Australia declared polio free

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Abstract

For Australia to be declared polio free, evidence of the absence of circulation of wild poliovirus was required by the Regional Commission for the Certification of Eradication of Poliomyelitis in the Western Pacific in August 2000. Data on surveillance of poliomyelitis, acute flaccid paralysis (AFP), vaccine associated paralytic polio and enteroviruses were provided to document the absence of circulation of wild poliovirus. The last wild poliomyelitis virus case in Australia was in 1972. AFP surveillance has improved since it was initiated in 1995 and achieved a rate of 0.94 per 100,000 population in 1999. No wild polioviruses have been isolated from stool samples of AFP cases. Australia has in place a comprehensive network of laboratories for enterovirus surveillance and this provides further evidence for the absence of wild poliovirus infection. The immunisation coverage in the country has been over 80 per cent over the last 3 years. If there were an importation of a case of poliomyelitis into Australia, a national outbreak response would be coordinated through the Communicable Diseases Network Australia. Plans for containment of laboratory stocks of wild poliovirus are being implemented. The evidence provided was sufficient to satisfy the Regional Commission that there was no wild poliovirus circulating in the region and enabled Australia to be declared polio free on October 29, 2000 along with the other 36 countries in the Western Pacific Region. Australia must remain vigilant against importations of wild poliovirus from endemic countries and maintain high immunisation coverage and sensitive surveillance systems. *Commun Dis Intell* 2002;26:253-260.

Key Words: poliomyelitis eradication, Australia, acute flaccid paralysis surveillance, laboratory containment, enterovirus surveillance

Introduction

The Regional Commission for the Certification of Eradication of Poliomyelitis in the Western Pacific[1] had determined that the Region would only be certified as poliomyelitis-free after all countries of the Region had met the following criteria:

- no evidence of indigenous wild poliovirus transmission had been detected for a period of at least 3 years during which surveillance had been maintained at the level of performance needed for certification;
- a National Certification Committee in each country had validated and submitted the certification documentation required by the Regional Commission; and
- appropriate measures were in place to detect and respond to importations of wild poliovirus.

In 1997, the Australian National Polio Certification Committee was set up, comprising of a public health physician, a virologist and a neurologist. The National Certification Committee reviews progress made on activities related to certification of poliomyelitis eradication and has submitted documentation annually since 1998 to the Regional Commission for the Certification of Eradication of Poliomyelitis in the Western Pacific.

In 1998, the Polio Expert Committee was set up, comprising of a paediatrician, an epidemiologist and a virologist. This committee was to review all cases of acute flaccid paralysis (AFP) that were investigated through the AFP surveillance system and to undertake a retrospective review of hospital cases and classify them according to the World Health Organization's (WHO) virological classification.[2]

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Surveillance of poliomyelitis

The surveillance strategy for confirming poliomyelitis eradication in Australia consists of 5 components:

1. the National Notifiable Diseases Surveillance System;
2. surveillance of acute flaccid paralysis cases;
3. surveillance of vaccine associated paralytic polio (VAPP) cases;
4. surveillance of enteroviruses; and
5. intratypic differentiation of all polioviruses isolated in Australia.

1. National Notifiable Diseases Surveillance System

Poliomyelitis has been a notifiable condition in Australia since 1922. The National Notifiable Disease Surveillance System (NNDSS) was established in 1990 under the auspices of the Communicable Diseases Network Australia New Zealand (CDNANZ).[3] The last 2 epidemics of polio were in 1956 and 1961 to 1962. The number of polio cases dropped substantially since the introduction of the inactivated vaccine in 1956 and subsequently the oral polio vaccine.[4]

The last 3 cases of poliomyelitis diagnosed as such on clinical grounds occurred in Victoria in 1972 but were not confirmed virologically. Apart from the imported case in 1977, other AFP cases initially notified have been reclassified as VAPP. Virological investigations of stored viruses from Victoria indicate that the last wild poliovirus was isolated from a patient with clinical poliomyelitis in 1967. If these Victorian stored polioviruses are representative of all Australian isolates it is possible that wild poliovirus may have disappeared from Australia in the 1960s and that cases notified later were all VAPP or imported cases, as were all the cases notified after 1972. However, in the absence of virological testing and without further investigation of the 1972 cases, 1972 must be considered the year in which Australia had its last cases of indigenously acquired wild poliovirus infections.

