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Traffic Accidents in the Americas

Introduction

Traffic accidents have ceased to be the exclusive domain of the developed countries and have become, particularly among active young people, one of the principal causes of injuries, disabilities, and deaths in developing countries. Consequently, for each death in a traffic accident, on the average about 30 man/years of life expectancy are lost. This figure is considerably lower for cardiovascular diseases and cancer, which precede traffic accidents as a cause of mortality among the general population. On the other hand, individuals disabled by injuries in traffic accidents have displaced those affected by poliomyelitis in rehabilitation centers.

The economic impact is considerable; to direct costs such as damage to vehicles, roads, and property, medical care for the injured, and expenditures for administrative services indirect costs should be added, especially those due to the loss of potential productivity on the part of the victims.

In the countries of Latin America and the Caribbean (where great differences exist between countries or subregions), activities for the prevention and control of accidents and their consequences are, in general terms, at an incipient stage of development. In these countries, traffic accidents are assuming epidemic proportions due to the increase in the population and in the total number of registered vehicles, as well as to the growth in urbanization and industrialization. Advances in traffic legislation, highway education for motorists, and road and vehicle safety have not kept pace with the factors generating the problem.

Latin American and Caribbean countries should consolidate the progress some have achieved and promote similar developments in the rest. Improved support systems can translate that progress into concrete projects for preventing accidents and diminishing their consequences; the experience of the industrialized countries in this field can be creatively utilized and studies can be made of the countries' own situation in order to design appropriate programs.

Current Situation: Measuring the Magnitude and Seriousness of the Problem

As mentioned above, the countries of the Region of the Americas present widely diverse socioeconomic and cultural scenarios which include the most and

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least developed countries in the world; between these two extremes there is a great variety of situations. Human transportation is, of course, among the important variables in development.

Table 1 presents the number of motor vehicles registered in 1969 and 1980 and the percentage increases which ranged between 13.3% and 324.4% for 15 countries in the Region.

Table 2 relates the population and the total registered vehicles through the motorization index (number of motor vehicles/number of inhabitants), which ranged from 0.004 to 0.500 in 1969 and from 0.027 to 0.728 in 1980. A total of 14 of the 15 countries in which a comparison could be made had percentage increases in that period ranging between 12.2% and 875.0%; only one country (Cuba) experienced a decrease in this indicator. This table supports the assumption that the risk of traffic accidents among the population increased in almost all the countries analyzed.[1]

Regrettably, registration is uneven, since in most countries, data are collected only on those accidents considered serious. This inconsistency hinders verification and renders deaths caused by accidents a necessary yardstick, even though these are defined in notably different ways: for some, these are deaths at the site of the event, and for others, they are deaths within the month or the year following the accident.

Table 3 presents the traffic accident deaths in 1969 and 1980 as well as the rates per 100,000 inhabitants and per 10,000 vehicles, including the percentage variations observed for each of these two indicators. An analysis of this table reveals the following: in Costa Rica, Cuba, Ecuador, Guatemala, Panama, Peru, Trinidad and Tobago, Uruguay, and Venezuela the specific mortality rate from 1969 to 1980 registered an increase which oscillated between 9.7% and 167.3%; in Argentina, Chile, Canada, Colombia, Dominican Republic, El Salvador, and the United States reductions were noted in that rate ranging from 4.0% to 26.4%. The mortality rate per 10,000 vehicles increased in Cuba, Guatemala, Panama, and Uruguay and ranged between 1.9% and 90.0%; in the rest of the countries the rate decreased, ranging between 1.6% and 73.8%.

Table 4 summarizes the percentage variations of the five above-mentioned elements to provide a better comparative analysis. In general, it could be assumed that the increase in the motorization index contributed to raising the death rates per 100,000 population in nine of the countries analyzed; in contrast, it appears to have contributed to reducing the death rates per 10,000 vehicles in 10 of the countries.

[1] Another important index correlates the total registered vehicles with the kilometers of roadway: greater density suggests greater risk.

Table 1. Number and percentage variation of vehicles registered in selected countries of the Americas in 1969 and 1980.

Country	Registered vehicles		Variation
	1969	1980	(%)
Argentina	1,804,700	4,234,527	134.6
Brazil	2,490,900	...	...
Canada	7,746,800[a]	...	...
Chile	254,500	828,480	225.5
Colombia	264,300	817,611	209.3
Costa Rica	51,600	213,904	314.5
Cuba	265,700	371,287	39.7
Dominican Republic	51,400	207,501	303.7
Ecuador	56,300	...	...
El Salvador	47,200	145,680	208.6
Guatemala	52,800[b]	209,289	296.4
Mexico	1,465,800	6,221,397	324.4
Panama	53,200	137,721	158.9
Peru	306,900	486,048	58.4
Trinidad and Tobago	86,400	216,341	150.4
United States of America	99,563,400	165,700,000[c]	66.4
Uruguay	232.300	263,119	13.3
Venezuela	863,784	2,532,000	193.1

...No data available.
[a] 1968.
[b] 1967.
[c] 1981.

Table 2. Index and percentage variation of motorization in selected countries of the Americas in 1969 and 1980.

Country	Motorization index[a]		Variation
	1969	1980	(%)
Argentina	0.076	0.160	110.5
Brazil	0.028	...	...
Canada	0.373	...	...
Chile	0.027	0.076	181.5
Colombia	0.013	0.031	138.5
Costa Rica	0.032	0.098	206.3
Cuba	0.035	0.032	-8.6
Dominican Republic	0.004	0.039	875.0
Ecuador	0.010	...	...
El Salvador	0.014	0.030	114.3
Guatemala	0.011	0.027	145.5
Mexico	0.031	0.095	206.4
Panama	0.039	0.076	94.9
Peru	0.024	0.027	12.5
Trinidad and Tobago	0.085	0.187	120.0
United States of America	0.500	0.728	45.6
Uruguay	0.082	0.092	12.2
Venezuela	0.086	0.182	111.6

...Data not available.
[a] Ratio of vehicles/population.

Figure 1 shows clearly the correlation between the two indicators most widely used in measuring the magnitude and seriousness of traffic accidents: mortality rates per 100,000 population and per 10,000 vehicles. It can be seen that in the countries with a *very high* motorization index (as in the United States) the mortality rate per 10,000 vehicles reaches, approximately, 22.2% of the value of the rate per 100,000 population. In countries with a *high* motorization index (0.160-0.187) that rate reaches 50-75%

Table 3. Number of deaths from traffic accidents in selected countries of the Americas in 1969 and 1980 and percentage variation.

