

Vaccine Preventable Diseases in the Mediterranean Basin and Black Sea:
immunization strategies and coverage in the general population and the newly arrived migrants
the ProVacMed project

Poliomyelitis: successful and critical issues in the eradication process



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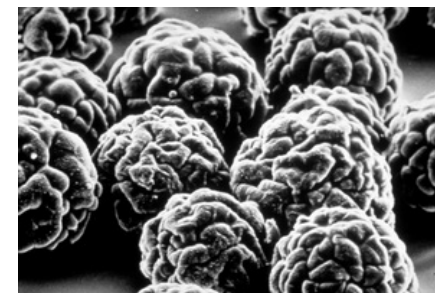
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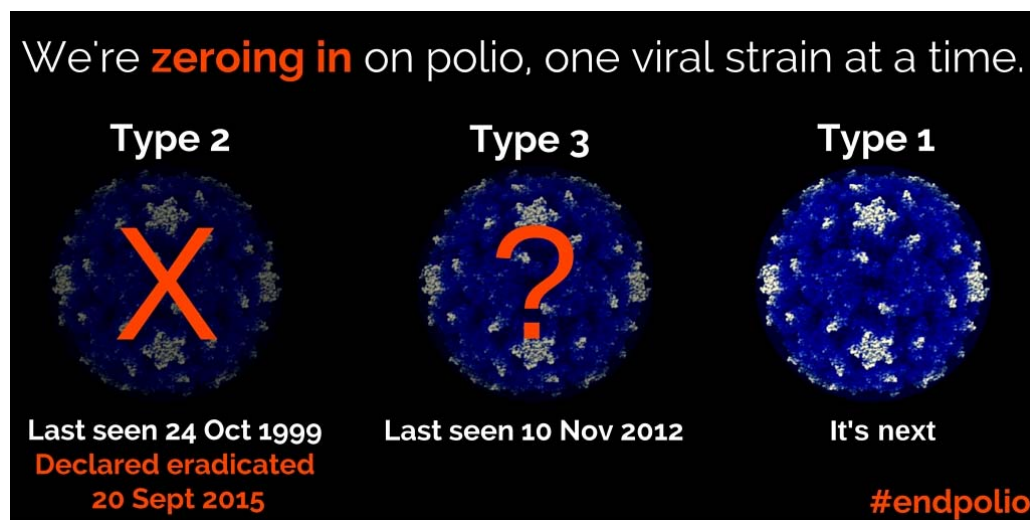
Poliomyelitis (polio)



Polio is caused by a human enterovirus called the poliovirus
Wild polioviruses are those that occur naturally

The poliovirus consists of an RNA genome enclosed in a protein shell called a capsid

There are three serotypes of wild poliovirus – **type 1, type 2, and type 3** – each with a slightly different capsid protein



In this final stage of polio eradication, only type 1 and type 3 wild poliovirus continue to circulate in endemic areas

Both are highly infectious and both cause paralytic polio

Type 1 is the most pervasive strain of poliovirus and type 3 is at very low levels

VAPP and VDPV

Vaccine-associated paralytic poliomyelitis (**VAPP**) occurs in an estimated 1 in 2.7 million children receiving their first dose of oral polio vaccine

Vaccine-derived polioviruses (**VDPV**)

Vaccine-derived polioviruses (VDPVs) are rare strains of poliovirus that have genetically mutated from the strain contained in the oral polio vaccine.

