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Smallpox Eradication: Memories and Milestones

10/26/2007

Thirty years ago, on October 26, 1977, a Somali man, Ali Maow Maalin, was diagnosed with a case of smallpox. A World Health Organization (WHO) team led by Jason S. Weisfeld, MD, MPH, from CDC, and Karl Markvart from Czechoslovakia, conducted a surveillance and containment program that confirmed this to be **the last case of endemic smallpox in the world**. This historic achievement was possible only through the persistent efforts of thousands of local health workers who identified people with smallpox and vaccinated around them to prevent the spread. International leadership was vital, but without the dedication of local and national governments, eradication would not have been possible.

Today in **CDC Connects** we look back at that historic achievement as we talk with key scientists involved in the program to eradicate smallpox. Read on for memories from Weisfeld and also D.A. Henderson, Don Millar, Bill Foege, and Mike Lane.

Words from Weisfeld: "I Had the Premonition I Was Being Given a Major Responsibility"

Who were you and why were you in Somalia?

At the time of my assignment in Somalia, I was a Career Development officer with CDC having completed two years of EIS, more than a year seconded to WHO for Smallpox Eradication Programmes in India and Bangladesh, a Preventive Medicine residency and an MPH at Harvard. I felt very privileged to be selected for the first group of Westerners invited to work in Somalia and had begun work in various endemic areas of central Somalia in May 1977.

What was the smallpox situation in Somalia?

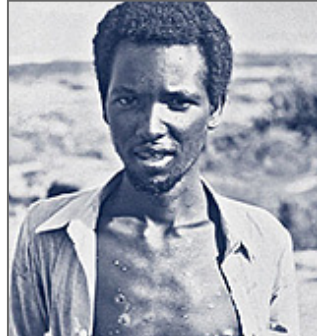
Although national authorities had attempted to conceal active transmission prior to our arrival, intense surveillance and active public participation soon revealed that smallpox was being transmitted in many areas of southern and central Somalia. By the time of the last case in October 1977, we had interrupted all of the known chains of transmission and there was heightened anticipation that we would soon identify any last remaining cases.

How did the last case become infected? How was his case identified?

Ali Maow Maalin was a 23-year-old cook at the Merca Hospital along the coast of southern Somalia when he became infected. He had volunteered for the local Smallpox Eradication Programme staff and had been immunized, but no one checked his vaccination site and his subsequent illness revealed that he must not have had a successful immunization and was not protected.

One evening, after office hours, two cases of smallpox were brought to the hospital and Ali was selected to drive with them in a closed Land Cruiser with the windows closed and the air conditioning running to the local team leader's house. We estimated that Ali was probably exposed to these cases for a maximum of five minutes—but that was sufficient.

When Ali became symptomatic with fever and rash, his history of being immunized against smallpox led the local hospital staff to assume that he had chickenpox. He



Ali Maow Maalin holds the dubious distinction of being diagnosed with the last case of endemic smallpox in the world.



Epidemiologist Jason Weisfeld (front) attends a meeting along with epidemiologists from Holland and Egypt. Such monthly staff meetings were held during the Bangladesh smallpox eradication program to monitor progress. The world came together to rid mankind of this horrible viral disease. *Photo by PHIL*



Smallpox is a serious, contagious and sometimes fatal infectious disease. The name smallpox is derived from the Latin word for "spotted" and refers to the raised bumps that

was hospitalized briefly but then discharged to the small room he rented near the hospital. When being visited by one of the male nurses from the hospital, it was suspected that he might have smallpox and the team leader reported the suspect case to the Ministry of Health in Mogadishu.



A vaccinator travels by camel during a smallpox outbreak in Niger. Dedicated smallpox pioneers worked long hours and traversed rugged terrain to provide immunizations. Photo by PHIL

anyone who had not been recently immunized.

What was your role?

I was requested to identify all contacts and then to immunize them and their families as well as to maintain rash-and-fever surveillance on all of them every two days for six weeks. By establishing a close, personal relationship with Ali in his containment camp, I was eventually able to identify 161 contacts and their close family members. With the assistance of a local team of dedicated health workers and a fleet of motorcycles, we were able to maintain close surveillance for the required six-week period.

What were your thoughts when it was realized that this was the last case of smallpox?

