
REVIEW OF AUSTRALIA'S POLIO SURVEILLANCE

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Abstract

With eradication almost within reach, the importance of detecting every poliomyelitis case has taken on additional significance. The selected surveillance strategy must be effective and efficient. A review of polio surveillance in Australia was conducted to consider whether current strategies were optimal. Document review and semi-structured key informant interviews were used to conduct the review. Interviews were recorded, transcribed and thematically analysed. The review was an iterative process with feedback on the findings sought from interviewees.

Since Western Pacific Regional polio-elimination status was certified, one imported adult case was detected in 2007 in Australia, with no evidence of further transmission, and no Australian paediatric cases identified. Respondents reported that: it was not possible to prevent importations; paediatric cases were more likely to be identified than adult cases; and there may be a low level of suspicion among clinicians.

Case detection and outbreak mitigation were considered key reasons to undertake polio surveillance. While Australia has not achieved one of the key World Health Organization (WHO) surveillance targets, this did not compromise Australia's polio-free status. Identified issues with polio surveillance were the potential for an importation with high attendant investigation and containment costs, low stool sample collection rates, and the opportunity to improve safeguards around the importation and laboratory storage of biological samples containing poliovirus. The review found strong support for ongoing polio surveillance, particularly to detect imported cases and to demonstrate commitment to maintaining a polio-free region. Existing polio surveillance strategies were considered appropriate for Australia.

Keywords: Polio, surveillance, evaluation, epidemiology, acute flaccid paralysis

Introduction

Global polio occurrence is at its lowest level, with only 223 wild polio cases reported in 2012. However the goal of eradication is elusive with three countries, Pakistan, Afghanistan and Nigeria remaining endemic and cases also reported in Chad and Niger during 2012.¹ Under the International Health Regulations (2005), poliomyelitis caused by

wild poliovirus is one of four specific diseases that must be notified to the World Health Organization (WHO) on detection.²

In the 1980s, acute flaccid paralysis (AFP) surveillance was implemented globally as the key surveillance strategy for validating the eradication of polio.³ AFP is a marker syndrome for poliomyelitis and a number of other conditions including Guillain-Barré Syndrome (GBS), the most common cause of AFP.⁴ Identification of all AFP cases prevents paralytic polio being missed and adequate investigation, including the timely collection of two stool samples, ensures that polio has been excluded as a diagnosis.⁵ As part of the certification process to declare WHO Regions polio-free, WHO recommended implementation of AFP surveillance in all member countries.⁶

Australia is one of a decreasing number of developed countries to maintain AFP surveillance. Over the past five years Australia has consistently achieved the non-polio AFP surveillance target of one case per 100,000 children aged less than 15 years, but the stool collection surveillance targets, of two stool specimens collected from 80% of cases classified as non-polio AFP, has never been met.

Poliomyelitis has been a notifiable condition in Australia since 1922.⁷ Queensland is the only state where AFP is notifiable. Australia has high immunisation rates. In 2012, Australia had a 92.3% national average coverage rate at 12 months with three doses of polio containing vaccine,⁸ and has experienced no community polio outbreaks since the 1970s. The WHO Western Pacific Region, which includes Australia, was declared polio free in 2000.⁹ In 2007, one imported polio case was detected in a Melbourne student returning from a visit to Pakistan, without further known local transmission.^{10,11}

A number of Western Pacific countries, including Papua New Guinea, remain classified as 'high risk' for polio outbreaks by the WHO (Personal communication, Dr Sigrun Roesel, WHO). Australia is currently classified as 'low risk', but continues to receive a large number of short term arrivals, students, migrants and refugees from countries classified as endemic or 'high risk' or that continue to use oral poliomyelitis vaccine (OPV).¹²

From 2000 a range of surveillance strategies were implemented in Australia to document the absence of circulating wild poliovirus, and detect AFP cases to confirm ongoing eradication. The surveillance

systems continued to monitor vaccine-associated paralytic poliomyelitis (VAPP) until 2005, when use of OPV was discontinued in the immunisation schedule.¹³ A response plan for polio importations and potential outbreaks has also been developed. Australia has two peak polio committees, the National Certification Committee for Poliomyelitis Eradication (NCC) and the Polio Expert Panel (PEP). Australia hosts a WHO accredited National Enterovirus Reference Laboratory (NERL) at the Victorian Infectious Diseases Reference Laboratory (VIDRL).

