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Leprosy in the Americas

According to the historical evidence, leprosy is or has been decidedly cosmopolitan. In Europe the disease still persists in eight countries, with a small number of autochthonous cases (15,000). Today, more than 90 per cent of all known leprosy cases in the world are concentrated in the tropical and subtropical regions*(1,2)*.

In the Americas, the study of pottery and Inca and pre-Inca mummies gives no indication of lesions compatible with the pathology of leprosy. One is led to believe, therefore, that *Mycobacterium leprae* was introduced into the New World by the colonists and emigrants from Europe.

Despite its lengthy history, leprosy is still perhaps the least known of the main infections affecting humans. Its diagnosis is still a matter of discussion, its pathogeny is not clearly defined, and its mode of transmission is still the subject of controversy.

Leprosy research has received a new stimulus from the discovery that model animals make possible the study of bacilli for basic research and also from the fact that leprosy is one of the six diseases dealt with by the WHO Special Program for Research and Training in Tropical Diseases.

Although progress has been made in its epidemiology, much remains to be done, mainly as regards the nonspecific factors that can influence the behavior of the disease such as nutrition, environmental conditions, hygiene practices, and social and cultural relations*(3)*.

With the advent of dapsone in the 1940s it was thought that the leprosy problem would be solved quickly. However, 40 or more years later the number of cases worldwide is over 11 million. In the Region of the Americas the number is estimated at approximately 480,000 cases. The problem assumes even more serious proportions since some 5 per cent of the cases present primary or secondary resistance to dapsone. There are other factors that underscore the importance of the disease as a public health problem:

- Leprosy is a chronic disease with severe forms that tend to worsen with time and constitute sources of contagion for life.
- More than a third of the untreated and advanced cases show physical disabilities that worsen with time and result in permanent deformities or mutilations. These disabilities mainly affect the extremities, the face and the eyes, rendering sufferers totally unfit for work and destroying their social life.

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• The disabilities and deformities caused by leprosy have fostered the belief in many groups, including health workers, that the disease is incurable. The degree of ostracism resulting from this attitude is such that even the sufferer believes that his exclusion from the community is justified; a similar feeling is shared by his family.

For all these reasons, a more representative evaluation of the leprosy problem could be made in general terms if one bears in mind the human suffering it brings, in addition to the consequent economic and social losses of the individual, family, and community caused by the disease.

Epidemiological Situation

Leprosy is endemic in all the countries and territories of the Americas except for mainland Chile and certain limited areas in other countries. Table 1 summarizes the data PAHO received from the countries and territories of the Region (mostly relating to 1982) on registered or estimated cases. The existing information does not reflect the true epidemiological picture owing to the limitations of the countries' data-gathering and recording systems. The majority of countries has not standardized the data which are collected from different levels of the health care system; this produces multiplicity of criteria for what should be recorded. Almost all the countries keep patients permanently on their active registers, even those in good health and those who have died. This is mainly because of the lack of standardized criteria for defining a leprosy case. In addition, lack of knowledge about the disease and the way the problem is assessed have led to underrecording of cases in nearly all the countries. For this reason, in order to estimate the current number of cases, a scale of percentages ranging from 125 to 300 per cent (equivalent to increases from 25 to 200 per cent) has been applied to the total known cases in each country, in accordance with the degree of development of their respective control programs and the coverage achieved in case detection*(4)*.

A brief description is given below, by country and territory, of the leprosy situation in the Americas.

Among the Southern Cone countries, Paraguay is the one with the highest endemicity (2.5 per 1,000) and, as almost always happens, the geographic distribution of the cases is not uniform; most patients are concentrated in the eastern provinces (including Asunción, the capital).

In Argentina epidemiological surveillance of the disease has improved considerably in recent years. Most of the cases live in or originate from the northeastern provinces (Chaco, Córdoba, Entre Ríos, Santa Fé).

Uruguay's endemic western provinces (Paysandú, Salto, and Artigas) adjoin the most seriously affected areas of Argentina.

Table 1. Leprosy in the Americas, situation in 1982 or most recent year.

Country or territory	No. of cases		Estimated rate[a] per 1,000 population
	Registered	Estimated	
Anguila	5	10[b]	1.1
Antigua (1981)	47	94[b]	1.2
Argentina	12,198	18,297[c]	0.6
Bahamas (1981)	36	72[b]	0.3
Barbados	33	66[b]	0.2
Belize (1971)	1	10[d]	0.0
Bolivia (1981)	1,842	3,684[b]	0.6
Brazil (1981)	180,380	315,665[e]	2.6
Canada	185	370[b]	0.0
Chile[g]	19	29[c]	0.0
Colombia (1980)	20,669	31,004[c]	1.0
Costa Rica	606	1,061[e]	0.5
Cuba	5,716	8,574[c]	0.9
Dominica	16	32[b]	0.4
Dominican Republic	5,002	8,754	1.5
Ecuador	2,333	4,666[b]	0.5
El Salvador (1980)	31	93[h]	0.0
French Guiana (1971)	957	1,436[c]	27.1
Grenada (1981)	33	66[b]	0.6
Guadeloupe (1981)	1,340	2,010[c]	6.1
Guatemala (1980)	354	708[b]	0.1
Guyana	547	1,368[i]	1.5
Haiti (1980)	484	1,452[h]	0.3
Honduras	223	446[b]	0.1
Jamaica (1979)	796	1,194[c]	0.5
Martinique (1981)	1,176	1,764[c]	5.7
Mexico	16,054	28,095[e]	0.4
Montserrat	5	10[b]	0.8
Nicaragua (1981)	116	232[b]	0.1
Panama	147	221[c]	0.1
Paraguay	4,755	8,321[e]	2.5
Peru (1980)	3,359	10,077[h]	0.5
Saint Lucia (1981)	236	354[c]	3.0
St. Kitts/Nevis (1981)	23	46[b]	0.8
St. Vincent and the Grenadines	45	90[b]	0.9
Suriname (1973)	2,311	5,778[i]	13.1
Trinidad and Tobago	367	551[c]	0.5
Turks and Caicos (1981)	18	36[b]	6.0
United States	4,330	5,412[f]	0.0
Uruguay	625	1,250[b]	0.4
Venezuela	14,746	18,433[f]	1.2
Total	282,166	481,831	

a 0.0 indicates a rate below 0.05.
b 200 per cent.
c 150 per cent.
d Estimate: 10 cases.
e 175 per cent.
f 125 per cent.
g Easter Island only.
h 300 per cent.
i 250 per cent.

