

CASE 4

Eliminating Polio in Latin America and the Caribbean

Geographic Area: Latin America and the Caribbean

Health Condition: In the 1970s, Latin America had an estimated 15,000 paralysis cases and 1,750 deaths each year due to polio. The oral polio vaccine was introduced in the region in 1977.

Global Importance of the Health Condition Today: Today, polio is on the verge of being erased from the globe. As recently as 1988, 125 countries were endemic for polio, with an estimated 350,000 cases. By the end of 2003, just six countries reported polio cases, and fewer than 800 cases were reported worldwide. This dramatic reduction is the result of massive OPV immunizations around the world through a global eradication campaign.

Intervention or Program: In 1985, the Pan American Health Organization began a polio eradication campaign in Latin America and the Caribbean, to complement the routine immunization efforts of the newly formed Expanded Programme on Immunization. To increase immunization coverage in areas with weak routine health services, all endemic countries in the region implemented national vaccine days twice a year to immunize every child under 5, regardless of vaccination status. In the final stages of the campaign, "Operation Mop-Up" was launched to aggressively tackle the disease with house-to-house vaccinations in communities reporting polio cases and with low coverage. An extensive surveillance system helped track outbreaks.

Cost and Cost-Effectiveness: The first five years of the polio campaign cost \$120 million: \$74 million from national sources and \$46 million from international donors. Taking into consideration the savings from treatment, these donor contributions would pay for themselves in just 15 years. The administration of the vaccine is highly cost-effective, at just \$20 for a healthy year of life in a high-mortality environment.

Impact: In 1991, the last case of polio was reported in Latin America and the Caribbean. The disease reemerged briefly in 2000 when 20 vaccine-associated cases were reported in Haiti and the Dominican Republic, but no other cases have been reported since 1991. Today, polio has been eliminated from Latin America and the Caribbean.

As the world struggles to wipe out the last traces of polio, one region has been polio-free for more than a decade. The experience of polio elimination in Latin America and the Caribbean shines a light on what can be done when regional cooperation and support are strong, funding is sufficient, and the strategy covers all the bases. As a result of these factors, polio—which used to cripple thousands in the region each

year—is now becoming a distant memory, as it is in the industrialized world.

A Mighty Disease

Polio, short for poliomyelitis, is one of history's most feared infectious diseases. It is caused by the

intestinal poliovirus, which enters its victim through the mouth or nose and multiplies in the lymph nodes. Polio's most distinguishing symptom, paralysis, develops in less than 1 percent of all victims and is caused when the virus invades the central nervous system and irrevocably kills the nerve cells responsible for muscle movement. If enough nerve cells are destroyed, the victim is left with lifeless limbs (primarily the legs) in what is called acute flaccid paralysis. In as few as four days, a previously healthy person can become stricken with paralysis and condemned to a lifetime of crutches and wheelchairs. Quadriplegia occurs when extensive paralysis develops in the trunk and muscles of the thorax and abdomen.

The most serious form of the disease, called bulbar polio, occurs when the virus invades the motor neurons of the brain stem and paralyzes the relevant muscles so that the victim loses the ability to swallow, breathe, and speak. Respiratory support is needed to keep bulbar polio victims alive, and fatality runs as high as 40 percent (de Quadros 2000).

During the virus' incubation period, ranging from 4 to 35 days, infected individuals are extremely contagious and can spread the virus to others through their contaminated faeces. The virus can live for as long as two months outside the body and resides in swimming pools, drinking water, food, and clothing. Transmission is silent; 90 percent of the carriers show no sign of the disease at all, thanks to their development of protective antibodies. Of the 9 percent of victims who develop nonparalyzing symptoms, their fever, fatigue, headache, vomiting, or stiff neck rarely point conclusively to polio. As a result, for each case of distinctive polio paralysis reported in an area, the community is further threatened by another 2,000 to 3,000 contagious carriers, who may show no further sign than a fever—rendering even a single documented case indicative of an epidemic (Atul Guwande, "The Mop-Up: Eradicating Polio from the Planet, One Child at a Time," *The New Yorker*, January 12, 2004, 34–40).

Today, polio is on the verge of being erased from the globe. As recently as 1988, 125 countries around the world were endemic for polio, with an estimated 350,000 polio cases. At the end of 2003, only six were endemic, and there were fewer than

800 reported cases (personal communication with Bruce Aylward, August 30, 2004). This is due to the coordinated efforts of regional and international polio eradication campaigns, which have immunized hundreds of millions of children against the deadly scourge. The regional polio campaign in Latin America and the Caribbean, in particular, is an outstanding success and eliminated polio from the region in just six years.

