



# Epidemiological Bulletin

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## Health Indicators: Building Blocks for Health Situation Analysis

The availability of information based on valid, reliable data is a *sine qua non* condition for the analysis and objective evaluation of the health situation, evidence-based decision-making and programming in health. The search for objective measures of a population's state of health is an old tradition in public health, particularly in epidemiology. Starting with the works of William Farr in the 19th century, health descriptions and analyses were, for a long time, based on measures of mortality and survival.<sup>1,2</sup> The need for considering other dimensions of a population's health status was recognized more recently. This realization came in part as a result of the successful control — mostly in the most industrialized areas — of infectious diseases that were traditionally responsible for the greatest burden of mortality. It is also the product of a more comprehensive vision of health and its population determinants. As a consequence, measures of morbidity, disability and non-biological determinants of health (such as access to services, quality of care, living conditions and environmental factors) are increasingly necessary to document people's capacity to function physically, emotionally and socially, as well as to objectively analyze the health situation (See figure 1).<sup>3</sup> Health indicators facilitate the quantification and evaluation of these different dimensions of a population's health.

A health indicator is “a construct of public health surveillance that defines a measure of health (i.e., the occurrence of a disease or other health-related event) or a factor associated with health (i.e., health status or other risk factor) among a specified population.”<sup>4</sup> In general terms, health indicators represent summary measures that capture relevant information on different health attributes and dimensions, and the performance of the health system. Seen together, these measures attempt to reflect and monitor the health status of a population.

The construction of an indicator is a process with various degrees of complexity, ranging from a direct count (for

example of the number of new cases of malaria in a week) to the calculation of proportions, rates, ratios, and more sophisticated indices (for example life expectancy at birth).<sup>5</sup> Accordingly, the quality of an indicator strongly depends on the quality of its components (frequency of cases, size of populations at risk etc.) The quality of the data information, recollection, and registration systems is equally important. More specifically, the quality and usefulness of an indicator are defined by its *validity* (effectively measures what it attempts to measure) and *reliability* (repeated measurements in similar conditions produce the same results). Additional attributes to ensure quality are its *specificity* (measures only the phenomena that it is meant to measure), *sensitivity* (has the capacity to measure changes in the phenomena that it is meant to measure), *measurability* (is based on available or easy to obtain data), *policy-relevance* (is capable of providing clear responses to key policy issues) and *cost-effectiveness* (results justify the investment in time and other resources).<sup>6-8</sup> Indicators must also be easy to use and interpret by analysts, as well as understandable by information users, such as managers and decision-makers.

Important attributes to insure quality of the *set* of indicators are: integrity (no missing data) and internal consistency (when seen alone or in a group, the values of the indicators are realistic and coherent and do not contradict themselves).<sup>9</sup> Therefore, the systematic use of standardized operational definitions and measurement and calculation procedures is fundamental to guarantee the quality and comparability of the indicators.<sup>2,9</sup>

An appropriately defined and maintained set of health indicators provides information for the elaboration of a relevant profile of a population's health situation. The selection of such an indicators set — and its levels of disaggregation — can vary with the availability of information systems, data sources, resources, and specific needs and priorities of each region or country.<sup>2</sup> Maintenance of an indicators set also

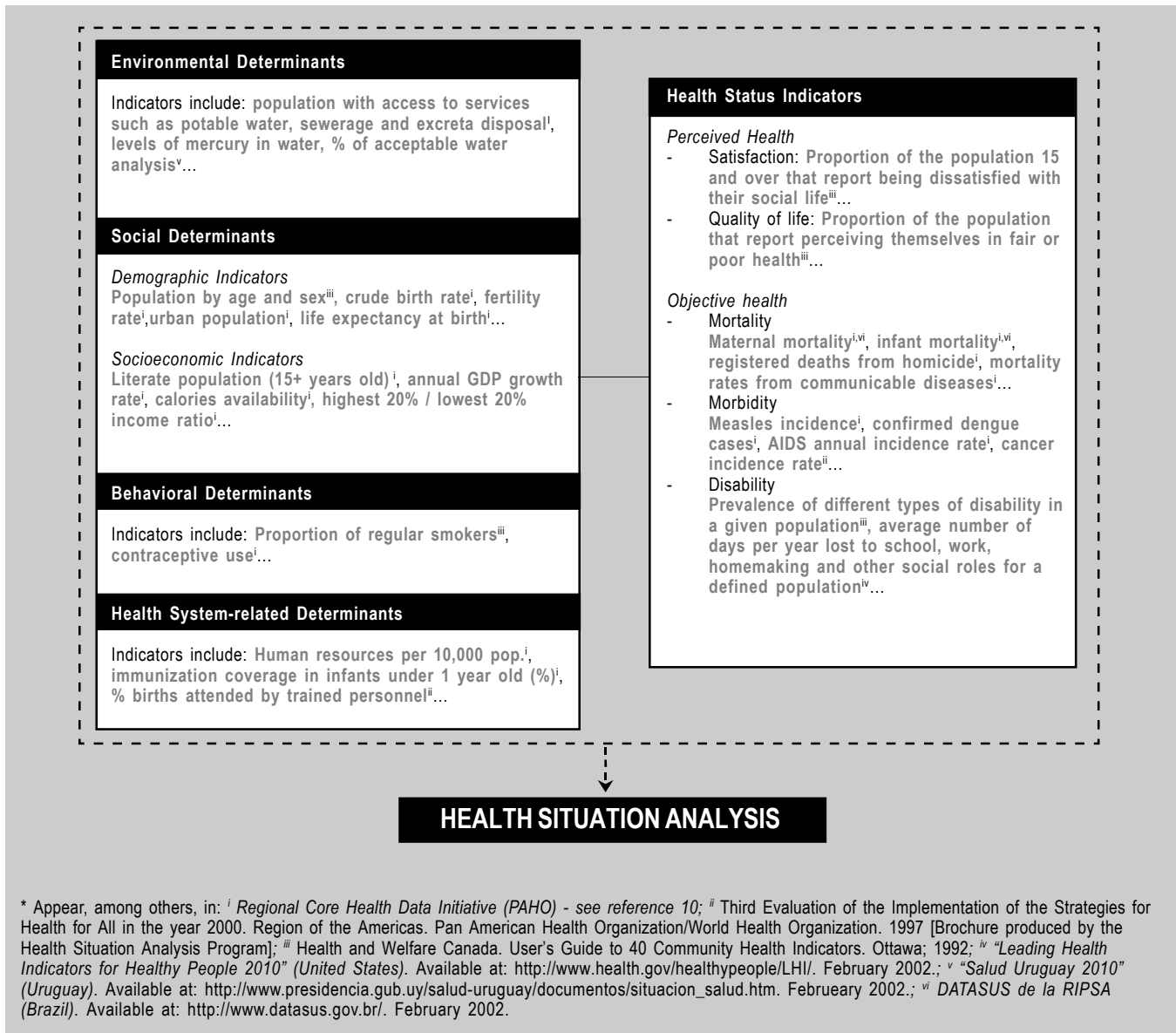
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Pan American Health Organization:  
Celebrating 100 Years of Health

**Figure 1: Examples of Indicators of the Health Status and some of its Determinants\***



depends on the availability of data sources and regular operation of information systems. Additionally important is the simplicity of the instruments and methods used in compiling the indicators.<sup>9</sup> Quality must be monitored regularly because it is crucial in building and maintaining the information users' confidence in the indicators. It is a condition for their regular use, which also depends on the indicators' dissemination policy, including their frequency of compilation and timeliness. For example, the time lag between data collection, analysis and dissemination of an indicator used in monitoring must be short for it to maintain its relevance.<sup>8</sup>

When generated and administered within a functional information system, health indicators constitute a fundamental tool for decision-makers at all management levels. In general, a basic set of health indicators —such as the one that is part

of the Regional PAHO Initiative of Core Health Data and Country Profiles<sup>10</sup> (see box)— generates evidence on the status and trends of the health situation in the population. This includes documentation of inequalities in health, which may—in turn—serve as empirical basis for the determination of population groups with the greatest health needs, stratification of epidemiological risk, and identification of critical areas. The availability of an indicators set provides the material for this analysis. Concomitantly, health indicators facilitate monitoring of health objectives and goals, strengthen the analytical capacities of health teams, and serve as a platform to promote the development of interconnected health information systems. In short, valid and reliable health indicators are basic and important epidemiological tools for health management.