This review of current Australian polio surveillance activities was undertaken to ensure that the current suite of strategies provide optimal surveillance for a high income country with sophisticated medical and laboratory infrastructure, and a long history of freedom from endemic polio circulation. The review specifically examined whether Australia was able to detect an imported case of poliomyelitis, determine if surveillance helped to mitigate the risk of an outbreak, and whether there was sufficient evidence to demonstrate that Australia was free of circulating wild poliovirus.

Methods

This polio surveillance review was conducted by an independent epidemiologist from the Hunter Medical Research Institute, University of Newcastle, engaged by the NCC, between April and November 2012.

The framework for the review was adapted from the Centers for Disease Control and Prevention (CDC) framework for evaluating surveillance systems,¹⁴ the WHO guide for monitoring and evaluating surveillance and response systems for communicable diseases,¹⁵ and techniques commonly used in public health evaluations.^{16,17} Generous timeframes and small numbers of interviewees permitted the use of semi-structured, face-to-face interviews that enabled an in-depth investigation of respondents' views of the surveillance system. Interview guides were prepared and tailored to expert informants' roles. A desktop review of relevant documents was also conducted, which included published articles, unpublished government reports and other grey literature.

Concepts and identified issues were explored and validated in subsequent interviews. Expert informants were chosen in consultation with the NCC, based on their knowledge, roles, or involvement with the surveillance system. Interviewees included personnel of the NERL and Enterovirus Reference Laboratory Network of Australia (ERLNA), paediatricians, policy makers, surveillance system administrators, research nurses, academics and members of the polio peak committees. Twenty seven key informants

were interviewed face to face, in Western Australia, Victoria, New South Wales, Queensland and the Australian Capital Territory, and a further nine by phone or email. During interviews, interviewees were encouraged to identify other key informants. Additional key informants were interviewed until information saturation, where no new information is obtained from the interviews, was reached. One hundred percent of the approached informants participated in the interviews. Interviews were recorded and transcribed.¹⁶ Thematic analysis was applied to transcriptions using NVivo software. Situational analyses have been undertaken where appropriate.

The review was iterative, with feedback sought from key informants on identified issues, gaps in understanding and draft recommendations. The reliability of identified themes was tested during subsequent interviews and the document review.

Findings from the interviews and draft recommendations were presented to the NCC, for discussion and comment, prior to preparation of the final report.

Human ethics approval was not required as this was a service evaluation and quality assurance exercise, thus not requiring such clearance.

Results

System description

The stated objective of Australian poliovirus surveillance is to conduct surveillance for poliovirus in Australia to detect imported cases, mitigate the risk of an outbreak and provide additional virological evidence that Australia continues to be free of circulating wild poliovirus (Personal communication, Nicolee Martin, Department of Health). Poliomyelitis surveillance system components include AFP surveillance, and virological, laboratory and environmental surveillance (Table 1). The VIDRL coordinates most polio surveillance activities in Australia, including:

- The NERL
- National AFP surveillance system
- The ERLNA
- Environmental surveillance.

AFP surveillance focuses on children less than 15 years of age, with research nurses actively identifying potential AFP cases for inclusion in the surveillance system or clinicians notifying AFP cases through the APSU. There is no active surveillance system to detect polio specifically. AFP case detection in

