-hour visit – may be necessary to fill information gaps.

c) Gaps in existing knowledge: Cover locations about which little is known or where key information is lacking, especially where no relief agencies are yet working.

d) Worst-/best-case scenarios are often used to provide some reference for interpreting data. Even if, based on the practical criteria above, sites selected are those most urgently in need of assistance, one may need to have some reference of comparison – the best and worst cases in areas heavily affected and in comparable unaffected areas.

Given time and other constraints, it may be useful to stratify possible localities according to socio-economic or demographic criteria and visit diverse areas in order to capture the variations in impacts of the crisis. It may be useful to list and select sites in different livelihood or agro-ecological zones, in both urban and rural areas, and with both residents and non-residents (displaced persons). Additional criteria for stratifying and selecting sites could include:

- sites with more/less access to services;
- sites with higher/lower levels of known poverty;
- sites with known higher/lower prevalence of chronic malnutrition;
- sites in areas with different ethnic group composition.

Once sites, villages or households have been stratified by some fixed criteria then a form of quota sampling can be applied. This would involve specifying a minimum number of sampled units in each category. These numbers may not be large but should be enough to ensure that something can be said about even small groups in the population. This method is the non-probabilistic analogue of stratified random sampling in that it is typically used to ensure that smaller groups are adequately represented in your sample.

"Systematic" random walk

An approach which is often used in post-emergency surveys when complete data on the affected populations is still not available is the so-called *'random walk'* to select the individual households for interview. In a rapid assessment undertaken in the immediate aftermath of an emergency, the random walk method is a systematic approach for ensuring that information is collected from households with different proximity to the village centre, roads, stream etc.

In a random walk process:

- Interviewers are instructed to begin the sampling at some randomly defined geographical point, and then follow a specified systematic path of travel in order to select the households to be interviewed.
- This might entail selecting every nth household, or else screening each household along the path of travel to locate the presence of the special target population such as children under 5.
- In the latter case, each qualifying household is interviewed, until the quota is reached.

Useful details on conducting the random walk method can be found in the FANTA-2 project document (**FANTA-2 Project, 2009**) and in the ICRC/IFRC guidelines (**ICRC/IFRC, 2008**).

Using sampling techniques for estimating population size

Collecting demographic information is usually one of the first priorities in an emergency situation (**Depoortere & Brown, 2006**). For instance, in the case of a natural or man-made disaster, the total number of displaced persons will provide a useful indication of the magnitude of the disaster. Knowledge of the total affected population, and of average household size, will be useful when planning an intervention, and when calculating needed quantities of food, water, etc. Population figures are also needed to provide the denominators for indicators (such as mortality rates) that will later be calculated and compared to international standards. It is also useful to know the age and sex distribution of the population, so that programmed interventions can target specific groups, such as children under 5 or pregnant and lactating mothers.

There are various demographic assessment techniques that can be used to estimate the size of the target population. The principal ones are:

- **Census and/or registration:**

  In a census, every person is counted and registered individually. It is the ideal method to use, but needs to be done at the time of day when most people are "at home". It takes a long time to carry out a census, and it requires a lot of human resources for its successful completion, both of which are probably lacking at the time of an emergency. In the case of displaced persons, it may be possible to carry out a systematic registration of persons as they arrive at the new site. This may be coupled with other aid activities, such as distribution of food cards, detection of malnutrition, measles immunization, etc.

- **Exhaustive counting of habitats (or households)**

  Habitats in the target area are counted one by one. This is often only feasible in small sites, involving small surface areas. The average number of persons per household is obtained from a sample of households, selected at random or through systematic sampling.
  The total population is then obtained by multiplying the total number of habitats by the average number of persons per household.
  An exhaustive counting of habitats can be done while walking, or driving in a car, or even by aerial photography (provided the pictures are of sufficient quality).