Country	Number of deaths		Mortality rates per 100,000 population			Mortality rates per 10,000 vehicles		
	1969	1980	1969	1980	Variation (%)	1969	1980	Variation (%)
Argentina	3,524	3,779	14.9	14.3	-4.0	20.0	8.9	-55.5
Brazil	...	20,217	...	16.4	...	...	...	...
Canada	5,696	5,170[a]	27.4	21.7[a]	-20.8	7.0	...	...
Chile	1,668	1,434	17.8	13.1	-26.4	66.0	17.3	-73.8
Colombia	2,026	2,242	10.2	8.5	-16.7	70.0	27.4	-60.9
Costa Rica	201	363	12.3	16.6	35.0	39.0	17.0	-56.4
Cuba	947	1,212	11.3	12.4	9.7	32.0	32.6	1.9
Dominican Republic	286	353	7.1	6.7	-5.6	56.0	17.0	69.6
Ecuador	837	1,817[a]	14.7	21.8[a]	48.3	149.0	...	...
El Salvador	296	371	9.1	7.7	-15.4	63.0	25.5[b]	-59.5
Guatemala	261	1,123	5.5	14.7	167.3	49.0	53.6	9.4
Mexico	...	17,507	...	26.8	...	...	28.1	...
Panama	114	364	8.3	20.0	141.0	21.0	26.4	25.7
Peru	1,336[c]	2,103	10.5[c]	11.8	12.4	44.0[c]	43.3	-1.6
Trinidad and Tobago	148	230	14.5	19.9	37.3	17.0	10.6	-37.6
United States of America	56,400	50,800[b]	28.3	22.2[b]	-21.6	6.0	3.1[b]	-48.3
Uruguay	177	400	6.3	14.0	122.2	8.0	15.2	90.0
Venezuela	2,424	5,211	24.2	37.4	54.5	28.0	20.6	-26.4

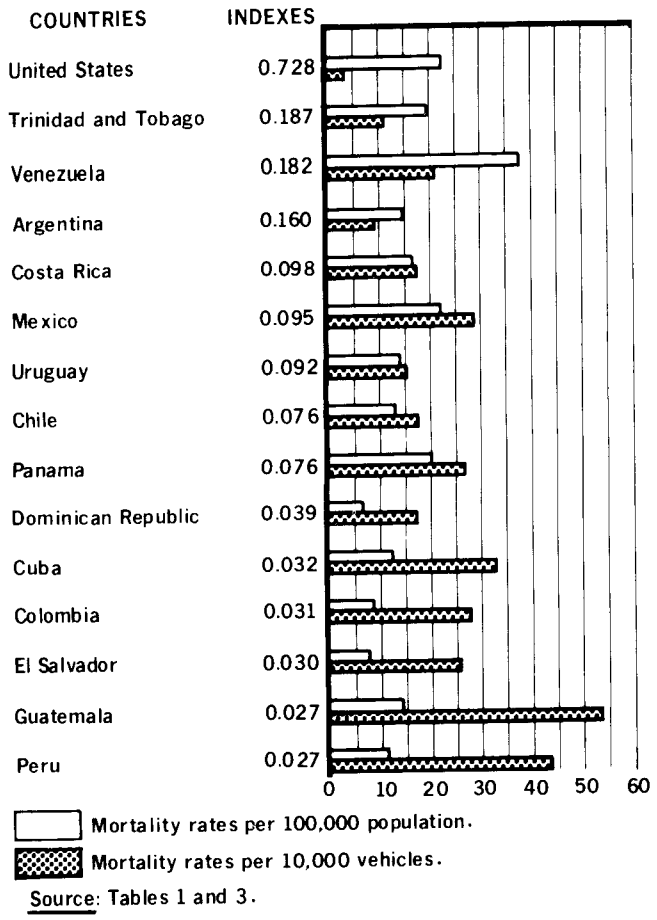
...Data not available.
[a]1978.
[b]1981.
[c]1967.

Table 4. Percentage variations of some indicators related to deaths from traffic accidents between 1969 and 1980 in selected countries of the Americas.

Country	Percentage variations				
	Population	Vehicles	Motorization index	Mortality rates per 100,000 population	Mortality rates per 10,000 vehicles
Argentina	-4.0	134.6	110.5	-4.0	-55.5
Canada	4.7	...	...	-20.8	...
Chile	6.5	225.5	181.5	-26.4	-73.8
Colombia	11.6	209.3	138.5	-16.7	-60.9
Costa Rica	11.4	314.5	206.3	35.0	-56.4
Cuba	5.0	39.7	-8.6	9.7	1.9
Dominican Republic	12.3	303.7	875.0	-5.6	-69.6
Ecuador	16.0	...	...	48.3	...
El Salvador	20.1	208.6	114.3	-15.4	-59.5
Guatemala	31.2	296.4	145.5	167.3	9.4
Mexico	8.4	325.3	206.4	...	...
Panama	9.4	158.9	94.9	141.0	25.7
Peru	13.9	58.4	12.5	12.4	-1.6
Trinidad and Tobago	7.0	150.4	120.0	37.3	-37.7
United States of America	6.9	66.4	45.6	-21.6	-48.3
Uruguay	-6.5	13.3	12.2	122.2	90.0
Venezuela	16.0	193.1	111.6	54.5	-26.4

...Data not available.

Figure 1. Ratio of mortality rates per 100,000 population and per 10,000 vehicles, according to motorization indexes in selected countries, Region of the Americas, 1980.



Source: Tables 1 and 3.

of the rate related to population (Trinidad and Tobago, Venezuela, and Argentina). In the countries with a *low* motorization index, Costa Rica, Mexico, and Uruguay (0.092-0.098) the two rates are close or equal; finally, in the countries with a *very low* motorization index (less than 0.080) the mortality rate per 10,000 vehicles is one or more times higher than the value of the rate for the population.

It should be noted that categorization of the countries according to the value of the motorization index is conventional and is only an attempt to explain the numerical phenomenon observed.

The PAHO/WHO Commitment

WHO categorically expressed its interest in traffic accidents during the XIX World Health Assembly in 1966 when the Member States approved a resolution encouraging the Organization to play a more active role in accident prevention. In 1976 a decision was adopted to delegate responsibilities to the Regional Offices of WHO, entrusting the management of the world program to the Regional Office for Europe.

