

South African doctors move quickly to contain new virus

Four people died after they were infected by a new strain of Old World arenavirus. The rapid response of the investigating team was crucial in halting the outbreak in southern Africa and calming public fears. Claire Keeton reports.

When a microbiologist at a private laboratory requested assistance in a case of suspected viral haemorrhagic fever (VHF), alarm bells started ringing at the National Institute for Communicable Diseases (NICD) in South Africa.

Dr Lucille Blumberg, head of the epidemiology division at the institute, said her team noted that the doctor who had treated this potential VHF patient, an adult male, had also treated a woman safari agent from Zambia. The woman had been suffering from fever, vomiting and diarrhoea, followed by rash, liver dysfunction and convulsions. On 12 September, she was evacuated in critical condition to a private clinic in Johannesburg. A day after being admitted, she died.

It transpired that the suspected VHF case was a male paramedic who had become ill on 21 September, nine days after caring for the safari agent during her evacuation from Zambia. He died on 2 October.

Blumberg's fears of a disease outbreak were heightened when a third case, a nurse who had treated the safari agent at the Johannesburg clinic, was admitted to hospital on 30 September. Five days later, she too was dead.

"I thought there was something very wrong, something going on," said Blumberg, "and then on Thursday night we heard about the nurse who had been admitted."

Two further cases were identified in October. One had cleaned the hospital room occupied by the safari agent, the index case in this outbreak. The cleaner died on 6 October. The fifth case was a nurse who had cared for the paramedic (case number two). This nurse was treated with ribavirin, which has been effective in patients with Lassa fever, and she has since made a good recovery. She was the only one of the five to receive this treatment because the virus had been identified by the time she became ill.

All patients initially had non-specific flu-like illness. Symptoms included

fever, headache and muscle pain. The illness increased in severity over a week, with the patients developing diarrhoea and pharyngitis. A rapid deterioration, with respiratory distress, neurological signs and circulatory collapse were terminal features in all four patients who died.

Blumberg's fears that "something was very wrong" were borne out when the cause of the outbreak was found to be a distinct new strain of Old World arenavirus. This was established in tests done by the special pathogens unit (SPU) of the NICD at the National Health Laboratory Service in Sandringham, South Africa, the infectious diseases pathology branch of the Centers for Disease Control and Prevention (CDC) in Atlanta, USA, and Columbia University in New York.

The new strain, which was isolated by SPU head Dr Janusz Paweska, is a distant relative of two Old World arenaviruses known to be pathogenic for humans: Lassa virus, which is common in western Africa, and lymphocytic choriomeningitis (LCM) virus, which

can be found worldwide. But neither LCM virus nor Lassa fever virus has ever been found in southern Africa. The newly discovered virus is now the third Old World arenavirus species known to cause a severe and frequently fatal infection in humans.

Arenaviruses are broadly divided into two groups: New World arenaviruses, found in the Americas; and Old World arenaviruses, found in Africa. Both are associated with rodents and have co-evolved with them. Rodents are common in village houses in western Africa and therefore human exposure to the virus can be frequent.

That the outbreak has been contained to five people speaks volumes for the work of the provincial outbreak response teams in partnership with the NICD, which was formed in 2002 to gather intelligence on communicable diseases and provide expertise throughout the southern Africa region.

Its epidemiology team was alerted to the problem early, while the SPU – a WHO Collaborating Centre for the research and diagnosis of VHF's



Dr Janusz Paweska, head of the special pathogens unit (SPU), at the National Institute for Communicable Diseases (NICD) in South Africa – the only biosafety level 4 laboratory in Africa.

SPU, NICD

and other viruses – was able to help identify this new species of Old World arenavirus. This swift identification of the virus led to the successful treatment of the fifth case and containment of the outbreak through close monitoring of the victims' contacts.

Blumberg said the successful outcome had been the result of strong teamwork within NICD and with its various partners, as well as a measure of luck. "It was serendipitous that the same doctor treated both of the first two victims," she said.

The experience had also emphasized the need for extensive testing and gathering of case details. "What was important in the whole story was that the physician treating the second case (the paramedic) also treated the first index patient, whom he had originally diagnosed as having 'tick-bite fever'. Nevertheless, he knew of a link between the two cases and sent off blood from the second case (paramedic) for viral haemorrhagic fevers testing," Blumberg said, adding: "You never say 'never'. A disease might not normally be seen in a geographical area, but you should never rule it out."

Paweska said his team was under "high and constant" pressure from many quarters to find answers quickly amid much media and public anxiety.