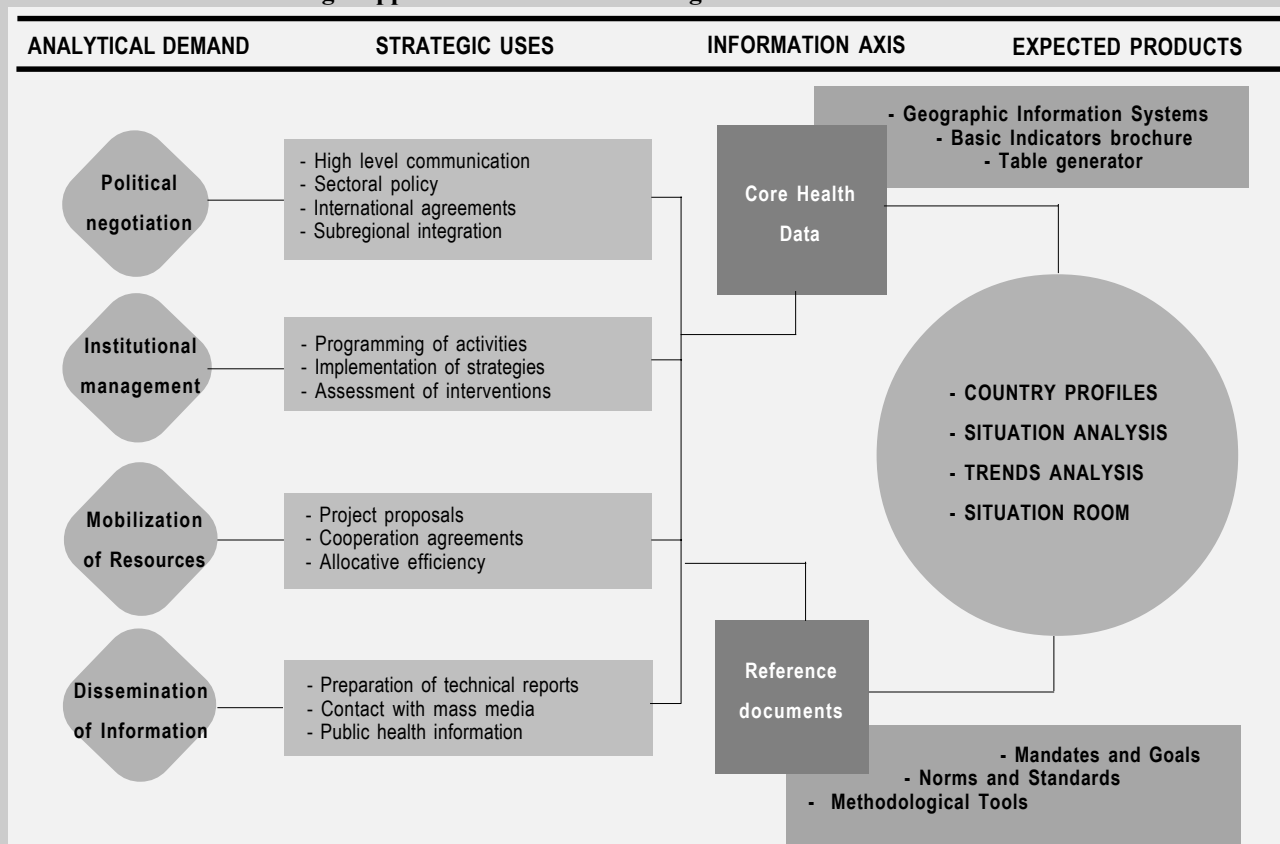
## The “Core Health Data” Initiative

The Core Health Data (CHD) Initiative was launched in 1995 to monitor the level of advancement of the health objectives and mandates adopted by PAHO/WHO and its Member States in the region of the Americas. The CHD Initiative seeks to provide a standardized information platform on the regional health situation and trends. This information can be used by managers and policy makers for: i) formulation, adjustment, and evaluation of health policies and programs; ii) reorientation of health services and public health surveillance systems; iii) programming, monitoring, evaluation, and adaptation of technical cooperation; iv) mobilization of resources; and, v) dissemination of technical health information.<sup>10</sup> Therefore, the CHD Initiative is a process that promotes the use of epidemiology for health management, strengthening analytical capacities and creating evidence for decision-making in public health policy, including detection of health inequalities and identifying priorities for technical cooperation. CHD is part of the response by the Epidemiology Services and PAHO towards the current demand to rethink essential public health functions, in-

crease institutions’ transparency and technical credibility, and efficiently prioritize cooperation in health.

The CHD Initiative’s principal component is its database. Including the 48 countries and territories of the Americas, the database is made up of 109 indicators disaggregated into 405 core data and their historical series since 1990. The CHD Initiative includes mortality, morbidity and access, resources and health services system coverage, socioeconomic health determinants, and environmental and demographic indicators. The Initiative includes a Web-based system allowing the user to generate tables and permitting fast access and versatile queries to the regional database. Published annually since 1995, the brochure “Health Situation in the Americas: Basic Indicators” displays 58 indicators aggregated by country and 38 aggregated by subregion. Among the CHD Initiative’s components is an up-to-date series of Country Profiles and a set of technical reference documents, including a glossary of harmonized definitions of indicators and standardized criteria for validation and data consistency.

### Strategic Approach for the Use of the Regional Core Health Data Initiative



Source: PAHO’s Special Program for Health Analysis (SHA). Regional Initiative of Core Health Data and Country Profiles. I Meeting of National Epidemiology Directors and SHA Focal Points. Santo Domingo, Dominican Republic; September 12-15, 2000.

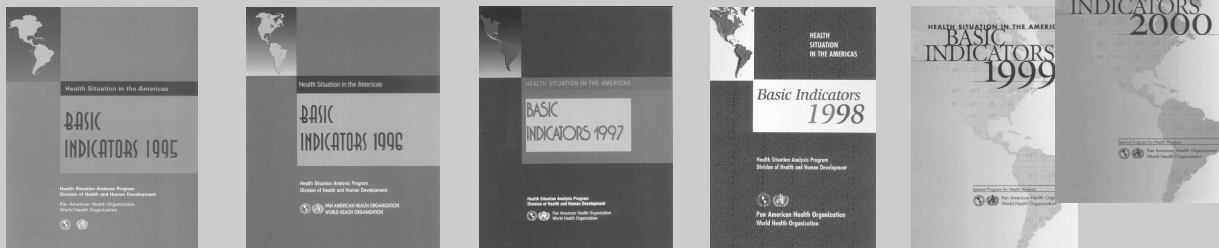
The CHD Initiative has been broadly supported by the countries of the Americas. Presently, 23 of the 35 Member States have adapted the CHD and produced national pamphlets of Basic Indicators, disaggregated at subnational levels. For example, in Argentina, Brazil, and Cuba pamphlets have been published annually since 1996 and in Costa Rica, Ecuador, Guatemala, Mexico, Nicaragua, Peru, Uruguay, and Venezuela, from 1997-98. Some countries have even attempted to extend and adapt the CHD Initiative to the local-level. Cuba maintains a disaggregated database at the municipal level; in Colombia, the department of Santander already published its departmental version and Amazonas is in the process of doing the same; Nicaragua recently published the complete set of basic indicator brochures for each of the 17 Local Integral Health Care Systems (“Sistemas Locales de Atención Integral de la Salud (SILAIS)”), which are the geographic and administrative organizational units for the health sector. In 2001, Haiti launched its first publication of the Basic Indicators. This was an impressive endeavor given the challenges presented by the structural and organizational management of health information in the country. Publication of subnational core data for Bolivia and Jamaica is imminent in 2002. Also on the agenda for 2002 is the strengthening of the Core Data Initiative in Central

America within the framework of current subregional integration agreements.

