Eradication of poliomyelitis in South Africa

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An international campaign under the leadership of the World Health Organisation is underway to eradicate polio from the world by the year 2000. South Africa may already be free of polio. However, to ensure eradication we need to move from a polio control programme to a polio eradication programme. This necessitates the institution of a surveillance programme for acute flaccid paralysis (AFP) and improvement of the delivery of polio vaccine. All children with AFP (including those with suspected Guillain-Barré syndrome) should be investigated with stool culture to exclude polio. Primary care services need strengthening so that oral polio vaccine coverage greater than 90% is achieved in all regions by all authorities. Outbreak response activities need to be developed. Consideration needs to be given to national immunisation days and mopping-up activities.

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In 1977 a milestone was achieved when smallpox became the first disease to be eradicated globally, following an 11-year eradication campaign.[1] In 1988 the World Health Assembly committed the World Health Organisation to the global eradication of polio by the year 2000.[2] Numerous other international bodies have committed themselves to the eradication of polio, including the International Conference on the Eradication of Disease (1980), the Pan American Health Organisation (1985), the World Summit for Children (1990) and the WHO Regional Committee for Africa (1992).[3-8] Eradication means the complete elimination of wild poliovirus and not just the elimination of clinical disease. Worldwide eradication will enable vaccination against the disease to be discontinued.

The Department of National Health and Population Development (DNHPD) has agreed to be part of this worldwide campaign[9,10] and will be initiating a national eradication campaign in 1994 - 1995. This article aims to introduce South African practitioners to key issues in the international campaign and discusses their relevance to South Africa.

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Global progress in polio eradication

The last decade has seen a dramatic increase in estimated global polio vaccine coverage in the first year of life, from 48% in 1985 to 80% in 1992 (WHO — personal communication).[11] This is illustrated in Fig. 1. It has been associated with a progressive decrease in the incidence of polio reported worldwide, from 56 921 cases in 1981 to 15 059 in 1992 (WHO — personal communication).[11] The number of countries reporting no polio cases has increased from 90 in 1985 to 140 in 1992.

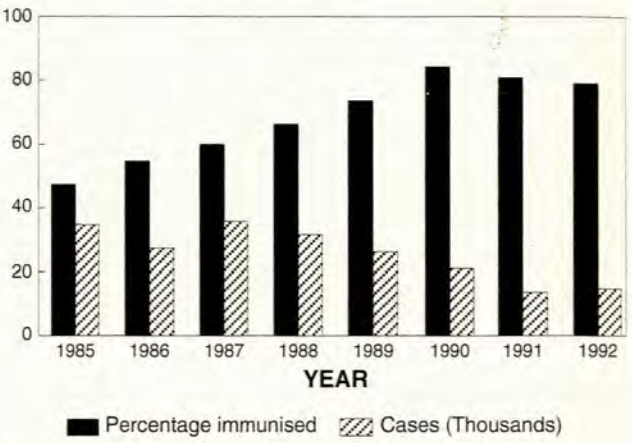

Fig. 1. Global immunisation coverage with OPV3 and reported incidence of poliomyelitis, 1985 - 1992.

The phenomenal success of the campaign in the Americas has led to the eradication of polio from both continents (their last case was recorded in 1991[12]) and has provided a significant impetus to the international eradication programme.

Epidemiology of polio in South Africa

Notifications for polio in South Africa are shown in Table I and Fig. 2. The number of cases has been decreasing over 3 decades and our last case of polio was notified in 1991. Epidemic peaks, such as the 1988 KwaZulu and the 1982 Gazankulu outbreaks, are shown.

Estimates of immunisation coverage with three doses of oral poliovaccine (OPV-3) for all health regions in 1991 is shown in Table II.[13] Certain regions such as the Western Cape have very high coverage (DNHPD — personal communication). Various surveys have shown low vaccination coverage, particularly in areas such as Transkei (55%),[14] Botshabelo (43%),[15] Ingwavuma (48%),[16] Khayelitsha (56%)[17] and QwaQwa (33%).[18] Areas with low coverage are at particular risk for polio outbreaks and warrant specific attention in the eradication programme.

