Epidemiological Bulletin

PAN AMERICAN HEALTH ORGANIZATION

ISSN 0256-1859
Printed on acid-free paper

Vol. 12 No. 2, 1991

Cholera Situation in the Americas. An Update

Since publication of the previous issue of the *Epidemiological Bulletin*, official information has been received on cholera from Peru, Ecuador, Colombia, Chile, Brazil, the United States, and Mexico. The information on the Latin America countries is provided by the Ministries of Health to the Country Representative Offices of the Pan American Health Organization (PAHO/WHO), who transmit it to Headquarters in Washington. Cases in the United States are reported by the Centers for Disease Control (CDC) in that country.

The CDC's Enteric Diseases Laboratory Section, which serves as the reference laboratory for the national laboratories in the Latin American countries, has reported identifying strains of *Vibrio cholerae* 01 from Peru (46), Ecuador (2), and Colombia (6). All of the strains were *V. cholerae* 01, serotype Inaba, biotype El Tor, and produced cholera toxin. They were unlike the Gulf Coast strain by hemolysis and molecular analysis of the cholera toxin and ribosomal RNA genes.

Peru

Since it began on 23 January 1991, the cholera epidemic has affected all 24 departments of the country, and as of 22 June 1991 it had produced 223,564 cases. Of these patients, 86,954 were hospitalized and 2,163 died. In Peru, every case of acute diarrhea occurring in places where a cholera case has previously been confirmed is defined as a probable case of cholera.

From the beginning of the epidemic to 22 June 1991 the cumulative incidence rate (the cumulative number of cases in relation to the total population) was 1,037.4 per 100,000 inhabitants for the entire country. The epidemic spread from the Coast to the Mountains and then to the Jungle, and the cumulative incidence in these three geographical areas was 1,444.9 cases per 100,000 population on the Coast, 206.1 in the Mountains, and 1,093.9 in the Jungle.

As of 22 June, the hospitalization ratio (cases hospitalized in proportion to the total number of cases) was 39% for the country as a whole. On the Coast, 37% of patients were hospitalized; in the Mountains, 52%; and in the Jungle, 44%.

The case fatality ratio was 1.0% for the entire country and 0.5%, 4.1%, and 3.9% for the Coast, Mountains, and Jungle, respectively. The ratio of deaths to hospitalized cases was 2.5% for the country as a whole. The figures for the Mountains and Jungle were clearly higher than those for the Coast—8% for the Mountains and Jungle as opposed to 1.2% for the Coast—proportions that are analogous to the figures for all fatal cases.

After the first cases occurred at several points on the Coast, the disease spread quickly along the extensive Peruvian shoreline. From the week of 20-26 January, during which 149 cases were registered, the number

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Figure 1. Cases of Cholera Reported Weekly. Peru, 1991.

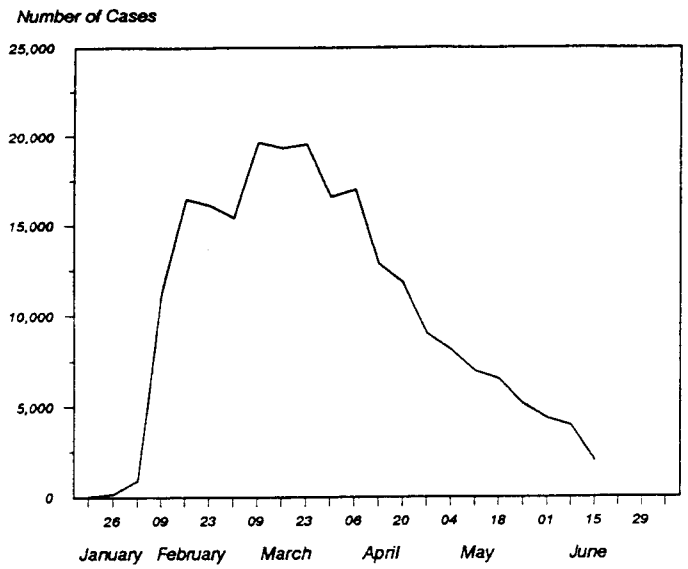
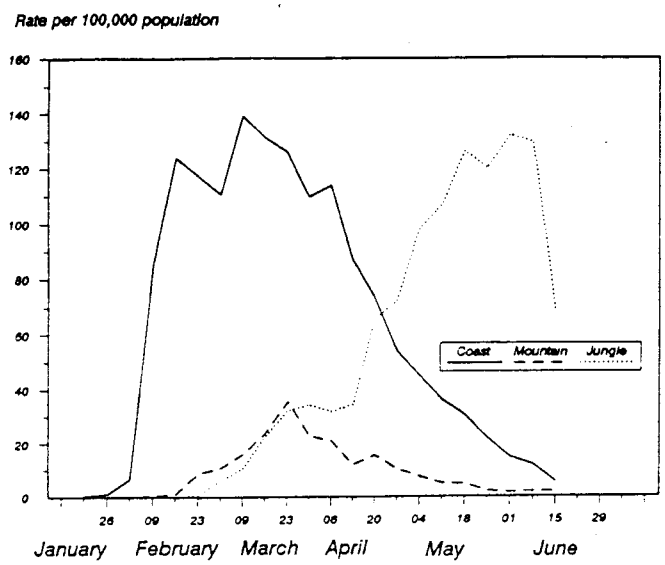


Figure 2. Cholera Weekly Incidence Rate in Three Regions of Peru, 1991.



jumped to 16,335 during the week of 10 to 16 February. The existence of large population groups with deficient basic services, the frequent contacts between the various coastal populations (Lima included), and the nation's lack of preparedness for dealing with the situation from the outset help to explain the rapid spread.

Toward the end of the period considered, the national epidemic curve was clearly falling (Figure 1). On the Coast and in the Mountains the decrease in appearance of new cases began during the weeks of 3 to 9 March and 17 to 23 March, respectively; in the Jungle, however, only the last week of reporting shows a decline of the frequency (Figure 2).

On the Coast, where 61% of the population lives, the disease spread rapidly and caused a great number of cases, but case fatality was low. The Mountains, which account for 31% of the population, had the smallest proportion of cases of the three regions. However, one of every two patients was hospitalized, and case fatality was highest in this region. In the Jungle, a reduction in cases was observed during the last week of this reporting period, but it is difficult to give an immediate prognosis. This region accounts for 8% of the country's population. As of 22 June, the incidence relative to the total population was higher than that for the Mountains and lower than the level for the Coast, but case fatality was the same as in the Mountains. This can be attributed to the fact that the population does not have ready access to health services.

Ecuador

From 1 March 1991 to 15 June, cases had been reported in 19 of the country's 21 provinces. The two provinces untouched by cholera are in the eastern area, and in this area's other three provinces only 11 cases had been reported as of the date indicated. In Ecuador, any patient presenting with manifestations that are clinically and epidemiologically consistent with the disease is considered to be a cholera case.

By 15 June the total number of reported cases had risen to 24,435, which in relation to the total population of the country represents an cumulative incidence of 259.1 cases per 100,000 inhabitants.

For the coastal region (where 50.3% of the country's population lives), the incidence reached 384.5 per 100,000 inhabitants, and for the mountains (45.6% of the total population) it was 139.3 per 100,000. For the eastern region (4.1% of the population), the incidence was just 2.9 per 100.000, but for the island region, which accounts for only 0.1% of the population, the cumulative incidence rose to 820.6 per 100,000.

According to the information available, 78 of every 100 cases registered in the country have been hospitalized, the figures for the mountains and coast being 64% and 82%, respectively. In the other two regions there were no patients hospitalized for cholera.

