

# The use of community-based data in health planning in Mexico and Central America

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Sentinel site surveillance methodology is used in Nicaragua, Honduras, El Salvador, Guatemala, Panama and in the Mexican state of Guerrero to collect reliable planning-oriented health information at community level. Limited resources available for health measurement can be concentrated in these sites which, when taken together, reflect the diversity of health conditions; some sites include health facilities and others do not, in proportion with the coverage of the population at large. Changes in health status over time have been measured in relation to coverage with health care activities, using repeatable problem-specific cycles of household interviews. A key consideration is the development of methodologies and tools to facilitate the decentralization of capabilities of questionnaire design, and the organization and analysis of data. Infant and child mortality are key concerns, but the methodology has also been used to investigate other mortality and morbidity in relation to coverage and costs of health services, and knowledge, attitudes and practices related to priority diseases at the community level. These data cannot easily be obtained from sources other than community surveys, and the sentinel site framework allows for their collection in a manner that facilitates systematic planning under conditions of limited resources, including limited capabilities of handling data, and of making it available for planning.

## Introduction

Considerable quantities of health data are available for – and, for the most part, incompletely exploited by – health planning processes in developing countries. An important limitation is that the data are almost entirely service-based, yet many people do not have effective access to health care services. In the Mexican state of Guerrero, for example, an estimated 25–40% of the population has no effective access to the official health services. In Nicaragua and Panama, the coverage is more extensive. In El Salvador, 40–50% of health posts in some regions are not accessible to the government health services, due to the war, and in Honduras and Guatemala, health care coverage is roughly of the same order as in Guerrero. Under these conditions, meaningful estimation of true coverage of health care (those who benefit from a given health care activity among those who need it) is very difficult. Yet, if the health care apparatus is to be effective in improving health status of the entire population, data are needed on the health condition of

all the people, including those who do not use the services – with their reasons for failing to do so where health services exist.

Another important deficiency of information systems in many developing countries, even within the context of service-based data, is the lack of reliable measurement of change in parameters such as infant mortality rates (IMR). Population census data can sometimes be used retrospectively to estimate IMR and child mortality rates but, since these are only carried out every decade or so and they do not reflect specific causes of death, they are of little use in local health care *planning*. Honduras, Nicaragua and El Salvador have not seen a census since the early 1970s, and population migration in all the countries in this review is such as to render population projections virtually obsolete within two or three years after deriving the original data. Adding to this difficulty, in none of the countries described here are health administrative and census boundaries coterminous.

A further problem that reduces the usefulness of routinely collected health information in planning is its heterogeneous quality. Characteristically, the collection process is weakest and least reliable in those localities where the need for incisive information on health conditions is most urgent. Furthermore, the health sector tends to be fairly introspective about its information, neither seeking data from – nor sharing them with – other sectors that determine health status, such as education, agriculture, water supply or public works. Even within the health sector, different agencies may have difficulty combining information for integrated planning. In Mexico, for example, the three main state-run health services – the Instituto de Seguridad y Servicios Sociales de Trabajadores del Estado (ISSSTE) for state employees, the Instituto Mexicano de Seguro Social (IMSS) for people with personal health insurance and the Secretaria de Salud y Asistencia (SSA) which is roughly equivalent to the Ministry of Health in other countries – each have different data collection formats and produce a very different quality of data. In Panama, similar difficulties are seen in the integration of the Ministry of Health and the Department of Social Security and, in Guatemala and Honduras, there is no integration at all.

Despite the difficulties in obtaining useful data on coverage from the existing health information systems, the maintenance of these data collection schemes can be extremely costly. One of the main reasons for this is the established habit of collecting a wide and poorly discriminated variety of data on virtually all diseases and health activities. Much of the cost of this data collection is hidden, taking up working time of health workers who are being paid to provide health care services. If time used by health workers at all levels to maintain the routine information system is taken into account in terms of salary, it was estimated at a workshop of planners from seven countries in Guatemala in October 1987, between 10% and 25% of the total wage bill of the Ministries of Health could be considered the minimum cost of the routine health information system.<sup>1</sup> The collection of these data is based on the concept that it takes little additional effort and time for health workers in contact with the public to record a few basic elements of age, nature of disease, and so forth. Theoretically, these data are fed back to

