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Earthquakes in El Salvador

On January 13, 2001, El Salvador was ravaged by an earthquake with a magnitude of 7.6 on the Richter Scale, located at longitude 88°46'W and latitude 12°52'N. The epicenter was located off the Pacific Coast of El Salvador, 65 Km south of Usulután, at a depth of 60 Km (Figure 1). This massive earthquake originated in an inclined rupture zone that covers a distance of some 100 Km, parallel to the Central American Basin or Entrenchment, and was felt from Costa Rica to Mexico. The rupture covered an area of approximately 6000 Km^2.

A month later, on February 13 at 8:22 a.m., a second earthquake struck with a magnitude of 6.6 on the Richter Scale, located in San Pedro Nonualco, 30 Km southeast of San Salvador, at a depth of 6 Km. The tremors were felt in Guatemala and Honduras. Analysis of the origins of the earthquake indicate that it was associated with a local, geological fault that has a steep, vertical inclination, and was caused by displacement in the north-south or east-west direction. This earthquake was superficial and associated with the central volcanic chain of El Salvador, a different seismic source than the one that produced the previous earthquake.

Central America is subject to a series of geotectonic failures at the global level and is also exposed to local faultages in all the countries comprising it (Figure 2). To the north in the Atlantic, the North American and Caribbean Plates are interacting, divided by the Pit of Grand Cayman; to the south in the Pacific, the Cocos Plate can be found along all Central American countries (subduction zone), forming the Pit of Mesoamerica. This geological structure reaches the Cocos ridge at the border between Costa Rica and Panama. The plate of Nazca is active from Panama through the Galapagos Plate, with parallel movement to the Block of Panama that also affects Costa Rica through a transcurrent fault. This tectonic structure generates important seismic activity and has created major, destructive tremors in the Central American region. In the last hundred years, El Salvador has been affected by at least 13 major earthquakes. Among the most destructive were those of Jucuapa-Chinameca on May 6, 1951; San Salvador on May 3, 1965 and San Salvador on October 10, 1986.

It is important to note that the damages caused by previous earthquakes pale in comparison to the damages caused by these recent ones. Landslides have exacerbated the direct damages of the earthquakes and caused greater destruction. In El Salvador, the National Emergency Committee, (COEN from its Spanish name, *Comité de Emergencia Nacional*) is the agency that coordinates emergency activities. COEN is composed of the Ministries of National Defense, the Interior, Public Safety and Public Works, Agriculture and Livestock, Foreign Affairs, Education and Health, as well as relief, scientific, autonomous, and international Agencies, and private companies. This committee began to meet a day after the earthquake and provided the first data on the magnitude and severity of its effects on the population. These data were updated daily.

The data provided by COEN, until February 21 of this year, recorded 944 dead; 5,565 injured and a total of 1,364,160 victims. This represents a mortality rate for the country of 15.04 per 100,000 population. However, some departments were more seriously affected than others. The department of La Libertad, for example, recorded a higher mortality rate of 100.43 per 100,000 population. It is estimated that 21.74% of the entire population of the country was affected. The populations of Usulután and La Paz account for a disproportional amount of this percentage as these populations were affected almost 100% and 79%, respectively.

With regards to structures, a total of 1,155 public buildings were affected, while 169,792 houses were damaged, 108,261 destroyed and 688 buried. Additionally, 405 churches and 43 piers were damaged, amounting to a total of 280,344 affected constructions. Among these, 38.6% corresponded to destroyed houses. The departments with the greatest proportion of houses destroyed among all buildings were La Libertad (50.6%), Usulután (48.5%), and Cuscatlán (47.1%).

With regard to health services, even though none of the health buildings were totally destroyed, of the total established health services infrastructure, 19 (63%) hospitals, 75 (21%) health units, and 12 (7%) health centers were damaged.

The water supply network was severely affected, particularly storage tanks in the pumping plants of the water supply system for some sectors of San Salvador and the general infrastructure in the Central, Western and Eastern regions. The costs of reported damages amount to more than five million dollars.

People who were evacuated from danger zones were relocated into 82 shelters, distributed in 10 of the most affected

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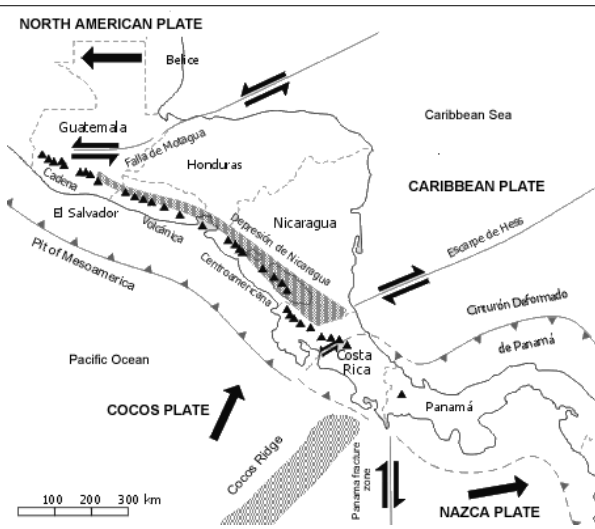
Figure 1: Approximate location of the earthquakes

Source: PAHO's Special Program for Health Analysis (SHA)

Figure 2: Tectonics of Central America



Source: Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC)

departments. A total of 64,606 people were taken to these shelters. The department of La Libertad contained the greatest registered number of shelters (18) and sheltered people (31,397).

An epidemiological surveillance system was activated by the country's health authorities, given the epidemiological characteristics of the country at the time of the earthquake. Principal conditions included: 1) the recent dengue epidemic, 2) the presence of an epidemic of diarrheal disease by rotavirus, 3) the sporadic circulation of *Vibrio cholera*, 4) the presence of malaria endemic areas, 5) previous presence of cases of leptospirosis and 6) the presence of a cold front that affected the country after the disaster. Post-disaster sanitary conditions together with the epidemiological characteristics of the country favor the presence and dissemination of these illnesses, requiring improved surveillance. To achieve better monitoring and control of diseases after the disaster, all suspected cases of 20 diseases are reported to this surveillance system.

Until February 16 of this year, the principal health problems of the country were: acute respiratory infections with 117,871 cases (incidence rate of 1,878.2 per 100,000 population), diarrheal diseases and gastroenteritis with 29,128 cases (464.1), dermatoses with 8,620 cases (137.4), injuries with 7,901 cases (125.9) and depression and anxiety disorders with 7,252 cases (115.6). In the same period of time, 515,250 medical consultations had been carried out.

The second earthquake, of a smaller magnitude (6.6 degrees in the Richter Scale), occurred on February 13, and aggravated the health situation. By February 21, COEN reported 315 deaths, 3,399 injuries, and 252,622 victims in all. The mortality rate for the country was of 5.0 per 100,000 population. The affected area includes the departments of Cuscatlán, La Paz, and San Vicente, which reported mortality rates of 81.3, 19.8, and 54.0 per 100,000 population, respectively.

With regard to structures, by February 21, 57,375 affected constructions had been recorded, of which 41,362 (72.1%) were totally destroyed. The greatest number of affected constructions was in the department of La Paz with 88.7%, followed by the departments of San Vicente and Cuscatlán, with 66.9% and 62.3% respectively.

On the occasions of both earthquakes, the Pan American Health Organization responded immediately, mobilizing both national and international financial and technical resources. The different areas of technical cooperation provided included disaster relief, assessment of the vulnerability of structures, hospital evaluation, use of the humanitarian supplies system (FUNDESUMA/SUMA), assistance with issues of mental and environmental health, information dissemination, and analysis of information and social communication.

Immediately after the first earthquake, the international community was present in the country to provide its collective assistance financially and in terms of human resources and materials. With these resources, the community supported activities that were carried out to assist the Salvadorian population. These efforts were undertaken by rescue personnel, physicians, nurses, paramedics and brigadiers from many countries. Additionally, personnel from Non-governmental Organizations (NGOs), supported activities to control the sanitary situation in the country. By the end of the month of February, the total monetary amount received for the two earthquakes was US$ 11,611,598. These funds have come from governments, international organizations, civil society, non-governmental organizations, banks, and private companies.

References:

(1) PAHO. Representation in El Salvador. Terremoto en El Salvador. Available at: http://www.ops.org.sv/terremoto/

(2) Comité de Emergencia Nacional. Ministerio del Interior, El Salvador. Available at: http://www.coen.gob.sv/

(3) Centro de Coordinación para la Prevención de los Desastres Naturales en América Central. Sismicidad en Centroamérica. Available at: http://www.cepredenac.org/temas/sismo/

(4) Universidad de Chile. Departamento de Geofísica. Available at: http://www.dgf.uchile.cl/

(5) Departamento de Investigaciones Sismológicas. Centro de Investigaciones Geotécnicas. Ministerio de Obras Públicas de El Salvador. Cronología de sismos destructivos en El Salvador. Available at: http://www.geotecnico.com/sismologia/1crono.htm

(6) Incorporated Research Institutions for Seismology. Available at: http://www.iris.washington.edu/

Source: prepared by Dr. Gabriela Fernández and Dr. Guadalupe Verdejo, from PAHO's Special Program for Health Analysis (SHA), and Dr. Luis Jorge Pérez from PAHO's Emergency Preparedness and Disaster Relief Program (PED).

