

Victory over Smallpox: Interview

On October 26, 1977, in Merka, Somalia, the last case of naturally occurring smallpox was reported. For the first and so far the only time, a human disease had been eliminated through concerted international effort.

Over the centuries, smallpox was one of the most devastating diseases known to mankind. It occurred throughout the world, killing 20 to 40 percent of those afflicted. Except for isolated populations, virtually everyone eventually contracted smallpox. Those who survived usually were left with the disease's trademark—scarred and pitted skin—and some were blind. The smallpox vaccine, developed in 1796, was widely available from the early 1800s (see p. L-154). Even so, as recently as 1967 an estimated 10 to 15 million persons developed smallpox each year, and some two million died.

In 1959 the World Health Assembly concluded that smallpox could be eradicated, and WHO began to pursue this goal. Over the next seven years, however, little progress was made. In 1966 the Assembly provided special funds for an intensified program to eradicate smallpox in 10 years (156, 594). Through this program smallpox was eliminated from Western and Central Africa by 1970, South America by 1971, Asia by 1975, and finally, East Africa in 1977 (177, 594).

As WHO had forecast, the cost of eradicating smallpox was negligible compared with what was spent controlling the disease (including treating victims, mounting national vaccination programs, and managing outbreaks). Between 1967 and 1980 an estimated \$313 million (US) was spent eradicating smallpox. This figure includes both international support and national input. In contrast, it is estimated that worldwide costs of controlling smallpox exceeded \$1,000 million each year (594).

Much of what was learned from running the campaign can be applied to current immunization programs. Donald A. Henderson, M.D., M.P.H., Chief Medical Officer of WHO's Smallpox Eradication Unit from 1966 to 1977 and now Dean of the Johns Hopkins School of Hygiene and Public Health, discusses some of the lessons learned from smallpox eradication for this issue of **Population Reports**.



Donald A. Henderson

What were the elements most central to the success of the smallpox eradication program?

There were three main technical factors important to the eradication of smallpox. First, the disease itself was easy to identify and relatively easy to contain. People with smallpox were contagious only when the characteristic rash was present. Thus outbreaks could be stopped by finding infected people, isolating them, and tracking and vaccinating their contacts. Second, in part because of the characteristics of the disease, it was not necessary to vaccinate all susceptibles. A surveillance-containment strategy was used, in which only those at risk of being in contact with smallpox cases were vaccinated. Third, the smallpox vaccine was easy to store and transport, and reconstituted vaccine could be easily administered by 15 jabs with a special bifurcated [2-pronged] needle—a technique that could be taught in just a few minutes.

There were five major management-related factors important to smallpox eradication. First and foremost, personnel: We recruited, from many different countries, generally young, energetic, good-quality people who were committed to the program. Furthermore, personnel at all levels spent at least 30 percent of their time in the field. This kept program staff aware of the practical problems faced in the field and kept them involved in developing strategies to overcome these problems.

Second, the objective of the program was defined as zero cases of smallpox instead of the administration of millions of vaccinations, as had previously been the case. Progress was then monitored in terms of reductions in the number of smallpox cases and in the number of infected countries. Progress also was monitored in terms of specific operational objectives—for instance, reducing the time it took to discover cases and to contain outbreaks.

A third element was the development of systems for quality control. The program arranged for the testing of all vaccines by WHO Collaborating Centers and used only vaccines that met international standards of potency and stability. Vaccination campaigns were regularly assessed to be certain that the vaccine "took" and that coverage met specified standards.

A fourth element was the establishment of a research agenda at the beginning of the program—research which was continued until smallpox was eradicated. This research ran the gamut from laboratory studies to improve vaccine production methods to observational studies of community participation in case-finding efforts. Most important, new findings and observations were promptly incorporated into program operations.

The last element, no less important than the others, was the fact that through WHO, an international organization, it was possible to coordinate programs throughout the world and to receive and disseminate information about all aspects of the smallpox campaign.

Which of these elements of management can be applied to the Expanded Program on Immunization?

All of these elements are crucial to the success of EPI, including that of an international agency to take the lead in coordinating efforts. Many different agencies—both international and national—are involved in EPI activities. These agencies must work together not only to tackle short-term problems but also to establish permanent systems for regularly immunizing children. The widely proclaimed goal to vaccinate all of the world's children by 1990 should, in fact, be redefined as a goal to develop systems which will serve to vaccinate all young children from 1990 onwards. Such systems, once in place, can be used to

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provide other preventive health services as well as immunization—such as family planning, vitamin A, and oral rehydration therapy.