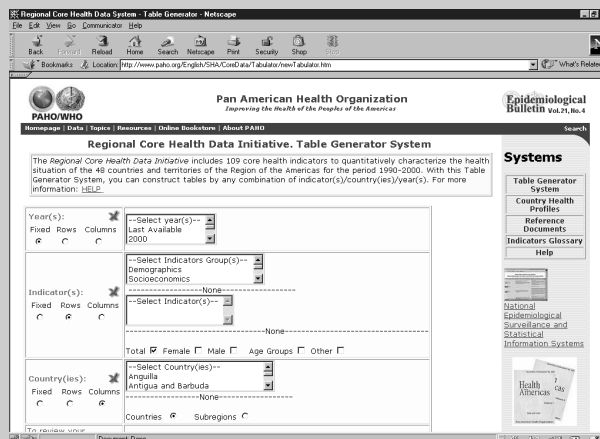
Experiences within countries in implementing the CHD Initiative have demonstrated the crucial importance of intersectoral coordination to guarantee the data quality and analytical use of the information. The most successful example of this type of coordination is Brazil’s Interagency Network of Information for Health (“Red Interagencial de Información para la Salud (RIPSA)”). A network of institutions, RIPSA coordinates national entities responsible for production and/or data analysis in health. Through the work of subcommittees, RIPSA is responsible for technical quality, coverage, validation, and harmonization of core data including aspects of dissemination of information. This includes maintenance of the unified health system (DATA-SUS) Web page, managerial use of the situation analyses, including the establishment of health situation rooms and the continuity and sustainability of the network.

The CHD Initiative has formed a rich venue of technical cooperation for strengthening information systems and networks for communicating in health. CHD contributes to the creation of epidemiological intelligence for public health management and the formulation of more efficient, effective, and equitable health policies in the Americas.

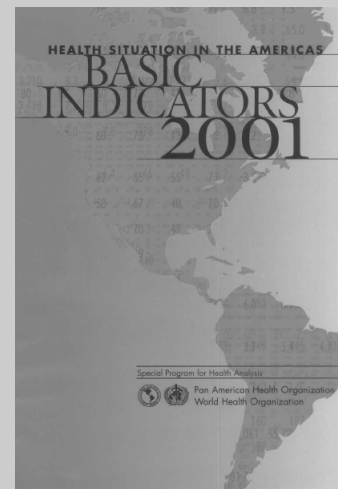
### Regional Basic Indicators Brochure Published Annually since 1995



### Table Generator System

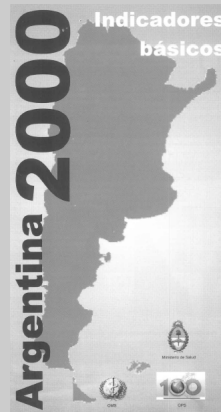


<http://www.paho.org/English/SHA/coredata/tabulator/newTabulatorFirst.htm>

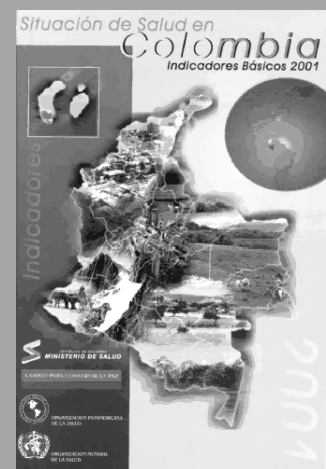


## Examples of National Basic Indicators Brochures

### National Brochures



### Different levels of disaggregation: National and Departmental brochures



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- (10) Pan American Health Organization. Collection and Use of Core Health Data. Washington, DC:PAHO; 25 September 1997. Document CD40.R10.

Source: Prepared by the Analysis Group from PAHO's Special Program for Health Analysis.

# Epidemiological Surveillance System for Acute Pesticide Poisoning

## Introduction

Surveillance in public health requires the systematic and continuous collection, analysis, and interpretation of data on health events. These data are then used in the planning, execution and evaluation of health interventions. A surveillance system requires developing the functional ability to compile, analyze, and disseminate data in a timely fashion to those able to undertake effective prevention and control actions.

In public health, it is imperative to direct surveillance actions not only to health problems of infectious or chronic origin, but also those caused by external agents. These agents can be closely related to the environment, which has been deteriorating at an increased pace over the last decades.

In the case of pesticides, the Pan American Health Organization (PAHO) established as a priority promoting better methods for collecting data related to acute pesticide poisoning (APP) in member countries. The aim is to better understand health problems caused by pesticides, the magnitude of which are still not known with precision. This document presents some preliminary guidelines proposed and adopted by PAHO on this subject.

An APP surveillance system makes it possible to determine how poisoning is affecting the population's health, population groups most affected, types and characteristics of high risk exposures, main pesticides involved, and other determining factors. This information is used to direct prevention and control actions to reduce the negative health effects of chemical substances in places where cases are identified (i.e. in practical terms, an epidemiological blockade).

Furthermore, if surveillance system data are cross-checked with complementary information from other sources, surveillance can facilitate the identification of pesticide use patterns and evaluation of contaminated soils, water and pesticide residues in food.

## 1. Objectives of the surveillance system

- Determine the number of cases and deaths by APP according to time, place, and person (in populations and regions of greater risk, with trends over time) and their principal determining factors, to implement timely prevention and control measures. This makes it possible to calculate the APP morbidity and mortality incidence.
- After an outbreak of cases is identified, investigate the origin and develop training activities aimed at avoiding new cases (epidemiological blockade).
- Define high-risk populations.
- Detect situations of alert where effective and timely actions are required to minimize the negative public health effects of poisoning.

- Characterize pesticide exposures that pose the greatest risks for the population.
- Determine the causes of poisoning and death in the population.
- Identify pesticides more frequently related to APP.
- Focus the design of prevention and control strategies towards these problems in the population.
- Facilitate the evaluation of environmental conditions that create risk situations, in order to propose control measures.
- Direct research proposals to determine the public health implications of pesticide use and the effectiveness of prevention and control actions.

## 2. Case Definition

A case of APP is defined as any person who, after having been exposed to one or more pesticides, presents clinical manifestations of poisoning, or specific laboratory test results compatible with poisoning, in the first 24 hours after contact.

Manifestations of the diseases caused by APP are often not very specific. One source of information that contains a list of the most important signs and symptoms is a manual from the United States Environmental Protection Agency (EPA): Recognition and Management of Pesticide Poisonings. Fifth edition, 1999; USA. This manual is available in electronic format at the following Internet address: <http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>.

At the state level in the United States, a monitoring index is used to assign a level of severity to different diseases due to APP. Table 1 shows the signs and symptoms according to severity categories (Original table available at: [www.cdc.gov/niosh/pestsurg/pdfs/pest-sitablev6.pdf](http://www.cdc.gov/niosh/pestsurg/pdfs/pest-sitablev6.pdf)).