In Chile an unusual epidemiological situation prevails: no autochthonous cases have been notified. The prevalence data given in Table 1 refers to Easter Island, located 5,000 km off the Pacific coast. The 19 registered cases represent a prevalence rate of nearly 10 per 1,000 among the Polynesian inhabitants.

Regarding the Andean area, in Bolivia leprosy apparently does not propagate itself in the Altiplano (Departments of Oruro, Potosí, and part of La Paz), even though environmental and personal sanitation are unsatisfactory and the population density is high. However, the climate is cold and dry. The situation is different in the northeast, with its "valles", the Amazon basin, and the eastern plains where the climate is hot and humid. In the province of Vallegrande (Santa Cruz Department) a census taken in 1974 recorded 500 cases in a population of 32,000 (more than 15 per 1,000)*(5)*.

Colombia registers about half of the recorded cases in the Andean Area. The main foci are located in the southeast branch of the Andes. In the Department of Santander there are municipalities in which the prevalence rates (registered, not estimated cases) exceed 20 per 1,000*(6)*. It is significant that many patients contract the disease in localities above 2,000 m altitude.

In Ecuador, leprosy is virtually limited to the Pacific coastal region (Provinces of Guayas, Los Ríos, El Oro, and Bolívar). In the Andean sierra the reported cases are few.

In Peru, most cases are found primarily in Amazonia (Departments of Loreto and San Martín), and mainly in the area of the Ucayali River and its tributaries. The prevalence rates probably are similar to those in the neighboring areas of Brazil (Amazonas and Acre States). Other less active foci have been identified in the sierra (Apurímac Department)*(7)*.

Venezuela presents the highest morbidity rate of the Andean Area, but is also the country with the best organized case-finding system. The geographic distribution of the cases is not uniform, with a greater frequency in the Andean region (continuation of the southeast branch of the Andes) and in the southeastern plains (States of Apure and Barinas).

The larger part of the cases registered in the Americas is concentrated in Brazil. The country's population comprises 20 per cent of that of the Region, but claims nearly two thirds of the registered leprosy cases. In Brazil, as in other areas, the distribution of the disease is not uniform, the estimated morbidity rates (per 1,000) are 5.1 in the Amazon, 3.5 in the Midwest, 2.5 in the Southeast, 1.5 in the South, and 0.5 in the Northeast.

The contrast is notable between Amazonia, a hot and extremely humid region, and the Northeast which has little rainfall and therefore low humidity. It should be pointed out that more than half the cases are diagnosed in the Southeast Region (States of São Paulo, Minas Gerais, Rio de Janeiro and Espírito Santo)*(8)*. Over the past 10 years the case detection and treatment coverage in the Amazon Region has been expanded, with good coordination among the health sector institutions. The integration of the program with the basic services is functioning satisfactorily in various states, including control actions at the primary care level. In certain areas simple disability prevention techniques are being implemented.

In the Central American Isthmus the occurrence of leprosy cases is relatively low. With the exception of Costa Rica, which has maintained an efficient case reporting system, the estimated prevalence rate is approximately 0.1 per 1,000. The main foci are located around the Gulf of Fonseca in the Pacific, in the Provinces of Choluteca and Valle (Honduras), Chinandega (Nicaragua), and San Miguel (El Salvador). On the Atlantic coast Limones (Costa Rica) and Bocas del Toro (Panama) have been identified as foci.

In Mexico the disease is considered to be of medium intensity, but in the mid-Pacific States (Guanajuato, Sinaloa, Nayarit, and Jalisco) prevalence rates are estimated to exceed 1 per 1,000. The control program is in a transition stage which will result in full integration of program activities into the general health services.

As regards the Latin Caribbean, in Cuba leprosy is of greatest significance in the eastern provinces; in the Dominican Republic the highest rates are found in the east of the country, with 55 per cent of the registered cases living in the capital Santo Domingo. In Haiti, even if actual prevalence is estimated to be 200 per cent higher than the known figure, i.e. three times the cases registered, the rate still does not exceed 0.3 per 1,000*(9)*.

In the remaining countries and territories of the Caribbean, the frequency of leprosy cases varies greatly from one country or territory to another; the French territories and Suriname are the most affected. Among the English-speaking countries, Saint Lucia and the Turks and Caicos Islands have the highest prevalence. It will be noted that Dominica, which has a relatively low prevalence (0.4) is located between two other islands with very high morbidity rates (Guadeloupe and Martinique)*(10)*.

In North America, Canada reported 133 cases as of 31 December 1980. Apparently all of these infections were imported from 30 different countries. Four countries (Philippines, India, Vietnam, and Guyana) accounted for 44 per cent of the cases*(11)*.

In the United States there are an estimated 5,000 cases with an annual incidence of 130 patients. The most important foci are located in the States of Louisiana, Florida, and those bordering Mexico (mainly Texas and California). There are 4,330 registered cases, 300 of whom are hospitalized in Carville, Louisiana. Of 1,432 cases registered between 1967 and 1976, 76 per cent were

persons born outside the country, mostly in Mexico and the Philippines, and more than half the cases were of the lepromatous form*(12)*.

Table 2 gives data on leprosy cases notified in 19 countries of the Americas, according to age group, clinical forms, and degree of physical disability. Only 8.7 per cent of the cases were in the 0-14 years age group, with a range from 42.1 per cent of cases under age 14 in Guyana, to 2 per cent in Argentina, for those countries reporting at least 100 cases*(13)*.

With respect to the percentage of cases with positive bacilloscopy, countries where case-finding is efficient such as the Dominican Republic, Guyana, and Trinidad and Tobago*(9,14)*, show a low number of positive cases, while a high proportion of positive cases is observed in a country such as Venezuela, where case detection is very efficient.

