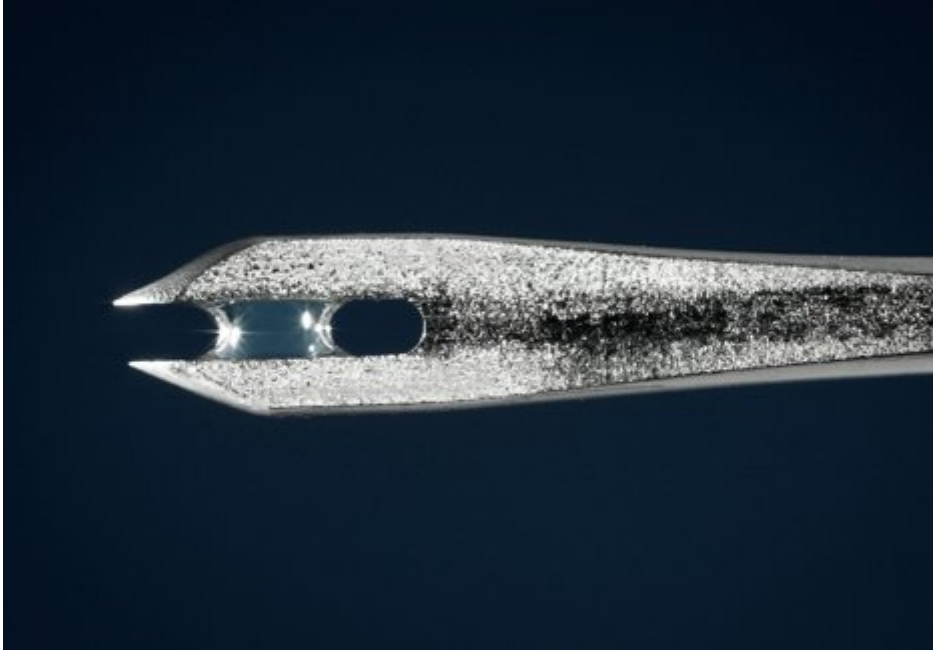


## PROFESSION



Bifurcated needles, first used in 1968, have replaced all other smallpox vaccination instruments.

## Smallpox -- The Death of a Disease (book excerpt)

■ In just 10 years, a WHO team headed by D. A. Henderson, MD, accomplished the daunting task of eradicating smallpox.

By D.A. Henderson, MD, amednews correspondent — Posted Aug. 17, 2009

*A book by Dr. Henderson, now a professor of medicine and public health at the University of Pittsburgh, details those efforts. This first excerpt details the development of a fast and effective immunization technique.*

In 1967, soon after the global program began, we discovered the ultimate vaccination solution: the bifurcated needle, invented by a Wyeth Laboratory scientist, Dr. Benjamin Rubin. Made of stainless steel, it was two inches (five cm) long, with a two-pronged fork at the end. The bifurcated needle was intended for a multiple pressure vaccination, but I suggested that we try holding it at right angles to the skin and making fifteen rapid punctures to the skin. This was simpler, and because of the fork, the needle could not penetrate too deeply. A trace of blood usually appeared at the site after fifteen to twenty seconds. Medical textbooks at that time warned that if bleeding occurred, the vaccine virus would wash out and the vaccination would be unsuccessful. The opposite proved true. Nearly every vaccination with the new "multiple puncture" method was successful -- better still, most local vaccinators could learn the proper technique within ten to fifteen minutes. A plastic needle dispenser was designed in Pakistan by Dr. Ehsan Shafa, an Iranian, who was our WHO regional smallpox adviser. With the needle, we could vaccinate a hundred people with a vial that previously (using the older techniques) had provided only twenty-five vaccinations. Suddenly, our ever-stressed vaccine supply was quadrupled. Best of all, the needles could be boiled and reused almost indefinitely -- and they cost only US \$5 per thousand.

### BOOK EXCERPT



A peek inside what's new on the shelves on topics pertinent to physicians.

» **More excerpts**

As a last step in simplifying vaccination, I questioned the need for using alcohol to cleanse the vaccination site. A 1960s study in the *British Medical Journal* reported that wiping the vaccination site with alcohol did little more than rearrange the bacteria. Therefore, we did away with alcohol and cotton swabs and directed that if the site was caked with dirt, it should be wiped off with a damp cloth.

