



[THE ROTARIAN CONVERSATION]

DONALD A. HENDERSON

The doctor who stopped smallpox
didn't believe that polio could be eradicated.
We changed his mind.

ILLUSTRATION BY LAUREN MONTAGNE

WHEN YOUNG PHYSICIAN Donald A. Henderson chose the fields of epidemiology and public health in the mid-1950s, he didn't know they would be the great medical challenges of our time. After all, he says, "we had vaccines. We had antibiotics."

But he was captivated by his work as a "disease detective" at the Epidemic Intelligence Service, part of the Communicable Disease Center (later the U.S. Centers for Disease Control and Prevention). In the early 1960s, he became chief of the surveillance section of the center's epidemiology branch. It was there that he got involved with smallpox programs.

In 1966, at the request of the World Health Organization's director-general, Henderson became head of the global smallpox eradication program. The disease was still endemic in Brazil, Africa, and South Asia.

In 1980, WHO declared smallpox eradicated.

In his book, *Smallpox: The Death of a Disease*, Henderson recounts those times – the science, the politics, the frustrations – and the ultimate success of the campaign to eradicate a terrifying disease that had plagued humans for thousands of years.

But he felt differently about the potential to end polio. In 1988, Henderson took a strong stand against starting an eradication program because he thought it wouldn't work. He has since changed his mind.

In the late 1990s, he became founding director of the Johns Hopkins Center for Civilian Biodefense Strategies, and later worked to convince the U.S. government of the possibility of a biological assault. In November 2001, he was appointed director of the Office of Public Health Emergency Preparedness. He then served as principal science adviser in the Office of the Secretary of the Department of Health and Human Services. Now Henderson is a distinguished scholar at the Center for Health Security at the University of Pittsburgh Medical Center and a professor of public health and medicine. He is also a distinguished service professor at Johns Hopkins University and dean emeritus of its Bloomberg School of Public Health.

Though challenges remain in the fight against polio – earlier this year, WHO issued an alert in response to international outbreaks, warning that travelers, including fleeing refugees, can spread the virus – Henderson believes polio eradication can be accomplished with intense surveillance. Frequent contributor Warren Kalbacker talked to him about the difficulties – and the possibilities – of ending a disease, and why he changed his mind about polio.

THE ROTARIAN: Did the WHO polio alert signal a setback for the eradication of the disease? Can an infected passenger arriving on a jet, or a refugee fleeing a war zone, deal a serious blow to a country considered polio-free?

HENDERSON: It has been hard to sustain an operation for the eradication of polio. People are moving around all the time, and those who are infected carry the virus to other countries as they travel. There is fatigue in a number of countries, so they are not vaccinating. Their immunization levels are lower, so the virus can spread to them. But we differentiate between the imported cases and the endemic cases that are circulating. We consider a disease eliminated after proof that there are no human cases in a country. Then if a case comes in, that's an imported case. That does not change the status of the country where the disease has been eliminated.

TR: You led the worldwide campaign against smallpox. How do you certify the eradication of a disease?

HENDERSON: Eradication of smallpox – or polio – means that you have eliminated the virus so there's no longer any spreading in the population. There are no cases occurring among humans at all. With smallpox, we calculated that we would spend two years on an intensive search for cases, to make sure it was completely eradicated. We would offer a reward to anybody who could come forward with a suspected case. We searched in almost every area. Eradication is declared in a particular country only after years, and after an independent committee certifies that the job has been done. The transmission of smallpox has stopped throughout the world. There was agreement that two laboratories would keep the virus for research purposes: One lab is in Siberia, and the other is in Atlanta.

TR: At one time, you were skeptical about the possibility that polio could be eradicated. Why?

HENDERSON: I was active in opposing an eradication program for polio in discussions that were held in 1988. The reason was the vaccine. Live-virus polio vaccine [oral vaccine] is not stable. I saw enormous difficulties with trying to carry a refrigerated vaccine out into the field. And it requires a number of feedings [vaccinations] for the individual to become protected.

TR: Why have you changed your mind?

HENDERSON: A couple of things changed my mind. One was the effort to eradicate polio throughout the Americas, led by a Brazilian doctor named Ciro de Quadros. Ciro was a born administrator, and he set a goal: He said, "Here's the data we

have, and we can do it.” I was chairman of the advisory committee at the time, and I was doubtful. We finally agreed to endorse a five-year program. This was the first effort to involve local people in a multi-country project. We tried to get them knowledgeable and working. That makes all the difference. Rotarians had a lot to do with this first effort to eradicate the poliovirus in an entire region. Rotary clubs in Latin American countries pitched in. Rotarians are good at publicity; they knew people at newspapers, and they could talk with mayors. In the whole of the Americas, the last case was in 1991.

Also, a number of organizations are committed now. That is different from the past. I was talking with Bill Gates, and he told me this was his No. 1 priority: “I will go to leadership in the different countries and help persuade those who need persuading.” He has done that. We never had support like that during smallpox eradication. Here we are now with the support of Bill Gates, WHO, CDC, and UNICEF. That’s unique. That impresses me.

TR: Do you think we are really “this close” to ending polio?

HENDERSON: There’s fatigue among many of the workers; they’ve been at this for a long time. And the vaccine problem is still there. There are better methods for carrying vaccine out to people than when we got started, but they are difficult and expensive. The Salk vaccine is much more expensive than the oral vaccine, and you can have a lot of trouble just getting kids in front of a needle and syringe. The Sabin oral vaccine is preferred in virtually all countries except the industrialized ones, where vaccine cost is not a serious consideration. *(Editor’s note: Despite the benefits of the oral vaccine, it is made up of live virus, so the Global Polio Eradication Initiative will need to phase it out for the world to be polio-free. The use of the Salk vaccine is a primary element of the endgame strategy and is already under way.)*

TR: Are people who were vaccinated at an early age in developed countries still protected against polio?