About 14 per cent of the cases in the 19 countries observed had some type of disabling lesion; this percentage does not reflect the true picture since registration of disabilities is irregular and sporadic in almost all the countries. Given the prolonged lag time before disabilities become apparent, most newly discovered patients should be free of disabilities. The proportion of physical disabilities among recently detected cases is an indicator of the operative efficacy of case-finding methods. In 1976 Colombia analyzed a sample of 950 patients and found some 20 per cent were disabled. When broken down by clinical form, 21.9 per cent of those cases were lepromatous and dimorphous and 24.8 per cent with tuberculoid forms had disabilities*(15)*.

Table 3 sets out the control situation in 22 countries and territories of the Americas. The definition of "cases under control" varies from country to country: it is generally taken to be the regular attendance by the patient at a medical consultation, while patients are considered to be "out of control" when they have failed to attend medical consultations for longer than two years.

With the introduction of the multidrug chemotherapy approach, the definition of "case under control" should be revised and related to the regularity of drug ingestion.

The accelerated urbanization now taking place with greater intensity in Latin America, is changing the epidemiological profile of leprosy. Domestic migrations are playing a significant role in this situation.

An evaluation made in Colombia in 1960 showed that nearly 70 per cent of the patients lived in rural areas (communities of fewer than 10,000 persons) whereas in

Table 2. Leprosy cases notified in 19 countries of the Americas: breakdown by age group, bacterioscopic status, and degree of physical disability.

Country	No. of cases notified in 1982	Age 0-14 years		Positive Bacilloscopy		Disabilities Degrees II and III[a]	
		No.	(%)	No.	(%)	No.	(%)
Argentina	946	19	2.0	276	29.2	...	...
Canada	37	5	13.5	...	...	...	...
Colombia[b]	900	80	8.9	449	49.9	165	18.3
Costa Rica	21	12	57.1	6	28.6	4	19.0
Cuba	328	9	2.7	130	39.6	...	...
Dominica	1	1	100.0	1	100.0	1	100.0
Dominican Republic	305	68	22.3	57	18.7	28	9.2
Ecuador	102	17	16.7	34	33.3	—	—
Guyana	107	45	42.1	24	22.4	6	5.6
Haiti	27	1	3.7	4	14.8	4	14.8
Honduras	9	2	22.2	1	11.1	—	—
Mexico	565	24	4.2	200	35.4	69	12.2
Paraguay	305	13	4.3	189	62.0	54	17.7
Peru	43	10	23.3	30	69.8	4	9.3
Saint Lucia	25	5	20.0	7	28.0	7	28.0
St. Vincent and the Grenadines	8	4	50.0	—	—	1	12.5
Trinidad and Tobago	30	9	30.0	9	30.0	4	13.3
Uruguay	41	2	4.9	17	41.5	15	36.6
Venezuela	375	36	9.6	274	73.1	27	7.2
Total	4,175	362	8.7	1,708	41.3	389	13.6

[a] Degrees by WHO classification in 1982 incidence (for Colombia 1981).
[b] 1981 data.
... Information not available.
— None.

Table 3. Leprosy control situation in 22 countries and territories of the Region of the Americas, 1982.

Country or territory	Registered cases	Under control No.	(%)
Anguila	5	5	100.0
Argentina	12,198	12,198	100.0
Barbados	33	24	72.7
Brazil[a]	180,380	127,626	70.8
Canada	185	185	100.0
Chile	19	14	73.7
Colombia[a]	20,669	16,728	80.9
Costa Rica	606	519	85.6
Cuba	5,716	5,635	98.6
Dominica	16	16	100.0
Dominican Republic	5,002	4,474	89.4
Ecuador	2,333	2,333	100.0
Guyana	547	468	85.6
Honduras	223	200	89.7
Mexico	16,054	12,172	75.8
Montserrat	5	3	60.0
Paraguay	4,755	3,879	81.6
Peru	3,359	828	24.7
Saint Lucia[a]	236	171	72.5
St. Vincent and the Grenadines	45	43	95.6
Trinidad and Tobago	367	320	87.2
Uruguay	625	525	84.0
Total	253,378	188,366	74.3

[a]1981 data.

1981 only 57 per cent were living in rural areas*(15)*.

In 1975 De Mello reported that in Brazil a 36.6 per cent of the patients on the active registers lived in the nine metropolitan areas of the country (cities with over 1 million inhabitants); these areas accounted for 27.1 per cent of the total population*(16)*.

In 1981 in Venezuela the urban-rural distribution of leprosy cases diagnosed between 1949 and 1979 was studied. During this period the country's population as a whole tripled and its urban population quadrupled (areas with 2,500 and over are considered urban), while the patients living in rural areas represented 74.2 per cent of the total in 1949 and only 30.3 per cent in 1979. In absolute terms, the urban patient population has increased seven times*(17)*.

Few countries of the Americas—in which incidence rates have been monitored for over 20 years—have had a clearcut decline in leprosy.

In Brazil, the number of cases registered is increasing from year to year, in both absolute numbers and morbidity rates. Even in Cuba, which has an efficient case-detection and supervised treatment program, the incidence of new cases (about 3 per 100,000) has remained practically the same over the past 10 years. Venezuela is the exception, with a leprosy incidence that has declined by nearly 75 per cent over 25 years.

Integration of Leprosy Control with the General Health Services

Integration of leprosy control activities with the basic health services is intended to extend program coverage without adding to its costs. However, where it has not been accompanied by meticulous planning, the practical implementation of this strategy has proved disastrous, although the negative results should not be blamed on the strategy but rather on poor organization and planning.

The countries with totally vertical programs are faced with problems of high cost and the limited capacity of the specialized services to extend case-detection and treatment activities to the groups that need them. This situation is apparent in both urban and rural areas. The problem is aggravated by the need to apply combined and supervised chemotherapy in conjunction with the necessity of decentralizing treatment in order to bring it to the patients' homes.

Acceptance of integration with the general services as a leprosy control strategy is still a goal to be achieved in most of the Region. This strategy has been put into practice in some countries of the Caribbean including Cuba, in Costa Rica, and in Brazil. Colombia and Mexico are in the transition stage. In certain countries the experiment has resulted in failure owing to deficient implementation (Peru and Ecuador). In the Dominican Republic a new experiment is under way that seeks to integrate the leprosy and tuberculosis control programs.

Treatment

The traditional leprosy treatment method based on self-administered monotherapy is now largely ineffective due to the prevalence of primary and secondary dapsone resistance, which has increased considerably over recent years. In 25 countries worldwide cases of dapsone resistance have been identified in places where monotherapy has been employed for over 20 years*(18)*.