"Identifying an agent that is causing an outbreak of great public health concern is important for a number of reasons; it allows for streaming down diagnostic tests for laboratory case confirmation, implementation of appropriate containment, treatment and hospital infection control measures," Paweska said, adding: "It also helps in calming public fears and anxiety when

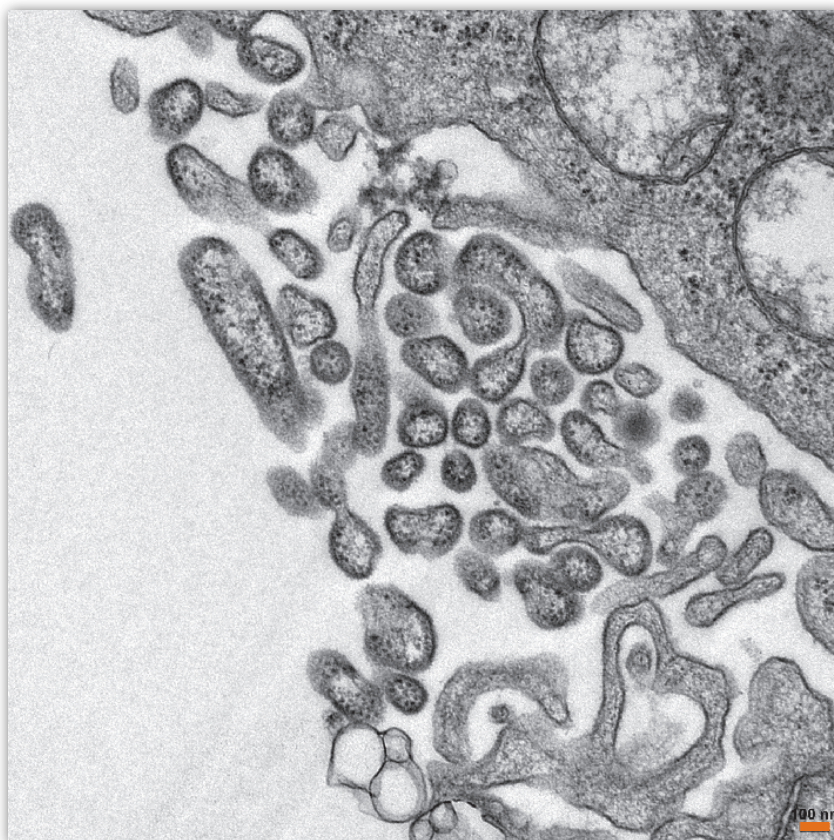


Image of arenavirus particles with their typically sandy appearance, from which they get their name *arena* meaning "sand" in Latin. Bar 100 nanometres.

scientists can show what is causing a disease."

When the paramedic died (case number two), a strong connection was made with the safari agent (index case). "We started thinking of a link to prove it. But it was difficult as we had only one single collection of blood sample from him," he said, explaining that by the time the sample was taken the disease agent may not have been present in the bloodstream any more. "Even when the virus has been cleared from the bloodstream, it can still replicate or traces of it can be found in other tissues."

Paweska continued: "At this stage we thought it was most likely a viral haemorrhagic fever. A number of tests were set up, including those for Ebola, Marburg, Lassa, Rift Valley fever and Crimean Congo haemorrhagic fever, but they yielded negative results. It was quite puzzling. When the next cases were identified it was obvious we were dealing with a cluster of hospital infections."

It became crucial to obtain liver, skin and muscle biopsies. Subsequent analysis of sequencing data of these samples generated at the SPU, CDC

and Columbia University in New York indicated that the outbreak was caused by a unique Old World arenavirus. SPU is the only biosafety level 4 laboratory in Africa – the highest level of laboratory safety that is required for work with extremely dangerous pathogens.

"Taking biopsies during this outbreak was pivotal to the successful recognition of the outbreak, virus isolation and identification – a milestone in this investigation," Paweska said. "I wonder where we'd be now if we had not done it – still fishing around probably."

Paweska said that he and his colleagues in Zambia are discussing how to name the virus. In the past arenaviruses were often named after the places where they originated, but today scientists feel it is unfair to stigmatize these places with a disease name.

"We can no longer call it the Zambia, Lusaka or Johannesburg virus. One has to give this virus a neutral name but still reflecting its origin, for example using a very old name of a region or location, which is not in common public use." ■

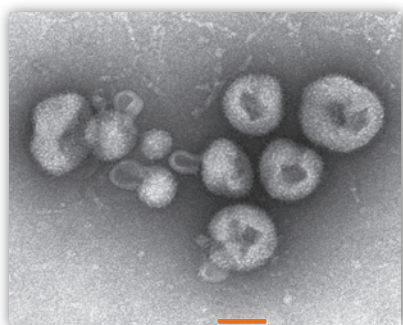


Image of arenavirus particles obtained from infected cells. The distinctive grainy appearance and surface projections are typical for arenaviruses. Bar 100 nanometres.