a point where they enter the planning process. Yet there is scant evidence that this process works even in the proportion of the population that has effective access to health care.<sup>2,3</sup> The repetitive nature of the data registration processes, in the absence of prompt use of the data to improve health, tends to result in reduced accuracy and quality over time, with changing and unquantifiable biases. Schemes to deal with deteriorating quality of data with repetition rest on various supervisory processes, often implying quite elaborate and time-consuming bureaucratic procedures.

### **Sentinel site methodology**

An initiative was taken in 1984 in Central America to develop, under field conditions, durable and inexpensive techniques to measure impact of health interventions. A methodology was required that, within stringent resource constraints, could produce data on health conditions throughout the region, yet which linked with and reinforced the existing information systems on critical aspects (such as data on mortality and morbidity, coverage and costs of health care). Data generated by the new methodology should gradually improve the quality and use of existing data, which it would complement by the addition of data on variables such as the attitude of the communities to the health services and, in the event of under-use, the nature of deficiencies of the service. A requirement of the methodology was that it should facilitate decentralization of health care management through decentralizing measurement and analytical capabilities. The underlying philosophy was that increasing use of community-level information in the planning process would optimize the use of available health resources in relation to local health priorities.

Cluster surveys and the concept of sentinel sites, variously defined, have been used elsewhere in several situations to provide data for health planning. The highly publicized Danfa Project in Ghana measured reasons for not seeking health care in 2000 households in randomly selected villages.<sup>4</sup> Nchinda reported in 1977 the use of 208 clusters in the Mezam Division of Cameroon in the exploration of care-seeking behaviour as a basis for planning.<sup>5</sup> A cluster survey of five villages in Hararge region in Ethiopia in 1977

provided cross-sectional medical and anthropological data to be fed into the planning process.<sup>6</sup> Although based on routine data sources rather than repeatable surveys, the concept of 'small areas statistics' in the United Kingdom has elements in common with sentinel site surveillance.<sup>7,8</sup> Supported by the University of Hawaii, the government of Thailand conducted repeated surveys of 4000 households in a number of experimental districts, using two-stage sampling with random selection in the second stage, to investigate morbidity, mortality and use of health care facilities.<sup>9</sup>

For many years, the Expanded Immunization Programme (EPI) supported by the World Health Organization, has used cluster surveys to evaluate coverage.<sup>10,11</sup> Woodall provides examples of how sentinel surveillance has been used successfully in EPI programmes in Malawi, Tanzania, Bangladesh, Turkey and India.<sup>12</sup> An unpublished Royal Commonwealth Society for the Blind study measured the impact of floods on childhood blindness in Khorabar Block, Gorakhpur, in northern India. In Bhopal, sentinel site surveillance is being used to evaluate short- and medium-term consequences of the catastrophic methyl isocyanate exposure in December 1984.<sup>13-15</sup> Perhaps one of the most detailed descriptions of intersectoral data generated from repeated cluster surveys comes from Kerala in India.<sup>16,17</sup>

Sentinel site surveillance in Mexico, Central America and Panama is conceived as a scientific continuation of this extensive field experience with cluster sample methodology, and an opportunity to systematize and validate the processes involved for a potentially more extensive use in health planning in developing countries. This paper describes four years' experience in several countries, in the search for a methodology that provides for representativeness of data, the longitudinal assessment of health impact at an affordable cost, the accessibility and turn-around time of data in the planning process and, perhaps most importantly, the decentralization of measurement capabilities that facilitate planning.

### **Representativeness and the selection of sites**

Planners considering the value of any health data, whether from routine sources or from

specifically designed studies, need to know the limits of the conclusions they can draw from those data. For example, in the case of incomplete birth and death registration in many developing countries, they would be concerned that inferences made could not be generalized to the country as a whole. In the case of a localized intensive study of infant mortality in one community – however complete the data may be within that community – health planners would be concerned about mere chance determining the measured mortality: it may so happen that no child died in the year of that particular study. Even if the community was large enough to be fairly sure that chance alone could not explain the result, health planners would need to know the extent to which that community represents the area, region or country for which they plan.