This situation threatens to wipe out the limited progress achieved in the past 30 years and underscores the urgency of taking steps to deal with the problem, such as adopting a multidrug chemotherapy that will control the generation of *M. leprae* strains resistant to dapsone and the problem of bacterial persistence.

The WHO Study Group on Leprosy Chemotherapy recommends application of new therapeutic regimes with associated drugs for all cases, both multibacillary and paucibacillary. It also recommends that the drugs be administered to the patient under the direct supervision of a health worker. This will require decentraliza-

tion of treatment to the vicinity of the patient's home, thus calling for a sufficiently extensive health infrastructure to apply supervised treatment in rural areas and in the areas around urban centers. At the same time, carefully planned education work with the patient and his family members is vital for assuring their regular and continuing cooperation in the treatment*(19)*. This new method has very significant repercussions, such as resource mobilization on a larger scale, personnel training, and integration of the program into the primary health care service and, accordingly, into the basic health services.

Leprosy Research

Research, in the following areas, is a priority in the fight against the disease*(20)*:

- Prevalence studies, including sample surveys, to measure the magnitude of the problem and its various dimensions, including the distribution of the disease by age group, sex, contact status, geographic location, etc. The criteria for diagnosis of the disease, its classification, and the control activities need to be standardized. The irregular distribution of leprosy justifies designing appropriate sample surveys.
- Studies of incidence in certain sectors to identify, where possible, risk factors, vulnerable groups, and trend of the disease, by means of changes in its distribution by clinical form, contacts, age groups, sex, etc. The resulting information would be most valuable for future vaccine trials.
- Studies on the pathogenesis of leprosy in different regions, especially the development of the multibacillary form and other evolutive forms, and factors which contribute to the development of other forms of leprosy into multibacillary leprosy.
- Studies of the effect of treatment with various medications, utilizing prevalence and incidence studies covering a period of time, especially among the younger age groups. When the means are available to identify the subclinical infection, the incidence of the infection ought also to be studied.
- Studies on transmission, especially in connection with attack rates between contacts under different conditions, and factors that influence transmission from contacts.
- Studies on the interaction between leprosy and environmental mycobacteria.
- Epidemiological studies on resistance to medications, with emphasis on the ineffectiveness of drugs for cases resistant to medication.
- New analyses of all the available data from BCG trials, including small-scale studies on selected groups, such as contacts, to ascertain whether there is a common profile of protection against leprosy. Case studies with a control group could also help determine the value of the BCG vaccine in other sectors.

It is probable that reliable immunologic instruments will be available in the near future, from both serologic and cutaneous tests. An inventory ought to be drawn up of the studies that should be made once these instruments are available:

- Studies on the correlation between the infection and the disease under different conditions.
- Studies to identify the groups for whom the risk of contracting lepromatous leprosy is high.
- Studies on the development of different types of leprosy under differing conditions.
- Studies to demonstrate endogenic reactivity and the hypothesis of leprosy reinfection.

There are similarities, differences, and interactions between tuberculosis and leprosy that are not fully understood. The epidemiological interactions between tuberculosis, leprosy infection, and the disease itself must be explored, together with the immunologic function of other mycobacterial infections.

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(*Source:* Tropical Diseases, Health Programs Development, PAHO.)

Yellow Fever Vaccination in the Americas

Yellow fever (YF) continues to be a major threat in endemic areas of South America and in adjacent areas where the virus may reappear even after long intervals of quiescence. In the Americas, this disease primarily affects workers engaged in forest activities. The latest cases of urban YF documented in the Region were ecorded in Brazil in 1942, although there is evidence that urban transmission took place during the 1954-1955 outbreak in Trinidad. Outbreaks in recent years in the vicinity of certain South American towns infested with *Aedes aegypti*, raise great concern regarding the possibility of urbanization of jungle YF.

Vaccination Programs

Vaccination is the only effective method of protecting man against jungle YF, and the 17D strain of YF virus is now used almost exclusively for vaccination against the disease.

The first 17D vaccine field trials were conducted in Brazil in 1937. Following these studies which showed that a practicable, safe, method of large scale immunization against YF was available, several South American countries initiated vaccination programs. As a result, in subsequent years these countries observed a significant reduction in the number of YF cases.

Routine Vaccination

Some countries maintain routine vaccination programs in areas where jungle YF is endemic. The criteria for selecting these areas is based on the occurrence of cases of the disease; forested areas with monkeys and vectors are also taken into account by certain countries. The latter criterion seems justified since YF has reappeared in some places after a dormant period of two or more decades.

Good vaccine coverage is hampered by the wide endemic area which covers practically half of South America. Operational limitations, such as transportation and communication difficulties and the lack of an adequate infrastructure to ensure a reliable cold chain are some of the drawbacks programs in many places commonly face. Moreover, dispersed population and isolated communities (as observed in the Amazon region) pose additional problems in reaching high-risk groups.

In countries where routine vaccination programs are carried out, the vaccine is delivered through stationary health facilities. In Brazil and Venezuela, however, this activity is also carried out by mobile teams. In Brazil rural communities located in endemic areas are visited by teams at five-year intervals. Since small-town residents within the same area may be in constant contact with forests, they are also vaccinated. The vaccinees are issued a certificate, but because the document is often lost, many revaccinations are probably performed unnecessarily.

In addition to these activities, vaccination is recommended for persons who travel from urban centers to rural endemic areas. In accordance with International Sanitary Regulations, individuals who travel abroad are also vaccinated. A total of 78 mobile and 66 stationary teams are maintained by Brazilian health authori-

ties. Most of the stationary teams are assigned to large cities. In Venezuela, a radio communication system links a central station with the vaccination posts, allowing daily monitoring of vaccination activities.

Other countries which regularly vaccinate against YF maintain stationary posts strategically located in endemic areas. Educational methods (including posters) are used to remind the population at risk to obtain YF vaccination. In some countries vaccination stations are placed along the routes of migratory populations moving to endemic areas. In certain colonized areas such as the Trans Amazonian highway, YF vaccination was required for the settlers before they were permitted to work.

