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Health for All by the Year 2000 and the Evaluation and Monitoring Processes

In adopting the regional strategies for attaining the Goal of Health for All by the Year 2000 and the Plan of Action for their implementation,[1] the Member Governments of the Pan American Health Organization, in order to reduce existing health disparities both among and within each of the countries of the Region, defined the following minimum regional goals:

- *Life expectancy at birth.* No country in the Region will have a life expectancy at birth of less than 70 years.
- *Infant mortality.* No country in the Region will have an infant mortality rate of more than 30 deaths per 1,000 live births.
- *Mortality in the age group 1-4 years.* In no country in the Region will the mortality rate in children aged 1-4 years be more than 2.4 deaths per 1,000 in this age group.
- *Immunization.* Provide immunization services to 100 per cent of the children under one year of age against diphtheria, whooping cough, tetanus, tuberculosis, measles, and poliomyelitis. In addition, to provide immunization services against tetanus to 100 per cent of pregnant women in areas endemic for tetanus neonatorum in accordance with established norms. Other vaccines should be included in the delivery system whenever warranted by the specific epidemiological situation.
- *Safe water and excreta disposal.* Safe water should be provided to approximately 100 million inhabitants in the rural areas and 155 million in the urban areas, as well as sewerage or excreta disposal to 140 million in rural areas and 250 million in urban areas, by 1990. Between 1991 and the year 2000 safe water, sewerage, or excreta disposal should be provided to some 30 million rural dwellers and to 100 million urban inhabitants to maintain total coverage.
- *Health service coverage.* To provide 100 per cent of the population with access to health services.

In addition, the following regional objectives were defined in order to ensure the health sector's specific contri-

[1] See *PAHO Official Documents* 173 (1980) and 179 (1982), respectively.

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bution to the reduction of social and economic inequalities:

- Reorganization and expansion of the health service systems so as to improve their equity, efficiency, and effectiveness.
- Promotion and improvement of intersectoral linkages and cooperation.
- Promotion and improvement of regional and interregional cooperation.

Features of the Goal of Health for All by the Year 2000 in the Region of the Americas

The goal and the strategies for attaining it encompass the entire population, but they assign top priority to the population in extreme poverty in rural and urban areas. Within these groups, emphasis is given to the families at greater risk, including children under five, mothers, and workers and, in countries with an "aging" population, to the elderly as well.

The strategy is based on the differing degrees to which the various priority groups are exposed to multiple risk factors, and thus calls for the design of a combination of promotional, preventive, curative, and rehabilitative activities that are effective and viable, and at the same time more efficient in controlling those factors. Each country will have to articulate and integrate these activities into program packages geared to their particular health problems and national characteristics.

The objectives, minimum goals, and strategies are drawn from the concept of primary care, in the recognition that it is more than just an extension of basic health services and that its implementation will have an effect on economic and social development. All this requires the formulation of additional strategies for reinforcing social policies and harmonizing intersectoral plans and measures so as to ensure the effective participation of the health sector, together with the other socioeconomic development sectors, in the supply of foodstuffs and housing, ecological balance and the organization and participation of the community for its development and well-being.

The implementation of the Plan of Action has substantive implications for the Governments since they must examine the consistency of their priorities and strategies with the goals and priorities agreed upon at the regional level in light of each national situation in order to adjust and reorient the implementation of their own health plans. They must develop suitable mechanisms for improving the programming and coordination of international and intercountry cooperation. Finally, and as the process develops, they must periodically review and evaluate their national strategies and introduce the necessary adjustments into the national development context. It is urgently necessary to adapt the national information systems with a view to the initiation and development, within a fixed time frame, of the national, regional, and global monitoring and evaluation process.

The Evaluation and Monitoring Processes

At the country level, the evaluation and monitoring processes should serve as effective tools for the progressive strengthening and improvement of the national processes for attaining Health for All by the Year 2000, and at the global level should supply the countries, PAHO, and WHO with the minimum information necessary for the intensification, adjustment, or reorientation of those processes. Specifically, this information will be used to:

- estimate progress toward Health for All by the Year 2000;
- evaluate the effectiveness and efficiency of the strategies applied;
- contribute to the identification of innovative solutions and of new problems as they may arise in the course of the process; and
- support the decision-making processes for the adjustment of policies, strategies, plans, and programs.

To be of use to the countries, the evaluation and monitoring process should promote the development of the analytical, decision-making, and managerial capabilities of the various agents in the health sector, as well as the adaptation or creation of appropriate instruments for intra-and intersectoral negotiation and for planning and administration at the various sectoral and institutional levels.

Consequently, the national evaluation and monitoring systems should provide the governments with feedback on their own strategic control and administration, and on their short, medium, and long term planning processes. At the regional level, the system will allow the adjustment of the policies, strategies, and plans of action of PAHO through decisions of its Governing Bodies and will constitute the input of the Region of the Americas to the global evaluation and monitoring processes.

As stated in the Plan of Action:

"The act of evaluating consists of the issuance of a value judgment that results from the comparison of the characteristics observed in a subject with a reference model and of the explanatory analysis of the similarities and differences detected in this comparison.

"Evaluation requires a clear definition of both the subject and the reference model. Usually, due to practical reasons, such definition can not be exhaustive as to describe the totality of the subject's attributes, thus certain operational definitions of the subject, called indicators must be used to express the most salient characteristics of the subject with a certain degree of validity. In the process of Health for All by the Year 2000 there are a number of areas that will be the subject to evaluation, and for which the indicators have already been selected; but certain other areas require better operational definition. Therefore it will be necessary to design the indicators that may be used for this purpose. For instance, a number of matters related to the

demand, utilization, accesibility, and impact of the services, would require special consideration. Likewise, ad hoc indicators will have to be developed in order to determine the characteristic and the degree of implementation of the strategies."[2]

To assist in the analysis of not only the different projects and programs, but of the national policies and strategies as well, it is furthermore proposed to convene that monitoring is an analytical procedure for producing information related to the execution and consequences of the activities carried out to implement a given policy; and that evaluation is another analytical procedure for producing information on the capacity of the policy to solve the problem it is intended to solve.

Evaluation is based on monitoring, but its nature is different. Evaluation seeks to determine the social value or utility of the change achieved relative to the change planned. Monitoring focuses on the execution of the activities designed to implement a policy.

Hence, monitoring differs from evaluation in that the former does not question or review the objectives of established policy, or the assumptions and explicit values underlying it, but focuses on analyzing progress and its characteristics under these established objectives and assumptions. Evaluation, on the other hand, consists primarily in questioning or analyzing the assumptions themselves, that is, in reviewing the established objectives and strategies and the underlying values that prompted their choice, as much in light of the experience acquired as in that of the changes produced, whether or not these are brought about by the process itself.

No evaluation-monitoring process can accomplish its basic purpose without a research component which, based on the findings of evaluation and monitoring, will contribute to a better explanation of the phenomena identified and to the search for more efficient, effective, and viable solutions.

Consequently, systematic evaluation-monitoring-research constitutes the source of and the chief instrument for orienting the subjects and strategies of training for the different agents of the formal and informal health system and for the community as a whole.

According to the Plan of Action, the regional evaluation and monitoring process operates at two levels. At the regional level, the organization and development of monitoring and evaluation will be the responsibility of PAHO. At the country level the process will follow the system each government adopts for the evaluation and monitoring of its own national efforts. The development and operation of the regional system will depend on the extent to which the Governments develop and strengthen their own national evaluation and monitoring processes.