## Case classification

### *Suspected Case*

A case that suggests acute pesticide poisoning by presenting a symptomatology compatible with poisoning (systemic or localized) and/or is suspected to have been exposed to pesticides.

### *Confirmed Case*

A case in which at least one of the following criteria is established:

- Epidemiological visit where the background of exposure to the toxic substance, the means of exposure, the agent, the mechanism, and their relation in time are identified and, additionally, presenting clinical manifestations of poisoning.
- History of exposure to the toxic substance and altered

**Table 1: Signs and Symptoms of Acute Pesticide Poisoning by Severity Category**

Organ System	Fatal	Severity Category		
		High Severe and life-threatening signs	Moderate Pronounced or Prolonged Signs and Symptoms	Low Mild, transient, and/or spontaneously resolving symptoms
<b>Gastrointestinal System</b>	Death	<ul style="list-style-type: none"> <li>Massive hemorrhage/perforation of gut</li> </ul>	<ul style="list-style-type: none"> <li>Diarrhea</li> <li>Melena</li> <li>Vomiting</li> </ul>	<ul style="list-style-type: none"> <li>Abdominal pain, cramping</li> <li>Anorexia</li> <li>Constipation</li> <li>Diarrhea</li> <li>Nausea</li> <li>Vomiting</li> </ul>
<b>Respiratory System</b>	Death	<ul style="list-style-type: none"> <li>Cyanosis + Respiratory depression</li> <li>Pulmonary edema</li> <li>Respiratory arrest</li> </ul>	<ul style="list-style-type: none"> <li>Abnormal pulmonary x-ray</li> <li>Pleuritic chest pain/pain on deep breathing</li> <li>Respiratory depression</li> <li>Wheezing</li> <li>Dyspnea, shortness of breath</li> </ul>	<ul style="list-style-type: none"> <li>Cough</li> <li>Upper respiratory pain, irritation</li> <li>Dyspnea, shortness of breath</li> </ul>
<b>Nervous System</b>	Death	<ul style="list-style-type: none"> <li>Coma</li> <li>Paralysis, generalized</li> <li>Seizure</li> </ul>	<ul style="list-style-type: none"> <li>Confusion</li> <li>Hallucinations</li> <li>Miosis with blurred vision</li> <li>Seizure</li> <li>Ataxia</li> <li>Slurred speech</li> <li>Syncope (fainting)</li> <li>Peripheral neuropathy</li> </ul>	<ul style="list-style-type: none"> <li>Hyperactivity</li> <li>Headache</li> <li>Profuse sweating</li> <li>Dizziness</li> <li>Ataxia</li> <li>Peripheral neuropathy</li> </ul>
<b>Cardiovascular System</b>	Death	<ul style="list-style-type: none"> <li>Bradycardia/heart rate &lt;40 for adults, &lt;60 infants and children, &lt;80 neonates</li> <li>Tachycardia/heart rate &gt;180 for adults, &gt;190 infants/children, &gt;200 in neonates</li> <li>Cardia arrest</li> </ul>	<ul style="list-style-type: none"> <li>Bradycardia/heart rate 40-50 in adults, 60-80 in infants/children, 80-90 in neonates</li> <li>Tachycardia/heart rate=140-180 in adults, 160-190 infants/children, 160-200 in neonates</li> <li>Chest pain + hyperventilation, tachypnea</li> <li>Conduction disturbance</li> <li>Hypertension</li> <li>Hypotension</li> </ul>	
<b>Metabolism</b>	Death	<ul style="list-style-type: none"> <li>Acid Base disturbance (pH&lt;7,15 or &gt;7,70)</li> </ul>	<ul style="list-style-type: none"> <li>Acid Base disturbance (pH = 7,15-7,24 or 7,60-7,69)</li> <li>Elevated anion gap</li> </ul>	<ul style="list-style-type: none"> <li>Fever</li> </ul>
<b>Renal System</b>	Death	<ul style="list-style-type: none"> <li>Anuria</li> <li>Renal failure</li> </ul>	<ul style="list-style-type: none"> <li>Hematuria</li> <li>Oliguria</li> <li>Proteinuria</li> </ul>	<ul style="list-style-type: none"> <li>Polyuria</li> </ul>
<b>Muscular System</b>	Death	<ul style="list-style-type: none"> <li>Muscle rigidity + elevated urinary myoglobin + elevated creatinine</li> </ul>	<ul style="list-style-type: none"> <li>Fasciculations</li> <li>Muscle rigidity</li> <li>Muscle weakness</li> </ul>	<ul style="list-style-type: none"> <li>Muscle weakness</li> <li>Muscle pain</li> </ul>
<b>Local effects on skin</b>	Death	<ul style="list-style-type: none"> <li>Burns, second degree (involving &gt;50% of body surface area)</li> <li>Burns, third degree (involving &gt;2% of body surface area)</li> </ul>	<ul style="list-style-type: none"> <li>Bullae</li> <li>Burns, second degree (involving &lt;50% of body surface area)</li> <li>Burns, third degree (involving &lt;2% of body surface area)</li> </ul>	<ul style="list-style-type: none"> <li>Skin edema/swelling, erythema, rash, irritation/pain, pruritis</li> <li>Hives/urticaria</li> </ul>
<b>Local effects on eye</b>	Death	<ul style="list-style-type: none"> <li>Corneal ulcer/perforation</li> </ul>	<ul style="list-style-type: none"> <li>Corneal abrasion</li> <li>Ocular burn</li> </ul>	<ul style="list-style-type: none"> <li>Lacrimation</li> <li>Mydriasis</li> <li>Miosis</li> <li>Ocular pain/irritation/inflammation (diagnosis of conjunctivitis)</li> </ul>
<b>Other effects</b>	Death			<ul style="list-style-type: none"> <li>Fatigue</li> <li>Malaise</li> </ul>

Source: Adapted from "Signs and symptoms [for pesticide active ingredients] by severity category" from SENSOR (Sentinel Event Notification System for Occupational Risk) Case Definition and Severity, National Institute for Occupational Safety and Health, United States.

biological indicators of exposure or effect in accordance with the pesticide, and presence or no presence of clinical manifestations.

- In case of death, confirmation with medical-legal procedures.

*According to the circumstance of the exposure:*

- Occupational: Exposure to pesticides during the industrial processes of manufacture, storage, transportation, application, and final disposal.
- Accidental: Unintentional and unexpected exposure to pesticides. This includes food poisoning.
- Intentional: Exposure to pesticides with the intention of causing harm. This includes suicide attempts, suicides, and homicides.

*According to characteristics of the pesticide:*

- Chemical Group:

- Bipyridyls
- Carbamates
- Arsenical compounds
- Copper compounds
- Organochlorine compounds
- Organotin compounds
- Organophosphate compounds
- Organomercury compounds
- Derivatives of phenoxyacetic acid
- Coumarins and Indandiones
- Derivatives of hydrocarbons, halocarbons, oxides, and aldehydes, composed of sulfur, composed of phosphorus, composed of nitrogen (all as fumigants)
- Nitrophenolics and Nitrocresolic
- Pyrethrins and Pyrethroids
- Thio- and dithiocarbamates
- Triazines
- Others

- Organisms to control:

- Insecticides
- Herbicides
- Fungicides
- Rodenticides
- Nematicides
- Acaricides
- Bactericides
- Others

- Toxicological Classification of Pesticides/WHO \*

- Ia: Extremely hazardous
- Ib: Highly hazardous

\* This classification is available at the following address: [http://www.who.int/pcs/pcs\\_act.htm](http://www.who.int/pcs/pcs_act.htm) (select WHO Recommended Classification of Pesticides by hazard and Guidelines to Classification).