Simplicity and speed were achieved. The only pieces of equipment a vaccinator required were the now hundred-dose vials of freeze-dried vaccine, vials of a saline solution to reconstitute the freeze-dried vaccine powder, a pot for boiling the needles every night, and two plastic tubes, one for clean needles and one for used needles.

*Rules had to be bent sometimes to get the vaccine to where it was needed as quickly as possible. But the following lesson in personnel management was an eye-opener, even for Dr. Henderson.*

To work effectively in different cultures, it is essential to understand and adapt. But how to reconcile divergent practices?

At a smallpox meeting in New Delhi, an obviously troubled [Dr. Abdul Mohammed] Darmanger [the Afghan program director] came to me seeking advice. He said, "I am an educated man, a physician, the director of the program. I had two serious discipline problems and I'm concerned that I may not have handled them like a professional should have." I asked for the details. The first, he said, was with his driver. "I often came back from the field late in the evening and he was angry about having to work long hours. I told him it was his duty. One morning he didn't show up for work. I was told he had gone to see the minister of health." (At that time in Afghanistan, the principle of a chain of command was often ignored. If one had a problem, an appeal directly to the top was not uncommon.) Darmanger continued, "I took with me two of my biggest vaccinators and went to the ministry. I found the driver in the inner office, about to meet with the minister. My two vaccinators each grabbed an arm and held him. I spoke quietly to him -- if you go into that office, I will kill you. He knew I meant it. He has been no trouble since."

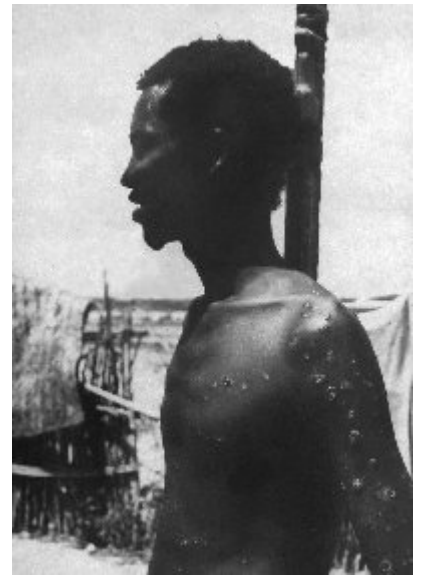
The other problem had been his response to a decision by the Kandahar-based vaccination teams to go on strike. I asked Darmanger why they had gone on strike. He said, "They hadn't been paid for three months but they shouldn't have gone on strike. It is their duty to work for their country." I asked what he had done. "Well, I took the leader into the office and beat him." And, what happened, I asked. "They went back to work and they haven't made any further trouble."

*This next excerpt details the last case of smallpox, which was discovered in Somalia.*

On October 31, 1977, a final case was discovered in the port town of Merca.

Ali Maow Maalin was a twenty-three-year-old cook at the local hospital. He developed fever on October 22 followed by a rash on October 26. His case was a classic one in depicting omissions and mistakes in program operations. He had never been vaccinated despite having once served as a vaccinator and despite having worked at the hospital where employee vaccinations were supposed to be mandatory. On October 12 two sick children arrived at the hospital in a vehicle from a nomad encampment. They were to be housed in an isolation camp nearby. Both of them had smallpox, and one died two days later. Maalin volunteered to ride with them to direct the driver to the camp about 200 yards away. His exposure was brief but adequate.

Maalin was admitted to the hospital on October 25 with a presumptive diagnosis of malaria. He received numerous visitors and walked freely around the hospital and outside the compound. A day later he developed a rash that



**In 1977 Ali Maow Maalin became the world's last person to contract naturally occurring smallpox. Although he served as a vaccinator in Somalia, he had never been vaccinated. The last U.S. smallpox case was in 1949**



**D.A. Henderson, MD**

was diagnosed as chicken pox and he was sent home. A popular man, he received many visitors until October 30 when a male nurse suspected that Maalin had smallpox. He was then sent immediately to the isolation camp.

