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Organization and Status of Civil Registration and Vital Statistics in Countries of the English-speaking Caribbean

It has long been recognized that vital statistics are the principal foundation for health situation analysis and health planning. As part of an effort to assist countries in improving their registration and vital statistics systems (Box 1), in 1999 the Pan American Health Organization (PAHO) and the International Institute of Vital Registration and Statistics (IIVRS) carried out an evaluation survey in English-speaking countries of the Caribbean. This survey has provided a first overview of the structure of civil registration and vital statistics systems in these countries. It has also generated information on the level of registration of vital events. For all the above, is has been considered important to publish the results of this study. Even though the data presented (among others, of birth and death registration) cover the period 1996-1999, the situation is not thought to have changed radically in the countries covered by the survey. More importantly, the recommendations arising from the analysis of data gathered through this survey form the basis of PAHO's recommendations to countries and institutions striving to reduce underregistration of vital events and improve the administration of civil and vital registration systems.

Methods

Using two questionnaires – one to focus on civil registration topics and one for vital statistics matters – information was obtained on 16 of the 21 English-speaking countries in the Caribbean: Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago. All are former British colonies and all but two (Belize and Guyana) are islands. Bermuda is geographically part of North America. In terms of population, only two of the sixteen – Trinidad and Tobago and Jamaica – have more than one million inhabitants, while the median population in the group of countries studied is less than 100,000. In terms of physical size, countries surveyed vary from as small as 21 km^2 in Bermuda to as large as 22,700 km^2 in Belize, while the median size is around 430 km^2.

In most countries, two separate ministries are responsible for civil registration and vital statistics, although in five both systems fall within the same ministry. Accordingly, for each of the 16 countries, the civil registration questionnaire was directed to the Registrar General or equivalent officer and the vital statistics questionnaire was sent to the Chief Statistician or similar statistical officer. Of the countries that responded to the survey, nine completed both the civil registration and vital statistics questionnaire, three completed only the vital statistics questionnaire and two completed only the civil registration questionnaire. The overall response rate for the Civil Registration questionnaire was 68.8% and for the Vital Statistics questionnaire, 75%. Observations made from the collected data are not expected to have been biased greatly by the non responses.

Organization of the Civil Registration System

In 63 percent of the English-speaking Caribbean countries, unlike any other region of the world, the Registrar General is part of the judiciary system. Although the functions of a civil registration system are nearly universally in place on a worldwide basis, the *responsibility* for national oversight of the system varies from country to country. The organizational placement of civil registration may be found in a variety of ministries or departments of government, the most common-

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Box 1: Definitions of civil registration and vital statistics

Civil Registration System

Civil registration is defined as the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events (among others, live births, deaths, foetal deaths, marriages and divorces) pertaining to the population as provided through decree or regulation in accordance with the legal requirements of a country.

Civil registration is carried out primarily for the purpose of establishing the legal documents provided by the law.

These records are also a main source of vital statistics. Complete coverage, accuracy and timeliness of civil registration are essential for quality vital statistics.

A *civil registration system* refers to all institutional, legal, technical settings needed to perform the civil registration functions in a technical, sound, coordinated, and standardized manner throughout the country, taking into account cultural and social circumstances particular to the country.

Vital Statistics System

A *vital statistics system* is the total process of:
(a) collecting information through civil registration or enumeration on the frequency of occurrence of specified and defined vital events, as well as relevant characteristics of the events themselves and of the person or persons concerned,
(b) compiling, processing, analyzing, evaluating, presenting and disseminating these data in statistical form. The main source is civil registration, supplemented by data from population census, sample surveys and administrative records.

Source: United Nations. Statistics Division. Vital Statistics [Internet Page]. Available at: http://unstats.un.org/unsd/demographic/vital_statistics/cr.htm. Accessed on 22 September 2003.

ly encountered being the Ministries of Interior, Justice, or Health. Because of the many legal uses for vital records, a Ministry of Justice is considered an appropriate locus for the registration function by many countries; alternatively, a Ministry of the Interior typically has a national network of local government offices which can facilitate the registration of vital events at the local level, while a Ministry of Health has under its jurisdiction community clinics, health centers, and hospitals where many of the births and deaths occur and where prenatal, postnatal, and infant care is provided. No one of these or any other organizational location can be considered, *a priori*, to be superior to any other and each country must take into consideration a wide range of factors before making its own organizational arrangements. However, the uses of vital records and their derivative information usually involve several ministries and departments of government and should be taken into account in the design and operation of the system. For example, civil registration data, in addition to their legal uses to establish the facts of birth and death on an individual basis, become important tools for government activities such as the issuance of passports, establishment of eligibility for school enrollment, social security and other social entitlements, health programs, clearance of deceased persons' names from voter registration and other official lists, and for such applications as intercensal population estimation and the production of national demographic and vital statistics.

In addition to the placement of the national registration authority, registration systems may be *centralized* or *decentralized*. A centralized system is where the regional and/or the local registration offices are part of the same Ministry or Department as is the national registration office. A decentralized system is where the regional and/or the local registration offices are part of another Ministry or Department. The difficulty with a decentralized system is that the functionaries at the sub-national level usually have other responsibilities which they consider more important than the registration function. Therefore, the registration of vital events is given low priority. Generally speaking, the centralized system is to be preferred. However, even in a centralized system, there are instances where the regional office personnel have little time to devote to registration activities or to the supervision or monitoring of the work of the local registrars under their jurisdiction. What is really important is that there exists a clear chain of command with respect to registration matters from the director of the national registration office down to the local registrars.

Among the 11 countries responding to the civil registration questionnaire and five other English-speaking countries, based on information from prior surveys (Table 1), the placement of central responsibility for civil registration was most frequently found in a ministry for legal or judicial affairs (10 countries); ministry of health (3), home affairs (2) and ministry of finance and economic development (1). Again, the ministry of choice in a given country is less significant than the recognition that civil registration has multi-disciplinary importance and a fully successful program requires inter-agency coordination and cooperation.

An important consideration for the accuracy and completeness of a registration system is the *number* and *distribution of local registration offices* and their accessibility to the general public. In countries small in geographic area or in population size, such as many of those included in this study, the number and placement of local registrars can be an important concern. Even where the geographic area is not large, it may be difficult to make it convenient for the public to visit a local registrar to register vital events because of difficult terrain and lack of transportation or because the population density is so low that it is not feasible to locate registration offices in remote areas. For these reasons, timeliness, accuracy, and completeness of registration often varies significantly among cities, towns, and rural areas. In the English-speaking countries of the Caribbean, the number of local registration offices ranges from none to as high as 330. In some of the smaller countries, a single registration office serves the entire population. This is the case in five of the countries: Anguilla, Bermuda, Cayman Islands, Dominica, and Montserrat. On the other hand, Grenada reports 7 local offices, Saint Lucia reports 20, and Saint Vincent and the Grenadines reports 16. In some countries with more than just a few local offices, district offices have been set up to assist in the management of the registration information from the local offices. For example, in Belize 6 district offices oversee 53 local offices, in Guyana 10 district offices oversee 135 local offices, and in Jamaica 4 district offices oversee 330.