Road to a Vaccine

In the first half of the 20th century, polio was most prominent in industrialized countries in Europe and North America. Tens of thousands of children became infected with the disease each year in the United States, and thousands more died. Each summer the disease would cause widespread panic when its indiscriminate path left a trail of paralysis and death in its wake. Public pools, movie theaters, and beaches were shut down out of fear of the disease, and crippled children supported by crutches and breathing through imposing iron lung machines were common sights.

In the 1930s and 1940s, following a series of prominent polio outbreaks, the American public rallied behind the drive for a vaccine. The mobilization effort was led by the disease's most famous victim, US President Franklin D. Roosevelt, who was left permanently paralyzed after suffering a bout of polio in 1921 while vacationing with his family. In 1938, President Roosevelt created the National Foundation for Infantile Paralysis, later renamed the March of Dimes, to support the disease's victims and to raise funds "a dime at a time" for the urgent quest for a vaccine.

Fourteen years later, in 1952, the millions of nickels and dimes collected through the grassroots March of Dimes campaigns finally paid off. Dr. Jonas Salk made history that year with his discovery of an inactivated polio vaccine (IPV), made from a deactivated ("killed") version of the poliovirus. Administered through an injection, the IPV is capable of protecting against the ravages of polio. The successful results from large community trials were

printed in exuberant headlines around the world, and mass immunization led to a rapid and dramatic reduction in disease incidence in the United States over the next few years. Between 1955 and 1961, more than 300 million doses were administered in the United States, resulting in a 90 percent drop in the incidence of polio (Henderson et al. 1992).

In 1961, a second scientific breakthrough presented the world with a new form of the vaccine, which would later prove ideally suited for widespread use in developing countries. Dr. Albert Sabin's oral polio vaccine (OPV) is made from a live attenuated (weakened) virus and is administered orally. Just three doses of OPV, properly spaced, can confer lifetime immunity to both the user and his or her close contacts. The vaccine works like the IPV by producing antibodies that stop the spread of the poliovirus to the nervous system, thus preventing paralysis. OPV goes a step further, however, by reducing the multiplication of the virus in the intestine, thereby helping to halt person-to-person transmission. At approximately 5 cents per dose, OPV is considerably cheaper than its predecessor (Olivé and de Quadros 1989). Because no needles are required, administration of OPV is also easier, and volunteers can do it on a wide scale.

The power of the new oral vaccine was first demonstrated during a trial in Chiapas, Mexico, which suffered a polio outbreak in 1961. In as few as four days, Dr. Sabin's team reached 80 percent of children under 11 with the new oral vaccine (Atul Guwande, "The Mop-Up: Eradicating Polio from the Planet, One Child at a Time," *The New Yorker*, January 12, 2004, 34–40). After polio was successfully wiped out from the city a few weeks later, Dr. Sabin believed he had discovered not only an improved vaccine but also a successful strategy for large-scale immunization. It would take another two decades, however, for Dr. Sabin's model of intensive, widespread vaccine campaigns to be deployed.

Polio in Latin America

Polio was not recognized as a major public health threat to developing countries until the middle of

the 20th century, at the same time that the disease was being erased from North America and Europe. In the 1980s, the incidence of paralysis in developing countries rivaled the level in developed countries before the introduction of a vaccine (Hinman et al. 1987). Estimates suggest that there were more than 250,000 cases of paralytic polio worldwide in 1987 (PAHO 1995).

In Latin America in the 1970s, there were an estimated 15,000 paralysis cases and 1,750 deaths each year due to polio (Musgrove 1988). Countries in the region first added the OPV to regular immunization in 1977 as part of the new Expanded Programme on Immunization (EPI). At the program's outset, immunization in Latin America for the six targeted diseases in the EPI—diphtheria, tetanus, pertussis (DTP), polio, measles, and tuberculosis—was quite low at 25 percent, with OPV coverage among children under 1 higher, at 38 percent. With the support of a broad coalition of both international and national partners, EPI promoted the delivery of immunization services for polio and the five other principal diseases through the routine basic health services of Latin American countries. By 1984, coverage with OPV grew to an impressive 80 percent, the highest of all EPI vaccines. Between 1975 and 1981, the incidence of polio in the region was cut almost in half, and the number of countries reporting cases of polio dropped from 19 to 11 (de Quadros 2000). (See box 4.1.)