- II: Moderately hazardous
- III: Slightly hazardous

### Definition of Alerts

A set of events related to pesticide poisoning which, according to epidemiological criteria, demand immediate intervention. They include:

- Death
- Poisoning in pregnant or lactating women
- Poisoning in children (minors as defined by each country legislation)
- Severe poisoning
- Two or more cases in a week, in the same place
- Two or more cases on a given day or cases on consecutive days in the same place
- Poisoning with unregistered or prohibited pesticides
- Alerts that the local pesticide monitoring commission consider should be investigated
- Emergencies where pesticides are involved such as: leaks, spills, natural disasters, technological disasters and others

### 3. Operational organization of the surveillance system

#### Surveillance Types

Through *passive surveillance* the background of pesticide exposure is sought in persons attended by health services personnel who present compatible signs and symptoms.

Notification of APP cases is made on a periodic basis. Reports are made immediately at the local level, weekly at the national level, and quarterly at the level of international agencies. These reports are integrated into the established notification system within the local public health surveillance system or pesticide prevention and control program when applicable.

In specific cases, surveillance can be carried out to monitor occupational risks with evaluation of environmental conditions and/or utilization of biological markers (*active surveillance*). Some biological markers can identify early alterations due to pesticide exposure.

In the case of an *alert* situation as previously defined, notification to the local health authority should be immediate and a compulsory epidemiological investigation should be conducted for every case.

#### Data collection

##### Data Sources

*Morbidity:* APP case notification forms; notifications by Local Pesticides Commissions; community notifications. If resources are adequate, it is possible to use registries of medical consultations and emergencies, clinical histories of patients and hospital discharge information to confirm that there were no additional cases.



Research findings and laboratory results can be used to actively look for active cases of pesticide poisoning in high-risk groups.

Consolidated monthly reports of data summarizing the epidemiological behavior of APP.

*Mortality:* individual death certificates, hospital or emergency mortality records, vital statistics and community medical and legal records.

*Field investigations:* reports of epidemiologic field studies carried out due to the presence of alert situations such as poisoning outbreaks or cases of special importance.

*Other registries (when resources are available):* reports of occupational injuries and labor absenteeism; registries of companies and of the Ministry of Labor; press reports and results of special research, for example on evaluation of underreporting.

*Environment:* Soil and water monitoring reports and reports of pesticide residues in food. Classification of pesticides used; hygiene and safety conditions and use of personal protection against pesticides.

### Minimum data recommended

For each case of APP:

*Socio-demographic variables:* age, sex, origin (urban / rural), education, occupation.

*Exposure variables:* place and activity at time of exposure, date, hour of exposure, means of exposure, cause of the poisoning (occupational, accidental, intentional).

*Variables related to the clinical manifestations:* date and hour of onset of symptoms, type of clinical manifestations, severity of clinical manifestations, condition of discharged patient (alive / dead).

*Variables related to the implicated pesticide(s):* type of pesticide, generic name, brand name, classification according to chemical group and according to type of organism controlled; type of crop.

**Note:** These data are included in the notification form at time of patient admission or subsequently based on clinical history data.

Data consolidated periodically (monthly or yearly):

- Total number of poisonings
- Number of poisonings by sex
- Number of poisonings by 5-year age groups
- Number of poisonings in children (minors as defined by the legislation of each country)
- Number of poisoning by cause: occupational, accidental, intentional
- Number of deaths from poisoning
- Number of deaths from poisoning by age and sex
- Number of deaths from poisoning in children (minors as defined by the legislation of each country)

- Number of deaths from poisoning by cause: occupational, accidental, intentional
- Number of occupational poisonings by type of crop
- Total poisonings per month
- Total weight of pesticides imported annually by country (in kg): by chemical group, type of organism to control and by toxicological classification
- Number and type of alert situations
- Number and type of prevention and control measures carried out (inspection visits, active search of new cases, hygiene and safety conditions improvement, education, compliance with legislation, follow-up of previous activities, others)
- Cases by place of occurrence (company, neighborhood, city)

### Instrument

The form for Report of Acute Pesticide Poisoning should be used for every person that is attended by health services, or who dies and meets the criteria established in the Case Definition.

### Additional sources

*The following information will be needed to analyze the data provided by the surveillance system.*

- Socio-demographic information (total population, population of economically active age, proportion of economically active population working in agriculture, distribution of the population by age and sex, by urban/ rural origin and by level (local, regional or national).
- Imports of pesticides by chemical group, by type of organism to control, and according to toxicological classification.
- Types, areas, and seasons of crops. Technologies used for these crops.
- Pesticide waste inventory.
- Monitoring of pesticide residues in food.
- Environmental impact assessments. Contamination of water and soil.
- Census of job sites by Municipality.
- Directory of organizations and institutions which work with pesticides that may have resources available.
- Available legal framework (laws, regulations, technical standards)
- Laboratory capacity at local and national level.
- Investigations and studies in the area.

## 4. Data analysis

### Epidemiological Indicators

*Incidence rate of acute poisoning:*

Number of new cases of APP in a period / Population at mid-period x 100,000

*Mortality from acute poisoning:*

Number of deaths by APP in a period / Population at mid-period x 100,000

### *Case-fatality:*

Number of deaths by APP in a period / Number of cases of APP in a period x 100

### *Rate or in case of not having data for denominators, proportional distributions:*

Proportion of cases by sex

Proportion of cases by age group

Proportion of cases in children (minors as defined by each country legislation)

Proportion of cases according to type of pesticide (chemical group, organism to control and WHO toxicological classification)

Proportion of cases according to cause of poisoning (occupational, accidental, intentional)

Proportion of cases of occupational poisoning by type of agriculture

Proportion of cases by place or company

### Indicators regarding the importation of pesticides

- Kilograms of Imported Active Ingredients\* / Number of inhabitants in the country
- Kilograms of Imported Active Ingredients\* / Population economically active in agriculture.
- Kilograms of Imported Active Ingredients\* / Hectares cultivated

In the analysis of these epidemiological indicators, monthly or yearly trends can be calculated. These trends can be analyzed for different localities, regions or countries. Behavior by sex, age group, cause of poisoning, type of pesticide according to chemical group, and type of organism to control also can be analyzed in time.

To present this information, trend graphs are used to illustrate rates and pie or bar graphs to represent the proportional distributions of the proposed variables. Maps are also useful to geographically locate where cases occur and define high-risk areas in a locality.

## **5. Dissemination of Information**

It is of vital importance that information from a surveillance system reach the people and institutions responsible for decision-making in a timely fashion. With this information, decision-makers will be able to effectively direct timely prevention and control actions.

In situations where APP is involved, information needs to be shared not only among health authorities but other organizations as well. These situations require the involvement and commitment of regulatory agencies, occupational health programs, local pesticide commissions, and the community.

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\* These calculations should be carried out taking into account that 85% of the imported active ingredients are used in agriculture.

Dissemination of information can be carried out through bulletins which include epidemiological analysis of APP using proposed indicators. Also, the mass media can be used to strengthen education related to the proper use of pesticides.

## **Uses of data for decision-making**

### *Surveillance:*

- Analyze the epidemiological behavior of APP and related mortality.
- Estimate the magnitude of the problem by using incidence rates of APP and mortality in the population, by locality and year.
- Monitor the characteristics of APP cases and deaths by sex, age, and specifically in children, using incidence and mortality rates.
- Characterize APP according to cause (occupational, accidental, intentional) through proportional distributions of cases by place and year.
- Describe the pesticides responsible for APP cases and deaths through a classification list according to chemical group, organism to control, and toxicological classification.
- Identify and characterize alert situations according to year, place, source of poisoning, type of pesticide, number of affected people, number of deaths, cause, and prevention and control actions.