Measuring Health Inequalities: Gini Coefficient and Concentration Index

Equity in health is one of the basic values that guide the Pan American Health Organization's technical cooperation with the countries of the American Region. The fundamental difference between inequities and inequalities resides in the fact that inequities represent inequalities that are considered and qualified as unjust and avoidable. As a result, measuring health inequalities represents the first step towards the identification of inequities in health. In the Region of the Americas, the availability of health information aggregated by geographical units generally permits the analysis of inequalities, which should serve as a basis for decision-making. Indeed, 21 countries of the Region can already make use of data at the subnational level within the Core Data Initiative. Carrying out these analyses is essential to reducing the inequities that are characteristic of the health profile of the Region.

There exists a wide variety of summary measures for the magnitude of inequalities in health. One specific indicator is the Gini Coefficient, which, along with the Concentration Index, has been taken from the field of economics and applied to the study of health inequalities.

Gini Coefficient and Lorenz Curve

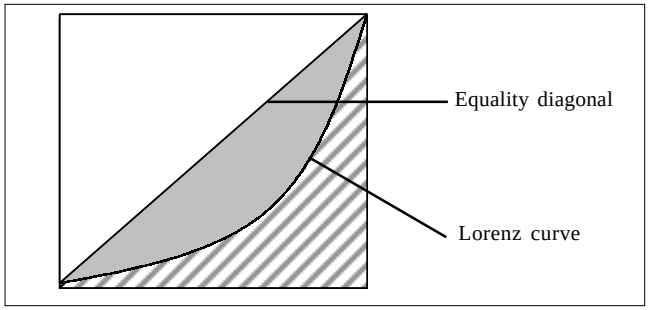
The Gini coefficient is based on the Lorenz curve, an accumulated frequency curve that compares the distribution of a specific variable with the uniform distribution that represents equality (Figure 1). This equality distribution is represented by a diagonal line, and the greater the deviation of the Lorenz curve from this line, the greater the inequality.

When applying this index to health variables, the cumulative proportion of the population is generally shown on the X axis, and the cumulative proportion of the health variable on the Y axis. The greater the distance from the diagonal line, the greater the inequality. The curve can be below or above the diagonal depending on the variable used. When the variable is beneficial to the population, as for example in the case of access to water, the curve is found below the diagonal line. In contrast, when the variable is prejudicial, as in the case of deaths, it is found above the line.

The Gini Coefficient ranges from 0 to 1, 0 representing perfect equality and 1 total inequality. It corresponds to twice the area between the Lorenz curve and the diagonal (Figure 1). There are different methods to calculate the Gini, but a simple formula, shown in Box 1, was provided by Brown (1994).

The first step for calculating the Gini coefficient using geopolitically aggregated data is to sort the geographic units by the health variable (e.g., infant mortality rate) from the worst to the best situation (highest to lowest rate). The rates are then transformed into continuous variables and the cumulative proportion is calculated for both variables. The graph showing the cumulative proportion for the health variable (Y axis) and the cumulative proportion of the population is then prepared, and the Gini coefficient can be calculated as the absolute value of the result of the Brown formula.

Figure 1: Areas for calculation of the Gini Coefficient



Box 1: Brown's formula for calculating the Gini coefficient

$$G = 1 - \sum_{i=0}^{k-1} (Y_{i+1} + Y_i)(X_{i+1} - X_i)$$

G= Gini Coefficient
Y= cumulated proportion of the health variable
X= cumulated proportion of the population variable
k= number of geopolitical units

Although the level of inequalities is reflected in the value of the Gini coefficient itself (for example, a value very close to 0 will represent a low level of inequality), the interpretation of the coefficient is usually done in comparative terms, by contrasting the calculated value to that of other geographic units, population groups etc. Again, a coefficient of 0.2 will represent a higher level of equality than a coefficient of 0.4. The cumulative proportions of both variables can also be read directly from the graphical representation of the Lorenz curve (see following example).

Concentration Index and Concentration Curve

The socioeconomic dimension can be included in the analysis through the calculation of the Concentration Index if the population or the geographic units are ordered by socioeconomic status and not following a health variable. The Concentration Index is calculated in the same way as the Gini Coefficient, but it varies between –1 and +1. The values are negative when the curve is above the diagonal and positive when it is under the diagonal. If the order resulting from sorting by the socioeconomic and health variables are the same, the concentration index will have the same absolute value as the Gini coefficient.

Following is an example of calculation of Gini Coefficient using infant mortality rates from 5 countries of the Andean area in 1997.

Example of Gini coefficient and Lorenz Curve: Infant mortality rate in five countries of the Andean Area

The data for this example are presented in Tables 1a and 1b below. The Lorenz Curve is shown in figure 1. The steps for the calculation of the Gini coefficient and graphing of the Lorenz curve are the following:

- Sort the geographic units by the health variable (infant mortality rate) from the worst situation (highest rate) to the best situation (lowest rate).
- Calculate the number of infant deaths for each geographic unit.
- Calculate what proportion of the total of all infant deaths and what proportion of the total of all live births is observed in each geographical unit.
- Calculate the cumulative proportion of each of the two variables.
- Calculate the Gini coefficient using the formula
- Graph the curve using the X axis for the proportion of the cumulative population (live births) and the Y axis for the proportion of cumulative health variable observations (infant deaths).
- Interpretation:

  Gini Coefficient: In our example, the result was 0.20, which is not a high value and is closer to zero (total equality) than 1 (total inequality). However, to be able to have a complete picture of the situation, it would be necessary to compare this value with the values obtained from other geographic areas.

  Lorenz Curve: For example, we read on the graph that 30% of infant deaths occur among 20% of the population of live births.

Figure 1: Lorenz Curve

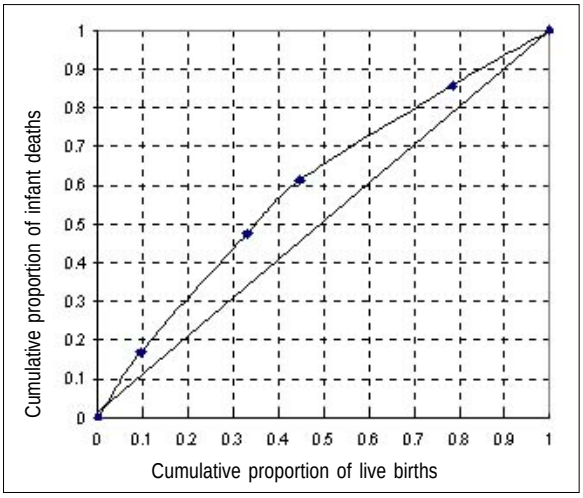


Table 1a: Country, GNP per capita, Infant mortality rate (IMR), live births, infant deaths, proportion of live births population, and proportion of deaths

Country	GNP per capita 1996	IMR (per 1,000 LB) 1997	Live births (1,000) 1997	Infant deaths	Proportion live births	Proportion infant deaths
Bolivia	2,860	59	250	14,750	0.09	0.17
Peru	4,410	43	621	26,703	0.24	0.31
Ecuador	4,730	39	308	12,012	0.12	0.14
Colombia	6,720	24	889	21,336	0.34	0.24
Venezuela	8,130	22	568	12,496	0.22	0.14
Total		33	2,636	87,297	1	1

Table 1b: Cumulative proportion of live births, cumulative proportion of infant deaths and steps for the calculation of the Gini coefficient

Country	Cumul. prop. live births	Cumul. prop. infant deaths	$Y_{i+1} + Y_i$ (A)	$X_{i+1} - X_i$ (B)	A * B
Bolivia	0.09	0.17	0.17	0.09	0.02
Peru	0.33	0.48	0.65	0.24	0.15
Ecuador	0.45	0.62	1.10	0.12	0.13
Colombia	0.78	0.86	1.48	0.33	0.50
Venezuela	1	1	1.86	0.22	0.40
Total					1.20

Gini coefficient:	0.2

Source: PAHO. Basic Indicators Brochure 1998.

References:
(1) Whitehead M. The Concepts and Principles of Equity and Health. WHO Regional Office for Europe. Copenhagen, Denmark. 1991
(1) Brown M. Using Gini-style indices to evaluate the spatial patterns of health practitioners: theoretical considerations and an application based on Alberta data. *Soc. Sci. Med*. Vol. 38, No. 9. pp. 1243-1256. 1994
(2) Wagstaff A, Paci P, Van Doorslaer E. On the Measurement of inequalities in health. *Soc. Sci. Med.* Vol. 33, No. 5. pp 545-577. 1991

Source: Prepared by Drs. Carlos Castillo-Salgado, Cristina Schneider, Enrique Loyola, Oscar Mujica, Ms. Anne Roca and Mr. Tom Yerg of PAHO's Special Program for Health Analysis (SHA).

The Public Health Importance of Transmissible Spongiform Encephalopathies: The "Mad Cow" Disease

In March 1996, the Spongiform Encephalopathies Advisory Committee (SEAC) reported to the British Government that 10 cases of Creutzfeldt-Jakob Disease (CJD), recently evaluated in patients less than 42 years of age, presented a different pattern from the classical form of this disease. The Committee concluded that the most probable explanation was that of a possible exposure to Bovine Spongiform Encephalopathy (BSE), also known as "mad cow disease."

To date, this new form of the human disease, called variant Creutzfeldt-Jakob disease (vCJD), has claimed a total of 95 victims in the United Kingdom (UK), three in France and one in Ireland. In the UK in particular, the figures show a clear rising trend, although no one ventures to predict the future incidence of this neuropathy (Table 1).