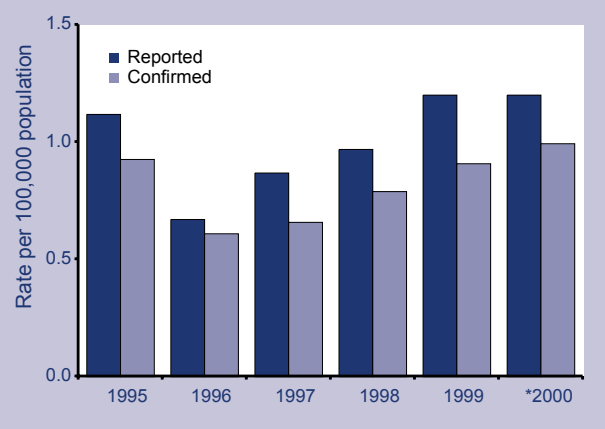
2. Surveillance of acute flaccid paralysis

While it is unlikely that Australia has indigenous wild poliovirus, adequate investigation of cases of AFP is required for the certification process. The surveillance of AFP was initiated in Australia in March 1995 through the Australian Paediatric Surveillance Unit (APSU).[5] The expected number of AFP cases in Australia in children less than 15 years is 1 case per 100,000 population per year i.e. 39-40 cases in a year. This is an internationally accepted indicator of a highly sensitive surveillance system for acutely paralysed children and is based on the experience of other non-endemic countries.[1] The methods adopted for AFP surveillance and findings from 1995 to 1997 have been reported.[4,6]

There have been a total of 161 AFP cases investigated over the five-year period (March 1995 to April 2000) after excluding duplicates and errors. The main causes of AFP in Australia in the last 5 years have been Guillain Barré Syndrome (GBS) and transverse myelitis (TM), which represent 63 per cent of the cases, followed by trauma and encephalitis.

Since there is no wild poliovirus in Australia, the non-polio AFP rate is the same as the AFP rate. The average reporting rate of AFP cases for 1995 to 1999 based on the notifications received by the APSU and the Surveillance and Epidemiology Section, Department of Health and Ageing (DoHA) is 1.2 cases per 100,000 population under the age of 15 years. The average AFP rate based on investigated cases i.e. those reports with completed questionnaires for 1995 to 1999 is 0.79 cases per 100,000 population under 15 years of age. The rate of AFP in Australia has increased over the last 5 years and reached 0.94 cases per 100,000 population under 15 years of age in 1999[7] and the adjusted rate for 2000 (adjusted for the number of months of surveillance) is 0.99 cases per 100,000 population under 15 years of age (Figure 1). This rate, which is lower than the benchmark of 1 case per 100,000 population under 15 years of age, is due to paediatricians reporting and investigating only those AFP cases that they consider to be poliomyelitis compatible. The Australian Poliomyelitis Expert Committee has adhered strictly to the case definition of AFP and some mild Guillain Barré cases have been excluded as non-AFP cases. Therefore the AFP rate in Australia is based on a very narrow AFP case definition. If the committee was not so strict, the non-poliomyelitis AFP rate would be higher.

Figure 1. AFP rate per 100,000 children under the age of 15, Australia, 1995 to 2000



* Data as at April 2000.