Since the beginning of the 1970s, several seminars and meetings have been held in the Region of the Americas under the auspices of PAHO for the purpose of promoting the formulation of comprehensive national programs for preventing traffic accidents. Among these activities, the following may be mentioned: a seminar on "Alcoholism and Drug Addiction and the Problem of Traffic Accidents" (Lima, January 1976); two Andean subregional seminars (Lima, November 1977 and Guayaquil, December 1978), and a seminar on "Traffic Accidents in Developing Countries," held jointly with the World Bank (Washington, D.C., May 1979).

As part of the plan for studying the problem and establishing effective measures for accident prevention, a conference was held in Mexico City in November 1981 on "Traffic Accidents in Developing Countries." About 130 delegates from some 50 countries participated, representing different sectors of public and private service (particularly transportation and public health) and a broad range of disciplines. The discussions and recommendations were directed toward seven specific points: information, organization, legislation, alcohol and drugs, training and education, roads and vehicles, and international cooperation.

An important area of PAHO cooperation with countries interested in the problem is the provision of epidemiological and statistical support for measuring the problem; assistance in the planning and organization of services, including better data collection; and promotion of the training and education of personnel involved in the respective programs. An example of this is the "Course on Prevention and Control of Injuries in Traffic Accidents in Developing Countries," sponsored by WHO and held in June 1983 at the Johns Hopkins University, Maryland, United States.

PAHO's role is to collect and disseminate information on traffic accidents in the countries and thus promote the adoption of uniform terminology and statistical systems that make possible the collection of correct and comparable data.

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

Status of Chagas' Disease in the Region of the Americas

Current Status

Chagas' disease or American trypanosomiasis is a disease exclusive to the Region of the Americas that is transmitted to man mainly through contact with the feces of triatomid insects. Although vectors and infected wild reservoirs exist even in the southern United States and vectors may be found as far north as the State of Illinois, human infection is distributed almost exclusively from Mexico to Argentina and Chile (Figure 1). The majority of cases originate in the rural and periurban areas, where the disease persists because of the unstable socioeconomic conditions of the population combined with the domestic nature of the vector. However, the increasing migration from rural areas into the cities has made transmission through blood transfusion a possibility that must be taken into account. Studies made over the past 10 years also show that transplacental transmission is more frequent than had been assumed, since between 0.5% and 2% of the children of mothers with the disease are apparently born infected.

Calculations based on seroepidemiological studies suggest that there are between 10 and 20 million infected individuals in the Region and that 65 million persons are exposed to risk. There is evidence in South America that roughly 10% of the individuals infected develop the clinical symptoms and signs characteristic of chronic Chagas' disease.

This brief report summarizes the present status of Chagas' disease in the countries of the Region by compiling data available from various sources.

Figure 1. Distribution of Chagas' disease in the Region of the Americas.

Argentina

The area of transmission of infection by *Trypanosoma cruzi* includes the zones of the country located above Latitude 44° 45' South, totaling approximately 1,946,000 km^2. The high-transmission zone comprises eight provinces where the exposed population is estimated at 6,900,000.

In 1980 a total of 5,562 cases of Chagas' disease were notified.

The prevalence of infection among the male population of 18 years of age prior to entry into military service was 5.8% for the entire country in 1981, but in the high-transmission provinces this figure may go as high as 30%. That same year, in 13 provinces where there is a Chagas' disease control program, 8.7% of blood donors were found to have positive serology for *T. cruzi*.

In 1982 control activities reached more than 50% of homes in the critical areas, resulting in a distinct reduction in infestation percentages in the treated homes. These activities are currently being carried out in the 19 provinces affected.

Bolivia

The endemic area covers some 80% of the country's territory, which amounts to 1,099,581 km^2. Infected vectors have been found in seven of the nine departments into which Bolivia is divided. Based on data obtained by means of serology in different population groups, it is estimated that in the Cochabamba, Sucre, Tarija, and Santa Cruz areas, there could be more than 500,000 infected persons.

Brazil

Based on a serologic survey made from 1975-1981 in States of Acre, Alagoas, Amapá, Amazonas, Bahia, Ceará, Espírito Santo, Federal District, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraiba, Paraná, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Rondônia, Roraima, Santa Catarina, and Sergipe, it is estimated that 4.2% of a population of 40 million could be infected. The percentage of infected individuals who develop pathology is variable: in Minas Gerais, cardiopathy affects up to 40% of the infected adults, while this percentage is much smaller in Rio Grande do Sul. The majority of megaviscera were registered in the states of São Paulo, Minas Gerais, Goiás, and Bahía. The control activities have succeeded in interrupting domiciliary transmission in large areas of the State of São Paulo and in the more localized zones of Minas Gerais. The prospects are good for similar success in the short or medium term in the States of Rio Grande do Sul and Paraná and in part of Goiás and Mato Grosso do Sul. As of 1983 a sizable expansion in control activities has taken place.

Chile

The area of endemic transmission is in the rural and suburban areas of the northern half of the country between Latitudes 18°30' and 34°36' South. There are approximately 1.8 million persons living in the endemic area and it is estimated that 17% of them could be infected. A study is currently underway of 0.6% to 1% of the population at risk and preliminary data indicate that from 13% to 59% of the houses studied had triatomids. The percentage of human infection was 20.3%, and 19% of those infected presented electrocardiographic changes. The serologic positivity rate for *T. cruzi* in blood banks ranged from 1.9% to 6.5%.

Control activities are being carried out in the area located between Latitudes 29°12' and 32°10' South, measuring 170 km across and 340 km in length; the exposed population numbers approximately 110,000.

Colombia

Of Colombia's natural regions, that of the Catatumbo River basin, the eastern region (mainly in the Piedemonte, Macarena, and Meta Cercano subregions) and the Magdalena River Valley region are those with the highest transmission. Studies conducted in the Norte de Santander Department showed that around 30% of the individuals studied had positive serology and 9% of them displayed electrocardiographic changes. In the same area, 15.6% of the houses studied had the vector and 2.25% of the triatomids captured were infected with *T. cruzi.*

Costa Rica

The vector is found in the country's central plain and adjoining zones, extending primarily to the northwest and southwest regions. Research in the center of this area, in Alajuela Province, has revealed 34.6% of the houses surveyed to be infested, with 30% of the insects captured carrying *T. cruzi.* Serology was positive in 11.7% of the individuals studied and 24.3% of the infected persons had electrocardiographic changes.

