Medical History . . .

THE WORLDWIDE ERADICATION OF SMALLPOX*

D. A. HENDERSON, M.D., M.P.H.
Dean, Johns Hopkins School of Hygiene and Public Health;
Professor of Epidemiology and International Health

with an introduction by
ROBERT E. RAKEL, M.D.
Chairman, Department of Family Medicine;
Associate Dean, Academic and Clinical Affairs
Baylor College of Medicine, Houston

Dr. D. A. Henderson was born in 1928 in northern Ohio. After attending Oberlin College, he obtained a degree in Medicine at the University of Rochester School of Medicine. His postgraduate training was in Internal Medicine, and he earned a Master's degree in Public Health from Johns Hopkins University, where he now serves as Dean of the School of Hygiene and Public Health.

Dr. Henderson is best known, however, for being the medical officer in charge of smallpox eradication for the World Health Organization. In 1965, he was appointed to direct a campaign to eradicate smallpox and measles in 18 African nations. One year later, he became the director of the worldwide campaign to eradicate smallpox, at which time he moved his family to Geneva. During his first year (1967), about 15 million cases of smallpox were reported in the world, with 2 million deaths in 43 countries. Just ten years later, on October 26, 1977, the last naturally occurring case of smallpox in the world occurred. That is a dramatic achievement in a short period of time, and it was largely due to the methods of surveillance and containment that Dr. Henderson will tell us about.

On May 8, 1980, the World Health Organization officially declared that smallpox had been eradicated. Never before in the history of the human race had a disease been totally eliminated from humanity. In 1976, the Albert Lasker Public Service Award was presented to Dr. Henderson, who accepted it on behalf of the World Health Organization. His achievement was described as "one of the most brilliant accomplishments in medical history." Now, Dr. Henderson . . .

Smallpox has, indeed, been relegated to history; it is the first and, as yet, the only disease to have been eradicated worldwide. As I will note toward the end of my comments, the smallpox program has had profound ramifications in launching a broad new range of initiatives in international health.

Since I returned from Geneva, I've often been asked, by students in particular, "What is the most important lesson you

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learned from this experience?'' One thing I learned was a very simple lesson: Choose one's specialty with care. For more than eleven years, my professional life was entirely devoted to smallpox. By the end of that time, I was regarded as an international expert on that disease — and suddenly there was no more smallpox! I suppose from such events Deans are made.

Much of what I will tell you today is contained in a book, *Smallpox and Its Eradication,* whose chief author is Dr. Frank Fenner.[1] He and I undertook this as an archival effort, trying to summarize both the disease and its history. A substantial part of the book is devoted to the eradication effort. Our assumption was that no one ever again would want to write a major history of smallpox, so the book contains more than I think anyone really wants to know about the topic. In retrospect, producing this two-kilo tome was as difficult a task as eradicating the disease!

In my remarks today, I will touch on some of the high points of the saga, not all of which are part of the official record, and then comment upon the implications of the program with regard to international health.

Throughout the whole course of written history, and indeed, until a decade ago, smallpox was by far the most feared and devastating disease known to man. When the intensified eradication program began in 1967, we had an estimated 15 million cases and somewhere between 2 and 3 million deaths, as well as a great many cases of blindness due to smallpox. Half the children in blindness rehabilitation centers in India were there because of smallpox. This dread disease was a matter of of concern throughout the world, even in the industrialized nations that had no disease but feared importations.

In the United States, the last case of smallpox occurred in 1948; yet 23 years later, in 1971, we were still vaccinating close to 20 million people a year in this country. Smallpox vaccination was required for school entry, and people returning from abroad had to have the little yellow card attesting that they had been vaccinated within the preceding three years - all of this to prevent smallpox from coming back into the U.S. In terms of today's dollars, we were spending about $300 million a year on these vaccinations and their resulting complications.

The situation in Europe was not too different: the fear of smallpox remained. The United Kingdom had five hospitals for smallpox patients — hospitals that were left vacant but available in case smallpox recurred there. In the 1960s, two new hospitals were built in Germany and maintained, empty but in readiness, for fear that smallpox would return.