Table 1: Ministries responsible for civil registration and vital statistics

Country	Legal / judicial	Home Affairs	Health	Finance and economic development	Other
Anguilla	■			▒	
Antigua and Barbuda			▒		
Bahamas[2]	■			▒	
Barbados[2]	■				▒
Belize	■			▒	
Bermuda[2]		■▒			
Cayman Islands[2]				■▒	
Dominica	■		▒		
Grenada			■▒		
Guyana		■			▒
Jamaica			■▒		
Montserrat	■			▒	
Saint Kitts & Nevis[2]			■▒		
Saint Lucia[1]	■				▒
Saint Vicent & Grenadines	■			▒	
Trinidad and Tobago[2]	■			▒	
Turks & Caicos Islands[2]	■				▒

■ *Civil Registration* ▒ *Vital Statistics*

[1] In Saint Lucia, civil registration is located in a combined Ministry of Legal Affairs, Home Affairs and Labor and tallied under "Legal/Judicial" for purposes of this review

[2] Information based on IIVRS survey conducted in 1994 for both civil registration and vital statistics for Bahamas, Barbados, St. Kitts & Nevis, Trinidad and Tobago and Turks & Caicos Islands, and for vital statistics only in Bermuda and Cayman Islands.

The local registrars in most countries have a very small workload. This is a part time activity for them since they typically register, on average, fewer than one vital event per day. Thus, registration is usually not a priority concern to them, which results in difficulties at the central level in improving accuracy and completeness of reporting. However, it is important for the public to have easy access to the registration system at the local level. As a consequence, the optimum number of local, and where warranted, district, offices for efficient operation and for accurate and complete registration is not easily determined and should best be arrived at on a country by country basis. This is particularly true in the Caribbean region because of the combination of both small population sizes and remote, sparsely settled areas.

Organization of the Vital Statistics System

A central statistical office is responsible for the national compilation of vital statistics in most countries of the world, but these statistical offices are found in various ministries. The placement of central authority was most frequently found in the ministry of finance and economic development (7); ministry of health (5); Home affairs (1) and other ministries (4). Table 1 summarizes the information obtained from the countries surveyed. Among the countries for which information is known about both civil registration and vital statistics, Bermuda, Cayman Islands, Grenada, Jamaica, and Saint Kitts and Nevis, carry out civil registration and vital statistics within the same ministry. The advantage of having both functions in the same ministry is that it makes coordination between the two less difficult. This is most important from the standpoint of compilation of national vital statistics where uniformity of data is a prime requisite. It is essential that all areas in a country use the same basic definitions and registration procedures, identical forms for the collection of data, and the same classifications of data in order to produce uniformly comparable vital statistics for all parts of the country and from year to year. It is also essential that the *definitions* of the items to be tabulated for statistical purposes be understood and precisely applied both in the collection of the information through the registration process as well as in the interpretation of the resultant statistics. In the case where the registration and statistical functions fall under different ministries of government, special mechanisms for coordination and cooperation should be established and maintained in order for the civil registration and vital statistics systems to fully meet their objectives.

Essential factors in assessing the quality and usefulness of vital statistics data are the measures of completeness of the registered birth and death data, and the timeliness of their availability in tabulated form. There are no standards for the registration of births and deaths for legal and administrative purposes. For statistical purposes, the *standard of completeness* of birth and death registration has been arbitrarily set at 90 percent or more. However, the method of determina-

tion of completeness of registration coverage is left up to the national authorities. Therefore, the basis for the reported estimates may vary. Even in the case of measurements, the results may differ considerably depending on the method used. For example, the Central Bureau of Statistics in one of the countries reported the completeness of death registration to be 85 percent based on an indirect method of measurement. In another study in the same country, only 70 percent of the deaths occurring in the hospitals of two urban districts were found to be registered. This estimate was obtained by matching the hospital deaths with the registration records. If the same study had been conducted countrywide, the estimated completeness of death registration would surely have been much lower than 70 percent. On the other hand, if the Central Statistical Office had made different assumptions regarding the estimated population size when using the indirect method, the resulting estimate of completeness would have been higher or lower than the 85 percent that they obtained. These varying outcomes illustrate some of the problems involved in the measurement of registration completeness.

As mentioned before, in five countries for which information on both civil registration and vital statistics was provided (or available from the earlier survey), there is a single ministry for both of these functions. In Grenada, Jamaica and Saint Kitts and Nevis the two systems are part of the Ministry of Health. In Bermuda, both systems are in the ministry for home affairs and in the Cayman Islands in finance and economic development. While there may be compelling reasons in a country for having these functions located in separate ministries, administrative processes should be put in place to facilitate the cooperation between the two.

It has been reported that the public does not appreciate the importance of vital registration, pointing to the need for promotion of public education on the subject. To solve the under-registration problem, it will be important to shift the responsibility for registration from the parents or guardians to the medical attendants at birth or death.

Completeness of registration is a self-assessed measure of the quality of the vital statistics data in each country. Some countries do a better job than others in estimating completeness, basing their assessment on objective measures such as cross checks of hospital records of deliveries with registered events of births or reviewing the annual volume of requests for late registration (one or more years after the event) of births in order to establish age for school enrollment or to establish citizenship and other basic facts for passport applications or other entitlements. In some countries, completeness is assumed without specific measurement; e.g., that death registration is complete because the law requires registration before burial can take place. It is in the best interests of the individuals living in a country and of the government itself to periodically assess completeness of registration and to take steps to improve or maintain satisfactory completeness percentages.

Table 2 presents assessments of completeness of birth and death registration as estimated by each country. As can be seen, most assess their systems as virtually complete. Without hard evidence to support these estimates, some question can be raised about the actual degree of completeness, particularly in view of the fact that the informants responsible for registration are, typically, the parents of the child in case of births, and relatives of the deceased in case of deaths. Because many informants do not see the need for a birth or death record, their failure to register vital events is a real problem. Therefore, consideration should be given by each country to a periodic assessment of registration completeness until the registration officials are satisfied that birth and death registration is complete.

Lack of timely availability of vital statistics data has been a chronic problem in countries all around the world. Part of this problem is unavoidable since there is a time lag built into the collection of birth registration information. Informants are given a legally specified time period after an event occurs to report to the local registrar. Therefore, in order to include as many events as possible in the annual tabulations, the statistical office must wait after the end of a calendar year not only for the informants' legal reporting period to pass but also for the registered information to be sent from the local registrars to the central office and prepared for tabulation. Furthermore, in countries where there are large numbers of delayed or late registrations, tabulation may be additionally delayed in order to maximize the number of events to be counted in the appropriate year of occurrence. Alternatively, some countries, (e.g., Anguilla, Antigua and Barbuda, Dominica, Grenada, and Jamaica) tabulate their vital statistics data ac-

Table 2: Estimated completeness of registration, and latest data year available at the time of the report (2001)

Country	Births	Deaths	Year of latest data available
Anguilla	C	C	1999 *
Antigua & Barbuda	C	C	1999 *
Bahamas	7	C	1998
Belize	C	8	1998
Bermuda	C	C	1999
Cayman Islands	C	C	1996
Dominica	C	C	1999 *
Grenada	C	C	1999 *
Guyana	8	8	1999
Jamaica	C	8	1999 *
Montserrat	C	C	1999
Saint Lucia	C	C	1998
Saint Vincent & Grenadines	8	C	1999
Trinidad and Tobago	C	C	1997

C = 90% or greater completeness of registration
8 = Between 80 and 89% completeness
7 = Between 70 and 79% completeness
* Indicates annual data tabulated by year of registration of events

cording to the year of registration instead of the year of occurrence of the events. Depending on the proportion of delayed and late registrations, this latter practice may lead to misleading annual statistics.

