
Editorial

Protecting investments in polio eradication: the past, present and future of surveillance for acute flaccid paralysis

In September 2003 a WHO consultation group on vaccine-derived polioviruses (VDPV) concluded that in order to prevent future generations of paralytic polio after interruption of transmission of wild poliovirus, the use of trivalent oral polio vaccine (OPV) must be stopped [1]. Another important global policy decision along the road to polio eradication thus became possible – cessation of OPV use at some time after eradication. The question now is not whether OPV must be stopped, but rather when.

The evidence underpinning the decision to stop OPV use came from a complete review of the data from three well-studied outbreaks of circulating VDPV (cVDPV) known to have occurred since 1999 (Hispaniola, Philippines and Madagascar) and one that was thought to have begun in Egypt in 1988 and was identified retrospectively through testing of stored poliovirus isolates.

These cVDPV outbreaks were identified by the international system of surveillance for acute flaccid paralysis (AFP) among children less than 15 years of age, a technical and financial investment of the polio partnership. Once reported, each child with AFP is investigated and two faecal samples are collected, 24–48 h apart, and within 14 days of onset of paralysis [2]. Faecal samples are then sent under cold conditions to WHO-accredited virology laboratories where they are analysed in cell culture for isolation of poliovirus, with subsequent sequencing of the VP1 section of the genome as appropriate.

The AFP surveillance system links poliovirus isolates to specific individuals, and is usually followed by a more intense investigation of those AFP cases and communities from whom wild or vaccine-derived poliovirus has been isolated. Confirmed polio virus triggers a massive immunization response using OPV, and the surveillance system is constantly monitored for performance using as standards the capacity to detect at least 1 AFP case for every 100 000 children less than 15 years of age; the collection of adequate faecal specimens from at least 80 % of these AFP cases; and processing of 100 % of these specimens in a WHO-certified laboratory.

In 2000, the AFP surveillance system identified a polio outbreak in Hispaniola just over 10 years after the island had become polio-free. Genetic sequencing of the putative type 1 virus from the 21 confirmed cases (13 in the Dominican Republic, 8 in Haiti) suggested that all cases were derived from a single OPV dose, estimated to have been given in late 1998 or early 1999 [3]. All isolates from the Dominican Republic outbreak were recombinants with

a common recombination region (VP2A), although each had additional recombination events in other non-capsid regions. The degree of sequence similarity of the outbreak virus with Sabin poliovirus type 1 was lower than observed in isolates from cases of vaccine-associated paralytic poliomyelitis (VAPP), and the sequencing results suggested that the outbreak in the Dominican Republic began with the importation of VDPV from Haiti. Within Haiti it appears that the outbreak was caused by four separate type 1 viral lineages.

In 2001 the AFP surveillance system identified a polio outbreak in the Philippines. Genetic sequencing confirmed that isolates from three cases were closely related to type 1 Sabin strain, but even more closely to each other sharing a common recombination site (VP2B) [4]. The three cases occurred in geographically separate communities, and sequence similarities suggested that the virus had spread in a single chain. Based on the lack of sequence divergence among the isolates and the lack of detection of viral ancestors through the functional AFP surveillance system, it was thought that the virus may have been imported, though no similar virus was identified by the AFP surveillance system elsewhere in the world.

In 2001 AFP surveillance again identified a cVDPV outbreak, this time in Madagascar [5]. The outbreak continued into 2002, with five cases caused by a type 2 virus, and possibly two geographically separate lineages of independent origin. Finally, a type 2 VDPV outbreak that occurred in Egypt from 1988 to 1993 was identified through the AFP surveillance system and retrospective sequencing of virus strains that had been stored in an Egyptian laboratory [6]. Sequencing data suggested that VDPV circulation began in Egypt with an OPV dose given sometime between 1979 and 1986.

The risk of cVDPV will remain as long as OPV use continues. International AFP surveillance must, therefore, be maintained through cessation of OPV use in order to ensure identification of any outbreaks of cVDPV should they occur. At the same time OPV coverage must be maintained as high as possible: the circulation of VDPV in all four cVDPV outbreaks occurred in areas with low OPV coverage (20–30 % in the Dominican Republic, 7–30 % in Haiti, <50 % in Madagascar, and in areas with inconsistent coverage in the Philippines caused by vaccine shortages).

As planning for OPV cessation continues, considerations other than maintenance of AFP surveillance and high OPV immunization coverage also arise. Global policies for coordinated cessation of OPV, for example, must be developed.

Countries that decide not to continue immunizing against polio after cessation must be assured that there is an international vaccine stockpile and response mechanism should poliovirus be released from a laboratory or manufacturing facility, as occurred during the 1990s [7]. Likewise, the risk of polio virus re-entering human populations must be minimized through destruction, or consolidation of potential or known poliovirus-containing samples under secure storage conditions, and ensuring safe manufacture of polio vaccine that requires use of live poliovirus [8, 9].

Three billion US dollars will have been invested by the polio eradication partnership by the end of 2005. With the increased government commitment of the remaining polio-endemic countries during early 2004, demonstrated by the signing of the Geneva Declaration, polio eradication now appears to be within sight [10]. The international AFP surveillance system which began in the mid-1980s has been one of the beneficiaries of the investment in polio eradication. This investment has permitted not only the interruption of wild poliovirus transmission, but has also identified a major risk to polio eradication – VDPV – and provided the evidence needed to minimize this risk. With the cessation of OPV use and certification of polio eradication, this unique global surveillance system will no longer be required in its present form. The opportunity to broaden it to encompass other viral diseases such as yellow fever, measles and influenza must not be missed.

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REFERENCES

1. World Health Organization. Report of the WHO consultation on identification and management of vaccine-derived polioviruses (in press).

2. Expanded Programme on Immunization. Field guide for supplemental activities aimed at achieving polio eradication. WHO/EPI/GEN 95.1.
3. Kew O, Morris-Glasgow V, Landaverde M, et al. Outbreak of poliomyelitis in Hispaniola associated with circulating type 1 vaccine-derived poliovirus. *Science* 2002; **296**: 356–359.
4. Circulating vaccine-derived poliovirus – Philippines. *MMWR* 2001; **50**: 874–875.
5. Rousset D, Rakato-Andrianarivelo M, Razfindrastimandresy R, et al. Recombinant vaccine-derived poliovirus in Madagascar. *Emerg Infect Dis* 2003; **9**: 885–887.
6. Yang C-F, De L, Holloway BP, Pallansch MA, Kew OM. Circulation of endemic type 2 vaccine-derived poliovirus in Egypt from 1983 to 1993. *J Virol* 2003; **77**: 8366–8377.
7. Mulders MN, Reimerink JHJ, Koopmans MPG, van Loon AM, van der Avoort HGAM. Genetic analysis of wild type poliovirus importation into the Netherlands (1979–1995). *J Infect Dis* 1997; **176**: 617–624.
8. WHO global action plan for laboratory containment of wild polioviruses, 2nd edn. WHO/V&B/03.11.
9. World Health Organization. Guidelines for the safe production and quality control of IPV manufactured from wild polioviruses. Geneva: World Health Organization (in press) [latest publication information available at: <http://www.who.int/biologicals/>].
10. Geneva Declaration on the Eradication of Poliomyelitis. WHO, January 2004.

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