

THE STATUS OF THE GLOBAL SMALLPOX ERADICATION  
PROGRAMME IN SEPTEMBER 1969

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Although presently confined to the developing countries of Africa, Asia and South America, smallpox continues to represent by far the most universal and serious threat of any infectious disease to countries throughout the world. Once introduced, smallpox can be readily transmitted in any country, in any climate – irrespective of the degree of economic development. Europe is quite as much at risk as Central America or Oceania. Case-fatality ratios among those infected with variola major are normally 35 to 40%. No specific treatment is available.

Our only weapon for attack and virtually our only defence against smallpox is vaccination. As with no other disease, vaccination against smallpox is practiced today in every country throughout the world. As with no other disease, certificates of vaccination are universally required for international travel. Of all the immunizing agents available, far more smallpox vaccinations are performed annually than the total of all other immunizations combined.

Despite this extensive use of smallpox vaccine, despite the known frequency of complications which occur following its use, the vaccine itself and the techniques for producing it have really not changed substantially in a century or more. This symposium is, therefore, certainly most timely.

In dealing with smallpox, the principal emphasis of all countries until 1967 was based on a defensive posture – of keeping smallpox out of one's own country and, if introduced, of containing it quickly. The key principles were vaccination of one's own population, quarantine and surveillance. The simple axiom, »the best defense is a good offense«, was largely ignored.

In 1966, an intensive global programme of smallpox eradication was proposed and unanimously adopted by the World Health Assembly. Supported by a modest budget from the Organization and pledges of additional support from a number of countries, particularly the Soviet Union and the United States of America, the programme was initiated in January 1967. It is now in its third year. I should like to review with you the progress made to date and the present status of the programme for, in all respects, it is a unique venture in preventive medicine and could represent a milestone in man's efforts towards international co-operation.

During the first year of the eradication programme, reported cases of smallpox actually increased from 89000 cases to over 129000 cases (fig. 1). In part, this may be attributed to better reporting but, in part, longer term cyclical trends may have been responsible. During 1968, the incidence decreased by 40% to 79000 cases and, in 1969, a further decline of almost 40% has been observed to date. In 1967, 14 countries recorded 5000 more cases per 100000 population (fig. 2). Based on present trends, it is likely that only two countries, Indonesia and the Democratic Republic of the Congo, will record rates of 5.0 per 100000 or greater during 1969 (fig. 3). The decreasing incidence is also reflected in the number of countries which have been afflicted with the disease. At the beginning of the programme 42 countries recorded cases; last year, the number fell to 39; this year, only 30 countries have experienced smallpox. The benefits of the programme to Europe can be summarized succinctly by noting that it is now one year and two days since the last case was introduced.

Although programmes are now in effect in 26 of the 27 countries considered to be endemic at the beginning of this year, progress, not surprisingly has been greater in some areas than in others.

In the Americas in 1969, (fig. 4) cases have been recorded only in Brazil, the sole endemic country in this Region. The eradication programme has been intensified in Brazil during the past year. The number vaccinated in the systematic vaccination campaign is between 1.5 and 2 million persons per month; over 35 million have been vaccinated since the programme began. Smallpox incidence began declining approximately a year ago and, to date in 1969, 1803 cases have been recorded, 10% fewer cases than were recorded last year at this time.

The modest decline does not accurately reflect the situation, however. More than half of all cases recorded this year have been discovered by special surveillance teams which have been formed recently. In Brazil, as in many other countries now, such teams have been created specifically to investigate all suspect cases, to search for additional cases and to take appropriate containment measures. Through this approach, we

feel that smallpox transmission may be interrupted much more quickly and the duration of the eradication effort shortened. Although reported incidence increases initially when surveillance teams commence their work, the incidence later falls at an accelerated rate. In the meantime in South America, those countries bordering Brazil have intensified their vaccination programmes and strengthened surveillance activities to prevent reintroduction of the disease.

By far the most dramatic progress to date has been in western and central Africa (fig. 5). Programmes in 20 countries embracing a population of 120 million persons were begun in January 1967, with bilateral assistance from the United States of America and additional help from the World Health Organization. By the end of this year, 100 million vaccinations will have been administered. Smallpox incidence has declined steadily. Except for a recent small outbreak of 31 cases in Dahomey, no cases have been detected in this extensive area since 25 June. Intensive efforts to detect cases continue, however, and will continue but we feel reasonably confident that this area will be smallpox-free by the end of this year. This is particularly remarkable when it is realized that five of the 10 countries which recorded the highest rates of smallpox in the world during 1968 were located in western and central Africa.