The average annual AFP rate for the years 1997 to 1999 is 0.79 cases per 100,000 population under the age of 15 years of age. Only two jurisdictions, New South Wales and the Australian Capital Territory reached the expected rate of 1 case per 100,000 population under 15 years of age. Victoria has performed poorly over the last 5 years. Western Australia achieved a rate of 1 case per 100,000 population under 15 years of age in 1998 but did not report all acute flaccid paralysis cases in 1999. When the 4 cases picked up in a review of the hospital records are included, the rate for Western Australia is 1 case per 100,000 under 15 years of age in 1999. The Northern Territory has not reported a case of AFP in the last 5 years and therefore will need further investigation. Tasmania and the Northern Territory are very sparsely populated and therefore the small number of AFP cases may make the estimation of rates unreliable.

At least 80 per cent of AFP cases should have 2 stool specimens collected at least 24 hours apart and within 14 days of onset of paralysis.[2] The proportion of AFP cases from whom 2 stool samples were collected increased from 11.5 per cent in 1997 to 40.5 per cent in 1999 and 54 per cent in 2000. There has been considerable reluctance by the paediatricians to order stool specimens when they have a confirmed clinical diagnosis based on other investigations. This has resulted in a failure to reach the expected target of 80 per cent stool collection rate of AFP cases. There have been numerous efforts to improve the notification of AFP cases and stool collection over the last 5 years.

Based on the clinical and laboratory information provided by the paediatricians, the Poliomyelitis Expert Committee was able to exclude 94.4 per cent of cases as being non-poliomyelitis even in the absence of stool specimens (Figure 2). There are 9 residual cases for whom additional information has not been forthcoming and which cannot be formally classified as non-poliomyelitis.

Evaluation of AFP surveillance system (retrospective hospital review of AFP cases)

As the AFP surveillance in Australia had not reached the expected rate of 1 case per 100,000 population under the age of 15 years during the period 1995 to 1997, a search of medical records was made in 2 main hospitals in Victoria[8] and one hospital each in the Australian Capital Territory and the Northern Territory. In addition, a state wide search of hospital separation data was carried out in New South Wales and Western Australia.[9] The rationale for doing state-wide searches in these 2 States which had reached the expected rate of AFP, was to identify additional cases missed by the active AFP surveillance and therefore establish the true AFP rate.

There were 61 additional cases of AFP found in the hospital record review for the period 1995 to 1998 that were not investigated through the AFP surveillance (Table). More than 50 per cent of the cases were identified in 2 hospitals from Victoria, which had a poor AFP reporting rate. The hospital searches in New South Wales and Western Australia identified GBS and TM cases that were not reported to the active AFP surveillance.

The code for GBS was the most reliable in identifying true AFP cases and almost 99 per cent of cases of GBS were true AFP cases as compared to TM which is coded as unspecified myelitis and had a much higher false positive rate.

There were no poliomyelitis cases found in the hospital reviews. As the AFP surveillance and hospital reviews both missed cases, the combined total gives a better approximation of the true AFP rate, which is in the range of 1.14 cases per 100,000 population under the age of 15 years (Figure 3).

Table. AFP cases identified from hospital review (1995 to 1998)

Additional AFP cases from hospitals	1995	1996	1997	1998	Total
ACT (1995-98)	2	1	2	0	5
NSW (1995-98)	4	6	3	3	16
WA (1995-98)	4	1	2	2	9
Vic (1995-97)	12	8	10		31*
Total	**22**	**16**	**17**	**5**	**61**

* Includes 1 case with unknown year

Figure 2. Virological classification of AFP cases and case outcome following Poliomyelitis Expert Committee