The regional system includes the indicators deemed mandatory by the Governing Bodies at both the regional and the global levels and also includes other indicators dealing with vital aspects of the regional strategies. It is important to bear in mind that many of the areas that must be evaluated are expressed by variables that cannot be measured by numerical indicators and for which it will be necessary to define ad hoc analytical criteria. Interpreting the process as it unfolds will require a combination of the epidemiological, economic, and historical approaches, and should not be limited to a mere statement of numerical differences between proposed targets and results obtained.

As approved by the Directing Council of PAHO, there will be four regional evaluations at the end of each six-year period beginning in 1983, and monitoring will be done every two years in the intervening odd years.

The national evaluation and monitoring systems should be designed to meet from the outset the minimum requirements imposed by the global and regional goals and objectives, starting with information available in the countries, and seeking to improve and expand as they develop. The relative complexity of their requirements combined with the short span of the monitoring and evaluation intervals decided upon at the regional and world level, make it necessary to rely on crude approximations in the early stages. The national systems will have to be refined and adjusted during the course of their operation and in step with progress made in national administrative processes for health development, with which the evaluation and monitoring should be integrated.

To bring this about, personnel at all levels must work actively together in each and every area and stage of the system's development, as well as in the review and adjustment of approaches and mechanisms in a process of learning by doing and of successive trials, within a program of joint activities organized in conjunction with the national socioeconomic planning unit and with other pertinent sectors.

[2] *PAHO Official Document* 179 (1982), 67-68.

Diseases Subject to the International Health Regulations

Cholera, yellow fever, and plague cases and deaths reported in the Region of the Americas as of 31 October 1982.

Country and administrative subdivision	Cholera cases	Yellow fever		Plague cases
		Cases	Deaths	
BOLIVIA	–	*94*	*34*	*1*
Beni	–	1	–	–
Cochabamba	–	3	–	–
La Paz	–	2	2	1
Santa Cruz	–	88	32	–
BRAZIL	–	*21*	*21*	*44*
Bahía	–	–	–	1
Ceará	–	–	–	37
Maranhão	–	4	4	–
Mato Grosso	–	1	1	–
Mato Grosso do Sul	–	13	13	–
Pará	–	3	3	–
Pernambuco	–	–	–	6
COLOMBIA	–	*1*	*1*	–
Cundinamarca	–	1	1	–
PERU*	–	*11*	*11*	*4*
Loreto	–	6	6	–
Piura	–	–	–	4
San Martín	–	4	4	–
Ucayali	–	1	1	–
UNITED STATES	– *	–	–	*17*
Arizona	–	–	–	4
Colorado	–	–	–	2
New Mexico	–	–	–	8
Oregon	–	–	–	1
Texas	–	–	–	1
Wyoming	–	–	–	1

– None.
*Revised data.

Human Rabies Vaccination in the Americas

Human rabies is endemic in some parts of the Americas. During the 1970-1979 decade an average of 280 cases/deaths was reported per year *(1, 2)*.

Studies done in Brazil in 1976 found that 7.0 per cent of the country's population had been bitten, usually by pet dogs and cats *(3)*. If this percentage were projected onto the population of Latin America and the Caribbean, it could be estimated that about 26 million persons are bitten every year. Only a small percentage of the persons bitten have to be vaccinated against rabies.

The WHO Expert Committee on Rabies recommends that human rabies vaccine be administered only to per-

sons who have been exposed or who are at high risk of exposure. In these cases vaccination is regarded as rabies treatment. Because of the possibility of postvaccination reactions and complications, associated primarily with the administration of suckling mouse brain (SMB) vaccine, this treatment should be administered under medical supervision. In Brazil between 1975 and 1978 there was one severe postvaccination accident for every 24,568 doses administered *(3)*.

In addition to measures for the control of rabies in animals, programs for the prevention of human rabies should include proper treatment of 100 per cent of all persons exposed to the risk of contracting the disease with a potent and safe vaccine, using effective vaccination schedules *(4)*.

What follows is a review of information reflecting the current situation regarding the human rabies vaccine and vaccination schedules used in the Region.

Types of Vaccine

There are two types of inactivated rabies vaccine in use today:

- *Vaccine prepared in suckling mouse brain (SMB) (5).* Produced and used in the countries of Latin America (but not used in Canada or the United States), this vaccine is administered subcutaneously. The Pan American Zoonoses Center (CEPANZO) reports that 5,830,231 doses of SMB vaccine were produced for human use in Latin America in 1980.
- *Human diploid cell rabies vaccine (HDCV).* This vaccine is made only by the Mérieux Laboratories of France, and its use is permitted in Canada, the United States, and some countries in Latin America and the Caribbean. It is administered intramuscularly.

There are two other vaccines whose production and use have been discontinued:

- *Duck embryo vaccine (DEV).* This vaccine was used until 1981 in the United States and some Latin American countries; production was suspended in 1981, and it is no longer in use.
- *Semple vaccine prepared in rabbit brain.* Up to 1981 this vaccine was prepared and used in a single Central American country. The most recent information is that its production has been permanently discontinued.

Vaccination Schedules

Preventive treatment (pre-exposure vaccination)

The WHO Expert Committee on Rabies *(4)* recommends the administration of three doses of a potent vaccine to persons at high risk of exposure (veterinarians, persons who handle dogs, laboratory personnel working with rabies virus, speleologists, etc.) at intervals of five to seven days, followed by a booster dose one month after the last dose. It is also recommended that the antibody titer be checked three or four weeks after the last injection in the series. If no antibodies are detected, additional boosters should be administered until a satisfactory antibody response is obtained. In all other cases, booster doses should be given at intervals of one to three years. When a person who has been given pre-exposure immunization and has shown a good antibody response is again exposed to rabies, he should be given only one booster dose. Persons in whom no neutralizing antibodies are found in the wake of preventive treatment, should undergo the full vaccination series upon reexposure to infection.

The vaccination schedules for the different biologicals are as follows:

- *Suckling mouse brain (SMB) vaccine.* In CEPANZO studies of pre-exposure vaccination, a satisfactory response was observed following the administration of three doses, one every other day. In Mexico, preventive treatment consists in the administration of the vaccine on days 0, 5, and 10, with booster doses at 30 days and at one year.
- *Human diploid cell rabies vaccine (HDCV).* The Advisory Committee on Immunization Practices (ACIP) of the United States recommends three 1 ml injections, one each on days 0, 7, and 21 or 28. The Centers for Disease Control (CDC) of the United States recommend taking a serum sample two or three weeks after the last dose, which should yield an adequate antibody titer. If the antibody titer is not adequate, a booster should be administered and the CDC notified.
- *Booster doses.* Persons who work with the rabies virus (in vaccine research and production laboratories) should have their antibody titers checked every six months and be given boosters whenever needed to keep the antibody titer at an adequate level. Persons at continual risk of exposure to rabies should receive boosters or have their antibody titers checked every two years. If the titer is inadequate, a booster should be administered.

Postexposure rabies treatment

The rabies treatment schedule for exposed persons depends on the severity of the bites:

1. *Mild bites*

- *Human diploid cell rabies vaccine (HDCV).* WHO recommends schedules of six doses administered on days 0, 3, 7, 14, 30, and 90. The ACIP *(6)* recommends five doses on days 0, 3, 7, 14, and 28. If the five-dose schedule is used, it is recommended that a serum sample be taken for the determination of antibodies on the 28th day when the last dose is administered, or two or three weeks following the last dose.