During 1969, recorded cases of smallpox in eastern and southern Africa (fig. 6) have declined more than 50% from the number reported in 1968. Smallpox incidence is presently at a record low level. No cases have been reported to date in Swaziland or Zambia and only four countries, the Democratic Republic of the Congo, Ethiopia, the Union of South Africa and Sudan, have reported more than 100 cases this year.

In the Democratic Republic of the Congo, 1050 cases have been recorded in 1969 compared with 2527 cases at this time last year. In this country of 17 million persons, vaccination activities have been sharply increased during the past two years as indicated below:

	No. of Vaccinations			
	Eradication Programme		Other health services	Total
1967		302 000		302 000
1968	2 275 000		574 000	2 849 000
1969 (7 months only)	2 914 000		2 187 000	4 101 000

Since the beginning of 1969, special efforts have been made to improve the completeness of routine case notification and plans are being developed to undertake intensified investigation and containment activities later in the year. A successful programme in the Congo is particularly important as this country occupies a strategic position in Africa, having common borders with nine other countries.

The two other countries of major concern, Ethiopia and the Sudan have this year recorded a total of 283 cases, an increase of 20% over the number of cases recorded at this time last year. In the Sudan, smallpox outbreaks commenced in mid-December in the southern part of the country and continued into May. A total of 125 cases were detected in 34 towns and 4 provinces. The outbreaks coincided with a very large seasonal migration of agricultural workers into east central Sudan from the southern part of the country and from Ethiopia. While an eradication programme has begun in the Sudan, little information is available regarding smallpox activities in Ethiopia. No formal programme of control or eradication is planned. Reporting is recognized to be very incomplete and it is reasonable to assume that the actual incidence of disease is many times that which is presently recorded. Ethiopia, at present, represents the most serious threat to the eventual success of the eradication effort.

Smallpox incidence in Asia (fig. 7) declined by 40% in 1968 and appears to be declining at a comparable rate in 1969. However, from one country to the next, progress in the smallpox programmes differs widely as do the trends in incidence and factors influencing these trends.

The most active programme in Asia is in Indonesia. The programme commenced in July 1968 and has progressively been extended throughout the country. Paradoxically, in 1969, the reported incidence of smallpox is little different from that in 1968. Reporting, however, has been greatly intensified and containment teams, initiated in January of this year, have steadily broadened their extent of activity. The impact of the vaccination programme in reducing reported incidence has thus been nullified by the improvement in notification. Comparatively few foci of smallpox are present outside of the island of Java, on which resides 65% of the population and on Sumatra. East Java and Bali with a population of 30 million are now smallpox-free. Intensive containment operations in parallel with the systematic vaccination programme have sharply curtailed smallpox in Central Java.

Increased notifications were received during 1968 from both Afghanistan and Nepal, and a further increase in 1969 from Nepal. In both countries, eradication programmes are steadily being intensified and more complete reporting is apparent.

A marked decline in smallpox occurred this year in East Pakistan which, in 1968, recorded its highest incidence in a decade. However, the fall in incidence must be attributed to expected cyclical variation as little progress has yet been made in the eradication programme. The opposite pattern has occurred in West Pakistan which is one of the few reporting areas which has recorded an increase in smallpox in 1969. An eradication programme in West Pakistan is just beginning; surveillance activities have not yet been organized.

In India, an increased emphasis has been placed on vaccination of those never previously vaccinated, particularly pre-school children; the use of liquid vaccine has been totally abolished; vaccine storage has been improved; and the bifurcated needle is being substituted for the rotary lancet in the vaccination programme. Although reporting is still very incomplete and surveillance activities are still very limited, there appears to be a continuing decline in incidence from 1968 and 1967.

#### *General Programme Activities*

In the development of the eradication programme, initial efforts were directed toward the development of the technical and operational strategy. These were fully discussed by a Scientific Group on Smallpox Eradication which met in October 1967 and presented in a report (*Technical Report Series No. 393*). A »Handbook for Smallpox Eradication« was also written, which is being revised this year to take into account the experience of the past two years. Additionally, a special manual which discusses the theory and practice of surveillance-containment operations has been prepared.