China's village doctors take great strides

Village doctors have dramatically improved access to health care in China's rural communities over the last few decades. Cui Weiyuan reports.

China's barefoot doctors were a major inspiration to the primary health care movement leading up to the conference in Alma-Ata, in the former Soviet Republic of Kazakhstan in 1978. These health workers lived in the community they served, focused on prevention rather than cures while combining western and traditional medicines to educate people and provide basic treatment.

Dr Philip Lee, then a professor of social medicine at the University of California in San Francisco, wrote glowingly in the *Western Journal of Medicine* about China's primary health care system after visiting the country in 1973 as part of a United States of America (USA) medical delegation. He said prior to the founding of the People's Republic of China in 1949, epidemics, infectious disease and poor sanitation were widespread. "The picture today is dramatically different ... there has been a pronounced decline in the death rate, particularly infant mortality. Major epidemic diseases have been controlled ... nutritional status has been improved [and] massive campaigns of health education and environmental sanitation have been carried out. Large numbers of health workers have been trained,

and a system has been developed that provides some health service for the great majority of the people."

Dr Zhang Zhaoyang, the deputy director general of China's Department of Rural Health Management, says the barefoot doctor scheme had a profound influence on the Declaration of Alma-Ata. "WHO research in the 1970s found problems relating to the health-cost burden and unequal distribution of health resources. To try to solve the inequality, it did research in nine countries, including four cooperation centres in China. China's experience inspired WHO to launch the health for all by 2000 programme."

Zhang says the barefoot doctor scheme, initiated by central government but largely administered locally, had its origins in the 1950s. "The name barefoot doctor became popular in late 1960s after an editorial in the *People's Daily* by Chairman Mao in 1968," he says. "The name 'barefoot doctor' originated in Shanghai because farmers in the south were often barefoot working in the paddy field. But China's village doctors had been there long before. In 1951, the central government declared basic health care

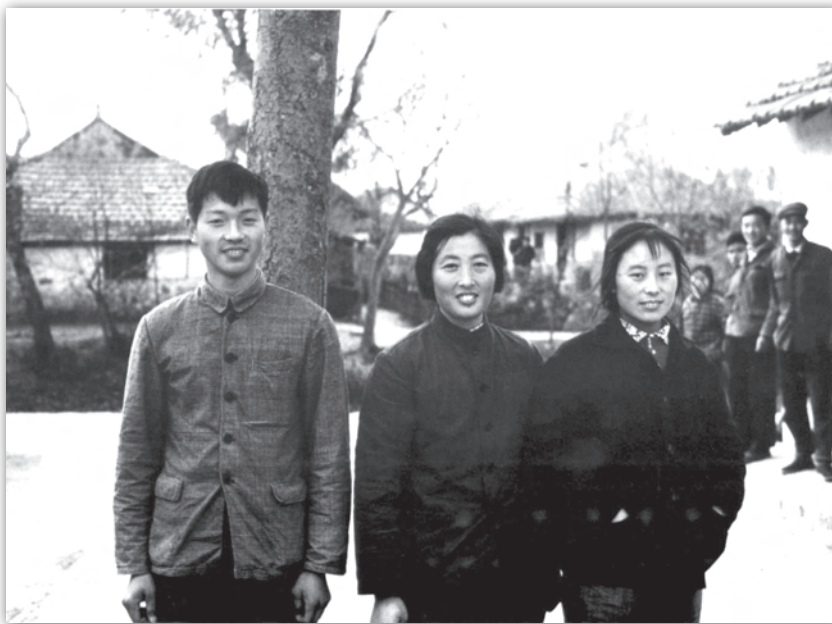
should be provided by health workers and epidemic prevention staff in villages. In 1957, there were already more than 200 000 village doctors across the nation, enabling farmers to receive basic health care at home and work every day. The barefoot doctor scheme was simply the reform of medical education in the 1960s. In areas lacking medicine or doctors, village doctors could go through short-term training – three months, six months, a year – before returning to their villages to farm and practise medicine."

“China now has more than 880 000 rural doctors, about 110 000 licensed assistant doctors and 50 000 health workers.”

Dr Zhang Zhaoyang

Zhang says the scheme has evolved over the decades, though the term barefoot doctor is no longer used. "The scheme has never stopped. In the early 1980s, the State Council (the Central People's Government, the highest executive organ in China) directed that barefoot doctors, after passing an examination, could qualify as a 'village doctor'. Those who failed would be health workers and practise under the guidance of the village doctors. The village doctors and rural health workers still undertake the most primary health work – prevention, education, maternal and child health care, collecting disease information. The quality of [care provided by] rural doctors keeps increasing in line with social and economic development."