In the early 18th century, *Śitalā Mata*, a Hindu goddess, became closely associated with smallpox. Her shrines and temples were widely patronized throughout India.[2]

So what was this disease that was so dreaded and so prevalent? It was caused by a virus (and we can now use the past tense), and it spread by person-to-person contact. The incubation period was 10 to 12 days; then a rash appeared, along with a high fever. By the seventh day, the characteristic vesiculopapular lesions would have formed pustular lesions, most prominent over the face and lower extremities. If the patient survived (death most commonly occurred in the second week), scabs began to form, which would leave deep pitting scars. Of the individuals who had severe smallpox, the *variola major*, as many as 80% were left with these scars on the face; in many cases, blindness occurred; and approximately 20% of those who had smallpox died.

Climate did not restrict the spread of smallpox; it was found in every part of the world. Before a vaccine was available, the disease was endemic in every country. As was true of measles until quite recently, virtually everyone eventually contracted the disease. In some parts of central Europe during the 18th century, it was customary not to name a child until the child had contracted smallpox and survived.

Smallpox is a disease that can be traced into antiquity. It probably did not arise until the first agricultural settlements developed because the disease has to spread from person to person in a continuing chain of transmission. There is no carrier state in humans, and the disease is unknown in animals. The assumption is that one of the wide family of pox viruses that infect animals mutated, infected humans, and spread. The earliest case which we can document is that of Ramses V, who lived some 3,000 years ago. In 1980, his mummy was unwrapped so that an expert on smallpox, Dr. Donald R. Hopkins, could examine it again. On and under the chin were seen the typical lesions of smallpox, for Ramses died while the pustular lesions were still present. The lesions on the face are very small, but with smallpox comes an immense edema, and it's believed that the binding of the mummy resulted in contraction of the lesions.

The 3000-year-old mummy of Ramses V has smallpox lesions.

Because the disease was so well recognized and feared, in some countries it became a part of the culture. In India, many temples are dedicated to the goddess *Śitalā Mata*, to whom prayers were offered for survival from smallpox. The goddess shown in the photograph above has the marks of smallpox, though not all her images did. These temples were important to our surveillance program in India, because we found cases we didn't know about until people turned up at them.

When the Spanish explorers brought smallpox to the Americas, literally millions of Aztecs and, later, Incas died. Many historians attribute the eventual collapse of the Aztec and Incan civilizations to these wholesale deaths.

When the disease reached the Indians on the east coast of North America, it was far more lethal than among many other population groups. The reason for this difference is unclear, but there are documented epidemics with death rates as high as 80% to 90%. So the early settlement of this country was facilitated by the literal decimation of the Indian tribes that were exposed to smallpox for the first time.

A sidelight on American history: Abraham Lincoln had a fever when he gave the Gettysburg Address. Upon returning to Washington, he was confined to the White House with a rash that we now know was from smallpox.[3]

In England in the early 1600s, the disease afflicted so many people and the scars were so common that Ben Jonson referred to the complexion of a beautiful woman scarred by the pox in these words: "envious and foul disease, could there not be one beauty in an age free from thee?" In later English literature, one finds frequent allusions to the typically unscarred complexions of milkmaids. Edward Jenner (1749-1823), an English country doctor, observed how infrequently milkmaids were stricken with smallpox, but they did routinely acquire cowpox from the cows. In 1796, Jenner took some material from a cowpox pustule and inoculated a boy named James Phipps. When a lesion developed, he took some of that material and inoculated others and later was able to show that those he had inoculated were protected from smallpox. This was our first vaccine, and immunologists consider that the discipline of immunology began with Jenner's vaccinations.

Within five years, vaccination against smallpox had spread around the world. Carried by sailing ships and overland to countries around the world, vaccination was propagated on an arm-to-arm basis. One person was vaccinated, the lesion arose, pustular matter was taken, and another person was vaccinated. This was not an entirely practical method; periodically vaccinations would fail to "take." A better method was needed, and a new source for vaccinial material would have to be found. By the late 1800s, it was known that one could grow the vaccine virus on the skin of a cow. In India, even into the 1900s, cows infected with cowpox were led from house to house, while the vaccinators took some of the pus and inoculated the family members.

More pertinent to our eradication program was a system of freeze-drying the smallpox vaccine that was perfected in the 1950s. The freeze-dried vaccine was stable for more than a month at 37 C. This made it possible to extend vaccination into the tropics, where control of the disease had been extremely difficult. With this new method of preserving the vaccine, worldwide eradication became feasible for the first time.

