

Testimony

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INFECTIOUS DISEASES

Analysis of Eradication or  
Elimination Estimates

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Mr. Chairman and Members of the Committee:

We are pleased to be here today to discuss the results of our review of the World Health Organization's (WHO) estimates for eradicating or eliminating the following infectious diseases: dracunculiasis, polio, leprosy, measles, onchocerciasis, Chagas' disease, and lymphatic filariasis.<sup>1</sup> These diseases exact an enormous cost on the developing world, killing almost 1.1 million people and afflicting millions of others with serious disabilities and deformities. Measles alone kills almost 1 million children each year, the vast majority of them in the least developed countries.

In April 1997, WHO provided the House International Relations Committee with estimated costs and target dates for eradicating or eliminating the seven diseases. Subsequently, WHO revised some of the costs and time frames based on more recent information. We reviewed the estimates provided to us by WHO as of December 1997. WHO officials estimated that about \$7.5 billion would be needed to eradicate or eliminate the targeted diseases.

Today, we will discuss (1) the soundness of WHO's cost and time frame estimates, (2) U.S. spending related to these diseases in fiscal year 1997 and any potential cost savings to the United States as a result of eradication or elimination, (3) other diseases that international health experts believe pose a risk to Americans and could be eventual candidates for eradication, and (4) U.S. costs and savings from smallpox eradication and whether experts view smallpox eradication as a model for other diseases. We did not attempt to assess the cost-effectiveness of these initiatives as compared to other options such as improving primary health care delivery systems.

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## Background

Eradication of infectious diseases involves reducing worldwide incidence to zero, thereby obviating the need for further control measures. Elimination of infectious diseases involves reducing morbidity to a level at which they are no longer considered major public health problems. Elimination still requires a basic level of control and surveillance.

Global disease eradication and elimination campaigns are initiated, primarily by WHO, to concentrate and mobilize resources from both affected and donor countries. WHO provides recommendations for disease

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<sup>1</sup>Infectious Diseases: Soundness of World Health Organization Estimates for Eradication or Elimination (GAO/NSIAD-98-114, Apr. 23, 1998).

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eradication and elimination to its governing body, the World Health Assembly, based on two general criteria—scientific feasibility and the level of political support by endemic and donor countries. Formal campaigns were initiated for dracunculiasis and leprosy in 1991, and for polio and lymphatic filariasis in 1988 and 1997, respectively. Regional or subregional campaigns are also underway against measles, onchocerciasis, and Chagas’ disease. Disease eradication and elimination efforts are normally implemented by national governments of the affected countries. Developing countries typically receive assistance from bilateral and multilateral donors, nongovernmental organizations, and the private sector.

Developing costs and time frames for these efforts is difficult due to challenges in gathering and verifying data from countries with minimal health infrastructure. Unpredictable and unstable country conditions, such as civil unrest, further complicate efforts to project how much these efforts will cost and how much time is needed. The appendix at the end of this statement provides a breakdown of costs and time frames for eradicating or eliminating each disease.

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## Summary

WHO and other experts we contacted generally agree on five factors necessary to estimate the cost of eradicating or eliminating a disease: (1) product costs; (2) information on disease incidence, prevalence, and the size of the target populations; (3) administrative and delivery costs; (4) disease monitoring and surveillance costs; and (5) primarily for eradication, the costs of certifying that countries are free of the disease.

We focused our assessment on the accuracy and completeness of the underlying data for these five factors. WHO’s estimates and our analysis did not include an assessment of opportunity or indirect costs that may be incurred as a result of eradication campaigns, such as the impact on routine health care services in developing countries or the costs to individuals of seeking vaccines or other treatment.

We found that the soundness of WHO’s cost and time frames varied by disease. Generally, the estimates were most sound for those diseases closest to meeting eradication or elimination goals, including dracunculiasis, polio, and leprosy. Estimates for these three diseases were based on firm data about target populations and intervention costs from ongoing initiatives. For the other diseases, WHO’s estimates are more speculative because underlying data are incomplete or unavailable. WHO

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officials acknowledged this fact and said that estimates are continuously revised as better data become available. They also noted the difficulty in gathering and verifying data for countries with minimal health infrastructure.

The United States spent about \$391 million in 1997 to combat these diseases. The United States spent \$300 million on polio and measles prevention and on leprosy treatment in this country. About another \$91 million went for overseas programs, primarily the polio eradication campaign. Savings to the United States from eradicating or eliminating these diseases would result primarily from not having to vaccinate U.S. children against polio and measles.