Vaccination Campaigns

During YF outbreaks, most countries institute massive vaccination programs. In such circumstances vaccination teams are transported to the problem areas. Information on their arrival and activities is widely disseminated to the public by radio broadcasts and other means.

In certain outbreaks, new colonizers and temporary workers arriving from nonendemic areas are the main target for the disease; every effort should be made to immunize these population subgroups. In such cases, vaccination teams are deployed along the route taken by these migratory workers. In some instances roadblocks are built to detain vehicles transporting the migrants so that the vaccination teams may complete their work.

Although such campaigns usually are effective at halting the progression of the outbreaks, by the time they begin, a great number of cases have often occurred. Moreover, epidemics in South America often involve extensive areas, and consequently the campaigns may not effect an immediate reduction in the number of cases.

Since the campaigns are hastily implemented, many persons are often unnecessarily revaccinated; this problem is difficult to overcome. In any event, the campaigns are undoubtedly very useful, not only in controlling epidemics but also in preventing the reccurrence of more extensive and lengthy outbreaks in areas where adequate vaccination coverage is achieved.

In French Guiana, campaigns have been conducted at 10-year intervals since 1967. Over 90 per cent of the population was immunized in both the 1967 and 1977-1978 campaigns. The YF vaccination is compulsory in French Guiana, and is routinely administered, even during the campaign year.

In Trinidad and Tobago a mass vaccination campaign was undertaken in response to an outbreak of jungle YF that struck the island in 1978-1979; 96.4 per cent of the population over one year of age was immunized. A prior campaign aimed at vaccinating persons from forested areas was conducted in 1972 (in the absence of YF cases).

Certain countries adopt the containment vaccination tactic when sporadic cases are documented in the absence of evidence of an epidemic. The containment consists in vaccinating residents of the surrounding area where the reported case was living or working.

Vaccine Administration Methods

The ped-o-jet injector method of vaccine administration permits large numbers of persons to be vaccinated in a short period of time and should be used in emergency situations. During the 1973 YF outbreak in the State of Goiás, Brazil, 1,240,249 vaccinations were administered in approximately three months. The same method proved very useful in Colombia during the 1978 outbreaks which occurred in the northern part of the country. Cases were reported in the vicinity of certain Colombian towns highly infested with *Aedes aegypti*, and several patients required hospitalization in various towns, indicating that the risk of YF urbanization was imminent. The availability of the ped-o-jet facilitated prompt action and in the city of Valledupar, for instance, 92 per cent of its 117,000 inhabitants were vaccinated in four days. In Bolivia and Paraguay, also, ped-o-jets are used to vaccinate large population groups.

Vaccination by needle is the method elected for routine programs when a small number of persons is to be immunized. In French Guiana, however, this method is employed during campaigns as well, possibly because the country's population is small and dispersed.

Minimum Vaccination Age and Vaccination Coverage

In compliance with WHO recommendations, the minimum age adopted for vaccination is six months. Certain countries, however, administer the vaccine mainly to children above the age of one year.

Table 1 shows the number of persons vaccinated or the number of vaccine doses administered in seven countries and French Guiana, during the past five years (1978-1982). In general, countries consider the popula-

Table 1. Estimated population at risk and yellow fever vaccination coverage in some countries of the Americas and French Guiana, 1978-1982.

Country or territory	Estimated population at risk	No. of persons vaccinated or vaccine doses administered	Estimated vaccination coverage in endemic areas (%)
Bolivia	1,766,015	1,350,497	76
Brazil[a]	6,000,000	7,410,874[b]	80-100
Ecuador	309,818	137,720	44
French Guiana[a]	...	26,133	prob- > 80 ably
Panama[a,c]	96,212	39,617	41
Paraguay	1,744,973	682,349	39
Peru	3,638,602	979,582	27
Venezuela	1,076,633	826,073	77

[a]Vaccination campaigns undertaken in selected areas of Brazil (1973 and 1980-1982), and in Panama (1974) and French Guiana (1977).

[b]Includes revaccinations among the indigenous population and vaccinations of fluctuating populations.

[c]Data from Panama refers to 1977-1981.

...Data not available.

tion at risk to be those living in rural endemic areas. Caution must be used in interpreting such data in terms of vaccination coverage in the endemic areas, however, because in some countries a fraction (albeit small except, perhaps, for Brazil) of the vaccinees probably lives in large urban centers inside or outside the endemic area. A more important factor is that many persons are probably being revaccinated. Consequently, the true vaccination coverage may actually be lower for the period studied.

On the other hand, it should be noted that several countries undertook extensive vaccination campaigns in the 1973-1977 period. Therefore, if persons immunized at that time and those immunized by routine vaccination programs are included in the vaccination coverage estimate, obviously the figures would be higher.

In any event, it is important to develop a monitoring system to more accurately determine the vaccination coverage in the populations at risk, particularly in those areas where outbreaks are known to occur. For a true reading, such systems should estimate the coverage by locality.

Evaluation of Immunity

A few studies have been carried out recently to assess immunity among vaccinees. In Bolivia 142 persons from Santa Cruz presumably vaccinated against YF were examined in 1982, and 88 per cent had neutralizing antibodies to the French neurotropic strain (FN) of YF virus; antibodies were measued by a plaque reduction neutralization test (PRNT) and serum samples which neutralized 90 per cent of virus challenge at a 1:10 dilution (starting dilution) were considered positive. In Brazil at least 95 per cent of about 80 serum samples collected from persons bled 30 days, after vaccination under field conditions, had PRNT antibodies to the FN strain. In French Guiana 51 of 55 persons (92 per cent) had hemagglutination-inhibiting antibodies to YF antigen.

Although these studies indicate a good vaccine response, their limitations are obvious. It would be desirable, therefore, to assess the immunity to YF in representative samples randomly selected from certain population groups in endemic areas.

Vaccination Applications

It is estimated that tens of millions of persons have been immunized with the 17D vaccine which induces a seroconversion rate greater than 95 per cent. Less than 20 cases with neurological complications associated with its use have been reported, only one of which was fatal. These observations demonstrate that the vaccine is highly immunogenic and safe.