Eradication of smallpox on a global basis was first proposed in 1958 by the Minister of Health for the Soviet Union, Victor Zhdanov, an academician and superb virologist. Zhdanov, while Chief of the Department of Sanitary and Epidemiological Services in the U.S.S.R., had managed to eliminate smallpox within the Soviet borders, but the disease was being reintroduced from other countries — Iran and Afghanistan in particular. His view was that if the Soviets could eliminate smallpox in their country, despite its size, abundant population, and many remote areas, why couldn't it be accomplished worldwide?

In 1958, the 11th World Health Assembly was held in the United States, in Minneapolis. (This was the last year it was held anywhere other than in Geneva.) Realizing that bacteria and viruses don't recognize national boundries, people from around the world come to the World Health Assemblies to discuss health policies and to coordinate programs. Zhdanov (who recently died) told me with great glee how he attended the Minneapolis meeting and quoted Thomas Jefferson, a great advocate of vaccination. Zhdanov's initiative for worldwide vaccination was accepted by the Assembly, but little was done about it. At the time, the United States was enthusiastic about eradicating malaria, and for a while this was regarded as an East-West conflict. The Soviets wanted to get rid of smallpox, and the Americans wanted to get rid of malaria.

"Owing to your discovery ... in the future, the peoples of the world will know about this disgusting smallpox disease only from ancient traditions." (President Jefferson in a letter to Edward Jenner.[1](p. 367)

In the ensuing seven years, a program was started that aimed at vaccinating 80% of the world's people. The belief was that smallpox would disappear when that was accomplished. The first flaw in this reasoning arose in New Delhi in India. The Indians were undertaking an aggressive program of vaccination. In fact, they reported that they had vaccinated 120% of the population, which is not a bad achievement. They were counting the number of vaccinations as the numerator and using the number of people in the area as the denominator. But they were vaccinating schoolchildren every six months, while those not attending school and slum-dwellers were not being vaccinated at all. However, the World Health Organization convened an expert committee that solemnly proclaimed the need to vaccinate 100% of the population — an impossible task.

Finally, in 1966, the Assembly realized they were getting nowhere, and it was suggested for the first time that a special allocation of money be made for the program to eradicate smallpox. The sum of $2.5 million was proposed. In terms of the World Health Organization's total budget, this was a substantial sum, but little indeed for an effort that would require special programs in 50 countries. In a masterpiece of

good planning, the Assembly decided upon a goal to wipe out smallpox within ten years. One of the delegates noted that President Kennedy had said the United States would land a man on the moon in that length of time. He reasoned that "if they can put a man on the moon in ten years, we can eradicate smallpox in ten years" — and the program got started.

Many at that time expressed grave doubts about successful completion of the project. The year before the program began, René Dubos, in his book entitled *Man Adapting*,[4] devoted a chapter to eradication, calling it a "social utopia" that should be laid to rest. He argued that every organism has a well-developed niche in the whole ecology, and to believe that one could remove an organism from that niche and eradicate it was arrogant and beyond possibility.

"Eradication programs will eventually become a curiosity item on library shelves, just as have all social utopias."
— René Dubos[4]

More common were doubts based on the fact that smallpox was worst in the most primitive countries, the most remote countries, the worst places to work. Civil war, famine, refugee movements — all could be expected in these areas. And how could all the countries of the world work together on a project when it was virtually impossible even to get a majority of them to agree on anything?

When the eradication program began, smallpox was still endemic in Brazil, in almost all the countries south of the Sahara, on the Indian subcontinent, and throughout Indonesia. Primarily through vaccination programs, smallpox had been largely eliminated in the rest of the world, though it was being reimported into many European countries by travelers and immigrants. The populations of the countries with endemic smallpox totaled about one billion.

We adopted a strategy of vaccinating 80% of the people. This had nothing to do with epidemiology — it was just an achievable target. We began by procuring good quality freeze-dried vaccine. The Soviet Union provided more than a billion doses in all, but contributions were also made by more than 30 countries. Development and production of the vaccine were independently monitored by laboratories in Holland and Canada. Gradually, the developing countries began producing their own vaccine, and by the sixth year of the program, 75% of the vaccine was being produced in developing countries for their own use and for other developing countries. This was one of the unique features of this project.