Dr Liu Xingzhu, the programme director at the Fogarty International Centre at the National Institutes of Health in the USA, was a barefoot doctor from 1975–1977. Aged 19, his senior secondary school classes were interrupted during the Cultural Revolution drive to equip people with practical skills. "The county's health bureau organized medical training in my school and provided free accommodation and food. The trainers were



WHOM Grata

Three barefoot doctors, part of a production brigade near Shanghai.

the best from the county's central hospital in various fields. Many of the doctors were dispatched from the urban hospitals during the Down to the Countryside Movement (when Mao decreed 'privileged' urban youth go to rural areas to learn from workers and farmers) and showed great professionalism. They were very good trainers and doctors.

"After graduating in June 1975, I became a barefoot doctor at the Suliuzhuang commune (in north-western Shandong Province, south of Beijing) serving 1800 residents. Despite the knowledge I learned from the strict training, the conditions and equipment in the countryside were very limited. I was given only a bag of some basic medicine with two syringes and 10 needles."

Therein lay both the strength and weakness of the barefoot doctor scheme. It provided the rural poor with health care not known in pre-Revolution days, but the doctors' limited training, equipment and medical supplies meant they could not do a lot.

Another of the barefoot brigade, Dr Liu Yuzhong, still offers basic health care to his fellow villagers after 43 years' service. Now 69, he is known by patients as a caring, skilful doctor, though he says, "I learned something of everything, but specialized in nothing." He adds: "There are great advantages to having a barefoot doctor in the village. The patients are all my neighbours. I know each family's situation, lifestyle and habits. Since I see my patients very often, even if I cannot diagnose precisely the first time, I can follow up closely and give a better diagnosis the next time."

When the rural cooperative health-care system was dismantled in the 1980s as a result of China's economic liberalization, Liu Yuzhong was hired by the local Dingfuzhuang Health Centre on the eastern outskirts of Beijing. "I was lucky because I had passed a Ministry of Health exam in 1981 and acquired the certificate to practise as a village doctor."

Liu Xingzhu believes health-care services did suffer in the late 1970s and early 1980s when the agricultural sector was privatized. "The barefoot doctors, who were paid collectively by the commune, lost their source of income. Many turned to farming or industry. The most direct effect was that few did inoculations or provided primary health care for the peasants. Many diseases that had been eradicated emerged in the countryside again."

“I was lucky because I had passed a Ministry of Health exam in 1981 and acquired the certificate to practise as a village doctor.”

Dr Liu Yuzhong

The user-pays system introduced in China in the 1980s left many out of pocket or unable to afford treatment. The government in recent years has recognized the need to increase health spending and promote new health insurance schemes, a reflection perhaps of China's special commitment to a primary health care system that "everyone can enjoy, reflects social equality, is affordable for everyone and matches social and economic development," according to Zhang. Dr Lei Haicho of the Department of Health Policy and Regulation at the Ministry of Health, says the New Rural Cooperative Medical Scheme introduced in 2003 now covers more than 800 million rural residents, while public financing of the health system has increased substantially.

Zhang maintains, however, health-care standards have risen steadily in China, thanks in part to the work of village doctors and health workers, who, he says, receive excellent training and support. "The maternal mortality rate in rural China has decreased from 150

per 100 000 before 1949 to today's 41.3 per 100 000. The infant mortality rate for the same period has decreased from 200 per 1000 to 18.6. China now has more than 880 000 rural doctors, about 110 000 licensed assistant doctors and 50 000 health workers." He believes primary health care has also helped reduce poverty in China. "Only with a health body can people undertake education and production activities and improve their living standards. Village doctors have played a significant role in preventing people from becoming impoverished."

Despite the challenges China faces in providing a modern health-care service to all of its 1.3 billion people, the barefoot doctors and their successors can still show the way to the rest of the world in primary health care, according to Zhang Lingling. Writing in the Young Voices in Research for Health 2007 essay competition sponsored by the Global Forum for Health Research and the *Lancet*, the doctoral student at the Harvard School of Public Health said: "The impact of barefoot doctors in rural health-care services still exists. Today, both researchers and policy-makers have widely acknowledged it is hard to bring people to work in rural areas. Even the developed countries have experienced a difficult time attracting medical professionals to rural places [so] training local people seems to be the optimal solution [in] building sustainability in rural health-care services."