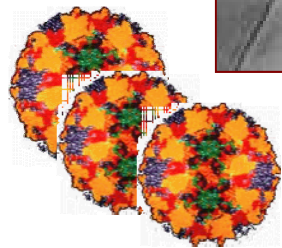
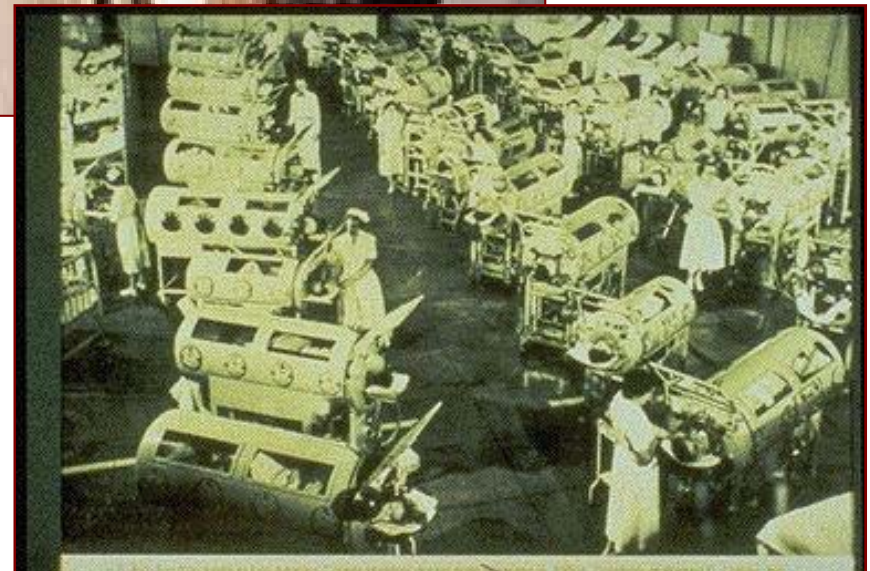
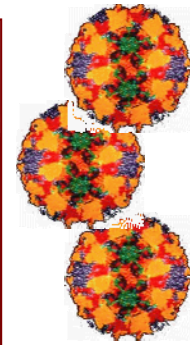
Types of vaccine-derived poliovirus

There are three types of vaccine-derived poliovirus:

1. circulating vaccine-derived poliovirus (**cVDPV**)
2. immunodeficiency-related vaccine-derived poliovirus (**iVDPV**)
3. ambiguous vaccine-derived poliovirus (**aVDPV**)

Episodes due to cVDPV are rare

Between 2000 and 2011 – a period in which more than *10 billion doses* of OPV were given worldwide – 20 cVDPV outbreaks occurred, resulting in 580 polio cases. In the same period, wild poliovirus paralysed over 15 500 children



poliomyelitis

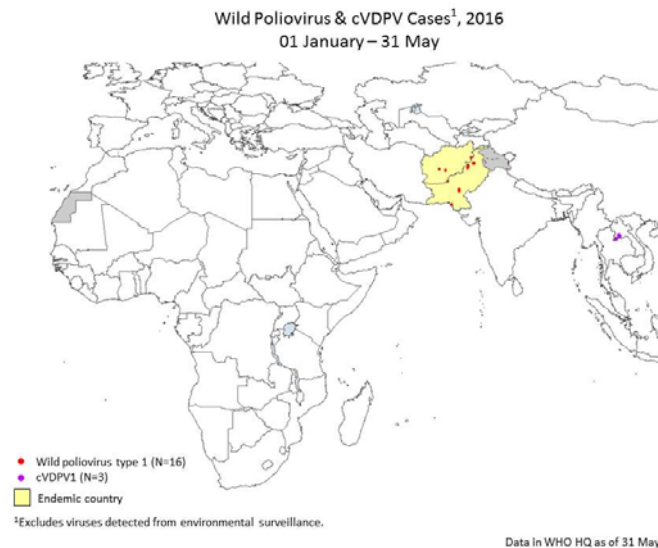
TYPES OF POLIOVIRUS		
	WILD POLIOVIRUS (WPV)	CIRCULATING VACCINE DERIVED POLIOVIRUS (cVDPV)
Definition	Infectious virus that invades the nervous system. Can cause paralysis or death.	A very rare, circulating infectious virus mutated from the weakened strain of poliovirus in OPV. Under certain conditions, may cause paralysis or death.
Risk Factors	Low immunization rates, poor sanitation, high population densities.	Low immunization rates, poor sanitation, high population densities.
To Stop Transmission	Increase immunization rates with OPV.	Increase immunization rates with OPV.
Strains	Type 1: Caused 100% of 2014 cases Type 2: Eradicated in 1999 Type 3: Last seen in 2012	Type 1: Causes 8% of cVDPV Type 2: Causes 90% of cVDPV Type 3: Causes 2% of cVDPV
Cases in 2014	358	52