Country Self-Assessment of Problems and Areas Needing Improvement

Several common themes were observed of which the most common was the need to improve computerization. In most countries, even those with computerized central systems, registration at the local level continues to be a labor-intensive manual process and the transmission of registration information from the local level, through the district level where districts have been established, to the central registration authority is not automated, nor is there much evidence of sharing of electronic data files among agencies of government having a need for the registration data. In addition, where electronic data processing does exist, e.g., at a central statistical office, there was mention of the need for help in developing computerized editing programs that can check for data inconsistencies among key variables such as age, sex, and cause of death.

Timeliness of the availability of registration files and of tabulated vital statistics data was mentioned frequently, usually in conjunction with automation issues. In fact, respondents to the questionnaires frequently reported that timeliness continues to be an important concern, this in spite of the fact that most of these countries have recently made significant improvements in this area. Several countries suggested that a review of their current procedures, coupled with greater use of automation could add further enhancements in data quality and timeliness. Improvement can be brought about through changes in the methodology of registration, particularly in those systems which are completely manual and which rely on redundant hand-copying of records, and in the application of electronic data capture, transmission, and tabulation.

Another problem area mentioned by several countries is the need for training and upgrading of staff. The need for training of local registrars and for records management workers and others at the central registration office was emphasized, but training for vital statistics and data processing staff were also indicated as important needs. Still another kind of training need that received mention was training for physicians and medical officers on how to properly complete the medical certification section on death certificates and how to use the International Classification of Diseases to correctly arrive at underlying cause of death statistics.

A need for coordination between registration officials and vital statisticians and other users of registration data was apparent in the comments from several countries. It was pointed out that several of the national registration systems do not collect items such as birth weight, usual place of residence of mother, occupation, or other variables deemed to be important by statisticians and other users of vital statistics data, and that no mechanism existed to address these and other cross-cutting issues.

Other problems or issues mentioned included the need for greater public awareness of the importance of timely and complete registration of births and deaths, better remuneration for local registrars, and needs for local area statistics and for quarterly data in addition to the annual tabulations.

Conclusions

Although detailed recommendations for the improvement of individual national civil registration and vital statistics systems cannot be made without an in-depth, on-site, review in the countries, several generic recommendations can be made on the basis of the findings of this overview.

There is a general need for coordination of the registration system that ensures that the needs of the users of the system are met. This need could be addressed by a coordinating committee made up of representatives of each government group with an interest in registration records or in vital statistics, as well as representatives of other interested non-government groups. This is especially true in those countries where civil registration and vital statistics functions fall in different ministries.

To evaluate the quality of the existing information, periodic objective reviews of completeness of registration of births and deaths should be carried out by each country until registration officials are satisfied that registration is virtually complete. Each country should review its own registration procedures to determine if there are redundant manual steps which could be eliminated, either by using redesigned registration forms or through the use of computers. The item content of registration forms, i.e., birth and death certificates, and the design of tabulations should be compared with United Nations recommendations for conformity with international standards for "minimum basic vital statistics data sets" and with the recommended standard vital statistics tabulations.

Consideration should be given to assigning responsibility to hospitals and local health clinics for the registration of births and deaths occurring within their purview, and for medical attendants outside of institutions to have a direct responsibility for the registration of events for which they are cognizant.

Registration officials should determine needs for training of local registrars and others working in the system in terms of course content and frequency of need and to arrange for such training.

Source: Article based on a report prepared in 2001 by the International Institute for Vital Registration and Statistics (IIVRS) for the Pan American Health Organization.

Recommendation for the Monitoring of Measles Eradication in the American Region

Situation of the Problem

In 1994, the countries of the Americas set a goal of measles eradication. [1-3] During 2001 in the Region of the Americas, only 503 confirmed cases were identified, the lowest total ever and a 71% decline over the 1,754 cases reported during 2000. Only three countries, Haiti and the Dominican Republic (on the island of Hispaniola) and Venezuela (after a 2001 importation from Europe), had evidence of indigenous measles transmission during 2001 (table 1).

For the Region to reach and maintain the interruption of indigenous measles transmission in the absence of global eradication, it is crucial that vaccine program managers provide adequate supervision to the staff at the local level, routinely verifying the quality of the vaccination and surveillance efforts. The methods below are recommended by the Pan American Health Organization (PAHO) for monitoring vaccination coverage during regular visits to health centers by supervisors and during vaccination campaigns, for investigating measles outbreaks, and performing and validating routine surveillance.

Monitoring vaccine coverage

Official country reports are the main source of information on vaccination coverage. However, the population denominators used are often extrapolated from census data that are more than 10 years old, and population growth and rural-urban migration patterns have substantially changed since then, making census information often unsuitable for providing appropriate denominators for local vaccine program managers to determine vaccination coverage. The problem is often evident even with aggregated provincial or national data. As a consequence, there are often no reliable coverage standards to make program managers accountable for their vaccination efforts and reward a job well done. Although performing regular coverage surveys that are valid at the local level could provide precise estimates of coverage, their regular use would be prohibitively expensive and would drain human resources not easily available in most countries.

Methodology for house-to-house monitoring

The 95% coverage level required to maintain the interruption of indigenous measles transmission means, in practical terms, that all (or almost all) children must be vaccinated. An overseer could rapidly assess the completeness of the vaccination effort at the local level by visiting a limited number of houses with 1- to 4-year-old children and asking for evidence of their prior vaccination with a measles-containing vaccine. To decrease the likelihood of missing problem areas (thus wrongly concluding that the neighborhood is well vaccinated when it is not), the overseer is encouraged to select a total of four blocks far away from the health center in zones that are difficult to access or underserved, have a high proportion of recent migrants of rural origin, or where recent cases have been reported. It is important that a member of the local staff directly involved in vaccination accompanies and assists the overseer in this task, thus becoming a direct witness to the monitoring process. This person should not participate in the choice of blocks or houses to be visited.

Starting in a corner of the block chosen, the team moves from one door to the next nearest one until five houses with 1- to 4-year-old children for whom immunization information is available are visited. The same procedure should be followed for the remaining three blocks. A child is considered vaccinated if the vaccination is recorded on the vaccination card. In some countries (e.g., Haiti), where vaccination cards are not always updated during door-to-door vaccination, verbal confirmation of vaccination by the parents or caretakers is also accepted during campaigns. If unvaccinated children are found, the monitors should ask parents to explain why the children are not vaccinated. If the adult responsible for providing the card is absent or if it is convincingly shown that the vaccination card is kept elsewhere (e.g., the child does not live there), the household is excluded from the sample and not registered on the chart.

The monitoring ends when a total of 20 houses with eligible children have been visited. Because it would be very unlikely to find many houses with eligible unvaccinated children in a well-vaccinated neighborhood, the finding of a total of two houses with at least 1 nonimmunized child each (even before 20 houses are visited) is reason enough to stop monitoring immediately and consider that vaccination efforts in that neighborhood were ineffective.

The finding of unvaccinated children plus the information gathered from parents will be the basis for providing feedback to the local vaccination authorities as to the necessity and methods to improve immunization in the area. For this feedback to strengthen the vaccination program at the local level, house-to-house monitoring should be done regularly during all supervisory visits and should be followed by specific recommendations.

Supervision during campaigns

In addition to routine vaccination, countries rely on periodic national vaccination campaigns (i.e., follow-up campaigns) and mop-up operations to achieve the interruption of indigenous measles transmission. These campaigns can be affected by a number of problems, including the lack of proper day-to-day supervision and inappropriate definition of territories to be vaccinated.

