

Eradication of Infectious Diseases:
Utopian or Realistic?

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In May 1976, I was one of the privileged first recipients of the Ernst Jung Prize for my work in smallpox eradication. In conferring this great honor, the Foundation expressed confidence and optimism that the objective would ultimately be achieved. The support was especially appreciated because smallpox, at that time, was continuing to spread tenaciously in areas of Ethiopia which were torn by civil war. The goal was in sight but its achievement was, by no means, a certainty. However, through heroic efforts of national and WHO staff, transmission was interrupted in August 1976, but not before smallpox had spread to Somalia where the problems proved almost as intractable. An additional 14 months of hard work were required before the last case occurred - on 26 October 1977. This was followed by more than two years of continuing search in previously endemic countries to be certain that there were no remaining foci. Finally, on 8 May 1980, the World Health Assembly, in a specially convened plenary session, proclaimed "that the world and all its people have won freedom from smallpox" and recommended that vaccination against smallpox be discontinued (WHO, 1980). Thus concluded the first program to eradicate a disease from the earth.

Inevitably, the question was soon raised as to whether other diseases might not also be suitable for eradication (Stuart-Harris, et al. 1982). Possible candidates are those for which man is the only host for the pathogen and the pathogens themselves do not survive for long periods in nature or man. Other considerations must also be weighed, however. The disease must be viewed by the affected countries and possible donor agencies as being of sufficient importance to warrant the necessary

allocation of funds. Moreover, preventive measures must be affordable, necessarily inexpensive, and comparatively simple to apply. Few diseases meet all or even most of these criteria. Candidate diseases which have received the most attention are poliomyelitis, measles and Guinea worm (dracunculiasis).

That global disease control programs, including those for eradication, are now being seriously considered represents a significant change in attitude from that which prevailed only a decade ago. Smallpox eradication was a turning point as countries throughout the world came to appreciate how much could be achieved at such little cost by their own health services, given reasonably well-organized community-wide programs. This recognition provided the stimulus to member states of WHO to decide, in 1974, on a global program of immunization which would provide six vaccines to children throughout the world. Gradually, this program gained momentum and in 1983, it further accelerated when UNICEF launched its Child Survival and Development Revolution (Vittachi, 1985), one component of which was the immunization program. Only a decade ago, less than 2% of the children in the developing world were receiving the six vaccines, but today more than 50% are being vaccinated and the commitment has been made to reach 90% of all children by the year 1990 (WHO, 1977). Other community-based programs have begun as well. One is to provide a simple sugar and salt solution, oral rehydration therapy, to prevent death from diarrhea. When this program began in 1975, one million oral rehydration packets were stocked, a supply which lasted 18 months. Today, more than one million packets are used daily. Other community-wide programs can be foreseen as new vaccines, created by modern biotechnology, emerge from the laboratory. At least a dozen different vaccines are now being tested in children and adults in the field; more than 40 vaccines are at earlier stages of development.

With heightened international interest in and support for community-wide health programs, and with improving technology, prospects for disease control and ultimately its eradication have measurably improved over the past decade. Indeed, formal commitments regarding eradication have already been made by international organizations with respect to two

diseases - poliomyelitis and Guinea worm. In 1985, the Pan American Health Organization, encouraged by the precipitous decrease in poliomyelitis incidence as a result of immunization, proclaimed its intent to eradicate poliomyelitis from the Western Hemisphere by 1990 (PAHO, 1985). One year later, in 1986, the World Health Assembly decided on a program to eliminate Guinea worm throughout the world (WHO, 1986) although, in doing so, it did not suggest a target date. The latter program, directed at improving water supplies, is intended to break the transmission cycle of a parasite which causes painful skin abscesses in man but requires growth in an intermediate aquatic host before being ingested by man and migrating to the skin surface to cause infection. Initial results in both programs are encouraging but much remains to be done. The path to be traveled between an international commitment and its realization is inevitably a difficult and uncertain one as was well-illustrated in the Smallpox Eradication Program (Fenner, et al. 1987).