One of the main advantages of sentinel site surveillance is the ability to gain representative data, not only in relation to people who attend the health facilities but also those who do not have effective access to health care. This is done at a relatively low cost since only a sample of communities are included. The fundamental criterion of representativeness in any sample is that, if it is repeated, the same results would obtain. This can be derived by purposive sampling (selection on the basis of prior knowledge) as in the case of the Mexican state of Guerrero, Nicaragua, Honduras and El Salvador, or by stratified probabilistic sampling, as in the case of the Instituto de Nutrición de Centro America y Panama (INCAP) in Guatemala, and the San Blas Region of Panama.

### **Guerrero, Mexico**

The preliminary site selection in Guerrero was made in 1985 on the basis of different types of existing knowledge, followed by validation and adjustment of the selection as knowledge of health conditions improved and as capabilities to handle a larger number of clusters increased. Prior to selection, climatological and census maps (employment, education, demography, migration, housing, water supplies and sanitation) were analysed to determine the principal characteristics of the 75 municipalities that make up the state of Guerrero. The results formed the basis of formal and informal discussions which eventually led to the selection of 5-7 provisional sites

considered to be representative of each of the seven health regions (total 43 sites). Approximate representativeness was thus achieved – at least within the limits of existing knowledge of health conditions – at regional level.

Retrospective validation of the selection was made comparing data from the first study cycle in 1986 (infant mortality rates, number of people per household, use of wood as cooking fuel, use of the kitchen as a bedroom, and maternal literacy) with data from the 1980 census. Infant mortality data were projected retrospectively using the Feeney modification of the Brass technique<sup>18</sup> to estimate the 1978 infant mortality from the two data bases (the 1980 census and the 1986 sentinel site survey). The results from the two data bases proved to be almost identical. More definitive validation of the site selection is planned in 1989 when a large probabilistic stratified cluster sample will be investigated in relation to three key variables on which data are available from the sentinel site surveillance:

- Data using the Brass technique to calculate infant and child mortality
- Days of illness from diarrhoea and acute respiratory infections in the previous two weeks, among children under the age of 5 years
- Coverage with immunization and trained attendance at births

These results will be compared with the data from the existing sentinel sites which can then be added to, to improve representativeness at regional level. It will also be possible to give different types of site different weights in the aggregate by increasing the number of households contacted in each site.

### Nicaragua and Honduras

In the UNICEF-funded sentinel site surveillance scheme in Nicaragua, selection was based on the prior knowledge of the regional health teams who selected 12 health sectors considered to be representative of their region (there are approximately 2000 people per sector, with 50–100 sectors per region). The representativeness of these sectors as sentinel sites was validated by a *post hoc* comparison of infant mortality estimated by the Brass technique in the first study cycle, with the same sort of data derived from a previous

study based on a probabilistic sample two years earlier. Retrospective estimations of infant mortality for urban and rural areas in each region in 1977–8 in the two studies revealed only decimal point differences.

In contrast with the selection by regional teams in Nicaragua, in Honduras the regional health teams were asked to submit a list of several potential sites in each category in a matrix of high and low health status, health care coverage and density of population. This matrix was then used for stratified random selection to achieve representativeness.

In both Nicaragua and Honduras, whatever the theoretical issues raised by visiting scientists and resident aid agencies, there was no need to convince the planners of representativeness of the sites; they had themselves selected the sentinel sites as representative of the conditions where they worked and, in most cases, they had participated in the collection of data.