During door-to-door campaigns, the supervisors should verify daily that the vaccination teams visited all houses in the selected sector by checking that the doors of all houses were correctly marked by them. During both door-to-door and fixed-post campaigns, house-to-house monitoring should be performed by a selected team of overseers once vaccination in a neighborhood or health sector is considered done by the program managers. Its findings, including the proportion of children unvaccinated and reasons for a lack of vaccination, will be the main tools used to define if the work in that neighborhood was indeed finalized or needs to be redone. Monitoring results are more reliable if the monitors are not the same people who were responsible for vaccination in that neighborhood or health sector. Some countries (e.g., Bolivia, Dominican Republic, Haiti, Paraguay, and Venezuela) have used overseers from the national and provincial level. Bolivia and Ecuador have successfully used the program managers responsible for vaccination in one health sector as monitors for another.

Adjustment and validation of population denominators

Ad hoc adjustments of coverage data by selecting alternative denominators appropriate for the area may also be used. In areas with high rates of institutional births, the denominator "population aged <1 year" could be replaced by the number of bacille Calmette-Guérin (BCG) doses administered to infants (coverage for the year = no. of doses of a measles-containing vaccine administered to 1-year-old children divided by the number of BCG doses administered to infants during the same year).

In areas with low rates of institutional births but high coverage with the first dose of diphtheria-tetanus toxoids-pertussis (DTP) vaccine, a better replacement for the denominator might be the number of first doses of DTP administered to infants.

Use of birth registries

In some countries (e.g., Guatemala), in order to get birth registration the parents must show the vaccination card with the first doses already registered, and health centers use the yearly number of births to validate their population denominator. In that way they establish the target population and set parameters ("Tabla de Salvación") for the monthly vaccination of 8.4% of the population under 1 year of age. Coverage is measured monthly at this level. In addition, coverage data are centralized and analyzed at the provincial level to determine monthly which areas are at risk for low coverage and which ones among them will need mop-up operations. This method could help to both improve vaccination coverage and validate census information. Nonetheless, not all births are registered and some are registered with important delays, and misclassification of children who migrate within the first year of life also occurs.

Universal birth and vaccination registry

The reference standard for validating routine coverage is a universal registry that includes the whole birth cohort. Such a system has been used in Uruguay since the 1980s. In brief, all newborns are registered in a national database that is also used for immunizations. This is updated electronically every time the child receives a new vaccination. Although very accurate, data entry for this system is still highly centralized; thus, data are not immediately available at the local level for the day-to-day monitoring of undervaccinated children. A project is ongoing to decentralize the system.

Zonification (Canalizaciones)

Another useful method is to divide the municipality by neighborhoods or groups of blocks and place each one under the responsibility of a nurse or a primary health care worker (health agent). This worker must visit all houses in the neighborhood a number of times per year (usually up to 3) to provide vaccinations and other preventive services. When well implemented and supervised, this strategy can help underserved areas reach universal coverage for vaccination, prenatal care, and other services. Variations of this strategy have been used in Cuba, in some areas of Colombia, Bolivia, Brazil, and other countries. Nonetheless, it is labor-intensive and needs close supervision.

Drop-out rates

In areas with a stable, low-migration population, where vaccination coverage does not vary substantially between years, the DTP1-measles drop-out rate (i.e., [no. of first doses of DTP administered to children <1 year of age - no. of first doses of measles vaccine given to 1-year-old children/no. of first doses of DTP administered to children <1 year of age]) could also provide useful insights as to the proportion of children lost by the system. In countries where health centers keep reliable records, a review of vaccination records at the center can provide very valuable information on drop-out rates.

Outbreak investigation and surveillance

Quality of outbreak investigations

Because measles can be transmitted through aerosolized particles, an infectious individual can transmit the virus to persons near and far away.[4] Also, the virus can remain in the air and remain infectious after the infectious person has left the room, thus allowing transmission even to people with whom this person has had no direct contact (e.g., transmission in hospital waiting rooms, public places, and on public transport systems). Therefore, the thorough investigation of all contacts and places visited by the patient during the 7-18 days before rash onset is essential in order to identify who could have transmitted the disease to a new patient and where and when transmission could have occurred.[5] Also, the investigation of all contacts and places visited by the patient during the period between the first respiratory symptoms until

4 days after rash onset becomes fundamental in determining the existence of secondary transmission. Moreover, because 7-18 days will elapse between contact with an infectious person and rash onset in the secondary case, repeated visits to persons who may have been exposed and repeated active-case searches are required for the investigation of a measles case to be considered complete.

Serum samples should be obtained from the first 5-10 suspected cases of each outbreak during the first visit to a health provider to detect measles IgM. To be useful, these samples should be obtained within 30 days after rash onset. Also, nasopharyngeal, oropharyngeal, or urine specimens should be obtained within 7 days after rash onset to identify the responsible virus. Obtaining viral specimens from all outbreaks is crucial to assess the interruption of indigenous transmission. The virus genotype can identify a foreign virus or the continuing circulation of an indigenous strain. In the absence of indigenous transmission, all outbreaks should be import-related. Therefore, a timely and adequate investigation of all outbreaks in countries without indigenous transmission (including taking specimens for virus isolation) should establish the link to an imported case in most outbreaks investigated (table 1).

Regarding outbreak size, the experience from Chile, Uruguay, Bolivia, Brazil, and other countries during the last 3 years showed that outbreaks reaching at least 25 cases often reveal important risk factors for disease transmission that, if not appropriately controlled, could allow indigenous transmission to resume. Also, local vaccination coverage data, adjusted as appropriate, should be obtained and door-to-door monitoring of vaccination should be done in the neighborhood of residency and in all municipalities visited by the case-patient during the exposure and infectious periods. The information thus obtained should be summarized in an outbreak

Table 1: Characteristics of the 2000 and 2001 outbreaks in countries that notified confirmed cases of measles

Year, country	Suspected cases already discarded	No. of discarded cases/100,000	Total of confirmed cases	No. of sporadic cases	No. of outbreaks	No. of cases per outbreak	No. (%) of outbreaks linked to importations	Genetic characteristics and source of outbreak virus
2000								
Argentina	929	2.5	6	0	1	6	0	Unknown
Bolivia [a]	1,391	16.7	122		3	66, 12, 11	0	D6 (endemic)
Brazil [a]	54,357	31.5	36	22	1	15	--	D6 (?) (endemic)
Canada [b]	6,000	19	199	0	4	2, 6, 30, 165	4 (100)	D6, D7 (imported)
Colombia	2,047	4.8	1	1	0	--	--	--
Dominican Republic [a]	3,397	40	254	0	1	254	0	D6 (endemic)
Haiti [a,c]	187	2.3	990	0	1	990	0	D6 (endemic)
Mexico	2,231	22.2	30	7	8	2-5	?	Imported (?)
Peru	5,680	21.8	1	1	0	--	--	--
United States	1,386	0.46	86	11	10	3-9	5 (50)	Imported (D6, D4, G2, D3)
Venezuela	1,562	6.3	22	0	1	22	Unknown	Unknown
2001								
Brazil	38,679	18.2	1	0	0	--	1 (100)	D4 (to be confirmed)
Canada	N/A	N/A	33	11	6	7, 3, 3, 3, 3, 3	6 (100)	H1, D3, D5 (imported)
Colombia	1,514	3.5	1	1	0	--	--	--
Ecuador	1,575	12.3	2	2	0	--	--	Unknown
El Salvador	372	5.9	2	0	1	2	1 (100)	D7 (imported)
Mexico	717	0.7	3	0	1	3	1 (100)	Unknown (imported?)
Dominican Republic	1,056	12.4	113	0	1	1,132	--	D6 (endemic)
Haiti [a]	65	0.8	159	0	1	159	0	D6 (endemic)
United States [d]	N/A	N/A	109	N/A	10	3-14	9 (90)	Imported (D7, D5, D3, H1)
Venezuela [a,e]	1,544	6.2	113	9	1	104	1 (100)	D9 (imported)

NOTE: N/A = not applicable

[a] Countries with reported endemic transmission in 2000

[b] No. of discarded cases is an approximate minimum based on the no. of measles IgM-negative cases reported each year.