Table 1: Australia's polio surveillance system, 2012

Surveillance System	System component	Description	Findings
Acute Flaccid Paralysis (AFP)	Australian Paediatric Surveillance Unit (APSU)	Commenced in 1995. Approximately 90% (~ 1360) of paediatric clinicians submit a monthly report card to the APSU. It includes request for the collection and testing of two stool samples and the completion of a clinical questionnaire.	The system may not be timely. Provides the only method to access regional and non-tertiary hospital AFP cases. Important mechanism for communicating with paediatricians. Low workload for respondents. Clinicians may not report AFP cases through the APSU system at PAEDS hospitals.
	Paediatric Active Enhanced Disease Surveillance (PAEDS)	Commenced in 2007. Four tertiary paediatric hospitals – Perth, Adelaide, Melbourne, Sydney. Brisbane is expected to commence in 2013. Uses hospital-based research nurses to actively identify cases of AFP, seek consent and ensure the collection of two stool samples. AFP is one of four conditions collected through the system.	Becoming the most important system for AFP surveillance. Some frustration that stool collection rates have not improved uniformly since implementation of the system. Some challenges in ensuring clinician engagement.
	Mandatory notification in Queensland	AFP is notifiable under the Queensland <i>Public Health Act 2005</i> by a clinician on the basis of clinical or provisional diagnosis.	AFP should not be made nationally notifiable.
	National Enterovirus Reference Laboratory (NERL)	World Health Organization-accredited polio reference laboratory. Receives samples from AFP surveillance.	Effective mechanism for enterovirus (including poliovirus) surveillance. Provides enterovirus testing in the Region.
Virological and enterovirus	Enterovirus Reference Laboratory Network of Australia (ERLNA)	Established in 2008. Coordinated by the NERL. Sends untyped enterovirus samples for testing to the NERL. In 2011, 331 enteroviruses were typed by members of the ERLNA.	Provides epidemiological data on enteroviruses in Australia.
	Three sentinel sites in Newcastle, Byron Bay and Armidale	Implemented in 2010. Sites were chosen based on local public health support. Population size served and areas with large overseas student populations from endemic areas (Newcastle and Armidale) or relatively low immunisation coverage and regular international visitors (Byron Bay). Sewerage samples from the sentinel environmental sites are tested for poliovirus and other enteroviruses at the NERL	Successful implementation of sentinel sites. Useful to trial a site at a major metropolitan location. Demonstrates that an outbreak is contained rather than used for case detection. Retention of sentinel sites maintains skills and capacity.
Environmental			
National Notifiable Diseases Surveillance System (NNDSS)	Poliomyelitis nationally notifiable	Notifiable since 1922. Poliomyelitis (paralytic infection) and Poliovirus (non-paralytic infection) are currently notifiable. Includes wild poliovirus infection, Vaccine-associated paralytic poliomyelitis (VAPP) and Vaccine derived poliovirus (VDPV) infection.	Passive notification of poliomyelitis and poliovirus. One adult case notified in 2007.

Australia occurs actively through two systems; the APSU monthly reporting system, and Paediatric Active Enhanced Disease Surveillance (PAEDS). Samples from AFP cases are forwarded to the NERL, a WHO-accredited polio reference laboratory. De-identified AFP case information is reviewed by the PEP every two months for classification.

Environmental surveillance for enteroviruses is currently implemented at three sentinel sites in Australia. Testing for poliovirus and other enteroviruses is conducted at the NERL for stool samples from the AFP surveillance system, adults where polio is suspected, and sewerage samples from the sentinel environmental sites.

Australia reports key polio surveillance indicators to the WHO and also provides an annual report to the Regional Certification Committee with evidence to verify that Australia continues to remain polio-free.

System performance

Following the introduction of the PAEDS system in 2007, Australia met the non-polio AFP rate for children <15 years of age every year for the years 2008–2011. Prior to this the surveillance target was only achieved sporadically; in 2000, 2001, 2004 and 2006.¹⁸ Australia however has never achieved stool sample collection rates that meet the WHO surveillance criterion.⁸ In 2011, 34% of non-polio AFP cases had adequate stool samples collected.¹⁹ Factors identified by the respondents to improve stool sample collection rates included; active, daily visits with ward staff, monitoring whether stool samples had been submitted, and regular feedback and engagement of clinicians

Surveillance objective 1: Is Australia able to detect an imported case of poliomyelitis?

Respondents unanimously agreed that it was not possible to prevent importations. Most felt that undetected importations were likely to have occurred in Australia. Reasons cited for the possibility of missed importations were that most poliovirus infections are asymptomatic and would not present to a hospital, clinicians may have missed cases because of a low level of suspicion, or the case would have presented in a non-classical manner (without paralysis). One respondent observed, “We’re looking for a needle in a haystack really.”

“We are actually a well-protected country at threat of importation (of polio).”