As mentioned, even prior to the identification of Ali's case, most of the Programme staff were quite aware that we had interrupted almost all of the remaining chains of transmission within Somalia. Special attention was being given to ensuring that an outbreak among a nomadic group near Merca was prevented from spreading to non-protected populations. So, when I was asked to shift to Merca to assist with Ali's case, I had the premonition that I was being given a major responsibility and would need to be especially rigorous in whatever ways I could assist. In addition to coordinating the immunization and surveillance of contacts, I also helped Karl supervising night-time immunizations of the town population.



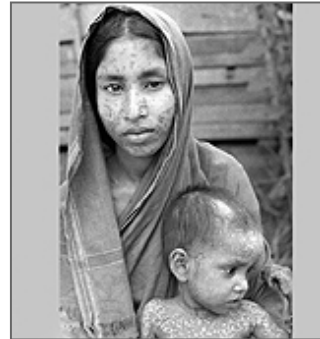
The Smallpox Eradication and Measles Control Programs, West Africa, 1968. boys in West Africa while standing in front of a poster announcing Smallpox Eradication and Measles Control Programs. Note the use of jet guns. Photo by PHIL

What action did finding Ali precipitate?

Upon confirming the diagnosis, the National Smallpox Eradication Programme initiated a major response. Dr. Karl Markvart, a Czech colleague, and I were requested to transfer immediately to Merca and assume responsibility for the management of the outbreak. We had the full support of additional international and national staff as well as the local police and Party authorities.

Our first priority was to organize **surveillance** within Merca Town and to establish working relationships with local authorities and community groups to immunize the entire population of the town and surrounding areas. We **established check-points at all entrances to the town and local staff kept log books of who arrived, and departed, and their immunization status**. Vaccinators were stationed at these check-points and immunized

appear on the face and body of an infected person. Photo by PHIL



Both this mother and her child bore the scars after surviving smallpox. The symptoms of smallpox begin with a high fever, head and body aches, and sometimes vomiting. A rash follows that spreads to raised bumps and pus-filled blisters that crust, scab and fall off after about three weeks, leaving a pitted scar. Photo by PHIL

Of course, some of us were not very confident that this WAS the very last endemic case until sometime after Ali's recovery. We still feared ongoing transmission in inaccessible areas of Ethiopia. But this never came to pass.

Many people have described their experience in the smallpox eradication effort as a career-changing moment. How did your experience affect your career?

I had been attracted to a career in public health with CDC because of the opportunities to work internationally and my early assignments with the WHO Smallpox Eradication Programmes in India, Bangladesh and Somalia provided very gratifying experiences. Through working closely with dedicated national staff and communities, I was motivated to continue working in International Health activities for almost all of my career. And since retiring from CDC, I have been very fortunate to be able to continue serving internationally as well as being able to share my experience with students at Harvard, Boston University, Tufts and Dartmouth.

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Use of boats such as the ones seen here, was essential to the success of the smallpox eradication program, as well as general public health maintenance of Bangladeshi communities. General essential items such as food, and medicinal goods were transported via the waterways, for many of the towns affected by illnesses which included smallpox, were situated along rivers throughout the country. *Photo by PHIL*

What has become of Ali? Did he become involved with EPI?

When I visited Somalia in the mid-1990s for UNICEF, I tracked down Ali in a small roadside town near Merca. He was working as an untrained drug seller in a local shop and we had a wonderful reunion over a proverbial cup of sweet tea. Subsequently, I understand that he joined the national Polio Eradication Programme— perhaps fulfilling his earlier dream of helping out with Smallpox Eradication. Wouldn't it be wonderful if he could participate in a celebration of a special anniversary of the last endemic case or Global Smallpox Eradication at some time in the future?

Success Seemed “Inevitable” to Former CDC Director Bill Foege

One of the major events in the globalization of CDC was the USAID/CDC Smallpox Eradication Measles Control Program in 21 countries of West and Central Africa from 1966–1972. Among the key participants was former CDC Director, William Foege, MD, MPH.

Foege is an epidemiologist who became chief of CDC's Smallpox Eradication Program; he was appointed director of the CDC in 1977. He joined the Carter Center as executive director in 1986 and became a senior adviser to the Bill and Melinda Gates Foundation in 1999, where he is now emeritus as a fellow.



This 1980 photo shows three former directors of the Global Smallpox Eradication Program as they read the good news that smallpox has been eradicated on a global scale. Shown (left to right) are J. Donad Millar, MD, (director 1966–1970); William H. Foege, MD, (director 1970–1973); and J. Michael Lane, MD, (director 1973–1981). *Photo by PHIL*

His contribution to smallpox eradication is legendary. He worked as a medical missionary in Eastern Nigeria, where he developed a surveillance and containment strategy that changed the worldwide approach to smallpox vaccination and eventually led to the disease's eradication in the 1970s. He provides this reflection on his thoughts concerning eradication back then.