### Longitudinal measurement of impact, coverage and costs

Nearly four years of experience with sentinel site surveillance in Mexico and Central America provide evidence that what is required is an early start in *approximately* representative sites, with three concepts clearly articulated. Firstly, the domain of representativeness is limited to regional level, and data from the component sentinel sites should not be aggregated to achieve national estimates without careful weighting. Secondly, even with a rough representativeness, the statistical handling of the data should permit the separation of sites to determine the importance of different locations; the Mantel-Haenszel technique for stratified risk analysis has proved to be an accessible and appropriate method for this.<sup>20</sup> Thirdly, the real use of data in health planning is not to declare absolute levels of health status (morbidity or mortality levels); this tends to be a need of politicians and aid agencies. Planners in general need to know the precise coverage with one or other activity that is known to *improve* health status. It is the conjuncture of health status and coverage that is important. Sentinel sites provide data on how health status can change across a range of social conditions –



as reflected by the diversity of sentinel sites – with a given health intervention. The ability to deliver timely information on changing health status related to health care coverage is a key advantage of sentinel site surveillance.

A fairly typical study cycle is illustrated by experience from Guerrero.<sup>19</sup> The most common cause of childhood death in Guerrero in 1980 was chest infection, so this was elected as the priority problem for initial study. A questionnaire was designed to last an average of 7 minutes per household (range 2–20 minutes) enquiring into:

- the period prevalence of respiratory disease (days of illness in the last two weeks)
- management of the condition in the household
- decision thresholds for use of health services
- reasons for non-use of services
- immunization history
- household crowding
- use of kitchen as a bedroom and fuelstuff used for cooking
- mortality from chest disease (by age) in the last year<sup>19</sup>

This survey was carried out in 1986 and, each year since then, it has been possible to repeat the measurement of period prevalence and mortality to relate these to use of health services and management of the condition in the household. It has also been possible to consider childhood mortality in the light of immunization history among the 7000 children under the age of five years covered by the sentinel site surveillance scheme. This history was validated in 20 of the 43 sites by collection of fingerprick blood samples from all children to measure the effectiveness of the vaccination in changing levels of antibodies against measles, as determined by the ELISA technique.

In Nicaragua, repeated cycles have been carried out in relation to diarrhoeas. Thus, in the second diarrhoea cycle (the first was in 1986 and the second in 1988) it was possible to determine that infant mortality from diarrhoea had decreased in two of the three health regions operating the sentinel site surveillance scheme, whilst increasing in the third. A large part of this increase was considered attributable to the finding that, in that region, the more educated mothers had erroneously adopted the habit of withholding food

from children with diarrhoea. Since the survey involved 11 062 children under the age of five years in 5341 households in 20 urban and 14 rural sectors, it provided fairly convincing findings. The health education scheme run by a non-governmental agency, encouraging mothers to withhold food from children with diarrhoea, has been stopped since the cycle in question.

### Data collection and 'turn-around' time

Experience in five countries using sentinel site surveillance, with repeated surveys of over 300 000 people, has led to a refinement of the conventional concept of a survey questionnaire. This is now conceived as having four integral components. The first is a brief list of the objectives of the study cycle, preferably expressed in terms of questions which, when answered, will lead to specific planning decisions. This list of specific objectives not only orients the design of the data collection instrument, about which it focuses discussion very effectively, but is also useful to inform planners and administrators at different levels about the nature of the exercise. Since each cycle is about only one disease and its determinants, the contents of the questionnaire should be structured in terms of what planning decisions can be taken about that specific disease, not by general issues such as 'it would be interesting to know . . . '.

The second component of the questionnaire is the physical data collection instrument, including the specific questions to be asked, the form of asking them and the format for recording and dealing with replies. This component has undergone considerable transformation since the initial mimeographed questionnaires of several pages stapled together. The first major modification was the adoption of fixed-leaf ledgers with pages cut or folded vertically and questions glued to the inside cover, using one page per person; this had the advantages of providing a permanent record for follow-up of individuals in subsequent study cycles, of limiting the number of questions that could be asked and of being relatively easy to manage and prepare. This instrument does not require printing delay or costs, and can be modified in the course of pilot studies right up to the moment of initiating the study. The latest range of questionnaire instrument is the computer-based data bank. Several models

have been tested and the ideal combination of portability and flexibility is yet to be found.