- **Immunization coverage or programme activity data**

  This method uses the results of an immunization coverage survey or the number of vaccines administered during a mass immunization campaign, for a specific age group (e.g. 6 to 59 months). By using the known reference age group distribution, the total population can be deduced. For instance, suppose the immunization coverage rate among this age group was 80 percent and that 10,000 children in this age group were immunized. The total children in this age group is therefore 10,000/0.80 = 12,500. Further, if we know that children in this age group represent about 16 percent of the total population, we can estimate the total population at about 12,500/0.16, or about 78,000 persons.

- **Area sampling**

  Using area sampling methods (see Box 3), the surface area is first estimated. Then the total population is calculated, by counting the number of persons in a randomly selected sample of blocks or habitats. **Brown et al. (2002)** have noted that, while this method of estimation is a valuable public health tool in emergencies, it does have some limitations. In particular, they suggest that issues relating to population density (since this is often used as a factor in dividing the total area into a number of strata) and the number and size of blocks to be selected require further research.

Box 3: Using area sampling methods for estimating population size

1. Delineate the boundaries of the target area in which people are living. Walk or drive along the boundary to identify key landmarks. Note their location, preferably using GPS.
2. Draw a map, and calculate the total surface area.
3. Draw a grid on the map, using squares of 25m x 25m or 100m x 100m, depending on the scale of the map.
4. Randomly select a number of squares or GPS points, say 15.
5. Count the number of people living in habitats within each square.
6. Estimate the population by extrapolating the average number of persons per square, to the total number of squares counted for the full surface area.

"Guesstimates"

Many organisations make very rough estimates based on visual assessments. In practical terms, this means an educated guess and it can only be done with some kind of visual picture of what, for example, 1,000 people looks like. It should be noted that in developed countries where this technique has been used for assessing the size of public demonstrations and crowds, different sources often come up with figures that differ by 100 percent or more. Therefore this is not a refined science and should only be used in the absence of other data.

Key informants' estimates, i.e. estimates by people and community leaders from the area, can also be used. The margin of error may be no greater than with the bird's-eye view. However, this can be particularly useful at the initial stages of an emergency, until conventional wisdom becomes challenged. In these situations it is important to select more than one informant and to triangulate the information provided by each to determine its reliability.

5. Issues of bias in sampling in the immediate response phase

One of the main criticisms of rapid assessments has always related to sampling issues and in particular to the use of non-probability sampling methods. The absence of a proper sampling frame means that it is impossible to calculate the probabilities of selection, and the method of sampling used gives the possibility that there may be sub-groups of special interest (such as the inaccessible and the poorest) who cannot get into the sample or are severely under-represented in it. Such a selection bias would have serious implications for analysis.

Bias is a key issue in any sampling exercise particularly when the existence of displaced populations and time constraints make it impossible to employ randomised sampling techniques, and a blend of purposive and convenience sampling will therefore be used. These carry the inherent risk of introducing bias. This is particularly so when assessors are forced to rely on a small number of more easily accessible informants and observation points, which may not be at all representative of the population or situation as a whole. For instance, for key informant interviews, where a site includes a host population and a displaced population, key informants should be selected for interview from both groups, so as to minimize the risk of bias. In the case of group discussions, assessors should consider the possibility of bias arising from the way in which they have located the group of people chosen for the discussion.

Bias can arise in many different ways. For example, the omission (accidental or intentional) of some part of the target population from the sampling frame would mean that the omitted section of the population was not represented in the sample, and would be likely to produce biased results. Even if at the analysis stage nothing can be done about this, this should be clearly highlighted in the assessment report.

Bias can occur in the field if the interviewer is given the task of selecting the households or people to interview. They may decide to pick certain types of people, rather than follow the set instructions on whom to select for interview.

Various examples of situations giving rise to bias can be found in reports published on the Internet. A good example is the experience of **Collins (2001)**, which is described in Box 4.

One way of reducing bias in data reporting is through triangulation. The aim here is to use different approaches for collecting the same data and then to crosscheck the results to identify inconsistencies. For instance, this can be done by comparing results from the key informants, from the group discussions, and from the team's own observations.