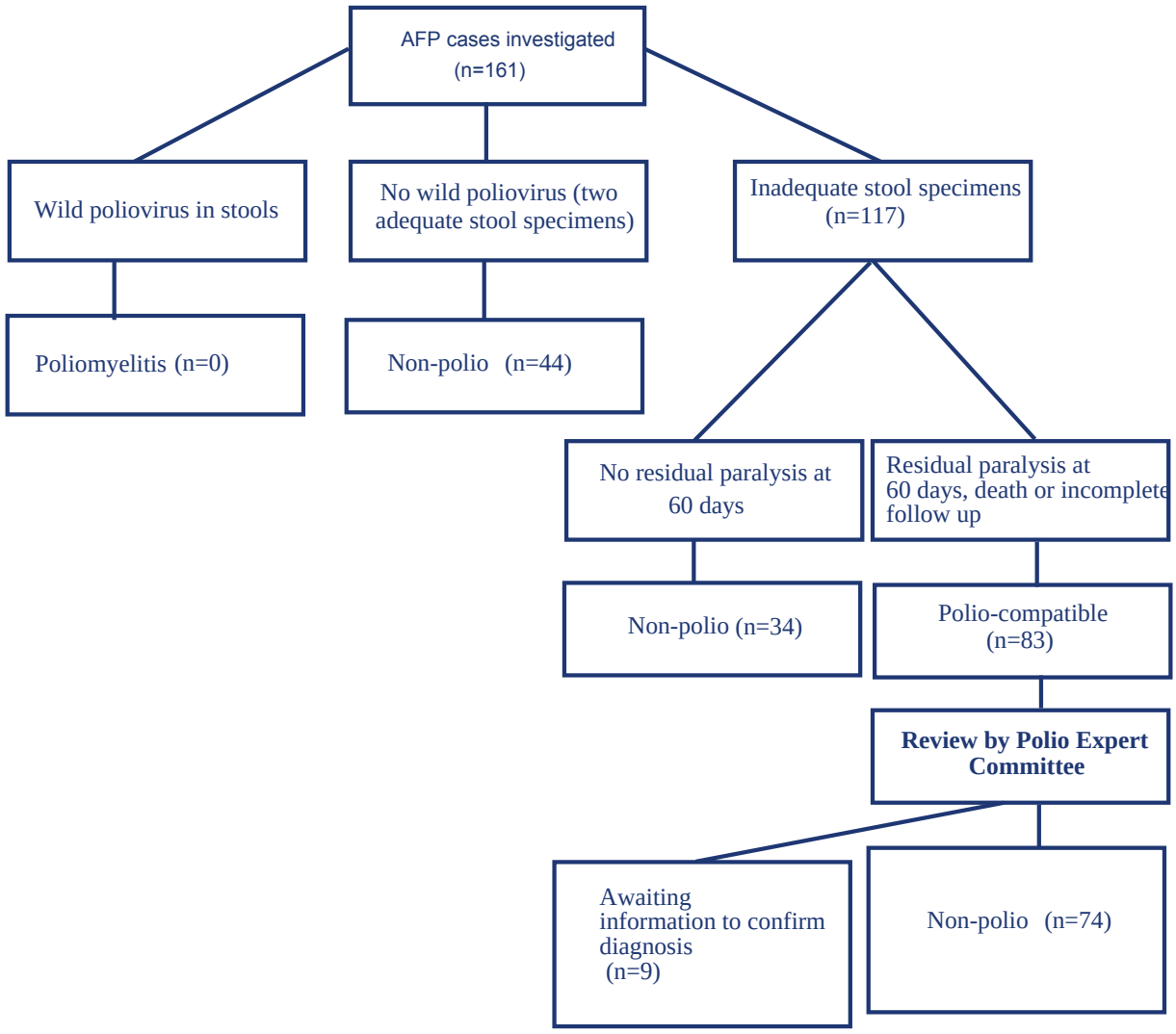
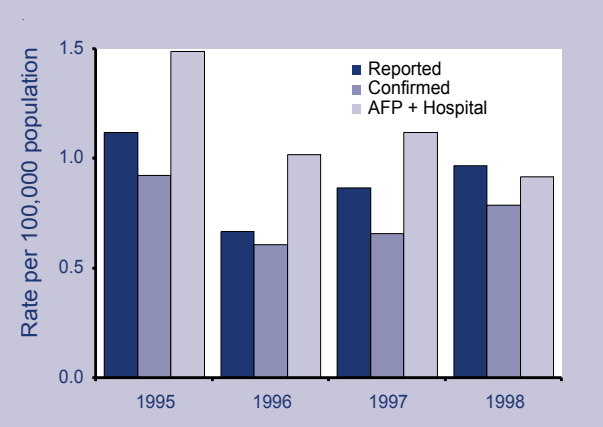


