PROGRESS IN SMALLPOX VACCINATION

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Since the advent of the global smallpox eradication programme in 1967, the problem of smallpox in Africa has changed dramatically. Only five years ago, endemic smallpox was found in most African countries south of the Sahara and, in some, the rates were the highest recorded anywhere in the world. Today, major endemic foci persist in only two countries - Sudan and Ethiopia. The only other suspected areas with residual problems are localized to border districts of Botswana and Transvaal Province, South Africa. Eradication programmes in these areas are in progress. If effectively supported by the respective governments and if, at the same time, active surveillance and maintenance vaccination programmes are continued in the other countries to prevent reintroductions - all of Africa could be free of smallpox within two to three years.

The factors responsible for this rapid progress might profitably be examined and I believe many of the problems, as well as certain of the solutions have a direct bearing on the conduct of other immunization programmes in Africa.

Of first importance in the development of the smallpox programme was the provision of adequate quantities of fully potent, stable vaccine. In 1967, it was a shock to us to find that not more than 10 p.100 of all smallpox vaccine in use throughout Africa was freeze-dried vaccine which met WHO recommended standards. Limited quantities of freeze-dried vaccine were being produced by several established laboratories and accepted for use in the field without question. Those laboratories producing the poorest vaccines were precisely those most ill-equipped to determine whether or not the vaccine met accepted standards. With the establishment of a WHO International Reference Centre for vaccine testing, vaccines from countries throughout the world were able to be tested regularly at no cost to the government concerned. Initially, over half of the lots tested were found to be substandard and, in fact, in some lots of vaccine produced in Africa as well as in vaccine imported for use, no live vaccinia virus whatsoever could be detected. Within two years, the situation was able to be changed completely but I wonder about other vaccines which are currently in use. Do all lots of vaccine meet accepted minimum standards of potency and purity ?

Some countries were producing liquid (glycerinated) vaccine of satisfactory quality. This vaccine produced excellent vaccination responses so long as it was properly handled.

However, within three days after exposure to normal temperatures, it was worthless. In country after country, we found such vaccine being used by vaccinators during the course of two to three week field trips and we found quantities of such vaccine in health centres where there was no refrigeration or where the refrigerators were inoperable. Provision of freeze-dried smallpox vaccine which must demonstrate satisfactory potency after incubation at 37° C for a month, has solved most of the practical problems of field vaccination. But, in respect to other immunization programmes, can these be effective when highly unstable vaccines are used ?

Throughout Africa now, fully potent freeze-dried smallpox vaccine is in use with the result that when vaccine is administered to 100 persons, virtually all are, in fact, vaccinated as contrasted to perhaps 10 p.100 or less only 5 years ago. This, of course, has played a major role in the demise of smallpox.

The introduction of the jet injector and, later, the bifurcated needle constituted a significant advance in vaccine administration. With these devices, there was a saving of 50 p.100 or more in vaccine consumption, take rates were significantly higher than with the older scratch technique and vaccinations were able to be performed at a much faster rate of speed - thus saving on personnel expense. And, of these two, the simple, inexpensive bifurcated needle has, with time, clearly demonstrated its practical superiority. Regretably, currently available jet injectors bring with them the inevitable problems of maintenance, repair and provision of spare parts. But for other antigens, might not a simpler technique of application greatly facilitate programme execution ? For example, could the bifurcated needle or some other simple device be employed for administration of BCG, yellow fever and measles vaccines? Could more simplified and rugged jet injectors be developed which could be used for subcutaneous inoculation ?

Finally, I believe the programme has clearly demonstrated that it is far more effective, as well as economical, to employ mobile vaccination teams which move from village to village than to adopt any other approach for vaccination of the population. Many have insisted that, ultimately, for vaccination, one should strive to have a network of health units to which people would come for vaccination. While good in theory, this approach has proved both expensive and disastrously ineffective in practice whether in Africa, in Asia, in Europe or North America. Health centres, however well-equipped, have rarely succeeded in sustaining immunity levels of 75 p.100 even within one or two kilometres of the centre and, beyond this range, coverage has been shown to decrease markedly ; freeze-dried vaccines, which at the end of a day following reconstitution must be discarded, are largely wasted as comparatively few are normally vaccinated in the course of a day ; and experience throughout the world has repeatedly demonstrated that very few health centre personnel, however instructed, refrigerate and handle vaccine properly. Finally, in all communities, it is the poorer, less well-educated who will not travel any distance to present themselves for vaccination and it is invariably in these concentrated foci of population that major disease problems persist.

Systematic programmes of vaccination, employing mobile teams, are vastly easier to supervise, their work may be continually assessed, vaccine wastage is consistently less, personnel costs per dose of vaccine administered are sharply reduced and the less

motivated lower socio-economic groups are, by and large, receptive to being vaccinated if the vaccine is offered in or near their residence.

Illustrative of what may be achieved by vaccination programmes conducted by mobile teams is the experience of the Congo. With staff which usually numbered less than 250 persons, more than 21 million smallpox vaccinations and 11 million BCG vaccinations were administered in less than 3 years. Coverage, as determined by assessment was consistently higher than 90 p.100 and take rates usually were in the range of 98 to 99 p.100.

In brief, the success of the smallpox vaccination programme may be attributed to progress in several important areas :

1. Provision of stable vaccine of assured potency.
2. Improved vaccination techniques.
3. Effective use of mobile teams in vaccination.

These factors, coupled with an intensive surveillance programme have reduced smallpox incidence to « nil » in most areas of Africa and may well reduce the incidence to « nil » in all of Africa within two to three years.