

Can we stop smallpox vaccination?

The cessation of vaccination will not only save thousands of patients who would otherwise have suffered from complications but will also save the world community some \$1,000 million a year

by Isao Arita



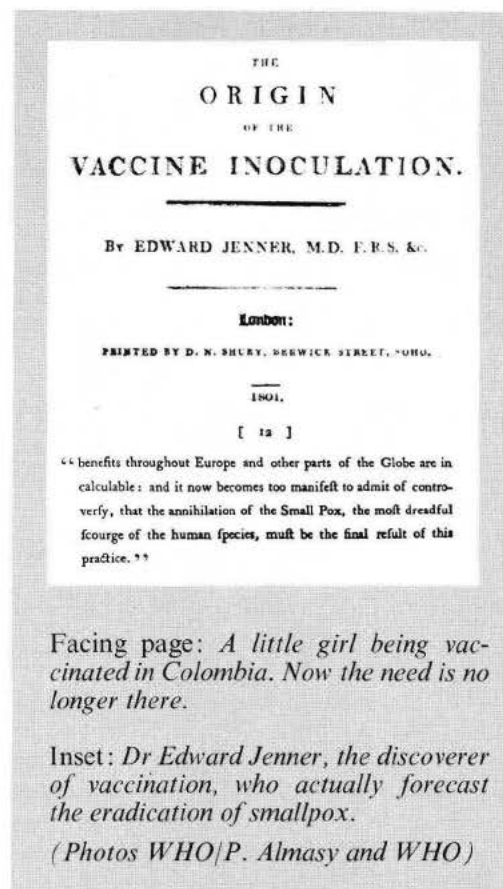
As early as 1801, Edward Jenner, the discoverer of smallpox vaccination, wrote that "the annihilation of the smallpox, the most dreadful scourge of the human species, must be the final result of this practice". He was probably the first person ever to predict smallpox eradication, yet one wonders whether even he considered that the practice of smallpox vaccination would come to an end if his prediction came true.

The first official indication that wiping out the disease would also spell the end of smallpox vaccination appeared in 1958, in a resolution of the Eleventh World Health Assembly. This proposed the start of the global eradication programme and suggested that "...with the eradication of smallpox, vaccination and all expenditures involved in its application will be redundant".

The Global Commission for the Certification of Smallpox Eradication, an independent group convened by WHO to consider all issues related to the programme, has delivered its formal judgement that smallpox has now been eradicated and that there is no evidence that it will return as an endemic disease. It recommended that "smallpox vaccination should be discontinued in every country, except for investigators at special risk". And it added that "international smallpox vaccination certificates should no longer be required of any traveller".

These recommendations were made because the risks of complications from vaccination, however small, certainly exceed the risk of smallpox infection,

which is negligible. The only instance in which smallpox vaccination is justified is for personnel who are directly engaged in work that involves handling variola virus or related viruses. Understandably,



Facing page: *A little girl being vaccinated in Colombia. Now the need is no longer there.*

Inset: *Dr Edward Jenner, the discoverer of vaccination, who actually forecast the eradication of smallpox.*

(Photos WHO/P. Almsy and WHO)

however, there may be some hesitation about abandoning a practice which has been shown over a long period of time to bring great benefits. So let us look at a few of the major issues bearing on the decision to terminate smallpox vaccination.

Has smallpox really been eradicated?

Minutely detailed documentation of the eradication programme and continued investigation of smallpox suspects has been carried out in 79 countries, including those where smallpox had recently been endemic, where there had been a risk of importations leading to the possible establishment of endemic foci, or where information was inadequate to permit confirmation of freedom from smallpox. All these investigations failed to detect any evidence of continuing smallpox transmission, since the world's last endemic case of smallpox occurred in Somalia in October 1977.

In 1978 and 1979, no fewer than 9,170 specimens were collected for laboratory confirmation by WHO Collaborating Centres from suspected cases in the Horn of Africa and elsewhere throughout the world; not one of them contained the smallpox virus. Furthermore, all the remaining 121 countries and areas submitted to WHO a declaration of freedom from smallpox. These were the countries which had not had endemic smallpox for at least the last ten years and which had effective surveillance systems. This was the evidence that convinced the Global Commission that the WHO programme had indeed reached its goal.

Could virus stocks cause epidemics?

Variola virus stocks in laboratories can be considered to be a potential danger for the introduction of a new



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Left:

This child reacted badly to vaccination and suffered severely from eczema. The Global Commission has now recommended discontinuing vaccination because the risks of complications, however small, certainly exceed the risk of smallpox infection, which is negligible.