The success of EPI in reducing polio in Latin America during the 1970s and 1980s inspired Dr. Carlyle Guerra de Macedo, then director of the Pan American Health Organization (PAHO), to propose the eradication of indigenous wild poliovirus in Latin America and the Caribbean by 1990 through a coordinated regional effort. A polio eradication campaign was seen as a stepping-stone to strengthening the entire EPI, to improving health infrastructure throughout the region, and to establishing a greatly needed surveillance system to monitor the impact of interventions on the reduction of polio and other diseases. Encouraged by the success of the smallpox eradication campaign 14 years earlier, the PAHO Directing Council passed a resolution in 1985 launching the program to eradicate polio from Latin America and the Caribbean.

Box 4.1 Expanded Programme on Immunization

In May 1974, the World Health Assembly created the Expanded Programme on Immunization (EPI). The initiative brought together a diverse coalition of both national and international partners to achieve the goal of immunizing by 1990 all children under 5 years of age against six vaccine-preventable diseases: diphtheria, tetanus, pertussis (DTP), measles, tuberculosis, and polio. The second expressed goal of EPI, to “promote the countries’ self-reliance on the delivery of immunization service within the context of their comprehensive services,” set in motion the strengthening of the overall health infrastructure.

Immunization was integrated into regular maternal and child health services and made a fixture in primary health care. Program managers were trained, a comprehensive cold chain established, and a vaccine procurement fund put in place. To decrease the number of visits that mothers with small children would have to make, the program synchronized administration of several vaccines.

The success of EPI has been extraordinary: At the outset of the program in 1974, the average immunization coverage rate in developing countries was just 5 percent. By 1991, 83 percent of children in developing countries received three doses of DTP vaccines, and 85 percent received the polio vaccine (de Quadros 1997).

EPI has succeeded in decreasing the share of the six diseases in the total burden of disease among children under five from about 23 percent in the mid-1970s to less than 10 percent in 2000. At a cost of just \$20, fully immunizing a child against the six designated diseases is one of the most affordable interventions in existence.

Putting Together the Pieces: Political, Financial, and Managerial

The polio campaign was immediately charged with two crucial objectives: mobilizing the necessary political, financial, and social commitment for the intense regional effort; and organizing the managerial oversight to carry out immunization in each country.

To marshal political and financial support, an Inter-Agency Coordinating Committee (ICC) for Latin America and the Caribbean was established. The committee, comprising representatives from PAHO, the United Nations Children’s Fund (UNICEF), US Agency for International Development (USAID), the Inter-American Development Bank (IDB), Rotary International, and the Canadian Public Health Association, contributed more than \$110 million between 1987 and 1991. The structure was an innovative model with a level of coordination never before attained in the region. “Prior to the formation of the ICC, many of these agencies had been working independently and sometimes in com-

petition with each other, even duplicating efforts at the country level,” explained Dr. Ciro de Quadros, the leader of the regional eradication initiative. “It was the first time that such a mechanism was established in the Americas and it proved to be a fundamental means of securing permanent coordination and continuous support for the program. Its advocacy has been key for the sustained political and social will generated by the initiative.” The success of the ICC, according to Dr. de Quadros, demonstrated that “diverse organizations can work together to achieve an important health objective.”

Because national-level leadership, funding, and management were paramount to the initiative, the ICC model was duplicated at the country level. Each national ICC worked under the coordination of the country’s ministry of health to develop a five-year National Plan of Action to set immunization program strategies and streamline national resources. The plans delineated objectives, targets, strategies, activities, expected outputs, and time frames. Furthermore, because the cost and expected source of

funding (either internal or external) were identified for each activity, the national plans provided a vehicle for systematically analyzing the financing of immunization activities (Olivé and de Quadros 1989). National commitment in the region was extremely strong and was demonstrated in the financial support from Latin American governments. In the first five-year plans from 1987 to 1991, 80 percent of the \$544.8 million budget for EPI was derived from national resources. This figure climbed to 90 percent in the second five-year plan.

To address managerial needs, PAHO created an EPI technical advisory group of five international health experts to review the initiative's progress and set priorities. Thousands of health workers, managers, and technicians were subsequently trained in tasks ranging from cold chain management to surveillance. Furthermore, "resources were decentralized to strengthen the response capabilities of the local health systems," added Dr. de Quadros.

Extreme Vigilance

Even one confirmed case of polio could threaten an entire community, so the initiative immediately recognized that a well-developed surveillance system capable of detecting even low levels of infection was essential to the program's success and to ensuring immediate investigation of each case. At the outset of the program in 1985, however, such a system was lacking.