The case fatality ratio was 1.6% for the country as a whole, 1.0% for the Coast, and 3.3% for the Mountains. No deaths were registered in the other two regions.

After the first cases of cholera occurred on 28 February in El Oro Province on the Peruvian border in the south of the country, the epidemic spread to the north through small fishermen communities (Bajo Alto and Tendales) and reached the city of Machala, affecting disadvantaged neighborhoods were basic sanitation is deficient. From there it spread to Guayaquil, the country's most populous city, which has more than a million inhabitants, a large percentage of whom live in conditions of deprivation. Chronic unemployment has forced a great number of people into the informal economy, where they work as street vendors, mainly selling food and beverages. Cases proliferated in the

poor neighborhoods of Guayaquil, and by the end of March, following festivities that brought rural inhabitants to the city, there began to be reports of cases in various parts of El Guayas Province, of which Guayaquil is the capital.

Cholera spread from Guayaquil not only to the interior of the province but also to the coastal provinces of Los Ríos in the east and Manabí and Esmeraldas in the north. In the south, an epidemic was reported in March in the Province of Loja on the border with Peru, concurrent with a recrudescence of cholera in neighboring Peruvian communities (Las Pircas and El Suyo).

Guayaquil was also the source of contagion for the first cases in the mountain province of Chimborazo, where secondary cases of cholera were reported at the beginning of April when Indian patients presented ill after traveling to the city to sell their agricultural products.

The presence of cases extended to several highland provinces, where situations similar to that in Chimborazo were reported. In some locations, the great frequency of cases in short periods of time suggested that transmission might have occurred through water sources used for mass consumption, such as irrigation ditches, wells, and watersheds from which water is drawn not just for irrigation but also for drinking and general domestic use. In another group of Indian communities in the Provinces of Bolivar, Cotopaxi, and Pichincha, the number of cases was low but case fatality was high: 6.6%, 7.1%, and 8.7% respectively in these three provinces; for the country as a whole, the ratio was 1.6%.

The epidemiological curve showed a decline beginning the week of 12-18 May, with a reduction in the number of new cases in the Provinces of El Guayas and El Oro on the coast, and Carchi, Loja and Chimborazo in the mountains. In other highland provinces, including Azuay, Bolivar, Cotopaxi, Tungurahua, and Pichincha, the number of cases continues to rise, especially in the rural areas.

Colombia

The data collected as of the week of 16-22 June 1991 show a total of 2,599 probable cases; of these patients, 1,970 (75.8%) were hospitalized and 31 (1.2%) died. In the Department of Cauca the fatality rate was 3.9%, which could be due to difficulties of access to health services because of fundamental geographic and socioeconomic barriers. To date, no in-hospital deaths have been registered. Of the first 1,103 reported cases, 24% corresponded to children under 10 years of age and 58.5% to males.

According to the Ministry of Health a probable case of cholera is defined as one in which the clinical diagnosis is consistent with cholera, and which occurs in areas where there has been previous bacteriological identification of *V. cholerae*. The high rate of hospitalization suggests the need for additional information on the reliability of case registration and the hospitalization criteria.

The epidemic has spread to eight of the 33 major jurisdictional divisions in the country (23 departments, 3 intendancies, 5 commissaries, and 2 special districts).

The first cases of the epidemic were registered at the end of March 1991 in the communities of Tumaco and Salahonda on the southern Pacific coast near the border with Ecuador, in the Department of Nariño. Since then the epidemic has spread relatively quickly, affecting various settlements along the Pacific coast. Owing to the commercial fishing activities and the flux of cargo and people through these ports, Tumaco and Buenaventura have been the principal foci for the spread of cholera. From the Department of Nariño, cases spread north toward the Departments of Cauca, Valle, and Choco, and then, in June, eastward to the Department of Tolima in the Andean area. With the appearance of cases in Tolima there is a risk that cholera will contaminate the Magdalena River, the country's major north-south waterway.

The spread of the disease in the departments on the Pacific coast was favored by a high level of vulnerability to intestinal infectious diseases due to the deprived conditions in which the 34 communities in that area are living.

Before the disease spread to the east, there were reports of cases from a second primary focus in Leticia, a city on the Amazon border with Peru and Brazil. The first cases in Leticia were confirmed bacteriologically on 8 April 1991. The spread has been very slow to date. Although this is one of the poorest areas in the country, most of population is scattered and there is little internal mobility. The problem spots in the area are located along the river. These areas are at risk as a result of coastwise shipping and considerable commercial activity in the ports.

In the Atlantic area, no cases have been registered as yet, but the geographical location, economic conditions, and status of sanitation in this region make it highly vulnerable.

Brazil

From 22 April to 29 June 1991 a total of 18 cases of cholera were reported, 16 of them in the cities of Tabatinga and Benjamin Constant in the state of Amazonas in the Northern Region, and the other two in the city of Pontes e Lacerda in the state of Mato Grosso, Midwestern Region. Five patients were less than 5 years old, and 9 patients were hospitalized.

The cities of Tabatinga and Benjamin Constant are located in the region of Alto Solimões along the Amazon River. They are part of a circuit of intense commercial activity, especially trade in agricultural products. This circuit also includes the cities of Iquitos, Santa Rosa, and Islandia in Peru and Leticia in Colombia. All these cities are in contact via the river, and from the practical standpoint there is no geographical distinction between Tabatinga and Leticia.

The sanitation conditions in the area are poor. In Tabatinga, only 39% of the dwellings have house connections, 29% have wells, 17% get their water from their neighbors, 10% use rainwater, and 5% use water from the river. Wastewater runs into the Solimões River.

The national research institute Pesquisa da Amazonia reported that *V. cholerae* biotype El Tor, serotype Inaba, was detected in four of 20 samples collected from the Solimoes River.

Chile

From 7 April to 22 May, a total of 41 cases were reported, 34 of them (83%) in the Santiago metropolitan area and its outskirts; four of the other 7 cases occurred in the northern part of the country.

All patients were over 10 years of age, and 60% of them were males. Thirty-seven patients (90%) were hospitalized and there were two deaths. Of 2,757 samples of feces cultures examined for *V. cholerae,* 13 (0,47%) tested positive. From 22 May to 22 June, no new cases were reported.

United States of America

From 9 April to 31 May 1991, 14 cases of cholera were reported.

Two of the cases, one in Atlanta, Georgia, and another in the state of Florida, occurred in travelers who had recently returned from Peru and Ecuador, respectively. The other 12 cases occurred in two groups of people, one in New York and the other in New Jersey, who consumed shellfish brought in by individuals returning from Ecuador.

Mexico

During the period 17-28 June there have been reports of 27 cases of cholera from two different foci, both in the central region of the country. All the cases were confirmed bacteriologically, and eight of them required hospitalization. Three water samples from the San Miguel River tested positive for *Vibrio cholerae* 01.

After the first case was confirmed on 17 June in the Sultepec basin, epidemiological research, including visits to all the dwellings in the area and collection of samples of fecal matter, brought to light 25 additional cases. Seven of the patients required hospitalization. No new cases have been reported in this area since 24 June.

The other confirmed case occurred in Tepeji del Rio, Hidalgo, in the Tula valley, in a 5-year-old child, who was hospitalized with diarrhea.

(*Source*: Information consolidated by the Health Situation and Trend Assessment Program, PAHO.)