Experts we contacted identified four other diseases that pose health threats to the United States and could be possible candidates for eradication: rubella, mumps, hepatitis B, and Hemophilus influenzae type b, or Hib. WHO told us that, while it may be technically possible to eradicate these diseases with existing vaccines, the international community cannot support too many eradication initiatives at one time. Therefore, it is unlikely that other diseases will be considered for eradication before success is achieved with some of the diseases currently targeted.

The United States has saved almost \$17 billion as a result of the eradication of smallpox in 1977, due mostly to the cessation of vaccinations. Experts generally agreed that the primary lesson from smallpox is that a disease can actually be eradicated. The smallpox eradication effort also provided a valuable lesson in how to mobilize community, national, and international efforts. However, smallpox had unique characteristics that made it particularly vulnerable to eradication and therefore has limitations as a model for current efforts. Smallpox was less infectious than polio or measles, easily diagnosed, and multiple mass campaigns were unnecessary because the vaccine was effective with one dose.

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## Soundness of Estimates Varies by Disease

WHO's cost and time frame estimates, with the exception of measles, addressed all five of the relevant factors. However, the completeness of the data underlying the estimates varies by disease. Generally, estimates for those diseases with long-standing eradication or elimination campaigns are more complete, as the underlying data are based on actual experience in endemic countries. For the other diseases, WHO is still gathering data and refining its assumptions. Estimates for diseases with target dates of

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5 years or longer are more speculative due to incomplete data and the difficulty in predicting sustained commitment and stable country conditions. We will briefly discuss the estimates for each disease and the barriers to be overcome.

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### Dracunculiasis (Guinea Worm Disease)

WHO's cost estimate of \$40 million for eradicating dracunculiasis included data on each of the five key factors and appears to be sound. Community-based programs to control this disease have been underway since 1980. Continuing civil unrest in some endemic areas of Africa precluded meeting the original 1995 target date for eradication. WHO now expects that all countries except Nigeria and Sudan will be free of dracunculiasis by 2005 at the latest, assuming safe access and appropriate funding. WHO's cost estimate includes certification costs that will continue until 2011. The Centers for Disease Control and Prevention (CDC) and officials from the Carter Center believe that some country-level eradication goals may be met even sooner than WHO estimated. The main barrier to eradication is ongoing civil strife in the endemic region. Experts also point to the need for continued national and donor support.

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### Polio

WHO's cost estimate of \$1.6 billion for eradicating polio is generally sound. It includes well-developed data on all five factors based on experience in controlling the disease. Many countries began polio vaccinations in the 1970s and 1980s. Most experts agreed that global interruption of the wild polio virus will occur by 2002 or shortly thereafter. Global certification is to take place about 3 years after the last case is reported—probably around 2005. However, some experts have raised concerns about the ability of less developed countries to maintain the required level of polio vaccinations and surveillance until eradication is achieved. In addition, WHO is concerned about the ability of some countries to detect and report acute flaccid paralysis, a key component of polio surveillance. According to WHO, unless sufficient resources are mobilized to improve detection capability, eradication cannot be certified.

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### Leprosy

WHO's cost estimate of \$225 million for eliminating leprosy includes well-developed data on all key elements and appears to be sound. The current elimination strategy is based on the multidrug therapy begun in 1981. Endemic countries have made great progress toward eliminating leprosy since that time, but some challenges remain. WHO noted that it is possible that some countries with concentrated pockets of leprosy might

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need to continue campaigns beyond the target year 2000 to reach the global leprosy elimination target of less than 1 case per 10,000 people. In addition, ongoing civil strife in endemic areas and difficult country conditions may preclude meeting all targets. Also, since leprosy patients are often ostracized and hidden, case identification is difficult. However, experts generally agreed that WHO's cost and time frame estimates appeared reasonable.

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## Measles

WHO's estimate of \$4.9 billion for global measles eradication by 2010 is speculative. While vaccine costs are well known, we found several areas in which the current estimates may be low or based on incomplete data. Essentially, data are incomplete regarding the number of children to be vaccinated, administrative costs, the number of mass campaigns that may be needed, and the costs of surveillance in less developed countries. Finally, the estimate does not include certification costs. WHO officials noted that they used information from their previous experience with polio eradication in developing the measles estimate. The vaccine administration and surveillance costs for polio are adjusted upward to account for difficulties in administering an injectable rather than an oral vaccine.