[c] The first cases may have been imported. Dominican Republic had measles circulation after 1999 and shares a large border with Haiti.

[d] Preliminary data.

[e] The first case of the outbreak was reportedly a traveler from Europe.

investigation report form (the form can be found on the Web at http://www.paho.org); this should allow the epidemiologist to determine the outbreak duration and size, its link to importations, the age groups most affected, the proportion of vaccinated cases by age, and the vaccination status in the area. This information is vital to assess whether indigenous transmission exists and to guide public health authorities as to the most appropriate control measures, including the decision to conduct mop-up operations, how extensive they should be, and which age and risk groups should be vaccinated.

Surveillance indicators

Because of the clinical similarities between measles and rubella, because most countries in the Region already use measles- and rubella-containing vaccines (mostly measles-mumps-rubella vaccine) in their routine program, and because the control of rubella and congenital rubella are priorities for the Region, PAHO recommends the integration of measles and rubella surveillance.

No surveillance system can detect all cases. Moreover, imported cases are often overlooked: Visitors do not always seek medical care locally, and those who do often go to private practitioners, who are less likely to report cases. Therefore, a very sensitive system is needed to detect cases in countries where indigenous transmission is low or absent. Such a system requires that the quality of surveillance be regularly monitored and validated.

Even in the absence of suspected or confirmed measles or rubella cases, all health centers in PAHO's sentinel surveillance system should report weekly. The weekly reporting rate, calculated as the proportion of the reporting health centers that sent their surveillance report in time, even in the absence of cases, was successfully used to eradicate poliomyelitis and is an effective tool for assessing surveillance compliance at the local level. The quality of the data reported should also be monitored weekly. This includes the percent of investigations that included a visit to the patient's home made within 48 hours of notification of a suspected case, the percent of suspected cases with a blood sample obtained within 30 days after rash onset, the percent of samples received by the reference laboratory within 5 days after being obtained, the percent of laboratory results reported within 4 days after receipt of the sample, and the percent of cases discarded on the basis of a laboratory test. PAHO recommends 80% compliance with all indicators. They are monitored weekly through the publication of a weekly measles bulletin that provides information from all countries of the Region. Although an expected baseline for the incidence of acute flaccid paralysis in the absence of poliomyelitis is widely utilized, no such baseline is available for suspected cases of measles or rubella. In the Region, such rates can vary between <1 and 40 per 100,000 (table 1). Nonetheless, the proportion of discarded cases per 100,000 population reported to the PAHO integrated measles-rubella surveillance system is useful for comparing the surveillance sensitivity between municipalities with similar demographic and geographic characteristics. It also permits the assessment of sensitivity of the surveillance system over time in the same geographic area.

Active case searches

The main surveillance validation tool used by PAHO is active-case search. Active-case searches should be performed regularly in silent (those not reporting weekly) and underserved areas and in areas where cases have been identified, areas with high rural-to-urban migration, or areas often visited by tourists. Case searches should be implemented in health centers, hospitals, and private clinics and at the workplace, schools, preschools, and other educational institutions. The case search is usually limited to cases that occurred within the 30 days preceding the investigation because viable serum samples can still be obtained from the patients to confirm the diagnosis.

Case searches at health care institutions

The investigators visit health centers, hospitals, and private clinics and practices and interview all health care personnel and statisticians, asking them for suspected cases of measles or rubella or cases of rash and fever seen within the previous month. Because most practitioners have never seen a measles case in their practice, it is recommended to show them a picture of a case and remind them of its main clinical characteristics. After the interviews, the investigators check the outpatient, emergency room, and hospitalization records, looking for unreported rash and fever cases. If a suspected case is found, the investigators should record all information available, visit the patient's home, and perform a full case investigation, including obtaining a serum, nasopharyngeal, or urine specimen as appropriate. At the end of the visit, the investigators should discuss the problems detected with the staff, provide them with up-to-date information on how to report suspected cases, encourage them to report, and provide them with report forms. Pictures of measles cases, descriptions of the main characteristics of the disease and the phone number to call if cases are found, should also be hung in readily visible places.

Case Searches at Schools

These active-case searches serve a dual public health and education purpose. The visitors, usually epidemiologists and other local public health personnel, explain class-by-class the main characteristics of measles, using either a picture of a measles case or by making a blackboard drawing of a child sick with measles. They then briefly discuss the role of vaccination in measles prevention and ask the students if they know of recent cases either at school or in their neighborhood. Each class visit usually takes 10 minutes. If the students report a case compatible with measles, the investigators should visit the house of the person suspected of having measles, perform the investigation, and obtain a serum sam-

ple. In well-conducted searches, the investigators might find as many as 1 suspected case per school.

Comments and recommendations

The interruption of indigenous measles transmission in the Region of the Americas in the absence of global eradication is challenging. Without a perfect vaccine that protects 100% of those vaccinated, wild measles infections will continue to occur due to importations from countries where the disease is endemic, even if coverage is ≥ 95%. In such cases, all outbreaks should be related to importations (i.e., the index case should be imported), and disease transmission originating from these importations should quickly die out. Therefore, the absence of indigenous transmission means that, without intervention, the outbreaks will be self-limited, and the average number of secondary cases *(R)* produced by a typical imported case in a given population should be <1.[6]

Poor-quality coverage information due to inaccurate denominator data is an important problem, particularly in rural areas that lose population due to migrations not forecast by the census and in the highly populated urban settings that attract migrants. Therefore, a systematic bias often occurs that underestimates coverage in underserved rural areas and overestimates it in heavily populated cities. Moreover, even if data at the provincial or municipal level were reliable, these aggregated data often hide important inequalities at the local level, where the most disadvantaged people (who would benefit more from vaccination) usually have the lowest real coverage.[7] As shown by others, rigorous monitoring is the key to the success of disease-control initiatives.[8] The supervisor's use of routine house-to-house monitoring to assess if the eligible children have been vaccinated is time- and cost-efficient (it usually takes less than 2 hours of the supervisor's time). The adjustment and validation of population denominators through selecting alternative denominators (DTP1 or BCG coverage), using universal registries, corrected birth registries, or drop-out rates, can be useful depending on local characteristics. The decision to use any combination of these tools to independently verify the vaccination status of the community and assure accountability of the local vaccine program managers relies on the supervisor's experience. Nonetheless, assessing coverage will not, by itself, resolve the problem. Local vaccine program managers should be given the authority and resources needed to efficiently perform their work; otherwise, supervision becomes a futile exercise.

In the absence of a 100% specific confirmatory test, some suspected measles cases will be laboratory-confirmed even in countries without real measles transmission and no imported cases. These "confirmed" cases will be either false-positives (because of errors inherent to a less than 100% specific confirmatory test) or true IgM positives due to a recent measles vaccination in a person that otherwise has no wild measles infection. Because these "sporadic" confirmed cases will continue to occur, PAHO emphasizes the importance of a thorough case investigation, including visiting households, obtaining samples and specimens for laboratory analysis, and performing coverage monitoring and active-case searches.