Liu Xingzhu also believes the Chinese model can inform other countries' approach to primary health care. "Chinese experience showed that to promote primary health care, the key issues are human resources and medicine. Chairman Mao advocated there was no need for five years' training; one year was enough to train a doctor. Short-term training focusing on specific types of work, such as antiviral treatment or prenatal care, is sufficient to meet the demands of primary health care, especially in the countryside or poverty-stricken areas." ■

The new *Bulletin*

The *Bulletin* underwent a major transformation in 1999. By changing its title and subsuming other WHO periodicals, it was pitched to a wider audience and expanded its thematic range. This is the third and last part of a series about the history of the *Bulletin* to mark its 60th anniversary. Research and report by Brigit Ramsingh.

Under former Director-General Gro Harlem Brundtland, two World Health Organization (WHO) periodicals – the *World Health Forum* and the *World Health Statistics Quarterly* – were incorporated into a bright new *Bulletin*. A position of editor-in-chief was created, and Brundtland appointed Dr Richard Feachem to lead the *Bulletin's* transformation as the “international journal of public health”.

The stated aim of the *World Health Forum*, which was established in 1980 and echoed the Declaration of Alma-Ata in 1978, was “to give substance to the revolutionary idea of ‘health for all’ by the year 2000.” It published accounts of field work and was oriented towards primary health care. The *World Health Statistics Quarterly*, formerly known as the *World Health Statistics Report*, published mainly epidemiological data.

These changes were reflected in the content of the new *Bulletin* as well as in its staff. Desmond Avery, a former editor of the *World Health Forum* later served as an Editorials/Reviews editor at the *Bulletin*. He recalls how “the new management argued that the new *Bulletin* would incorporate the *World Health Forum*, but in reality very little of the *Forum* approach was carried over.”

With the absorption of some of the functions of these two publications, the *Bulletin* was targeted specifically to the public health community and it was expanded and redesigned to include “policy-relevant discussions” alongside the research papers that it had always published.

Under Brundtland and her senior managers Dr Julio Frenk and Dr Christopher Murray, the revamped 1999 *Bulletin* shifted from bimonthly to monthly publication and its articles were more rigorously peer reviewed. An editorial committee was established of WHO staff, representing a wide range of expertise and publishing expe-

rience. Despite some tensions, overall, the revamp was a success.

Avery remembers that “the change in 1999 was exciting for us because the new team under Brundtland wanted the *Bulletin* to compete with journals like the *British Medical Journal*, *New England Journal of Medicine* and the *Lancet*, whereas the traditional *Bulletin* was more focused on work going on in WHO and its programmes. With the new regime, there was a more energetic and ambitious atmosphere. At editorial meetings there was often well-informed and high-powered discussion about articles. It was refreshing as I had been working at an under-funded quarterly journal, which had not been getting much attention.

“The *Bulletin* could and did draw attention to WHO’s work and policy positions as appropriate, but this was not its main or primary purpose.”

Dr Richard Feachem

“Richard Feachem, when recruited as editor-in-chief, took the job seriously and was good at it. We used to get him on the telephone from San Francisco to lead the monthly editorial committee meetings. He was very able at directing discussion and getting decisions made,” Avery recalls.

Feachem left the *Bulletin* in 2002 when he became the first Executive Director of the Global Fund to fight AIDS, Tuberculosis and Malaria. Reflecting on his time and goals as editor-in-chief of the new *Bulletin* from 1999 to 2002, he recalls: “We wanted the *Bulletin* to become a more independent, more influential and a more credible scientific voice on major issues

in global health. We sought to dispel any notion that it was a mouthpiece for WHO or that its content was in any way censored or controlled by WHO staff.”

“The *Bulletin* could and did draw attention to WHO’s work and policy positions as appropriate, but this was not its main or primary purpose. We wanted active and lively debate and we sought to attract strong papers by credible authors, even if these were critical of WHO policies or positions. We sought to make the *Bulletin* more ‘meaty’, and the theme issues format was the flagship innovation for achieving this,” says Feachem, who is Professor of Global Health at the University of California in San Francisco and Berkeley.

These special ‘theme issues’ began to appear in 2000, along with an expanded news section, mainly in response to demand from *Bulletin* readers provided in feedback for surveys. Other popular sections included Public Health Classics and Letters to the Editor.

WHO persuaded the *British Medical Journal* to second a senior editor to run the *Bulletin* on a day-to-day basis. “I was seconded to WHO to edit the *Bulletin* with a clear remit to make it an independent, influential and high impact journal,” recalls Dr Kamran Abbasi. “I believed the best way to develop the *Bulletin* was to ensure the journal’s coverage reflected what was topical and relevant in global public health, which was not necessarily always the same as WHO’s agenda.”

Not everyone was in favour of this, as Abbasi continues, “Several senior WHO staff members were angered by this change in editorial policy and tried to go above me to have their work published in the *Bulletin*. They were unsuccessful ... The focus had to move away from WHO and towards the key issues in global public health.”

