



# FOCUS on Field Epidemiology

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## Rapid Needs Assessments and GIS

A tornado sweeps through your town overnight, destroying countless homes and buildings. You arrive at your job at the county health department early the next morning knowing that there will be a lot to do in the wake of this disaster.

You want to figure out what your community needs, and you want to do it quickly. Are families in need of shelter? Do people with chronic health conditions need special assistance? Has there been a disruption of essential services such as water and electricity? And how can you know what the needs are when they are changing minute by minute?

Fortunately there is a tool that can help you quickly find out what you need to know: rapid needs assessment.

This issue of FOCUS tells you how to conduct a rapid needs assessment, and how to use geographic information systems to help gather and analyze information quickly and efficiently.

### Rapid Needs Assessments

Rapid needs assessments are designed to quickly provide accurate and inexpensive population-based information about community needs in the aftermath of a disaster. (1)

Rapid needs assessments provide the information needed to match a community's emergency needs with the available resources. Early assessments combined with rapid mobilization of resources can significantly reduce harmful public health consequences of a disaster. (2)

### Methodology

When conducting a rapid needs assessment, it is important to accurately sample the population being surveyed. The World Health Organization's Expanded Programme on Immunization (EPI) adapted the method of cluster sampling to assess levels of immunization coverage. (4)

The EPI method, which involves a 2-stage cluster sample, requires sampling 30 clusters from an area of interest and selecting 7 "points" in each



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The North Carolina Center for Public Health Preparedness is funded by Grant/Cooperative Agreement Number U90/CCU424255 from the Centers for Disease Control and Prevention. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the views of the CDC.

### Rapid needs assessments can:

- establish the extent and possible evolution of an emergency;
- measure the present and potential public health impact;
- determine existing response capacity and identify any additional immediate needs; and
- inform priority response actions. (3)

Figure 1. A brief timeline of the use of 2-stage cluster sampling in public health

1960s	1970s	1980s	1990s
Rapid surveys developed as a tool for local health departments to assess community coverage of immunization, population morbidity (diarrheal and respiratory diseases), service coverage, and health service needs.	Modified to provide community-based information to guide the smallpox eradication program in West Africa.	Adapted by WHO for the Expanded Program of Immunization (EPI) to assess immunization coverage.	Revised to include community volunteers, incorporation of census data and random sampling of second-stage participants rather than random start and next nearest neighbor.  Adapted by CDC for rapid needs assessment after natural disasters.

cluster, a strategy referred to as a “30 x 7” survey. Clusters are defined geographical areas—whether a town, city or rural area—and “points” are housing units or parcels within that area.

To carry out the sampling, a housing unit is randomly selected for the first interview and information is collected from that household. The interviewers then gather information from the next housing unit closest to that point (or the 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup> housing unit, etc.) until 7 interviews have been conducted. (5)

This method is easy to implement in the field, requires few resources, and yields reasonably valid and precise estimates. Two-stage cluster sampling has been adapted over the years for various purposes (see Figure 1). (6)

*EPI Cluster Sampling Example: Hurricane Andrew*

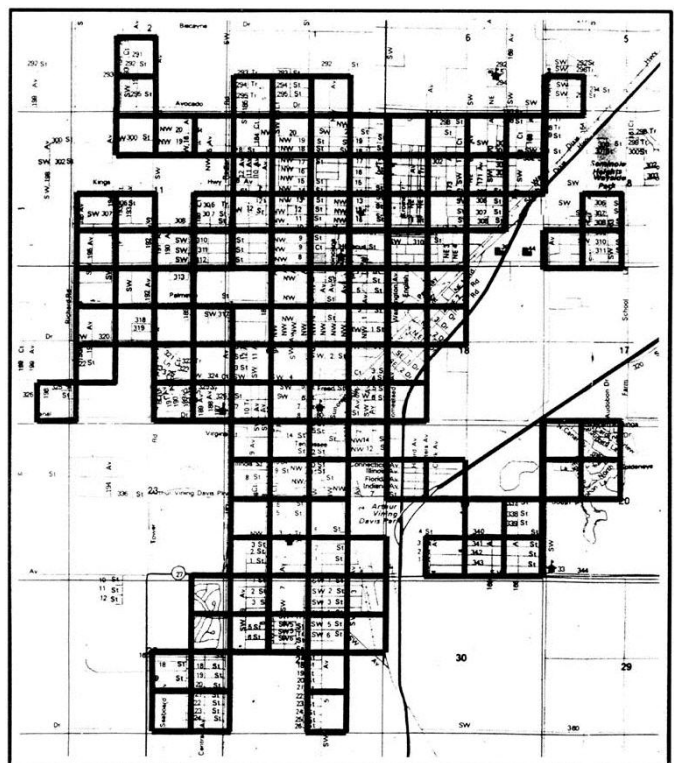
The EPI cluster-sampling method was used in Florida after Hurricane Andrew. Public health officials defined clusters by creating a grid of quarter-mile square areas using street maps of 2 adjacent communities hardest hit by the hurricane (see Figure 2).