The campaign set out to establish uniform indicators throughout the region. *Suspected* cases were cases of acute paralytic illness that a doctor strongly suspected to be polio. Epidemiologists were to investigate each suspected case within 48 hours. For *probable* cases, or instances of acute flaccid paralysis, two stool specimens would be sent for examination to one of the diagnostic laboratories established in the network. A probable case would be dubbed a *confirmed* case if the laboratories found evidence of the wild poliovirus in the sample within 10 weeks, if the patient died within 60 days, or if the patient could not be traced later. To encourage community involvement in case identification at the end of the campaign, PAHO offered a reward of \$100 for the reporting of suspected cases (de Quadros and Henderson 1993).

A "Field Guide for Surveillance and Polio Eradication" was widely disseminated, and hundreds of health workers were trained in surveillance. Surveillance indicators to track program performance were established, and the overall system was computerized by 1989. A reporting network of 22,000 health institutions was established, through which local clinics were required to report weekly on either the presence or absence of suspected cases. Furthermore, eight diagnostic laboratories were equipped to detect wild poliovirus in stool specimens (de Quadros et al. 1991).

Immunization Strategies

The immunization strategy of the polio campaign centered around three primary components: achieving and maintaining high immunization coverage, prompt identification of new cases, and aggressive control of outbreaks. All countries in the Latin American and Caribbean region were grouped into two categories: (1) "polio-free" countries where no case of polio was reported in the previous three years and (2) "polio-endemic" countries that had at least one identified case. The countries in the former category were encouraged to maintain their polio-free status through routine immunization—a central pillar of the eradication campaign—and through effective surveillance.

The approach implemented to increase polio immunization coverage in "polio-endemic" countries was based on Brazil's OPV experience. Beginning in 1980, after disappointing coverage rates in the previous decade exposed that routine health services alone would not accomplish the EPI goals, Brazil embarked on a new strategy of national vaccine days. Held twice a year, one to two months apart, each national vaccine day administered OPV to 20 million children, accounting for nearly all of those in the under-5 age group (de Quadros and Henderson 1993). The national vaccine days were designed to vaccinate as many children as possible, regardless of their vaccination status, to instantly deprive the virus of its lifeline and halt its transmission.

Brazil's strategy was not new; in fact, it was the very approach that Sabin tested in Chiapas and subsequently recommended. In the 1960s, Cuba used

the strategy to interrupt the disease with the help of more than 80,000 local committees that were mobilized to conduct a series of weeklong house-to-house campaigns (Atul Guwande, "The Mop-Up: Eradicating Polio from the Planet, One Child at a Time," *The New Yorker*, January 12, 2004, 34–40). In fact, every country that had halted polio transmission employed some sort of mass vaccination campaign. Brazil's experience, however, was a powerful example of how poor countries in the region with less developed health infrastructures could bolster coverage and interrupt polio transmission.

By 1987, all 14 countries in the "polio-endemic" category had incorporated national vaccine days to complement, but not replace, regular immunization, and immunization coverage quickly rose. DTP and measles vaccines were likewise incorporated into the national vaccine days to help boost the overall EPI goals.

"Operation Mop-Up" and the Final Case

While the national vaccine days helped slow polio's transmission in most of Latin America by 1989, the disease still lingered in 1,000 of the 14,000 districts. "Operation Mop-Up" was launched that year to aggressively tackle the virus in its final bastions. The initiative targeted the communities where polio cases had been reported; where coverage was low; or where overcrowding, poor sanitation, weak healthcare infrastructure, and/or heavy migration prevailed. In these communities, two house-to-house vaccination campaigns were held to finally wipe out the disease.

In 1991, just seven cases of polio were confirmed: six in Colombia and one in Peru. An aggressive mop-up campaign was launched in Colombia to vanquish the disease. House-to-house vaccination campaigns reached almost a million households, and nearly a million children under 5 were immunized.

In August 1991, two-year-old Luis Fermin Tenorio of Pichinaki, Peru, made history as the last polio victim in Latin America. By the end of 1993, two years later, 9,000 stool specimens had been examined, and no poliovirus was found. In 1994, vaccine coverage rates through routine immunization services peaked at 86 percent in the region,

meeting the high surveillance standards set by the International Commission for Certification of the Eradication of Poliomyelitis in the Americas (de Quadros 2000). Polio was then declared eradicated from Latin America and the Caribbean (see figure 4.1).

