5. Cholera in Chile

5.1 Panorama of the Country

Chile, with a total population of approximately 14 million inhabitants, has an area of over 292,000 sq. miles. 39% of the population lives in the Santiago, Valparaiso and Concepcion metropolitan areas. Since 1989, the country has undergone transformation from a military to democratic government, with impressive economic growth. Nevertheless, according to a 1990 survey done by the University of Chile, 13.8% of the population lives in extreme poverty, mostly in the rural extreme southern region. However literacy is over 96%, and average life expectancy is 72 years.

5.2 Risk Evaluation and Public Health Action in Chile

Chile did not suffer the thousands of cases of cholera which burdened Peru. While Chile did have higher levels of potable water coverage, and more advanced socio-economic status, the preventative strategies adopted by the country were a hallmark of successful cholera prevention. The Chilean Ministry of Health, along with other government bodies, formed the National Cholera Commission, which embodied inter-sectorial coordination and swift action. The Commission evaluated the major risk factors for the spread of cholera in Chile, which included: 1) only 3% of wastewater was treated, and the untreated water was used for massive irrigation, 2) the Chilean population consumed raw vegetables (irrigated with untreated sewage, especially in the Santiago metropolitan area (SMA), 3) the public and many health professionals were unaware of cholera prevention and treatment, and 4) a lack of professionals trained in laboratory techniques made implementation of active surveillance for cholera impossible. To address these risks, the government imposed the following measures in 1991: a) the entire agricultural area surrounding the SMA was subjected to strict laws which prohibited the use of wastewater to irrigate crops for human consumption - this was enforced through barricades, certification and destruction of illegal crops b) the prohibition of the sale of raw seafood and vegetables in restaurants and of the sale of non-packaged food items, c) the implementation of a massive public education campaign to educate consumers concerning "a and b", as well as other cholera prevention measures, especially personal hygiene, and d) the immediate training of laboratory personnel and implementation of active surveillance for cases.
A document entitled "Epidemiological Association between Water Contamination and Illness" sponsored by PAHO and World Bank contains a broad description of the trends observed in other enteric diseases between 1976 and 1992, a period that encompasses several years prior to the arrival of cholera in Chile and includes a year of post-intervention observation. According to this document, infections such as typhoid fever and hepatitis A have undergone reductions of 60% and 11%, respectively, between 1983 and 1985. Similarly, subsequent reports from the Ministry of Health for the period between 1989 and 1992 show that the rates of hepatitis A and typhoid fever decline again (from 81.4 to 38.8 per 100,000 inhabitants for hepatitis A, and from 51.6 to 13.8 for typhoid fever). A series of associations are reported between wastewater used for crops eaten by the SMA population and their health conditions. The objectives of this study were to evaluate the impact of the different control measures on the prevalence of typhoid fever and hepatitis A using information obtained from health registries by statistical methods of time series analysis and regression models. Due to a lack of available data, the authors were unable to demonstrate a direct association between the levels of consumption of wastewater-treated produce and the health indicators of the study population. However, the rate of reported infection was significantly greater in the community exposed to contaminated water than in the community using well water as a form of irrigation (4.3% vs 1.2% respectively).

Another report generated by the World Bank (Bartone, 1994), evaluated the health impacts of actions taken to prevent the spread of cholera and other enteric diseases in Chile and a cost/benefit analysis was implemented. As quoted from Bartone:

"The emergency measures taken in 1991 resulted in reducing the health costs of typhoid fever by US$1.4 million per year and in avoiding the risks identified above (loss of fruit exports equivalent to US$50 million in 1991). Summing these potential losses gives the total annual expected health and related benefits, which are estimated to be US$66.1 million. The corresponding costs, however, were not insignificant. On an annual basis these costs included intervention costs of US$1.6 million, losses to farmers of about US$4.9 million, and increased consumer costs of about US$7.2 million. The total annual costs are thus about US$13.7 million. Compared to the risks of inaction, these costs appear acceptable, and the decision to implement the emergency measures seems reasonable."

See Table 5.1. As can be seen, the net benefit was US$52.4 million!