Ecuador

Transmission is considered to be highest in the coastal region, which includes the Provinces of Manabí and Guayas. The greater part of the human cases are from the city of Guayaquil, the capital of Guayas Province. In 1980 a control program was carried out in Guayaquil and in Manabí Province.

El Salvador

The data accumulated to date suggest that American trypanosomiasis is endemic in a large part of the country. The vector is present in 30-80% of the rural dwellings and small or medium urban nuclei that account for 70-80% of the homes in the country. Around 25% of the triatomids are infested with *T. cruzi.* The positive serology observed among the populations concerned was over 20%.

Guatemala

Data covering more than 20 years indicate that 6% of the human sera examined were positive for *T. cruzi.* The infection is most frequent in the Departments of Chiquimula, Jalapa, El Progreso, Santa Rosa, and Zacapa. More recent data show 15% of the sera to be reactive.

Honduras

The vector has been found to be present in the Departments of Choluteca, Comayagua, Copán, Francisco Morazán, Intibuca, Lempira, Ocotepeque, Olancho, El Paraíso, La Paz, Santa Barbara, and Yoro. Depending on the species, between 32.2% and 34.7% of the insects captured were infected. Limited serologic surveys among the population of the Departments of Choluteca, Comayagua, Francisco Morazán, El Paraíso, and Valle showed that 36.8% of the individuals studied had *T. cruzi* antibodies.

Mexico

Human cases of infection by *T. cruzi* have been described in the States of Chiapas, Guerrero, Mexico, Michoacán, Oaxaca, Tabasco, and Zacatecas. Prevalence is considered greatest in the Pacific Coast States from Chiapas to Nayarit, in the Yucatan Peninsula, and in certain places in the Altiplano. Serologic surveys made in 60 communities in Oaxaca State showed 16.3% of those studied to have positive serology. The fact that a very low percentage of children was found to be infected suggests that transmission has been virtually interrupted. In the locality of Nopala, Oaxaca State, it was found that between 8% and 20% of the population with positive serology for *T. cruzi* had electrocardiographic changes. In another two serologic surveys conducted in communities in Chiapas State, positive sera percentages of 0.3% and 3.6%, respectively, were found. In five of the communities studied, the positive serologies among children under 12 suggests the existence of active transmission of the infection.

Nicaragua

While no recent data are available, earlier studies indicate that individuals infected with *T. cruzi* have been found from Chinandega, Estelí, Jinotega, Madrid, Managua, Masaya, Matagalpa, and Rivas. The main area where the domestic triatomids are apparently found is the mountainous part of the northwest and of the central region and parts of the Pacific coast.

Panama

The vectors of *T. cruzi* are found in seven of Panama's provinces and in the Canal Zone. In certain areas up to 16% of homes were found to be infested, and 30% of the triatomids captured were infected. The prevalence of individuals with positive serology ranged from 3% to 22%.

Paraguay

Practically all the country's rural areas can be considered endemic *T. cruzi* infection zones. Isolated studies suggest that the prevalence of human infection may vary from 10% in the Misiones region, to 53% in the Cordillera, and 72% in the Paraguayan Chaco. In general, in the Departments of Itapúa, Alto Paraná, Canendiyú, and part of Amambay the prevalence of infection is less than in the other Departments. Control activities were carried out in the Yacireta program area and in localities of the Departments of Boquerón and Nueva Asunción. In these Departments, triatomids were caught in 31.3% of the houses surveyed; 18.2% of these were found to be infected.

Peru

The greatest prevalence of human infection (approximately 12%) has been found in the Departments of Arequipa, Moquegua, and Tacna. The house infestation index in Arequipa Department was 13.1% with a tripano-triatomid index of 27.6%. In Moquegua Department these figures were 19.1% and 27.5%, and in Tacna Department 3.6% and 7.1%, respectively. The control program is carrying out its activities in the southwest of the country, covering an area of 119,500 km^2.

Uruguay

The endemic area covers approximately 125,000 km^2 of the country's total area of 187,000 km^2, and includes the Departments of Artigas, Cerro Largo, Colonia, Durazno, Flores, Florida, Paysandú, Río Negro, Rivera, Salto, San José, Soriano, and Tacuarembó. It is estimated that 132,000 of the 950,000 persons living in this area are infected. Partial serologic surveys indicate that the prevalence of human infection in the Departments of Artigas, Paysandú, Rivera, Río Negro, and Salto, is from 4.5% to 15.7%. The percentage of homes in which the vector was captured was from 1% to 6% and between 4.8% and 12.4% of the insects captured were infected. This area, considered to be the one of highest endemicity, covers about 76,000 km^2 and has a population of around 470,000. Control program activities covered these Departments and the Cerro Largo Department.

Venezuela

Data from the beginning of the 1970s showed that almost 50% of a sample of rural area residents were infected with *T. cruzi*. It was accordingly possible to estimate at 1,200,000 the number of persons in the country who might be infected. The number of cases with cardiopathy due to Chagas' disease was put at 270,000. The aim of the control program was to eliminate domiciliary transmission in the infested area, which comprises 591 municipalities covering 697,049 km^2 with a population estimated at 11,392,894 in 1982. Serologic surveys of the population aged from 0 to 9 years showed that the prevalence of infection, some 20.5% between 1959 and 1968, decreased to 1.3% in 1980-1981. Thus, the control program has brought about a substantial drop in domiciliary transmission of Chagas' disease.

Other Countries

Vectors and infected wild reservoirs or only wild triatomids have appeared in: Antigua, Aruba, Bahamas, Cuba, Curaçao, Grenada, Guadeloupe, French Guiana, Haiti, Virgin Islands, Jamaica, Martinique, Dominican Republic, St. Croix, St. Vincent and the Grenadines, and Trinidad and Tobago. In the latter, as in Belize, cases of human infection have been found. In Guyana three cases were confirmed in 1981. In 1982 the first autochthonous case was noted in the State of California; this was the third registered in the United States of America.