(Photo Royal College of General Practitioners, UK)

Right:

The humble hen's egg had a part to play in the campaign. Vaccines were quality-tested by being inoculated into the outer membrane of embryonated eggs; if the vaccine was effective, the membrane would develop characteristic pocks two days later.

(Photo WHO/J. Mohr)

infection of smallpox. The occurrence of smallpox in Birmingham, UK, in 1978 demonstrated this risk. Scientists have been aware of this danger and in recent years, under WHO's coordination, efforts have been made to reduce the number of laboratories retaining variola virus. In 1976, there were 76 laboratories retaining variola virus, but the number has now been reduced to six—one each in China, Netherlands, South Africa, USSR, United Kingdom and United States. All of these laboratories have been inspected by WHO teams of biosafety experts, virologists and epidemiologists. Adequate containment measures have been established by these laboratories and by the national health authorities concerned, and the WHO inspections will continue periodically. In two years' time, when the current priority research projects have been completed, a review will be made to evaluate whether the retention of variola virus is still scientifically justified. Meanwhile, a further reduction in the number of such laboratories is anticipated.

Is there an animal reservoir?

Since the intensified programme began in 1967, there has been an active research programme looking into the question of whether an animal reservoir of variola virus exists. All epidemiological investigations of smallpox outbreaks in tropical areas of Africa, Asia and South America turned up no evidence that such outbreaks originated from a source other than man.

In the course of these investigations, a disease called human monkeypox was first detected in West and Central Africa in 1970. Up to February 1980, 48 cases had been discovered. This disease resembles smallpox clinically, but infected persons do not easily transmit the disease to others. Only four patients seem to have caught the disease from primary cases, and there has been no evidence of spread to a third case. The causative agent is monkeypox virus, which is related to but distinct from variola virus. It appears to be maintained by some monkeys and possibly other animals; it very infre-

quently causes an infection in humans. The Global Commission indicated that monkeypox does not constitute a threat to the permanence of smallpox eradication. As a further precaution, however, close surveillance of human cases will continue as part of a collaborative study between WHO and countries in Africa to investigate further the natural history of this disease.

Do scabs pose a threat?

It has been shown that variola virus in the scabs of smallpox cases become non-infectious quickly in a tropical climate when they fall off the skin and remain in the patient's home or elsewhere. A similar query arose about the specimens maintained by variolators—people who inoculated material from the skin lesions of smallpox patients into other persons in order to immunize them; this ancient practice was still being carried out recently in some countries of Africa and Asia. Forty-five specimens of scabs were collected from variolators



in Afghanistan, Ethiopia and Pakistan. Only on four occasions was variola virus isolated from these specimens. There was no positive result from specimens which were collected more than nine months before testing. These findings suggest that within a year of collection, variolation material probably becomes inactive. In those countries where variolation was practised, there have been no smallpox cases detected for more than three years despite continued vigorous surveillance.

Can animal poxviruses mutate into smallpox?

Past studies on orthopoxviruses, the group of viruses to which variola virus belongs, have indicated that there has been no evidence that an orthopoxvirus has been or can be transformed into variola virus. Current genetic studies on poxviruses support this observation, and show that, because of the substantial difference between the genetic structure of variola virus and those of other individual poxviruses, mutation of other known

poxviruses into variola virus appears to be unlikely.

All these considerations indicate that the risk of smallpox being still present or re-emerging in the world is most unlikely. What about the risk of complications if vaccine is given? Very severe complications that may occur following smallpox vaccination include encephalitis (a frequently lethal disease involving the brain), eczema and necrosis of skin tissue at the vaccination site. The frequency of complications in the past varied according to the type of vaccine virus used, the age of persons receiving the vaccination and the state of health of each individual. However, a very conservative estimate is that, among one million persons vaccinated for the first time, one or two persons will die, and 10 to 20 persons will suffer severe illness.

By the middle of April 1980, 64 countries had already stopped their vaccination programmes, and it is anticipated that all the remaining countries will follow suit. Fourteen countries still required vaccination certificates from interna-

tional travellers. It is hoped that, by the time this issue of *World Health* is published, many more countries will have stopped vaccination and those requiring certificates may have fallen to very few. The universal termination of smallpox vaccination will not only save thousands of patients who might otherwise have suffered from complications but will also result in enormous savings in the health budgets of the world community, roughly estimated at around US\$1,000 million a year.

Finally, it is reassuring to note that, despite the overwhelming evidence that the world has been freed of smallpox, measures are being taken by countries and by WHO to assure the permanent status of smallpox eradication. The "insurance policy" includes continuing surveillance for suspected cases of smallpox, promotion of research on orthopoxviruses in laboratories and in the field, and the maintenance of a WHO vaccine reserve sufficient to vaccinate 200 million persons in case of an unexpected emergency. ■