Figure 3. AFP rate per 100,000 children under the age of 15, Australia, (AFP surveillance hospital review)



The information obtained from the medical records was adequate for the Poliomyelitis Expert Committee to review and exclude 88.5 per cent of the AFP cases as being non-poliomyelitis.

3. Surveillance of vaccine associated paralytic poliomyelitis

In rare instances, oral poliomyelitis vaccine (OPV) may cause a paralytic illness in healthy recipients and their contacts. Estimates of the frequency of this risk suggest that it occurs at the rate of one case of paralytic disease in immunologically healthy vaccine recipients for every 6.8 million doses of OPV distributed, and one case of paralytic disease among household and community contacts for every 6.4 million doses distributed. The reported risk for VAPP in the United States of America is 1/700,000 per first dose; 1/6.9 million per subsequent doses for all children and is greater in adult contacts than child recipients.[10]

The ability to detect VAPP, if reported separately, is a useful indicator of sensitivity of a surveillance system. Australia can expect to find about one case of VAPP every 3 years. One case of VAPP in Australia was reported in 1994 in a mother of a child who was immunised with OPV.[11]

There have been 2 parallel national surveillance systems for reporting serious adverse events following vaccination including VAPP. One was the Surveillance of Serious Adverse Events Following Vaccination (SAEFVSS) and the other is the Adverse Drug Reaction Advisory Committee (ADRAC).

The SAEFVSS[12] was a national surveillance system that is managed by the National Childhood Immunisation Program. Reports from providers of adverse events related to childhood vaccinations were forwarded by States and Territories and classified according to a list of defined serious adverse events. This system was modified on 1 January 2000 to allow greater integration of information collected through the SAEFVSS and ADRAC systems and is now known as the Adverse Events Following Immunisation (AEFI) Surveillance System. Since the modification, AEFI receives data on all adverse events via ADRAC. This enables the AEFI system to utilise the causality classification allocated to each report by the ADRAC system.

The ADRAC[13] system is operated through the Therapeutic Goods Administration and monitors adverse events after the administration of all drugs including vaccinations. This system accepts all reports, including those from parents, which are later reviewed by a committee and causality is assigned to the reports.

To date neither of these systems has reported a VAPP in the last 5 years. A patient with TM was detected during AFP surveillance in 1996. Poliovirus type 3 Sabin vaccine-like isolated from a stool sample may have been an incidental finding. It is possible that some AFP cases could have been VAPP cases but could not be proved as stool specimens were not taken.

4. Surveillance of enteroviruses

The laboratory activities for certification can be divided into 2 components; AFP surveillance and enterovirus surveillance. For AFP surveillance, at least 80 per cent of AFP cases must have an examination of 2 adequate stool specimens by an accredited laboratory. Since there should only be approximately 80 samples from 40 cases each year in Australia, it was agreed in 1996 that all samples would be transported to the National Polio Reference Laboratory (NPRL) at the Victorian Infectious Diseases Reference Laboratory (VIDRL) for enterovirus culture and poliovirus identification and characterisation. The laboratory which also serves as one of the Western Pacific Regional Reference Laboratories has been funded to carry out this work by the Commonwealth Department of Health and Ageing, since 1994.[14] In 1998 and 1999 the laboratory was accredited by the World Health Organization (WHO) as both a regional and national polio laboratory.