Special seminars dealing with programme execution have been conducted in 1967 for countries in Asia and in 1968 and 1969 for countries in Africa.

Because of the critical need for adequate supplies of freeze-dried vaccine which meet standards established by WHO, major efforts have been devoted to this problem. Assistance in the form of consultation, vaccine testing, equipment (in conjunction with UNICEF) and antigens for testing have been provided to laboratories throughout the world. To date, WHO consultants have visited 24 production laboratories; equipment, special reagents and testing materials have been provided to 30 laboratories. All countries have been urged to submit vaccine regularly for testing purposes. These are tested at one of two WHO Reference Centres, at the Rijks Institute, Netherlands, or the Connaught Medical Research Laboratory, University of Toronto, Canada. This service has been increasingly used as shown in the table below:

	1965	1966	1967	1968
No of samples tested	12	43	83	167

It is satisfying to note that almost all vaccinations now performed in endemic countries are performed with freeze-dried vaccine which conforms to the potency standards recommended by WHO. At the inception of the programme two years ago, it is probable that not more than 10 to 20% of vaccinations in endemic countries were performed with satisfactory vaccine.

Recommended vaccination techniques have been altered substantially to provide simpler methods which assure higher take rates and use smaller quantities of vaccine. In 1967, after several years of testing and evaluation, the foot-operated jet injector was first employed for routine field operations. It is now in widespread use in Brazil, in the Democratic Republic of the Congo, as well as in the countries of western and central Africa. It is being employed also in several other countries for special programmes of epidemic containment and for vaccination of large groups. Early in 1968, after a number of special field studies, the bifurcated needle, developed by Wyeth Laboratories, USA, was introduced for field use and has now been adopted in essentially all programmes. Employing bifurcated needles, vaccinators in western Africa have been able to vaccinate 400 to 700 persons daily, while realizing savings of several fold in vaccine. By the end of 1969, virtually all vaccinations in endemic countries will be performed either with the jet injector or the bifurcated needle, techniques unknown to routine vaccination programmes prior to the beginning of the global eradication effort.

Since the inception of the global programme, the importance of more complete reporting of cases of smallpox has been stressed and the majority of countries have made special efforts to strengthen their reporting and surveillance activities. In addition to various administrative measures to assure the regular notification of cases from health facilities throughout their countries, several have initiated the telegraphic reporting of cases; special case investigation teams have been established in many areas; and smallpox surveillance reports are now published regularly by seven of the endemic countries.

To facilitate the more rapid exchange of current information regarding the global status of smallpox and eradication activities throughout the world, WHO has, since June 1968, prepared a special surveillance report on smallpox which is published every two to three weeks in the Weekly Epidemiological Record. To permit more rapid and detailed analysis of disease trends, smallpox morbidity data is now being recorded and tabulated by computer.

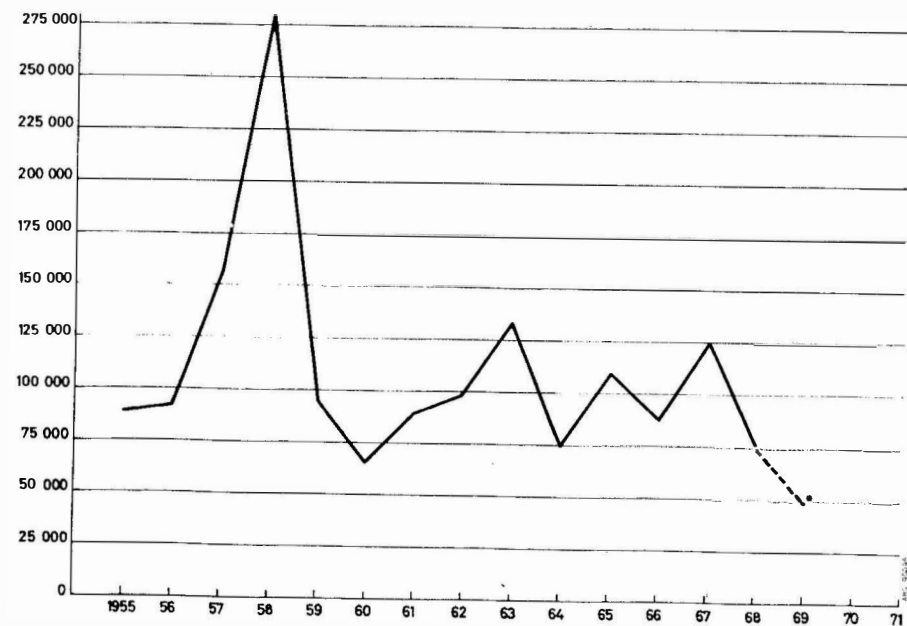
Reliable reporting rests in large measure upon the accurate clinical diagnosis of the disease. To assist health personnel and others responsible for the reporting of smallpox, WHO has produced for the African countries a series of teaching aids, including brochures, posters and slides, which show cases of smallpox and varicella at different stages of the evolution of the rash. It is anticipated that a similar series of teaching aids which show smallpox in Asian patients will be prepared next year.