Persons previously vaccinated against rabies can be given fewer doses depending on their antibody level. If a good antibody level was developed following the pre-exposure vaccination and the person is exposed to rabies, two boosters should be given on days 0 and 3. If a high antibody titer is not obtained, a full series should be administered.

- *Suckling mouse brain (SMB) vaccine.* Schedules using SMB vaccine are variable in Latin America. The main schedules used are:

a) *Classical schedule.* This consists of the administration of 14 doses and two boosters. Some countries in the Region have made slight changes in this schedule *(7)*:

Ecuador	14 doses plus 3 boosters
El Salvador	14 doses plus 2 boosters 10 and 20 days following the last dose
Mexico	14 doses
Paraguay	14 doses
Peru	14 doses plus 2 boosters

b) *Reduced schedule (8).* The availability of rabies vaccines of high antigenic potency such as those prepared in SMB and human diploid cell cultures has opened up the possibility of reducing the conventional number of doses. The WHO Expert Committee on Rabies *(9)* recommends that the vaccine be administered at a concentration of 1.5 per cent in 2 ml doses on days 0, 1, 2, 3, 4, 9, 13, 20, and 90 when antirabies serum is not given. If antirabies serum is given in addition, however, vaccinations should be administered on days 0, 1, 2, 3, 4, 9, 13, 23, 29, and 30. When using reduced schedules, the potency of each lot should be controlled in accordance with the recommendation of WHO reports *(9, 10)*.

The following countries in Latin America are using reduced schedules with some changes in the aforementioned original schedules *(7)*:

Argentina	7 doses plus 2 or 3 boosters
Brazil	7 doses plus 3 boosters on days 10, 20, and 30 following the last dose
Chile	6 doses plus 2 boosters
Colombia	7 doses plus 2 boosters 10 and 20 days following the last dose
Dominican Republic	7 doses plus 3 boosters 10, 20, and 90 days following the last dose
Guatemala	7 doses plus 3 boosters 10, 20, and 90 days following the last dose
Honduras	7 doses plus 2 boosters
Venezuela	7 doses plus 1 booster

2. *Severe bites*

When the bites are on the head or neck, or produce lacerations on any part of the body, it is recommended that human rabies immune globulin (RIG) or equine antirabies serum be administered as soon as possible after exposure (hypersensitivity to equine serum must be verified).

In cases of severe bites, antirabies serum is administered prior to the first dose of vaccine regardless of the vaccination schedule or vaccine type (SMB or diploid cell tissue culture) being used. For the treatment of rabies in Brazil, for example, victims of severe bites are given, in addition to serum, 10 doses of SMB vaccine plus three boosters on days 10, 20, and 30 following the last dose of the series.

In Costa Rica, the recommendation for cases of severe bites is the administration of antirabies serum followed by 14 doses of SMB vaccine plus three boosters on days 10, 20, and 60 following the last dose of the initial series.

In Mexico, hyperimmune antirabies serum is administered in conjunction with 14 doses of SMB vaccine and three boosters on days 10, 20, and 90 following the last of the series.

The prompt treatment of lesions is one of the most effective means of preventing rabies. They should be cleaned and washed with soap or detergent and plenty of water.

Epidemiological surveillance activities in programs for the prevention and control of human rabies should include studies to compare the efficacy of the vaccines and schedules in use. These studies should also examine the complications produced by the vaccines and their schedules in order to achieve the safest and most effective treatment possible.

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(Source: PAHO Special Program for Animal Health.)

Dengue-4 in the Americas

Prior to 1981 only dengue serotypes 1, 2, and 3 were known to circulate in the Americas. In 1981, however, the presence of dengue-4 was documented in the Hemisphere for the first time. Dengue-4 infections were initially confirmed in two U.S. citizens who visited the island of St. Barthélemy, French Antilles in March-April 1981. Both cases were serologically confirmed. Further investigations revealed that an outbreak of dengue occurred in St. Barthélemy during February-June. Dengue type 4 is known to be endemic in Southeast Asia and in the South Pacific. It remains unknown as to how the virus was introduced in St. Berthélemy, a small and relatively remote island in the Caribbean; however, it is possible that the island's links with French Polynesia may explain the appearance of the virus in the Caribbean.

Surveillance was intensified in the Caribbean and as a result outbreaks of dengue-like illness were known to have occurred in Curaçao, Dominica, Guadeloupe, and St. Martin. Dengue-4 activity in Dominica probably started in March of 1981, but laboratory studies were begun only in May. At least 59 strains of dengue-4 were isolated from Dominica residents. Four dengue-4 cases from St. Martin were reported in August 1981.

During the following months and in 1982, dengue-4 circulation was detected in other Caribbean islands and in Belize. Islands affected in the Caribbean included St. Thomas, Puerto Rico, Jamaica, Haiti, and Trinidad and Tobago. Laboratory evidence of infection was obtained from the indigenous population or from visitors to these islands. Dengue-4 isolates were also obtained from a few patients in Grenada and St. Kitts from August to October. It is not clear if these infections occurred in these islands or elsewhere.

Four cases of dengue-4 (three U.S. citizens and one Canadian) were documented serologically after travel to Haiti from July through September. A dengue-4 strain was also isolated from the Canadian patient.

In St. Thomas, 38 cases of dengue have been confirmed by hemagglutination-inhibition serologic testing and one case by virus isolation. The isolate was identified as dengue-4 and a serologic diagnosis of dengue-4 was made in another case. A total of 33 had onset of illness in August, and five in September.

Isolations of dengue types 2 and 4 were obtained from patients in Jamaica in the second semester of 1981. Evidence of primary dengue type 4 infection was confirmed in five U.S. citizens who visited Jamaica in October and one who visited in February 1982.

Trinidad and Tobago reported six imported cases of dengue type 4 (from Curaçao, Dominica, Martinique, and Saint Lucia) occurring from June to October 1981. Three additional isolations of this virus and one of dengue-1 were obtained between March and May of 1982 from autochthonous cases.

Dengue-4 activity was sporadic in Puerto Rico from August to October 1981, a period during which the island was being affected by an outbreak of dengue type 1. In November and December, dengue-4 was the dominant virus isolated in Puerto Rico; at least 79 strains of dengue-4 were obtained in the island during 1981. During the first two months of 1982, reported dengue-4 activity was increasing again. A primary serologic response to dengue-4 has been obtained from a patient in Belize with onset of illness during July 1982. Dengue-4 infections were also documented in two U.S. citizens who visited Martinique in February 1982.

Circulation of dengue-4 virus in South America was reported in 1982. As of June, 12 cases of dengue-4 infection of all age groups had been confirmed in Suriname through virus isolation. Nine seroconversions to flavivirus were also documented. Investigations undertaken in late March revealed that at least 10 per cent of the population of Paramaribo, Suriname, had suffered from a dengue-like illness since January 1982. Strains of serotypes 1 and 4 were isolated from several cases during an outbreak of dengue-like illness in Boa Vista, northern Brazil, during March-May 1982. Retrospective studies suggested that the outbreak may have started as early as October 1981.

Illness associated with dengue type-4 viral infection has been self-limited and generally mild, with no evidence of hemorrhagic fever. Virus activity has been low to moderate, and in spite of a widening dissemination of the virus, it has not caused a widespread outbreak in the Hemisphere. Nevertheless, countries should reinforce their surveillance system to detect the presence of the agent and implement control measures.