The association between vCJD and BSE, which both belong to the group of Transmissible Spongiform Encephalopathies (TSE), initiated a confidence crisis regarding the consumption of beef. In Europe in particular, the trade and consumption of this basic food have been destabilized. At the same time, the increase, at the end of 2000 and beginning of 2001, of the animal disease in herds of countries such as France, Germany, Spain, Portugal, Ireland, and Italy has caused panic among consumers around the world.

In the Americas, no existence of BSE has been found in livestock. After its detection in 1986 in the UK, countries such as the United States, Canada, Argentina and Uruguay, among others, have carefully assessed the risk of entry of the disease in their territories. To this day there has been no evidence of the disease in those countries.

The TSEs

The neurodegenerative phenomenon known in general terms as TSE has been recognized for some time. The name comes from observations of microscopic pores in the infected brain that make it look like a sponge. These diseases are characterized by a long incubation period and a progressive course causing degeneration of the central nervous system, affecting motor control, generally causing dementia and sometimes paralysis, and finally, death. There currently exists no cure for TSEs.

The group of TSEs includes encephalopathies that affect animals such as sheep and goat (Scrapie); mink (TME); mule, deer, and elk (CWD); cattle (BSE) and cat (FSE). Those that affect humans are known as Kuru, Creutzfeldt-Jakob Disease (CJD), and the Syndrome of Gerstman-Sträussler (GSS). BSE, which affects cattle, was described for the first time in the UK in 1986 and since then, nearly 180,000 cases have been recorded in this country.

With regards to the etiology of the disease, the most accepted theory to date is that the disease is caused by an agent known as proteinaceous infectious particles, or *Prions*. Lacking DNA and yet capable of replicating themselves without genes, prions are outside all known laws of traditional biology. They are resistant to inactivation by methods used to modify nucleic acids, and they have no identified background.

Table 1: Confirmed and probable cases of vCJD in the United Kingdom, 1995-2001*

Year	Confirmed (1)	Probable waiting for post-mortem results	Probable still alive
1995	3	-	-
1996	10	-	-
1997	10	-	-
1998	18	-	-
1999	15	-	-
2000	27	1	-
2001*	2	4	5
Total	85	5	5

* Until 2 February 2001
(1) Includes 9 probable cases which neuropathological confirmation will never be possible
Source: Department of Health, United Kingdom

Although all forms of TSEs are considered important, those that affect humans (CJD) and cattle (BSE), are without a doubt the ones of greatest importance for public and animal health.

Creutzfeldt-Jakob Disease (CJD)

Of the TSEs known in humans, CJD is considered of greatest interest to science. It occurs in two forms, one associated with genetic predisposition (approximately 5-10% of the cases) and another more common form, known as sporadic, that accounts for 85-90% of the cases. A small percentage of cases (less than the 5%) is of the iatrogenic type and results from accidental transmission of the causative agent by means of contaminated surgical equipment or by cornea or dura mater transplantation. It has also been demonstrated that CJD can be transmitted to humans as a result of treatment with human growth hormones, a risk that has been reduced by the replacement of this natural hormone with a recombinant hormone.

The incidence of CJD is estimated to be 1 case per million population per year, with a broad geographical distribution in all continents.

Variant of Creutzfeldt-Jakob Disease (vCJD)

When the first case of BSE in the UK was identified, concern about the risk for humans triggered a series of measures in an attempt to eradicate BSE and avoid potentially infected tissues from entering the human food chain. One of the earliest measures taken in the UK was the establishment of a surveillance unit for CJD in May 1990. Three or four years later this unit was extended to several European countries, through the European Union, in the hope that change in the epidemiology of CJD in the UK would be detected at an early stage, and the significance of this change could be estimated by comparing it with the epidemiology of the disease in the European continent.

Interest in the disease was enhanced by the discovery of infection in some ungulate animals as well as in domestic cats and wild felines in captivity. In these studies, the ungulate animals and domestic cats received meat and bone-based

food, whereas the wild cats consumed raw tissues, including tissue from parts of the central nervous systems of livestock. Findings of infection forced scientists to face the possibility that the disease could cross the inter-species barrier to humans, through the consumption of meat and milk products or possibly by contact with livestock by certain occupational groups such as milkers, livestock and slaughterhouse workers.

What initially silenced the concern for human infection was the fact that BSE had its origin in scrapie, which is not pathogenic for humans. Another consideration was that if BSE had originated from a spontaneous mutation in livestock, experimental studies on the susceptibility of some species to the new TSE were not sufficiently advanced to rule out the same phenomenon in humans. In spite of that, during the 10 years following identification of the first BSE case, cases of CJD did not increase in high-risk groups and continued to occur in the general population, showing the same clinical and neuropathological characteristics as before the appearance of BSE.

The first findings of vCJD

Between May and October 1995, the UK CJD Surveillance Unit received reports of three cases of CJD in patients of only 16, 19 and 29 years of age, who presented amyloid plates in their neuropathological examinations, an unexpected condition since it occurs in only 5 to 10% of the sporadic cases of CJD. Additionally, taking into account the fact that this disease generally affects elderly people, the young age of the patients and the pathology findings from their brain samples led investigators to search for similar cases in patients whose deaths could have been associated with another diagnosis. In particular, they searched for cases of Subacute Sclerosing Panencephalitis (SSPE), based on the fact that the three young patients with CJD had been previously identified by SSPE surveillance, but no case of that disease appeared in the UK records.

In December 1995, the CJD Surveillance Unit was informed of 10 suspected cases of CJD, all in patients younger than 50 years old. In two of these patients, who were 29 and 30 years old respectively, the disease had been confirmed by neuropathology. Similar to the three previously mentioned patients, they presented abundant amyloid plates in their central nervous system tissue. This led scientists to suspect an association between those cases and BSE, which could be explained by exposure of the patients to diseased cattle. At this point however, much evidence was still needed to confirm an association.

In January 1996, two more confirmed cases of CJD were reported in young patients. These two cases were eventually confirmed by neuropathology, and a clinically distinctive syndrome began to emerge. This syndrome was associated with the formation of amyloid plates and characterized by its appearance in young individuals, with psychiatric amnesia-like symptoms, marked ataxia, periodic absence of electroencephalographic activity and a prolonged duration of illness compared to what was previously known about CJD. Some of those characteristics, alone or combined, had been seen in sporadic or classic cases of CJD.

Table 2: Some clinical signs of vCJD

- Psychiatric signs
- Depression or Schizophrenia
- Stickiness of the skin
- Instability
- Walking difficulties
- Involuntary movements
- Prostration and death

Review of the histories of the patients with CJD registered before 1980 in the UK revealed that three young patients shared some of the aforementioned characteristics, and an inquiry concerning young patients with CJD in other European countries revealed an average age similar to that of the patients in the UK. Because of these findings, precautions were enhanced. The greatest concern was that those seven, apparently similar cases, could represent a heterogeneous group of patients with genetic or classic forms of CJD. Complete comparative pathological neuro-examinations of both the pre- and post-1980 patients were carried out, in addition to genetic sequencing analysis of the cases, whenever possible.

In February 1996, the Surveillance Unit received the report of another case with a similar clinical evolution to that of the seven previous patients. Analyses of the neuropathology of the patient revealed, as in his predecessors, the characteristic morphology of amyloid plates with an amyloid center surrounded by "petals" showing spongiform changes.

By March 4, genetic analyses were completed for six of the cases. Mutations had not been encountered in any of the results, which made it possible to rule out genetic causes of the syndrome. The information received on March 20 from the European CJD surveillance system indicated that none of the young patients in other countries showed the clinical or pathological characteristics of the cases from the UK.

The new variant

Two confirmed cases of the variant were added to the list. A report on the group of 10 cases concluded that a variant of CJD, unrecognized before and affecting people under 45 years of age, could be due to exposure to BSE. This association has recently been convincingly established through laboratory studies demonstrating identical, biological and distinctive molecular properties in the pathogen isolated from livestock infected with BSE and in the human cases of vCJD.

Transmission

The source of contamination is still unknown, but it is generally accepted that the most probable means of exposure is through food containing bovine tissues, particularly meat products contaminated with tissues from the central nervous systems of clinically sick animals more than two years old.

Contamination can occur in several ways, such as: contact of muscle with infected brain or spinal cord tissue through contaminated equipment during slaughtering; inclusion of paraspinal nodes in cuts of meat that contain vertebrate tissue (T-bone steak, chops and others); cerebrovascular clots due to stunning instruments used before bleeding out; and

perhaps most importantly, presence of the remains of spinal cord and paraspinal nodes in "mechanically recovered meat" (MRM), which is used in some countries as raw material for the preparation of cooked meat products.

The quantity of ingested infectious tissue could be a critical determinant in the transmission of BSE to humans in the form of vCJD, however there are numerous other factors not mentioned here, including genetic ones, may also influence susceptibility to the disease.

Diagnosis

Due to the characteristics of the prion, the usual analytical biochemical methods of detection cannot be applied directly. Diagnostic capabilities are further limited by the fact that there is no absolute certainty that the prion is the infectious agent. Additionally, infection by the prion does not seem to cause any immune reaction, making it impossible to detect antibodies, and there is no known genetic material that would enable the use of molecular biology techniques. Therefore, the diagnosis of vCJD can currently only be confirmed by histopathological examination of the brain, which makes it possible to see the "florid amyloid plates" characteristic of this new variant.