- Polio surveillance interviewee

Most respondents thought that a paediatric flaccid paralysis case would be detected because of AFP surveillance but that an adult case might be missed. The risk of outbreaks was mitigated by high vaccination coverage. Systematic environmental sampling for polioviruses was viewed as complementing AFP surveillance, although detection would only be limited to areas under surveillance.²⁰ No polioviruses were detected through environmental surveillance in 2010, 2011 or 2012, but other enteroviruses were successfully detected.⁸

Surveillance objective 2: Does surveillance help to mitigate the risk of an outbreak?

Respondents commented that the early detection of a poliomyelitis case was one of the main reasons to undertake surveillance. Early detection and a rapid public health response should mitigate the risk of further community transmission. They noted that the NERL had the capacity to rapidly increase virological testing in the event of an outbreak. This was successfully demonstrated during the 2007 polio importation. Virological surveillance amongst contacts and exposed high risk groups would help to determine whether an outbreak had been controlled. In particular, environmental surveillance conducted locally in the outbreak region, could help in assessing whether community transmission had occurred and would serve to demonstrate that an outbreak had been contained.

“It’s nice to have (environmental surveillance) as a surveillance strategy in your back pocket if you’re going to invest heavily in a community response.”

- Polio surveillance interviewee

Respondents noted that there was a response plan that would be activated in the event of detection of a single polio case to limit further transmission of poliovirus.²¹ A number of respondents commented on the public health and economic imperative for containing an outbreak as early as possible. The costs associated with the importation of a single polio case were substantial; however, a larger outbreak could have an even more profound economic impact. Effective surveillance (including virological and environmental), early detection and immediate response were considered necessary to mitigate the risk of any future outbreak.

Surveillance objective 3: Is there sufficient evidence to demonstrate that Australia is free of circulating wild poliovirus?

Respondents were unanimous that there was sufficient evidence to demonstrate that Australia continues to be free of circulating wild poliovirus,

as ratified annually since 2000 by the RCC. They indicated that AFP surveillance helped to demonstrate that Australia remains polio free and should continue in its current form.

While Australia did not achieve all the required WHO polio surveillance indicators, respondents considered that there was still sufficient evidence that Australia remained polio-free, with adequate AFP detection and accessibility to high quality laboratory services. The supplemental surveillance systems (environmental and enterovirus) were viewed as providing additional evidence that there was no circulating wild poliovirus. Prior to certification, WHO recognised that countries may have difficulty meeting all the reporting requirements, and that supplemental surveillance could be used to provide assurance that the country remained polio-free.

Identified gaps and issues

The major surveillance gaps identified were in:

- the detection of adult cases
- ensuring that clinicians would recognise a poliomyelitis case
- the risk of importations
- the need to improve stool sample collection rates
- the opportunity to improve safeguards around the importation and laboratory storage of biological samples containing poliovirus.

In general, respondents thought there was a low level of clinical suspicion for polio. It was acknowledged that this is because the disease is rare and it is unlikely that most clinicians have seen a case of poliomyelitis. Detection of cases are generally considered to rely on astute clinicians considering poliomyelitis as a possible diagnosis in AFP cases.

There was some concern that PAEDS had only demonstrated limited success in improving stool sample collection rates. Respondents recommended that active engagement of clinicians by the research nurses, or through the identification of a local clinical champion may improve clinician participation in stool sample collection. Respondents thought that Australia should be aiming for the highest possible stool collection rate in patients in which there was no obvious diagnosis. Stool sample collection should be based on the clinical imperative to test for diagnostic purposes.

"I think there is reluctance among clinicians to do unnecessary investigations."

- Polio surveillance interviewee

The possible inclusion of additional surveillance systems was mentioned by respondents. These included AFP being made nationally notifiable and through the Australian and New Zealand Paediatric Intensive Care (ANZPIC) registry. However the former had not demonstrated success in Queensland and the latter lacked the required timeliness.

Respondents considered that individuals infected with poliovirus could have entered Australia without detection. However they did not feel that this was of major concern as there had been no detected poliomyelitis outbreaks and that this was unlikely to occur because of Australia's high vaccination coverage. The majority of respondents believed that there was only a limited risk that a broader community outbreak would have gone undetected by the system. Respondents commented that there are a number of groups that pose a higher risk of poliovirus importation into Australia than others, particularly those from endemic countries. They suggested that it would be useful to explore whether the current policies around vaccination of immigrants, refugees and travellers to and from endemic areas were adequate to address importation risks.