Diagnosis and Treatment

Direct microscopic observation and xenodiagnosis are still the most commonly used methods for detecting parasitemia in cases of acute and chronic infection, respectively. As the latter is not a technique within the reach of all the services and is moreover of low sensitivity, other methods are being devised to take its place. Serologic diagnostic techniques such as complement fixation, indirect hemagglutination and immunofluorescence, direct agglutination, or immunoenzymatic methods have been simplified and the reagents can be supplied by laboratories in the Region. Using at least two of these techniques simultaneously in conjunction with adequate quality control minimizes the possibility of false positives or negatives. In general, their use is fairly widespread, even in laboratories of medium complexity. Unfortunately, many laboratories still do not routinely perform serologic diagnosis of Chagas' disease or are not connected with a referral system through which this service could be obtained. It is imperative that quick and simple screening techniques be developed to facilitate serologic diagnosis.

Two drugs, nifurtimox and benznidazole, are effective in treating 75% to 95% of recent *T. cruzi* infection cases. However, only a small proportion of recent infections are diagnosed and treated. Health workers need to be trained to take *T. cruzi* into consideration as an etiologic agent in cases where the symptoms displayed (including febrile syndromes normally attibutable to other etiologies) are not those characteristic of Chagas' disease; the primary and secondary care system must be provided with appropriate means at each level so that the diagnosis can be verified and effective treatment promptly instituted. Once the infection is chronic and the symptoms and signs such as cardiopathy and/or megaviscera are present, it is unlikely that the drugs mentioned above will be able to modify the progressive development of the disease.

Control Measures

Control of infection by *T. cruzi* depends primarily on elimination of the vector from rural housing. Although more than 50 species of triatomids with natural *T. cruzi* infection have been described, only 12 are of epidemiological importance and three *(Triatoma infestans, Rhodnius prolixus,* and *Triatoma dimidiata)* are well adapted to human dwellings and are the main vectors. However, and by way of example only, in parts of Bolivia, Brazil, Panama, and Venezuela other species such as *T. sordida, Panstrongylus megistus, R. pallescens,* and *T. maculata* can cause problems. Vector control is effected by means of residual insecticides. Problems with insecticiding arise from its cost, residual power, availability, and the fact that the houses are scattered and often reinfested. Although the resistance of *R. prolixus* and *T. maculata* to insecticides such as dieldrin and hexachlorohexane has been documented, there is no evidence to date that this problem affects the operation of the control program against these and other species. However, it will be necessary to implement a system for monitoring vector susceptibility to the insecticides used.

Improvement or change of housing offers a more permanent solution. Relatively simple steps such as changing a roof or flooring or plastering walls significantly reduce the population of *R. prolixus, T. dimidiata,* and *T. infestans,* respectively. The technical difficulties connected with the design of the dwellings, sociocultural factors which lessen the people's desire for change, and, of course, the financial cost are all problems that can be solved. There are eight countries with control programs based on health education and on interior and exterior domiciliary spraying with residual insecticides. Limited housing modification schemes have also been carried out in 12 of the 19 provinces in which Argentina's program operates, in the northeast of Brazil, and in certain areas of Venezuela.

The migration of rural dwellers into the cities has led to the frequent observation of Chagas' disease in urban areas. This adds to the work of the already overburdened health services and means that the risk of using infected blood in transfusions is increased. Since the use of crystal violet for eliminating *T. cruzi* from blood was not accepted and as long as there is no drug to take its place, serology must be

employed in identifying and rejecting as blood donors persons infected with *T. cruzi*.

The total and permanent elimination of transmission in rural areas cannot be achieved by the health sector alone. The integrated cooperation of the different sectors will be needed in a context of active community participation and sustained support from the policy-making level that will approach the problem from several different angles.

The end purpose is economic development of rural areas in order to increase their productivity and facilitate the marketing of agricultural production, thus raising the living standard of the rural population and breaking the vicious cycle of poverty, ignorance, and disease.

Until this is achieved, it should be ascertained that the basic tools are available for implementing a control program. These will have to be used in a coherent and sustained fashion in the areas of highest transmission, constantly evaluating the actions carried out and giving the community greater responsibility for epidemiological surveillance activities in the program which should itself be integrated in the health services' general network. Success in interrupting transmission will depend on proper and appropriate use of all available resources.

Clearly, rural development projects should consider introducing a housing improvement component. Malaria prevention and control programs which exist in various countries are a resource that should also be used in the control of Chagas' disease.

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

Diseases Subject to the International Health Regulations

Cholera, yellow fever, and plague cases and deaths reported in the Region of the Americas up to 30 April 1984.

Country and administrative subdivision	Cholera Cases	Yellow fever		Plague Cases
		Cases	Deaths	
BRAZIL	—	*16*	*15*	*5*
Amazonas	—	6	5	—
Bahía	—	—	—	1
Ceará	—	—	—	2
Minas Gerais	—	—	—	2
Pará	—	9	9	—
Rondonia	—	1	1	—
COLOMBIA	—	*3*	*3*	—
Cesar	—	1	1	—
Cundinamarca	—	1	1	—
Santander	—	1	1	—
ECUADOR	—	—	—	*6*
Chimborazo	—	—	—	6
PERU	—	—	—	*16*
Cajamarca	—	—	—	16
UNITED STATES	—	—	—	*4*
California	—	—	—	1
New Mexico	—	—	—	1
Texas	—	—	—	1
Washington	—	—	—	1

Application of Epidemiology in Medical Technology Assessment[1]

Medical technology presents both opportunities and problems: the former lie in its potential to assist in preventing, treating, or diagnosing health conditions or in rehabilitating and improving the function of those with health problems; the latter occur in the areas of cost, efficacy, and safety. Technology has contributed much to advancing health in this century. WHO and PAHO are deeply committed to promoting the development and use of appropriate medical technology. The array of potential drawbacks associated with this technology include: increasing costs, problems of efficacy and safety, issues concerning technology transfer from more to less developed countries, and political and social concerns such as the distribution of resources within a country.

These problems and opportunities have generated a variety of policies ranging from promoting certain types of research, to regulating the import of certain devices and controlling the adoption of new technology through budgetary means. Policy mechanisms are mentioned here merely to indicate that the main purpose of technology assessment is to assist policy makers in decisions that are implemented through public institutions.

The growing prominence of medical technology as a policy issue for all countries has stimulated a similar concern in the area of technology assessment whose central aim in the health sector is to question whether a particular action or policy is worth pursuing. This practical focus is essential—if the results of an assessment are not used, there is little point in doing it.