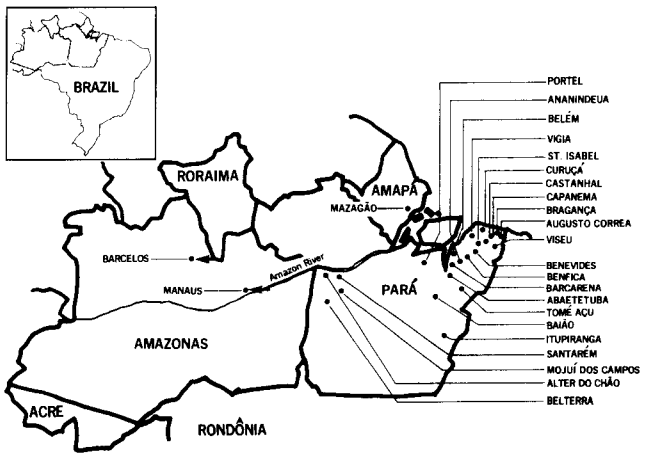
(*Source:* Viral and Rickettsial Diseases, Communicable Disease Control, Division of Disease Prevention and Control, PAHO.)

Oropouche Fever in Brazil

During the past two decades, Oropouche (Oro) virus (arbovirus family *Bunyaviridae,* Simbu serological group) has been recognized as a major cause of human febrile illness in the Amazon region of Brazil. Between 1961 and 1981 numerous outbreaks occurred in urban centers of the Amazon region, mostly in the State of Pará, in the eastern part (Figure 1). At least 250,000 persons were infected, including some 220,000 in 1978-1981, when the greatest wave yet recorded affected 19 localities in the States of Pará and Amazonas, and in Amapá territory. Outside of the Amazon region, human infection caused by Oro virus has been documented only in Trinidad where it was first isolated in 1955, but no epidemics have been reported to date in that country.

Three types of clinical syndromes have been associated with Oro virus infection: febrile illness, febrile illness with rash, and meningitis or meningismus. Although no fatalities have been attributed to the disease, many patients become severely ill, some to the point of prostration. Febrile illness is by far the most common clinical syndrome and in many instances is confused with malaria or with other febrile conditions. The incubation period of Oropouche fever has not been determined with precision, but observations made during outbreaks suggest that it may vary from 4-8 days in natural infection. The disease commonly has a sudden onset. Fever, chills, headache, myalgias, arthralgia, dizziness, and photophobia are the most common clinical manifestations; conjunctival congestion has also been observed. Nausea may occur, sometimes followed by a few episodes of vomiting and diarrhea. Certain patients refer to brief burning sensations in various parts of the body and to retro-orbital pain. Body temperature is usually in excess of 39°C, reaching 40°C in some cases. Severe headache, which does not respond readily to common analgesics, is a major complaint. Muscle pains are usually generalized and may cause great discomfort; they are most prominent in the neck, along the backbone, and in the sacral region. Epigastric pain, when present, is generally mild; arthralgia is usually generalized, and anorexia is present in virtually all cases. No jaundice, hepatomegaly, splenomegaly, or the enlargement ment of lymph nodes have been observed. Acute manifestations usually last one week or less, but many patients experience one or more episodes in which symptoms recur. The recurrence is characterized by the reappearance of a few or all symptoms present in the initial episode; this is particularly associated with patients resuming strenuous physical activities. A persistent headache lasting several weeks has been reported by some patients. Urinary infection due to bacteria has been documented in a few patients during the relapse and one patient developed an abscess, probably of bacterial origin, in the throat about 10 days after recovery from the acute disease. All attempts to isolate Oro virus during relapse periods have failed. Leukopenia associated with neutropenia is a common feature of Oro virus infection, and leukocyte counts as low as 2,000/mm^3 have been recorded. Serum levels of glutamic-oxalacetic and glutamic-pyruvic transaminases are within normal limits, or moderately increased without exceeding 135 units/ml of serum. Platelet counts are usually within normal range and are only occasionally slightly decreased. No abnormalities are found in the urine and red blood cell sedimentation rate is normal.

Figure 1. Oropouche fever epidemics in the Amazon region of Brazil, 1961-1980.



Instances of meningitis associated with Oro virus infection were observed during the 1980 outbreak in Pará. Meningitis was documented in 22 laboratory proven cases of Oro infection, of which 12 (4.1 per cent) were recorded among 292 patients from Belém (Capital, State of Pará) examined in outpatient clinics. Besides severe headache and dizziness, mild lethargy, diplopia, nystagmus, vomiting, and alteration of equilibrium were also present in some patients. Nuchal rigidity was detected in most of the 22 cases and an increase in cells of the cerebrospinal fluid (CSF) was demonstrated in each of the 20 patients for which cell counts were performed. The cell counts varied from 7 to 310/mm^3 but in most cases they ranged from 11 to 50. Neutrophils outnumbered mononuclear cells in all instances. In 18 of the 22 patients an increase of proteins was documented in the CSF, but the sugar remained within normal limits. Electroencephalography was performed on four patients but no abnormalities were noted. Oro virus was recovered from one CSF sample by inoculation into mice. Hemagglutination-inhibition antibodies

to Oro virus with titers ranging from 1:4 to 1:80 were demonstrated in the CSF of each of 10 patients tested. No bacteria or fungus was noted or cultured from 16 CSF examined. All patients recovered without sequellae.

A rash is also occasionally observed on the trunk, arms, and less commonly the thighs; it usually appears between the third and sixth day of illness and lasts 2-3 days.

Virtually all patients are viremic during the first two days of illness. Oro virus was detected in about 72 per cent and 44 per cent of patients on the third and fourth days after onset of symptoms, respectively, but in only 23 per cent on the fifth day.

Prior to 1980 all outbreaks of Oro fever occurred exclusively in Pará, with a wide geographic distribution in this State. In 1980, however, Manaus, the capital city of the State of Amazonas, and Barcelos were affected by the virus, as was the town of Mazagão in Amapá territory. The outbreak in Manaus started late in 1980 and lasted until the beginning of 1981; approximately 97,000 persons were infected. Serologic studies in Manaus revealed a low (1.8 per cent) antibody prevalence rate for the virus prior to the outbreak.

In the epidemics from which a sufficiently large number of sera were tested, there were no striking differences in attack rates within different age groups. In some localities a proportional difference between men and women of 3:1 or 2:1 was observed. No significant differences in the infection rates of males and females were noted, however, in other outbreaks. A follow-up study undertaken in 1979, involving 97 families with 537 persons, revealed that at least 63 per cent (49/79) of persons infected during an outbreak in the town of Santa Isabel developed clinical manifestations.

In some epidemics the distribution of the virus in large cities is markedly uneven, whereas studies in small villages showed the agent to be spread throughout. This pattern seems to correlate with the distribution of the insect *Culicoides paraensis,* which is the main vector of Oro virus.

All outbreaks occurred during the rainy season, and in several localities their decline coincided with the end of this period. In some places virus activity was detected for six months.