Box 4: Possible bias in Darfur – a salutary lesson

An NGO team in Darfur tried to focus its attention systematically on the most vulnerable areas and families, with the aim of describing the situation of the most-at-risk, rather than giving a general picture of the situation. Given this focus, it was surprising that their results suggested that the nutritional status of the population was not too bad, which conflicted with the results obtained through large-scale surveys.

A likely explanation for these differences is that the team had falsely assumed that the displaced are the most vulnerable. In Darfur such an assumption would be an oversimplification, because the displaced people who live around the wadis are the ones who still have cattle remaining, and are in fact the richest segment of the population.

This clearly illustrates the dangers of rapid assessments and convenience sampling. One erroneous assumption can completely alter the interpretation of the whole dataset.

Based on Collins (2001)

Those carrying out rapid assessments need to be alert to the possibilities of bias in the methods they are using, and to take remedial action if bias is suspected.

When a probability survey is carried out, it is possible to calculate the level of sampling error, which provides a measure of the variation between one sample and another as a result of using sampling. But all surveys are subject to non-sampling errors, which are due to errors of measurement, and these errors can arise from all manner of causes. Some response errors may be more or less random and cancel each other out, but in other situations there may be a consistency of errors leading to a definite bias.

Bias can occur at many different stages during the sampling process, including the following:

- Coverage – failure to adequately cover the population of interest;
- Sampling frame – inadequacies in the frame used for sample selection;
- Actual selection of the sample – bias introduced in method of sample selection wherever selection of sampling units occurs, i.e. office or field;
- Training of field staff – bias due to inadequate training of field staff.

6. Beyond the immediate response phase

Non-probability samples are often used by people in situations where many of the challenges faced in the immediate response phase no longer apply. The justification for conducting non-probability methods is often based on cost considerations or for convenience, or sometimes it is argued that a 'random' sample may not properly represent the target population. However 6-8 weeks after the emergency, conditions change and more information on the population may become available so the justifications for conducting assessments using non-probability methods no longer apply. From this stage on, great efforts should be made to ensure that assessments are representative of the population and area under study.

Box 5: Current WHO guidelines on sampling for health surveys

"Probability sampling means that every single individual in the sampling frame has a known and non-zero chance of being selected into the survey sample. **Non-probability methods of sampling such as quota or convenience sampling and random walk, may introduce bias into the survey, will throw findings into question, and are not accepted by WHO** *(their emphasis)*."

Source: WHO (undated)

Probability sampling describes the type of sampling where the sample is selected in accordance with statistical theory. There are three important conditions for probability sampling:

- Each element of the target population must have a known mathematical chance of being selected;
- This chance of selection must be greater than zero;
- It must be possible to calculate this chance.

One important point to note is that the chances of selection do not have to be the same for each element of the population. The chances can vary for different elements, depending on the objectives of the assessment.

As a result of using probability sampling, there are two important outcomes. First, it is possible to derive estimates from the survey, and to say that the sample is representative of the target population. Secondly, it is possible to calculate sampling errors, and thus get a good idea of the precision of the survey estimates. Neither of these steps can be carried out in the case of non-probability samples, which is why the use of probability sampling is strongly recommended, even if it does have cost implications.

Many aspects of sample design require assistance from a specialist who will be able to provide guidance on the calculation of the sample size, construction of frame(s) and evaluation of the sample design options. It is strongly recommended that a sampling statistician be consulted on the design of any data collection activity particularly when the assessment aims to use probability sampling.

For any probability survey in an emergency situation, the following points should be borne in mind (these are taken from Annex 1 of USAID (2005)):

- **Objectives**

  The purpose of conducting a survey is to describe key characteristics of the population under study, such as the proportion of houses damaged by an earthquake or the proportion of children vaccinated against measles. To derive an accurate estimate, the survey sample must be representative of the overall population. Therefore, if the affected population is very large or dispersed over a large area, the survey sample should be taken from as wide an area as is practical and not restricted to a small sub-area, which may not be typical of the population as a whole. Moreover, surveys should avoid sampling only the most accessible members of the affected population (e.g. those living along roads, near markets or in the centre of town).