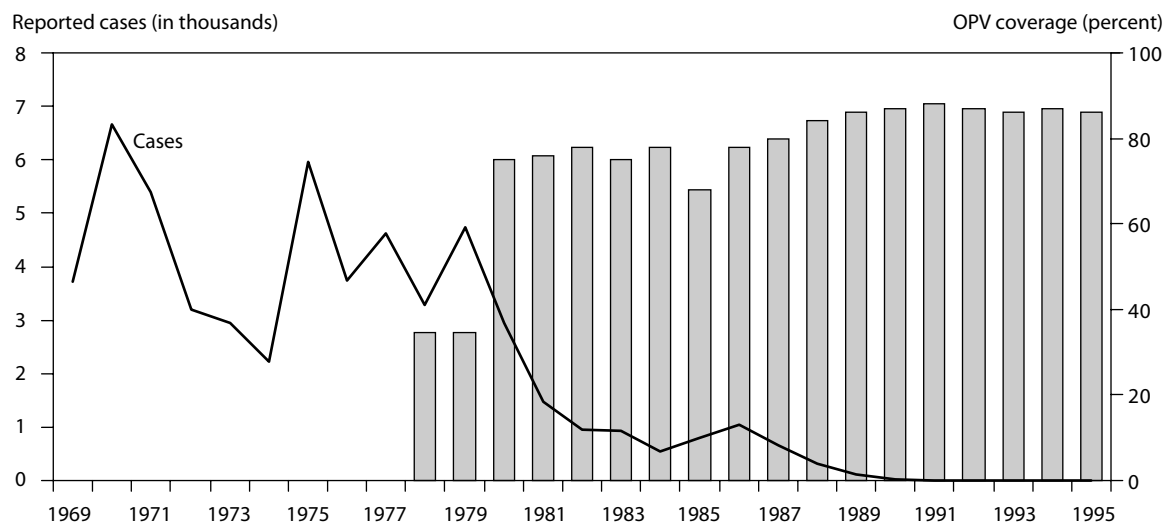
Impact of Elimination

In addition to the tangible benefits to the health and welfare of residents in Latin America following the eradication of polio, the program's success has left an indelible mark on the region's health infrastructure and its capacity to control other infectious diseases. Thousands of trained epidemiologists and health workers with experience in surveillance, disease control, cold chain management, and operational research currently are addressing new health challenges. The program's surveillance system is considered to be the "most comprehensive surveillance system for human health that has ever existed in the (western) hemisphere," and the network of diagnostic laboratories now detect and control additional public health threats, such as measles, cholera, and tetanus (de Quadros and Henderson 1993).

The health planning capacity of national governments also has improved considerably. The annual national plans of action continue to serve as an important program management tool and have expanded to cover broader mother and child health services. Finally, the polio campaign succeeded in advancing the overall goals of the EPI. By the end of 1990, coverage for the six EPI vaccines reached a historic high: Coverage for every vaccine was above 70 percent and in many regions exceeded 80 percent (de Quadros and Henderson 1993).

Economically Justified?

Administration of an oral polio vaccine is both an inexpensive and an extremely cost-effective intervention. It is estimated that the cost of immunizing a child with three doses of the polio vaccine (along with the DTP vaccine) is just \$21. The cost, then, of a healthy year of life from polio immunization is just \$20 in a high-mortality environment, placing it

Figure 4.1 Eradication of wild poliovirus from Latin America and the Caribbean: Acute flaccid paralysis, 1969–95

OPV = oral polio vaccine

Note: Bars represent percent of coverage.

Source: de Quadros (1997).

among the most cost-effective health interventions for children (Jamison et al. 1993).

Even without considering the additional benefits of productivity, strengthened capacity to fight other diseases, and reduced pain and suffering, the polio eradication campaign was economically justified based on the savings of medical costs for treatment and rehabilitation alone (Musgrove 1988). The cost of the first five years of the program was reported at \$120 million: \$74 million from national sources and \$46 million from international donors—and \$10 million annually from donor sources thereafter (Musgrove 1988). Comparing the savings from treatment costs with the cost of the five-year program, the net benefit of the eradication campaign (after discounting even at the high rate of 12 percent per year) in its first five years was \$217.2 million. In the 10 years after eradication, the discounted net savings climbed to \$264.2 million. Over a 15-year period, donor contributions would pay for themselves. In short, Musgrove concluded “the eradication of polio would actually put money in the coffers of the Min-

istry of Health, or whoever now pays to treat polio victims” (Musgrove 1988).