Many respondents noted their concerns about the lack of safeguards regarding the importation of biological samples that might contain poliovirus. They felt that it was of concern that a stool specimen containing poliovirus could be imported into Australia with relative ease. They noted that laboratories importing biological materials need to obtain an import permit for handling of these materials. However, as poliovirus is currently designated as a Risk Level 2 organism (moderate individual risk, low community risk),⁶ the controls around importation were limited. Respondents felt that it was critical that Australia should know where all poliovirus specimens were held, that they were secure and that importation of specimens potentially containing poliovirus were strictly controlled.

The future

Most respondents thought that if global polio eradication was achieved, Australia should maintain the current AFP and other surveillance strategies for at least three years post-eradication. Enterovirus surveillance should however, continue indefinitely post eradication to improve the epidemiological understanding of other important enteroviruses in Australia, including EV71.

Respondents commented that surveillance may need to be enhanced if polio eradication was not achieved.

Discussion

The thematic analysis of responses by enterovirus and public health surveillance experts and the document review, found that Australia meets some but not all of its polio surveillance objectives, and that there is room for improvement. Table 2 documents the recommendations arising from the polio surveillance review.

There is strong support for the continuation of polio surveillance, particularly to detect imported cases and to demonstrate solidarity with maintaining a polio-free status in the region. While recognising that the polio surveillance system

has developed in a relatively *ad hoc* manner and that there are some remaining gaps, the existing polio strategies were considered appropriate for Australia. Maintenance of the established AFP surveillance system requires a relatively small economic investment and was considered likely to successfully identify symptomatic, paralytic polio in children. PAEDS is becoming the most important surveillance mechanism for detecting AFP cases; however APSU, in addition to detecting AFP cases, serves a supplementary function as an important mechanism for communicating with all Australian paediatricians. Enterovirus and environmental surveillance were considered important supplementary surveillance systems, with complementary strengths, and the NERL was recognised as being a highly credible organisation playing an integral role in national and regional polio surveillance.

Table 2: Recommendations arising from the review of Australia's polio surveillance system, 2012

Recommendations	
1.	Australia should continue to undertake active polio surveillance.
2.	Existing polio surveillance strategies should occur for three years post-eradication and enterovirus surveillance should continue post-eradication. If eradication is not achieved, surveillance will need to be re-evaluated and may need to be enhanced.
3.	The consolidated purpose, objectives and activities of the Australian polio surveillance system, including Australia's commitment to the WHO Global Polio Eradication Initiative, should be documented by the Department of Health (DoH).
4.	Acute flaccid paralysis (AFP) surveillance should continue in its current form through Australian Paediatric Surveillance Unit (APSU) and the Paediatric Active Enhanced Disease Surveillance system (PAEDS) with regular case review by Polio Expert Panel and reporting of classified cases to the WHO.
5.	Stool collection rates should be improved including through enhancing the effectiveness of the PAEDS program.
6.	Polio should remain a nationally notifiable condition but AFP should not be nationally notifiable.
7.	Sentinel environmental surveillance sites to supplement AFP surveillance should be maintained and sentinel environmental surveillance should be trialed in a major metropolitan area.
8.	Enhanced communications to raise awareness of the importance of completing global poliovirus eradication and highlighting the need for clinicians to remain vigilant for cases of poliomyelitis should be developed by DoHA.
9.	The DoHA should review current policies relating to vaccination of immigrants, refugees and travellers to and from endemic countries to determine if these policies are adequate to address risks of importation.
10.	A review of biosecurity arrangements for the laboratory containment of polioviruses should be conducted in collaboration with accountable individuals.

There were ongoing concerns about the potential importation of poliovirus without adequate controls. The potential to apply the new Biosecurity legislation to address risks associated with the importation of biological samples containing poliovirus should be explored (Biosecurity Bill 2012).²²

Respondents believed that Australia had a responsibility to meet World Health Assembly (WHA) member requirements to maintain surveillance of such quality that Australia would be able to detect cases and respond to them.

Polio eradication is a global public health emergency and every effort should be made to complete this task.²³ Australia should continue to maintain high immunisation coverage, support global eradication efforts financially, and sustain current polio surveillance to ensure that this public health goal is achieved.

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