Meeting of the Scientific Advisory Committee of the Caribbean Epidemiology Center (CAREC)

The XVII Scientific Advisory Committee (SAC), met in Port of Spain, Trinidad and Tobago, from 6 to 8 March 1991. SAC has the role "to advise the Director of PAHO/WHO through the Council of CAREC on the scientific programme of CAREC".

SAC ratified CAREC's mandate "to assist and advise Governments in the attainment of that level of national epidemiological capacity necessary for defining health sector priorities, designing effective interventions, and evaluating performance, including the development and maintenance of effective surveillance and control measures for health problems of public health importance"; and CAREC's mission "to act as a Centre that conducts epidemiologic analysis including situational analysis and disease trend assessment for its member countries in the Caribbean".

SAC recommended the preparation of annual synoptic assessments of the health situation, highlighting major public health issues of the subregion and within individual countries.

With respect to the identification of priority health problems and the design of programs for their control, SAC stressed the benefits of CAREC's participation in the definition and review of the pertinent policies and strategies, as well as in the assessment of their feasibility in the countries. The Expanded Program for Immunization and the Communicable Disease Program were mentioned in this regard, especially in reference to tuberculosis and rubella control, and measless elimination.

Similarly, it was recommended that both CAREC and Member Countries should broaden the focus of the AIDS program, to include the prevention and control of other sexually transmitted diseases.

Finally, the importance was noted to continue to expand CAREC's collaboration with national laboratories, to strengthen their capability for the surveillance and investigation of specific diseases and outbreaks.

In the light of the foregoing, SAC strongly endorses the resumption of national epidemiologists' meetings, as a mechanism for the exchange and consolidation of opinions that should be given consideration when national and subregional policies, strategies and programs are defined.

Environmental Health Conditions and Cholera Vulnerability in Latin America and the Caribbean

Deficient environmental health conditions in the countries of the Americas have concerned health authorities over the years. The fact that contaminated water played a mayor role in the transmission of cholera and that it could be controlled, was demonstrated in 1854 by John Snow in London. This knowledge, together with the later discovery of *Vibrio cholerae* by Robert Koch in 1884, prompted the improvement of sanitation services to prevent the spread of the disease. Deficient environmental health conditions increase a country's vulnerability to cholera and, conversely, environmental health barriers remain the most effective measures to control and prevent cholera epidemics. This is unlikely to change in the future.

The Latin American and Caribbean countries have been making significant efforts to increase population coverage with drinking water supply, excreta and sewage collection and disposal, food sanitation, and solid waste disposal, among other public health measures taken to improve health conditions.

In 1961, the Governments of the Region committed themselves in the Charter of Punta del Este to provide water and sewerage to 70% of the urban population and to 50% of the rural habitants by 1971. In the main, in terms of coverage, the urban goals were met but in the rural areas progress was much slower than expected. In 1972, the Ministers of Health adjusted the recommended goals, urging faster progress in all aspects and particularly emphasizing that urgent attention be given to squatter settlements, which already represented about 25% of the urban population.

The coverage goals for the 1970s were met in the established urban areas but with significant deficiencies in the urban peripheries and rural areas. Although the provision of good quality water and sanitary excreta disposal services had been intended, the results in these aspects were less than satisfactory. The International Drinking Water and Sanitation Decade, 1981-1990, further prompted the countries to take more dramatic action and resolve once and for all the deficiencies of these services.

The evaluation report on *The Situation of Drinking Water Supply and Sanitation in the American Region at the End of the Decade 1981-1990, and Prospects for the Future (1)*, provides information on the status of these services and is the main source of information for what follows. Table 1 summarizes the water supply and sanitation situation in 25 countries of Latin America and the Caribbean, including population served and not served, by different types of service.

By the end of 1988, the latest year for which information is available, urban water supply services with household connections reached 79% of the population; when including the population served by public sources (access within 200 meters of dwelling), coverage came to 88%. Urban sanitary sewerage services covered 49% of the population; if other methods of excreta disposal are included, coverage came to 80%.

At the end of 1988 coverage with house connections and standposts in the rural areas was 55%, while coverage with sanitary excreta disposal services was 32%.

There has been a considerable longstanding imbalance between drinking water and sanitation coverage, due to greater priority afforded water supply than sanitation. In addition to coverage, Table 1 shows the deficit in the services. By late 1988, 89 million people (about 34 million in urban areas and 55 million in rural areas), comprising 21% of the population still lacked access to water supply, and almost 141 million (57 million in the urban areas and 84 million in the rural areas), i.e. 34% of the population lacked adequate wastewater and excreta disposal services. In 1988 there

Table 1. Drinking water supply and sanitation coverage in 25 countries of Latin America and the Caribbean, by the end of 1988.

Service	Population in millions			Percentage
	Total	Served	Not served	served
Urban water	291.6	257.8	33.8	88.4
Rural water	124.0	68.5	55.5	55.3
Urban sanitation	291.6	234.7	56.9	80.5
Rural sanitation	124.0	39.8	84.2	32.1

were about 52 million more inhabitants with water supply services than with sewerage or alternative systems for excreta disposal (23 million in the urban areas and 29 million in the rural areas). The disparity is increasing.

Quality of Water and Sanitation Services

From the public health point of view, providing safe water and sanitation implies adequate quantities and guaranteed quality, on a permanent, continuous basis (24 hours a day) at a cost people can afford, as well as commensurate sanitary collection, treatment and disposal of wastewater, and excreta. The coverage figures shown above do not necessarily mean that the services provided meet the minimum standards of drinking water and sanitation. In fact, large deficiencies exist in practically all countries of Latin America and the Caribbean.

Almost all countries reported having water quality control programs in urban and rural areas but with few notable exceptions these are only partially or inefficiently implemented. Control measures are usually the responsibility of the water supply institutions themselves. Health authorities seldom incorporate sufficient water quality surveillance in their programs. Furthermore, they are not oriented toward corrective action and have not allocated sufficient financial resources, materials, and personnel duly trained to do this work effectively *(1)*.

Water supply programs have focused primarily on expanding services or building new ones, with less attention to the quality of water distributed. Access to a public source or even a household connection do not guarantee the quality of the water supplied. Evidence of this was found in the results of inquiries carried out in the workshops organized by PAHO to present and promote the new WHO Guidelines for Drinking Water Quality (1984), and in later studies that indicated that 75% or more of the water supply systems did not disinfect at all or had serious operational problems that interfered with effective and continuous disinfection. Several subsequent national studies indicate a somewhat larger percentage of failure.

National quality standards are generally not met in the peripheral urban areas, where water services are intermittent, nor in the small and medium size systems, particularly in remote areas. With losses as high as 60% of the water produced, water use is very inefficient. Frequently even major cities have intermittent services, at least in certain areas, with high levels of water loss. Seventeen of the 25 countries indicate that they have intermittent services; eleven consider the situation to be serious. Even countries with very high coverage, such as Costa Rica, report that they have some intermittent water supply services that do not meet the minimum standards of quality *(1)*. Lack of system integrity makes it impossible to maintain water quality, especially without disinfection.

Drinking Water Quality in the Cholera Affected Areas

Various studies exemplify the deteriorated situation of drinking water supplies in the cholera affected areas. Between 1984 and 1985 a study of 60 water supply systems, complemented by 40 more at a later date, was conducted in the central highland and jungle areas of Peru*(2)*. The systems comprised different configurations and included wells, and slow and rapid sand filter plants, but the majority had springs as their sources. Most of the treatment plants produced water of poor bacteriological quality; only two of the 40 rural systems claiming to practice chlorination showed chlorine residuals. Among the simple gravity systems, none of 20 claiming to practice this treatment showed chlorine residuals.