1988– – Polio was endemic in 125 countries



polio paralysed more than 1000 children worldwide every day

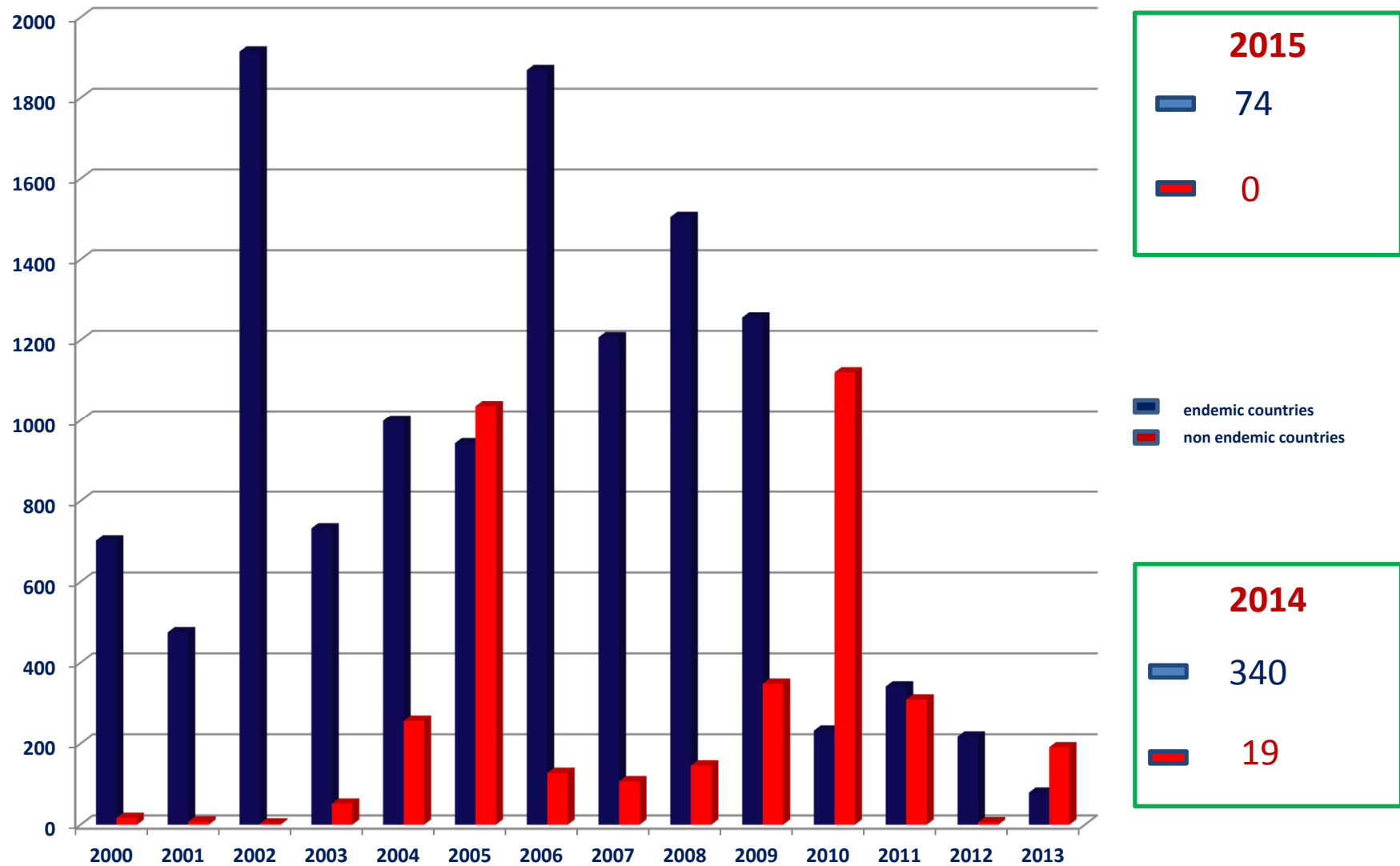
2016 – Polio remains endemic in two countries – Afghanistan and Pakistan



Case breakdown by country

Countries	Year-to-date 2016		Year-to-date 2015		Total in 2015		Onset of paralysis of most recent case	
	WPV	cVDPV	WPV	cVDPV	WPV	cVDPV	WPV	cVDPV
Afghanistan	5	0	2	0	20	0	04-Apr-16	NA
Pakistan	11	0	23	2	54	2	26-Apr-16	09-Feb-15
Guinea	0	0	0	0	0	7	NA	14-Dec-15
Lao PDR	0	3	0	0	0	8	NA	11-Jan-16
Madagascar	0	0	0	0	0	10	NA	22-Aug-15
Myanmar	0	0	0	0	0	2	NA	05-Oct-15
Nigeria	0	0	0	0	0	1	NA	16-May-15
Ukraine	0	0	0	0	0	2	NA	07-Jul-15