Bovine Spongiform Encephalopathy (BSE)

BSE is a form of TSE that affects cattle and the disease was described for the first time in the UK in 1986, although retrospective studies trace its possible presence as far back as 1985. Since then, more than 180,000 cases have been reported in that country, and the disease has been related to "lumbar pruritus" or *Scrapie* found in sheep and goats (a condition recognized in Europe since the middle of the 18th century).

Distribution

With nearly 180,000 cases of registered BSE coming from more than 35,000 herds in the UK, the disease is considered to be of sporadic occurrence. However, it is not restricted to the UK. Indeed, its presence has been detected in other countries as a result of animal importation (one case in Canada, another in the Falkland Islands and two cases in Oman), or importation of dietary supplements for livestock. Cases due to importation of animals or animal-tissue-based feed have also been registered in several countries of the world.

In some countries, such as the UK, the incidence of the disease shows a downward trend, while in others including Spain, France, Portugal, Germany and the Republic of Ireland, incidence is either showing an upward trend or the initial emergence of cases is being registered, a phenomenon that could be explained by improved sensitivity of the surveillance systems. Despite the fact that native cases of BSE have been identified in several countries, no authochthon case has been notified outside the UK. BSE has not been reported in countries that have been recognized importers of livestock, meat, meat products, or dietary supplements from the UK. The cattle epidemic seems to have emerged only in this country.

Etiology

The origin of the disease in cows is still the subject of serious debate. One of the most accepted theories attributes the cause of the disease to an unconventional communicable agent, not well known in nature, that would cause a modification in the Prion. This modification would induce a neurodegenerative type of disease without inflammation or demyelinization, that is communicable and always fatal.

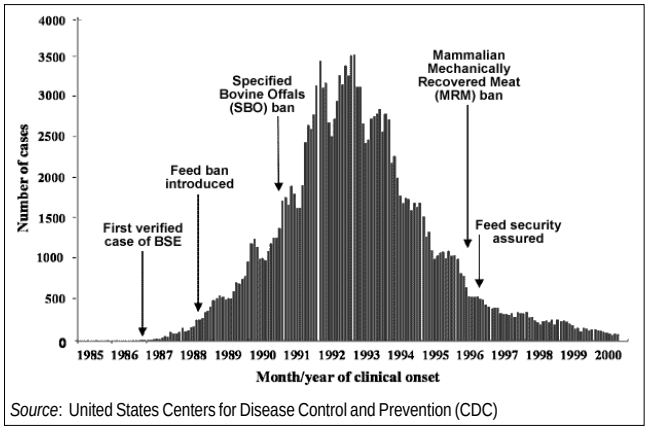
The Prion, a protein coded by a cellular gene, presents two isoforms: normal (PrP^{C}) and abnormal (PrP^{Sc}) or infectious. It is accepted that the PrP^{C} sequence determines the existence of an interspecies barrier for TSEs, which, in the case of BSE, could have been crossed by the causative agent of Scrapie. Indeed, the gene sequencing of ovine and bovine prions show a 98% homology between both proteins, which would explain the crossing of the interspecies barrier. Another theory considers a pathogenic mutation that occurred in livestock in the decade of the 1970s.

Transmission

Epidemiological studies and the knowledge gathered to date make it possible to deduce that the appearance of BSE originated in the exposure of cattle to a common source: meat-and-bone meal provided for a balanced diet as a source of protein, and contaminated with the agent of sheep Scrapie. Changes in feed processing eliminated the use of solvents and stages that included heat treatments that inactivate the agent of Scrapie, which could have increased the levels of infectious agent found in the protein products. Despite the fact that animal dietary supplement production processes in other countries may have experienced similar modifications to those applied in the UK at the end of the 1970s, BSE seems to have emerged only in that country. The most apparent explanation is that the proportion of sheep remains in the input mixture to prepare those supplements and the proportion of infected sheep, was higher in that country that in any other.

Later, the recycling of tissues from livestock that had died from BSE contributed to strengthen the epidemic. In fact, it is estimated that the rapid increase of the disease in the mid-90s (850 cases per week in 1994) was probably due to the inclusion of undiagnosed sick animals in the manufacture of feed for bovine consumption. Therefore, the most important measure taken in the UK was to prohibit the use of ruminant animal proteins for feed in 1988. There has been a clear decline of the epidemic in this country since 1992 (Figure 1).

Figure 1: BSE incidence in the United Kingdom, 1985-2000



Source: United States Centers for Disease Control and Prevention (CDC)

Contrary to what is known about Scrapie and its frequent vertical transmission, neither vertical nor horizontal transmission has ever been demonstrated in BSE. In the UK, where intensive production systems prevail, the occurrence of the disease in herds remains sporadic.

Experimental transmission has been achieved through parenteral inoculation to livestock, sheep, goats, pigs, monkeys, mink, and mice. Oral inoculation has been attempted in these same species, (except monkeys) and was successful in sheep, goat, mink and mice.

The disease has an incubation period of 2 to 8 years, and induces changes in mental state that create nervous or aggressive behavior, difficulties in locomotion with loss of coordination and ataxia, and death after a clinical course that lasts from 2 weeks to 6 months.

Diagnosis

Because of the characteristics of the causative agent, the infection does not induce detectable immunological reaction in the host, which means that it is impossible to perform tests in live animals. The only sure diagnosis is done through histopathology and biochemical tests on nervous tissue from dead animals.

BSE is detectable through clinical examination when signs of the disorder are evident through changes in the Central Nervous System (CNS). Approximately 90% of cases are detected clinically by histopathology. The biochemical diagnosis is based on the identification of the infectious form of the Prion, the PrP^{BSE}, achieved using the "Western Blotting" technique.

Prevention and control of TSEs

The principal measure used to prevent these diseases from spreading is the elimination of all livestock parts that are likely to be high-risk vehicles of contamination in the human and animal food chain. Today, these are known as Specific Risk Materials (SRM), and include the brain, spinal cord, eyes, tonsils and intestines. Recently, the Scientific Committee of the European Union decided to add specific meat cuts and mechanically recovered meat (MRM) to this list.

Viscera (kidneys, liver, lung, pancreas, lymph nodes and placenta) are considered tissues with some level of infectious risk. Low-risk tissues include milk and its derivatives, sebum and gelatin. Nevertheless, milk is not completely ruled out as a possible agent of transmission. British scientists have recently reopened closed research that was based on the supposition that contaminated cow's milk did not transmit the causative agent to laboratory mice. Since species barriers were not taken into account in previous experiments, scientist are now attempting to inoculate infected milk directly to the female calves. The study is expected to last three years, which is the time required before the first symptoms of the disease manifest themselves.

The basic requirement for control of TSEs consists of eliminating the exposure of livestock to the agents of TSEs through feed. Affected countries are prohibiting the use of mammal remains or proteins derived from them, in ruminant feed. Tissues that contain the BSE agent should also be excluded from the human and animal food chains and countries should prohibit the use of ruminant tissues in animal feed. Other measures include prohibition of the use of ruminant meat and bone meal as fertilizer.

Since the first official report of BSE in Great Britain in 1986, the International Office of Epizootics (OIE) has coordinated the establishment of epidemiological surveillance in all the member countries, and is committed to report any case of the disease. In order to prevent the spread of BSE between countries, the OIE proposed directives for veterinary services of member countries, during the Expert Meeting held in 1994. Those directives are contained in the Reviewed Chapter 3.2.13 of the International Zoo-Sanitary Code.

In countries where BSE has not been reported, an analysis of the risk factors of BSE can provide an estimate of the potential risk of the emergence of the disease. Studies in Argentina and the United States have been pioneers in the Region.

Non-food related modes of transmission

Once the infectious agent is introduced in the human species, the risk of person to person transmission should be taken seriously. At the present time, there are no precise scientific data on the infection rate between humans. Data from other species show that transmission is much easier between individuals of the same species, while crossing the species barrier requires a higher infective dose.

Although person to person transmission is still hypothetical, it should be noted that certain international organizations have prepared a series of recommendations to minimize this risk. Following are some of the non-food related modes of transmission that could possibly result in contamination:

- Contact with intact skin or mucous membranes does not carry a notable risk, although it is highly recommended that people working with infected material avoid direct contact with this material. Other types of contact, such as for example cornea transplantation, inoculations with injections and contact with contaminated surgical material, seem to carry a high potential risk.
- To date, no case of spongiform encephalopathy transmitted through blood transfusion has been detected in humans, although there exists a low theoretical risk. However, health authorities of some countries have adopted preventive measures for such transmission. This problem is assessed taking into account that a balance should be found between rejecting some sources of blood and maintaining sufficient blood reserves for patients in need of transfusion.
- The United States is not accepting blood donations from persons that have spent six months or more in the UK between 1980 and 1996. Canada has recently added to that restriction donors who have spent a total of six months or more in France during the same period. Though some consider these precautionary measures exaggerated, they can contribute to the reduction of the theoretical risk. It is important to note, however, that all the known risks are not necessarily managed, even in countries where blood donations are very well organized.
- To date, no case of human transmission by dental manipulation has been found. However, experiments in animals

have shown that intraperitoneal inoculation of the infectious agent can contaminate the gums and dental pulps, and that these, in turn, can contaminate a healthy brain. As a result, the World Health Organization has recommended that in risky cases, disposable instruments be used and that they be destroyed by incineration. In cases where this is not possible, specific decontamination protocols should be followed. To allow for more extensive decontamination and cleaning, it is recommended that patients who need manipulation of neurovascular tissue be seen at the end of the day. Greater precautions are recommended for possibly contaminated patients needing a surgical process. Precautions such as these are designed to prevent contamination of hospital personnel, as well as of patients who are going to be treated using the same surgical instruments.