The preliminary steps in setting up the prevention program in Chile involved an inventory of the materials and human resources in the health services, and the prioritization of strengthening weak areas identified from this evaluation. This exercise permitted a better definition of the strategies to be adopted (e.g. management of patients, report of cases, and control of outbreaks), that in turn improved the efficiency of the treatment of cholera. The hospital records contributed valuable information used for public education programs, as well
Table 5.1

Policy Cost-Benefit Analysis Summary

<table>
<thead>
<tr>
<th>Annual Benefits</th>
<th>US$M</th>
<th>Annual Costs</th>
<th>US$M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reductions in typhoid mortality &amp; morbidity</td>
<td>1.4</td>
<td>Public education campaigns</td>
<td>1.5</td>
</tr>
<tr>
<td>Avoided cholera mortality/ morbidity</td>
<td>14.7</td>
<td>Farmer losses</td>
<td>4.9</td>
</tr>
<tr>
<td>Avoided export losses</td>
<td>50.0</td>
<td>Inspection program</td>
<td>0.1</td>
</tr>
<tr>
<td>TOTAL ANNUAL BENEFITS</td>
<td>66.1</td>
<td>Consumer losses</td>
<td>7.2</td>
</tr>
<tr>
<td>BENEFITS - COSTS</td>
<td>52.4</td>
<td>TOTAL ANNUAL COSTS</td>
<td>13.7</td>
</tr>
</tbody>
</table>

Source: Bartone, 1994

as the basis for the implementation of other control measures, such as agricultural restrictions and monitoring of water quality for irrigation of vegetables. Perhaps one of the greatest limitations in the available literature is the lack of attempts to establish rigorous correlations between disease surveillance and other environmental indicators such as water quality in a defined study population. The use of data collected as part of the cholera prevention program (e.g. levels of disinfectant in water, monitoring of Vibrio cholerae O1 in sewage and natural water sources, etcetera) were not incorporated into a well-designed field study. These gaps make a more rigorous evaluation of the prevention and control measures difficult, as will be illustrated in the evaluation of the studies that follow.

The majority of the Chilean literature focuses on the system of epidemiological surveillance. Some reports describe the situation by year and by regions of the country, between April 1991 until March 1993, during which 146 cases of cholera were reported. Of these cases, approximately 10% were imported. The available reports present valuable information concerning the distribution of cases by age group, and in some cases, in accordance with others variable (e.g. sex). The available reports present national as well as regional trends, in addition to a description of the evolution of the outbreak of cholera and its seasonal fluctuations. Only two of the documents contain complementary information
addressing the probable sources of contagion of *V. cholerae*, although in several of the reports risks associated with the intake of vegetables irrigated with wastewater, or seafood products (shellfish, molluscs), that were in contact with contaminated water (e.g. wastewater discharge) were discussed. At the onset of cholera surveillance in 1991, the ingestion of vegetables was the most frequent risk factor associated with 50-85% of reported cases in the metropolitan area (see figure 5.1). These same documents indicate that consumption of fish and shellfish was the origin of the outbreak of cholera in the northern region of the country (5 -15%). No greater details exist concerning these outbreaks, although the isolation of culturable *Vibrio cholerae* in 9-15% of samples gathered from raw vegetables and shellfish is reported (Ministerio de Salud, 1993). In other reports on epidemiological surveillance data outbreaks of cholera occurred in rural towns without basic water and sanitation services, located on the banks of sewage channels which are used to irrigate crops. In one of the reports (Ministerio de Salud de Chile, 1992) the isolation of *V. cholera* 01 in the channel waters is discussed.

**Figure 5.1**

*Confirmed Cases of Cholera in Chile by Source of Infection*

![Pie chart showing the sources of cholera cases in Chile. Vegetables 68%, Water 10%, Seafood 5%, Unknown 10%, More than one source 8%.

Source: MINSAL PG/RG-24/0791*
The information analyzed shows the need for strengthening environmental monitoring for the search of *V. cholerae*, particularly in wastewater used for the irrigation of vegetables that are consumed raw. The levels of *V. cholerae* in bodies of water that receive wastewater, may offer sentinel information on the potential evolution of an outbreak in populations that contribute this wastewater to agricultural sites, hence highlighting the importance of environmental surveillance. This same recommendation applies to harvest sites for molluscs and shellfish.

One of the initial obstacles in cholera control was the absence of an adequate system for the registry of diarrheal diseases. This obstacle was corrected by the adaptation of clinical-epidemiological files designing them to specifically track cases of cholera. Once the scope and limitations of the health services were defined, and taking into account the costs of medical care, the search for *Vibrio cholerae* 01 was limited to 20% of all suspected cases, although the search was intensified in patients with more suggestive clinical symptoms. The definitive diagnosis was the task of reference laboratories, through more sophisticated procedures. This approach permitted a more efficient and rational management of human and financial resources. This multi-faceted effort is likely to have contributed to a decline in enteric diseases registered beginning in 1991, with reported cases reduced by 80 and 35%, respectively, for typhoid fever and hepatitis A. It is possible that the overall effect of all the interventions prevented Chile from repeating the explosive epidemic which was experienced in Peru.