Table I. Poliomyelitis in South Africa — number of cases notified by region, 1980 - 1993

Region	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
E. Cape	10	13	3	4	7	2	4	0	4	3	0	0	0	0
W. Cape	10	17	6	3	2	18	5	8	11	1	0	0	0	0
N. Cape	4	6	3	2	0	1	0	0	0	2	0	0	0	0
Natal	11	12	6	11	14	0	2	0	17	0	0	0	0	0
OFS	1	0	0	1	1	3	2	0	0	1	0	0	0	0
C. Tvl	14	4	16	9	4	17	18	4	17	1	1	0	0	0
E. Tvl	3	0	1	1	2	3	1	0	2	0	0	0	0	0
N. Tvl	0	1	32	1	0	5	0	0	1	0	0	0	0	0
W. Tvl	0	0	0	0	0	0	2	0	3	0	1	0	0	0
Gazankulu	2	0	270	1	1	1	0	4	7	0	0	0	0	0
KwaZulu	18	63	24	50	24	4	2	4	95	2	0	0	0	0
Lebowa	8	0	72	3	5	14	2	3	15	0	1	1	0	0
KaNgwane	3	0	3	5	1	0	2	1	0	1	0	0	0	0
KwaNdebele	0	0	4	0	0	1	1	0	0	0	0	0	0	0
Qwaqwa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bophuthatswana	1	0	37	0	0	1	0	0	0	0	0	0	0	0
Ciskei	7	0	0	0	1	1	0	0	0	0	0	0	0	0
Transkei	20	9	2	1	8	0	0	0	1	1	2	1	0	0
Venda	0	2	2	0	1	1	0	1	1	0	0	0	0	0
Total	112	127	481	92	71	72	41	25	174	12	5	2	0	0
Population (1 000)	29 175	29 902	30 659	31 468	32 285	33 105	33 928	34 749	35 566	36 384	37 213	38 049	38 892	39 739
Inc. rate/1 000 000	0,38	0,42	1,57	0,29	0,22	0,22	0,12	0,07	0,49	0,03	0,01	0,01	0,00	0,00

Source: Notifications received by the Directorate: Epidemiology, DNHPD; estimated population figures based on 1991 census (*Epidemiological Comments* 1993; **20**(2): 1-24).

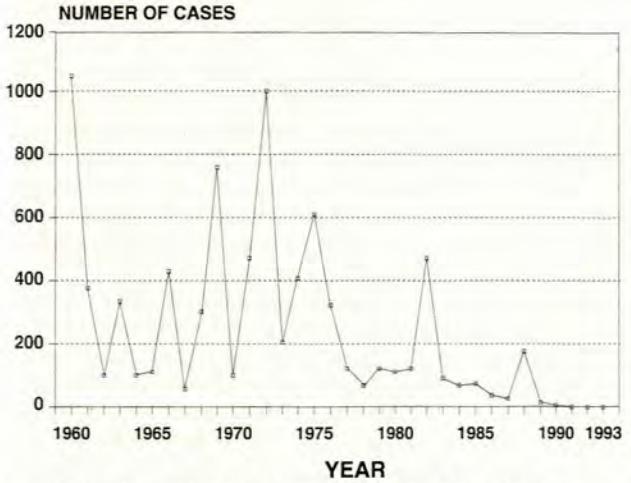

Fig. 2. Annual number of poliomyelitis cases in South Africa, 1960 - 1993.

Table II. OPV coverage (3rd dose), 1992

Region	Coverage (%)
E. Cape	91
W. Cape	100
N. Cape	84
Natal	100
OFS	61
C. Tvl	71
W. Tvl	44
E. Tvl	73
N. Tvl	84
Total South Africa	79

Source: *Epidemiological Comments* 1994; **21**(2).