Oro virus probably occurs in nature in two distinct cycles: a jungle cycle (vector still unknown), which is responsible for maintaining the virus in nature, where primates, sloths, and possibly certain species of wild birds are implicated as vertebrate hosts; and an urban cycle during which man may be infected and, once infected, probably serves as an amplifying host of the virus among hematophagous insects. Two insect species have been implicated as Oro vectors in urban settings: the ceratopogonid midge *Culicoides paraensis* and the mosquito *Culex quinquefasciatus.* Transmission studies from hamster to hamster have demonstrated that the former was the more efficient of the two vectors. Furthermore, recent findings showed that *C. paraensis* can transmit the virus from man to hamster, thus providing conclusive evidence of the insect's role as a vector of this important arbovirus disease. Methods for the control of *C. paraensis* will have to be developed in order to prevent or interrupt epidemics, particularly in view of the increasing activity of Oro virus in urban centers of the eastern Amazon region and the first report of an epidemic in the western part, where the large city of Manaus was extensively affected. It is also possible that Oropouche fever may spread to other areas, since *C. paraensis* is widely distributed throughout South America, Central America, Mexico, and the eastern United States.

(*Source:* Viral and Rickettsial Diseases, Communicable Diseases Control, Division of Disease Prevention and Control, PAHO.)

Genital Herpes Infections in North America

All the countries in the Region have limited their concept of sexually transmitted diseases (STDs) to the traditional venereal diseases which include gonorrhea, syphilis, chancroid, lymphogranuloma venereum, and granuloma inguinale. Available information on the severity of STDs in the Region is incomplete and there is a lack of case reporting in many countries. Although a number of countries maintain statistics on reported cases of gonorrhea and syphilis, many do not furnish PAHO with detailed information such as cases by age, or, in syphilis cases, by stage of development.

Determination of the true magnitude of the STD problem is restricted by the coverage and quality of data available on the occurrence of cases and related complications. The importance of these diseases as a public health problem stems from their serious chronic and weakening ef-

fect. New data suggest that other STDs may cause similar or more serious complications than those traditionally recognized. Recent advances indicate the existence of an association between herpes infection and cervical cancer, and between infection by *Chlamydia* and conjunctivitis and pneumonia in the newborn.

Genital herpes infection has received increasing attention in part because of its recurrent nature, the lack of specific definitive therapy, its epidemiological association with cancer of the cervix, the serious consequences of the disease in newborn infants, and the absence of methods to control its spread.

Canada

Because genital herpes is not a notifiable disease in Canada, the incidence of sexually transmitted herpetic infection is relatively unknown. The WHO Virus Reports sent to the Bureau of Microbiology, Laboratory Centre for Disease Control (LCDC), Ottawa, from 26 Canadian laboratories are, however, one source of information on these infections. Although not all physicians send specimens to the laboratories, the highly accurate and detailed diagnostic data contained in these reports have very useful epidemiological applications.

Throughout Canada in 1981 there were 4,542 reports of herpes viruses, almost double the 1980 total of 2,584. Included in these totals are herpes group, herpes simplex virus untyped, herpes simplex type 1, and herpes simplex type 2. Specific identifications of cytomegalovirus, Epstein-Barr virus, and varicella-zoster virus are not included. The "herpes group" category may include some of these viruses as well as herpes simplex.

A total of 2,520 reports involved females and 1,855 males, a 15 per cent difference (167 were unspecified as to sex). The largest percentage involved young adults: 20.4 per cent of the total sample (926) from 20 to 24 years of age, 15.6 per cent (709) from 25 to 29 years of age, and 16.6 per cent (753) from 30 to 39 years of age. The only major difference in the sexes occurred in the age group 15 to 29 where reports involving females predominated.

In Canada, STDs are reported most frequently during the summer months. An analysis of the month of onset of all herpes virus infections showed a low of 6.7 per cent in January and a peak of 10.0 per cent in November. However, when only the reports of specimens from the genital tract were analyzed, there was a low of 5.2 per cent in December and a high of 10.8 per cent in June, a seasonal pattern which follows that of other STDs.

The number of herpes virus reports by the site from which the specimen was taken and the virus type are presented in Table 1. Note that only 10.2 per cent of the reports indicated the type, with approximately the same percentage occurring for both (50.1 for type 1 and 49.9 for type 2).

The site from which the specimen was taken provides important epidemiological information. Over 40 per cent of the specimens were from the genital tract, suggesting a sexually transmitted infection. Some of the specimens isolated from a skin vesicle or wound may also have been sexually transmitted. Not surprisingly, 60.8 per cent of the specimens from the genital tract came from young adults 15 to 39 years of age, the group at the highest risk for acquiring STDs. Therefore, pregnant females in this age group are at greatest risk for transmitting the disease to their offspring.

While herpes simplex type 2 is often associated with genital tract infections and type 1 with nongenital infections, these data demonstrated a crossover effect between the type of virus and the source of the infection: 75.7 per

Table 1. Number of herpes virus reports by site of specimen and virus type, Canadian Virus Laboratories, 1981.

Site of specimen	Herpes group	Herpes simplex not typed	Herpes simplex type 1	Herpes simplex type 2	Total	
					Number	Percentage
Genital tract	55	1,649	35	109	1,848	40.70
Skin: vesicle/wound	189	580	90	76	935	20.60
Nasopharynx	70	160	48	2	280	6.20
Feces	17	20	0	0	37	0.80
Urine	2	8	1	0	11	0.20
Blood	0	4	0	1	5	0.10
Eye	1	3	1	0	5	0.10
Central spinal fluid	1	3	0	0	4	0.10
Postmortem: brain, spinal cord	1	9	4	1	15	0.30
Liver	0	1	0	0	1	0.02
Lung	0	3	0	0	3	0.07
Other (including serology)	106	1,197	53	42	1,398	30.80
Total						
Number	442	3,637	232	231	4,542	99.99
Percentage	9.7	80.1	5.1	5.1		

cent of the typed genital tract specimens were type 2 and 24.3 per cent were type 1.

A total of 25 (0.6 per cent) reports recorded a fatal outcome, but there may have been more than one report from the same fatality. Seven (29 per cent) of the reports with fatal outcomes involved infants less than six months of age, a figure which represents 17.5 per cent of the 40 reports involving infants. Another seven fatalities occurred among those 60 and older. The remaining 11 reported deaths were distributed among the other age groups. Further investigation of the 40 reports involving infants with herpes virus infection is currently under way.

United States

In the United States several attempts have been made to quantitate the magnitude of the problem. However, few States require reporting of herpes infections. In an attempt to measure the problem, the Centers for Disease Control (CDC) obtained data on genital herpes infections from the National Disease and Therapeutic Index (NDTI).

The NDTI survey is a nongovernment national, stratified, random sample of data from patient consultations with physicians in fee-for-service office-based practice in the United States (excluding Hawaii and Alaska). Included in the sample are all consultations between patients and physicians in an office, hospital, or nursing home, or in the form of a house call or telephone conversation. The survey procedures do not include confirmation of the physician's diagnosis. Patients with genital herpes may seek care from other health care facilities and providers, such as hospital emergency rooms, neighborhood health centers, STD clinics, and community hospital out-patient departments which are not included in the survey. Data were available for analysis from the NDTI survey for the years 1966-1979 inclusively.

CDC's *Morbidity and Mortality Weekly Report* (31 (11): 137-139, March 1982) published a report which analized NDTI data. The number and rate of consultations with fee-for-service office-based physicians for genital herpes infection from 1966 to 1979 increased markedly from 29,560 in 1966 to 260,890 in 1979. The rate increased almost nine-fold from 3.4 per 100,000 consultations in 1966 to 29.2 per 100,000 in 1979 (Figure 1).