Vaccination Production in South American Laboratories

Most 17D vaccine used in the Americas is prepared in Brazil and Colombia. The two laboratories annually produce approximately 10 million and 2 million doses, respectively. Recently, potency tests with some lots of the vaccines made in these countries have been performed regularly under PAHO's coordination at the Bureau of Biologics, U.S. Food and Drug Administration. Although the vaccines have met the WHO criteria for potency when kept frozen, some lots showed a decrease in virus titer (sometimes to levels below acceptable standards) after storage at +4°C for a few months.

Needs in Vaccine Production

Several improvements are required in the production and testing of the vaccines prepared in the South American laboratories. Lack of adequate thermal stability is a major constraint, and because of this, the vaccine

requires a cold chain which is often difficult to maintain continuously, particularly in remote areas.

Other major problems identified in vaccine production include:

- disparity of seed lot substrain and presence of avian leukosis virus contaminants;
- high content of egg protein in the final product;
- certain degree of instability of some seed lots even when maintained at -70°C, after desiccation;
- low quality of some batches of eggs used;
- deficiencies in the freeze-drying process which leads to undesirable moisture content levels;
- inconsistency and cumbersomeness of vaccine titration in mice;
- shortage of rhesus monkeys for testing the secondary lot substrain;
- difficulties in large-scale production.

Such constraints have been identified by a group of experts during a PAHO/WHO meeting of the Working Group on Modernization of Yellow Fever Vaccine Production held in Washington, D.C. in January 1981.

As a result of identifying and analyzing these shortcomings, the group made two recommendations: 1) modernize current production techniques of the presently available egg vaccine; and 2) conduct research on the development of a vaccine produced in cell cultures; this would greatly improve the speed and possibly the economy of vaccine production and allow rapid expansion in the event of emergency situations.

In response to the first objective, Brazil and Colombia have improved the physical structure of their vaccine production laboratories using national funds. Besides, both laboratories are modernizing their vaccine production methods, with funds made available by the International Development Research Centre, Canada, and the Canadian International Development Agency. A portion of these funds was also provided to conduct research on thermostabilizing media for yellow fever vaccine.

Aiming to implement the second objective, PAHO is planning to convene a meeting in Washington, D.C. for 21-23 February 1984, to develop guidelines and protocols for the adaptation of yellow fever vaccine production to cell cultures.

(*Source:* Epidemiology Unit, Health Programs Development, PAHO.)

Editorial Comment

A previous report (*Epidemiological Bulletin* Vol.4 No.1, 1983) presented information on the yellow fever (YF) situation in the Americas in 1981-1982. Since vaccination is the only effective method for preventing jungle YF, it seems opportune to review the vaccination programs carried out by affected countries to protect susceptible populations.

Diseases Subject to the International Health Regulations

Cholera, yellow fever, and plague cases and deaths reported in the Region of the Americas up to 31 December 1983.

Country and administrative subdivision	Cholera cases	Yellow fever		Plague cases
		Cases	Deaths	
BOLIVIA	—	*12*	*12*	*21*
Beni	—	1	1	—
Cochabamba	—	8	8	—
La Paz	—	3	3	21
BRAZIL	—	*6*	*6*	*66*
Amazonas	—	1	1	—
Bahía	—	—	—	8
Ceará	—	—	—	58
Pará	—	2	2	—
Rondônia	—	3	3	—
CANADA	*2*	—	—	—
Ontario	1[a]	—	—	—
Ottawa	1[a]	—	—	—
COLOMBIA	—	*1*	*1*	—
Santander	—	1	1	—
ECUADOR	—	*5*	*1*	*65*
Chimborazo	—	1	1	65
Pastaza	—	4	—	—
PERU	—	*27*	*26*	—
Huanuco	—	1	1	—
Junín	—	4	4	—
Loreto	—	1	1	—
Madre de Dios	—	4	4	—
San Martín	—	17	16	—
UNITED STATES	*1*	—	—	*40*
Arizona	—	—	—	10
California	—	—	—	1
Colorado	—	—	—	1
New Jersey	1[a]	—	—	—
New Mexico	—	—	—	26
Oregon	—	—	—	1
Utah	—	—	—	1

[a]Imported.

Quantitative and Qualitative Methods: A Choice or a Combination?

Program evaluation in health and human services has a fundamental problem: in attempting to be scientific, it has relied too heavily on the experimental approach and quantitative methods. Regardless of the choice of strategy for program evaluation, i.e., quantitative or qualitative approach, certain decisions have to be made regarding how to define services provided by the program and the results of those services*(1)*. Quantitative methods are limited by inherent characteristics and requirements.

Requisites to Quantitative Analysis

Since, by definition, quantitative analysis involves counting, one of the first tasks is to define operationally (that is, describe in terms that can be observed, tallied, and recorded) those elements of the program which are of relevant actors. Regardless of the approach, if the evaluation is not focused theoretically or conceptually —if it asks the "wrong" questions—the results will not be useful.

Evaluation questions are deceptively easy to generate. In most cases each involved person can identify a list of things he would like to know about various aspects of the program. One method for keeping the list of questions within some potentially manageable range is to have actors identifying questions also specify in advance how that information might be used—that is, what actions or decisions could be influenced by that information. If none can be specified, then it is probably not worth the investment to generate that particular information.

Specifying Relevant Actors

After the first round of questions has been posed and the relevant information and its uses specified, it is advisable to review the initial selection of relevant actors. In many instances, the relevance of additional actors becomes obvious. The research process should be reviewed to determine that all relevant actors have been adequately considered.

Data Collection

Data for qualitative research are collected through three basic processes: observation, interview, and content analysis of documents. Observation is the heart of qualitative research methodology. Onsite observation of the ongoing program enables the evaluator to develop an understanding which cannot be acquired through any other method. A thoroughly and rigorously trained researcher knows what to look for, recognizes it when he sees it, and communicates his findings through rich, vivid, descriptive writing.

Patton*(2)* describes four types of interviews: informal conversational, interview guides, standardized open-ended, and response limited or close-ended. While each has appropriate uses and functions, generally the most useful is the interview guide. With this approach a trained interviewer-observer thoroughly versed in the types of data and information desired is provided a list of topics or issues to be covered in the course of th interview. The interviewer then decides the actual form of the questions to be asked as well as their sequence. The key to this interview technique is well-trained interviewers who understand what data are required for the evaluation and who are skilled at probing for answers and information.