- **Coverage**

  The first step of any survey is to define the area under study. It is usually best to draw a rough map of the area that would include as much detail as possible about where people live, relative population concentrations, and major geographical features, such as roads and rivers. Use local informants to provide overall information about an area, as well as information on which areas are most and least affected. Investigators may wish to draw their sample from areas showing a wide range of severity of impact. It is a good idea to ask different people their opinion.

- **Size of sample**

  The next step is to decide how to select the sample and its size. This decision depends on a number of factors including:

  - size of the area under study, and number of investigators available;
  - time available for the survey, and availability of transport;
  - distribution of the affected population (isolated households, villages, camps);
  - circumstances facing people in various parts of the emergency-affected area.

The simplest and quickest survey can be done by choosing a sample of at least 50 households at random. Data collection in this survey may take two or three people only one afternoon or less to complete. More extensive surveys may be necessary, but will require more people and time to complete.

One problem that sometimes arises is that it is not possible for the survey to cover all the target population. For instance, it might not be possible (or too difficult) to cover nomads or boat people, and they may be left out of the sampling frame. This means that some members of the target population have a zero chance of being selected for the survey. In this case, the target population must be redefined so as to exclude these groups. The survey is then carried out on the redefined target population, but when the results are presented it is important to make clear which special groups were excluded from the sampling frame.

An approach to reduce the cost and time of the assessment is to use some form of cluster sampling. Cluster sampling is an approach in which each member of the population is assigned to a group (cluster) and then clusters are randomly selected and all members of selected clusters are included in the sample. In multistage sampling, on the other hand, clusters are again selected but this time sample members are selected within the cluster using simple random or systematic sampling, rather than taking the whole cluster. Typically, to carry out a survey in a rural area, one might select 30 villages at random (preferably by sampling with probability proportional to size) from a list of all the villages in the affected area, and then pick a sample of households in those selected villages.

Cluster sampling is the approach most often used by epidemiologists. It is appropriate for situations in which there is no readily available sampling frame (such as a camp census list) but for which it is easy to obtain lists of subgroups or clusters of individuals, e.g. compounds or buildings or tents. It is generally quicker and cheaper than non-stratified sampling.

An important design consideration is what size sample is required in order to obtain results of reasonable precision. There are two key elements to this decision: how many clusters to take and how many households to interview within each cluster. A paper by **Binkin et al (2007)** considers the issue of the appropriate sample size for a nutrition survey in a situation of famine. They consider that, on the basis of theoretical considerations, population-based surveys of 30 clusters of 30 children should provide reasonably valid estimates of the prevalence of malnutrition with at least 95 percent confidence that the estimated prevalence differs from the true value by no more than 5 percent. The 30 x 30 approach has been used most frequently in emergencies and is known to provide reliable population estimates, however it is also time and resource intensive.

The suggestion of aiming for at least 30 clusters in every domain represents good advice. The need to select 30 children within each cluster is, however, open to question. In many situations, where the characteristic of interest is fairly homogeneous within each cluster, very little benefit is gained by selecting so many elements within the same cluster. It might well be more efficient, from a sampling point of view, to select a smaller number of elements in the cluster (say 20), and to use those saved resources to increase the number of clusters that are selected.

A recent Guide on alternative sampling designs for emergency settings (**FANTA-2, 2009**) looks at alternative sampling designs which can provide reliable estimates on the prevalence of acute malnutrition that require substantially less time and cost than is required for carrying out a 30x30 design. Significant work has been undertaken to test and validate the following alternative designs 1) 33 clusters with 6 observations in each 2) 67 clusters with 3 observations in each and 3) a sequential design. The results suggest that, rather than using '30 x 30' designs, it will often be more appropriate to increase the number of clusters and reduce the number of observations within each selected cluster. For instance, it was found that a '67 x 3' design provides estimates that are almost as precise as those provided by the '30 x 30' design, but requires only one-third to one-half of the field time to collect the data.