– It is not known whether encephalopathy is transmitted from a mother to her child during birth. Familial cases of Creutzfeldt-Jakob disease are mainly due to genetic mutation. For this reason, it may not be necessary to adopt special measures during birth by an infected mother, except in the case of invasive procedures that imply contact with tissues considered high-risk. The newborn should be handled using routine infection control procedures and special precautions should be taken to avoid exposure to the placenta and its associated liquids, which should be incinerated.

Ultimately, the safest method for guaranteeing no risk of residual infection by contaminated instruments and other materials is their destruction by incineration. When this is not possible, other less effective methods can be used. These include following a specific soda (sodium hydroxide) washing protocol and then sterilization, or washing the contact surfaces with disinfectant solutions.

Another possible risk is that of human or animal vaccines that contain ingredients based on bovine tissues. It has been recommended that the pharmaceutical industry avoid the use of those materials as well as materials from other animal species in which TSEs occur naturally. If its use is absolutely necessary, such materials should be obtained from countries that have been proven BSE-free. Cosmetics manufacturers should also follow this last precaution.

The future of TSEs

The recent death of at least two people considered "older" from a medical standpoint has not resolved another enigma surrounding vCJD: its period of incubation, a challenge that scientists have not been able to explain. To date, the quantity of prions necessary to produce transmission in humans is also unknown, and therefore, the hypothesis that young infected animals do not represent a risk due to their low prion levels remains untouched.

The difference between BSE and vCJD is that humans have not been subjected to the recycling of infected tissues that triggered the epidemic in cattle, and therefore it is expected that the vCJD epidemic will evolve slowly.

Due to the unknown incubation period and other elusive variables of vCJD, the scientific community is concerned that there may be a large number of people silently incubating the disease. This would imply a potential for iatrogenic spread of the disease between humans.

The most pressing need is to develop *in vivo* diagnostic tests in order to answer several questions regarding the disease. In the UK, the government has sponsored a research project aimed at analyzing tonsil samples from public hospitals, as a way to better evaluate the prevalence of the new variant.

There are many controversies on the subject of mad cow disease. Several of these are based on the fact that any disease that has caused less than 100 deaths in a population close to 300 million should not create panic. There are other diseases that cause a much higher mortality and morbidity that are latent risks in our countries. However, it is important to recognize that it is the effect of the disease that terrifies, and is rooted in the myths and the atavism of our diet, which cannot be ignored by anyone.

For further information on BSE and vCJD cases, please visit: http://www.oie.int and http://www.doh.gov.uk/cjd/cjd_stat.htm

Source: Prepared by Dr. Juan Cuellar of PAHO's Pan American Institute for Food Protection and Zoonoses (INPPAZ). Division of Disease Prevention and Control (HCP).

Summer Sessions in Epidemiology

Two Summer Sessions, the ***XIth Session in Intermediate Epidemiology*** and the ***Ist Session in Advanced Epidemiology***, sponsored by the Special Program for Health Analysis of the Pan American Health Organization, will take place in July and August, 2001 at the College of Public Health of the University of South Florida in Tampa, Florida. The Advanced Session will be open only to students who have already completed a previous Intermediate Session.

The **Intermediate Session** will be held from July 16 to August 3 and will include three courses: Intermediate Methods in Epidemiology; Statistics applied to Epidemiology and the Use of Software Packages; and Use of Epidemiology in the Programming and Evaluation of Health Services.

The **Advanced Session**, which will take place from July 30 to August 3, will include two courses: Applied Methods for Measuring Health Inequities and Meta-Analysis.

Students are required to have approved training in Epidemiology. Courses will be conducted in Spanish, but participants must be able to read English. Applications must be received before *May 7, 2001*.

For more information and application, contact: Dr. Carlos Castillo-Salgado, Chief, Special Program for Health Analysis (SHA), Pan American Health Organization, 525 Twenty-third Street, NW, Washington, DC 20037. Tel: (202) 974-3327, Fax: (202) 974-3674, email: sha @paho.org

Situation of Malaria Programs in the Americas

Introduction

In 1999, there were 818 million people living in the Region of the Americas. Of these, 299 million (36.5%) were living in areas where ecological conditions were propitious for the transmission of malaria. Of the 35 countries and territories that are members of PAHO/WHO, 21 report areas with active malaria transmission. All these countries (Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, and Venezuela) have reoriented their control programs in keeping with the Global Malaria Control Strategy (GMCS) adopted in Amsterdam in 1992.

The Global Strategy called for a shift from the traditional emphasis on vector control towards case management as its focus. GMCS is based on four principles: (1) provision of early diagnosis and prompt treatment; (2) implementation of protective and preventive measures for the individual, family and community, including vector control; (3) development of the capability to predict and promptly contain epidemics; (4) strengthening local capacity in basic and applied research to permit and promote the regular assessment of a country's malaria situation, in particular the ecological, social, and economic determinants of the disease.

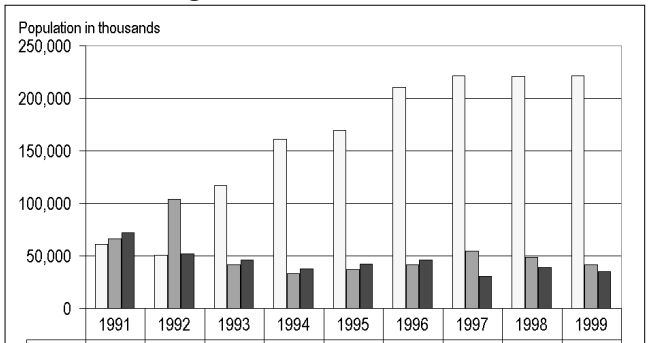
As a result, the countries of the Americas have redefined their malarious areas on the basis of different levels of exposure or the risk of transmission (Figure 1). Risk of exposure, within an ecologically propitious area, is the result of factors related to population movement, social stability, and adoption of individual and collective attitudes and behaviors that prevent malaria and protect against contact with vectors. The intensity of malaria transmission resulting from the interrelation of these factors is roughly reflected in the Annual Parasitic Index (API, see Box 1) and can be modified by access to early diagnosis and prompt treatment. This index is the basic variable used for epidemiological stratification of malaria endemic areas.

In the 21 countries presenting active malaria transmission, of 472 million people, 208 million (44.1%) live in areas with some risk of transmission. However, of these, 131 million (59.8%) are exposed to low or extremely low risk of malaria transmission. In these areas, 46,823 malaria cases were detected in 1999, a decrease from 53,778 cases in 1998. This decrease resulted from post-El Niño stabilization after epidemics in Colombia, Ecuador, and Peru in 1998. The remaining 77 million people (16.3 % of the total population of these 21 countries) live in areas with moderate and high risk of transmission. The decrease of the population at high risk, from 39 million in 1998 to 35 million in 1999, is accounted for primarily because of finer risk stratification at the department level in Peru. Severe malaria morbidity is still observed in populations of the Region at moderate and high risk of transmission, with APIs ranging from a low of 0.18/1,000 in Mexico to 309.8/1,000 in Suriname.

In the Americas, "case detection" has been used as a morbidity index (cases per 100,000 inhabitants) for easy comparison with other morbidity indices. There has been a decrease in "case detection" for the total population of the Americas, from 160.51 per 100,000 in 1998 to 147.56 per 100,000 in 1999. When considering only the population in areas ecologically propitious for transmission, the indices are higher, 418.31 and 404.37 per 100,000, respectively, for the same years. However, a decrease is again apparent in 1999. For the 21 malaria endemic countries, both the API and the Annual *P. falciparum* Index (AFI, see Box 1) are compared with the annual blood examination rate (ABER) (Figure 2). Since the AFI has remained relatively constant, this demonstrates a disturbing trend whereby the number of *P. vivax* infections reported (shown in the difference between the API and the AFI) increases with the number of blood slides examined. Such a pattern may be a reflection of incomplete treatment of the *P. vivax* reservoirs (i.e., incomplete case ascertainment). The same is not true of *P. falciparum* infections, as its transmission can be more effectively controlled by treatment administered immediately following blood slide diagnosis.