Many international health experts believe that measles is the next candidate for a formal global eradication effort,<sup>2</sup> pointing to some successes in controlling measles in the Americas as well as support from developing countries where measles is a major cause of mortality among children. However, experts also point out that there are some challenges to eradicating measles by 2010. Measles is highly contagious, requiring higher routine vaccination rates than smallpox and polio. In addition, outbreaks can occur even in areas of high routine vaccination coverage. Furthermore, costly mass campaigns are necessary to catch those still susceptible after routine vaccination because the vaccine is not 100-percent effective. Finally, some industrialized countries do not perceive measles to be a major public health problem and have not initiated measles elimination efforts. More than half of the estimated cost of measles eradication is expected to be incurred by developed countries. WHO and CDC estimate the cost of eradicating measles in less developed countries at up to \$1.8 billion.

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<sup>2</sup>The World Health Assembly has not yet voted on a resolution to eradicate measles.

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## Onchocerciasis (River Blindness)

WHO's estimate of \$143 million for eliminating onchocerciasis is speculative. It incorporates data on all key cost elements, but data on the size of the target population are incomplete. The control programs for West Africa and Latin America have been ongoing for a period of time and are likely to reach their elimination targets within or near the costs and target dates estimated by WHO. However, WHO is still mapping disease prevalence for the 19 African countries in the most recent control program. WHO's earlier estimates may have underestimated the population eligible for treatment upon which the cost and time frame estimates were based. For example, the latest estimate for those to be treated in this area is 42 million, compared to the original estimate of 35 million. Also, WHO does not yet have a reliable estimate on the number to be treated in the Democratic Republic of the Congo (formerly Zaire).

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## Chagas' Disease

Although WHO included data on all cost factors, the \$391 million estimated for eliminating Chagas' disease is speculative for two reasons—not all countries have submitted estimates, and countries that are targeted for elimination of Chagas' disease by 2010 only submitted estimates through 2005. The first regional program began in the southern portion of South America in 1991. Data from this region are more complete, and the program appears to be on track for completion by 2005. However, the efforts in the Central American and Andean countries only began last year and are targeted for completion by 2010. Costs and time frames in these countries are less certain because three countries have not submitted cost estimates or prevalence and incidence data, and all countries submitted cost data only through 2005.

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## Lymphatic Filariasis

The \$228 million estimated for eliminating lymphatic filariasis is very speculative. While all cost factors were addressed in the estimates, the data are very preliminary. WHO has limited historical data on costs because formal campaigns have only recently begun in some of the 73 countries in which lymphatic filariasis is known to be endemic. Also, WHO has not yet completed its assessments to establish the number of people to be treated in endemic countries and to determine whether there are other endemic countries.

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## U.S. Spending on These Diseases and Potential U.S. Savings Associated With Their Eradication or Elimination

The United States currently spends about \$391 million a year on these diseases. This includes about \$300 million on polio and measles prevention programs and leprosy treatment in the United States and about another \$91 million abroad for all the diseases under discussion except leprosy. Most of this amount would be saved if eradication and elimination goals were met and efforts to combat the diseases were ceased or reduced.

The overall savings to the United States if polio were eradicated are estimated to be at least \$304 million a year. This includes about \$230 million in public and private expenditures—including administration—for controlling polio within U.S. borders and about \$74 million for the global eradication efforts. CDC estimates that an additional \$20 million will be spent in the United States each year due to a 1996 CDC recommendation to administer two doses of the more expensive injectable vaccine before the two doses of oral vaccine.

The overall savings to the United States as a result of eradicating measles are estimated at about \$61.7 million a year, including about \$50 million for domestic vaccine costs and about \$11.7 million for global measles efforts. The \$50 million only includes the cost of the vaccine and not administration expenses. Immunization against measles is included in the vaccine for mumps and rubella, and the United States would continue administering the mumps and rubella vaccine even if measles were eradicated. Additional savings would be realized from preventing periodic measles epidemics in the United States. CDC estimates that the last measles epidemic of 1989-1991 cost \$150 million.

The United States spends about \$25 million a year for the other five diseases. The U.S. Department of Health and Human Services spends about \$20 million a year to treat a small number of leprosy patients in the United States. The U.S. Agency for International Development (USAID) funds the dracunculiasis effort at \$500,000 a year and the onchocerciasis control programs at \$3.5 million a year. CDC spends more than \$1 million for overseas efforts against dracunculiasis, Chagas' disease, and lymphatic filariasis. The United States does not currently track domestic costs related to Chagas' disease. However, U.S. blood banks may begin screening donated blood for the disease due to a significant number of infected Latin American immigrants in certain areas. An American Red Cross official estimated that this would cost about \$25 million a year.