To reach, maintain, and assess the interruption of indigenous measles transmission, countries in the Region of the Americas should follow all PAHO recommendations. These include (1) following the recommended vaccination strategies, reaching 95% coverage by municipality; (2) monitoring coverage house-to-house at the local level during supervisions, vaccination campaigns, and mop-up operations, and implementing corrective measures immediately if insufficient coverage is found; (3) investigating all cases and outbreaks within 48 hours of reporting, following the guidelines described above; (4) performing routine measles surveillance and validating compliance on a weekly basis using PAHO indicators; and (5) performing regular active-case searches for surveillance validation.

Full compliance with these recommendations will ensure that countries of the Region achieve and maintain the interruption of indigenous measles transmission for as long as necessary until global eradication is achieved.

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Introduction to Multilevel Analysis

In 2002, the *Epidemiological Bulletin* (Vol. 23, No. 1) published an introduction to social epidemiology and Dr. Nancy Krieger's "Glossary of social epidemiology." As mentioned in these articles, social epidemiology recognizes that individual characteristics are not sufficient to explain the distribution of health problems in the population. As a result, it relies on statistical methods that allow including several levels of determinants in a single model. Those so-called multilevel methods are important health analysis tools as they extend beyond the study of individual epidemiological factors by incorporating simultaneously different levels of variables (e.g. family, neighborhood, community) that influence the state of health.

In order to introduce the concepts of multilevel analysis, this issue of the *Bulletin* presents the glossary prepared by Dr. Ana Diez-Roux of Columbia University, which was originally published in the *Journal of Epidemiology and Community Health*. This glossary will be published in the *Bulletin* in three parts and will also include an appendix with the English and Spanish term equivalencies.

A Glossary for Multilevel Analysis

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PART I

Multilevel analysis has recently emerged as a useful analytical technique in several fields, including public health and epidemiology. This glossary defines key concepts and terms used in multilevel analysis.

Multilevel analysis, originally developed in the fields of education, sociology, and demography, has received increasing attention in public health and epidemiology over the past few years. This glossary defines key terms and concepts in multilevel analysis. The intent is to provide conceptual explanations of basic concepts, particularly those that are fundamental, that have been used inconsistently or that lend themselves to confusion. Selected terms and concepts more broadly related to the presence of multiple levels of organization (such as group level variables and inferential fallacies) are also included. Although the glossary often refers to individuals nested within groups, multilevel analysis is applicable to a broad range of situations involving units at a lower level (or micro units) nested within units at a higher level (or macro units) (including for example, persons nested within studies as in meta-analysis, and measures over time nested within individuals as in the analysis of repeat measures). References to terms that have their own specific entry are in SMALL CAPITALS.

AGGREGATE DATA

Term used to refer to data or variables for a higher level unit (for example, a group) constructed by combining information for the lower level units of which the higher level unit is composed (for example, individuals within the group). Examples of aggregate data include summaries of the properties of individuals comprising a group, for example, the percentage of persons in a neighborhood with complete high school or the mean income of state residents. Implicit in most uses of the term aggregate data is the idea that aggregate variables are merely summaries of the properties of lower level units and not measures of higher level properties themselves (although this is not necessarily true in all cases, see DERIVED VARIABLES).

ATOMISTIC FALLACY

The fallacy sometimes present when drawing inferences regarding variability across groups (or the relation between group level variables) based on individual level data, or more generally, the fallacy of drawing inferences regarding variability across units defined at a higher level based on data collected for units at a lower level. The atomistic fallacy arises because associations between two variables at the individual level may differ from associations between analogous variables measured at the group level. For example, a study of individuals may find that increasing individual level income is associated with decreasing coronary heart disease mortality. If it is inferred from these data that at the country level, increasing per capita income is associated with decreasing coronary heart disease mortality, the researcher may be committing the atomistic fallacy (because across countries, increasing per capita income may actually be associated with *increasing* coronary heart disease mortality). The sources of the atomistic fallacy are similar to those of the ECOLOGIC FALLACY. In the atomistic fallacy, the conceptual model being tested corresponds to the higher level, but the data are collected for a lower level.[1,2] The atomistic fallacy has sometimes been referred to as the INDIVIDUALISTIC FALLACY.[3,4]

COMPOSITIONAL EFFECTS

When inter-group (or inter-context) differences in an outcome (for example, disease rates) are attributable to differences in group composition (that is, in the characteristics

of the individuals of which the groups are comprised) they are said to result from compositional effects.[5] On the other hand, when group differences are attributable to the effects of GROUP LEVEL VARIABLES or properties, they are said to result from CONTEXTUAL EFFECTS.

CONTEXTUAL ANALYSIS

An analytical approach originally used in sociology to investigate the effect of collective or group characteristics on individual level outcomes.[4,6,7] In contextual analysis, group level predictors (often constructed by aggregating the characteristics of individuals within groups) are included together with individual level variables in standard regressions with individuals as the units of analysis (CONTEXTUAL EFFECTS MODELS). This approach permits the simultaneous examination of how individual level and group level variables are related to individual level outcomes. It thus allows for macro processes that are presumed to have an impact on individuals over and above the effects of individual level variables.[6] The terms "contextual analysis" and MULTILEVEL ANALYSIS have sometimes been used synonymously,[8–10] and both approaches are similar in allowing the investigation of how group level (or macro) and individual level (or micro) variables (as well as their interactions) are related to individual level outcomes. However, MULTILEVEL MODELS are more general than the original contextual models in that (1) they allow (and account for) the possibility of residual correlation between individuals within groups; and (2) they allow examination of between group variability and the factors associated with it. In contrast, contextual models often do not account for residual correlation (although they can be modified to do so) and do not allow the examination of inter-group variability or of the factors associated with it (see also VARIANCE COMPONENTS).

CONTEXTUAL EFFECTS

Term generally used to refer to the effects of variables defined at a higher level (usually at the group level) on outcomes defined at a lower level (usually at the individual level) after controlling for relevant individual level (lower level) confounders. The term is most often used to refer to the effect of a DERIVED GROUP LEVEL VARIABLE (for example, mean neighborhood income) on an individual level outcome (such as blood pressure) after controlling for its individual level namesake (for example, individual level income).[6,11] However, "contextual effects" is also sometimes used to refer to the effects of group level variables generally be they DERIVED VARIABLES or INTEGRAL VARIABLES, and can apply to any situation involving lower level units nested within higher level units (for example, contextual effects of country characteristics on disease rates for small areas, contextual effects of tissue characteristics on cell biology). Contextual effects are sometimes contrasted with COMPOSITIONAL EFFECTS.[5]

CONTEXTUAL EFFECTS MODELS

Regression models with individuals as the units of analysis that include both group level and individual level variables as predictors of individual level outcomes. Traditional contextual effects models are equivalent to multilevel models in which all coefficients are modelled as fixed (that is, no error terms are included in the group level or level 2 equations, see MULTILEVEL MODELS). See CONTEXTUAL ANALYSIS.

CONTEXTUAL VARIABLES

See DERIVED VARIABLES and GROUP LEVEL VARIABLES.