Figure 3 shows the API by geographic subregion between 1995 and 1999. The apparent marked reductions in the

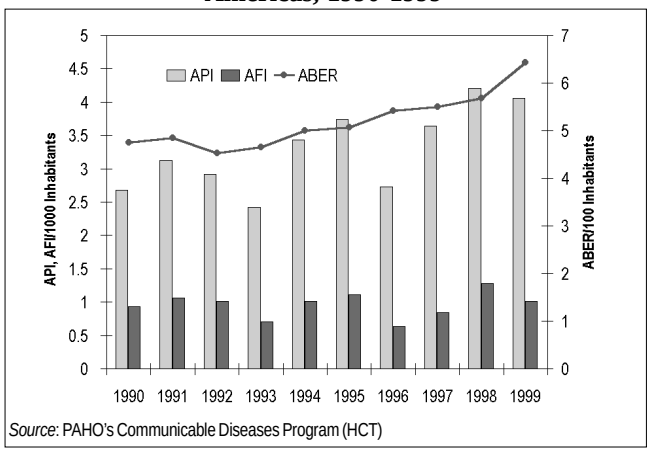
Figure 1: Population living in malaria endemic areas according to transmission level, 1991-1999



	1991	1992	1993	1994	1995	1996	1997	1998	1999
Low	61,235	50,801	116,914	160,947	169,643	210,519	221,341	220,702	221,175
Mod.	66,504	103,885	41,631	32,967	36,881	41,332	54,358	48,537	41,554
High	72,381	51,974	46,225	37,409	42,454	46,227	30,822	39,084	35,275

Source: PAHO's Communicable Diseases Program (HCT)

Figure 2: Malariometric indices of 21 countries of the Americas, 1990-1999



Source: PAHO's Communicable Diseases Program (HCT)

Box 1: Malariometric indices:

- Annual Parasitic Index (API):

$$API = \frac{\text{Number of confirmed cases}}{\text{Population at moderate and high risk}} \times 1{,}000$$

- Annual *P. falciparum* Index (AFI):

$$AFI = \frac{\text{Number of confirmed } P.\ falciparum \text{ cases}}{\text{Population at moderate and high risk}} \times 1{,}000$$

- Annual *P. vivax* Index (AVI):

$$AVI = \frac{\text{Number of confirmed } P.\ vivax \text{ cases}}{\text{Population at moderate and high risk}} \times 1{,}000$$

- Annual Blood Examination Rate (ABER):

$$ABER = \frac{\text{Number of slides examined}}{\text{Total population in areas at risk of transmission}} \times 100$$

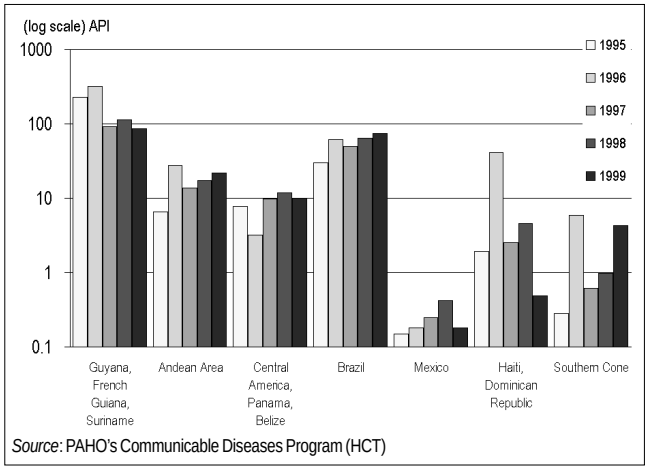
API in Guyana, Suriname, French Guiana, Haiti and the Dominican Republic during the 1996-1997 period reflect redefinitions of the estimated at-risk populations by malarious zones. As can be seen in Figure 4, *P. vivax* was the main cause of malaria morbidity in the American Region, but *P. falciparum* is the only parasite detected among cases in the Dominican Republic and Haiti and is the predominant species in French Guiana, Guyana and Suriname.

The distribution of malaria cases by geographic area in the Region, shown in Figure 5, reflects the burden of disease. An analysis by subregion indicates that Brazil reported the greatest absolute number of malaria cases (50.5%), followed by the countries of the Andean Subregion, which accounted for 32.3% of all cases. However, the greatest risk of transmission was registered in the subregion including areas of French Guiana, Guyana, and Suriname (API = 127.5/1,000), followed by parts of Brazil (API = 118.8/1,000).

In recent years the epidemiological stratification of malaria in the Americas has guided the integration of case finding, diagnosis, and immediate treatment into the local health services. The local health services, which include the community health workers network (volunteer collaborators) had a high diagnostic efficiency, confirming 10.6% of suspected cases, whereas active surveillance continues to show a low diagnostic efficiency and high operational cost, confirming 2.2% of "recent fever" cases. Efforts continue to be made to improve microscopic diagnosis at the referral level of the general health services by training laboratory technicians in malaria diagnosis and redeploying trained microscopists. Nevertheless, routine active case detection continues to absorb about 32% of the malaria microscopic resources of the countries, in spite of its recognized low efficiency.

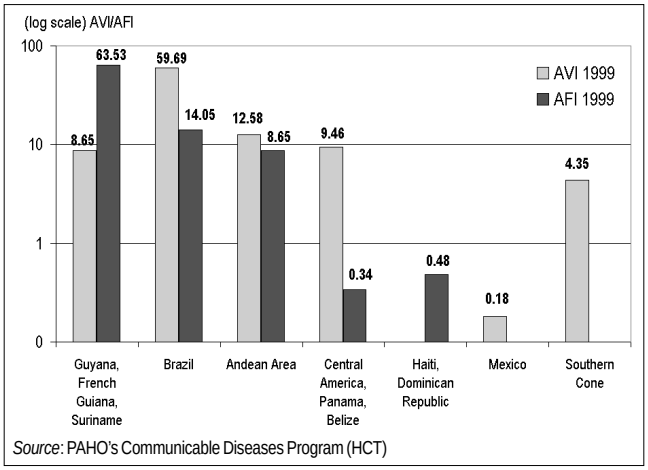
Table 1 displays the availability of treatment per diagnosed case, ranging from 0.57 to 241.8 first-line treatments per case reported. Up to 1999 all countries had an adequate supply of effective anti-malarial therapy. In 1999 however, all countries, with the exception of Colombia, experienced problems with drug supply to treat *P. falciparum* resistant strains. This reduced availability of effective drugs against *P. falciparum* resistant strains in Bolivia, Brazil, Ecuador, Peru, and Venezuela is among the key risk factors which may account for a potential increase in the number of resistant strains epidemics in the years to come.

Figure 3: Annual parasitic indices (API) by geographic subregion, 1994-1999



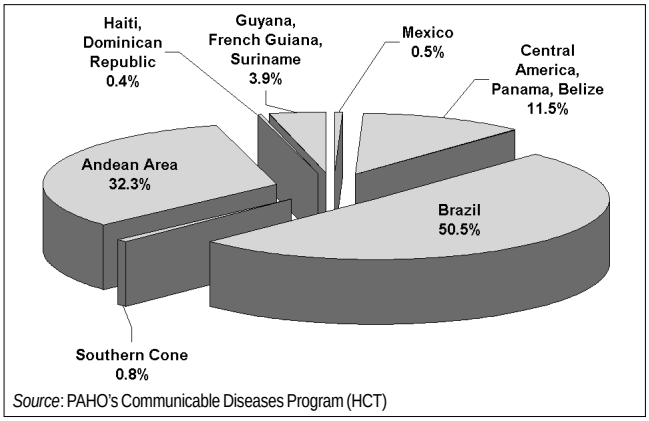
Source: PAHO's Communicable Diseases Program (HCT)

Figure 4: Malaria parasitic indices by geographic subregion, 1999



Source: PAHO's Communicable Diseases Program (HCT)

Figure 5: Distribution of malaria cases in the American region, 1999



Source: PAHO's Communicable Diseases Program (HCT)

From the characterization of factors leading to persistence of transmission, current and potential control measures can be identified. There is still a need to improve the selection and targeting of transmission control measures and to mobilize, guide, and support intersectoral coordination in order to ensure the sustainability of these measures. Vector

Table 1: Antimalarial treatment completed in 1999

Countries and territories by geographic subregion	Treatments complete @ 1,500 mg of 4-amino quinolines	Number of reported cases	Number of first-line treatments available per case reported	Number of treatments completed for resistant *P. falciparum*	Number of *P. falciparum* and mixed cases reported	Number of second-line treatments available per case of *P. falciparum*
Mexico	839,733	6,402	131.17	0	16	0.00
Belize	8,599	1,850	4.65	0	52	0.00
Costa Rica	38,130	3,998	9.54	0	15	0.00
El Salvador	297,376	1,230	241.77	0	9	0.00
Guatemala	210,107	45,098	4.66	0	1,707	0.00
Honduras	496,732	46,740	10.63	0	1,220	0.00
Nicaragua	2,270,800	38,676	58.71	0	1,689	0.00
Panama	19,100	936	20.41	0	40	0.00
Haiti	...	1,196	...	...	1,196	...
Dominican Rep.	130,478	3,589	36.36	0	3,584	0.00
French Guiana	...	5,307	...	...	4,528	...
Guyana	23,300	27,283	0.85	39,244	16,144	2.43
Suriname	12,096	13,939	0.87	8,301	11,685	0.71
Brazil	935,150	609,594	1.53	171,195	114,605	1.49
Bolivia	70,800	50,037	1.41	6,085	7,557	0.81
Colombia	195,230	66,845	2.92	112,101	25,389	4.42
Ecuador	177,842	87,620	2.03	110	49,993	0.00
Peru	94,259	166,579	0.57	57,653	67,169	0.86
Venezuela	79,497	19,086	4.17	1,576	3,531	0.45
Argentina	467	222	2.10	0	0	0.00
Paraguay	35,600	9,947	3.58	0	2	0.00

... no information available

Source: PAHO's Communicable Diseases Program (HCT)

control activities, almost exclusively indoor residual insecticide spraying, continue to be the main activity used by countries as a means to prevent transmission. However, 1999 country data reports were lacking insecticide usage data.