Until 1967, the typical method of vaccination was to put a drop of the vaccine on the skin and then scratch it with some sort of scarification instrument. In the United States, we used

a multiple pressure technique in which a needle was placed parallel to the skin surface and the vaccine was gently pressed into the superficial layers of the skin. With trained vaccinators, this system had been adequate, but we realized that in the field, the percentage of takes would not be satisfactory. We were fortunate that Wyeth Laboratories had just developed a vaccination device called a bifurcated needle. When the needle was dipped into the vaccine, just enough would be held between the two tines. The needle was held perpendicular to the skin, and multiple punctures were made rapidly. With a forked needle, penetration was not too deep. We tried this new device in Egypt and Kenya. It worked beautifully and the technique was much easier to teach the vaccinators. Even if a child had some blood oozing down the arm, we could be assured of a take. We could buy the new needles for $5 per thousand; they could be boiled and reused; and we could teach a vaccinator how to use them in less than 15 minutes. Moreover, they quadrupled our supply of vaccine. Before, a vial of vaccine provided 25 vaccinations, but the new needle provided 100 vaccinations. Within two years the bifurcated needle was in use around the world.

Before we got into the field, we had expected to have a shortage of health workers. But we discovered a plethora of health workers in nearly every developing country. They were just not working very well — they were not supervised adequately; they were not motivated; and they often had no equipment. When a small group from the smallpox program began working with these people, got them interested, and directed their activities, we found an excellent response.

After our program was proven to be a success, some statements were made that we were able to accomplish what we did because we "had an army of people working on a major program." Let me correct that misconception — our headquarters staff in Geneva consisted of five professionals and three secretaries, and that is all we ever had. In the field, we never had more than 100 international staff at a time. In Kenya, for example, we had perhaps 25 field workers, and in smaller countries such as Rwanda and Burundi, we had about 12. The numbers were small, but the people were motivated and they worked well. So it was a very small international staff serving as a catalyst for a very big effort. Among the international staff, we eventually had some 700 people who came from nearly 70 different countries. This was truly a program of international cooperation. The Soviet Union was most cooperative throughout the entire program, even at a time when U.S.-Soviet relations were probably at their lowest.

That is not to say we didn't have problems, and a lot of them. It's often thought that the World Health Organization (WHO) can tell its member countries to do X, Y, and Z once the

World Health Assembly has decided these things should be done. To the contrary, many things are decided by the World Health Assembly, but when the time for action comes, WHO cannot compel any country to do anything, no matter what it may have agreed to. Although everyone had *agreed* to support the smallpox program, many of the countries' representatives simply went home and forgot about it. This problem had to be solved in one-on-one visits, using many different techniques.

One of the more serious such stumbling blocks was Nigeria, which in 1967 was involved in civil war. Nigeria was a major country for smallpox, but neither the U.S. ambassador nor the United Nations representatives could even see the President of Nigeria to get his signature on an agreement to go ahead with the program. I instructed one of my staff to go down there and "do what you have to do, but get that signature!" After two weeks he returned with the signature. "How'd you get it?" I asked. He answered "I'm not telling you now, and I may never tell you," but eventually he did. It seems he participated actively in the social life of Lagos, the capital, and one evening wound up in the company of the President's mistress. He explained the problem to her, and the next morning we had our signed document!

There were many problems associated with the eradication of smallpox, and many solutions — and not all of them were taught in management textbooks. For example, in Western Africa, the Yoruba people and some of their neighbors in southwest Nigeria, Benin, and Togo, worshipped a smallpox god called *Sopona*. Worship was controlled by a large cult of priests that claimed the ability to bring on smallpox and to cure it. The priests had a good thing going, for when a patient died, they divided up the individual's possessions among themselves. And, of course, if the patient lived, they took credit for saving him. The priests were not overjoyed with our smallpox eradication program. We managed to overcome this problem by hiring the priests as vaccinators, thus letting them retain their "healing function."

The first part of our program was vaccination, but the second part was surveillance and containment, and that was the most important component of our strategy. Our basic philosophy was that every case of smallpox was in some way a failure of the program: failure to protect through vaccination or failure to prevent spread of the disease. Continuing epidemiological analysis permitted the program to be monitored and corrective measures to be instituted quickly. By having an up-to-date, accurate count of the cases, we could determine where and when they occurred and then adjust our program

accordingly. We found that a team of only two people in the field in a vehicle could monitor a population of from two to five million people, getting reports every week from every health center and every hospital.