### *Investigation:*

- Characterize the changes in APP frequency by time and place
- Identify populations at risk through periodic monitoring
- Characterize importation and utilization of pesticides in different places
- Identify the impact of specific pesticides on public health for the purpose of regulating their use
- Develop and strengthen enforcement of legislation in the area
- Provide impetus for organized education and control activities regarding the use of Pesticides
- Assess the impact of different intervention strategies for the problem of APP.
- Monitor soil, water, and work places, as well as pesticide residues in food.
- Characterize under-registration, using a standard model

## **6. Evaluation of the System**

To evaluate the fulfillment of APP surveillance activities, an assessment must be carried out at every participating level: local, regional, and national. Evaluation includes: 1) fulfillment of the directives established by the system, 2) ad-

ministrative and human resources, including appropriate materials for the development of the system and resources necessary to carry out activities of surveillance, 3) Aspects related to the system's capacity to detect cases and prevent and control future cases, 4) Reduction of morbidity and mortality rates.

Indicators of fulfillment of surveillance actions

- Proportion of reported cases with complete report file
- Proportion of cases reported by the community
- Proportion of alert situations that are investigated
- Proportion of alert situations with intervention follow-up in occupational and accidental cases
- Time elapsed between reported and investigated cases.

Attributes of the system:

It is considered a prerequisite that data available through the surveillance system are of good quality and consistent. The system must also be sustainable and stable.

*Simplicity:* Ease of collection and analysis of APP data.

*Flexibility:* Capacity to incorporate monitoring of the APP in existing surveillance systems.

*Acceptability:* Willingness of individuals and organizations to participate in the Surveillance System.

*Sensitivity:* Ability of the system to capture the cases of APP that really occur in the population. It can be affected by underreporting and low quality of the diagnosis.

*Positive predictive value:* Proportion of APP cases captured by the system that really are cases.

*Representativeness:* Capacity of the system to accurately reflect APP that occur at territorial levels. It can also be affected by underreporting.

*Opportunity:* Rapid availability of the APP data for its report and response.

## 7. Responsibilities of the Surveillance System at different levels.

Local level:

- Data collection
- Alert identification
- Epidemiological investigation of the alerts
- Epidemiological analysis
- Prevention and control actions
- Report to higher levels
- Dissemination of pertinent information

Regional level:

- Consolidation of information from local levels
- Epidemiological analysis of behavior of the problem in the region
- Report to the national level
- Advisory services at the local levels
- Dissemination of information at regional and local levels

– Evaluation of the System at the local level

National level:

- Consolidation of information from the regional levels
- Epidemiological analysis of the behavior of the problem at the national level
- Advisory services at regional levels
- Strengthening of sanitary regulation regarding pesticides
- Evaluation of the Surveillance System at the regional level
- Dissemination of information at the national, regional and local levels

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*Source:* Prepared by Dr. Samuel Henao from the PAHO/WHO Representation in Costa Rica and Dr. Maria Patricia Arbelaez from the Public Health Department of the University of Antioquia, Medellin, Colombia.

## Summer Courses in Epidemiology in 2002

■ The Twelfth Summer Session in Intermediate Epidemiology, sponsored by the Special Program for Health Analysis of the *Pan American Health Organization*, will take place from July 22 to August 9, 2002 at the College of Public Health of the University of South Florida in Tampa, Florida.

Courses offered are:

Intermediate methods in epidemiology

Statistics applied to epidemiology and the use of software packages

Use of epidemiology in the programming and evaluation of health services.

Students are required to have approved training in epidemiology. Courses will be conducted in Spanish, but participants must be able to read English. Applications must be received before May 24, 2002.

For application and more information, contact: Ms. Clara Ochoa, Special Program for Health Analysis (SHA), Pan American Health Organization, 525 Twenty-third Street, NW, Washington, DC 20037. Tel: (202) 974-3508, Fax: (202) 974-3674. email: [ochoacla@paho.org](mailto:ochoacla@paho.org)

■ *The Johns Hopkins University Bloomberg School of Public Health* will hold its 2002 Graduate Summer Institute of Epidemiology and Biostatistics from June 17 to July 5, 2002. A total of 25 courses will be offered, ranging in length from one weekend to three weeks:

*Three-week courses:*

Principles of Epidemiology

Methods in Epidemiology,

Infectious Disease Epidemiology

Design and Analytical Methods in Cohort Studies

Applications of the Case-Control Method

Clinical Trials: Issues and Controversies

Epidemiologic Basis for Tuberculosis Control

Statistical Computing in Public Health

Statistical Reasoning in Public Health I

Statistical Reasoning in Public Health II

*Two-week courses:*

Data Analysis

Genetic Epidemiology

*One-week courses:*

Regression Analysis in Public Health Research

Survival Analysis

Introduction to the SAS Statistical Package

Introduction to the Risk Sciences and Public Policy

Epidemiology in Evidence-Based Decisions

Epidemiology of HIV/AIDS

Epidemiologic Applications of GIS

Epidemiologic Methods for Planning and Evaluating Health Services

Molecular Biology for Genetic Epidemiology

New Perspectives on Management of Epidemiologic Studies,

Outcomes and Effectiveness Research

Teaching Epidemiology

Tobacco Control: National and International Approaches

For further information, contact: Ayesha Khan, Program Coordinator, Graduate Summer Institute of Epidemiology and Biostatistics, Department of Epidemiology, School of Hygiene and Public Health, The Johns Hopkins university, 615 N. Wolfe Street, Baltimore, MD 21205, USA. Tel: (410) 955-7158, Fax: (410) 955-0863, email: [akhan@jhsph.edu](mailto:akhan@jhsph.edu), website: [www.jhsph.edu/Departments/Epi/summer.html](http://www.jhsph.edu/Departments/Epi/summer.html).

■ *The University of Michigan School of Public Health* announces its 37th Graduate Summer Session in Epidemiology to be held from July 7 to 26, 2002. One and three week courses will be offered, including topics such as: Fundamentals of Biostatistics and Epidemiology, Infectious Diseases, Epidemiology in Public Health Practice, Cancer, Injuries, Clinical Trials, Computer Applications, Epidemiologic Measures, Logistic Model, Environmental and Occupational Epidemiology, Behavioral Change, Law, Violence, Health Economics, Social Epidemiology, Longitudinal Studies, PC-SUDAAN, Global Health, and Genetics.

CME Credit is available.

For application and information contact: Jody Gray, Graduate Summer Session in Epidemiology, The University of Michigan, School of Public Health, 109 Observatory St., Ann Arbor, MI 48109-2029, USA, Telephone: (734) 764-5454, Fax: (734) 764-3192, Email: [umichgss@umich.edu](mailto:umichgss@umich.edu), Website: <http://www.sph.umich.edu/epid/GSS>

■ *The Department of Epidemiology, Biostatistics, and Occupational Health of McGill University* will hold its 17<sup>th</sup> Annual Summer Program in Epidemiology and Biostatistics from May 6 to June 28, 2002.

The courses are intended for health professionals (physicians, nurses, psychologists, social scientists) or professionals in related fields (e.g. industrial hygienists, environmental specialists, urban planners, engineers) wishing to gain familiarity with the principles of epidemiology and biostatistics, and for graduate students from McGill, and from Quebec, Canadian or US universities, or from universities elsewhere seeking to accelerate course work in a summer term.

Academic credits are available to graduate students, residents and fellows from McGill and other universities. Physicians with a license from Canada and USA can register for Continuing Medical Education (CME) units, fully accredited by the Committee on Accreditation of Canadian Medical Schools (CACMS) and by the Accreditation Council for Continuing Medical Education (ACCME) of the USA. In addition, physicians coming from outside Canada or USA, as well as health and other professionals can obtain a professional interest certificate.