HENDERSON: Yes. Their level of protection is good. But in developing countries, if you’re using the oral polio vaccine, it may take five, six, or seven different feedings before an individual is protected. A word about that: You’re giving a live virus by mouth. It’ll grow in the intestinal tract. In the developing world, there are lots of individuals with other intestinal-tract viruses that compete with polio for places to grow. So somebody can be fed the vaccine several times and have no protection. You can’t tell whether an individual is protected.

TR: Why is the Sabin oral vaccine so common in the field?

HENDERSON: The Sabin oral vaccine contains live virus. The Salk vaccine contains killed virus. You have to give a great big dollop of killed virus to stimulate the system to produce antibodies. If the vaccinated person subsequently ingests wild poliovirus, it may grow in the intestinal tract, but antibodies prevent the virus from getting into the bloodstream and causing paralysis. Oral vaccine viruses grow in the intestinal tract, and the individual makes antibodies to the virus itself that protect against subsequent infection by wild poliovirus.

There’s another reason the oral vaccine is so common: One of the most difficult groups of people to vaccinate are children in poor areas, such as crowded slums. The oral vaccine virus growing in the vaccinee can spread within families and com-

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munities and vaccinate them as well. This has made a huge difference in the likelihood of achieving eradication. In the developing world, it is exceptionally rare to find a case in anyone over four years of age. The others already will have been infected and developed immunity.

TR: Can health workers hope to reach a vaccination rate of 100 percent?

HENDERSON: They try to get to the level of 90 percent. They look at several feedings – three doses of the oral polio vaccine. But that’s little more than an indication of how extensively they’ve given the vaccine. Polio vaccination is different from smallpox vaccination. The poliovirus can infect 200 individuals and only one will get paralysis. With a case of smallpox, we knew that if we saw a scar, we would be able to trace a person’s movements over the preceding weeks, find out who he got it from, and trace any other outbreaks. With polio, you can’t do that – there are no scars. But polio surveillance picks up from the smallpox approach. You get a report every week from every health unit. Ciro

de Quadros in the Americas showed how effective this was. The reports provided education for the heads of each country's effort and made comparisons to other countries possible. And it was a stimulus, sort of like watching a football game.

TR: Bureaucratic inertia and interagency competition inhibited the effort against smallpox. You said, "So many of the problems in disease eradication are not medical at all." What did you mean?

HENDERSON: Militant groups are the biggest problem in polio eradication. There's al-Shabaab in southern Somalia, Boko Haram in northern Nigeria, and the Taliban. We had trouble persuading groups to help us eliminate smallpox, but we never had violent reactions. How are these militants going to be over-

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come? Difficult question. But it's important to sustain the program even if the spread of polio can't be totally stopped at the moment. Strengthen the expanded program of immunization in these countries, and be ready to go the minute you have an opportunity to move in and get rid of polio where there's been fighting.

TR: Why is it important for health officials to go into the field?

HENDERSON: I believe in going into the field. After a few weeks in Geneva, I'd get frustrated and depressed because of the red tape, and I'd head out to check a couple of countries. When I went to a country, a provincial head and a district head would go along. That communicated the message that top people were interested in this program. I'd talk with the people who were doing the job and ask them questions. Is there anything we can do to make your job easier? I could learn things. Did supervisors understand what they were doing? I could get a sense of their morale and their plans. We found tremendous people in the field who were working like nobody's business, who were so

enthusiastic about what they were doing and would hardly take time off. I'd come back rejuvenated and feel like we're going to get this done. And I'd be ready to tackle the red tape.

TR: Disease eradication remains a goal, but won't epidemiologists have to contend with a constantly changing – and increasingly challenging – environment?

HENDERSON: We now have greater population concentrations, and people travel extensively. That increases the possibility of an outbreak halfway around the world within 36 hours. And different diseases have emerged. Middle East respiratory syndrome (MERS) is a big problem. It's common in camels. It's still a puzzle as to how cases are spreading; the virus spreads to people in close contact with patients in hospitals. Chikungunya virus has been in Asia and spread into the Caribbean several months ago, causing a huge number of cases. It's spread by mosquitoes that commonly breed around houses. Symptoms include very high fever and aching joints and muscles. Some individuals are left with long-term arthritic pain in the joints. There are a number of rare diseases, such as Ebola, that have posed real problems. We're going to have more of them.

TR: You served for two years after 9/11 as director of the Office of Public Health Emergency Preparedness. Do you continue to be concerned about bioterrorism?

HENDERSON: It is a concern. People could distribute a virus as a dust, in envelopes, as has happened once. There's a lot of material on the Internet. There's been significant development of sophisticated laboratories in many parts of the world. The most important thing communities can do is organize so they're in a position to respond to a severe flu, for example. Hospitals must work with public health officials who can work with volunteer agencies to make plans for taking care of lots of sick people. If necessary, you could vaccinate a lot of people quickly. Develop a communications system with a command center. That can make all the difference. The response to the Boston Marathon bombing was very effective in getting patients to hospitals quickly.

TR: Despite this year's polio alert, emerging viruses, and the bioterror threat, can you find any reason for optimism?

HENDERSON: I'm encouraged by the amount of cooperation we see in reporting disease promptly. That was unheard of during my time at the CDC from the 1970s into the '90s. Today there's interest and determination to communicate and to help. ■