An intensive search began to find everyone with whom he had come into contact. In all, ninety-one face-to-face contacts were identified, twelve of whom had no vaccination scar, and six who had been hospital patients or visitors. Heroic measures were taken, including a search and vaccination of the town and of everyone entering or leaving town at any one of four checkpoints. House-by-house searches throughout the region were conducted monthly, and a national search was completed on December 29.

Between the declaration of a state of emergency and the last case, only 141 days had elapsed. Veterans from around the world had surmounted one more unprecedented challenge. The epidemic was stopped before the annual pilgrimage to Mecca got under way. Meanwhile 3,022 cases had occurred.

Ali Maow Maalin survived his illness and continued to reside in Merca doing a variety of different tasks. But he has a place in history as the last naturally occurring case in a continuing chain of transmission extending back at least 3,500 years.

*Excerpted from "Smallpox -- The Death of a Disease: The Inside Story of Eradicating a Worldwide Killer" (Prometheus Books, 2009). Reprinted by permission of the publisher. \$27.98.*

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## ADDITIONAL INFORMATION

### Author Q&A

**Was smallpox a good candidate for eradication? Has the eradication of polio proven more difficult since there are still countries where the polio virus is being transmitted?**

Smallpox had an important attribute in that only man could be infected; there was no animal reservoir. And we had a good vaccine. We didn't need refrigeration, and you only had to vaccinate once and it would protect for at least 10 years. We also knew where smallpox was. We just had to ask the grandmothers -- they all knew where it was.

In 1970-71, it was proposed that the program be expanded to other vaccines, and polio was selected. The goal was to reach 80% of kids by 1999, and we got pretty close. We found that polio in the Americas went away surprisingly quickly. The last case of polio in the Western hemisphere occurred in 1991.

But the polio vaccine is not as stable, and you couldn't tell where the virus was. You had to inspect 200 children before you found one with paralysis. It was the next easiest disease to eradicate, but it was so much more complicated than smallpox.

**The smallpox virus still exists in secure sites in this country and in Russia. Do you think it should be destroyed?**

It's in Atlanta [at the Centers for Disease Control and Prevention] and Siberia. The question is: Are they the only places? You can't be absolutely sure, but I think there has been enough pressure put on countries to destroy their stock that they have done so. If we destroy what we have left, it would put pressure on any other countries that might have it and want to fool around with it that this would be regarded as a crime against humanity.

My feeling is that there is a risk the virus could escape -- it has escaped from some very good laboratories. I would say at this time a great majority of countries are very much in favor of having it destroyed. We had a vote in the World Health Assembly 1966 to support the program to destroy the virus. And if we had a vote now, the majority would agree to destroy it. We said we don't want any risk of this virus escaping and getting started again. We've lived with this disease and don't want any part of it.

In 1980, a [World Health Organization] committee I was part of looked at all the questions about the virus. We sequenced it and made different strains and prepared clone segments so people could work on it. WHO wrote to five different international organizations, including the advisory committee for the CDC and its counterpart in Russia, to ask if they supported destroying the virus. And all five said they supported its destruction. This

went through 15 years of work before we made the recommendation to the director-general [of WHO] to destroy the virus. At that point, the U.S. objected, because the Dept. of Defense said not to destroy it. So it was kept.

It's been mainly Russia and the U.S. who have the primary desire to keep it. They argue that maybe we can get a better vaccine with fewer complications or maybe we could get a drug that could treat smallpox. We said you could still do that without the virus.

**Are there lessons to be learned from the smallpox eradication campaign that can be applied to efforts under way to fight the influenza A(H1N1) pandemic?**

One lesson learned is that it is critical to work with other countries. There's an attitude that has developed that we [the U.S.] know it all and we're going to tell you what to do. The smallpox eradication could never have been achieved without the WHO and without the ability to work closely with a lot of other people. We had 73 nationalities on our staff. It wasn't a U.S. program or anyone else's program, but a world program. You can do a lot more that way than you can by going it alone.

So far with the new flu pandemic, by and large everyone is sharing information. We have a pretty good idea what's going on in other countries. Mexico shared information. Information from Australia is coming in. It's come quite a long way from what it was when I went first to WHO. This level of cooperation was not present at all.

-- *Interview by Susan J. Landers*

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