The third component in the questionnaire is a document defining the contingency tables that will be produced from each question included in the data collection instrument, framed preferably in terms of the decisions that will be taken on the basis of the data (impact, coverage and costs). Experience from Central America reflects some delay in the adoption of this component as integral to the development of a questionnaire, with the result that current study cycles still produce some data that cannot be easily used. The fourth component, also to be completed in the design stage and modified in the course of field testing of the data collection instrument, is the data entry format to be used if computerized organization of data is contemplated. The formal acceptance of these four components (specific objectives, instrument of collection, contingency tables and data entry format), although common sense to the trained epidemiologist, has been a major methodological advance in the development and decentralization of monitoring and evaluation capabilities among formerly untrained health personnel. Each data collection instrument is designed to minimize training time necessary for its correct use. At least five field tests of the questionnaire are required to iron out problems in the integration of its four components, with additional local field tests to take account of language and cultural differences.

In Guerrero, Honduras and El Salvador, each survey begins from a fixed point in the sentinel site, with interviewers moving radially outwards contacting all households on their given route in the course of one day. Since there is no incentive system regarding the number of households to be contacted, there is no pressure for interviewers to cut corners in the interviews. Each questionnaire is designed to be as simple as possible. Instead of returning to a sentinel site for a second day, the investigating team moves to a new site thus maximizing interviewing time in different locations in a given period of field time. In Guerrero, each cycle fails to contact only 5–6% of households.

Each interview is begun by handing a printed summary of the results of the previous study

cycle to the participants, by way of introducing the current cycle. So successful has this feedback process been in engendering goodwill in the participating sentinel communities that people in some of the rural communities not infrequently stay at home when informed in advance of a forthcoming study cycle, in order to participate. In Nicaragua, a sentinel site is defined as a health sector, so the whole sector is interviewed irrespective of the time it takes.

In Guerrero, each team of interviewers has a medically qualified supervisor who provides consultations for people who require medical attention. Part of the task of these supervisors is to carry out a random sample repeat or partial repeat survey to validate the enquiry process. This practice has also been adopted in El Salvador. The field value of this procedure has been questioned, since it is time consuming, expensive and jeopardizes the goodwill of the communities who, perhaps after not having contact with the health services for several years, find themselves answering the same questions twice in the space of a few hours.

The choice of interviewer has been variable in the countries using sentinel site surveillance. In Guerrero, medical and other university students are used as interviewers, each one of them accompanied by a member of the community, or, where necessary in communities that do not speak Spanish, a translator (usually a bilingual teacher from the community). In Nicaragua, health personnel at regional level do the interviewing, although earlier cycles experimented with medical students and professional interviewers. In Honduras, early cycles relied on the extremely expensive professional interviewers who live off the plethora of once-off studies conducted by various aid agencies. Later, interviewers were hired locally and, more recently, the tendency has been to have regional and local health personnel perform the surveys as part of their work. Since the Honduran Ministry of Health has expanded the sentinel site surveillance scheme from three regions (initiated in 1985) to all eight regions, it has become more important to contain special costs of the cycles.

In each of the countries applying the methodology, 'turn around' time for each cycle has been

decreasing as capabilities have improved and as the techniques have become more polished. In a recent cycle to determine the coverage of childhood immunization in El Salvador, barely two weeks elapsed between the conception of the study cycle (elaboration of the objectives and the questionnaire) and the preliminary report being presented to the Minister. The study involved some 5000 children under the age of five years in 54 sentinel sites throughout the country.

### Decentralization of analytical capabilities

If sentinel site surveillance has a single major advantage over traditional measurement methodologies, it is in its potential to decentralize monitoring and evaluation capabilities, at least to regional level. After selecting the sentinel sites, regional teams can also be involved in the selection of the priority health problem to be studied, the analysis of existing data to determine the contents of the study cycle, the four components of the questionnaire, the fieldwork of data collection, and analysis of the data. For the first few study cycles in Guerrero, Honduras and Nicaragua, all sorting was carried out by hand using stratified  $2 \times 2$  and  $2 \times C$  contingency table formats. Formerly untrained staff were quick to adopt and apply this type of analysis, deriving summary estimations of relative risk, risk difference and their respective confidence intervals. Apart from the absence at that stage of alternatives to manual sorting, this was intended to encourage planners being trained in the scheme to develop a feel for their data and not to rely on high technology before mastering the essentials of measurement methodology. Later, data entry processes for microcomputers were introduced, relying on widely available word-processing packages (such as the N-mode of Wordstar) for data entry, with data sorted into biaxial plots and contingency tables using the compact and easily managed Healey's Nanostat.<sup>21</sup>