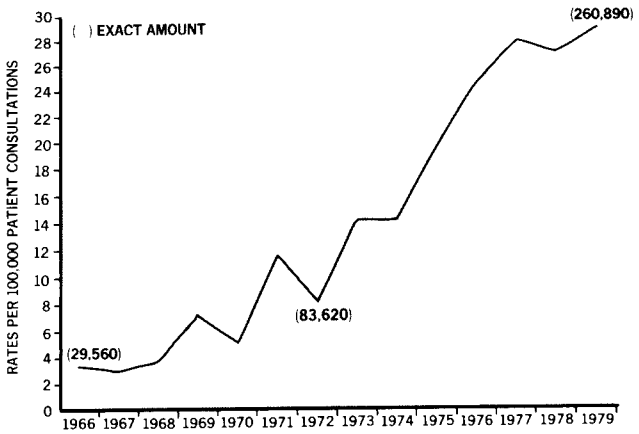
In contrast, the NDTI survey showed a less than two-fold increase in the rate of consultations for oral herpes infection (comprised of conditions cited as herpes labialis and herpetic stomatitis) and for ocular herpes infection. Three other codes used in the NDTI survey are herpes febrilis, herpes simplex, and herpes "not otherwise stated." The trend in the rates of these physician contacts was stable from 1966 through 1979.

The only other national data set available for estimating the number of consultations with U.S. private physicians for herpes infection is the National Ambulatory Medical Care Survey (NAMCS), a study conducted by the National Center for Health Statistics. NAMCS first used a separate code for genital herpes in 1979. The NAMCS estimated number of consultations for all types of herpes infection increased from 838,000 in 1973 (earliest data available) to 937,000 in 1979 (latest data available), an 11.8 per cent increase. For that same period (1973-1979), the NDTI data showed an increase in all types of herpes infection of 9.9 per cent.

The observed increase in the rate and number of consultations for genital herpes infection supports the widely held point of view that the disease has reached epidemic proportions in the U.S. The data do not permit differentiation of first infections from recurrences, and sometimes the atypical nearly asymptomatic nature of some first infections makes this distinction even more difficult. Nevertheless the CDC estimated that some 200,000 to 500,000 new cases occur annually.

To date no drug, vaccine, diet, or other therapy has proven effective in preventing recurrences of the disease. Smallpox, poliomyelitis, BCG, yellow fever, and heat inactivated herpes simplex type 2 (Lupidon G) vaccine have not been effective in decreasing the number of recurrences. Although no clear defects in the immune systems of infected patients have been demonstrated, immune system stimulants or immune regulators, such as L-tetramisole, isoprinosine, and interferon, have been tried without success. Ethyl ether, vitamins B_{12}, C, and E, lactobacilli, 2 deoxy-D-glucose, zinc, lysine, and betadine applied topically may provide some local symptomatic relief, but these agents are likewise ineffective in preventing recurrences. Among antiviral compounds such as idoxuridine, ribavirin, vidarabine, and acyclovir, only

Figure 1. Estimated rates of consultations with private physicians as a result of genital herpes infections, United States of America, 1966-1979.*



*SOURCE: IMS AMERICA, NDTI.

the latter two have some use in the treatment of herpes infections. Vidarabine has been successfully used intravenously and topically for herpes encephalitis and ocular infections, respectively, provided therapy is initiated early in the course of illness. Recently concluded randomized placebo-controlled clinical trials with topical acyclovir demonstrated that the drug does alleviate symptoms and hastens healing of the lesions of first infections. To date, however, it has not been shown to be effective for recurrent infections or that recurrences are prevented.

In summary, available data indicate that an epidemic of herpes simplex type 2 infections is currently taking place in the United States. The lack of a specific cure and methods to control its spread preclude any attempts to interrupt transmission and control the epidemic. Furthermore, the limited available information does not estimate the personal costs in terms of human suffering or the economic costs incurred by desperate patients searching for a cure for their repeated infections.

(*Sources:* Sexually Transmitted Diseases and Treponematoses, Communicable Diseases Control, Division of Disease Prevention and Control, PAHO, and *Canada Diseases Weekly Report* 8(32), 1982, and *MMWR* 31(11):137-139, March 1982).

Rotaviruses

Introduction

Acute diarrheal diseases have long been recognized as a major public health problem throughout the world. Recent technological advances during the past decade, however, have now permitted the identification of viruses in feces during the acute stage of disease. This breakthrough has enabled scientists to assign a viral etiology to many diarrheal episodes in infants, young children, and adults in developed and developing countries.

Rotaviruses have emerged as the single most important worldwide cause of diarrhea in infants and young children requiring admission to hospitals for the treatment of gastroenteritis. Infection with these viruses also accounts, to some extent, for malabsorption and malnutrition in infants, especially in developing countries. Identification, characterization, and a clearer understanding of rotavirus diarrheas is necessary in order to find measures to prevent their transmission and, most importantly, to develop suitable vaccines and appropriate technologies which can be effectively adapted to the needs of all countries.

This article is the first of a two-part series which reviews new knowledge and understanding of many aspects of rotavirus diarrheas. Part I deals with the clinical features and epidemiology of rotavirus. Part II will present laboratory methods for the detection and identification of rotaviruses.

The Virus

In 1973 rotavirus was first detected in a human reservoir in Melbourne, Australia, by thin-section electron microscopic examination of duodenal biopsies obtained from children with acute diarrhea. Shortly afterwards, in Australia, Canada, the United Kingdom, and the United States, it was detected by electron microscopic examination of diarrheal stool specimens. The virus is 70 nM in size, contains RNA, and has an inner and outer capsid. The name is derived from the Latin word "rota," meaning wheel, which it resembles in appearance. It has also been referred to as "orbivirus," "duovirus," "reovirus-like agent," and "infant gastroenteritis virus."

Clinical Features of Rotavirus

The incubation period of rotavirus enteritis ranges from one to seven days, and is usually less than 48 hours. Excretion of rotavirus frequently precedes the onset of symptoms; however, in severe infection this has been observed more frequently in males than in females, as is the case with many other diseases in the early years of life.

The symptoms of enteritis vary according to the age of the patient and present similar characteristics to those seen in infections with other enteric pathogens. In newborn babies, diarrhea may be minimal with mild transient temperature elevation. In this case, treatment is usually not required, although infected babies may be slow to regain their birth weight. In infants and young children, the onset of disease is usually marked by explosive and watery diarrheas, often accompanied by mucus which is found in the stool in approximately 25 per cent of cases. Vomiting is often a prominent early symptom and may precede diarrhea. In addition, mild temperature elevation occurs

in about 30 to 50 per cent of patients. Concurrent respiratory symptoms, pharyngitis, and otitis media have also been observed, but whether rotavirus per se is directly responsible for causing these clinical descriptions is not known; to date, rotavirus particles have not been demonstrated *in situ* in such instances.

The average duration of illness due to rotavirus infection is approximately 5 to 7 days. Virus shedding in the stool commonly continues for up to 10 days and has been observed for as long as 29 days. In immunodeficient children, rotavirus infections can persist for months.

In older children and adults, the symptoms are similar, although usually less severe. Vomiting is less frequent and associated respiratory symptoms have rarely been described. In this age group, diarrhea is usually not life-threatening, although death occasionally occurs in elderly patients.