A network of diagnostic laboratories to provide geographically convenient diagnostic services to every country is also being developed by WHO. It is planned for each participating laboratory to be able to conduct at least three basic examinations for the identification of variola virus - a microscopic smear examination, a precipitation-in-gel test and virus isolation on the choriollantoic membrane of chick embryos. A 48-page manual has been prepared entitled »Guide to the Laboratory Diagnosis of Smallpox« which describes in detail and pictorially each of the tests noted. Arrangements have been made with collaborating laboratories to produce requisite antisera and antigens and additional materials for each of the tests have been procured.

Training courses have already been conducted in the Americas and a network of 12 diagnostic centres established. During 1969 and 1970, it is planned for additional courses to be conducted in other regions. Following the training course and the designation of laboratories as diagnostic centres, arrangements are being made to distribute twice each year to each of the laboratories specimens as »unknown« to ensure that each of the laboratories has retained its competence or, if not, to assist in retraining the technicians concerned.

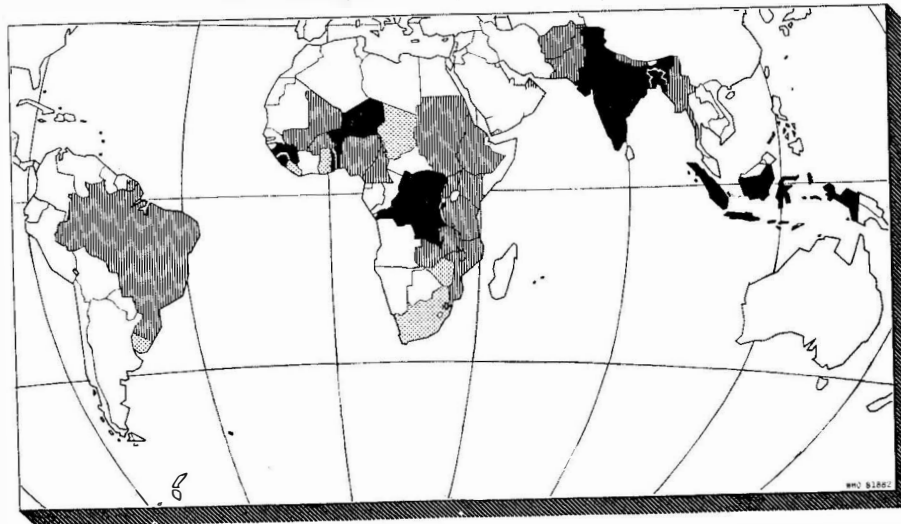
Fig. 1

Reported Cases of Smallpox in the World - 1955-1969



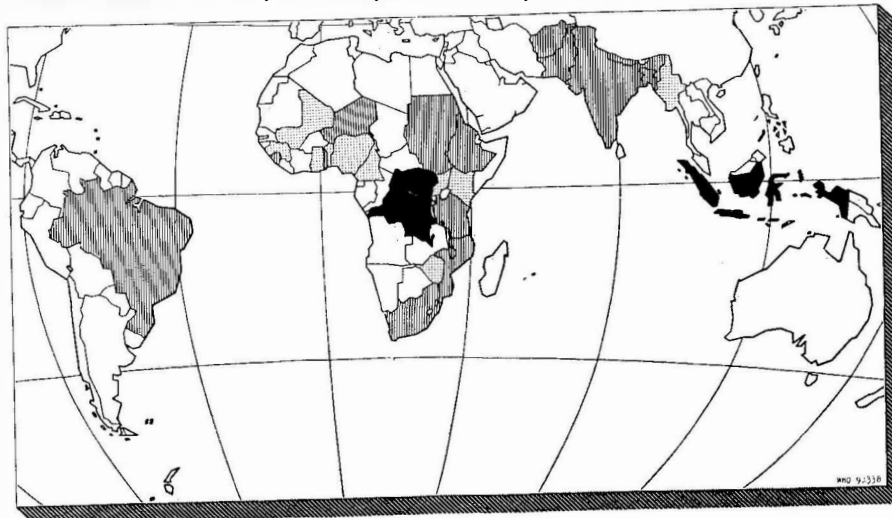
\* Estimated en present trends

Fig. 2  
1968 - Smallpox Cases per 100 000 Population



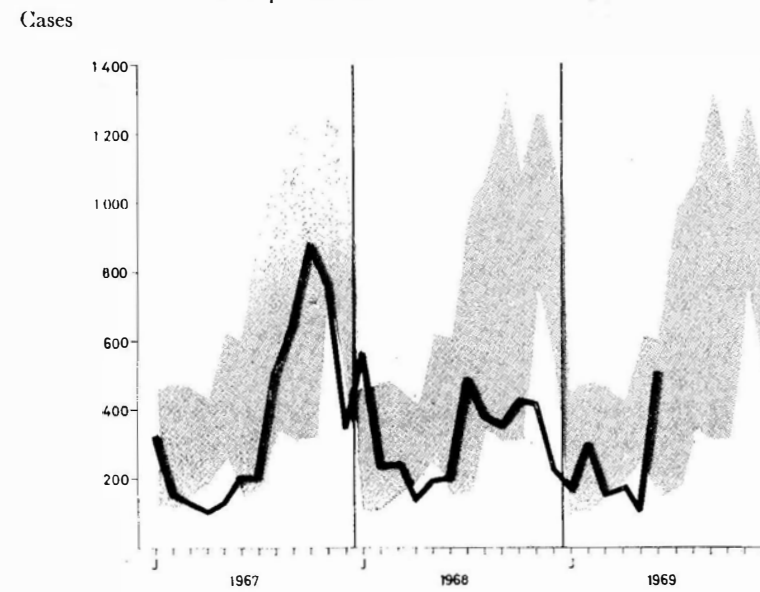
> 5.0 ■ 0.5-5.0 ▨ > 0.5 ▩

Fig. 3  
1969 - Estimated Smallpox Cases per 100 000 Population Based on Present Trends