Today’s *Bulletin* is the result of a 60-year evolution from the “principal scientific organ of the WHO” to the “international journal of public health.” It has also taken its place among the world’s leading health journals. In 2007, the journal achieved an impact factor of 4.019, placing it ninth in the ISI Web of Knowledge’s category of the most cited public, environmental and occupational health journals. ■

Smallpox: dispelling the myths



Mark Simevich, Staash Press

Dr Donald A Henderson

Dr Donald A Henderson is a resident scholar at the Center for Biosecurity, University of Pittsburgh Medical Center and a Distinguished Professor and Dean Emeritus at Johns Hopkins University. Chief of the World Health Organization's global smallpox eradication programme (1966–1977), he has been recognized for his work by many institutions and governments, having received 17 honorary degrees and awards such as the National Medal of Science and the National Academy of Sciences Public Welfare Medal. He was instrumental in initiating the WHO Expanded Programme on Immunization that is now providing six vaccines to children and saving tens of millions of lives throughout the world.

Twenty years ago Henderson and his colleagues published an exhaustive account of one of the World Health Organization's (WHO) most successful campaigns, *Smallpox and its eradication*. The 1500-page tome with its trademark red cover became known as 'the Big Red Book'. Next year, Henderson will publish his own reflections on the campaign in a new book *Death of a disease*.

Q: In 1966, the World Health Assembly voted to undertake a global eradication programme for smallpox. What was the immediate impact of this decision?

A: There was considerable debate as to whether that was a good idea or not. Several countries felt that it was impossible to do the job, and some were reluctant to provide more money to WHO to accomplish this. The Director-General (Marcolino Gomes Candau) was very much opposed to the programme, because the malaria eradication programme wasn't doing very well. His view was that if WHO were asked to undertake a second eradication programme, it would fail and that would reflect very badly on WHO and the public health community. He felt that the [United States of America] had played an important role in the debate in the assembly in persuading delegates to vote for this so he asked that an American – and specifically me – be assigned to the job, so when the eradication effort failed, the responsibility for it would be seen partly as that of the United States.

Q: What did you say when you were first approached about this?

A: I was reluctant to accept the challenge because in November 1965 the US government had decided to sup-

port a smallpox eradication–measles control programme in 18 countries of western and central Africa. I was asked to assume the responsibility for doing that. It was a big job and I was reluctant to leave the Centers for Disease Control and Prevention (CDC) barely a year later to work with a global programme. Second, only US\$ 2.7 million was allocated by the World Health Assembly, not enough even to buy the vaccine we needed. So I could see some real difficulties in executing the programme.

Q: The eradication programme was originally conceived as a mass vaccination programme. Do you think that was the right approach?

A: The idea that this was conceived as a mass vaccination programme is a myth. It was not. Before 1966 special smallpox control efforts were primarily mass vaccination programmes. Little attention was paid to the reporting and control of cases and outbreaks, which we felt were the most important things. So when we worked to prepare a manual for the 18-country programme in western and central Africa – a manual that was printed in October 1966 – we made a very strong point about the need for surveillance of cases and their containment. That manual was used in western Africa, but when I went to

WHO we modified it so it would be appropriate for countries throughout the world.

Q: How did you get through all those initial challenges to a successful programme in the end?

A: To answer this requires an entire chapter in my new book! A host of problems had to be resolved – special measures were needed to persuade many governments to give the programme adequate support; vaccine production laboratories needed to be developed and improved in many countries; far more funds and personnel were needed than the budget would accommodate; the WHO bureaucracy was unaccustomed to dealing with a programme such as this; new strategies were needed; training programmes and teaching materials had to be developed. But, as in many programmes, personnel were key and we soon discovered a surprising number of very good young people, in particular, who were enthusiastic, working very hard and who were willing to sacrifice considerable time and effort. They were willing to look at difficult problems and create new solutions. We tried to keep in close communication with all our staff constantly, charting progress, encouraging them and illustrating the successes and possible new approaches. This was not easy without telephones, e-mail or other means of rapid communication. At our Geneva headquarters, there were only nine of us and we never had more than 150 international staff in the field. We served primarily as catalysts, as it was the countries themselves that actually did the job, that took an interest in the programme and that became increasingly enthusiastic and committed.

Q: Those challenges are familiar today for many public health programmes. Your work and the success of the eradication programme is an inspiration to people today.

A: I would hope it would be. The point we've also made is that there's no way in the world that this programme could have been implemented by any single country. It really required the World Health Organization. Interestingly it was during the time that the Cold War

was at its peak between the US and the Soviet Union. They both cooperated fully with the programme itself, and donated very generously to it. So we saw bridges being built where they didn't exist politically.