In childhood diarrhea, dehydration and electrolyte imbalance can often be fatal if not properly treated. Treatment consists of administering oral rehydration solution to all but the most severely dehydrated cases, i.e., patients who are unable to drink, or patients with intractable vomiting. In many developing countries, the glucose-electrolyte oral rehydration salt (ORS) solution, developed originally for the treatment of cholera, has been used repeatedly with successful results for rehydrating patients with rotavirus diarrhea.

Studies of the pathophysiology of rotavirus diarrhea have revealed a sequence of events in the small intestine consisting of infection of the absorptive villous epithelial cells, replacement of the tall columnar villous epithelial cells with cuboid cells, shortening of the villi, lymphocytic infiltration of the villous lamina propria and repair. Such changes appeared in a cephalocaudal direction and suggest that diarrhea may be related to a loss of absorptive capacity in the small intestine. In addition to their loss of absorptive surface area, the villi are covered by undifferentiated crypt cells that lack the ability to digest disaccharides in the diet. Although the exact importance of rotavirus as a contributing factor to malnutrition is not known, the resulting malabsorption of fats and secondary sugar intolerance could theoretically initiate or exacerbate malnutrition. Similarly, there is little documentation on morbidity and mortality due to rotavirus infections in children already suffering from malnutrition.

Epidemiology

Rotavirus enteritis is a disease which appears to have a worldwide distribution generally affecting infants and young children. It is the most frequently observed virus in stools of those in this age group, with diarrhea in almost all investigated areas in the world. The majority of cases are children 6 to 24 months old representing a peak incidence at 9 to 12 months. In a number of hospital-based studies carried out in infants and young children in developed and developing countries, rotavirus has been detected in approximately 50 per cent of diarrhea cases, sometimes with seasonal variation. In other studies, the number of male cases is 20 per cent higher than that of female cases, however, it is not known whether this is due to a greater susceptibility or exposure of male children, or to a higher likelihood of their being brought for medical care. Data from community-based studies are much more limited. Studies carried out in Guatemala and Bangladesh suggest that rotavirus accounts for approximately 10 to 20 per cent of all community diarrhea cases.

Numerous studies on the monthly and annual frequency of rotavirus infection in children admitted to hospitals with acute diarrhea have been undertaken in both tropical and temperate countries. Incidence rates vary with techniques used for detection, but, in general, rotavirus infection accounts for 20 to 40 per cent of diarrheas in children up to five years of age admitted to hospitals in tropical countries, and 40 to 60 per cent of such cases in temperate countries.

In contrast, there are few studies in either developing or developed countries that document the true incidence rate of rotavirus infection. One study in Washington, D.C., USA, found that 3.7 per 1,000 children in the community aged less than 12 months, 2.2 per 1,000 aged 13 to 24 months, and 0.18 per 1,000 aged 25 to 60 months, were hospitalized each year with rotavirus infection. A community-based study in rural Bangladesh, associated rotavirus with 4.7 per cent of all diarrheal episodes in children aged two to 60 months (but 39 per cent of all episodes associated with dehydration); incidence rates were 0.5 episodes of rotavirus diarrhea per child per year during the first two years of life, decreasing to a negligible level thereafter. Additional community-based studies in Guatemala and rural El Salvador showed that between 7 and 14 per cent of all diarrheal episodes in children under three years of age were due to rotavirus and that almost all children could expect to have at least one episode of rotavirus diarrhea during their first three years of life.

Mortality rates from rotavirus diarrhea are low in developed countries and virtually unknown in developing countries. Of interest are observations made in Bangladesh, Ethiopia, Finland, and Guatemala which indicate that rotavirus diarrhea is more likely to bring children below the age of two years to treatment facilities than any other diarrheal infection. This suggests that the disease is more likely to result in death if left untreated.

Recent evidence has also demonstrated the existence of more than one serotype of human rotavirus. Workers in Belgium, using a complement-fixation assay and immune electron microscopy, in England, using neutralization of immunofluorescent foci, and in the USA, using an enzyme-linked immunosorbent assay (ELISA), have all defined two distinct serotypes. These serotypes appear to be widely distributed geographically. In the Washing-

ton, D.C. metropolitan area, the sera of most children aged two years contained antibodies to both serotypes, and in hospitalized patients type 2 rotavirus was seen more frequently. In addition, studies of patients who experienced sequential infections revealed that illness caused by one serotype did not provide protection against illness caused by the other serotype. It is not certain whether other serotypes exist; however, workers in England using a fluorescent neutralization test have claimed to have found two other serotypes.

Seasonality

It has been clearly demonstrated in studies performed in North America, England, and Australia that rotavirus disease is more prevalent during the colder seasons of the year. One exception may be infection in newborns, in Sydney, Australia, where no seasonal variation was found when rotavirus infection was studied in newborn nurseries. Whether this seasonal pattern occurs in developing countries with tropical climates is unclear. In studies from Venezuela and Costa Rica, little or no seasonal variation in occurrence has been observed; however, in studies from Vellore and Kozhi-kode (Calicut), India, and Bangladesh, rotaviruses have been found most frequently in stool samples collected from diarrhea cases between November and March, the coolest months of the year. In the Vellore study, as in the Australian study cited above, rotaviruses were present in the neonatal nursery throughout the year. One small study conducted in Mexico City, where almost no seasonal difference in temperature occurs, revealed a peak of cases in the autumn months.

Transmission

All evidence to date indicates that rotavirus infection spreads by fecal-oral transmission; this has been confirmed by volunteer and animal experiments. There is no evidence, however, which suggests that rotavirus multiplies with production of infectious particles other than in small bowel enterocytes.

Although immunoglobulin A (IgA) specific antibody has been found in the colostrum and breast milk of lactating mothers in a number of countries, it is not clear what role breast milk plays in protection against rotavirus disease, especially in developing countries where breast feeding frequently continues past the sixth month of life when rotavirus diseases are most common.

Factors such as climate, density of population, or local habits also influence the incidence of rotavirus infection. However, as precise data are not available, the role played by these factors in the transmission of the disease is still a matter of speculation. The true role and relative importance, if any, of water, food, air, and fomites in transmission still needs to be elucidated.

Environmental Aspects

Studies conducted on rotavirus have indicated relatively heat-resistant properties. It has been discovered that rotavirus infectivity is rapidly lost on treatment with 5 mM of either EDTA or EGTA. On the other hand, a number of chemical disinfectants have been found to be relatively ineffective in the inactivation of rotavirus suspended in fecal matter.

In comparison with certain enteroviruses, rotavirus seems to have a lower capacity to absorb a variety of soil types, aluminum hydroxide, and activated sludge flocs. This, together with their relative resistance to chlorine, suggests that conventional methods of water and sewage treatment may be relatively less effective for the removal and inactivation of rotavirus.

Rotavirus has also been detected in raw and treated sewage and fecally-polluted waters. Samples of drinking water collected in Egypt and Mexico have been found to contain viable rotavirus particles.

More research is needed on factors that influence the survival of rotaviruses in the environment, both in the community at large and within closed communities such as hospital wards, day care centers, and nursing homes. In addition, the true role and relative importance of water, food, air, and fomites as vehicles in the spread of rotavirus infection require future research.

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(*Source:* Enteric Disease Control Program, Communicable Diseases Control, Division of Disease Prevention and Control, PAHO.)