“It is interesting about thoughts at the time of eradication. Mine seem to have been much different than most. For me the high point was when I saw in my mind that this could happen. All of our actions were simply carrying out the plan and so I felt no surprise at the end. It seemed inevitable. I was content to leave (India) before smallpox was gone because I had no doubt that it was on track. Indeed, it always seemed to me that surprise was inappropriate and it indicated a lack of faith in the idea. I don't think that resonates with many, however.”

For related stories on Foege and smallpox see [Calling the Shots](#); and A Lifetime [Spent on the War on Disease](#). For more on the former CDC director see [CDC History: Focus on Foege](#).

More on the Mission: Don Millar Calls it “Special Era”

Indeed, many had doubts says Don Millar MD, who retired from CDC as Director of NIOSH. “But it was a very special era. I have more doubts that we could do it today than back then. The 21 African countries where we were working were recently independent of colonialism so there were things in place that worked, line railroad lines and telegraphs. Some of that infrastructure is just no longer in place now. But beyond that, it was the people involved. Dave Sencer saw to it that the World Health Organization (WHO) had what it needed to get the job done, both medical and non-medical American resources. He always found a way to get things done.”

“And in India Bill Foege was the leader and Bill Watson was the chief administrator. In Bangladesh it was Stan Foster and Andy Agle. In Geneva, D. A. Henderson was key; no one else could have done what he did. These

people were just remarkable. And it was a special era. We were still in the post World War II mentality, not yet disenchanted by capitulating in Vietnam. There were lots of young Americans who believed in smallpox eradication, who had the can do mentality, the Peace Corps mentality, the desire to work toward Utopia. Our people were our resources and our power.”



David Sencer, MD, former CDC Director, Sencer snaps a photo in Ghana where he was attending a celebration marking the 25th million smallpox and measles vaccination. The umbrellas are part of the gathering of traditional chieftains which is called durbar. Read more about [Sencer](#).

"Today there is nowhere near that optimism of getting things done globally. We were naïve and innocent perhaps, but it worked."

When CDC first established a smallpox surveillance unit, Millar was put in charge. He says for him the greatest thrill was his work in West Africa. "Nothing else in my career has been as fulfilling as the four years I worked on smallpox eradication in West Africa."

Another highlight was in Somalia, he says, when the International Commission certified Somalia free of smallpox two years after the last case. "I had some rigorous assignments in Somalia which was engaged in civil war with Ethiopia. But it was thrilling. Even when we went to the most remote locations, out in the bush, the nomads would be yelling and cheering. They all knew about smallpox eradication. The program had penetrated so far—that was a real thrill."

It's an accomplishment with impressive global significance, says Millar. "Smallpox is still the only disease in the world eliminated by human intent."

Now back then, I didn't realize that smallpox could still be a threat today. I'm talking about biological terrorists. Mike Lane actually conceived of that possibility, he recognized even back then that human evil could be the worst threat to the eradication of smallpox. I don't think most people back then gave any thought to how vulnerable we could be to bioterrorism. But it could happen. We've had decades now of no one being vaccinated. It's a tinder box."

"Back then we were euphoric about human nature," says Millar. "It pains me how fragile it is. But I am so grateful to have been part of it, of the smallpox eradication program."

These days Millar is "living in the woods, doing consulting for occupational and environmental health, and trying to motivate myself to write." He has new twin grandchildren, a "wonderful distraction," and says he also does a lot of string-bass playing which is very "soul restorative."

His memories of CDC's involvement in smallpox eradication are good ones. On the day the announcement came in that India was certified smallpox free, Millar was serving as acting CDC director. "I got to call a meeting and talk about it. And I remember I said, well we have put two deities out of business!"

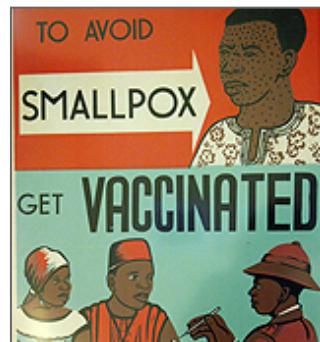
He was talking about Shpona, whom the Yoruba of West Africa identified as the god whose wrath created smallpox, and Shitala, a deity worshipped in India as the goddess of smallpox.