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## Other Diseases as Possible Eradication Candidates

International public health experts identified several diseases that pose health threats to the United States and that are technically possible to eradicate with existing vaccines: rubella, mumps, hepatitis B, and Hib. CDC suggested rubella and mumps could be considered as part of the measles eradication effort, since vaccinations against all three are often administered in one trivalent shot. CDC estimated that the United States spends about \$255.5 million a year in administering this vaccination. Rubella is considered a significant health burden in the form of birth defects and is being discussed as an eradication initiative for the Americas. However, health experts generally believe that the costs to eradicate mumps would be difficult to justify because the global burden is considered low. The primary challenges in eradicating rubella and mumps are diagnostic difficulties and the additional costs that would be incurred.

Hepatitis B is considered a possible candidate because the vaccine is effective and relatively inexpensive, and a good diagnostic tool is available. Hepatitis B is viewed as a major public health threat, causing almost 1.2 million deaths per year, usually from liver cancer or chronic liver disease. CDC estimates that the U.S. public and private sectors spend from \$308 million to \$383 million a year for hepatitis B vaccines alone. The major barrier to an eradication initiative is that some people are chronic carriers and would have to die before the disease could be considered eradicated.

Hib is a bacterial infection that is the most common cause of childhood meningitis. About 400,000 to 700,000 children in developing countries die each year from the disease. U.S. public and private sectors spend about \$162 million a year on Hib vaccines. According to CDC, Hib has potential for eradication, but more needs to be known about the vaccine before this disease could be an eradication candidate.

WHO told us that rubella, hepatitis B, and Hib could be eventual candidates for eradication due to their associated public health burdens and the success in controlling these diseases in some parts of the world. However, they noted that, due to the high costs associated with eradication efforts, it is important to limit the number of ongoing efforts, and they do not support adding campaigns at this time.

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## Smallpox Eradication Showed That Success Was Possible

As the first and only disease to be eradicated through human intervention, smallpox is used as evidence that disease eradication is technically feasible. According to some experts, the smallpox effort yielded lessons that have since been applied to other efforts, such as the role of

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surveillance and the ability to garner resources for massive campaigns. It also showed that eradication can be cost-effective. Using 1967 estimated smallpox costs as a baseline measure and adjusting for annual birth rates, we estimated the cumulative present value global savings in 1997 dollars for the period 1978-1997 at \$168 billion. For the United States, cumulative savings from smallpox eradication are estimated at almost \$17 billion. The United States spent about \$610 million in 1997 dollars for domestic smallpox control in 1968 and about \$130 million in 1997 dollars during 1968-1977 on the overseas eradication effort. We estimated the annual real rate of return for the United States at about 46 percent a year since smallpox was eradicated.

Smallpox had characteristics that experts consider desirable for eradication. The disease was easily diagnosed, and all infection resulted in visible symptoms. The vaccine was effective in only one dose, stable in heat, and inexpensive. Polio and measles share many of the desirable eradication characteristics of smallpox. Both diseases are caused by viral agents, are found only in humans, and have effective interventions available that provide long-lasting immunity. However, certain differences exist that may limit the usefulness of smallpox as a model for other eradication efforts. Smallpox was less infectious than either polio or measles and required less immunization coverage. Polio and measles require mass campaigns in addition to routine coverage to interrupt virus transmission. Polio and measles are also difficult to diagnose without laboratory confirmation. The vast majority of polio infections show no symptoms, and the typical paralytic manifestations of polio can be due to other causes. Dracunculiasis differs from smallpox in that it is a parasitic disease and not vaccine preventable. However, like smallpox, it is vulnerable to eradication because the interventions are inexpensive and effective, and the infection is easily diagnosed.

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Mr. Chairman, this concludes our prepared remarks. We would be happy to answer any questions you or the Committee members may have.

# World Health Organization Estimated Target Dates and Costs for Eradicating or Eliminating Selected Diseases as of December 1997

1997 dollars in millions

<b>Disease</b>	<b>Goal</b>	<b>Target date</b>	<b>Estimated cost<sup>a</sup></b>
Dracunculiasis	Eradication	2011 <sup>b</sup>	\$40
Polio	Eradication	2000 <sup>c</sup>	\$1,600
Leprosy	Elimination	2000	\$225
Measles	Eradication	2010	\$4,900
Onchocerciasis	Elimination	2010	\$143
Chagas' disease	Elimination	2010	\$391
Lymphatic filariasis	Elimination	2030	\$228

<sup>a</sup>These costs represent projected public expenditures by national governments and donor countries for eradication or elimination campaigns.

<sup>b</sup>WHO expects that all but two countries will be free of dracunculiasis by 2005.

<sup>c</sup>Certification of polio eradication is expected by 2005.

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