The development of simple but appropriate analytical tools for use at regional and, eventually, local level has been a priority. Three main analytical formats are used:

- biaxial scattergrams (for example, level of coverage and degree of improvement of health status) to obtain an idea of the distributions of the variables being studied

- stratified two by two contingency tables, using the Mantel-Haenszel procedure<sup>20</sup> and its associated tests<sup>22,23</sup>
- stratified two by multiple ( $2 \times C$ ) contingency tables using the Mantel-extension of the Mantel-Haenszel procedure.<sup>24</sup>

These tests can be calculated in a few seconds using a programmable calculator or a microcomputer statistical package such as NANOSTAT. This permits rapid, on-the-spot calculation of relative risk and risk difference whilst 'excluding' factors from the analysis by stratification. Sequential stratification by variables of interest, followed by multiple stratifications, permit even the inexperienced user rapidly to gain insight into the nature of the relationships being studied. Data bases in sentinel site surveillance tend to be very large (39 000 people in Guerrero, 74 000 people in Honduras and 38 000 people in Nicaragua), so formal significance testing is almost superfluous where a large relative risk is detected. The Mantel-Haenszel procedure is thus used to separate out the components of risk, rather than merely to exclude chance findings.

### Summarizing the results

In order to assure that data generated by sentinel site surveillance finds its way rapidly into the planning process, considerable attention has been given to the report formats. Traditionally in Latin America, as in many developing countries, a 'good' report is considered to be a document that is measured in centimetres of thickness and, since reports are generally not oriented for planning, its contents are read only by very few people.

An instrument identified as a *summary format* has been developed in the course of the sentinel site schemes in Mexico and Central America. This one-page combination of three types of data (impact, coverage and costs) is intended to start discussions and to precipitate decisions about what other types of data are required. Very occasionally, the summary format can precipitate a decision that promptly changes health policy, but such changes are usually the product of a much larger process.

The summary format can be read by community leaders, clinicians, regional or national planners,

or the news media, each of whom may make their own interpretation to contribute to the planning process. In the Central American countries, timely reporting of data is the weakest aspect of the sentinel site experience, perhaps because of the power advantage to be derived from protecting data. The increasing insistence of regional teams to take up the management of their own sentinel sites is a particularly interesting development in this context.

The links between the sentinel site schemes and the existing health information systems in Central America is proving to be a key feature in the strengthening of decentralized planning and analytical capacities. Sentinel site data do not suffer from some of the biases of routine sources, particularly those that are service-based. The comparison of mortality estimates from the sites with those from routine sources – particularly in Nicaragua where the sentinel sites are coterminous with the health sectors – permits the questioning and, one hopes, the eventual improvement of the routine information sources. In Honduras, an interesting by-product of their cycle on diarrhoea was the dramatic reduction in the number of standard forms to be filled in at different levels in relation to that condition, from 18 before the cycle to 3 once it was completed. Each new cycle begins with an analysis of existing data to see how far the specific health problem can be evaluated before going to the community. Apart from the training value of this exercise for the regional teams, it provides them with an opportunity to reflect on the amount of time and energy spent collecting data in relation to its scant use in planning. A recurrent theme in existing data collection schemes is the lack of flexibility to deal equally with common and rare conditions, and with 'hard' and 'soft' data on health status. Sentinel site surveillance allows the operators to gain experience with several types of measurement including, as mentioned above, the collection of biological samples for analysis and comparison with data from routine data.