Definitions

Technology has been defined as the "systematic application of scientific or other organized knowledge to practical tasks" (*1*). Medical technology, then, may be understood as "the drugs, devices, and medical and surgical procedures used in medical care, and the organizational and supportive systems within which such care is provided" (*2*). This article focuses on drugs, devices, and procedures.

Technology assessment is a comprehensive form of policy research that examines the short- and long-term consequences (e.g., societal, economic, ethical, legal) of the application or use of technology. Its goal is to provide decision-makers with information on policy alternatives such as the allocation of research and development funds, formulation of regulations, or development of new legislation (*3*). Medical technology assessment tends to focus on efficacy and safety by asking "Does it work?" "Is it safe?" and "How large an impact on the health status (e.g., mortality) can we expect from widespread application?" There are many aspects open to evaluation besides the efficacy and safety of medical technology.

Technology assessment provides a basis for a functional definition of appropriate health technology—one especially suited or compatible with needs, whose efficacy and safety (for the populations and health conditions affected), costs (in the context of local financing and priorities), and cultural compatibility meet the requirements of the local area or group (*4*). Assessment reveals whether or not the technology satisfies these needs.

Broad social, ethical, and cultural concerns are not evaluated by epidemiological methods, so they will not be addressed here; costs, however, can be assessed in this type of study and will be discussed briefly subsequently. This article focuses primarily on assessing the efficacy and safety of medical technology.

Determining Needs

The appropriateness or utility of a technology is grounded in knowing the status of the society's needs. The major tool for determining these is the evaluation of present health conditions through routine data collection and epidemiological surveys. Often, important information for determining these necessities is not available, especially in less developed countries. The best obtainable data should be used in planning health care services which ought to include selection and deployment of appropriate technological interventions.

The Distribution of Technology

Knowledge of what technology is already implemented is an element of rational planning that helps pinpoint unmet needs.

[1] Presented by Dr. H. David Banta, Deputy Director of the Pan American Health Organization at the Seminar on Uses and Perspectives of Epidemiology, Buenos Aires, Argentina, 7-10 November 1983.

Like diseases, technologies may be identified through a variety of epidemiological techniques. Existing registries and data sources are obviously the easiest way to determine the distribution of technology: for example, the U.S. Food and Drug Administration requires the reporting, for regulatory purposes, of any new computed tomography (CT) scanner installed in the United States. Health planning agencies often have data on existing medical technology; unfortunately, technologies regularly reported in this way are the exception.

Medical technology is also frequently the subject of routine, recurrent surveys: the Hospital Discharge Survey of the U.S. National Center for Health Statistics asks about certain technologies, especially surgical procedures; the American Hospital Association conducts an annual survey of hospitals in the United States and includes a number of questions on specific technologies and technological applications.

Few technologies can be identified this easily; often, a special survey is required to determine their distribution. For example, the U.S. Office of Technology Assessment carried out a survey to determine the location of CT scanners in the United States (*5*). In this instance there were a number of data sources, but none of high quality. Health planning agencies were asked to verify data and contradictions or gaps were confirmed by directly contacting the institutions and offices involved. Likewise, a special survey was made in Mexico to determine the presence of certain technologies in public hospitals (*6*). J.F. Wennberg and his colleagues (*7*) studied small area variations in discretionary surgery using such data. They found that rates varied dramatically between different contiguous areas in New England. They also encountered remarkable differences among countries: the rate of hernia repair in New England is 276 per 100,000 (age- and sex-adjusted), compared to a rate of 186 in Norway and 89 in England. Rates in England and Norway also vary considerably among different areas. Results such as these indicate that technology is not being used rationally.

The main purpose of this kind of research is a quest for causes or determinants, as in epidemiology. Why does a technology have a certain distribution? How could it be affected? Public policies can also be examined in light of their results. Research in the United States indicates that health planning agencies produced little impact on the distribution of CT scanners, but that public agencies which controlled rates of reimbursement to hospitals had a significant effect (*8*).

Little is known about the distribution of medical technology in Latin America. While it is often said that expensive technology is found primarily in private hospitals, no systematic information is available on the subject; much fruitful research could be done in this area. The effective use of machines is another problem which needs investigating: 96% of all medical equipment imported in one country between 1973 and 1976 was not functioning in 1981 in part due to a lack of maintenance, but also because much of the equipment had not even been removed from its crates.

Examination of Efficacy

Overall, little is known about the efficacy of specific technologies. Few have been studied by rigorous methods (*2*) and this greatly hampers a rational approach to their deployment. In the United States, while there is an apparent overuse of many technologies, information on the efficacy and safety of medical technologies is increasingly used in making policy decisions (e.g., whether specific procedures should be provided by the Medicare program).

Specific methods are available for evaluating the effect technologies have on health. There are methodologic principles that guide the interpretation of any particular investigation. Each method has its strengths, weaknesses, and limitations for detecting favorable or unfavorable outcomes associated with a technology. Some of these methods are purely epidemiological; others, such as the randomized clinical trial (RCT) use epidemiological principles and depend on statistical methods for their design and interpretation.

Perhaps the most important use of epidemiological principles in approaching efficacy, however, is in the interpretation of available data. Often, planners fail to carefully scrutinize available study data which frequently contains important clues to efficacy. The data should be sufficient to give an idea of expected effects of applying a technology, especially in comparison with its alternatives. This can be critical in designing an experimental study.

RCT's are considered the most definitive method for evaluating the efficacy or health benefits of a technology (*9*). An essential element of an RCT is randomization: patients are randomly assigned to one of at least two groups—one or more study groups in which subjects are exposed to the experimental treatments, and a comparison group in which the subjects are exposed to the control situation. The control con-

dition can be either no treatment (usually a placebo treatment), the standard treatment (for comparison with a new treatment), or a variation (e.g., a different dosage) of the experimental treatment. The basic question is: are the effects observed in the experimental group also observed in the comparison group? If the answer is essentially "no", the effects observed in the experimental group can be attributed (within the limits of probability) to the treatment technology.

Efficacy assessment in the area of diagnostic technologies is more complicated. A treatment technology should result in a clear health objective, such as preventing mortality or morbidity. The main product of a diagnostic technology is a diagnosis and epidemiological concepts of sensitivity, specificity, reliability, and validity are often used in an attempt to determine the efficacy of diagnostic methods. Screening procedures are even more awkward to evaluate using standard questions related to yield and whether there is an efficacious treatment available for those conditions.