Q: Dr William Foege is sometimes credited with introducing the surveillance–containment approach to the programme. Is that a fair assessment?

A: Foege was one of the first to begin to apply the surveillance–containment strategy that is described in the Director-General's Report to the 1966 World Health Assembly and outlined in the first training manual as mentioned above. The concept of infectious disease surveillance was introduced in 1950 and fostered by Dr Alexander Langmuir at CDC in Atlanta. In simple terms, it calls for the continuing, routine collection of data about cases and deaths due to infectious diseases; the regular analysis and interpretation of this material; and its regular distribution to those responsible for disease control. Simple and logical – but for smallpox control before 1966, countries made little or no effort to routinely collect reports of cases, to determine how the disease was spreading or to evaluate their vaccination control efforts. A WHO Expert Committee in 1964 stated that it really couldn't tell how many smallpox-endemic countries there were or how many cases were occurring because the reports were so poor. Foege was one of the people who was trained at CDC for the programme in mid-1966. Then he went to eastern Nigeria and, in December, they came across some outbreaks. They didn't have much vaccine or transport. So they decided to vaccinate in the area where outbreaks were occurring. By June 1967, the outbreaks had pretty well stopped in eastern Nigeria, even though they had vaccinated only about 750 000 of the 12 million people in the state. This demonstrated that the surveillance–containment approach could be effective in a setting such as Africa.

Meanwhile we supported a team in the state of Tamil Nadu in India, which had a population of 50 million people. With Dr A Ramachandra Rao heading this team, transmission was stopped in four or five months – another indication that surveillance and containment could be effective even in a populous Indian setting. Classical medical textbooks of that time talked about small-

pox spreading like a wild fire. But the disease did not transmit that readily, so one could break the chains of transmission by vaccinating possible contacts in areas where there were cases.

Q: In 1972, you flew to Belgrade during the last smallpox outbreak in Europe. Can you talk about what you saw there?

A: In former Yugoslavia there were some 170 cases. It was the largest outbreak in Europe in 20–25 years. The concern was how well they were succeeding in stopping the spread. Initially, they were using an unsatisfactory vaccine and so they asked WHO to provide a new vaccine. We provided a couple of million doses and they took very heroic steps to stop the spread. They stopped cars along the road to vaccinate people; they went from village to village, vaccinating almost the entire country – 18 million out of 20 million people. The secretary of health was deeply concerned as to whether they were succeeding so he asked me to come and review what was going on. I did, and I told him they had done a really fine job and I agreed to say so on the radio to reassure the country.

“There's no way in the world that this programme could have been implemented by any single country. It really required the World Health Organization.”

Q: Did you really send a jeep tyre to a WHO official who said he would eat one if the India smallpox eradication campaign were successful.

A: [laughs] I reminded him later on of his bet and said that we had a tyre waiting and where should we send it. He laughed and said “No, no, I really didn't mean it.” So the tyre never got sent.

Q: Is it true that you were in favour of destroying the remaining stocks of smallpox?

A: Yes, that's correct. A WHO international committee has met in many different sessions since 1986 and held intensive discussions about whether to

destroy the virus: is it valuable genetic material? Is this ethically appropriate? We recommended that a library of cloned fragments of selected strains be prepared. Later, we recommended that selected strains be sequenced. Of the 10-person committee, eight voted to destroy the known stocks immediately and two argued to wait for three years. As far as we could tell then, there had been no research using the smallpox virus for at least 10 years. The developing countries that had been plagued with smallpox said, “Look, we have played a major role in getting rid of this disease and we think we should have a say as to whether we are going to destroy the virus or not. We think the virus stocks are unnecessary and ought to be destroyed.” The Assembly eventually agreed but has repeatedly postponed the date of destruction. No one could be absolutely certain that the virus was not being retained in laboratories other than in the two WHO Collaborating Centres in Novosibirsk (the Russian Federation) and in Atlanta (USA). A deterrent, however, would be a resolution to say that any country, laboratory or scientist found with smallpox virus after that date would be guilty of a crime against humanity. That, we believed should reduce the likelihood of smallpox being released.

Q: But the World Health Assembly decided not to go ahead and destroy those known stocks. Were there valid arguments for keeping them, for example, for research in case of a bio-terror attack?

A: We are not proposing to destroy the vaccine. One doesn't need the virus to conduct studies to develop an antiviral agent or a vaccine. One justification for keeping the virus is that one day it might be needed for studies not now foreseen. This has to be weighed against the possible escape of the virus from the laboratories now holding the virus – unlikely perhaps, but not a zero risk.