In 1991 the USA Centers for Disease Control conducted an epidemiological investigation of cholera in Piura and Trujillo, Peru. It concluded that "the principal route of transmission in both cities was via municipal drinking water, with potential points of contamination in wells, distribution systems and houses", the principal risk being intermittent non-disinfected supplies (Dr. Robert Tauxe, personal communication). The study also implicated contaminated ice, beverages, contaminated food, locally raised vegetables and fruits and shellfish eaten raw. In Piura and Trujillo water samples were found to contain cholera organisms and in the Lima-Callao area the distribution system water contained fecal coliforms *(3)*. Data from the treatment plant of Lima, La Atarjea, showed a Total Coliform content of less than 1/100 ml in the finished water, a Fecal Coliform content of less than 1 /100 ml, and an Heterotrophic Plate Count of less than 1-11/100 ml, after post chlorination, from March 4-9, 1991, even though the raw water contained up to 130,000 Fecal Coliform/100 ml.

Although the examples above refer specifically to cases in Peru, this water quality situation is representative of many countries of Latin America and the Caribbean.

As stated by PAHO, ensuring the supply of adequate quality water, both to those who already have services and to those who will receive new services, poses one of the greatest challenges that most of the countries of the Region will have to face in coming years *(1)*.

Wastewater Disposal and Water Pollution

The discharge of untreated municipal wastewater is a rapidly growing problem in all countries and water pollution has already reached crisis proportions, especially from the enormous discharges originating in the metropolitan areas and large cities.

Information on wastewater treatment facilities in Latin America and the Caribbean is limited. Based on the coverage data (1988) and assuming a daily per capita generation of 200 liters of wastewater for the population served with water connections and sewerage, it is estimated that 142 million inhabitants would produce

Table 2. Pollution caused by domestic wastewater in 25 countries of Latin America and the Caribbean, by the end of 1988.

Service	Population served (millions)	Flow m^3/sec.	Contamination
With sewerage and water	142.0	328.7	
- Sewerage with complete or partial treatment (10% of the total)	(14.2)	(32.9)	Partial contamination depending on the extent of treatment
- Sewerage without treatment	(127.8)	(295.8)	Contamination from raw sewage
With house water connections, without sewerage	88.4	51.2	Partial and indirect contamination
Total with house water connections	230.4	379.9	

328.7 m^3/sec, of which only 16.3 m^3/sec to 32.6 m^3/sec is receiving some treatment. The urban inhabitants who have water in their residences without sewerage connections, at a daily rate of 50 liters per capita, would produce some 51.2 m^3/sec more of wastewater. The contribution of the 61.2 million urban population without access to public sources of drinking water is negligible. The total urban population, estimated at 291.6 million, would thus produce about 379.9 m^3/sec of wastewater (Table 2). These figures should be considered only as indicators of the order of magnitude of current demand for wastewater treatment. Future volumes will increase significantly.

The contribution to water pollution by wastewater from smaller communities is also important. Although they do not pose the mega-problems of large cities, in their limited milieux they cause damages to watercourses, including groundwater, which is the source of water supply for both large and small communities.

The treatment of urban wastewater poses a major challenge both to decision makers and administrators and to the technical personnel in the countries, because of the related problems connected to natural resources, water supply, and other uses, the high cost of treatment facilities, and the lack of appropriate policies and technologies for the special characteristics and situations of the countries of the Region *(1)*.

In relation to the foregoing, it is important to bear in mind that municipal wastewater, if properly treated, can be a valuable resource and play an important part in the management of water resources. There is a considerable economic value attached to reusing such waters for irrigation, aquaculture, and other activities, especially in arid regions. However, the uncontrolled use of untreated wastewater for irrigation, which is reported by several countries of the Region, and for other uses, poses high risk from pathogenic microorganisms and possibly toxic substances. A few countries have initiated actions in this respect, but in general the countries must yet adopt the necessary measures to guarantee that water reuse is carried out in accordance with appropriate sanitary standards.

Another important factor that contributes to the pollution of surface waters and groundwater is municipal solid waste, especially when it is disposed of with no controls, in open dumps or directly into bodies of water and even "landfills" that are not well-designed, well-built, or properly operated.

Future Requirements of Water Supply and Wastewater Collection, Treatment and Disposal

In the future, the first consideration of the countries will continue to be extending coverage of water supply and sanitation services that are adequate in quantity and quality to the population without services and those poorly served. Table 3 illustrates the population projected to the year 2000 and the population served as of the end of 1988.

The difference between the population served in 1988 and the population projected for the year 2000 is the population that should receive services in the course of the 12-year period in order to achieve 100% coverage. The following are the figures: urban water, 122.8 million; rural water, 59.2 million; urban sanitation, 145.9 million; and rural sanitation, 87.9 million.

In Latin America the increase in the urban population is particularly noteworthy. The annual increase from 1990 to the year 2000 is projected to be 2.5%, and is expected to happen primarily in marginal urban areas. In 1970 it had been estimated that on average 25% of the population lived in the urban marginal areas, in precarious conditions *(4)*. Although there is no recent thorough information, it is estimated that this situation continues to prevail, and may have worsened in the marginal areas of the larger cities, where according to a definition of low-income population, this category comprised 40% of the population of urban human settlements in 1981, in some cases accounting for more

Table 3. Unsatisfied and potential demand for services in 25 countries of Latin America and the Caribbean, 1988-2000 (Population in millions).

Service	Total year 2000	Served year 1988	To be served year 2000
Urban water	380.6	257.8	122.8
Rural water	127.7	68.5	59.2
Urban sanitation	380.6	234.7	145.9
Rural sanitation	127.7	39.8	87.9

than 60% of the urban population. Moreover, it has been calculated that from 1984 to 1995 the low-income population may increase by an additional 40 million *(5)*, further overtaxing the already inadequate water supply and sanitation services.

The population growth in the larger cities is especially significant, given the rapid increase and concentration. In 1990 there were 14 cities with over two million people and a total population of 99.7 million (32% of the urban population). By the year 2000 the 14 cities mentioned will have a combined population of 123.7 million, to which 16 million will be added from 8 additional cities of two million each, for a total of 22 cities making a total of some 140 million (34% of the urban population) in these cities. These data give an idea of the enormous quantities of water that will be required and also of the volumes of wastewater that will be produced, which will require collection, treatment and disposal in an appropriate manner.

In the next decade the greatest demand for water supply and sanitation services will be in the marginal urban areas, where at least 40% of the population, mostly poor, will reside. The rural population without services will still be numerous, including the scattered population, which will also require attention.

Meeting the coverage goals implies not only extending services to the entire population, but also providing safe water in sufficient quantity on a permanent basis. This means that the services must be reliable, operate 24 hours a day, and use appropriate technologies that people can afford. In addition, excreta and wastewater disposal will have to be sanitary so as not to present health or environmental hazards.

Degradation of water resources caused by pollution from major discharges of wastewater and solid wastes produced by the population, as well as those resulting from rapid industrial and agricultural development, are affecting the availability of water suitable for drinking water supply, crop irrigation, and aquatic products for human consumption, to such an extent that the authorities of several countries have expressed great concern.

This situation is making it necessary to use increasingly distant water resources or resources requiring complex treatment processes, which makes the services less reliable and drives up economic and ecological costs to unmanageable levels, especially in the metropolitan areas and larger cities. One notable characteristic of the second half of the 20th century has been the emergence and rapid advance of water pollution in Latin America; this is a major problem, as it impacts not only on water supply and sanitation services and thus on health, but also on the social and economic development.

