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Global polio eradication: Where are we in Europe and what next?

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ABSTRACT

The world was never so close to reach the polio eradication: only 37 cases notified in 2016 in only three countries, but the game is not yet at the end. The risk of polio outbreaks in the EU is smaller than it has ever been in the past, but it is not so small that we can ignore it. The EU MS must remain alert and plan and prepare for managing polio events or outbreaks because of the possible dire consequences. The IPV only vaccination schedule universally applied in EU has achieved satisfactory coverage, but constantly leaving small accumulating pockets of susceptible individuals. Moreover the IPV only schedule is not an absolute barrier against poliovirus silent transmission as demonstrated in the recent Israel outbreak. The availability of annually revised S.O.P. from WHO GPEI on the identification and response of a polio event, without local poliovirus transmission or a polio outbreak with sustained transmission, helps and challenge EU countries to update their polio national preparedness plans. The EU/EEA area, in fact, is a peculiar area regarding the polio risk both for its vaccination policy, the large polio vaccines manufactures and the constant immigration from areas at polio high risk, but also EU include cultural and financial potentials crucial to sustain the polio end game strategy and reach the benefit of a world without polio risk. Poliovirus eradication will continue to be challenged as long as there is the worldwide presence of polioviruses in laboratories and vaccine production plants. Most of the world's OPV vaccines are produced in the EU and many laboratories and research centers store and handle polio viruses. EU Member States are engaged actively in implementing the poliovirus biocontainment plans that are part of the polio eradication strategy and to certify the destruction of poliovirus strains and potentially contaminated biological materials.

1. Background

The world is on the brink of eradicating poliomyelitis. The incidence of acute flaccid paralysis (AFP) caused by wild-type polioviruses (WPV) is steadily decreasing. In 2015, WPV caused 74 cases of AFP worldwide, down from 359 cases in 2014. The total 2016 case count stands at 37 cases, and wild-type viruses circulate only in a few inaccessible areas in three countries: Afghanistan (13 cases), Pakistan (20 cases) and Nigeria (4 cases). The number of AFP cases caused by circulating vaccine-derived polioviruses (cVDPV) is declining as well. In 2015, cVDPV caused 32 paralytic infections in seven countries (Pakistan (2), Lao People's Democratic Republic (8), Madagascar (10), Myanmar (2), Ukraine (2), Nigeria (1), and Guinea (7)) compared to 56 cases in 2014 [1]. At the end of 2016 just five cases of cVDPV have been reported worldwide in 2016, three from Lao PDR, one from Pakistan, and one from Ukraine [1] (see Table 1).

Of the three serotypes of wild-type poliovirus, only type 1 (WPV1) is still in circulation. In September 2015, the Global Certification Commission (GCC) concluded that WPV2 ceased to circulate in 1999 and WPV3 has not been isolated anywhere in the world since November 2012 [2]. In May 2014, the WHO declared that the continued circulation of WPV1 constitutes a Public Health Emergency of International Concern (PHEIC) and implemented temporary recommendations [3] to reduce the risk that exportation of the virus from endemic countries would re-establish transmission in vulnerable countries. The PHEIC emergency measures regarding the international spread of polio are reviewed every three months by the International Health Regulation (IHR) Committee. Its latest assessment is that polio remains a PHEIC and the temporary recommendations remain in place.

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Table 1
Cases of poliovirus identified in 2015–2016 (GPEI WHO).

Countries	2015		2016	
	WPV[a]	cVDPV[b]	WPV	cVDPV
Afghanistan	20	0	13	0
Pakistan	54	2	20	1
Guinea	0	7	0	0
Lao PDR	0	8	0	3
Madagascar	0	10	0	0
Myamar	0	2	0	0
Nigeria	0	1	4	1
Ukraine	0	2	0	0
Total	74	32	37	5

[a] Wild polio virus.
[b] Circulating vaccine derived polio virus.