Documents concerning all phases of program conceptualization, implementation, and functioning are rich sources of data for program evaluation. Program documents provide information and insights regarding the philosophy and rationale of the program, its origins, how the program changes over time, the primary actors in various phases and aspects of the program, and different perspectives regarding the intents, functioning, and purposes of the program.

Data Analysis and Presentation

One of the hallmarks of qualitative research is the "depth" of rich, vivid, descriptive detail which characterizes reports. Qualitative evaluations, in a sense, have some of the characteristics of a good novel in that the enable the reader to understand, envision, and exp

ıce the situation described. Qualitative evaluations seek to draw conclusions regarding the current state of the program and to make recommendations regarding changes to improve the future functioning and/or impact of the program.

The Case for Combination

While quantitative and qualitative research methods do differ, it is most productive to view them both as contributing toward our purposes in program evaluation. From a methodological perspective, it can be argued that the limitations of each approach are at least partially compensated for by the strengths of the other. Through qualitative methods, the context and functioning of a particular program can be described so that any results identified through quantitative methods can be understood and replicated.

In cases where the results of the two methods converge, the validity of the research is enhanced. For example, in a recent evaluation of an effort to regionalize public health services among six counties, one of the major questions was the extent to which regionalization had taken place. The quantitative indicators of regionalization portrayed "equity" among the counties ative to total population and various subpopulations deemed to be "at risk" or "in need". However, this documentation took on added meaning in the context of the manner in which program employees from each of the counties referred to the regionalized health department as "us" or "we".

Frequently, an initial divergence of research results offers an opportunity for enhancing understanding of the program, the problem it seeks to address, and the process by which the program achieves (or fails to achieve) some impact. It is likely that new understanding will be deeper and more complex than that which could be derived from the use of either of the methods alone*(3)*.

For example, in a primarily quantitative evaluation of a school curriculum, qualitative interviews were done with students, parents, teachers, and principals. It was found that one of the key teachers in the experimental program had not used the curriculum being studied because it had arrived too late. Needless to say, this surprising finding was useful in both understanding and interpreting the quantitative data.

When the two methods yield information that appears to be contradictory, it is the responsibility of the researcher to seek explanations. When there seems to be no way to integrate the data so that they "make sense", "the quantitative results should be regarded as suspect until the reasons for the discrepancy are well understood"*(4)*.

Perhaps the best, most simply stated case for integration of qualitative and quantitative methods is that "qualitative methods provide the context of meanings in which quantitative findings can be understood"*(5)*. And understanding of health and human service programs is what virtually all practitioners and program evaluators seek.

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(*Source:* Charles Taylor Grubb, Kenneth R. McLeroy, and Allan B. Steckler. *Focal Points,* August, 1983. Center for Health Promotion and Education, Centers for Disease Control, Atlanta, Georgia, USA.)

Reports on Meetings and Seminars

Meeting of the PAHO Advisory Group on Sexually Transmitted Diseases

Sexually transmitted diseases (STD) include the classic venereal diseases (syphilis, blennorrhagia, venereal lymphogranuloma, soft chancre, and inguinal granuloma) and a growing number of syndromes and clinical entities (nongonococcal urethritis, genital herpes, vaginitis, etc.) and primarily affect young adults and adolescents, constituting some of the most common reportable communicable diseases in the countries that have reliable statistics. Their serious economic and health consequences are manifested mainly in women (pelvic infection, infertility, ectopic pregnancy, chronic pelvic pain, etc.) and in infants (congenital problems, pneumonia, ophthalmia, infections of the central nervous system, perinatal mortality, etc). However, the social stigma associated with their genital acquisition has stood in the way of solid popular and governmental support of programs for the control of STD. In many countries these programs are limited to sporadic or periodic "control" of prostitutes and to the care (frequently inadequate) of symptomatic patients, for the most part males, who go to medical consultation units. Finally, a large number of patients are treated inappropriately by pharmacists and by persons without medical knowledge or outside the health sector.

An Ad Hoc Advisory Group on STD met in Washington, D.C. from 14 to 16 March 1983, for achieving health for all by the year 2000 and to formulate recommendations in regard to the collaboration PAHO can provide to Member Governments for the control of these diseases. The Group included participants from Brazil, Chile, Panama, and the United States.

The Group considered several factors in formulating the recommendations. Among these was the lack of knowledge about the magnitude of the STD problem due to the paucity of data and of adequate epidemiological analyses on the distribution of STD and their complications in the Region. On the other hand, the complex etiology of STD, the multidisciplinary attack that is required for its detection, diagnosis, treatment, and control (on the part of clinicians, epidemiologists, microbiologists, laboratory technicians, administrators, educators, sociologists, investigators, and other health personnel), plus their link with sexual behavior, were considered to not only distinguish them from the other communicable diseases but in addition to make it difficult for control activities to have an impact on them.

The lack of appropriate, accessible, and inexpensive technology for diagnostic tests, therapeutic compounds, and strategies for intervention were also recognized as factors that complicate control in many countries. On the other hand, the reduction and elimination of instruction on the STD in schools of medicine, nursing, and the health sciences and in graduate-level clinical programs in most of the countries of the Region was identified as a cause for the lack of trained personnel.

The sociodemographic trends in Latin America and the Caribbean, which indicate the formation of large urban nuclei and increases in the high-risk age groups population (15-39) in the next 16 years, presage a considerable rise in the number of cases and complications from STD and, consequently, an increase in the magnitude of the problem.

The appearance in 1976 of strains of penicillinase-producing *Neisseria gonorrhoeae* (PPNG) in North America, where they are now endemic, and their detection in 14 countries of the Region illustrate the vulnerability to the introduction of new pathogenic agents and the importance and need to develop and maintain a system of international and national epidemiological surveillance that makes it possible to respond to this type of problem.

The specific recommendations of the Advisory Group on PAHO technical cooperation for the control of STD at the regional level are as follows:

- Promotion and support of programs and activities aimed at the maintenance and reorganization of multidisciplinary national nuclei of high technical capability in the clinical, educational, microbiological, administrative, epidemiological, biostatistical, and operations research areas, which can advise the governments and facilitate integration of STD control in the existing health system.
- Organization and support for the development of manpower training programs in the clinical and laboratory areas, control methods, and program administration for STD.
- Support for the organization of advanced educational programs for training professors in the schools of medicine and health sciences in the Americas who are responsible for educating future professionals and technical personnel in medicine.
- Promotion and support of research proposals that contribute to a better knowledge of epidemiology of STD in different geographical areas and population groups (adolescents, pregnant women).
- Support to the countries for the updating, implementation, and evaluation of guidelines and standards for the diagnosis, treatment, and control of STD as adapted to local conditions.