Funds utilized by the control programs have varied greatly over the last five years. However, in recent years, expenditure per person in malarious areas has steadily decreased with the exception of a slight upturn in 1999. In 1999, average expenditure was US$ 0.45 per person for the 16 countries which reported their budget for malaria control to PAHO. This represents a 31% decrease compared to 1996 (US$ 0.65), a 4.2% decrease compared to 1997, but a 7.1% increase over funds available last year.

Major Epidemiological Changes

Implementation of the GMCS in the Region has resulted in a significant drop in the malaria specific mortality rate. In 1994, the first year with comparable records, the *P. falciparum* crude mortality rate was 8.3 per 100,000 exposed population. By 1999, the mortality rate dropped to 1.7 per 100,000 exposed population, a decrease of 78%.

The major operational improvement associated with this reduction in the *P. falciparum* death rate is the constant increase in the coverage with second/third line treatments. The last column in Table 1 shows a remarkable reduction in the availability of *P. falciparum* resistant treatments, expressed as a number of second-line treatment smaller than one, which could certainly revert this important achievement.

Current Situation of *P. falciparum* Resistance

Chloroquine resistance is highly prevalent in South America, although there is still some clinical response to chloroquine in the Andean countries. The number of reported treatment failures is increasing, having reached up to 20% in some areas of the Peruvian Amazon. Sulfadoxine/pyrimethamine resistance is also widespread and quinine and tetracycline are increasingly being used as first-line antimalarials in Colombia, the Guyanas and Suriname. In the Brazilian Amazon, mefloquine has been introduced as first-line treatment of *P. falciparum* infections, following diagnosis with a dipstick test. Artemisinine derivatives are still reserved for severe and complicated malaria. Isolated chloroquine treatment failures of *P. vivax* infections have been recently reported but not confirmed by epidemiological studies.

Major Problems and Constraints

There are three major barriers to the implementation of a successful malaria control strategy. The first is related to the need for a change in the common perception that malaria control is achieved by insecticide spraying that can only be accomplished by a major operational institution. This perception reinforces the natural institutional resistance to change, which has been targeted by all parties involved in malaria control since 1992.

The second major constraint is the drastic reduction in central budgets, concomitant with the major administrative process of decentralization of health services. Due to its focus on local health services, the implementation of the GMCS will benefit from health sector decentralization. However, the drastic reduction in human and budgetary resources generated by the process has become a major constraint for the implementation of GMCS.

Another concern is the lack of an effective vector control or vector interception measure to follow and complement the successful prevention of mortality and reduction of morbidity.

Roll Back Malaria in the Americas

Introduced by WHO in 1998, the Roll Back Malaria Initiative will complement the activities of the GMCS in the Americas. Through reinforcement of the health sector, its general objective is to significantly reduce the global burden of malaria through interventions adapted to local needs. The following five themes have been identified as important components of the initiative. Through these activities, Roll Back Malaria targets a 50% reduction in mortality rates by the year 2010.

1) Structured Interventions

The 21 malaria endemic countries of the Region all have organized malaria programs, integrated on distinct levels (national/regional/local) and with their general health services. The degree of decentralization varies among countries, but in general, municipalities (local governments) are responsible for undertaking public health activities at the local level, and a few already have control of financial resources.

Decentralization of responsibilities to the local level has not necessarily been accompanied by decentralization of technical capability. As a result, there is a significant need for technical capacity building at this level of execution as well as increasing participation of the local authorities in planning and budgeting.

2) Integration of Resources

The Community Health Worker scheme, which involves volunteers and/or paid workers, has been strongly promoted in the Region and has shown to be of great benefit in expanding coverage of the general health services. This structure is the foundation upon which intensified training efforts in malaria diagnosis, immediate treatment and transmission control have been and will continue to be undertaken.

3) Anti-Malaria Drug Policy

Assuring availability and quality control of anti-malaria drugs requires monitoring the effectiveness of anti-malaria drugs in all geographic and social settings of the Region. In addition, a definition of therapeutic regimens must be developed in accord with local situations. Protocols for drug efficacy have been developed and trials are on going in eight centers in six countries of the region, namely Brazil, Colombia, Guyana, Peru, Suriname, and Venezuela. These trials will continue to be promoted to assure continued monitoring and evaluation of drug efficacy and the constant development of alternate drug regimens, determined according to the local susceptibility.

4) Referral System

The diagnostic and treatment capabilities of the general health services have been strengthened in Brazil, Colombia, and Venezuela. Currently, the capability to manage severe and complicated malaria is being strengthened in Bolivia, Peru, and Suriname in order to provide an adequate referral system. This will expand accessibility of the population to satisfactory monitoring and diagnosis of treatment failures as well as management of severe and complicated malaria.

Continued expansion on the use of materials for the clinical level will assist in further reduction of mortality and continuous updating of both health personnel and the referral system itself will be required to adapt to changing epidemiological situations.

5) Resource Networks

In the Roll Back Malaria initiative, resource networks will be created to provide direct support to control operations and address critical issues for malaria control policy.

Of the resource networks established by Roll Back Malaria, those of particular relevance for the Region of the Americas are: prevention and control of epidemics (which will collaborate with the disaster preparedness and mitigation programs at the international, national and local levels); quality and provision of anti-malaria drugs at the local level; and monitoring of resistance to anti-malarial drugs and insecticides. In addition, it will be necessary to establish a network for validation and improvement of alternative methods for selective transmission control. There is also the need for increased financing to permit a continuation of ongoing activities and initiation of others in efforts to Roll Back Malaria in the Region of the Americas.

A sixth element is deemed necessary for successful implementation of the initiative in the Americas:

6) Control of Malaria Transmission

While continuing their efforts to reduce malaria mortality, the countries of the Region are pursuing the additional objective of reducing malaria incidence through transmission control. Efforts have been and will continue to be undertaken in testing the use of insecticide impregnated materials in the Region. However, this and other transmission control activities continue to offer a great challenge to the decentralized health services of the Region.

Since the 1950's and the advent of malaria eradication programs, the countries in the Region of the Americas have developed extensive expertise in indoor spraying of insecticides for the control of malaria transmission. The efforts were effective in large areas of the Region, especially those experiencing a stable social and economic development. Nevertheless, the indoor residual spraying of insecticides was not helpful in interrupting malaria transmission in areas with unstable social/demographic and political situations. In such areas, alternative methods to intramural residual spraying of insecticides are being actively sought to further reduce morbidity through alternative efforts aimed at controlling transmission.

Plan of Intensive and Simultaneous Actions

In endemic areas where the population at risk is demographically stable and in areas of newly formed rural and peripheral urban settlements, reduction of transmission can be accomplished by means of antiparasitic measures applied simultaneously to human and vector reservoirs. This technique, developed by Mexican authorities, requires an organization with national, state/province/department, municipality/district/canton, district/locality/sector, infrastructure in order to be efficiently and systematically applied in each endemic community of the country. The costs of such a program (US$ 40 million/year for 6 continuous years, or US$ 1/person living at risk of acquiring malaria, as estimated by Mexican authorities) may be considered high for some countries, but can be feasibly financed by most countries of the Americas.

Selective Vector Control

In areas of "economic frontier" expansion, such as forested regions under human settlement pressure and areas with low technological exploitation of natural resources, the intramural spraying of insecticides has had very limited effect in controlling malaria. In these epidemiological situations, alternative methods for transmission control have been proposed by a Regional Expert Committee on Selective Vector Control. They include: source reduction of breeding sites, personal family and community protective measures, biological control of vectors, and space spraying of insecticides in epidemic situations.

Utilization of stratification techniques based on epidemiological and entomological parameters allows for the prioritization and selection of the combination of transmission control methods appropriate to each transmission focus.

Conclusions

GMCS implementation in the Americas is far from complete and requires an intensified effort to overcome the detected barriers to its full implementation. The implementation of the GMCS is very complex and calls for a political commitment, which can be provided by the Roll Back Malaria initiative in the following ways:

- Changing from a traditional approach, characterized by vertical organizations and programs;
- Organizing health services in areas of difficult access;
- Preparing human resources capacity for the effective implementation of a decentralized health services;
- Providing adequate financial and material resources in time and quantity.

The challenge is even greater in the context of health sector reform. Only a joint commitment by all interested partners can achieve this goal. The Roll Back Malaria initiative provides the mechanism to do this and is essential for the success of malaria control in the Region of the Americas.

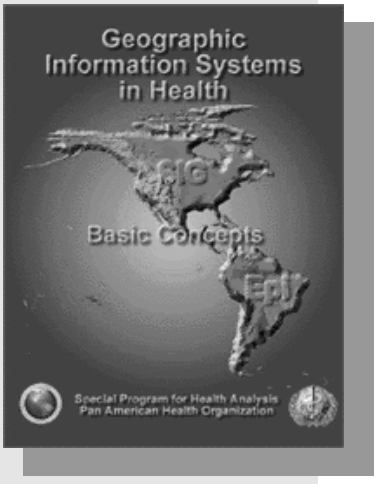
Source: PAHO. Division of Disease Prevention and Control. Communicable Diseases Program (HCP/HCT).

Course and Textbook on Geographic Information Systems in Health

The first **graduate course** on the ***Uses of Geographic Information Systems in Tropical Medicine and Epidemiology*** organized by PAHO's *Special Program for Health Analysis* and the *Johns Hopkins University School of Hygiene and Public Health*, took place during the Winter Institute of Tropical Medicine and Public Health in Baltimore, MD, USA, from January 15-19, 2001. This academic credit course presented the methods and uses of epidemiology towards the development and application of Geographic Information Systems (GIS) in public health. Emphasis was made on the potential of GIS as an epidemiological analysis tool for describing the magnitude of priority health problems, identifying health determinants and supporting health decision-making. Specific topics included epidemiological risk assessment and GIS, thematic mapping of unmet health needs, malaria risk assessment and GIS application for evaluation of public health programs. The course included conceptual aspects, hands-on experience and laboratory exercises using GIS software.