Polio cases in endemic/non endemic countries



States currently exporting wild poliovirus or cVDPV

Afghanistan (WPV)

Pakistan (WPV)

States infected with wild poliovirus or cVDPV but not currently exporting

Guinea (cVDPV)

Lao People's Democratic Republic (cVDPV)

Madagascar (cVDPV)

Myanmar (cVDPV)

Nigeria (cVDPV)

Ukraine (cVDPV)

States no longer infected by wild poliovirus or cVDPV, but which remain vulnerable to international spread, and states that are vulnerable to the emergence and circulation of VDPV

Cameroon

Equatorial Guinea

Iraq

Israel

Somalia

South Sudan

Polio Eradication Strategies



Jonas Salk 1914 - 1995

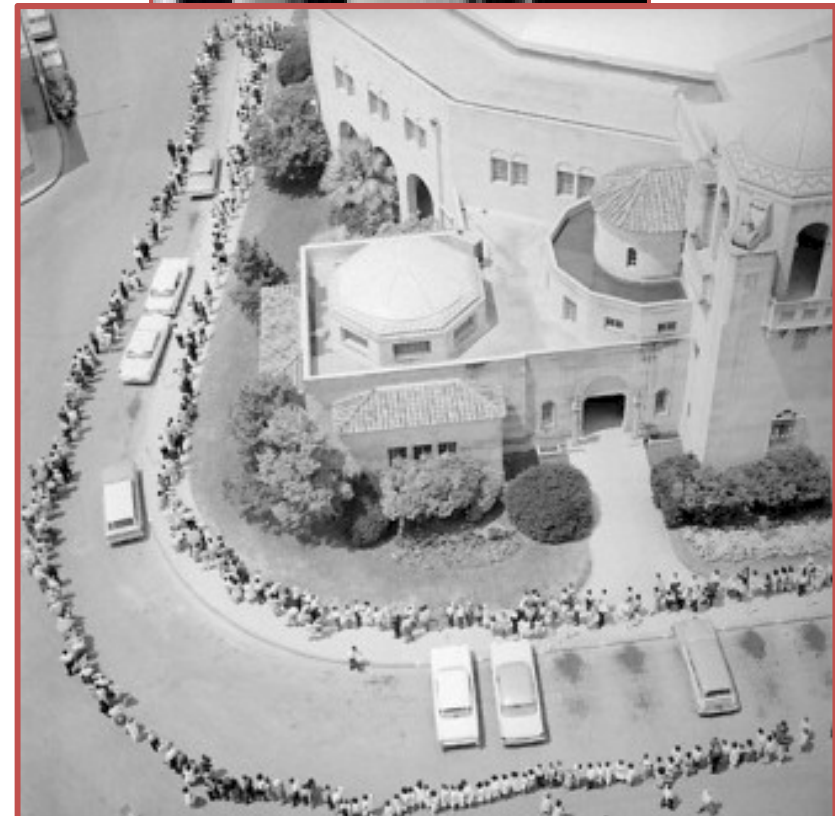


1955 the *Cutter Incident*

200,000 people were inadvertently injected with live virulent polio virus: 70,000 became ill, 200 were permanently paralyzed, and 10 died

5,394,000 were vaccinated in 1955.

Albert Bruce Sabin 1906 - 1993



Comparison of Oral Polio Vaccine (OPV) and Inactivated Poliovirus Vaccine (IPV).

Property	OPV	IPV
Mode of administration	By mouth	Injectable
Type	Live attenuated	Inactivated
Gastrointestinal tract immunity	Yes	No
Virus shed in feces	Yes	No
Requirements for transport and storage	Strict	Not strict
Ability to revert	Yes	No