Strategies for eradication

The WHO is encouraging and assisting countries to transform their national polio control programmes into disease eradication programmes. In February 1993 a WHO mission visited South Africa.[19] According to the WHO[5] some of the most important strategies for eradication are: (*i*) political commitment to ensure resources for eradication; (*ii*) effective surveillance that will detect every case of poliomyelitis and any circulating wild poliovirus; and (*iii*) delivery of polio vaccine in the manner most effective at interrupting transmission of wild poliovirus.

Political commitment

Political commitment is essential to achieve the financial resources and organisational activity necessary for the eradication programme. South Africa recently became a signatory of the World Declaration of Children and various bodies have declared their support for a polio eradication campaign.[9,20] The non-governmental organisation, Rotary, has raised hundreds of millions of dollars for the programme internationally.[21,22]

Surveillance

Surveillance is considered a cornerstone of an effective polio eradication programme. Surveillance data are important to identify and monitor areas where poliovirus persists (or is reimported) as well as areas at high risk. For a surveillance system to be effective, reporting must be rapid and complete. Diagnosis must be accurate, so appropriate case definition and case investigation are important. Teams must be trained in outbreak response activities, including active surveillance.

Case definition

Immediate reporting and detailed investigation of suspected cases are important. An official *case definition* of suspected polio, which will be sensitive enough to detect a high percentage of possible cases, is required. The current WHO definition[5] is as follows:

A suspected case of polio is any child under 5 years of age with acute flaccid paralysis (AFP) (including Guillain-Barré syndrome) for which no other cause can be identified, or paralytic illness at any age when polio is suspected.

The precise age limit chosen for investigation of AFP depends on each country's resources; 15 years, until recently recommended by the WHO, may be more appropriate for South Africa than the 5-year cut-off. Eighty-two per cent of all polio notifications received by the DNHPD for the period 1980 - 1993 were for children under 5 years of age, 95,2% of children were less than 10 years and 98% younger than 15 years (Directorate of Epidemiology, DNHPD — personal communication).

Reviews of AFP notifications have suggested that the use of additional diagnostic criteria such as age under 5 years, the presence of fever at the onset of paralysis, complete development of paralysis within 4 days of illness or the presence of residual paralysis significantly improve the specificity of the WHO definition with only a slight drop in sensitivity.[23,24]

Case investigation

Polio must be actively excluded as a cause in any child with AFP.[25] AFP may be caused by numerous conditions including poliomyelitis, Guillain-Barré syndrome, transverse myelitis, traumatic neuritis of the sciatic nerve (injections) and Coxsackie viral infections. AFP may be misdiagnosed as myopathies, myositis, trauma or meningo-encephalitis. The clinical differentiation of various causes of AFP is more fully discussed elsewhere.[25-27]

The role of the laboratory is critical to distinguish polio from other causes of AFP. Viral culture of stools is the recommended test for diagnosis and the WHO recommends that two specimens be collected 24 - 48 hours apart. While regional laboratories may do primary culturing, national laboratories (National Institute of Virology in South Africa) are usually responsible for subtyping the virus which includes differentiating wild from vaccine strains. Serological tests have, in addition, been used in many countries, although they are not regarded by the WHO as an essential component of the programme. Laboratory tests are discussed in more detail elsewhere.[10,25]

Expert review committees, including a paediatrician, neurologist, virologist and epidemiologist, have been set up in certain countries to arbitrate on cases of AFP. The most recent WHO system for classifying AFP and polio is shown in Table III.[23] This system is an improvement on the previous one[25] and should be strongly considered for use in South Africa.

Most countries have an AFP incidence rate of approximately 1:100 000 per year in children under 15 years of age.[28] South Africa can expect approximately 150 cases of AFP per year in children under 15 years. Each of these cases of AFP needs to be thoroughly investigated to exclude polio. Until approximately this number of cases of AFP is being reported in South Africa, polio surveillance may be considered deficient. South Africa needs to establish a surveillance system for AFP and the DNHPD is currently in the process of making AFP a notifiable condition (as is the case in many countries).