Q: What do you believe are the prospects for future eradication programmes such as polio?

A: Even towards the end of smallpox eradication, the senior staff never talked about potential eradication of any other disease. There's a reason for this. No other disease had so many of the attributes that made smallpox amenable to eradication. The polio vaccine can be

expensive and requires several doses and even then protection is not guaranteed. Protection against smallpox for 10 years or more is possible with a single vaccination. The smallpox vaccine could be kept at 37 °C for a month, whereas the polio vaccine has to be kept cold up until it is actually administered in the field. This is difficult to do in developing countries. We knew exactly where smallpox was because each infected individual had a distinctive rash. With polio, there are 200 infected children for one paralytic case, so the other 199 are perfectly able to transmit it to others. And they could spread it, undetected, to many different parts of the country. You could not do what we did with smallpox in terms of focusing specifically on an outbreak and on vaccinating the people around that to prevent spread.

Q: If we hadn't eradicated smallpox at that time, would it still have been possible to vaccinate so many people given the emergence of HIV/AIDS?

A: The question is raised because complications of vaccination can be more serious among those with advanced HIV infection. However, we now give live vaccines, such as those against measles, polio and yellow fever, to people with AIDS and they seem to handle those vaccine infections quite well. This

is undoubtedly true for many of those who are given smallpox vaccine. In Africa, for example, where health conditions are challenging, individuals with severe immunodeficiency disease, don't live very long. I think that even with AIDS – and evidence indicates that by as early as 1970 some areas had already been infected with HIV – smallpox still could have been stopped.

“If we could defeat the disease in India, we could defeat it in Bangladesh, Pakistan and Ethiopia.”

Q: Was there any turning point in the smallpox campaign when you knew you were going to succeed?

A: Yes. During 1973 and early 1974 we were doing really well: Latin America was free, Indonesia was free and Africa seemed pretty much free, except for Ethiopia. The problem was in India, where we were simply not succeeding. So in late 1973, WHO and Indian government staff worked out a plan to visit every house in India in the space of 7–10 days. The concept was that if we could discover the cases more quickly

than before, the containment teams could interrupt the chains of transmission. The results were astounding. One state had been reporting about 500 cases a week, but the search teams found 10 000 cases. This was really a black day. We had no idea it was this bad. But in January and February, searches were steadily improving. India reported the largest number of cases in about 20 years. However, we sensed that we were successfully implementing the right strategy and, if we could defeat the disease in India, we could defeat it in Bangladesh, Pakistan and Ethiopia. And indeed the last case in India occurred little more than a year later.

Q: Is there anything you would like to add?

A: The most important legacy of smallpox eradication was its demonstration of how many people could be protected through vaccination, so rapidly and inexpensively with a well planned programme and quality-control monitoring. This is what led us to organize the first meeting that would propose an Expanded Programme on Immunization and which, in turn, led to the polio eradication campaign and a rapidly growing global interest in immunization as a highly cost-effective programme worthy of investment by every country. ■

Recent news from WHO

- WHO said, on 13 November, that it was launching an intensive operation with its health partners to prevent and control a **cholera outbreak** in the eastern part of the Democratic Republic of the Congo. Insecurity, massive population displacement – at least 250 000 people since early August – weak health services and a lack of safe water and proper sanitation facilities have caused a marked increase in the number of people with cholera in North and South Kivu. As yet, no data are available on the number of deaths linked to the current outbreak, but in complex emergencies the case fatality rate can surpass 30%. WHO sent 60 tonnes of medical supplies to the Democratic Republic of the Congo in collaboration with the Italian and Norwegian governments.
- WHO's Regional Office for Africa said, on 6 November, that it had provided training to 46 laboratory staff from across Africa, in collaboration with WHO headquarters and the Kenyan Medical Research Institute, to **build capacity to identify dangerous pathogens**.
- WHO welcomed the decision of the United Nations General Assembly on 3 November to **ban smoking and tobacco sales** at United Nations headquarters in New York.
- A WHO study that provides a comprehensive picture of people's health around the world, including the top 10 causes of death, was published on 27 October. **The global burden of disease: 2004 update** is available at: http://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/index.html
- On 31 October, WHO's Office for the European Region published a manual for young public health students on planning, conducting and publishing the findings of **epidemiological research in environmental health**. The manual, a collaborative effort with the United Nations Development Programme and the United Nations Office for Programme Support, draws on the experience of the Sumgayit Cancer Study in Azerbaijan.
- WHO sent medicines and other **supplies to eastern Yemen** to treat over 50 000 people for diarrhoeal diseases, malaria and other conditions after floods on 3 October.

For more about these and other WHO news items please see: <http://www.who.int/mediacentre>