Of the countries that reported in 1988, 15 expressed concern about the situation of water resources, and three of these considered the situation serious. In addition, 16 countries indicated that knowledge of the condition of water resources was not complete, and four considered that the situation was critical.

In several countries pertinent and in some cases extensive legislation on water resources has been approved, but actions for prevention and control of pollution are mostly not sufficient.

An important related aspect the countries will have to face decisively is the disposal of increasing quantities of urban wastewater. The prediction of how much municipal waste water will be produced in addition to what is already discharged, and require treatment to avoid pollution of water courses, is difficult to make as it will depend on many factors such as the number of people that will get sewers, increased consumption of water, introduction of new household fixtures, waste water control, quality of the new sewers, and others. In Table 4 a very rough estimate is shown, made on the assumption that, as a minimum, the proportion of population with different levels of service by the year

2000 will be the same as that estimated at the end of 1988 (Table 2).

The 185.4 million urban inhabitants expected to have sewers will contribute 429.2 m^3/sec of sewage. In addition 115 million with water but no sewers in their homes will contribute 66.7 m^3/sec, for a total of 495.9 m^3/sec. To prevent extreme health and gross environmental degradation these discharges will have to receive some degree of treatment.

The urgency of putting in place comprehensive policies for the management of water resources can be appreciated in the degradation of important rivers such as the Mapocho in Chile, as well as the Bogota, the Cauca, and the Magdalena in Colombia, the Mantaro in Peru, and those of the River Plate system in Argentina *(6)*. In general, the Latin American situation is worsening in relation to rivers and smaller bodies of surface water, as well as to groundwater, which is a major source of water supply for small and large communities, including metropolitan areas such as Mexico City, Lima, Buenos Aires, Santiago, and others.

Some rivers have become so contaminated that they are virtually open sewers and introduce a health threat when used for water supply or for irrigation. In water deficient areas the recycling of wastewater for agricultural purposes without adequate sanitary standards is a major cause for concern. Preliminary information suggests this practice to be associated with a high incidence of gastro-intestinal infectious diseases.

Hygiene and Environmental Health Education

Past experience has confirmed that one of the conditions for attaining the greatest health benefits from the provision of water supply and sanitation services is that these be accompanied by adequate and pertinent health education.

As of late 1988, 18 countries of the Region reported that hygiene education activities in the water supply and sanitation sector were in general insufficient, and eight of these considered this to be a serious shortcoming. The subject was taught in school in nine countries and five of these reported that it was part of the normal curriculum. The type of activities as well as their intensity and frequency varied considerably among countries; in some, notable efforts have been made, while in others they have yet to be initiated. In several countries the water supply and sewerage institutions, on occasions with the collaboration of the local authorities, have taken innovative initiatives and organized ad-hoc campaigns and activities in related aspects. However, the great majority of the countries consider that efforts in this regard are still insufficient.

Future Outlook and Conclusions

Although considerable efforts have been mounted to increase water supply and sanitation coverage in Latin America and the Caribbean, large segments of the population, especially those economically disadvantaged, remain without adequate service. Additionally, in many cases the dependability and quality of water supply has deteriorated and there is widespread failure to adequately treat municipal sewage or human excreta before their discharge into the environment. This situation greatly increases the vulnerability of the population to diseases of public health significance such as gastro-intestinal infections, and cholera in particular. In reviewing the areas adversely affected by cholera it can be seen that there is a direct correlation between the prevalence and speed of propagation of this disease and deteriorated environmental health conditions.

To prevent the propagation of cholera it is absolutely necessary to establish environmental health barriers. Without them other interventions to control cholera epidemics will not be effective. This is especially important since after a number of months a cholera epidemic will diminish of itself, after it has taken its toll of susceptible people. The resulting reduction in the number of new cases can induce a false sense of security, and diminish the incentive for mounting the necessary environmental barriers on a permanent basis. This lull in the epidemic is a critical period of time, for

Table 4. Estimated pollution caused by domestic wastewater discharges in 25 countries of Latin America and the Caribbean, year 2000.

Service	Population served (millions)	Flow m^3/sec.	Contamination
With sewerage and water	185.4	429.2	
- Sewerage with complete or partial treatment (10% of the total)	(18.5)	(42.9)	Partial contamination depending on the extent of treatment
- Sewerage without treatment	(166.9)	(386.3)	Contamination from raw sewage
With house water connections, without sewerage	115.3	66.7	Partial and indirect contamination
Total	300.7	495.9	

if the necessary interventions do not continue to be implemented the chances that cholera will become endemic are greatly increased. This would entail regular seasonal outbreaks that would become a source for the introduction of the disease and subsequent epidemics in other countries.

Adequate supplies of clean water are essential for health and wellbeing as well as for life itself. All development, whether economic, social, agricultural or industrial, is totally dependent upon adequate water resources. Although on a per capita basis Latin America and the Caribbean enjoy the most abundant fresh water resources in the world, negligence in protecting these resources from pollution currently threatens both the health and the economy of the countries. Presently, this is being clearly manifested in the cholera epidemic. However, cholera is only one of more than 20 serious water related diseases, each of which will become more prevalent without sufficient investment in environmental health. The countries of the Region have little choice: either they make the necessary investments in environmental health interventions, including pollution control, or they pay the consequences in terms of economic loss as well as suffering, disease and death.

References

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(2) Lloyd B., Pardon M., Kengwood K., Bartram J. *Phase One Reports, Developing Regional Water Surveillance in Health Region XII, Peru.* Lima, January 1986.

(3) Investigation of the Microbial Quality of Water Supplies During the 1991 Cholera Outbreak in Peru, Geldreich E.M., Fox K. USA Environmental Protection Agency. 16 April 1991.

(4) United Nations - Economic Commision for Latin America and the Caribbean. *Water Suply and Sanitation for the Poor: The Achievements of the International Drinking Water Supply and Sanitation Decade in Latin America and The Caribbean.* Document LC/L.481, 16 November 1988.

(5) Campbell, T. *Water Supply and Wastewater Services and Excreta Disposal to Low/Income Urban Settlements in Latin America and the Caribbean.* Proceedings of the Symposium on Drinking Water and Sanitary Disposal of Excreta in Marginal Urban Areas. Pan American Health Organization, 5-9 November 1984, Santiago, Chile.

(6) United Nations - Economic Commision for Latin America and the Caribbean. *The Water Resources of Latin America and the Caribbean: Water Pollution,* Document LC/L.499, 2 May 1989.

(Source: Environmental Health Program, PAHO.)

Epidemiology Meeting in the Dominican Republic

From 19 to 22 November 1991 the II National Scientific Meeting on Epidemiology will be held in Santo Domingo, to consider "Epidemiology and Crisis: Impact on the Quality of Life." The objectives of the meeting will be:

- To generate a favorable environment for a discussion of the health problems that have been accentuated by the crisis, with a view to proposing urgent reforms of the health care system.
- To promote the research necessary to obtain information regarding the impact of the crisis and of different models of development on the population's quality of life.
- To promote the development of epidemiology, both in its methodological aspects and in its areas of application, as a basic discipline for public health decision-making.
- To contribute to the development of the scientific community active in the health field.

In the meeting there will participate international guests, and various group techniques will be used to discuss the challenge of attempting to deal with the social differentials of health, in order to provide the opportunity for intervention and open analysis by all those interested in the problems of the sector from an epidemiological perspective.

For further information, contact the Office of the II Meeting on Epidemiology, Dr. Pineyro # 41, Santo Domingo, Dominican Republic.