DA Henderson Called Smallpox an "Ideal Disease to Eradicate"

There were gods and goddesses of smallpox because people were so afraid of the disease, says D.A. Henderson, MD. "No other disease has deities and temples erected to it."

But because people were so terrified of smallpox, they were eager to stop it. "We enlisted the help of the local people. We trained them to identify it and report it. And the vaccine was really amazing. You needed only one satisfactory inoculation to protect someone for up to 10 years. Even more amazing, scientists found a way to make it into a powdered, freeze-dried form. You could put it in a vial and it would remain fully potent for a month, even at high temperatures, which made it ideal for the tropical areas. A vaccinator could just stick a vial in his pocket and go out into the field, no worries about refrigeration."

Still Henderson had doubts about eradicating the disease from time to time. "But we were all hopeful. Against such formidable obstacles, we had to wonder if we could succeed. The confidence came in 1974, when things looked up in India. It's a huge country and there were a large number of cases and the government of India had spent lots of money trying to eradicate polio. People were getting discouraged. But then in 1973 we began a huge push to go village to village, house to house, in a period of 10 days. Bill Foege and I were together in India then and I remember



This double image includes an illustration of a smallpox victim contrasted with a family receiving smallpox vaccinations. In this case, the Nigerian public health worker is using a bifurcated needle, which ultimately replaced the ped-o-jet as the most efficient vaccine delivery system. *Photo by Kathy Nellis*



This is a statue of Shpona, the West African god of smallpox. Smallpox was thought to be a disease foisted upon humans because of Shpona's diving displeasure. This figure is part of CDC's Global Health Odyssey collection of artifacts. The wooden figure is adorned with

there were more cases of smallpox being reported than ever. It was because the surveillance was so much better but it certainly made the epi curves look bad. But we realized we were on our way and that if we could eradicate smallpox in India, we could do it globally.”

It was Henderson who tied smallpox eradication to the measles immunization program which was already underway in Africa at the time. Henderson saw the combination of the two campaigns, measles and smallpox, as “politically desirable, humanely urgent, and economically feasible.” Within a week after CDC’s Smallpox Eradication Program was created, he was in Geneva to consult officials at the World Health Organization (WHO). And eventually he became chief of WHO’s smallpox eradication program.

Smallpox was actually an ideal disease to eradicate, explains Henderson. “It only existed in man, not in animals. People who were infected either recovered and became immune or they died. So we just had to stop the spread from human to human. We saw the virus as a chain. If we could just break the links we could prevent many more cases.”

The work was tiring and often dangerous he says. “There was civil war and insecurity. In Ethiopia the government would not allow any foreigners to go outside the capital city except those of us working in smallpox. We had their confidence. Still, workers were fired upon and sometimes kidnapped. UN officers would have to persuade the guerrillas to release the public health workers.”

It was also difficult technologically, Henderson recalls. “A phone call from Geneva to New Delhi could take hours to put through and it was very expensive to call. Today you have computers and cell phones and even GPS which would have been great to keep track of the teams.”

For Henderson, it was a wonderful and significant experience. “May 8, 1980 was an exciting day. The World Health Assembly held a special session to announce the eradication of smallpox and the recommendation to stop vaccinations everywhere, because they were no longer needed. That was a defining moment, but it really was the end. It was what we had worked for, for years, but ironically it was also kind of a let-down. We were used to working in the field with so many wonderful people, sharing meals and sharing problems, sharing a real camaraderie, and developing deep friendships. We were like soldiers in the battlefield but now the enemy was no more and we realized we would likely not see these people, these disease warriors again. The joy was in the trip rather than in the arrival.”

The program would never have succeeded had it not been under the banner of WHO, says Henderson. “The collaborative international effort was what was so important. Working as the head of the program in WHO, I could meet with ministers in various countries and talk openly and get cooperation. I don’t think one country could have achieved anything like this.”