CROSS LEVEL EFFECTS

Term used to refer to the main effects of higher level variables (for example, group level variables) on outcomes at a lower level (for example, individual level outcomes) as well as to modifications of the effects of lower level (individual level) variables by higher level (group level) variables (see CROSS LEVEL INTERACTION).[12] Examples include the effect of country level income inequality on individual level self reported health (effect of a higher level variable on outcomes at a lower level), and the presence of stronger associations between individual level income and self reported health in the presence of high country level income inequality (modifications of the effects of lower level variables by higher level variables). The term "ecological effects" has sometimes been used as a synonym for "cross level effects".[12]

CROSS LEVEL INFERENCE

The drawing of inferences regarding factors associated with variability in the outcome at one level based on data collected at another level (for example, drawing inferences regarding relations between individual level variables based on group level associations, or vice versa). See ECOLOGIC FALLACY and ATOMISTIC FALLACY.

CROSS LEVEL INTERACTION

Refers to the interaction between higher level and lower level variables—that is, to modification of the effects of lower level variables by characteristics of the higher level units to which the lower level units belong (or vice versa).[5,12] For example, if the relation between individual level income and blood pressure differs by neighbourhood characteristics (that is, neighbourhood and individual level variables interact), there is said to be a cross level interaction. In multilevel models whenever group specific estimates of the effect of a lower level variable are modelled as a function of higher level (group level) variables (as in equation (3) under the entry for MULTILEVEL MODELS), a cross level interaction appears in the final model ($\gamma_{11}C_jI_{ij}$ in equation (4) under MULTILEVEL MODELS).

DERIVED VARIABLES

A type of GROUP LEVEL VARIABLE constructed by mathematically summarizing the characteristics of individuals in the group (for example, means, proportions, or measures of dispersion, such as, percentage of persons with incomplete high school, mean income, standard deviation of the income distribution).[11,13] Some derived variables have no individual level analogue (for example, standard deviation of the income distribution) and therefore necessarily refer to group level constructs. Others (for example, mean neighbourhood

income) do have individual level analogues (for example, individual level income), but may provide information on group level constructs, distinct from their individual level namesake. The mean of the dependent variable in the group (for example, proportion infected in a study of the causes of infection) can be thought of as a special type of derived variable.[14] Although derived and INTEGRAL VARIABLES are sometimes presented as conceptually distinct, they are closely interrelated. Derived variables often operate by shaping certain integral properties of the group. For example, the composition of a group may influence the predominant types of interpersonal contacts, values, and norms or may shape organizations or regulations within the group that affect all members.[15] The terms "analytical variables" and "aggregate variables" have been used as synonyms for "derived variables". The term "contextual variables" has also been used as a synonym for "derived variables"[14] although it is sometimes used to refer to GROUP LEVEL VARIABLES generally.[6,13]

ECOLOGICAL FALLACY

The fallacy sometimes present when drawing inferences at the individual level (that is, regarding relations between individual level variables) based on group level data. The ecological fallacy arises because associations between two variables at the group level (or ecological level) may differ from associations between analogous variables measured at the individual level. These differences between individual level and group level associations were first described for correlation coefficients[16] but may also be present for other measures of association such as regression coefficients.[11,17] More generally, the fallacy may occur whenever data for units at a higher level are used to draw inferences regarding factors associated with variability across units at a lower level—that is, when the conceptual model being tested corresponds to the lower level, but the data are collected for a higher level.[1,2] Suppose a researcher finds that at the country level, increasing per capita income is associated with increasing mortality attributable to traffic accidents. If he/she infers that at the individual level, increasing personal income is associated with increasing motor vehicle related mortality, she may be committing the ecological fallacy, because within countries, motor vehicle related mortality may always be lower in high income than in low income persons. In the case of regression coefficients, the sources of the ecological fallacy include (1) the lack of information on constructs pertaining to a lower level of organization; and (2) the failure to realize that a variable defined and measured at one level of organization may tap into a different construct than its namesake at another level.[18]

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Case Definitions
American trypanosomiasis (Chagas' disease)

Rationale for surveillance

- Targeted by WHO for **elimination** by the year 2010 (Resolution WHA51.14), American trypanosomiasis affects 21 countries with 16-18 million infected and over 100 million individuals at risk of infection.
- The disease is prevalent in the northern part of South America (the Andean Region) and in Central America; almost 25 million people are at risk and there are 5 to 6 million infected.
- It is a chronic, potentially fatal disease. One third of those infected become incapacitated due to cardiac damage or digestive megaformations.
- Infection can also be acquired through blood transfusion and congenitally through the placenta.
- The infection can be effectively eliminated through interruption of vector transmission and systematic screening of blood donors, with selection of donors and disposal of infected blood. Elimination has been very successful in some countries of the Southern Cone of South America (Argentina, Brazil, Chile and Uruguay).
- Surveillance is necessary for prevention and control measures.

Recommended case definition

ACUTE STAGE

Clinical description

The main clinical signs are mainly fever, malaise, hepatosplenomegaly and lymphadenopathy in the acute phase. Many patients present without clinical signs. An inflammatory response at the site of infection (chagoma) may last up to 8 weeks.

Laboratory criteria for diagnosis

- Positive parasitology (direct, xenodiagnosis, blood culture) **and/or**
- Positive serology for *Trypanosoma cruzi* antibodies in two patterned reactions (indirect hemagglutination test (IHA), indirect immunofluorescent antibody test (IFAT)

Case classification

Suspected: Not applicable.

***Probable*:** Acute case in endemic areas: person with unexplained fever, hepatosplenomegaly and a *chagoma* (inflammation at site of infection).

Confirmed: A clinically compatible case that is laboratory-confirmed with positive parasitology or serology with two positive patterned reactions.

Indeterminate: Positive serology for *T. cruzi* antibodies in two reactions.

Congenital: Newborn with hepatosplenomegaly with positive xenodiagnosis in zones where the disease is endemic, or an asymptomatic child of a seropositive mother with positive parasitology or serology that is persistently positive over a three-month period.

***Blood donor*:** screening positive serology for *T. cruzi*, confirmed by two patterned tests.

Recommended types of surveillance

- In endemic areas, sentinel surveillance and periodic surveys in populations at risk are the feasible methods at present.
- Where possible, routine surveillance should be integrated in primary health services. At peripheral level, individual patient records must be maintained.
- Routine monthly reporting of aggregated data for acute cases from peripheral level to intermediate level. Routine biannual reporting of aggregated data to central level.
- All blood donations must be screened locally.
- Serological surveys (standardized and periodical) for surveillance and control.

Recommended minimum data elements

CLINICAL SURVEILLANCE

Individual patient records

Unique identifier, name, age, sex, geographical and environmental information, laboratory results.

Aggregated data for reporting

Number of cases identified from transfusion donors

Number of cases by age / sex / means of diagnosis

Number of cases with positive serology

Number of houses and localities infested by triatoma

Number of houses and localities subject to annual vector control

LABORATORY SURVEILLANCE

Isolate-based data for reporting[*]

Scientific name of organism, clinical form, organ or tissue, geographical information (patient location), date of isolation, name of laboratory, laboratory number of isolate, identification methods used, results.

Recommended data analyses, presentation, reports

Graphs: Number of cases by geographical area, month, and means of diagnosis.

Maps: Number of cases by geographical area

Vector control activities / geographical area / prevalence of disease.