The Expanded Programme on Immunization (EPI)

Probably the best-known rapid assessment survey tool is the Expanded Programme on Immunization (EPI) cluster sample method developed by WHO in the 1980s, which was designed to measure immunization quickly and cheaply. The EPI strategy was to sample 30 clusters with probability proportional to the most recent census estimate of size and then select seven children within each cluster, yielding a sample size of 210 children (hence their short title of '30 x 7 surveys'). At the final stage of household selection the random walk method is applied where in each selected cluster, the interview team starts at a central point, selects a random direction from that point ('spinning the pen'), and chooses a dwelling at random among those along the line from the centre to the edge of the community.

All children in the household in the age range 12-23 months are selected and the mother or caregiver interviewed. (In multi-household dwellings, all households are visited.) Starting from this household, the next nearest household is visited in turn until at least seven children have been found. In case of non-response, call-backs are not usually implemented, and the interviewers proceed to the next household.

Clusters are selected with probability proportional to estimated size, households within them are selected with approximately equal (but unknown) probability, and all eligible children in a household are selected. The overall probability of any child being selected is therefore roughly equal, and the design is approximately self-weighting, so that no weighting is needed in the analysis. Those advocating the use of the EPI approach say that the sample size allows vaccine coverage to be estimated with a 95 percent confidence interval of ± 10 percentage points, on the assumption of a design effect (increase in variance due to clustering) of 2. But considering the uncertain nature of the probabilities, it is doubtful whether sampling errors can really be meaningfully calculated.

If the region to be surveyed is very large or heterogeneous, it may be split into strata and 30 clusters selected from each stratum, allowing sub-regional estimates to be made. A sample of 30 clusters is the minimum acceptable number used for these types of surveys. The accuracy of the parameter estimate being measured could be increased by increasing the number of clusters sampled, but this would increase the costs and time for survey, both of which are scarce in most emergency settings.

While the EPI method proved adequate for the purpose for which it was originally intended (immunization surveys), problems arose when others tried to adapt the method for use on other types of surveys. We show in Box 6 some of the improvements that could be made to the methodology to improve its acceptability.

Box 6: Problems arising with EPI, and some remedies

Problem 1: In emergency situations, the use of PPS sampling for choosing clusters might be problematic. First, estimated population sizes for each cluster in complex emergencies are generally not accurate. Second, displacement among subpopulations is unlikely to be proportional across a region or district because of the chaotic nature of forced migration and the nearly constant inflows and outflows of migrants in many situations.

→ **Remedy 1:** Use the latest information available (e.g. food distribution censuses or other data) to update baseline population figures before sampling.

Problem 2: In the second stage, once sample clusters are chosen, households are chosen. At this stage, the sample of households may be biased towards households on roads or in the centre of the settlement if interviewers are not careful in their household selection methods. The interviewers' judgement on sampling households may affect the validity of the results.

→ **Remedy 2:** Either (i) use systematic sampling, with the sample drawn from right across the line drawn from the centre to the edge of the cluster

or (ii) use maps to create a sampling frame of households.

Methods that can be used to ensure that the whole geographic area is covered include using the **transect walk**, in which the investigator uses a compass and map to trace a straight line through the affected area. A walk along this line offers perspectives on both central and peripheral areas.

Problem 3: Non-responding households are ignored, and the sample is slanted towards readily available households who are willing to cooperate. The characteristics of these households may well be markedly different from the non-responding households.

→ **Remedy 3:** Do not substitute non-responding households with other households

Problem 4: EPI is not a strict probability sampling technique.

→ **Remedy 4:** Use compact segment sampling (the "modified segment design").

The area is divided into approximately equal size segments and segments are selected randomly. At the final stage of sample selection all the households in the sampled segments are interviewed, rather than taking a sample of these households as in the normal cluster approach.

Note: For further information on the problems with EPI, and suggested remedies, see Malilay et al. (1996), Turner et al. (1996), Macintyre (1999), Milligan et al. (2004), UNICEF (2006), Dieterich (2007) and Grais et al. (2007)

7. Further reading

In this short paper we have introduced ideas related to the use of sampling in emergency situations. We end by providing some guidance on the extensive literature that exists on the use of sampling in data collection, both in the particular context of rapid assessment and then in a more general sense. The specific references given on rapid assessment show how different agencies are addressing the issue of sampling in the context of rapid assessments, while the more general sampling reports will provide a useful reference source for anyone who wishes to improve their skills in the use of probabilistic methods of sampling. The two issues are inter-related; experience gained in implementing probability-based sampling schemes in pre-emergency situations will prove invaluable to anyone who is asked to design a probability (or even a non-probability) sample in the immediate aftermath of an emergency.