Cholera Vaccine Evaluation

In the light of the outbreak and spread of cholera in several countries in the Americas, the Pan American Health Organization convened a meeting of experts[1] to discuss recent developments and recommendations regarding cholera vaccines. The meeting took place on 3-4 May 1991 at Washington, D.C. The Final Report is presented below.

CHOLERA IN SOUTH AMERICA

The seventh pandemic of cholera reached the Americas in January 1991, when outbreaks of cholera were identified in four separate locations in Peru. By April, the disease had spread to Ecuador, Colombia, Brazil and Chile and some cases were documented in the United States. The rapid, relentless and unpredictable spread of disease raised the prospect that a much larger area of Latin America might soon be affected and that extraordinary preparedness and control measures were needed.

The measures recommended for epidemic control included setting up surveillance of disease, organizing effective treatment programs to prevent mortality, promotion of health education and other measures to ensure proper waste disposal, provision of safe water and food, investigation of the modes of transmission, and discouraging the use of mass chemoprophylaxis. While cholera vaccines are commercially available and have been offered by manufacturers to ministries of health in some of the countries affected, their use has been generally discouraged. Nevertheless, an effective vaccine would be a useful control measure when used in conjunction with the other activities described above. In the face of the current epidemic and in light of recent developments with new cholera vaccines, the status of this recommendation was reviewed.

BACKGROUND

1. Current recommendation for cholera vaccine

The current commercial cholera vaccine composed of killed whole bacteria given parenterally confers modest and brief protection, does not prevent asymptomatic infection, and has only been tested in endemic settings where naturally acquired immunity is also present. Since 1973, WHO has advised that the vaccine is ineffective for preventing the spread of cholera and has recommended that it not be required by countries as a condition of entry for persons arriving from an endemic area. Use of vaccination to prevent disease during an epidemic has also been discouraged because vaccine efficacy is low (about 30-60% protection), two doses are required and protection develops only after several weeks, mass vaccination requires resources that might otherwise be devoted to providing essential public health activities to control the epidemic and identify the modes of transmission, and vaccination can give the population a false sense of security, resulting in lessened efforts to implement other preventive measures.

2. Goals for a cholera vaccine

The prospect of developing an effective cholera vaccine has improved in recent years. This is based especially on a greatly improved understanding of the mucosal immune system that protects against enteric infections, and on evidence that volunteers recovering from cholera are substantially protected against reinfection for several years. The ideal vaccine would be cheap, safe, easy to administer, effective after a single dose, and would protect both nonimmune and immune persons from severe illness for a prolonged period, while possibly reducing the risk of asymptomatic infection. The vaccine would likely be given orally, to optimally stimulate enteric mucosal immunity. New oral vaccines, including the whole cell/B subunit formulation and the live mutant CVD 103 HgR represent considerable progress toward these goals.

3. Current status of candidate cholera vaccines

(a) *Killed whole cell/B subunit vaccine WC/B*

This candidate vaccine consists of killed *V. cholerae* of both serotypes (Inaba, Ogawa) and biotypes (classical, El Tor). To the WC component is added purified B subunit (B), a harmless but immunogenic component of cholera toxin. This vaccine, and WC component alone, have been extensively tested in volunteers and in a large field trial in Bangladesh. These studies showed that the vaccine, given orally, stimulates both local (intestinal) and serum antibody responses and has no side effects. The trial in Bangladesh, conducted

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[1]Participants included Paul Blake, Roger Glass and Kaye Wachsmuth, Centers for Disease Control; J. Clemens and Dale Spriggs, National Institutes of Health; Gerald Sadoff and David Taylor, Walter Reed Army Institute of Research; Myron M. Levine, University of Maryland; David Sack, The Johns Hopkins University, all of the United States; Bernard Ivanoff, Nathaniel Pierce and James Tulloch, World Health Organization, Alberto Pellegrini Filho,David Brandling-Bennett, Virgilio Escutia, Akira Homma, Marlo Libel, Gabriel Schmuñis, Juan José Urrutia, and other PAHO staff.

in children and adult women from 1985 to 1988 showed the following:

(i) The combined WC/B vaccine or WC alone, given in three doses, performed equally well after three years of observation, giving 50-52% protection against cholera in all ages. During the fourth year of observation, neither vaccine afforded appreciable protection.

(ii) During the first 6 months after vaccination the WC/B vaccine gave 85% protection in all ages, whereas the WC vaccine gave 58% protection. The WC/B vaccine also gave significant protection against diarrhoea caused by enterotoxigenic *Escherichia coli* that produce LT toxin.

(iii) During the first 12 months both vaccines were much less protective in young children aged 37-60 months (16-18% protection) than in older children and adults (67-78% protection).

(iv) Protection in children aged 2-5 years averaged 24-47% during the first two years of followup, but then disappeared. In contrast, protection in older persons was sustained for three years, averaging 63-68%.

(v) Overall, the level of protection against El Tor cholera was about 30% lower than for classical cholera.

(vi) Protection by two doses of vaccine, although evaluated in a much smaller group, was equal to that evoked by three doses; one dose was much less effective.

These results are the most promising obtained to-date with any cholera vaccine, especially as regards duration of protection. The lower and relatively brief protection seen in young children is not explained, but may reflect an important contribution to immunity by natural exposure to *V. cholerae*, which occurs frequently in Bangladesh and leads to significant natural immunity among adults.

(b) *Live oral vaccine, CVD-103 HgR*

This candidate vaccine consists of live *V. cholerae* that have been genetically manipulated to delete the gene encoding the A subunit of cholera toxin. A mercury resistance marker has also been inserted in the bacteria. The vaccine has a very small risk of causing brief and mild diarrhoea when fed to volunteers; however, most persons have no symptoms after immunization. The vaccine has not been evaluated in a field trial, but there have been extensive studies in volunteers. In the USA these have shown that:

(i) A single dose of vaccine ($5x10^8$ cfu) was more immunogenic and protective in American volunteers than three doses of WC/B vaccine:

- 92% had a 4-fold or greater vibriocidal antibody response;

- there was 89-100% protection against challenge with classical *V. cholerae*;

- there was 63-64% protection against challenge with El Tor *V. cholerae*, and,

- overall, there was 83% protection against "severe" diarrhoea (1 litre or more of stool).

(ii) In Thai and Indonesian volunteers Phase I trials have shown that:

- Seroconversion for vibriocidal antibody was much better in university students (63-92%) than military recruits (20-39%), and

- Seroconversion in Indonesian children aged 5-9 years was only 16% following a dose of 5×10^8 cfu, but incrased to 79-86% after doses of 5×10^9 or 1×10^{10} cfu.

EVALUATION AND USE OF AVAILABLE CHOLERA VACCINES

1. Public health use of vaccines for control of the epidemic in Latin America

This would include the use of vaccines to protect individuals from illness (especially serious disease) and, possibly control the spread of cholera.

a) *Parental cholera vaccine.* This is considered in the section on background.

b) *Candidate oral cholera vaccines.*

Whole cell/B subunit or whole cell oral vaccines. The efficacy of these vaccines has not been established for the sort of epidemic conditions prevalent in Latin America.

Although the vaccines might show efficacy equal to or greater than that seen in Bangladesh, there are several reasons why efficacy might be lower. These include:

(i) All illness in Latin America is caused by the El Tor biotype of *V. cholerae*, whereas in Bangladesh 60-70% was due to the classical biotype; in Bangladesh the level of protection evoked by the vaccines was about one-third less *versus* El Tor disease than against disease caused by classical strains.