Principal uses of data for decision-making

- Monitor disease prevalence and measure the impact of disease
- Monitor control and elimination program
- Target resources for prevention

Special aspects

- Control has depended on vertical programs. Monitoring and surveillance have been conducted through specific surveys. The current control trend is to integrate the control program into primary health care, which requires a

[*] (*WHO technical Reports Series N° 811: Control of Chagas disease.* Geneva: World Health Organization, 1991: 77-78)

network of laboratory services with different facilities with differentiated levels of complexity at different levels for diagnosis.
– Because of variation in specificity of the tests, cut-off points for reliability should be defined locally using a standard serum panel, provided by the reference laboratories of the intercontinental network for standardized serology in Brazil and Argentina.
– A national laboratory network should be established in each of the countries in which Chagas' disease is endemic.

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

African trypanosomiasis (Sleeping sickness)

Rationale for surveillance

The leading principle for sleeping sickness control is the reduction of human reservoir through treatment of infected individuals and the reduction of man-fly contact through adapted vector control. An intercountry approach for surveillance / control activities is essential and supported by WHO. The objective of surveillance is the precise identification and proper epidemiological assessment of all endemic foci.

Recommended case definition

Clinical description

In the early stages, a painful chancre*, which originates as a papule and evolves into a nodule may be found at the primary site of tsetse fly bite. There may be fever, intense headache, insomnia, painless lymphadenopathy, anemia, local edema and rash. In the later stage, there is cachexia, somnolence and signs of central nervous system involvement. The disease may run a protracted course of several years in the case of *Trypanosoma brucei gambiense*. In case of *T. b. rhodesiense*, the disease has a rapid and acute evolution. Both diseases are always fatal without treatment.

Laboratory criteria for diagnosis

Presumptive: serological: card agglutination trypanosomiasis test (CATT) for *T. b. gambiense* only or immunofluorescent assay (IFA) for *T. b. rhodesiense* mainly and possibly for *T. b. gambiense*

Confirmative: parasitological: detection (microscopy) of trypanosomes in blood, lymph nodes aspirates or CSF.

Case classification

Suspected: A case that is compatible with the clinical description and/or a history of exposure.**

Probable: A case with a positive serology with or without clinical symptoms in persons without previous history of trypanosomiasis diagnosis or treatment.

Confirmed: A case with positive parasitology, with or without clinical symptoms.***

Recommended types of surveillance

The surveillance system will use a village-based definition using 4 classes:
– Village of unknown epidemiological status
– Suspected village
– Endemic village
– Disease-free village

In the context of control programs, surveillance provides valuable village-based data, with the precise geographic location of each village using global positioning system (GPS). Data are analyzed using geographical information systems (GIS).

In areas not covered by control activities, surveillance provides valuable case-based information. Results of serological surveys based on micro-card agglutination trypanosomiasis tests (micro-CATT) will be indicators of endemicity.

Information collected at village level is aggregated at intermediate / central level and reported to WHO.

Recommended minimum data elements

Village-based data:

In addition to the number of parasitologically confirmed cases (presence of trypanosomes shown), and to the number of probable cases (suspected cases with positive serology), the system should include information on:
– strategy used
– village geographic coordinates (latitude, longitude)
– name
– administrative levels
– village type
– population at last census / date of last census, estimated population
– school (levels)
– health infrastructures (type, activities)
– protected sources of water

Recommended data analyses, presentation, reports

Mapping*:* at intermediate and central level: map of villages and their endemic status.

Principal uses of data for decision-making

– Knowledge of endemic and suspected areas to direct control activities
– Epidemiological monitoring of endemic foci
– Assessing impact of control programs

Special aspects

– Use of Global Positioning System (GPS) to define village geographic coordinates
– Sensitivity of parasitological techniques is low and depends on lab facilities and personnel skills

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

* The painful chancre is very rare in *T. b. gambiense* infection

** In the early stage or even early in the late stage of the disease there are often no clinical signs or symptoms which can be associated with the disease. Suspicion is then based on local risk of contracting the disease and local disease historical background.

*** Confirmed positive healthy carriers are a major public health risk. As a reservoir of parasites, they disseminate the disease, and must be treated as soon as possible.

Epidemiological Calendar 2004

EW		S	M	Tu	W	Th	F	S	
1	Jan	4	5	6	7	8	9	10	Jan
2	Jan	11	12	13	14	15	16	17	Jan
3	Jan	18	19	20	21	22	23	24	Jan
4	Jan	25	26	27	28	29	30	31	Jan
5	Feb	1	2	3	4	5	6	7	Feb
6	Feb	8	9	10	11	12	13	14	Feb
7	Feb	15	16	17	18	19	20	21	Feb
8	Feb	22	23	24	25	26	27	28	Feb
9	Feb	29	1	2	3	4	5	6	Mar
10	Mar	7	8	9	10	11	12	13	Mar
11	Mar	14	15	16	17	18	19	20	Mar
12	Mar	21	22	23	24	25	26	27	Mar
13	Mar	28	29	30	31	1	2	3	Apr
14	Apr	4	5	6	7	8	9	10	Apr
15	Apr	11	12	13	14	15	16	17	Apr
16	Apr	18	19	20	21	22	23	24	Apr
17	Apr	25	26	27	28	29	30	1	May
18	May	2	3	4	5	6	7	8	May
19	May	9	10	11	12	13	14	15	May
20	May	16	17	18	19	20	21	22	May
21	May	23	24	25	26	27	28	29	May
22	May	30	31	1	2	3	4	5	Jun
23	Jun	6	7	8	9	10	11	12	Jun
24	Jun	13	14	15	16	17	18	19	Jun
25	Jun	20	21	22	23	24	25	26	Jun
26	Jun	27	28	29	30	1	2	3	Jul
27	Jul	4	5	6	7	8	9	10	Jul
28	Jul	11	12	13	14	15	16	17	Jul
29	Jul	18	19	20	21	22	23	24	Jul
30	Jul	25	26	27	28	29	30	31	Jul
31	Aug	1	2	3	4	5	6	7	Aug
32	Aug	8	9	10	11	12	13	14	Aug
33	Aug	15	16	17	18	19	20	21	Aug
34	Aug	22	23	24	25	26	27	28	Aug
35	Aug	29	30	31	1	2	3	4	Sep
36	Sep	5	6	7	8	9	10	11	Sep
37	Sep	12	13	14	15	16	17	18	Sep
38	Sep	19	20	21	22	23	24	25	Sep
39	Sep	26	27	28	29	30	1	2	Oct
40	Oct	3	4	5	6	7	8	9	Oct
41	Oct	10	11	12	13	14	15	16	Oct
42	Oct	17	18	19	20	21	22	23	Oct
43	Oct	24	25	26	27	28	29	30	Oct
44	Oct	31	1	2	3	4	5	6	Nov
45	Nov	7	8	9	10	11	12	13	Nov
46	Nov	14	15	16	17	18	19	20	Nov
47	Nov	21	22	23	24	25	26	27	Nov
48	Nov	28	29	30	1	2	3	4	Dec
49	Dec	5	6	7	8	9	10	11	Dec
50	Dec	12	13	14	15	16	17	18	Dec
51	Dec	19	20	21	22	23	24	25	Dec
52	Dec	26	27	28	29	30	31	1	Dec

As in previous years, we are including the Epidemiological Calendar for easy reference and use.

The Epidemiological Calendar includes the 365 days of the year, which are grouped in 52 weeks. Its use during surveillance activities is important because by standardizing the time variable, it provides a means to compare events that occur in a given year or during a specific period to others occurring at a later time or in other countries.

The 2004 Epidemiological Calendar begins on 4 January 2004. This is due to the fact that 1) the epidemiological weeks all start on Saturday, and 2) to determine the first epidemiological week of the year, we must choose the first Saturday in January that follows four or more days in January.

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