7.1 Specific guides on sampling for rapid assessment

The Inter-Agency Standing Committee (IASC) is the primary mechanism for inter-agency coordination of humanitarian assistance. It includes both UN and non-UN humanitarian partners. The IASC has produced some guidance notes on Initial Rapid Assessments (IRA), intended to help people prepare to organize and carry out an IRA **(IASC, 2009)**. These notes accompany a Multi-sectoral Initial Rapid Assessment Tool, which was developed by the IASC global Health, Nutrition and WASH clusters in 2006-2009. The tool is intended to enable faster and better multi-sector rapid assessment in the first few days of a sudden-onset crisis, in order to guide the initial planning of urgent humanitarian interventions, identify needs for follow-up assessments, and inform initial funding decisions. It involves both primary data collection (in the field) and secondary data collection (from reports, maps, etc.).

In March 2008 a group of organizations in Pakistan came together to form the Multi-Cluster Rapid Assessment Mechanism (McRAM). McRAM was created within the framework of the Disaster Risk Management (DRM) Thematic Working Group of the One UN pilot in Pakistan, and the project is jointly administered by IOM and UNICEF under the guidance of the McRAM Steering Committee set up by the IASC Disaster Management Team. The steering committee includes representatives from the Government, international agencies, and international NGOs. (www.mcram.org)

The aim of McRAM is to put in place a well-designed multi-cluster assessment mechanism, and a system prepared to implement this mechanism at very short notice, so that accurate information can be collected rapidly on the ground in a post-emergency situation. The McRAM document (**UNICEF, 2009**) states that "there is a conflict between regular sampling surveys and the premise of timeliness in the context of a McRAM". Regular sampling surveys cannot have the name Rapid. In this current note on sampling, we have chosen nonetheless to widen the discussion so as to include issues related to regular household surveys.

The International Committee of the Red Cross (ICRC) and the International Federation of Red Cross and Red Crescent Societies (IFRC) have recently produced some guidelines for assessment in emergencies (**ICRC/IFRC, 2008**). They distinguish three types of assessment: rapid assessment, detailed assessment, and continual assessment. A rapid assessment is undertaken after a major upheaval such as an earthquake or sudden population displacement, and gathers information on the needs and existing capacities of the affected population, possible areas of intervention and resource requirements. It should be followed by a detailed assessment. A rapid assessment is expected to take only about a week. It will involve use of secondary information, information from local services, Government and NGOs, and a small sample of affected persons or households. There may be only limited access to information sources.

UNICEF has published a 400-page emergency field handbook for use by its own staff (**UNICEF, 2005**). The handbook deals with the first 72 hours of an emergency. It stresses the need for rapid assessments to be carried out in each of the priority areas defined by the Core Commitments for Children in Emergencies (health and nutrition; water, sanitation and hygiene; child protection; education; and HIV-AIDS). It contains a useful checklist of items to be considered for the initial rough assessment (Chapter 1.2) and practical advice on assessment and monitoring (Chapter 3.1).

UN Habitat maintains a Disaster Assessment Portal containing links to many useful manuals and tools that are relevant to the issue of sampling for emergencies. This site is at *www.disasterassessment.org/resources.asp?id=6&cid=1*. It is intended as a forum where members of the disaster management community can meet to exchange tools and case studies related to disaster risk assessment.

A publication from WHO provides useful guidance on appropriate techniques to use during rapid assessment (**WHO, 1999**). Annex 1 of that publication addresses the issue of the use of informal household surveys for rapid health assessment and the actual process of selecting the sample. It suggests that, during the initial assessment of an emergency, limited surveys using non-probability sampling of affected populations may provide an estimate of the extent of the damage and immediate health needs for guiding emergency decisions. But it acknowledges that it may be difficult to compare the results of these surveys with those of subsequent and more statistically valid surveys.