Because of primarily logistical and financial difficulties encountered in conducting RCT's, other epidemiological methods are being increasingly applied to medical technology. Observational studies may be valuable in generating or testing hypotheses about the effects a technology has on health once it is widely diffused. These studies also may be considered in situations where experimental ones are inappropriate or impossible to conduct. The common element in all observational studies is that the investigator does not control the application of the technology under study. The division of a population group into "cases" and "controls" or "exposed" and "unexposed" occurs through mechanisms unrelated to carrying out a study, such as the treatment preference of a physician. This leads to almost inevitable questions about the validity of the results of such studies. Observational studies may, nonetheless, allow evaluators to rule out competing explanations for the observed effects.

Another important factor in considering the results of efficacy studies is that an experimental study examines effects in a controlled setting. For the most part, this means that the staff are well-trained, the technology is used as optimally as possible, the patient is closely observed, and so forth. However, when applied in the community, a technology of previously demonstrated efficacy may not have beneficial effects: the patient may not take the drug; the surgeon may not be skillful; and the disease in the community setting may be less severe than the form found in the teaching hospitals. These real-life factors modify the health benefits the population receives. "Effectiveness" refers to benefits obtained in the community setting, and is studied by the epidemiological methods described above. Unfortunately, there have been few studies of effectiveness, and little is known about how the efficacy and effectiveness of specific technologies compare.

Finally, the policy maker is not necessarily interested merely in the question of whether a technology is efficacious. He or she usually will wish to know its efficacy in comparison with something else. What are the alternatives? How effective are they? Few technological studies are comparative and in general, this question cannot be effectively addressed by available data.

Examination of Safety

While the experimental study is the most important tool used to examine efficacy, epidemiology serves most effectively to determine technological safety. Most adverse consequences of medical technology occur at low rates and prospective experimental studies are necessarily limited in size. Therefore, an experimental study usually will not result in enough adverse consequences to determine with confidence that these were due to the technology in question.

There is a great deal of experience in studying drug safety. In addition to the very important animal studies, post-marketing surveillance using a prospective cohort design has proved useful. Typically, a user population of a particular drug is entered into a registry and followed over time through various health events, the rates of which are compared with those in a non-user population. Unusual medical occurrences may thus be associated with the use of the drug. Drug reactions may also be determined by methods such as reporting and special surveys; case-control studies are particularly useful for discovering rare complications.

Little systematic information is collected on the safety of technologies other than drugs. The mortality rate for surgical procedures is generally known from case reports. Some safety factors may be noted, depending on the technology and the setting in which it is used: if the technology is used primarily in the hospital, for example, common effects are likely to be observed while less severe ones often go undetected;

and such "trivial" effects as pain may not even be considered a problem by physicians providing the treatment.

Examination of Costs

Examined independently, costs have little meaning, even in poor countries; rational choice requires that they be seen in relation to benefits. Without knowing costs, benefits likewise resist interpretation. Ideally, the policy maker should consider both when making choices; the goal of technology assessment is to improve and inform that choice.

Cost-effectiveness analysis is probably the best available method for establishing costs in relation to benefits in the health field. However, this analysis cannot be usefully made of a single procedure—it must examine alternatives; this means that it is quite often difficult to put epidemiological data in a form that is useful for cost studies.

One option that has not been widely implemented is to include cost or economic aspects in a clinical or epidemiological evaluation (*10*). This could be done relatively easily in a prospective study requiring the participation of economists in a cooperative venture. Epidemiologists need technical assistance in making economic studies as do clinicians in performing epidemiological studies.

Summary and Conclusions

In an area of limited resources, choices become more and more problematic, particularly in less developed countries where health expenditures are being reduced. Now is the time to expand the use of technology assessment as an aid to making choices. An important implication of this situation is the need to include this kind of assessment in training and educating health professionals such as epidemiologists.

It should be remembered that these choices are not technical, but political and social in nature. They are appropriately made by politicians and policy makers on the basis of many factors, including some that cannot be easily assessed. Scientific studies, however, can aid policy making. The foregoing indicates how epidemiology can contribute to the development of knowledge on the effects of technology. The challenge is to appropriately integrate assessment results into the decision-making process.

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Reports on Meetings and Seminars

Inter-American Conference on Health Technology Assessment

The evaluation of health technology is a field of research that uses the epidemiological method to identify the real benefits obtained from science and technology to the promotion of health.

The National Council for Scientific and Technological Development of Brazil, in conjunction with the Ministries of Health, Education, and Social Security and Welfare, the National Institute of Medical Care and Social Security, the National Council on Human Resources, the Studies and Projects Financing Corporation, and with the participation, encouragement, and assistance of PAHO, organized and financed the Inter-American Conference on Health Technology Assessment (Brasília, 14–18 November 1983) which had the following objectives:

- Study the development, introduction, and use of modern medical technologies in health care in industrialized and developing countries;
- Examine the scientific methodologies available for assessing the use of existing technologies;
- Establish guidelines for fostering research to assess both new and established diagnostic and therapeutic technologies in order to evaluate (through cost-benefit and cost-effectiveness analysis) their potential benefits and optimum use.

The following conference report was approved in plenary session:

General Recommendations

- That each country establish policies for introducing new technologies such as equipment, drugs, and procedures for diagnosis, prevention, and cure of disease and rehabilitation of patients, and for implementing, using, and disseminating methods for assessing those technologies;
- That the assessment of health technology be consistent with the overall economic, social, political, cultural, and scientific development of each country, and be directed toward evaluating the technological development process and the impact technologies have on the population's health;
- That Third World countries seek their own development in the field of health technology, including production in accordance with internal priorities; and
- That PAHO include the topic "Assessment of Health Technology" in the agenda of the XXII Pan American Sanitary Conference (1986) and promote a "Year of Technological Self-Determination in Health."

Specific Recommendations

1. On policy for the introduction of technology:

- That a model to regulate and govern the introduction of health technology be rapidly devised for adaptation and use by each country in accordance with local conditions;
- That mechanisms be developed at the national level to oversee and control the importing of foreign technology in order to protect national development without neglecting the real demands for health care;
- That the countries themselves make policy decisions to strenghten their production facilities in the health field and promote technological research;
- That, until domestic production of health technology is underway, each country import foreign technology only to the extent that it supplies resources essential to the solution of its health problem.