As the results began to come in, the most dramatic early finding was the discovery that very few smallpox patients had scars of vaccination. At that time, the medical textbooks said that smallpox vaccination offered protection for three or four years. We scanned the list of people who had contracted smallpox, many of them adults, expecting to find that a lot had been vaccinated previously. But we found almost none. So we designed new studies and went out into the field to get some idea of the duration of protection. Contrary to the prevailing medical knowledge, we found that vaccine efficacy had remained better than 90% after 20 years. With these data, we switched our strategy almost at once to put emphasis on primary vaccination rather than on revaccination. As the program continued, we continued to learn. The program was anything but static.

Contrary to prevailing medical knowledge, we found vaccine efficacy of 90% after 20 years.

Our program of surveillance and containment was working. When we detected a case of smallpox, we isolated the patient and then vaccinated all the patient's contacts in the village and the surrounding area. By 1970, almost all of western Africa was free of the disease, and by 1973, all of South America, Indonesia, and most of Africa was, too. Only Ethiopia and the Indian subcontinent remained heavily infected. But "only" the Indian subcontinent meant 700 million people, and at that time India accounted for nearly 60% of the world's cases of smallpox. In many other areas, simple containment measures had sufficed to stop transmission, but efforts that had been so successful in Indonesia and South America simply were not working in India.

India is terribly crowded, and the people move around a great deal. The 1961 census showed that a third of the people were enumerated outside their places of birth, and this internal migration increased in succeeding years. The people travel to attend weddings and funerals; and numerous religious pilgrimages and gatherings attract huge crowds. Hundreds of thousands travel throughout the country on 10,800 daily trains. The state transport system alone (including buses and other motor vehicles) carries some 10 million passengers each day. They would come from villages, work for a while in the city, become ill with smallpox, and return to their villages, where the disease would spread once again. Many visited relatives and friends, including those who had smallpox, in other villages. Some simply hid themselves and their children when our teams were in their village.[1(p.715)] We were not keeping up with the spread of smallpox in India.

In the summer of 1973, we decided that the key to eradicating smallpox in India had to be to catch the cases very early. Over a period of eight months, a program was perfected in which 130,000 health staff would go into the field for two-week periods and visit every house in India. India's population is some 2½ times that of the United States, and there are 120 million households, so this was an enormous organizational feat. We had assessment teams that checked to be sure houses were visited, and we had assessment teams that checked the assessment teams. We know that 90% of the houses in India were visited.[1(p.755)] This house-by-house search created eight tons of paperwork, by the way, but it was necessary if we were to turn matters around in India.

One of the first house-to-house searches we undertook was in a state of 100 million people. We had already spent two years working on surveillance in that state, and we thought matters were under control, with no more than a few hundred cases being reported each week. But when the search results came in, nearly 7,000 cases had been found. We were stunned; we certainly had not expected that. But things started to improve. Although the first search turned up more cases than we expected, the second was much better, and the third search brought forth very few new cases.

As the number of cases diminished, the search for the remaining ones became more intensive. Teams would go into the markets and the schools with pictures of smallpox patients and ask "Have you seen anyone who looks like this? Where can we find him?" We learned that our best informants were young boys between 8 and 12 years old. They were always the most knowledgeable about what was going on in the village. Finally, we began offering a reward to anyone reporting a case (the 200-rupee award amounted to about $10). This proved most helpful in turning up the very last cases of smallpox in India.

We had begun this program in Asia in 1973. We began in India and then moved on to the other countries. In Pakistan, the last cases of smallpox occurred in October 1974; in Nepal, early in 1975; in India, in May 1975; and in Bangladesh in October 1975. Little more than two years after we started, smallpox was finished in Asia.

Still ahead of us was Ethiopia, and that country proved to be a formidable challenge. The land area of Ethiopia is equivalent to all of the states on the eastern seaboard of the United States, and we had a staff of only 100 there. A major problem facing us was that half the population lives more than a day's walk from any road. A lot of work was done walking

Ali Maow Maalin, a 23-year-old cook from the town of Merca in Somalia, who developed the last case of naturally occurring smallpox in the world on October 26, 1977.

and on muleback, and in the middle of the civil war that is still going on. Some of our staff worked with the rebel forces and some with the government people, and finally Ethiopia's last known outbreak was contained in August 1976, four months prior to our 10-year target date.

From the time the intensified program had begun, the smallpox eradication staff had speculated where the last case would occur.[1(p.1064)] Rugged mountainous areas such as Afghanistan or Ethiopia, or densely populated areas such as Bangladesh or India seemed likely candidates. However, the final episode in the eradication of smallpox occurred not in a country that had recently been heavily infected, but in Somalia, where the first endemic cases in 14 years were reported in late September 1976, seven weeks after the last outbreak in neighboring Ethiopia. It was a disappointing setback at a time when we had just completed the difficult campaign in Ethiopia, then thought to be the world's only remaining endemic country. So another intensive campaign was undertaken.