The **next course** on ***Epidemiologic Applications of GIS*** will be offered by the School of Hygiene and Public Health of the Johns Hopkins University and PAHO's Special Program for Health Analysis, during the Graduate Summer Institute of Epidemiology and Biostatistics in Baltimore, MD, USA, from July 2 to July 6, 2001. For additional information, contact: Ms. Ayesha Khan (akhan@jhsph.edu) or visit: http://www.jhsph.edu/summerepi/

The **textbook** for these courses, **"*Geographic Information Systems in Health, Basic Concepts*"** was prepared by the Special Program for Health Analysis (SHA) of the Pan American Health Organization (PAHO/WHO), in conjunction with the Collaborating groups on SIG-Epi in Chile, Cuba and Mexico. The objective of this book is to provide end-users (epidemiologists, health services managers, decision-makers, researchers and other public health workers) with some basic concepts of three related disciplines, Epidemiology, Geography and Informatics, which are considered essential for the appropriate use of Geographic Information Systems in Health. The book also includes real life examples on diverse areas of application, from health situation analysis to public health surveillance, unmet health needs assessment, priority setting and risk analysis to planning and programming of health services and evaluation of public health interventions. It is organized in three chapters, each containing a glossary of selected terms.



The first chapter (***Geographic Information Systems Applied to Epidemiology***) presents the methods and uses of epidemiology as they relate to the development and application of GIS in public health.

Chapter Two (***Cartography, Geographic Information Systems, and Spatial Analysis***) discusses basic geographic concepts, cartography, and aerial photography, in relation to GIS concepts and health situation analysis.

The third chapter (***Relational Database Systems in Geographic Information Systems***) introduces basic concepts of relational database systems and structured query language, including some of their applications to epidemiology.

The book is available upon request, for a nominal fee, from: Special Program for Health Analysis, Pan American Health Organization, 525 23rd St., NW, Washington, DC 20037 or *email*: sha@paho.org

Case Definition: *Legionellosis*

Rationale for Surveillance

Legionnaires' disease is a disease with epidemic potential and high case-fatality. Surveillance is important in order to detect epidemics and to institute appropriate investigations and control measures. In addition, the surveillance of sporadic disease may provide clues as regards source of disease and prevention.

Recommended case definition

Clinical description

An illness characterized by an acute lower respiratory infection with focal signs of pneumonia on clinical examination and/or radiological evidence of pneumonia

Laboratory criteria for diagnosis

Presumptive: one or more of the following**:**

- Detection of specific legionella antigen in respiratory secretions or urine.
- Direct fluorescent antibody (DFA) staining of the organism in respiratory secretions or lung tissue, using evaluated monoclonal reagents.
- A fourfold or greater rise in specific serum antibody titer to legionella species other than *Legionella pneumophila* serogroup 1, using a locally validated serological test.

Confirmative: one or more of the following:

- Isolation of *Legionella* from respiratory secretions, lung tissue, pleural fluid, or blood.
- A fourfold or greater rise in specific serum antibody titer to *L. pneumophila* serogroup 1 by indirect immunofluorescence antibody test or microagglutination.
- Demonstration of *L. pneumophila* serogroup 1 antigen in urine by radioimmunoassay

Case classification

Suspected: Not applicable.

Probable: A case compatible with the clinical description, with presumptive laboratory results.

Confirmed: A case compatible with the clinical description, with confirmatory laboratory results.

Recommended types of surveillance

Immediate reporting of case-based data from periphery to intermediate and central levels.

The identification of cases should prompt immediate investigation for risk factors and other cases. For a rapid response, active case finding is preferred.

International: Since travel and stays in hotels are important risk factors, effective international surveillance is essential to identify and control the point source of infections.

Legionella infection is usually diagnosed after the patient's return to the country of residence and is therefore likely to be considered as a sporadic, single case.

A surveillance scheme such as the European Working Group for Legionella Infections* (see special aspects) allows for the detection of clusters of cases (≥2 cases) with the same source of transmission, as case notifications from different European countries are collected in the same database.

Recommended minimum data elements

Case-based data for investigation and reporting:

Unique identifier, name, age, sex, geographical information, date of onset, outcome.

Underlying risk factors (e.g., immunocompromized patient, AIDS).

Exposure risk factors (hospitalizations, hotels, or other accommodation and travel history during the 2 weeks before the onset).

Laboratory data (specimen type, date collected, *Legionella* spp. isolated).

Recommended data analyses, presentation, reports

- Review data regularly to look for clusters of cases in time, place or person (this should be undertaken at all levels).
- Incidence of infection by month, geographical area, age group, risk factors, exposure factors.

Principal uses of data for decision-making

- Detect clusters/outbreaks
- Identify high risk areas and exposures
- Monitor impact of environmental control measures

Special aspects

There are 2 currently recognized distinct clinicoepidemiological manifestations of legionellosis:

- "Legionnaires' disease" (pneumonic form) and
- "Pontiac fever"(non-pneumonic Legionnaires' disease).

Both are characterized initially by anorexia, vomiting, myalgia and headache, followed within a day by rising fevers and chills.

In the pneumonic form, non-productive cough, abdominal pain/diarrhea, confusion/delirium are common. It is not possible, clinically, to distinguish *Legionella* pneumonia from other pneumonias; suspicion should be raised in any pneumonia connected with epidemiological information (e.g., recent travelling, hospitalization, gatherings, immunosuppression). In addition, age (>50), sex (Male), smoking, alcohol consumption have been shown to be risk factors.

Pontiac fever is not associated with pneumonia. It is thought to represent a reaction to inhaled antigen, rather than to bacteria.

The reservoir of *Legionella* spp. is probably primarily aqueous (e.g., hot water systems, air-conditioning, cooling towers and evaporative condensers). Environmental surveillance for *Legionella* in water sources can be undertaken usually as part of registration and licensing procedures. In any event, environmental surveillance should be undertaken for known sources of outbreaks, to ensure that the organism is eradicated.

*****European Working Group on *Legionella* Infections
PHLS Communicable Disease Surveillance Centre
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Source: "WHO Recommended Surveillance Standards, Second edition, October 1999", WHO/CDS/CSR/ISR/99.2

First Virtual Regional Meeting of PAHO Epidemiologists in the Americas

The First Internet-based Virtual Regional Meeting of PAHO Epidemiologists in the Region of the Americas took place on February 9 and 12. Epidemiologists from the Special Program for Health Analysis (SHA) in the PAHO/WHO Representative Offices in Colombia, Haiti and Honduras, and from Headquarters in Washington, DC participated in this meeting. In addition to testing the technology and methodology related to the virtual environment, the purpose of the meeting was to establish an information and monitoring process for the preparation of the country chapters of the quadrennial publication *Health in the Americas, 2002*. For this purpose, this meeting took place before the subregional meetings scheduled for the technical review of these chapters in April and May.

The meeting was made possible by computer-supported cooperative work tools (among them, Chat rooms, listserv, etc.) that are being used by SHA to improve efficiency and communication between its staff. Those specific tools and virtual discussion spaces are available through the Internet. Rather than use conventional tools available today, PAHO/SHA professionals are designing and developing Web tools that respond to the specific configuration, *ad hoc* content and organization of the field of health.

In addition to a discussion of the organizational aspects of the publication's contents and of the subregional meetings' logistics, some aspects of the use of virtual meetings were emphasized:

1. Resource saving. The costs of meetings or telephone conferences are reduced significantly using the Internet. The only requirement is access to an Internet line with reasonable connection speed, and an Internet "browser".
2. Record of discussion and agreements. A record of each meeting is automatically created, including the date, purpose, and exchanges between the participants. This written record, which is accessible through the Web using a security code, makes it possible to review and monitor different processes.
3. Safe discussion environment. Since this tool is used for specific meetings, the safety and confidentiality of the information discussed is left to the discretion of the participants, who determine who will be invited to the session.
4. Time organization. It is possible to set in advance the purpose and duration of the discussions. Moreover, the agenda makes it easier to organize the discussions and to focus on specific subjects. Another important aspect is that the discussion can be moderated by the person in charge of organizing and initiating the virtual meeting.
5. Synchrony. In the Americas, the small time differences allow for synchronized meetings. Participants can be invited to the meeting and the virtual space can be defined through a simple message.
6. Revisions of technical materials. With some of the collaborative tools, it is possible to display or explain specific analytical methods.
7. Links with other relevant information. The technology of the Internet makes it possible to establish links with different pieces of information that are relevant to the virtual meetings. Accordingly, meetings can be enriched with reference documents and links to technical information sites.

The SHA Program is developing this area of technical cooperation so countries of the Region can adapt it to their local needs. A first subregional effort is being carried out through the Subregional, Post Hurricanes Mitch and Georges Reconstruction Project, and the INFOCOM Platform in the countries of the Central American Isthmus, the Dominican Republic and Haiti. A note on these initiatives will be included in a next issue of the *Epidemiological Bulletin*.

Source: PAHO. Special Program for Health Analysis (SHA).

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