Aamir Shahzad Clin Infect Dis. 2009;49:1287-1288

Table 1: Overview of available polio vaccines



Vaccine	Wild Poliovirus (WPV) targeted	Description
tOPV	All three types	Historically, the most common form of OPV used in the routine and supplementary immunization activities in low and middle-income countries globally, because of cost, ease of administration, and excellent oral and intestinal immunity
bOPV	Types 1 & 3	Licensed in 2009 after a clinical trial showed non-inferior immunogenicity to use of monovalent types 1 or 3
mOPV1, mOPV2, mOPV3	Either types 1, 2, or 3	mOPV1 and mOPV3 were introduced by GPEI in 2005 to improve OPV effectiveness in the last WPV reservoirs in Africa and Asia.
IPV	All three types	Currently used in most high-income countries due to its excellent safety profile and high efficacy; SAGE recommends introducing at least one dose in routine immunization schedules of all countries before beginning OPV2 cessation in 2016

Vaccination strategies

Routine immunization (national programmes)

WHO/UNICEF: In 2014, 86% of infants around the world received 3 doses of polio vaccine (global coverage was 75% in 1990)

Supplementary immunization

National Immunization Days (NIDs)

Synchronized NIDs

Targeted “mop-up” campaigns



Monday, September 22, 2014

Synchronized campaigns in western and central Africa

Nearly 94 million children will be protected against polio this week in 18 countries



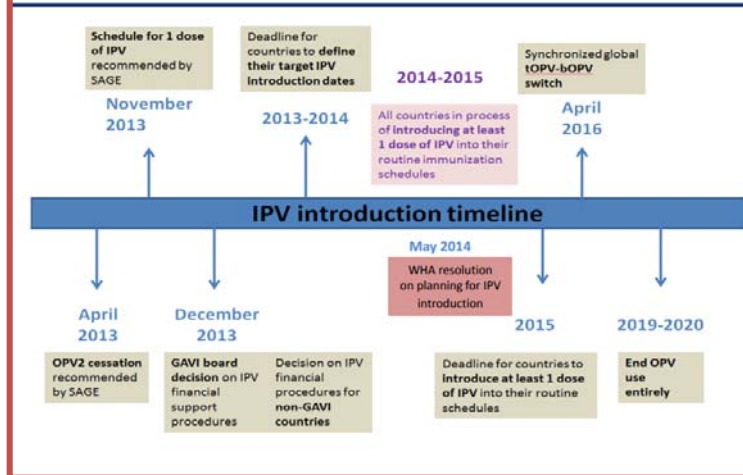
ANNEX B | PLANNED SUPPLEMENTARY IMMUNIZATION ACTIVITY SCHEDULE, 2016
[All activities are expressed in percentages*]

TRANSMISSION ZONE/COUNTRY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
West/South Asia												
Afghanistan	50	100	100	50	100	50		100		100		50
Pakistan**	100	50	100	50	100		50	50		50	100	
India**	100	100			5				5			
Nepal		50										
West/Central Africa												
Nigeria**	5	100	100		5						5	
Chad		100	100						50	100		
Niger			50						50			
Mali			50							100		
Burkina Faso		100	100									
Benin			100							100		
Cameroon		100		100					50			
Dem. Rep. of the Congo			50	100						50		
Central African Republic	50		100		50							
Guinea		100	100									
Equatorial Guinea		100	100							100		
Congo		100	100									
Liberia		100	100					100		100		
Sierra Leone		100	100					100		100		
Guinea	100		50					100		100		
Côte d'Ivoire		100	100									
Mauritania			100								50	
North Africa												
Saudi Arabia		100	100		50			50		100	100	
Egypt		50	100		50				50		50	
Kenya			50	100						100		100
South Sudan			50							100		100
Sudan			50							50		
Uganda		50	100	50								
Djibouti			100									
Yemen		100	100		100				100			
Middle East												
Syrian Arab Republic		100	100			50					100	
Egypt			100									
Jordan			100									
Lebanon		50	50									
Iraq		100		100		50				50		
Iran (Islamic Republic of)												
Libya			100								100	
Other												
Angola**			100									
Ukraine**			50								100	
Madagascar			100	100							100	
Laos People's Dem. Rep.										100	100	
Myanmar		50										
Indonesia**			100									

Countries with no poliovirus for more than 12 months. Countries with poliovirus within the last 6 months. Countries with poliovirus between 6 and 12 months.

Colorization includes cDPA
* Percentage of country coverage: 100% = national activity; >100% = more than one national activity in the month; and <100% = subnational activity
** These countries are partially or fully "self-financing".