The Somali people were largely nomadic or semi-nomadic, roaming across open and largely unmarked areas, which created difficulties in containing the spread of the disease. The Somalia government, unfortunately, endeavored simultaneously to control the outbreak while at the same time denying its presence. By the time effective measures could be taken, most of southern Somalia was infected. The epidemic peaked in June 1977 and finally, on October 26, 1977, the last patient became ill — Ali Maow Maalin, a 23-year-old cook in the port of Merca (*pictured, left*) — the last case in a continuing chain of infection extending back at least 3,000 years and perhaps as many as 10,000 years.

In May 1980, the World Health Assembly met in plenary session and passed a resolution declaring "that the world and all its peoples have won freedom from smallpox. Smallpox vaccination should be discontinued in every country, and no country should now require vaccination certificates from international travelers."

The total cost of the program in terms of all international support was $100 million, or about $8 million for each year. The savings in the United States alone is, in current dollars, more than $300 million. Savings worldwide are estimated to be about $2 billion. These are recurrent savings, year after year.

With the last case of smallpox in 1977, we ended an exciting and ultimately extremely successful program that for the first time totally eradicated a major disease in humans. But it was a beginning of what is being called a revolution in child survival.

One of the first things we learned from the program was that most countries had not realized their capacity to support an effective health program. The inexpensive cost of the smallpox program and its small staff impressed them, and now they were looking to other such opportunities. Though many developing countries gave care to their sick children, they had done little or nothing to immunize them. As we moved from country to country, we found wards full of children with measles, polio, tetanus, and whooping cough. Vaccines were available for all of these, yet no more than 5% of children in the developing world were receiving any of these vaccines.

The successful eradication of smallpox was the impetus for that "revolution in child survival" that I mentioned previously. In 1974, we proposed an expanded immunization program that would include six antigens — diphtheria, pertussis, tetanus, polio, measles, and BCG. Today, more than half of the world's children are receiving those vaccines. The results of this program have been dramatic. In Brazil, for example, the government and the Pan-American Health Organization undertook two national immunization days each year beginning in 1981. As a result, the number of new polio cases dropped precipitously and has remained at very low levels.

Today, more than half of the world's children receive these six antigens: diphtheria, polio, tetanus, pertussis, measles, and BCG.

In 1985, a decision was made to eradicate polio from the whole of the Western Hemisphere. This program is in progress now — with a greatly expanded cast of characters. The smallpox program had received no help from UNICEF and only small donations from most countries. Now, with the polio program, UNICEF is contributing generously; Rotary International has pledged to raise $125 million for polio vaccination by the year 2005 (which is its 100th anniversary) — but Rotary members have already raised $200 million. Others making important contributions are the United States Agency for International Development and the Inter-American Development Bank. And just last year, the president of the World Bank said the Bank was going to double the amount of money it puts into world health every year, from $500 million to $1 billion a year.

Not only immunization programs, but others of similar importance are under way. Unchecked diarrhea is a major cause of death in developing countries. A program of oral rehydration therapy was begun that involves simple packets with the proper mixture of salt and sugar. In 1975, UNICEF began distributing these packets. The first order of one million packets lasted 18 months. Today more than one million packets are being used *daily*, and in a number of countries deaths due to diarrhea have diminished by more than 50%.

Lastly, there is activity regarding vitamin A. It's been found that marginal vitamin A deficiency is very widespread. This deficiency increases susceptibility to and the deaths resulting from pneumonia and diarrhea. Now, with a single capsule costing seven cents, administered every six months, we can diminish the fatality rates in children under five by 35% to 40%.

In the last ten years, we have moved from almost no immunization to 50% immunization worldwide, to widespread use of oral rehydration therapy, and to expanding use of vitamin A. We have learned that public health workers cannot wait at the health clinics for people to come to them; they must go out into the villages with their programs. Although we succeeded in eradicating smallpox, there is much more to be done and time is wasting. I close with a quotation from Gabriela Mistral:

> We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the fountain of life. Many of the things we need can wait; the child cannot. Right now is the time his bones are being formed, his blood is being made, and his senses are being developed. To him we cannot answer "tomorrow"; his name is "today."

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