What are the differences in strategy and organization between eradication and immunization programs?

The major difference is that eradication programs are planned with an end point in mind while immunization programs are planned as a continuing effort. Eradication efforts require a greater flexibility in the use of resources to reach an end point in the shortest possible time. At the same time, they must take into account the long-term consequences of changes they may make in health systems. Continuing immunization programs must be planned to continue indefinitely and must use their resources throughout the world to develop permanent systems that can be used to vaccinate children year after year.

Do you think that integration is an important issue in developing a long-term immunization program?

Integration is one of the most controversial issues today, but thinking about it has been hopelessly confused. Many speak of primary health care as though it were comprised of a similar set of activities which are all delivered in a similar manner by a common health staff. Many programs have been organized based on this belief.

In fact, primary health care comprises quite disparate activities requiring different strategies. Curative care, for example, is actively sought by those who are ill and can be dispensed in clinics and health centers as has been traditionally the case. However, experience has shown that in such health centers curative medicine invariably takes precedence over preventive care despite the fact that it is far less cost-effective. A vivid example from the smallpox program was the fact that health centers seldom vaccinated anyone, even in the midst of smallpox epidemics. As they explained, they had too many sick people to treat—including many with smallpox—to devote time to the prevention of disease. In contrast, preventive interventions, such as immunization, are seldom sought by people. They have to be brought to the people and actively promoted. They require marketing and merchandising. Even when such programs are actively promoted, comparatively few will seek immunization if, for example, they have to make a special trip to the health center.

This suggests that preventive programs—including immunization, ORT, family planning, vitamin A administration, and malaria prophylaxis—will be more effective if organized differently from curative programs. They require community involvement through aggressive communication campaigns, including social marketing programs, and developing delivery strategies that make vaccines and the other needed commodities readily available in villages throughout a country.

What are the greatest challenges currently facing immunization efforts?

There are four major challenges to immunization programs today. First, recruiting, training, and keeping first-class personnel. Second, effectively coordinating the efforts of all agencies in developing long-term strategies and objectives for program performance. Third, obtaining

support for immunization programs from top government officials and assuring that this support is translated into action at all levels of the health department. And fourth, establishing a regular system for measuring program performance, including routine assessments of immunization coverage and, most importantly, disease incidence.

What diseases are currently the best candidates for eradication? Why?

Based on experience to date, the most likely candidate for eradication is polio. Transmission of wild poliovirus has been stopped in most industrialized countries and has been sharply reduced throughout the Americas. Accordingly, the Pan American Health Organization has recently set a goal of eradicating polio from the Western Hemisphere by 1990. The major questions that need to be answered before a worldwide polio eradication effort can be launched are: (1) does oral polio vaccine work sufficiently well in tropical regions to stop transmission and (2) what are the best strategies to use and how do we monitor the circulation of poliovirus? Those questions should be answered within the next three or four years.

Although some experts feel that measles also can be eradicated, I do not. One only has to look at the situation in the US, where measles transmission has not yet been stopped despite almost two decades of effort. If measles cannot be eliminated from the US with all its health resources, it is unlikely to be eliminated from developing countries.

What were the major contributions of the smallpox program to immunization programs in general?

A major contribution of the smallpox program was that it significantly enhanced WHO's credibility and prestige and served to pave the way for the Expanded Program on Immunization as well as other WHO programs.

Second, the smallpox program set a precedent in that, for the first time, vaccine standards were monitored internationally by independent quality-control laboratories. This system is now used for EPI vaccines.

Third, management of the smallpox program was organized around results obtained through surveillance systems. Targets were established, and performance was judged by progress towards these targets. This approach was an extremely effective management tool and can be applied in other programs.

Fourth, the smallpox program made many health ministries aware of the considerable talents and capabilities in their health systems and prompted them to attempt other programs, including immunization programs. I must note that the achievement of smallpox eradication must be attributed primarily to developing country health personnel. At any one time only about 100 WHO smallpox personnel were working in the field. Furthermore, smallpox was eradicated with international support that amounted to only about \$10 million per year.

Last, the smallpox program brought many young, talented people into the health field—both on the international and national levels. Many of these people continue to work in immunization, and it is through their efforts that many effective programs are being established.