> 5.0 ■ 0.5-5.0 ▨ < 0.5 ▩

Fig. 4  
Smallpox Incidence: South America, 1967-1969

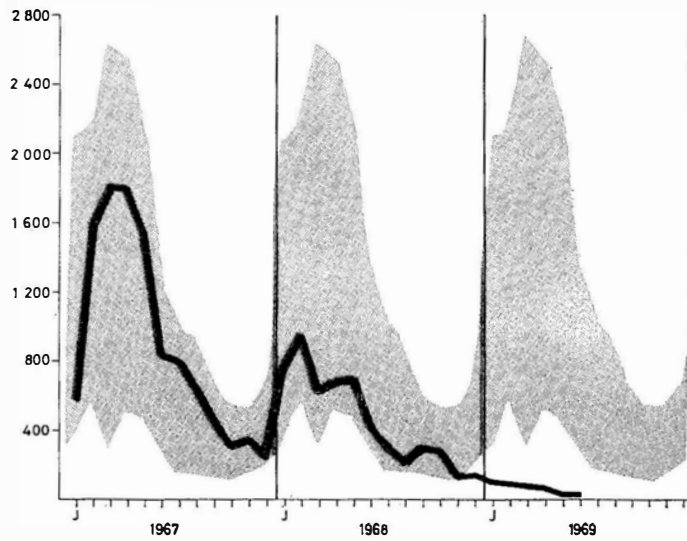


Note: The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

Fig. 5

*Smallpox Incidence: Africa, West and Central, 1967-1969*

Cases

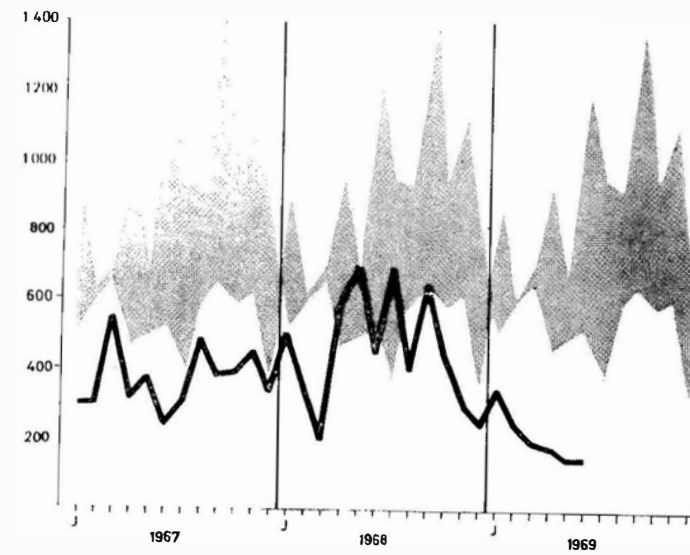


Note - The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

Fig. 6

*Smallpox Incidence: Africa, East and South, 1967-1969*

Cases



Note - The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

## SUMMARY

Since the inception of the global programme of smallpox eradication in 1967, recorded cases have fallen at a rate of 40% per year, despite steadily improved reporting. While 10 countries recorded rates of more than 5.0 per 100,000 in 1968, present trends indicate that only two will exceed this rate in 1969.

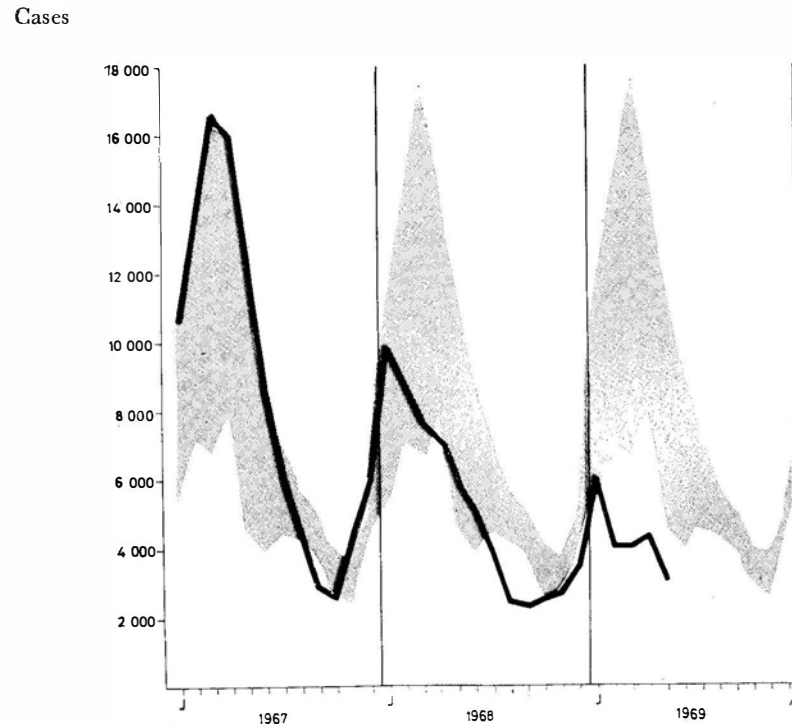
Eradication programmes are now in progress in all but one of the countries originally considered to have endemic disease. Most programmes are making excellent progress. The most dramatic progress to date has been in Western and Central Africa where almost 100 of the 120 million inhabitants have been vaccinated and smallpox has now decreased to the point that this region could become smallpox-free by the end of the year.

As a result of substantial assistance provided by WHO to vaccine production laboratories and because of contributions of vaccine by many countries, particularly the Soviet Union and the USA, virtually all vaccine now in use in endemic regions is freeze-dried and fully meets WHO standards. The jet injector and the bifurcated needle have replaced older techniques of vaccination. With these instruments higher take rates are consistently observed while smaller quantities of vaccine are employed.

The principal focus of the eradication programme is now on improved reporting, investigation and containment of cases and outbreaks. These activities, termed »surveillance« have been increasingly widely used and are serving to accelerate significantly the pace of the programme.

Although the disease trends virtually everywhere are highly encouraging, no major epidemiological region has yet become smallpox-free. This is the important next objective.

Fig. 7  
*Smallpox Incidence: Asia, 1967-1969*



Note - The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966