From January 1997 to mid-June 2000, 92 stool samples were processed and inoculated into WHO-supplied cell lines for enterovirus culture. No polioviruses were isolated. Samples were not collected from contacts of AFP patients and stool

surveys or environmental testing were not performed. Serological investigations were performed on patients with paralysis when stool samples were not collected within 14 days of onset of paralysis. There were no cases with evidence of poliovirus infection.

Two sero-surveys to determine immunity to polioviruses were carried out in the national laboratory. One was to determine the immunity to polio and other viruses in fully vaccinated Aboriginal and Torres Strait Island children.[15] The other compared immunity to childhood preventable diseases in local and recently arrived immigrant children in a Melbourne suburb (J Buttery, M Kennett, personal communication). Although over 90 per cent of all children had protective antibody levels to poliovirus types 1 and 2, only 60 per cent of the Aboriginal and Torres Strait Island and local Melbourne children had antibodies to type 3.

Documentation is also required to demonstrate that laboratory services are in place to identify wild polioviruses. Polio and also coxsackie A and B, ECHO and enteroviruses type 68 to 71 belong to the enterovirus family in the genus picornaviridae. Enterovirus culture is performed on a wide range of clinical specimens in state reference laboratories and some hospital, diagnostic and environmental laboratories in Australia. In earlier years, enterovirus isolates would have been referred to state reference laboratories for identification in neutralisation tests utilising type specific antisera but more recently many remain unidentified. In recent years, some laboratories have replaced culture by direct nucleic acid detection, a broad-based method in which complete identification is not performed.

5. *Intratypic differentiation of all polioviruses isolated in Australia*

The Sabin live attenuated OPV is the most commonly administered poliomyelitis vaccine in Australia. The three types, 1, 2 and 3, may be present in respiratory or stool samples from children who have recently received OPV for up to several weeks after immunisation. If samples are collected from such children for any reason, these Sabin vaccine strains may be isolated.

Wild and Sabin vaccine polioviruses are differentiated using 2 WHO recommended tests, nucleic acid hybridisation and enzyme immunoassay, at the NPRL. The NPRL has established an informal poliomyelitis laboratory network to facilitate in the collection and submission of stool samples from AFP patients and to ensure that all polio or untyped enteroviruses are transported to it for identification and characterisation. Fifteen laboratories in all States and the Australian Capital Territory report their virus isolations and serology findings to the Virology and Serology Laboratory Reporting Scheme (LabVISE) each month. As only positive results are reported, it is difficult to determine the number of specimens tested for enterovirus diagnosis in Australia.[16] From January 1997 to May 2000, 5,128 specimens were positive for enteroviruses of which 229 were polioviruses. Attempts have been made by the polio laboratory network and DoHA staff to contact reporting laboratories to ensure that all polio and untyped enterovirus isolates are referred to, identified and characterised at the NPRL.

From January 1994 to May 2000, 1,173 such isolates have been tested at VIDRL. Six hundred and fifty-seven were identified as Sabin polioviruses, 491 were non-polio enteroviruses and 24 were not enteroviruses or were not recovered. One referred poliovirus type 2 was shown to be non Sabin-like and on further investigation was found to be identical with an attenuated poliovirus (Koprowski) used in the original laboratory so was considered as a laboratory contaminant.[17]

Immunisation coverage

The immunisation coverage of OPV has generally been high in Australia over the last 10 years, as there has been commitment by the Federal government to promote immunisation. This rate has improved since 1997, in part due to financial incentives provided to general practitioners, better ascertainment of coverage and the use of financial disincentives (parents are to have family payments withheld if their child is not immunised).

The overall coverage of OPV in infants has been steadily increasing over the last 3 years and reached 88 per cent in 1999. Every State or Territory had achieved at least a minimum coverage of OPV of 86.6 per cent in 1999.[18] This reduces the risk of spread of poliomyelitis in the case of an importation.