The publication suggests that larger, statistically valid household surveys are a valuable tool during later stages of the emergency, when there is more time available to refine the initial estimates, based on the rapid health assessment. Given the variety of situations in which rapid household surveys may be conducted, each one must be designed specifically; the WHO manual does not attempt to provide a model.

A collaborative effort between USAID, CIDA, and UNICEF has resulted in the production of SMART which stands for Standardized Monitoring and Assessment of Relief and Transitions (**SMART, 2006**). It provides a standardized methodology for assessing needs that will facilitate comparability between countries and emergencies so as to prioritize resource allocations. In addition to the survey protocol and guidelines, it incorporates a Windows-based analytical software program and a standardized reporting format that simplifies the process of data entry and analysis of complex data. It is considered easy for field workers to understand and apply.

The SMART manual includes a detailed 25-page discussion of sampling issues. Among the topics covered are the following: types of sampling (exhaustive, representative, and convenience – though it emphasizes (p.36) that "convenience sampling is never used in a survey"); precision, bias, and sample size; sampling methods (simple random sampling (SRS), systematic, and cluster); calculating sample size; methods of choosing households for anthropometric and mortality surveys; what to do when the house is selected, and on arrival in the house; and problems often encountered.

Reference has already been made to the useful field operations guidebook produced by USAID (**USAID, 2005**), which covers disaster assessment and response. It includes a description of various types of sampling procedure. Also, as described earlier, a guide for survey planning, data collection and analysis has recently been produced under one of its projects, giving alternative sampling designs for emergency settings (**FANTA-2, 2009**).

A particularly useful source of information on issues relating to sampling in disaster situations is the publication from Johns Hopkins University (**CIEDRS and Hopkins Population Center, 2003**). The CIEDRS manual focuses on issues relating to the estimation of population size and mortality, but contains extensive advice on sampling issues. (CIEDRS is now renamed CRDR – Centre for Refugee and Disaster Response). Prior to this publication, a Roundtable on the Demography of Forced Migration was held in 2002, to discuss how to count the number of displaced persons following an emergency and assess their general well-being. The report of the workshop is online (**National Research Council, 2002**). CRDR, in collaboration with the International Federation of Red Cross and Red Crescent Societies, has produced a public health guide for emergencies (**CRDR, 2008**). The guide contains a chapter on epidemiology and surveillance, as well as several other sections dealing with the use of monitoring and evaluation in various contexts.

A useful source of information on rapid assessment surveys is maintained by the Department of Epidemiology at the **University of California, Los Angeles** (www.ph.ucla.edu). The website lists over 100 articles related to this topic.

One useful practical guide to rapid health assessment of refugee and displaced populations has been prepared by **Depoortere & Brown (2006)**. It is based on the experience of Médicins Sans Frontières and Epicentre in the field, and is intended for use by health personnel who need to carry out a rapid health assessment of a refugee or displaced population. It has a chapter on methods of data collection, covering in particular sample surveys and demographic assessment methods. An appendix gives more advice on how to do area sampling.

7.2 General guides to probability sampling for data collection

There is already a considerable body of literature, covering a wide range of survey types. These methodologies have been developed by various international survey programmes, and provide all the information that a person may require for carrying out surveys in a particular field of interest. Table 2 shows the key features of some of these programmes, and indicates what material is available on sampling.

One major source of information on sampling for household surveys is a new publication from the UN Statistics Division (**United Nations, 2008**). The main purpose of the handbook is to provide basic concepts and methodologically sound procedures for designing samples for surveys, in particular national-level household surveys, emphasizing applied aspects of household survey design. While a sampling background will be helpful to users of the handbook, others with a general knowledge of statistical and mathematical concepts should also be able to use it and apply its contents with little or no assistance. The handbook aims to present material in a practical hands-on format as opposed to stressing the theoretical aspects of sampling. Numerous examples are provided to illustrate concepts and techniques.