The **May session** (May 6 – 31) includes the following courses:

Focus on General Topics: Introduction to Epidemiology (3 credits), Topics in Clinical Epidemiology (3 credits), Psychiatric Epidemiology (3 credits), Scientific Medicine (2 credits), Statistical Inference I (2 credits), Epidemiology of Cancer (1 credit), Research Methods in Behavioural Medicine (1 credit), Environmental Risk Assessment for Epidemiologists (1 credit), Injury Prevention: Epidemiology, Surveillance and Policy (1 credit)

Focus on Clinical Trials: Clinical Trials: From Regulation to Practice (2 credits), Clinical Trials: Design and Analysis (1 credit)

Focus on Health Care Services Research: Evaluation of Health Services (3 credits)

Focus on Public Health: Decision-making in Public Health: Strategic Analysis (1 credit), Evaluation in Public Health: A Case Study of Montreal Street Youth (1 credit), Health Care Evaluation in the 21<sup>st</sup> Century (1 credit), Communications efficaces et gestion de crise (1 credit), Montreal Observatory on Social and Health Inequalities (1 credit)

The June session (June 3 - 28) includes the following courses:

Focus on General Topics: Practical Aspects of Protocol Development (3 credits), Analysis of Multivariable Data (3 credits), Statistical Inference II (2 credits)

Focus on Pharmacoepidemiology (a series of four consecutive one-week courses): PE 1: Introduction to Pharmacoepidemiology (2 credits), PE 2: Intermediate Pharmacoepidemiology (2 credits), PE 3: Advanced Pharmacoepidemiology (2 credits), PE 4: Pharmacoeconomics (2 credits)

Focus on International Health: Infectious and Parasitic Disease Epidemiology (3 credits), Health in Developing Countries (3 credits)

Focus on Health Care Services Research: Economics for Health Policy (3 credits)

Focus on Public Health: Data Security in Public Health II: Legal and Technical Aspects from an International Perspective (1 credit), Information Technologies in Public Health (1 credit)

For more information, contact: Summer Coordinator, 2002 Summer Program in Epidemiology and Biostatistics, Faculty of Medicine, McGill University, Purvis Hall, 1020 Pine Avenue West, Room 38-B, Montreal, Quebec, Canada, H3A 1A2, Tel: (514) 398-3973, Fax: (514) 398-4503, email: summer@epid.lan.mcgill.ca

■ The nineteenth International Course in Applied Epidemiology, conferring diploma status recognized by the National Autonomous University of Mexico, will take place in July 2001 in Mexico, D.F., under the coordination of the *Department of Epidemiology of the Ministry of Health of Mexico*. Courses, divided into two levels (basic and intermediate), are designed to provide training in two broad areas: theoretical and methodological aspects of epidemiological practice, and

specific subjects of applied epidemiology. They include, among others: basic and intermediate epidemiology, basic and intermediate biostatistics, epidemiological surveillance, Epi-Info 6.04, management of Health Services, design of research protocols, infectious disease epidemiology, social and cultural factors in epidemiological research and more.

Applications must be received by June 2002.

For further information, please contact: Dirección General de Epidemiología, Francisco P. Miranda No. 177, Col. Unidad Lomas de Plateros, Delegación Obregón, C.P. 01480, México, D.F., Mexico. Tel: 55 93 36 61, Fax: 56 51 62 86

■ The Biostatistics Program of the *Ohio State University* will hold its Summer Program in Applied Statistical Methods from 10 to 28 June, 2002. Weekly courses include: Analysis of Correlated Data, Analysis of Experimental Data, Applied Logistic Regression, Applied Regression Analysis, Applied Survival Analysis, Basic Biostatistics, Design and Analysis of Clinical Trials, Design and Analysis of Sample Surveys, Epidemiologic Study Design and Data Analysis, How to Report Statistics in the Biomedical Sciences, Introduction to STATA, Principles of Research in Epidemiology, Statistical Considerations for Confirmatory Clinical Trials with Regulatory Objectives, Statistical Techniques in Computational Biology

For more information, please contact the Biostatistics Summer Program, The Ohio State University, M200 Starling Loving Hall, 320 W. 10<sup>th</sup> Avenue, Columbus, Ohio 43210-1240. Tel: (614) 293-6899, Fax: (614) 293-6902.

■ The *Special Program for Health Analysis* (SHA) of the Pan American Health Organization (PAHO) and the *Universidad Abierta de Cataluña* (UOC) of Spain, are organizing the II Distance Learning Course on the Bases of Epidemiology and Biostatistics, offered in Spanish through the Internet starting in July of 2002, with a duration of six months.

The characteristic of this program is that it is based on the development of professional skills for the practice of epidemiology. Accordingly, the process of learning is oriented to the resolution of real-life problems addressed by professionals in their daily work. The course's thematic units are organized in 7 modules. Two of them are devoted to online learning methods and computational tools, while the rest includes concepts and fundamental methods of epidemiology and basic biostatistic tools required for the epidemiological analysis of the health status and its determinants.

Applications should include name, age, address, current position, degree, previous courses, and a recent photograph, in accordance with the application form (available at: <http://www.paho.org>). Each student should have access to a computer and to the Internet. Applications will be received from this date until 1 May 2002. Admitted students will be informed of their selection in May. For additional information, please contact: Special Program for Health Analysis, Pan American Health Organization, 525 23rd Street, NW - Washington, DC 20037 U.S.A., Email: sha@paho.org

# Case Definitions

## *Meningococcal Disease*

### **Rationale for Surveillance**

Meningococcal disease occurs sporadically and in epidemics of meningococcal meningitis; the majority of cases occur in children <5 years. Meningococcal meningitis is the only form of meningitis to cause epidemics. The case-fatality rate is between 5% and 15%. While sub-Saharan Africa is the most severely affected area, epidemic meningococcal disease can affect any country. Meningococcal bivalent A, C and quadrivalent A, C, Y, W135 vaccines are available; immunization of the entire population should be considered to halt epidemics due to A and C serogroup meningococci. In some countries, vaccine is used for close contacts of patients with meningococcal disease due to A, C, Y or W135 serogroups in order to prevent secondary cases. Immunization is also indicated for people travelling to endemic areas. Surveillance is needed to measure and detect epidemics and establish the impact of both epidemic and non-epidemic disease.

### **Recommended Case Definition**

#### *Clinical case definition*

An illness with sudden onset of fever (>38.5°C rectal or >38.0°C axillary) **and one or more** of the following:

- neck stiffness
- altered consciousness
- other meningeal sign **or** petechial or purpurial rash

In patients <1 year, suspect meningitis when fever accompanied by bulging fontanelle.

#### *Laboratory criteria for diagnosis*

Positive CSF antigen detection **or** Positive culture.

### **Case classification**

**Suspected:** A case that meets the clinical case definition.

**Probable:** A suspected case as defined above **and** turbid CSF (with or without positive Gram stain) **or** ongoing epidemic and epidemiological link to a confirmed case

**Confirmed:** A suspected **or** probable case with laboratory confirmation.

### **Recommended Types of Surveillance**

At peripheral level, individual patient records should be maintained (particularly for contact tracing).

Immediate reporting of all suspected or probable cases from peripheral level to intermediate level.

All cases must be investigated.

Follow-up data on the organism identified and on patient outcome to be sought by the intermediate level.

Routine weekly / monthly reporting of aggregated or case-based data, from intermediate to central level.

A parallel surveillance using reference laboratories for meningococcal diseases may provide detailed microbiological data on serogroup and genotype on a central basis (useful for epidemiological analysis).

**Note 1:** In countries with limited surveillance infrastructure, 2 approaches to clinical surveillance can be integrated:

1. A limited amount of data reported from all health sites (e.g., new cases and deaths by week)
2. More extensive data reported from selected referral health centres.