• Support for the evaluation of technological advances (diagnostic tests, new treatments, etc) and their selection and adaptation, in accordance with local needs and circumstances.

Fulfillment of the recomendations requires the collaboration of PAHO in the following ways:

• Technical cooperation for the planning, implementation, and evaluation of activities for the control of STD in the countries through consultantships that supplement national technological capability. (Priority areas for advisory services in STD include: information systems, laboratory support, and managerial and administrative training in the control of STD.)

• Distribution of laboratory equipment and reagents and educational material adapted to the needs of the countries and based on the PAHO budget.

• Utilization of own resources and promotion and coordination of agreements of international and national technical cooperation between philanthropic organizations, the Centers for Disease Control, and similar institutions, the country's health assistance and educational institutions for manpower training at all levels, development of programs, and conduct of research on STD in Latin America and the Caribbean.

Meeting of the PAHO Working Group on Programs for Chronic Disease Control

The meeting was held in Washington, D.C., from 6 to 10 June 1983 with participants from Argentina, Barbados, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Jamaica, Mexico, Panama, Peru, Trinidad and Tobago, Uruguay, and Venezuela. The objectives of the meeting were: 1) learn about the current situation of chronic diseases in the participating countries with respect to their magnitude and the existence of activities and programs for their control; 2) discuss specific areas of possible action and analyze the concept of integration of chronic disease control activities within the general health services; 3) outline PAHO's role regarding programs for chronic diseases and especially discuss a regional monitoring project (MORE) that will make it possible to collet valid information on the development of activities and programs in accordance with the needs posed by the countries and, therefore, to rationalize technical cooperation.

Among the more important conclusions of the meeting were the following:

• Special emphasis should be given to the analysis of available information, especially at the local level, in order to facilitate programming at this level.

• The following were identified as program priorities: arterial hypertension, coronary disease, diabetes mellitus, cancer of the cervix, and risk factors such as smoking, obesity, sedentarism, and diet. Other important problems identified by some countries were endemic goiter, sickle cell anemia, and chronic rheumatism, as well as occupational risks, "stress", and genetic factors.

• Primary care level units are of prime importance as a portal of entry to the health system and should include program "packages" geared to primary prevention and chronic disease control based on the concept of integration.

• The need was indicated for intrasectoral and intersectoral articulation in the care of noncommunicable chronic diseases.

• Through the MORE project for integrated chronic disease control programs, it will be possible to know the situation in the countries and to orient regional technical cooperation in the context of technical cooperation among developing countries.

Calendar of Courses

Clinical Epidemiology Courses

With funding from The Rockefeller Foundation, the institutions mentioned below will offer one-year intensive courses in clinical epidemiology for junior faculty members from clinical departments of medical schools in developing countries. Participants will learn to apply the basic concepts of causation, bias, clinical measurement, natural history, and disease frequency. Supervised by a designated preceptor, the fellows will apply these skills in completing the design of a research project to be conducted in their own country on return. The opportunity will be provided to take part in faculty research programs designed to gain experience in practical research methods.

Financial support will cover tuition, travel, and maintenance expenses. On successful completion of the course, modest research support at the participant's

home institution and a visit to that institution by the preceptor to consult on the research project also may be provided.

Applications should outline past experiences, current interests and responsibilities, and future plans, and should be accompanied by a curriculum vitae and endorsing letters from the department head and dean which would include reasons for sponsoring the applicant. Correspondence should be addressed as follows:

Professor Stephen R. Leeder, Director,
Asian and Pacific Centre for Clinical Epidemiology,
Faculty of Medicine. The University of Newcastle,
New South Wales, 2308, Australia.

Professor Paul D. Stolley, Director,
Clinical Epidemiology Unit
Department of Medicine
School of Medicine Room 229L, TRINEB/S2
Philadelphia, Pennsylvania 19104
U.S.A.

Professor Peter Tugwell, Chairman,
Department of Clinical Epidemiology and Biostatistics
Faculty of Health Sciences
McMaster University
1200 Main Street West
Hamilton, Ontario L8S 4J9
Canada

Courses in the Epidemiology and Control of Tuberculosis and Acute Respiratory Infections

The following courses, organized by the Governments with PAHO collaboration, will be offered in 1984:

- *Venezuela:* 28 May-30 June
  Contact: Dr. Elsa T. de Salazar, Chief,
  Departamento de Tuberculosis y Enfermedades Pulmonares
  Ministerio de Sanidad y Asistencia Social
  Caracas

- *Chile:* 4 weeks August-September
  Contact: Dr. Edgardo Carrasco, Director,
  Instituto Nacional de Enfermedades Respiratorias y Cirugía Toráxica
  Casilla de Correos 9634
  Santiago

- *Argentina:* 5 weeks September-October
  Contact: Dr. Eduardo Balestrino, Director,
  Instituto Nacional de Tuberculosis
  Casilla de Correos 106
  Santa Fé 3000

- *Cuba:* 4 weeks September-October
  Contact: Dr. Rodolfo Rodríguez Cruz, Director,
  Departamento de Epidemiología
  Ministerio de Salud
  Ciudad de La Habana

- *Mexico:* 4 weeks September-October
  Contact: Dr. Carlos Pacheco, Director,
  Dirección General de Control de Tuberculosis y Enfermedades Respiratorias
  Leibnitz 32, 5° piso
  México 5 D.F

- *Brazil:* 5 weeks October-November
  Contact: Dr. Germano Gerhardt, Director,
  Divisão Nacional de Pneumologia Sanitária
  Rua do Resende 128
  Rio de Janeiro

International Symposium on *Salmonella*

This symposium will be held 19-20 July 1984 in New Orleans, Louisiana and will focus on practical methods to prevent *salmonella* in food animals and their products, and in humans.

For more information contact: Dr. G.H. Snoeyenbos, Paige Laboratory, University of Massachusetts, Amherst, MA 01003.

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