While the decision has been taken in Honduras to begin sentinel site surveillance in each of the eight health regions of the country, in Nicaragua the development is taking another direction. In the strongest health region amongst the original three where the process was initiated, the process

is gradually being expanded from the original 12 sectors to include a further 12 representative sectors each year, as district level capabilities are developed. Eventually all health 'sectors' in the entire region will be covered by the same methodology, whilst having usable and representative data at any point until this full coverage is achieved. This illustrates how sentinel site surveillance can provide data that are not available from the existing health information system, at the same time serving as a framework for the development of capabilities that accompany the evolving of a more appropriate and flexible system.

## Conclusions

The framework of sentinel sites, although beginning as an externally supported fixed-term 'project', once established, can be used beyond the project life for on-going investigation of different health priorities. Its main strengths lie in its flexibility whilst retaining links with the existing health information system.

Although variably implemented in the six countries where it has been adopted, the process of sentinel site surveillance begins with the selection of a single priority health problem. This is followed by an analysis of existing data to determine what data are lacking. The next four steps are those involved in the development and field testing of the questionnaire (specific objectives, instrument of collection, contingency tables and data entry format). The actual collection of data may be carried out simultaneously in the different sites, or sequentially, depending upon existing logistical capacities and resources. Analysis should be done as soon after collection as possible, at the latest when the questionnaires in each region have been completed.

Experience is accumulating in Guerrero with the computerized collection of data and its analysis before leaving the sentinel community. The supervisor of the interviewers simply runs the data through a prepared programme to clean and organize the data, and produces a preliminary printout to leave with the community on the same day as the enquiry. The same process can be carried out at regional level on the day after the last sentinel site has been studied. It is hoped



that this ready availability of data will contribute to better communication between local, regional and central levels.

Methodological contributions of this initiative are likely to include the validation and systematization of cluster survey methodology in health planning, including the clarification of appropriate procedures for the selection of sentinel sites, questionnaire design, field logistics and analysis of data. Techniques for reducing turn-around time are still to be developed and refined, including the more generalized use of computerized data banks. The methodology will also be useful for scrutiny of the existing health data collection processes.

This scheme is proposed as an interim planning and training instrument to contribute towards the orderly decentralization of health services in developing countries.

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## Biographies

Neil Andersson is an epidemiologist who was a clinical lecturer in Occupational Medicine at the London School of Hygiene and Tropical Medicine for three years, and is currently Professor of Tropical Medicine in the Faculty of Medicine and Director of the Centre for Tropical Disease Research (CIET) at the Universidad Autonoma de Guerrero, Mexico. He worked for several years on refugee health problems in North Africa and, since 1984, has been involved in epidemiological and toxicological follow-up of survivors of the Bhopal tragedy.

Eduardo Martinez is currently Field Coordinator at the Centre for Tropical Disease Research (CIET) in Guerrero, Mexico. After graduating in medicine, he completed a Masters degree in Social Medicine (UAM-Xochimilco) with a thesis on Health Information Systems in Guerrero, Mexico. He has directed field research into acute respiratory infections, diarrhoea, Chagas' disease, tuberculosis, dengue and scorpion stings.

Franklin Cerrato is Director of Monitoring and Evaluation in the Ministry of Public Health, Tegucigalpa, Honduras. Before taking up this post, he served as Director of Vector Control and in senior hospital administrative posts in the Ministry. He is a graduate of the Medical Faculty of the University of Honduras and has a Masters degree in Public Health from Mexico. His field investigations include an enquiry into use of the health services in the case of acute respiratory infections in childhood, the determinants of diarrhoea, infant mortality in Honduras and the amount of time spent by health workers to maintain routine health statistics.

Enrique Morales is Director of the National Health and Vital Statistics Department (DINEL) in the Ministry of Health in Managua, Nicaragua, a post he has held for nine years. He is a statistician by training, specializing in the incorporation of

routine data and vital statistics in national level health planning processes. He has been involved in the use of sentinel sites in health planning since 1984.

Robert Ledogar is Project Officer for Monitoring and Evaluation in the UNICEF Central America Area Office in Guatemala. He has a Masters degree in Urban Planning from Massachusetts Institute of Technology and has studied epidemiology at the Centre for Tropical Disease Research in Guerrero, Mexico. Before working in Central America, where he has lived for nine years, he worked in Zambia on urban development projects.

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