Interviewers arrived at the center of each of 30 identified clusters, walked in a randomly selected direction (chosen by tossing a coin) to the nearest occupied housing unit, and surveyed an adult member of that household. They then visited the next nearest household, and the next, until they had completed 7 interviews. Houses unoccupied on the first visit were not revisited, only the people in the first unit of a multi-family housing unit were interviewed, and if a cluster was non-residential or destroyed, interviewers moved to the next closest cluster in a randomly chosen direction. Surveys were conducted at 3, 7, and 10 days after hurricane landfall. The surveys provided useful information to public health officials for both directing and monitoring relief efforts.(6)

*Modified EPI Cluster Sampling*

In 1996, Malilay et al modified the EPI cluster sampling method to add the ability to estimate the size of the overall post-disaster population, estimate the number of persons with specific needs, and assess the number of damaged or destroyed housing units. Using this modified sampling procedure, the disaster site is divided into mutually

Figure 2. Street map of Homestead-Florida City with superimposed sampling frame of quarter-mile square clusters used during rapid needs assessment after Hurricane Andrew (6)



### Using Rapid Surveys for Community Assessments

The rapid survey method used to conduct post-disaster needs assessments can be adapted for other types of community assessments involving the study of trends in a population.

For example, epidemiologists at the School of Public Health at the University of California at Los Angeles conducted a small rapid survey in a predominantly Hispanic area of Los Angeles to look at immunization status and related factors. The data suggest that this type of survey may have provided a more representative sample than a telephone survey, given the large percentage (~25%) of respondents who did not have a home telephone number. (9)

In North Carolina, county health departments are using rapid surveys as part of state-mandated community health assessments. They are also being used to assess population vulnerabilities prior to potential catastrophic events as part of preparedness planning. (10)

exclusive blocks or clusters with well defined boundaries. Natural dividers such as street grids or geographical features such as rivers or hills are good boundaries. Census data, aerial maps, and other data sources are used to estimate the number of housing units in each cluster.

In the first stage, a sample of  $n$  clusters ( $n = 30$  in the EPI method) is selected with “probability proportional to the estimated number of housing units,” which means that a cluster with more housing units is more likely to be included than one with fewer housing units. In the second stage, an equal probability sample of  $k$  housing units is chosen ( $k = 7$  in the EPI method), and an interview is conducted at each selected housing unit.

However, in this modified method, the interviewer makes multiple attempts (i.e., returning at another time) to conduct an interview at a selected housing unit (whereas in the EPI method, the interviewer moves to an adjacent housing unit if no one is available to be interviewed at the selected unit). If repeat efforts do not result in an interview, a “0” is recorded for that site.

As noted above, this method allows for the collection of more information than the EPI method. All housing units in each sampled cluster are counted, and those that have been destroyed/damaged are noted. The people in each selected household are counted, and these numbers can be used to estimate the size of the overall post-disaster population. Surveys are conducted as soon as possible following the disaster, and may be repeated over time to assess any changes in the population’s needs. (7)

This modified EPI cluster sampling method has been adopted by the CDC as the standard for conducting rapid needs assessments after disasters. The CDC has worked with numerous US state and local health departments to conduct post-disaster assessments. It was first used for this purpose in North Carolina after Hurricane Isabel made landfall on the coast of North Carolina on September 18, 2003. The CDC worked with the North Carolina Division of Public Health to conduct a rapid needs assessment of the affected population. (8)

### Role of Geographic Information Systems

Geographic information systems (GIS), which were discussed in *FOCUS* Volume 5, Issue 2, can be a useful tool when conducting rapid needs assessments. Using GIS technology, researchers can take a more scientific ap-



A student volunteer from the School of Public Health at the University of North Carolina at Chapel Hill conducting a survey in northeastern North Carolina after Hurricane Isabel, September 2003.



proach to selecting households to interview (second stage randomization). That is, rather than having each individual interview team use its own method of randomization to determine which households to interview, GIS software allows organizers to choose households in advance by selecting random points and plotting them on a map for interviewers to follow. Interviews are conducted with a resident of the house located nearest to the random point. This reduces potential sample selection bias by individual interview teams.

A second advantage to using GIS in field investigations is that it allows teams to use global positioning system (GPS)-based routing rather than paper maps. With handheld computers that run GPS software, interview teams can easily track their whereabouts as they travel through the assessment area. This allows the teams to spatially orient themselves in relation to their interview sites so they can easily identify the most efficient route to follow. Paper maps take more time for teams to interpret, are often not as up-to-date as electronic GPS maps, and can be easily misplaced or destroyed, particularly in a disaster assessment situation.

Finally, and perhaps most importantly, GIS technology can replace paper surveys with electronic computer-based surveys. Electronic surveys developed using GIS-related software can be uploaded to handheld computers for field

#### Additional Resource:

More information about sampling for public health assessments is available from the North Carolina Center for Public Health Preparedness and the North Carolina Public Health Regional Surveillance Team 5 at <http://nccphp.sph.unc.edu/PHRST5/>.

deployment. When a team conducts an interview with members of a household, they can enter data on their handheld computers rather than writing down every response. Then teams do not have to carry around stacks of paper that, aside from being cumbersome, might be lost or damaged during the assessment.

When the research team is ready to analyze the data, no one has to manually enter the data from paper surveys into an electronic database. Instead, data from the handheld computers are simply uploaded to a central computer where the data are merged into one large database through the GIS software.

Handheld computers with GIS technology reduce data entry time, as well as possible data entry errors that may occur in translating data from paper surveys to an electronic database. This makes it possible to analyze results quickly in order to guide response activities.

#### Conclusion

In summary, rapid needs assessment has come to be an essential component of efficient disaster relief operations. (6) Rapid needs assessments, particularly with the incorporation of GIS technology, allow public health officials to quickly identify and prioritize areas of need and appropriately target resources. As noted above, the methods used with rapid needs assessments can be extended beyond post-disaster settings and used in other areas of public health where surveys of the population are required.



A WHO rapid health assessment team engaged with the 2004 Indian Ocean earthquake-tsunami boards a helicopter in Banda Aceh, Indonesia.

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