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Ending Use of Oral Poliovirus Vaccine — A Difficult Move in the Polio Endgame

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When the world embarked on global polio eradication with the adoption of a World Health Assembly resolution in 1988, there was only minimal consideration of what would happen after the eradication of wild poliovirus (WPV) had been certified. Poliovirus-eradication efforts have targeted three distinct serotypes, using two vaccines each containing components against all three types — a live attenuated oral poliovirus vaccine (OPV) used in more than 100 mostly low and middle income countries worldwide, and an inactivated poliovirus vaccine (IPV) used in most of the developed world. Many experts believed that vaccination against polio either would continue to evolve with strengthening of routine immunization or might be stopped by countries when they no longer had circulating wild-type virus. This view of the post-eradication world changed with the first recognition, in 2000, of an outbreak caused by a virus resulting from the genetic reversion of one of the strains in OPV, which was subsequently named “circulating vaccine-derived poliovirus” (cVDPV).[1] The detection of this outbreak was aided by the development and implementation of improved molecular diagnostics, which were also used to demonstrate that cVDPV outbreaks had occurred in the past but had been thought to be outbreaks of indigenous WPV strains.

The logical inference from the detection of cVDPV outbreaks was that long-term use of OPV posed an ongoing risk.[2] Over the next several years, this finding convinced public health experts that the Global Polio Eradication Initiative (GPEI) needed to include more than certification and WPV containment; OPV vaccination also had to be stopped in order to ensure a polio-free world after eradication.

A more formal process was therefore begun to develop a strategic eradication plan that explicitly included stopping OPV use.[3] Since the last case of WPV type 2 (WPV2) had occurred in 1999, the plan for OPV cessation evolved from concurrently stopping the use of all three OPV types to a modified serial plan in which the type 2 component of OPV would be removed first. The Global Commission for the Certification of the Eradication of Poliomyelitis certified WPV2 eradication in September 2015, and in April 2016 there was a coordinated global switch from the trivalent OPV to a bivalent OPV containing only the type 1 and type 3 components.

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Such synchronized vaccine cessation was unprecedented, and there were therefore many uncertainties. The stage was set for the work described by Blake et al. in this issue of the *Journal* (pages 834–845). As the authors note, the GPEI has a robust surveillance system for tracking of polioviruses globally and has the ability to readily distinguish WPV, cVDPV, and OPV strains. This system allows public health officials to monitor whether, after the switch, all the OPV-related type 2 viruses will ultimately disappear, as predicted. Because cVDPV type 2 (cVDPV2) outbreaks are sometimes not detected right away, experts predicted that some outbreaks detected after the switch would turn out to have begun before the switch; but newly emergent, post-switch cVDPV outbreaks were also predicted.

Blake et al. focused on analyzing the surveillance data from both acute flaccid paralysis and environmental surveillance systems to characterize the kinetics of OPV2 disappearance and to identify specific instances of events that were not predicted. The authors describe the disappearance of the OPV2 strains after the switch and the cVDPV2 outbreaks that were newly detected. To date, these outbreaks have occurred in geographic areas where cVDPV and WPV outbreaks had occurred prior to the switch. These high-risk countries were also the ones where monovalent type 2 OPV (mOPV2) was used in response campaigns. The introduction of mOPV2 into these populations as part of an outbreak response resulted in detection of VDPV2 and OPV2-related viruses and subsequent disappearance of these viruses in the vaccine-coverage areas.

The heterogeneity of countries' experiences, at both national and subnational levels, allowed analysts to identify specific risk factors for cVDPV2 emergence, and variations in the rate of disappearance of OPV2-related strains. One major risk factor for emergence identified by the authors is low population immunity to type 2 virus. This factor was not only associated with virus emergence and circulation, but also had an influence on the rate of disappearance of OPV2-related stains after use of mOPV2 and accounted for some of the heterogeneity of the rates observed. The critical importance to WPV eradication of population immunity is well understood, and in models, such immunity has a strong influence on the success of cessation of OPV use. The authors provide the first analytic evidence that population immunity is a critical determinant of the successful implementation of the OPV-cessation strategy.

The analysis by Blake et al. covers the first 15 months after the switch, when it was too early to detect any trends as a function of time after the last OPV2 use. Since, as the authors note, universal introduction of a single dose of IPV has not resulted in high coverage as originally planned, in part because of a global supply shortage, several countries have seen dramatic decreases in population immunity to type 2 poliovirus among children born after the switch. How this heterogeneity among countries in decreasing immunity will affect the likelihood and severity of future outbreaks, the choices made regarding outbreak responses, the risk of new cVDPV emergence, and the ultimate disappearance of type 2 poliovirus is not clear from this analysis. Answers to these questions are not only important for the completion of the OPV2 switch but could also significantly affect planning for the ultimate cessation of all OPV use.

At this point, the type of virus monitoring and analysis described by Blake et al. will need to continue until all type 2 viruses are no longer detected by the surveillance systems. Since the period covered by their analysis, new cVDPV2 outbreaks have been detected in Somalia and Kenya, the Democratic Republic of Congo, and Nigeria. Responses to these outbreaks have resulted in additional detections of OPV2-related virus. It will be important to monitor whether there any observable changes over time in the disappearance of OPV2-related virus in these regions where new and past outbreaks have occurred. Each mOPV2 response to a cVDPV2 outbreak carries a risk of seeding new cVDPV2 outbreaks. The unfolding experience following the OPV2 switch will provide lessons that improve our understanding of problems confronting the endgame strategy of OPV cessation.

OPV withdrawal is only one of the elements of the polio endgame, which also includes the goals and challenges of laboratory and vaccine-manufacturing containment of poliovirus and sustaining of polio surveillance in order to detect and identify poliovirus infections. We still need to maintain a stockpile of polio vaccine for outbreak response. The existence of immunodeficient people who chronically excrete VDPV virus also necessitates an effective means of detection and intervention. Many of these issues will require additional research and development, including a better vaccine that produces mucosal immunity without the risk of VDPV, antivirals to treat chronic infections, and better surveillance tools for a world that will quickly forget about polio after eradication is achieved. Clearly, persistence and patience will be needed, not only to complete eradication of WPV, but also for the polio endgame.

References

1. Kew O, Morris-Glasgow V, Landaverde M, et al. Outbreak of poliomyelitis in Hispaniola associated with circulating type 1 vaccine-derived poliovirus. Science 2002;296:356–9. [PubMed: 11896235]
2. Dowdle WR, de Gourville E, Kew OM, Pallansch MA, Wood DJ. Polio eradication: the OPV paradox. Rev Med Virol 2003;13:277–91. [PubMed: 12931339]
3. Polio eradication & endgame strategic plan 2013–2018. WHO/POLIO/13.02, http://polioeradication.org/wp-content/uploads/2016/07/PEESP_EN_A4.pdf