(ii) Most persons at risk in Latin America are immunologically naive with respect of *V. cholerae*. It is possible that vaccine efficacy in Bangladesh was

enhanced in persons already partially immunized by natural exposure to *V. cholerae*.

(iii) Immunization in Latin America would likely be under epidemic conditions, or the threat of an epidemic. Conditions prevailing during an epidemic might overwhelm vaccine induced immunity, thus reducing its apparent efficacy.

(iv) These vaccines were less effective in persons with blood group O, than in those with other blood groups. The proportion of persons with O blood group is about twice as great in Latin America as in Bangladesh.

Additionally, it was noted that available WC/B vaccine would likely contain B subunit made of recombinant bacteria and therefore was a "new" vaccine. For this reason, Phase II studies, and possibly efficacy trials, should be completed before the vaccine is used for disease control.

It was agreed that neither WC nor WC/B vaccine should be used for disease control in Latin America until vaccine efficacy could be determined under carefully controlled conditions.

CVD 103 HgR live oral vaccine. There have been no efficacy trials of this vaccine either in cholera endemic or epidemic areas. This vaccine should not be used for disease control until such trials have been done. These trials should be preceded by Phase II studies in adults and children that clearly establish a safe and immunogenic dose of the vaccine.

2. Evaluation of candidate cholera vaccines

(a) *Objectives and general considerations*

These apply to all candidate vaccines now being considered for human trials: WC, WC/B, and CVD 103 HgR. The major objectives are to determine short term (e.g., 6 months) vaccine efficacy for preventing serious, life-threatening illness. Additional important objectives are to define vaccine efficacy in both young children and adults, to determine the duration of vaccine efficacy, and to determine the effect of vaccination on the occurence of asymptomatic infection.

These objectives will require carefully designed trials to determine vaccine efficacy or effectiveness. In either case, the trials would probably need to be randomized, controlled and preferrably double blind. Based on logistical considerations, randomization may either be on an individual basis or using clusters. It will be particularly difficult to plan and conduct such trials with a minimum of delay, especially given the political and social pressures related to vaccine evaluation during a cholera epidemic. Nevertheless, the general objective should be to institute one or more trials, if possible, late in 1991, when the next summer season begins and an increase in cholera cases is likely.

It is recognized that a successful trial would create a large demand for the vaccine. At a minimum, vaccine should be provided free for trial participants in the control groups. Efforts should also be made, in collaboration with the vaccine manufacturer, to maximize vaccine availability for the host country and the Region. However, this may take some time.

(b) *WC and WC/B vaccines*

In view of the substantial reduction already achieved in the cost of B subunit and the optimistic prospects for further substantial decreases, this component of the vaccine no longer accounts for the majority of the cost for WC/B vaccine. As B subunit enhances short term protection against cholera, and also stimulates cross protection for LT-ETEC lasting several months, it was agreed to focus further efforts only on development and evaluation of WC/B vaccine. Further studies with WC vaccine would not be proposed.

Studies required for WC/B vaccine in Latin America include:

(i) ***Phase II trials.*** These are planned first to be done in North American adults and then in children in Chile. The trials can begin when vaccine is available (July-August 1991) and should be completed before the end of 1991. The trials are being organized by the U.S. Army. The advice of external groups, including WHO, is sought with regard to the design of these trials.

(ii) ***Efficacy/effectiveness trials.*** The major need is for a trial to define vaccine efficacy under epidemic circumstances both in persons previously exposed to *V. cholerae* and those never exposed. This might require the ability to initiate a trial rapidly after a major outbreak begins. It is recognized that this would be difficult to achieve, but it should be attempted. The most appropriate approach was not agreed, but needs to be carefully explored and planned, possibly preparing for a trial in more than one site. WC/B vaccine (up to 300,000-400,000 doses) may be available for such a trial (or trials) from the U.S. Army. Alternatively, it could be produced by Swedish Bacteriological Laboratories (and possibly Pasteur-Merieux) by the end of 1991. Release of vaccine by the U.S. Army requires approval by the Surgeon General, U.S. Public Health Service.

A trial with WC/B vaccine could also be considered in an area already extensively affected by cholera. This would yield data on vaccine efficacy in persons previously exposed only to the El Tor biotype, which is different from the situation in Bangladesh, where exposure to classical *V. cholerae* is common.

These trials, or separate trials, should also be designed to evaluate the effect of the vaccine on asymptomatic infection.

The precise immunization schedule to be used was not defined, although at least two doses would be required. The shortest effective interval between doses should be explored during Phase II studies. The role of a booster immunization, e.g., at 6 months, in sustaining protection should also be considered.

(c) *CVD 103 HgR vaccine*

Further Phase II trials are required before efficacy or effectiveness trials of this vaccine can be planned. Phase II trials, in both adults and children, are planned for Chile, Peru and Costa Rica, to be completed before the end of 1991. If these define a safe and reliably immunogenic vaccine dose, vaccine efficacy should then be determined in a cholera-endemic population, and efficacy or effectiveness in an epidemic setting, as described above for WC/B vaccine.

FURTHER DEVELOPMENT OF CANDIDATE CHOLERA VACCINES

Efforts should be encouraged to "improve" both the WC/B and live oral cholera vaccines, based on results of the studies described above. Some agreed approaches included:

1. WC/B vaccine

The WC component should be modified to include a greater proportion (at least 50%) of El Tor strains. It should also contain maximum amounts of TCP antigen. Further efforts should be made to reduce vaccine cost, both with regard to B subunit and the WC component. The vaccine should be produced in a more convenient galenic formulation, presumably a lyophylized powder that would be reconstituted with buffer salts in water before use.

Longer term improvement of the vaccine should include efforts to develop a one-dose formulation, possibly by the use of microspheres that incorporate vaccine components, are taken up by M cells overlying Peyer's patches, and "deliver" the vaccine components to the mucosal immune system slowly or in a phased manner over several days or weeks. Approaches to improve the immunogenicity of WC/B with adjuvants should also be explored.

2. Live oral vaccine

Approaches to improve the immunogenicity of live oral vaccines should be pursued. These could include the use of other vaccine strains, e.g., CVD 110 (an El Tor strain that is negative for ZOT), CVD 103 HgR2, a strain with 10-fold greater colonizing capacity than CVD 103 HgR, and other live, genetically manipulated strains.

RECOMMENDATIONS

1. Established WHO policy on cholera and diarrhoeal disease control should guide national efforts to control cholera in Latin America. These efforts should not be relaxed or deferred in anticipation that they would soon be substantially modified by the availability of an effective vaccine. Nevertheless, research to evaluate and develop an effective vaccine should be accelerated to the greatest extent possible.
2. Existing WHO recommendations concerning parenteral cholera vaccine were confirmed; namely, it is recommended that it should not be used for control of cholera.
3. It is recommended that existing candidate vaccines (WC, WC/B and CVD 103 HgR) should not be put to public health use in Latin America at this time. Further information is required on the efficacy and effectiveness of WC/B and CVD 103 HgR before such recommendations can be made.
4. No further evaluation of oral WC vaccine is recommended.
5. Phase II studies should be conducted to define the most immunogenic dose of CVD 103 HgR vaccine in children and adults. If acceptable results are obtained, an efficacy trial should be done in an endemic area, and an efficacy or effectiveness trial in an epidemic area.
6. Phase II studies of WC/B vaccine (based on recombinant B subunit) should be done in adults and children. If acceptable results are obtained, an efficacy or effectiveness trial should be done in an epidemic area.
7. Trials with all candidate vaccines should seek to determine the extent of protection in adults and children, to define protection in persons previously exposed to *V. cholerae* and those never exposed, to define the duration of protection, and to evaluate protection against asymptomatic infection.
8. Efforts should be undertaken to improve existing candidate vaccines. This involves improving their immunogenicity, developing practical galenic formulations, and reducing production cost.
9. Decisions need to be made about a joint mechanism for WHO/HQ and PAHO to develop, review and monitor cholera vaccine studies in the Americas. It is recommended that WHO/HQ continue overall coordination of global vaccine development.