UNICEF has produced a comprehensive manual on survey methods relating to its own Multiple Indicator Cluster Surveys (**UNICEF, 2006**). This manual deals with all aspects of survey work for MICS3. One chapter of 50 pages relates to designing and selecting the sample. It offers four options for suitable sample designs for MICS surveys, but the ideas are equally applicable to other national surveys: use of an existing samples (the preferred option); a standard segment design; a modified segment design, involving the interviewing of all households within the cluster; and shortcut designs such as random walks (which are not recommended). Details of the methods are given in the manual.

The CWIQ survey represents a good compromise between the full-scale sample survey and a rapid assessment survey. The survey, developed by the World Bank in collaboration with UNDP and UNICEF, is designed to measure social indicators on a frequent basis. It collects indicators of household well-being, as well as indicators of access, usage, and satisfaction with community and other basic services.

Rapid survey implementation is achieved through using a short questionnaire with a standard set of multiple-choice questions, and by using scanning technology at the data processing stage. However, it is important to emphasize that there is no compromise on sampling. Wherever possible, a large sample is used, so as to provide data at a disaggregated geographic level, and the actual method of sample selection is based on traditional and sound methods.

Table 2: Guidebooks on sampling in national surveys

Name of survey programme	Key institution	Main purposes of the programme	Website	Sampling materials
Multiple Indicator Cluster Surveys (MICS)	UNICEF	Collecting information on indicators for monitoring goals and targets for Millennium Declaration and other international agreements.	http://www.childinfo.org/mics3_manual.html (Manual for MICS 3 round – UNICEF is now organizing MICS 4)	UNICEF (2006), *Multiple Indicator Cluster Survey manual 2005: Monitoring the situation of children and women*. Ch 4: Designing and selecting the sample
National Household Survey Capability Programme (NHSCP) – programme has now ended	United Nations Statistics Division	1. Assisted developing countries to obtain critical demographic and socio-economic data through an integrated system of household surveys. 2. Supported methodological work leading to the publication of several technical studies and handbooks.	UNSD has now published: United Nations (2008), *Designing household survey samples: Practical guidelines*. Can be downloaded from: http://unstats.un.org/unsd/demographic/sources/surveys/Handbook23June05.pdf	NHSCP (1986), *Sampling frames and sample designs for integrated household survey programmes*. NHSCP (1993), *Sampling errors in household surveys*. NHSCP (1993), *Sampling rare and elusive populations*.
Demographic and health surveys (DHS)	USAID – through Measure-DHS	Assists developing countries to collect data on fertility, family planning, and maternal and child health.	http://www.measuredhs.com/pubs/pub_details.cfm?ID=715&srchTp=advanced	Macro International (1996), *DHS sampling manual*
World Health Survey (WHS)	WHO	Compiling comprehensive baseline information on the health of populations and the functioning of health systems.	http://www.who.int/healthinfo/survey/whssamplingguidelines.pdf	WHO (undated), *The World Health Survey: Sampling guidelines for participating countries*.

Living Standards Measurement Study (LSMS)	World Bank	1. Capture various dimensions of welfare. 2. Explore ways to improve the type and quality of household data collected. 3. Foster increased use of household data as a basis for policy making.	www.worldbank.org/lsms	Margaret Ghosh and Juan Muñoz (1996), *A manual for planning and implementing the Living Standards Measurement Study Survey*. See Chapter 4: Sampling, pp.53-83
Core Welfare Indicators Questionnaire (CWIQ)	World Bank	1. Provide policy makers with quick feedback at a more disaggregated level than LSMS. 2. Measure people's access, utilization and satisfaction with key economic and social services.	go.worldbank.org/66ELZUGJ30 (download from bottom of page)	*CWIQ Handbook* (1999) See Chapter 4: Preparing the CWIQ sample design, pp. 59-77

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UNICEF Asia-Pacific
Shared Services Centre
19 Phra Atit Road
Bangkok 10200, Thailand
Tel: (66 2) 356-9499
Fax: (66 2) 280-5941
E-mail: apssc@unicef.org
Website: www.unicef.org