2. Vaccine-derived polioviruses

Live attenuated OPV viruses replicate in the intestinal mucosa and are excreted in the faeces on average for six to eight weeks after vaccination [4]. Vaccine-derived polioviruses (VDPV) are OPV vaccine strains that have lost their key attenuating mutations and biologically resemble WPVs. They develop through a series of mutations and acquisition of genetic material from other enteroviruses, a process that is estimated to take on average at least one year. The critical risk factor for the emergence of VDPVs is the duration that the vaccine virus circulates in a given population. Average circulation time for OPV viruses is longer in populations with low vaccination coverage, hence increasing the risk for VDPV strains to develop [5]. VDPV can acquire the capacity for person-to-person transmission and therefore the potential to cause outbreaks similar to WPV. When they do, they are labeled circulating vaccine-derived poliovirus (cVDPV). Confirmation of a cVDPV outbreak is based on isolation of a VDPV strain from a paralytic case along with isolation of a genetically related VDPV strain from either another paralytic case, a healthy individual or an environmental sample. Detection of cVDPV are considered polio outbreaks in accordance with the new classification of VDPV, and require rapid outbreak response [6], (see Table 2).

Recent detections of WPV1 and cVDPV strains in northern Nigeria have demonstrated that polioviruses can circulate undetected for years in inaccessible and under-vaccinated populations. Nigeria was declared free of wild-type polio in September 2015 but in July 2016, WPV1 was isolated from two children in the northern Borno State, the first WPV isolation in Nigeria since July 2014. Genetic sequencing of the isolates suggest that they are most closely linked to a WPV1 that was last detected in Borno in 2011 [5]. The most plausible explanation is that the strain has continued to circulate in the region despite the massive supplementary immunization activities over the last couple of years. Inaccessibility as a result of security concerns has resulted in low vaccine uptake, immunity gaps and ineffective surveillance which has allowed for continued undetected transmission in northern Nigeria.

The switch from trivalent OPV to bivalent OPV represents a milestone towards cVDPV control. In the past, over 90% of cVDPV isolates have evolved from the type 2 component of tOPV and its withdrawal will significantly reduce the risk of VDPV strains emerging. The worldwide introduction of at least one IPV dose in the immunization schedule as of April 2016 will reduce the risk further also considering the actual IPV production shortage that is reducing the capacity of some countries to implement the strategy. However, the cessation of OPV2 vaccination has reduced population immunity against type 2 viruses and hence increased the risk of cVDPV2 outbreaks in the short term, particularly in under-vaccinated populations [7], therefore the appropriate containment of PV2 becomes critical.

Table 2
Vaccine derived poliovirus classification.

iVDPV	Poliovirus detected from chronic immunodeficient carriers
cVDPV	Vaccine derived polioviruses with evidence of person-to-person transmission
aVDPV	Vaccine derived mutated polioviruses that do not meet the criteria for cVDPV or iVDPV

3. Risk of polio transmission and possible response

The Standard Operating Procedures (SOP) for responding to a poliovirus event and outbreak, updated yearly by the WHO Global Polio Initiative, guides national response to two scenarios during the end game: a polio event and a polio outbreak with sustained polio transmission. A polio event is defined as poliovirus detection without evidence of transmission and includes: the occasional identification of a VDPV (iVDP or aVDP) from one or more cases of AFP or an asymptomatic individual without evidence of further transmission in the community; environmental isolation of a Wild polio Virus (WPV) or a VDPV without evidence of prolonged circulation; an environmental isolation of a Sabin like type 2 virus (since vaccination with Sabin type 2 virus should have stopped worldwide).

A polio outbreak response is triggered by the identification of any excreation of any WPV or cVDPV. Similarly, by the isolation from two or more environmental samples of WPV genetically indicating sustained transmission or any cVDPV or a WPV with follow up evidence of virus excretion [8]. Table 3 offer the synthesis of those definitions according to the poliovirus type identified.

4. Possible response

A polio event in the EU will be most likely caused by a recent importation of one or more individuals matching the defined criteria or by the inadvertent or deliberate release of poliovirus from laboratories or vaccine production facility. The response includes an immediate strong cooperation between the Country, the WHO and GPEI partners to conduct a rapid risk assessment including epidemiologic and laboratory investigations as well as strength of evidence. A polio event may get escalated to an outbreak at any point during the investigation. Most of the possible polio events will not require Supplementary Immunization Activities (SIA), however a plan to potentially consider those should be embedded in the national polio plan.

A polio outbreak should be managed as a Public Health Emergency of International Concern (PHEIC). The recommended general steps to respond to all poliovirus outbreaks are similar to those of a

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