Table III. New classification of AFP in the Americas

1. Confirmed poliomyelitis — acute paralytic illness associated with the isolation of wild poliovirus, irrespective of residual paralysis.

2. Vaccine-associated poliomyelitis — acute paralytic illness in which vaccine-like poliovirus is isolated and believed to be the cause of the disease, This category is separate from confirmed poliomyelitis with wild poliovirus isolates.

3. Poliomyelitis compatible — acute paralytic illness with compatible residual paralysis at 60 days or followed by death or lost to follow-up, in which at least two adequate stool specimens were not obtained within 2 weeks of the onset of paralysis for examination in different laboratories.

4. Not poliomyelitis — acute paralytic illness in which at least two adequate stool specimens, obtained within 2 weeks of the onset of paralysis, were negative for poliovirus. Aliquots of the original samples should be held at the laboratory for possible future use. To ensure the accuracy of this designation, any patient who dies, is lost to follow-up or has residual paralysis at 60 days should have aliquots of the original specimens examined in two other laboratories in the PAHO network, with all the appropriate techniques. If the specimens were adequate and all were negative, these cases should be considered as 'not polio' and discarded.

Outbreak response

Outbreak response is defined as the immediate actions to be taken once a case of polio or AFP is detected. Since fewer than 1%[11] of persons infected with wild virus develop paralysis, one case may be considered an outbreak. All health authorities should plan responses to a suspected polio outbreak. These may include: (*i*) rapid case investigation to determine the diagnosis; (*ii*) active surveillance for additional cases such as publicising the outbreak, searches of local hospitals and crèches or house-to-house searches and testing of stool specimens of contacts;[25] (*iii*) outbreak response immunisation involving mass immunisation with OPV over a limited geographical area conducted rapidly in response to detection of a case of polio. Two doses are given 4 - 6 weeks apart mainly to children under 5 years of age. Activities cover a progressively larger circle as cases decline; and (*iv*) analysis of the outbreak to determine the cause.

Detailed descriptions of outbreak response activities are described elsewhere.[25,29] Outbreak response (or 'identification-containment') activities proved particularly efficient in the eradication of smallpox.[30]

Environmental monitoring

Environmental sampling is an attempt to isolate live virus in, e.g. sewerage and river water. With the elimination of cases, environmental sampling will remain as the final diagnostic mechanism of establishing and certifying eradication of polio.[3] It should be conducted in the last stage of the eradication programme.

Delivery of polio vaccine

WHO outlines four main immunisation strategies for the eradication of wild poliovirus.[5]

Routine immunisation of all children is the strategy currently used in South Africa and probably the most important. Immunisation coverage should be increased to more than 90% and should be high in all districts. Particular attention should be focused on areas which currently have low coverage. Sustaining high levels of coverage will require strengthening of primary health care infrastructure, training and support.

National immunisation days entail the immunisation of all children (usually) under 5 years of age, regardless of immunisation status. A second dose is given 4 - 6 weeks later. This strategy has been highly effective in eradicating polio in Latin America and is strongly supported by the WHO.[3] A recent editorial by Schoub[31] strongly motivated a mass immunisation campaign in South Africa. In developing countries poor sanitation leads to a higher reproductive rate of the virus. In addition vaccine efficacy has been shown to be poorer in these countries.[32] With 90% vaccine coverage and 90% vaccine efficacy, 81% of children are protected.[3] Substantial pools of susceptibles accumulate and reimportation of wild virus may lead to outbreaks. Schoub[31] cites several studies as well as the KwaZulu-Natal epidemic of 1977/78 where epidemics occurred despite high immunisation coverage. For these reasons many have argued that it will not be possible in developing countries to eradicate polio without mass campaigns.

Mass campaigns are expensive and logistically difficult. If conducted they should not be considered a substitute for the expansion of integrated comprehensive primary health care programmes.[33] The cost-effectiveness of national immunisation days for South Africa has not yet been calculated. They are likely to be more cost-effective in regions with low vaccination coverage and if combined with other immunisations, e.g. for measles.