Government agencies licensing the acquisition and use of new health technologies must establish minimum utilization requirements which should include the following criteria:

- The new technology must be applicable to priority health problems;
- The initial cost of technology installation must be made explicit;
- There must be a guarantee of proper maintenance of equipment which includes the availability of personnel, supplies, and financial resources;
- The expected service life of the equipment must be specified;
- The population to be served must be defined;
- There must be a projection of the impact the new technology will have on the population's health; and
- Satisfactory evaluation reports on the new technology must be available.

2. On technological evaluation:

- That a regional center be set up at PAHO for the collection, storage, technical analysis, and dissemination of existing information and data on the

evaluation of health technology, including literature reviews, availability of alternate techniques, and personnel and material resources in each country. Similar centers should be established at the national level;

- That provision be made for technical consulting services to evaluate health technology where and when needed;
- That interested agencies conduct campaigns to educate the population, governments, and universities on the need for health technology assessment;
- That a health technology assessment system be set up at the national level. As a prerequisite, information on health and related fields should be compiled in order to identify the principal problems in the area, establish priorities, and provide a context in which the evaluation of technology can be developed. These tasks should be entrusted to a specific technical group.
- That the system referred to in the foregoing recommendations be directly linked from its inception to all the components of and participants in the country's health system (i.e., medical associations and industries connected with the health system, and government agencies that determine economic and scientific policy);
- That the aforementioned health technology assessment system provide specific information on the country's imported and domestic technologies to all decision-making authorities in the areas of planning, advisory services, and technical assistance at the central level;
- That institutions using technology participate in studies to promote the production of health technologies, with a view to providing information to manufacturers on the efficacy of said technologies;
- That each country endeavor to devise effective machinery for the dissemination of information on alternative technologies generated by individual researchers, independent groups, and health research and service delivery institutions in Latin America; this information should emphasize technologies which render the greatest social benefit. Conditions for discussing the impact of technology on the health system should be fostered in meetings, conferences, and publications.
- That multi-level manpower training programs be established and promoted in each country, in order to disseminate methodologies geared to evaluating health technologies and developing critical assessments of new and currently used technologies.

The participants trust that PAHO, in view of its long-standing leadership in international health, its broad sphere of action, and the priority it assigns to information management, will find the means to implemented and advance these recommendations.

Calendar of Courses and Meetings

International Conference on Sexually Transmitted Diseases (STD)

The International Union Against Venereal Diseases and Treponematoses in association with the American Venereal Disease Association and the STD Division of Canadian Public Health, the Association of Medical Microbiologists of Canada, the Canadian Infectious Disease Society, the Canadian Society for Tropical Medicine and International Health, the Canadian Association for Clinical Microbiology and Infectious Diseases, and L'Association des Médecins Microbiologistes de la Province de Québec, will hold its Thirty-second General Assembly in Montreal, Quebec, Canada, 17-21 June 1984.

The scientific program will include the epidemiology, community health and social impact, pathogenesis, biology, diagnosis, management (treatment, follow-up, prevention) of STD caused by: *Neisseria gonorrhoeae, Treponema pallidum, Chlamydia trachomatis,* genital mycoplasmas, fungal and parasitic agents, viruses (including herpes simplex virus (HSV), cytomegalovirus (CMV), papilloma, hepatitis, etc.), and enteric pathogens.

Other subject areas discussed will be genital ulcers, STD in women (including vaginitis, urethral syndromes, STD in pregnancy, pelvic inflammatory disease (PID), and sterility), neoplasia and STD, STD in developing countries, and acquired immune deficiency syndrome (AIDS).

Plenary sessions will sum up major contemporary problems in the field of STD. Free communications will summarize current research in STD, and special sessions are planned for practitioners and paramedical personnel involved in the fight against STD.

For more information write to: International Conjoint STD Meeting, % Dr. Richard Morisset, Department of Microbiology and Immunology, Université de Montréal, 739 Dunlop Street, Montreal, Quebec, Canada H2V 2W5. Registration forms are available through the Epidemiology Unit, Pan American Health Organization, 525 Twenty-third Street, N.W., Washington, D.C. 20037, USA.

International Epidemiological Association: Xth Scientific Meeting

This Xth Scientific Meeting will take place from 19-25 August 1984 at the University of British Columbia campus, Vancouver, British Columbia, Canada. The meeting's main theme "Epidemiology as a Health Science" has six sub-themes: communicable disease, occupational health, noncommunicable disease, research into aging, environmental health, and health care research.

English is the working language of the meeting; simultaneous interpretation will not be available. For further information and registration write to: International Epidemiological Association Conference Secretariat, Suite 301, 1107 Homer Street, Vancouver, British Columbia, Canada V6B 2Y1.

Publications

Laboratory Biosafety Manual. Geneva: World Health Organization; 1983. 123 p. Sw. fr. 14. French and Spanish editions in preparation.[1]

The WHO laboratory biosafety manual produced by the Special Program on Safety Measures in Microbiology (SMM) is now available. It provides internationally applicable guidance on biosafety developed by several expert working groups.

Recognizing that laboratory accidents and infections are caused mainly by poor practice and technique, the manual emphasizes safe practice and training procedures. It also presents basic standards of laboratory design for work with microorganisms by degree of infective risk and a guide to the selection and use of essential biosafety equipment and materials. While oriented to biosafety, the manual provides an overall, general laboratory safety checklist and safety procedures for the use and handling of laboratory chemicals.

Other sections of the manual deal with the organization and management of safety programs, safe shipment of specimens and infectious substances, and contingency plans and emergency procedures. An extensive bibliography and a list of audiovisual training aids are included.

The manual is intended primarily for the guidance and use of laboratory supervisors, biosafety officers, and others responsible for laboratory safety programs.

A Dictionary of Epidemiology. John M. Last[2] [and others], eds. New York: Oxford University Press; 1983. 128 p.; 15 illus. 503256-X cloth: US$21.95; 503257-8 paper: US$10.95.

This dictionary includes both frequently used and less common words and defines terms from other disciplines on the periphery of epidemiology such as biostatistics, demography, and microbiology. It also provides brief biographical sketches of important figures in epidemiology.

[1]This report appeared in the *Weekly Epidemiological Record.* 1983; 58 (38):289-290.

[2]John M. Last is Professor of Epidemiology and Community Medicine at the University of Ottawa School of Medicine, and Scientific Editor of the *Canadian Journal of Public Health.*

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