Bolivian Hemorrhagic Fever

The disease was first identified in 1962 during an outbreak that caused a large number of deaths in the agricultural community of Orobayaya, Province of Iténez, Department of Beni, which was abandoned by its 600 inhabitants. Subsequently, an even larger outbreak occurred in San Joaquín, the capital of the Province of Mamoré, also in the Department of Beni, and was the subject of an in-depth study by Bolivian personnel and by the personnel of the Middle America Research Unit (MARU) of the United States Public Health Service.

The incubation period of Bolivian hemorrhagic fever is from 7 to 14 days. Direct transmission by nasopharyngeal secretions was confirmed in at least two of the cases. Onset of the disease is gradual. From the beginning, high and sustained fever and myalgia are usually present. About 30 per cent of the patients have hemorrhages from the third day onward. Half the cases show hypotension and tremors of the tongue and hands from the fourth to the sixth day. Leukopenia, as well as thrombocytopenia, are invariably present.

Most cases occur during the dry season and at the peak of agricultural activity—the pattern demonstrated by the outbreaks in Orobayaya and San Joaquín. The disease attacks persons of all ages and of both sexes.

Morbidity is usually high; in San Joaquín it exceeded 30 per cent of the total population. The highest mortality occurs among the very young and the very old.

In 1963 the etiologic agent—the Machupo virus—was isolated both from human and animal tissues and the rodent *Calomys callosus* was identified as the reservoir of the virus. The San Joaquín outbreak was brought under control by exterminating this rodent. Later outbreaks in hamlets and farms were also associated with the presence of *C. callosus* in the victims' houses and in their immediate neighborhood. However, in 1971 an outbreak occurred in a hospital in Cochabamba, a city situated outside the endemic area of the disease. The index case appeared to have contracted the infection on a ranch located in the community of Fortaleza, Province of Yacuma, Department of Beni. Five of the persons that were in contact with the patient during his stay in the hospital contracted the disease and four of them died.

Thus far it has not been possible to isolate the virus from any other animal species but *C. callosus,* its natural host. Between 1963 and 1966 the MARU research workers in Panama delimited the approximate area of dispersion of this rodent in Bolivia, which, in the Department of Beni, includes the Moxos plains; in the Department of Santa Cruz, the entire eastern and southeastern region, except for a strip that runs north to south and includes the foothills of the Mato Grosso; in the Department of Cochabamba, the northern part of the Province of Chapare; in the Department of Chuquisaca, the Province of Luis Calvo; and in the Department of Tarija, the Province of Gran Chaco. The total area involved is approximately 500,000 km^2.

The Machupo virus has been detected in *C. callosus* captured in the Provinces of Iténez, Mamoré, and Yacuma in the Department of Beni (an area of approximately 27,433 km^2 as a whole). In the Province of Velasco, Department of Santa Cruz, these rodents have been found to be infected with the Latino virus (Machupo II), which is an arenavirus apparently nonpathogenic for man.

In the experiments carried out, the Machupo virus did not produce acute disease in *C. callosus* of any age, regardless of the route of inoculation used. In sucklings, the virus multiplied rapidly in the lymphatic ganglia and the spleen, and between 7 and 10 days later was found in all the tissues (including the brain), and in blood, oral swabs, and urine. The infected animals did not grow as rapidly as their controls, but it is interesting to note that they showed chronic infection accompanied by persistent viremia and never demonstrated circulating antibodies.

In other investigations, adult *C. callosus* inoculated with Machupo virus responded in two ways: with chronic viremia, splenomegaly, and no antibodies, or without viremia (although the virus was present in the urine, buccal cavity, and other tissues), without splenomegaly, and with neutralizing antibodies two or three months after inoculation.

The presence of splenomegaly in infected *C. callosus* is an interesting characteristic that is observed from the second week after onset of the infection and appears to persist for many months. In the course of one epidemic, it was found that the weight of the spleen of those rodents was an important indicator of infection by Machupo virus. Spleens of more than 0.25 g were positive. However, no virus was found in more than half the spleens that weighed between 0.20 and 0.25 g and in none of those that weighed less than 0.20 g.

Taking into account the diagnostic techniques available in recent years, the criterion used in field work has been to consider all cases of splenomegaly in *C. callosus* as an indicator of suspected infection; unfortunately, confirmation in these cases has not been possible. The percentages of suspected infection ranged from 55 to 93 per cent.

No human cases of Bolivian hemorrhagic fever have been registered since 1974.

(*Source: Boletín Epidemiológico,* Ministry of Social Welfare and Public Health, Bolivia, Number 75, 1981.)

Editorial Comment

Since the program to control *Calomys callosus,* no addi-

tional human cases have occurred, but the epidemiological background of the disease indicates the possibility of its reappearance. Recently, *C. callosus* with splenomegaly were found in the Province of Cercado, Department of Beni, and, as stated in the article, this indicator raises the suspicion that the virus infection persists.

Publications

Emergency Vector Control after Natural Disaster. Washington, D.C., Pan American Health Organization, PAHO Scientific Publication 419, 1982. (ISBN 92 45 11419 6). 108 pages. Price: US$6.00.

This publication is a companion piece to the guide *Emergency Health Management after Natural Disaster* (PAHO Scientific Publication No. 407, 1981). Its specific purpose is to enlarge upon vector control sections contained in the parent guide, in the process laying down guidelines for senior technical officers responsible for postdisaster vector control measures. With this end in mind, the book has been written for individuals with a broad range of backgrounds in countries that might be struck by natural disasters. Besides helping government authorities confronted with vector (and pest) problems, the book should prove useful to evaluation teams seeking to determine the likehood of postdisaster emergencies arising as a result of vector-borne disease.

The first part of the book, which is relatively short, describes the general nature of the postdisaster vector control problem, lists types of information that need to be kept current at all times, outlines appropriate postdisaster actions, and provides a list of common disease vectors together with their possible immediate and delayed effects. The text notes that disasters do not generate "new" diseases, but by altering the environment may increase the transmission rates of those already present. It also points out that regular vector control programs tend to employ static administrative procedures with limited flexibility. As a result, their response to disaster situations is apt to lack the necessary adaptability and innovation, and overreactions to the actual and potential risks of vector-borne diseases may occur. This needs to be recognized in determining the resources available for dealing with a postdisaster situation and in finding the best ways of using those resources.

The second and longest portion of the book describes measures for controlling various vectors—including *Aedes aegypti,* the vector of dengue and yellow fever; the anopheline vectors of malaria; *Culex quinquefasciatus* and other pest mosquitoes; and flies, rodents, and other creatures. The most detailed chapters, on *A. aegypti* and the anophelines, each contain sections on larviciding, adulticiding, and subsequent evaluations.

A short final section deals with vector control consultants—their recruitment, briefing, action upon arrival, training work, recommendations and reports, and follow-up activities. Annexes include a 35-entry bibliography, a list of suggested vector surveillance equipment and supplies, a detailed list of pesticides to use against a wide range of pests and vectors, and a lengthy guide to products—insecticides, rodenticides, insect repellants, applicators, and other equipment—giving the names and addresses of their producers.

It is recognized, of course, that every natural disaster has unique features, and that no guide can completely cover every situation. Thus, *Emergency Vector Control after Natural Disaster* limits itself to specific technical and administrative problems, without delving into the particular environmental, public health, political, and economic conditions prevailing in potentially affected areas. Despite these limitations, and despite the fact that it presents guidelines rather than definitive treatment of its subject, *Emergency Vector Control after Natural Disaster* should prove an important and useful work for all concerned with postdisaster outbreaks of vector-borne disease.

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