(*Source*: Research Coordination Unit and Health Situation and Trend Assessment Program, PAHO.)

AIDS Surveillance in the Americas

Number of reported cases by year, and cumulative cases and deaths, by country and subregion, as of 15 June 1991.

SUBREGION Country	Number of cases Through 1986	1987	1988	1989	1990	1991	Cumulative total (a)	Total deaths	Date of last report
REGIONAL TOTAL	45,471	33,198	41,899	47,293	43,079	5,504	216,832	129,359	
LATIN AMERICA b)	3,679	4,663	7,510	8,855	8,521	476	33,880	14,210	
ANDEAN AREA	181	398	649	806	841	247	3,234	1,538	
Bolivia	3	3	10	2	7	...	25	20	31/Dec/90
Colombia	61	181	263	330	450	198	1,483	647	31/Mar/91
Ecuador	13	19	25	15	34	...	127	79	31/Dec/90
Peru	12	60	68	117	141	...	398	155	31/Dec/90
Venezuela	92	135	283	342	209	49	1,201	637	31/Mar/91
SOUTHERN CONE	112	126	264	335	523	13	1,373	430	
Argentina	73	72	169	229	377	...	920	263	31/Dec/90
Chile	29	40	63	65	58	...	255	60	31/Dec/90
Paraguay	2	5	4	3	12	...	26	18	31/Dec/90
Uruguay	8	9	28	38	76	13	172	89	31/Mar/91
BRAZIL	1,584	2,162	3,580	4,516	4,421	77	16,340	7,899	31/Mar/91
CENTRAL AMERICAN ISTHMUS	87	189	380	531	833	125	2,161	796	
Belize	1	6	4	0	1	...	12	8	31/Mar/90
Costa Rica	20	23	52	56	81	...	232	122	31/Dec/90
El Salvador	7	16	55	149	96	34	357	63	31/Mar/91
Guatemala	16	12	18	18	78	23	165	83	31/Mar/91
Honduras	17	102	188	231	513	66	1,133	359	31/Mar/91
Nicaragua	0	0	2	2	7	2	13	12	31/Mar/91
Panama	26	30	61	75	57	...	249	149	31/Dec/90
MEXICO	793	1,065	1,558	1,673	1,017	1	6,107	3,022	31/Mar/91
LATIN CARIBBEAN c)	922	723	1,079	994	886	13	4,665	525	
Cuba	3	24	24	12	10	...	73	40	31/Dec/90
Dominican Republic	124	222	324	529	246	13	1,506	188	31/Mar/91
Haiti	795	477	731	453	630	...	3,086	297	31/Dec/90
CARIBBEAN	465	374	489	725	699	38	2,802	1,572	
Anguilla	0	0	1	2	1	...	4	3	30/Sep/90
Antigua	2	1	0	0	3	...	6	5	31/Dec/90
Bahamas	86	90	93	168	162	...	599	296	31/Dec/90
Barbados	32	24	15	40	61	20	192	134	31/Mar/91
Cayman Islands	2	1	1	1	2	...	7	7	31/Dec/90
Dominica	0	5	2	3	2	...	12	11	30/Jun/90
French Guiana	78	25	34	54	41	...	232	144	30/Sep/90
Grenada	3	5	3	8	5	...	24	15	31/Dec/90
Guadeloupe	47	41	47	47	...	...	182	85	31/Dec/89
Guyana	0	10	34	40	61	...	145	49	31/Dec/90
Jamaica	11	32	30	66	62	...	201	92	31/Dec/90
Martinique	25	23	30	51	42	6	177	102	31/Mar/91
Montserrat	0	0	0	1	0	...	1	0	30/Sep/90
Netherlands Antilles	9	12	9	16	31	...	77	16	31/Dec/90
Saint Lucia	4	4	2	8	3	...	33	16	31/Dec/90
St. Christopher-Nevis	6	4	9	5	8	...	32	19	31/Dec/90
St. Vincent and the Grenadines	2	5	8	6	4	...	25	12	31/Dec/90
Suriname	4	5	4	35	35	...	83	65	31/Dec/90
Trinidad and Tobago	151	85	160	167	173	11	747	486	31/Mar/91
Turks and Caicos Islands	3	2	6	7	1	1	20	15	31/Mar/91
Virgin Islands (UK)	0	0	1	0	2	...	3	0	31/Dec/90
NORTH AMERICA	41,327	28,161	33,900	37,713	33,859	4,990	179,950	113,577	
Bermuda	51	21	28	35	33	4	172	135	31/Mar/91
Canada	1,185	865	989	1,099	704	43	4,885	2,912	31/Mar/91
United States of America c)	40,091	27,275	32,883	36,579	33,122	4,943	174,893	110,530	31/Mar/91

a) May include cases for year of diagnosis unknown.

b) French Guiana, Guyana, and Suriname included in the Caribbean.

c) Puerto Rico and the United States Virgin Islands included in the United States of America.

Diseases Subject to the International Health Regulations

During year 1991, Ecuador has reported a total of 19 cases of yellow fever and 9 deaths, occurred in the Provinces of Morona Santiago (4 cases and 4 deaths), Napo (9 cases and 4 deaths), Pastaza (2 cases and one death), and Zamora Chinchipe (4 cases and no deaths). For information on reported cholera cases and deaths, see article on cholera situation in this *Bulletin.*

Creation of the Department of Epidemiology in Chile

In October 1990, the Division of Health Programs (DIPROG) was created within the Ministry of Health and its principal functions were defined. Among the Departments that will be a part of this Division is the Department of Epidemiology and Program Support, which is expected to function as a study and analysis group that will provide an ongoing assessment of current health conditions in the country, and propose interventions appropriate to those conditions. It is hoped that this Department will thus be able to effectively support the other departments in the Division, as well as other units of the Ministry. Among the Department's main functions are the following:

- To maintain an ongoing assessment of current health conditions, and their determinants and trends in the country and the Health Regions and Services, and to supervise the Health Services with regard to epidemiological diagnoses and analyses.
- To develop and maintain an effective Epidemiological Surveillance System, with regional and local networks, both for communicable and noncommunicable diseases.
- To advise the other DIPROG Departments, the Health Services, and other entities that request assistance on operational and epidemiological research methodology, and to collaborate in the design and evaluation of such research and in the analysis of the results and conclusions.
- To develop and participate in staff training programs and support these activities at the intermediate and local levels.
- To disseminate the results of epidemiological assessments and research, operations research, and any other information considered to be of relevance, and to prepare and periodically publish the *Boletín Epidemiológico de Chile.*

In order to achieve a comprehensive approach, both in the diagnostic stage and in the health interventions development and program evaluation processes, the promotion of multidisciplinary participation will be necessary. This will require the collaboration of professionals and entities from other Ministry units, including the Department of Information Science and Coordination and the Analysis and Studies Unit of the Department of Planning.

Correction: In Vol.12, No.1, 1991 of the *Epidemiological Bulletin*, the report on the situation of cholera in Ecuador was prepared by Dr. Italo Barragán, PAHO/WHO Representative.

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