Mopping-up is defined as the administration of OPV in areas at high risk for transmission of wild poliovirus. Vaccine is given house-to-house to all under-5s regardless of immunisation status. High-risk areas include those where any polio case has occurred in the past 3 years, areas where monitoring of healthy children or environmental monitoring finds wild poliovirus, areas with a high risk of transmission such as urban slums and newly developed peri-urban areas, and areas where immunisation coverage is significantly below regional averages. Mopping-up is usually reserved for later stages of eradication programmes where there is only focal poliovirus circulation.

The fourth strategy, outbreak response immunisation, has been discussed above.

Reimporting polio

The lack of synchrony in the implementation of eradication programmes has led to importations of wild virus into areas that were considered polio-free. It is partly for this reason that eradication must be global and the WHO has encouraged countries to co-operate regionally. Sophisticated molecular techniques permit the 'fingerprinting' and epidemiological tracking of particular polio strains. The recent outbreak of polio in a religious community in the Netherlands and subsequent isolation of the identical wild poliovirus in 21 people in an affiliated community in Alberta, Canada, demonstrate this well.[34,35]

The reported incidence of polio in countries in southern Africa is shown in Table IV. The absence of polio in 1992 in South Africa, Zimbabwe, Botswana, Lesotho, Swaziland, Namibia and Malawi[28,36] led to speculation that these southern African countries may already constitute a polio-free zone. However the 1993 outbreak in Namibia and a review of AFP cases in Zimbabwe have shown that cases continue to occur. All countries in the region should increase their efforts to consolidate as well as extend a polio-free zone.[4,5]

Table IV. Incidence of polio and immunisation coverage with OPV-3 in southern African countries*

Country	Polio cases 1992	OPV-3 coverage (%)
South Africa	0	73
Botswana	0	82
Zimbabwe	0	88
Lesotho	0	75
Swaziland	0	79
Namibia	0	53
Malawi	0	78
Zambia	2	78
Mozambique	3	19
Kenya	835	42
Angola	50	26

*Data from the WHO.

Vaccines

OPV is the only vaccine recommended by the WHO because of its effectiveness in stopping the spread of wild polioviruses.[11] Several countries use inactivated polio vaccine (IPV) and some favour the combined use of IPV followed by OPV. Vaccine efficacy and the OPV versus IPV debate are discussed in more detail elsewhere.[37,38] Polio vaccine is the most heat-sensitive of all the Expanded Programme for Immunisation (EPI) vaccines and this necessitates careful monitoring of the cold chain.

Water and sanitation

Polio is an enterovirus and the main route of transmission is faecal-oral. Transmission is therefore more frequent in areas where water supplies and sanitation are poor, and where overcrowding is rife. Improvements in these areas will assist the eradication campaign as well as the control of many other enteric diseases.

Stages of eradication campaign

The WHO has a four-stage plan for polio eradication.[5] In the early stages of the campaign improvement of routine immunisation in all local authority areas and the

development of AFP surveillance systems are particularly important strategies. South Africa is still at this stage. There may be a role for a national immunisation campaign, possibly excluding certain regions with very high vaccination coverage. If proper AFP surveillance reveals no cases of confirmed polio we may move rapidly to later stages of the campaign including more thorough case investigation and outbreak response activities, mopping-up campaigns and, finally, environmental monitoring before certification of eradication. Until global eradication is achieved it will be essential to maintain high immunisation coverage to protect against reimported wild virus.

Cost-effectiveness

Polio vaccine costs approximately 7 American cents per dose.[1] Globally it has been estimated that the economic benefits of eradication far exceed the cost and that the programme will produce savings of US$3 billion by the year 2015.[5,32,38]

Conclusions

Polio has no animal reservoirs and thus has the potential to be eradicated. The global eradication campaign has already had major successes. The eradication campaign will require additional resources but international studies indicate that benefits will far outweigh costs in the long term. The eradication campaign may have additional spin-offs including the improvement of primary health care infrastructure, infectious disease surveillance and control, and social mobilisation for health.

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