Outbreak response

The risk of importation exists in Australia, as many tourists and immigrants enter from, or transit through, 'high-risk' (endemic) countries. Adult immigrants from high-risk countries are unlikely to be a source of infection because most would have acquired immunity in childhood. If there were an

importation of a case of poliomyelitis into Australia, it would be considered a public health emergency. Australia has the capacity, infrastructure and expertise to investigate and mount a disease control response to a suspected case of wild poliovirus. A rapid response would be co-ordinated by the Communicable Diseases Network Australia (CDNA). In addition, to the organised surveillance systems, the Public Health Laboratory Network, which provides laboratory based surveillance and technical expertise to CDNA, would alert virological laboratories about the need for stool collection to be forwarded to VIDRL for confirmation and intratypic differentiation.

Isolation of wild poliovirus constitutes a public health emergency and appropriate control efforts must be initiated in consultation with local health-care providers, State and Territory Health Authorities, DoHA and CDNA.

Australia has a history of tourism and other visits by people from polio endemic countries (India, Pakistan, Bangladesh etc). Despite these risks there have been no poliomyelitis outbreaks since the 1960s and no known transmission of poliomyelitis, even though it is probable that cases of acute flaccid paralysis have been missed through the existing surveillance system.

Laboratory containment of wild poliovirus in Australia

In countries like Australia where wild poliovirus has not circulated in the community for more than 20 years, laboratories are likely to be amongst the only places where wild poliovirus still exists. The laboratory containment of wild poliovirus and materials which may be potentially infectious for wild poliovirus is therefore a crucial part of the process of certification of a country as being free of wild poliovirus. In addition to the standard certification criteria, the regional certification committee requested all countries to provide documentation on progress towards implementation of the pre-eradication phase of wild poliovirus containment.

The Commonwealth has supported the appointment of a national containment co-ordinator based in the epidemiology division at VIDRL. The coordinator is responsible for preparing a national plan, coordinating its implementation and preparing the national inventory of poliovirus infectious materials.

A national workshop attended by representatives of States and Territories and all types of laboratories was held in March 2000 to discuss strategies for identifying laboratories and institutions in which wild poliovirus infectious materials might be stored and the practicalities of containment. A national advisory committee and State representatives were appointed to assist VIDRL staff in implementation of the plan. Two pilot surveys were conducted to evaluate the effectiveness of the documentation and survey materials. Subsequent surveys were based on the findings.[19]

The database of laboratories and institutions which may manage laboratories in which poliovirus materials may be stored included diagnostic, reference, research, regulatory, environmental and manufacturing laboratories, universities and independent research institutions.[17] Two thousand one hundred and eighty-four organisations were surveyed to determine which of these had at least one laboratory which may store biological materials for more than 4 weeks. Those organisations which did so were surveyed to determine if their stored materials were likely to contain wild poliovirus. The third stage was to prepare an inventory of all stored wild poliovirus materials. The project is still proceeding as intensive follow-up is required to complete all 3 stages.

Conclusion

The evidence to date confirms that there is no transmission of wild poliovirus in Australia. The evidence provided to the Regional Commission was sufficient to determine that there was no wild poliovirus circulating in the region and enabled Australia to be declared polio free on 29 October 2000 along with the other 36 countries in the Western Pacific Region. There is a strong commitment on behalf of the Commonwealth to continue to maintain high levels of OPV immunisation and AFP surveillance at an acceptable level until global certification is achieved.

Australia must remain vigilant against importations of wild polioviruses from endemic countries. There are surveillance systems in place to identify an importation of a case of poliomyelitis and laboratory surveillance is extremely good. The importance of the sensitivity of a surveillance system cannot be fully appreciated until the time when a disease is targeted for eradication. It was the sensitivity of the AFP surveillance system that was one of the main criteria for certification of eradication of polio from the Western Pacific Region. Secondly, in Australia, it was the national coordination of various sectors like surveillance

and immunisation sections in DoHA, APSU, VIDRL, laboratories, paediatricians and public health professionals in the country that provided the evidence of polio-free status in this country. This did require a major effort in increasing awareness of overall but especially in clinicians as some of the certification initiatives like AFP surveillance for polio were being instituted almost 20 years after the last case of polio was seen.