Maintaining and Expanding Success

The success of the polio eradication campaign was due in large part to exemplary political commitment and interagency and regional coordination. Complacency and polio importation from endemic regions, however, pose a risk to the program’s achievements. In 2000, these dangers were realized when incomplete immunization allowed polio to briefly return to Latin America and the Caribbean. A total of 20 cases and two deaths were reported in Haiti and the Dominican Republic after a child developed a rare strain of the disease when the circulating vaccine virus reverted to a more virulent form. Polio was then able to spread quickly because the immunization coverage in the poverty-stricken island was inadequate. The outbreak was eventually contained, but not without first illustrating the need for sus-

tained financial support for immunization, sustained political will, and effective surveillance to keep the region polio-free.

Prompted by the success in Latin America and the Caribbean, an effort in 1998 was launched to eradicate polio from the rest of the world. The global campaign, considered the largest public health campaign in history, has been led by the World Health Organization (WHO), Rotary International, UNICEF, and the US Centers for Disease Control and Prevention (CDC). More than \$3 billion have been rallied from the international community, including private foundations, donor governments, development banks, nongovernmental organizations (NGOs), and corporate partners. Rotary International has played a particularly instrumental role, raising more than \$500 million for the effort and providing volunteers to assist with national immunization days.

The global initiative has employed many of the same effective immunization strategies that proved successful in Latin America and the Caribbean, including national immunization days and "mop-up" campaigns. By the end of the 1990s, 575 million children were regularly immunized with OPV, and 5 million children who would have been paralyzed from polio without the vaccine are now walking. Today, polio transmission has been eliminated from all but six countries¹ (Global Polio Eradication Initiative 2003).

References

- de Quadros, Ciro A., and Donald A. Henderson. 1993. Disease Eradication and Control in the Americas. *Biologicals* 21: 335–43.
- de Quadros, Ciro A., Jon Kim Andrus, Jean-Marc Olivé, Claudio M. Da Sliveira, Roxane M. Eikhof, Peter Carrasco, John W. Fitzsimmons, and Francisco P. Pinheiro. 1991. Eradication of Poliomyelitis: Progress in the Americas. *Pediatric Infectious Disease Journal* 10, no. 3: 222–29.
- de Quadros, Ciro A. 1997. Global Eradication of Poliomyelitis. *International Journal of Infectious Diseases* 1 (January): 125–29.
- de Quadros, Ciro A. 2000. Polio. *Encyclopedia of Microbiology* 3, 2d. ed.: 762–72.
- de Quadros, Ciro A. 2004. Lessons Learned from Polio Eradication. www.endofpolio.org (accessed on August 10, 2004).
- Global Polio Eradication Initiative. 2003. Progress Report. www.polioeradication.org/content/publications/2003-progress.pdf (accessed August 10, 2004).
- Henderson, Donald A., Ciro A. de Quadros, Jon K. Andrus, Jean-Marc Olivé, and Carlyle Guerra de Macedo. 1992. Polio Eradication from the Western Hemisphere. *Annual Review of Public Health* 13: 239–52.
- Hinman, A. R., W. H. Foege, C. A. de Quadros, P. A. Patriarca, W. A. Orenstein, and E. W. Brink. 1987. The Case for Global Eradication of Poliomyelitis. *The Bulletin of the World Health Organization* 65: 835–40.
- Jamison, Dean T., Alberto M. Torres, Lincoln C. Chen, and Joseph L. Melnick. 1993. Poliomyelitis. In *Disease Control Priorities Project in Developing Countries*, ed., Dean Jamison, Henry Mosley, Anthony Measham, and Jose Luis Bobadilla. Oxford University Press.
- Marshall, Sarah Jane. 2004. The Last Days of Polio. *The Bulletin of the World Health Organization* 82, no. 1 (January): 67–70.
- Musgrove, Philip. 1988. Is the Eradication of Polio in the Western Hemisphere Economically Justified? *Bulletin of the Pan American Sanitary Bureau* 22, no. 1.
- Olivé, Jean-Marc, and Ciro A. de Quadros. 1989. The Polio Eradication Initiative: An Opportunity for Costing EPI. Expanded Programme on Immunization.
- PAHO (Pan American Health Organization). 1995. Final Report of the Taylor Commission: The Impact of the Expanded Programme on Immunization and the Polio Eradication Initiative on Health Systems in the Americas. Washington: Pan American Health Organization.
1. Nigeria, India, Pakistan, Egypt, Niger, and Afghanistan.