For those in public health whose mission is the prevention of disease, the ultimate achievement, the Holy Grail, if you will, is eradication of the disease itself. Disease eradication is a concept which was glibly and enthusiastically discussed in the 1950s and early 1960s, but it fell into disfavor coincident with the failure of an ill-considered global malaria eradication program. Expectations that malaria could be eradicated had been based on successful experiences over limited areas where the pesticide DDT had been used to destroy the mosquito vector. The fact that favorable climatological and socioeconomic characteristics were required was not fully taken into account. Confident that problems could somehow be solved as they arose, the World Health Assembly in 1955 agreed to a global malaria eradication campaign. Within a decade, it became apparent that ecological factors associated with the vector, and the epidemiological and biological characteristics of the parasite would thwart eradication unless other, more effective tools were used. Unfortunately, however, those responsible for implementation of the program perceived it to be primarily an administrative challenge and failed to nurture a research effort. When problems occurred, there were few alternative methods available and no substantive research

establishment to which to turn. The bitter disappointment of thwarted expectations inevitably compromised the credibility of public health scientists and international agencies alike and, indeed, caused some prominent scientists (Dubos, 1965) to label disease eradication as a utopian concept.

The smallpox program proved that disease eradication, although difficult, was not utopian. Experiences gained in the program demonstrated several principles of importance to other eradication efforts. First was the need for a continuing, active research effort. While the strategy and technology at the inception of the smallpox program appeared to be wholly appropriate and practicable, field and laboratory studies resulted in many changes. Without these, it is doubtful it would have succeeded. Second was the importance of widespread political support and adequate funding. Even for a disease such as smallpox which was of concern to all countries, international support and funds were barely adequate. Finally, finite time-limits for achievement of the task are needed. Sustaining interest and momentum, even for smallpox eradication, proved difficult over the ten-year period required.

Global eradication of the three principal candidate diseases to which I referred earlier - Guinea worm infection, measles and poliomyelitis - can ultimately and realistically, be foreseen. In my opinion, however, it is premature to launch as yet a global program for any which states a definite date for achievement. For each, one or more problems need yet to be resolved. For Guinea worm, necessary inexpensive technologies are available to deal with water supplies but few governments or donor agencies are yet highly motivated to support a program which addresses a little known tropical disease of poor rural areas. For poliomyelitis, the political interest is present but fully satisfactory vaccines are lacking. The attenuated oral vaccine, although inexpensive, is highly susceptible to heat and, for unknown reasons, appears to be insufficiently efficacious in some tropical areas. The inactivated polio vaccine, not yet sufficiently tested in developing countries, has the disadvantages of high cost and a need to be given by the cumbersome

syringe and needle. Experience in the regional eradication program of the Americas will be most instructive. Most problematical is measles for which neither adequate motivation nor a satisfactory vaccine is yet available. Some European countries, for example, still regard the disease as an inconsequential childhood illness and themselves have low levels of immunization coverage. Even where concern and interest is high, as in the U.S.A., transmission has not been able to be interrupted despite a special national program extending over a decade. The problem is caused in part by the high transmissibility of the virus and, in part, because of an inability to vaccinate children successfully before they have lost maternal antibody, i.e., about one year of age. What is required is a more heat stable vaccine which can be administered from the time of birth or at least within the first few months of life. With the now available biomedical research capacity, it is reasonable to expect this problem could be solved provided that adequate funds were made available. As yet, however, such funds have not been made available.

Thus to me, eradication of a second disease does not yet appear to be realistic but neither is the goal a utopian one. It lies just beyond our grasp. However, until the time comes when fully appropriate technology is available, as well as universal interest, and eradication can realistically be foreseen within a decade or less, the goal of global eradication of another disease is best expressed in terms of hope and not of policy.

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