In addition, plans for containment of laboratory stocks of wild poliovirus are being implemented. This again would require the cooperation, honesty and good will of all laboratories within the country. Although polio is only the second vaccine preventable disease to be eradicated from the Western Pacific Region, it has provided an infrastructure in the region to be working towards elimination of measles which is the next disease targeted for eradication. Hopefully the lessons learnt from the polio eradication initiatives can be applied to measles elimination and eradication.

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References

1. Regional Commission (Regional Poliomyelitis Eradication Certification issues) WPR/VID/EPI(3)97.
2. World Health Organization Regional Office for the Western Pacific Report Seventh Meeting of the Technical Advisory Group on the Expanded Programme on Immunization and Poliomyelitis Eradication (WP)EPI/ICP/VID/001-A January 1997).
3. Surveillance data in CDI. *Commun Dis Intell* 2000;24: 6-7.
4. D'Souza RM, Watson C, Kennett M. Australia's contribution to global polio eradication initiatives. *Aust N Z J Public Health* 1999;23: 289-294.
5. Elliott EJ, Williams K. Communicable diseases and the Australian Pediatric Surveillance Unit. *Communicable Disease Report* 7:14-16.
6. D'Souza RM, Kennett M, Antony J, et al. Surveillance of acute flaccid paralysis in Australia; 1995-1997. *J Paediatr Child Health* 1999;5:536-541.
7. Elliott E, Williams K, Ridley G, et al. Editors. *Australian Paediatric Surveillance Unit 7th (1999) Annual Report*. Colorcraft Printing. Pty Ltd, 1999.
8. Kelly H, Qing Y, Kennett M, Jolley D, et al. Estimating the incidence of acute flaccid paralysis in Victoria: An application of capture-recapture methods. Proceedings 6th National Public Health Association Immunisation Conference 4-5 November 1998.
9. D'Souza RM. Retrospective hospital-based searches for cases of acute flaccid paralysis. *Aust N Z J Public Health* 2002;26:45-49.
10. Strebel PM, Sutter RW, Cochi SL, et al. Epidemiology of poliomyelitis in the United States one decade after the last reported case of indigenous wild virus associated disease. *Clin Infect Dis* 1992;14:568-579.
11. Sullivan A, Boyel RS, Whitby RM. Case report - vaccine associated paralytic poliomyelitis. *Med J Aust.* 1995;163:423-424.
12. Surveillance data in *CDI*. *Commun Dis Intell* 2000;24:8.
13. National Health and Medical Research Council. *Australian Immunisation Handbook*. 7th edition, Canberra 2000;21-25.
14. Kennett M, Stambos V, Brussen KA, et al. Report of the Australian National Polio Reference Laboratory 1 January to 31 December 1998. *Commun Dis Intell* 1999;23:124-128.
15. Hanna JN, Sexton WL, Faoagali JL, et al. Immunity to hepatitis B, poliomyelitis and measles in fully vaccinated Aboriginal and Torres Strait Island children. *J Peadiatr Child Health* 1995;31:345-349.
16. National documentation for certification of poliomyelitis eradication in Australia. Submitted to sixth meeting of the Regional Commission for the Certification of the Eradication of Poliomyelitis, Western Pacific Region of the World Health Organization. 27-28 October 2000.
17. Kennett M, Stambos V, Turnbull A, et al. Report of the Australian National Polio Reference Laboratory 1 January to 30 June 1999. *Commun Dis Intell* 1999;23:324-327.
18. Australian Childhood Immunisation Register (ACIR). *Commun Dis Intell* 2000;24:8.
19. Kelly H, Prasopa-Plaizier N, Soar A, et al. The laboratory containment of wild poliovirus in Australia. *Commun Dis Intell* 2000;24:207–210.