J. Michael Lane Recalls Major Breakthrough with Surveillance/Containment

It was an amazing global effort, says Mike Lane, MD. “The international community just worked together and did it. Smallpox was eradicated in Chad during a major civil war. It was eradicated in Indonesia during secessionist efforts.” Success was achieved in country after country, despite the challenges. “People just laid aside their differences to work on smallpox because it was really so important.”

monkey skulls, cowrie shells and nails. *Photo by Jim Gathany*



Alexander Langmuir, MD, MPH, (sitting) was the father of infectious disease epidemiology. He began the EIS in 1951 and was CDC’s chief epidemiologist from 1949 to 1970. He is talking to Donald A. Henderson, MD, MPH, who eventually became chief of WHO’s smallpox eradication program. *Photo by PHIL*



This 1975 photo shows a volunteer smallpox eradication team member in the process of vaccinating a child in a makeshift tent in a basteen, an impoverished environment. *Photo by PHIL*

Another reason for the global success was conceptual, says Lane. "Bill Foege figured out that mass immunization was not the way to go. Instead he said we should focus on surveillance, and on finding infected people and immunizing their immediate contacts. Surveillance/containment was a major breakthrough." Foege called the idea eradication escalation and Lane quickly nicknamed it "E-squared."

Lane, a French speaker, worked in the French-speaking African countries and in Liberia, Sierra Leone, and Guinea. "It was a thrill to watch the curve go down in West Africa much more quickly than we expected. There was a sudden dramatic decline which was extremely satisfying."

Lane was director of the smallpox program at CDC at the time the last case was found. "We were all nervous about Somalia and Ethiopia. We had to go out and talk to village and community leaders to find cases. This was difficult in these two countries, where the last cases were, because the tribes were so fragmented because of the terrain. The roads were poor and communication was difficult. When the last case was announced there were cynics among us. How could we know for sure, when the population was so spread out? We crossed our fingers and held our breath as surveillance continued. But smallpox was really gone!"

That had global significance beyond the health consequences, explains Lane. "Back in the 1950s and 1960s smallpox was a major deterrent to international travel and commerce. Whenever a ship came into Manhattan, no passengers could disembark and no cargo could be unloaded until inspectors went on board to look for possible to check for possible smallpox cases. It was an expensive and cumbersome process. And global travelers had to show international certificates of vaccination against smallpox. Eradication removed those bureaucratic roadblocks."

Lane was also the leading person in getting the US to stop smallpox vaccination as routine in 1972. The risk of importation at that point was far less than the risk of severe adverse reactions to vaccine. He retired right before 9/11 but returned to public health to provide training and later took up a "third career" helping pharmaceutical companies improve smallpox vaccine. "It's been fun and interesting work."



The worldwide eradication of this dreaded disease was due to the Smallpox Eradication Campaign of the late 1960s and 1970s. Watch and listen to the seminar presented on the 30th anniversary of the eradication of smallpox, including appearances by Jason Weisfeld and fellow smallpox eradicators Bill Foege, DA Henderson, Don Millar, and Bill Griggs. It will be showing continuously today (Friday, October 26, 2007) at the Smallpox Eradication Exhibit in the lobby of the Visitors Center, Tom Harkin Global Communications Center, Roybal Campus. *Photo by PHIL*

Hear the Smallpox Pioneers!

Watch and listen to the seminar presented on the 30th anniversary of the eradication of smallpox, including appearances by Jason Weisfeld and fellow smallpox eradicators Bill Foege, DA Henderson, Don Millar, and Bill Griggs. It will be showing from 1-3 pm and 3-5 pm on Friday, October 26, 2007, at the Smallpox Eradication Exhibit in the lobby of the Visitors Center, Tom Harkin Global Communications Center, Roybal Campus. [This seminar will be archived on IPTV beginning October 30, 2007.](#)

In the years since smallpox was eradicated, all known stocks of smallpox have been destroyed, except the stocks at the CDC and the Russian [State Research Center of Virology and Biotechnology VECTOR in Koltsovo](#), where a regiment of troops guards it. Under such tight control, smallpox would, it was thought, never be let out again.

"I'm not a believer in the re-occurrence of smallpox," says Lane. "I think bioterrorism in this case is a political hoax. But I am grateful that we have rebuilt our vaccine supply and our capacity to make vaccine."

It's a scourge none of these dedicated public health pioneers ever want to see again.

This *Inside Story* by **CDC Connects** reporter **Kathy Nellis** with help from former CDC Director **Dave Sencer**, MD. For more on Sencer and smallpox eradication efforts. See [Smallpox Pioneers Share Public Health History](#).

Visit CDC's [Smallpox Home page](#) to find out more about efforts to protect the public.

And read up on the [Scourge that was Smallpox](#) to learn more about the deadly disease that wiped out civilizations and provoked this amazing global eradication effort.

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