**Note 2:** Surveillance of vaccine coverage may be undertaken in areas of mass vaccination or where vaccination for meningococcal disease is part of routine vaccination.

### **Recommended Minimum Data Elements**

#### *Clinical surveillance*

#### **Case-based data for individual patient records and for reporting:**

Case classification (suspected / probable / confirmed), unique identifier, age, sex, geographical information, date of onset, date of consultation, vaccination status, treatment received, history of contact with a case, close contacts.

#### **Aggregated data for reporting:**

By case classification (suspected / probable / confirmed), age group, week, geographical area, and outcome.

#### *Laboratory Surveillance*

#### **Isolate-based data for reporting:**

Unique identifier, age, sex, date of onset, date of specimen, specimen type, serogroup.

Genotype.

#### **Aggregated data for reporting:**

Cases by age group, specimen type, serogroup, genotype.

### **Recommended Data Analyses, Presentation, Reports**

- Incidence by week, month, geographical area and age group
- Use of incidence data to set epidemic thresholds by comparing weekly incidence rates during the same period in 3-5 previous non-epidemic years (flagging)
- Distribution by serogroup and genotype (if available)
- Vaccine coverage (if available).

### **Principal Uses of Data for Decision-making**

- Detect and control epidemics of meningococcal disease as early as possible, especially in areas such as developing countries where epidemic meningitis raises particu-

lar difficulties.

- Strengthen capacity for emergency response to epidemics of meningococcal disease.
- Mobilize immunization activities.
- Monitor immunization coverage by geographical area to monitor progress and identify areas of poor performance.
- Monitor impact of vaccination on disease incidence and vaccine efficacy during epidemics.

## Special Aspects

### Deciding when an epidemic is occurring or likely to occur (setting thresholds)

Hyperendemic areas: 15 cases per 100 000 per week averaged over 2 consecutive weeks. Once epidemic disease is detected in a given area, a lower value (say 5 cases/100 000 per week) may be used as a threshold in contiguous areas.

Other situations: 3 to 4-fold increase compared with corresponding time period in previous years, **or** Doubling of cases from one week to the next over a period of 3 weeks.

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## *Viral Meningitis*

### Rationale for Surveillance

Viral meningitis occurs sporadically and also as an epidemic disease. Case-fatality rates are generally low; infection may have potential long-term sequelae in those affected (mostly children), but the disease is rarely severe and recovery is usually complete. The early detection of epidemics through epidemiological surveillance allows for identification of the causal agent and the institution of targeted control measures and effective case management.

### Recommended Case Definition

#### *Clinical case definition*

A case with fever  $\geq 38.5^{\circ}\text{C}$  and **one or more** of the following:

- neck stiffness
- severe unexplained headache
- neck pain and **2 or more** of the following
  - photophobia
  - nausea
  - vomiting
  - abdominal pain
  - pharyngitis with exudates.

For **children <2 years of age** a case is defined as a case with fever  $\geq 38.5^{\circ}\text{C}$  and **one or more** of the following

- irritability
- bulging fontanelle.

#### *Laboratory criteria for confirmation*

The specific virus confirmed on cell culture.

### Case classification

**Suspected:** A case that meets the clinical case definition.

**Probable:** A suspected case with one or more of the following:

- normal CSF glucose and normal or mild increase in CSF protein ( $>50\text{mg/dl}$ ), moderate increase CSF cells ( $<500/\text{mm}^3$ ) and lymphocyte predominance ( $>50\%$ )

- CSF Positive for viral genomic sequences using PCR (Polymerase Chain Reaction)
- Epidemiological link to a confirmed case.

**Confirmed:** A suspected or probable case with laboratory confirmation.

### Recommended Types of Surveillance

- At peripheral level individual patient records should be maintained.
- Immediate reporting of all suspected or probable cases from peripheral level to intermediate level and central level.
- All cases must be investigated. Follow-up data on identified organism and patient outcome to be sought by the intermediate and central level.
- Routine weekly reporting of aggregated or case-based data from intermediate to central level.

A parallel surveillance using reference laboratories for viral diseases may provide more detailed virological data on specific causal agents on a national basis; these are very useful for epidemiological analysis.

### Recommended Minimum Data Elements

#### *Clinical Surveillance*

**Case-based data for individual patient record and for reporting:** Case classification (suspected / probable / confirmed), unique identifier, age, sex, geographical information, date of onset, date of consultation, treatment received.

**Aggregated data for reporting:** Case by case classification (suspected / probable / confirmed), age group, week, geographical area, and outcome.

#### *Laboratory Surveillance*

**Isolate-based data for reporting:** Unique identifier, age, sex,

date of onset, date of specimen, specimen type, organism identified.

**Aggregated data for reporting:** Cases by age group, specimen type, organism identified.

### Recommended Data Analyses, Presentation, Reports

Incidence by week, month, geographical area, age group, outcome.

### Principal Uses of Data for Decision-making

- To detect and control epidemics of viral meningitis as early as possible
- To strengthen the capacity for emergency response to epidemics of viral meningitis.

Source: "WHO Recommended Surveillance Standards, Second edition, October 1999", WHO/CDS/CSR/ISR/99.2

## 2002 FRED L. SOPER AWARD FOR EXCELLENCE IN HEALTH LITERATURE IN THE REGION OF THE AMERICAS

The Pan American Health and Education Foundation, a USA-based non-profit collaborating partner of the Pan American Health Organization (PAHO), seeks nominations for the 2002 Fred L. Soper Award for outstanding contributions to the health literature in the Americas.

The prize, which consists of a certificate and a cash prize of US\$2,500, stimulates excellence in medical/public health research and writing, and recognizes significant contributions to the literature on health in the Region of Americas. Articles published in scientific journals listed in the *Index Medicus* or in the official journals of the Pan American Health Organization (PAHO) are eligible for consideration.

The submissions may consist of:

- a report,
- an analysis of new data, experimental or observational,
- or a new approach to analyzing available data.

Preference will be given to studies involving more than one discipline and to papers related to infectious disease, a life-long concern of Dr. Soper. Eligible papers will deal directly with policy primarily affecting the Region of Americas.

The Award is limited to contributions by authors whose principal affiliation is with teaching research or service institutions located in the countries of the Region of Americas. Active PAHO staff members are not eligible for the Award.

Papers submitted by or on behalf of their authors may be considered for the Award. For purposes of the 2002 Award, only papers published during the calendar year 2001 will be considered.

Nominations must be received by **30 June 2002**, and should be submitted to:

Fred L. Soper Award Committee  
c/o Pan American Health and Education Foundation  
525 Twenty-third Street, NW  
Washington, DC 20037  
Phone: 202-974-3416  
Facsimile: 202-974-3636  
Email: [pahef@paho.org](mailto:pahef@paho.org)

### About Dr. Fred L. Soper (1893-1977):

First elected Director of the Pan American Health Organization in 1947 and re-elected in 1950 and 1954, inaugurated the modern era of PAHO, and oversaw its integration with the World Health Organization.

When he became Director of PAHO, Fred Soper's staff was a small group of workers from the United States and Puerto Rico housed in two small rooms. Their annual budget was \$300,000. There was the goal of eradication of malaria, urban yellow fever, smallpox and yaws. When he left 12 years later, the budget was \$8 million, the staff was large and multi-national and PAHO's programs were in every country in Latin America. After leaving the School of Public Health at Johns Hopkins in 1925, he directed the program that eradicated the malaria vector *A. gambiae* from Brazil. In the 1940s, he accomplished the same in Egypt. He also worked against urban yellow fever in Brazil and other countries and became the world authority on this deadly disease. Dr. Soper published more than a hundred works in medical and public health journals throughout the world. His book **Building the Health Bridge** in 1970 reflects a true work for human solidarity.

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