KEY DATES



Polio End Game Strategic Plan 2013-18

- **Objective 1**
 - Polio virus detection and interruption
- **Objective 2**
 - Introduce at least one dose of IPV, withdraw OPV, starting with OPV type 2, strengthen RI in 10 priority countries
- **Objective 3**
 - Containment and certification
- **Objective 4**
 - Legacy planning

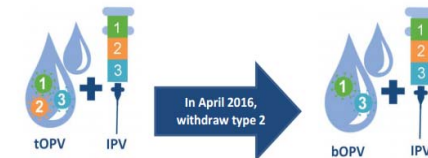


The role of IPV

- **Reduce risks** of an outbreak after type 2 OPV vaccine withdrawal
- **Help stop outbreaks quickly** if type 2 virus is reintroduced
- **Boost immunity** against polio types 1 & 3 to protect populations and hasten eradication

POLIO GLOBAL ERADICATION INITIATIVE

2



- Key elements of SAGE recommendations**
- ✓ Introduce at least 1 dose of IPV into the routine immunization programmes
 - ✓ IPV given at or after 14 weeks of age, in addition to the existing 3-4 doses of OPV of the primary vaccination series
 - ✓ All endemic & high-risk countries develop a plan for IPV introduction by mid-2014 & remaining by end-2014

Figure 3. Potential schedules of incorporating single dose of IPV with DTP/Penta and OPV vaccination schedule, SAGE recommendation, November 2013

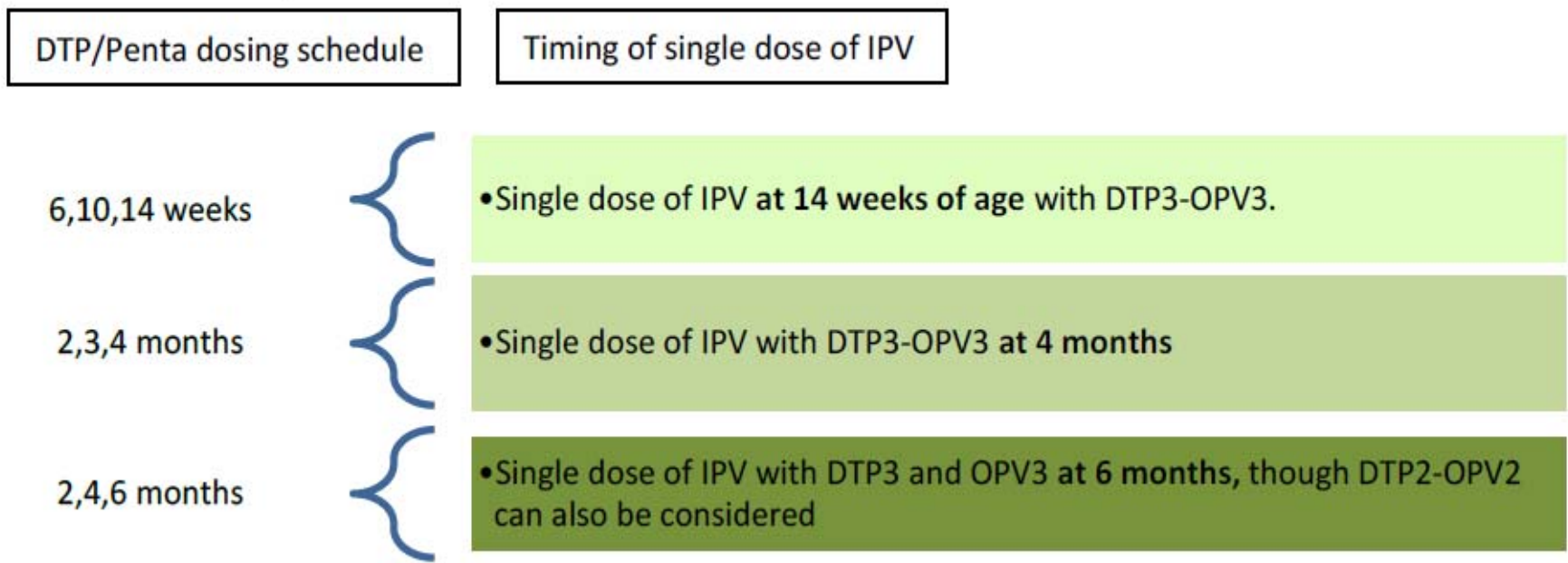
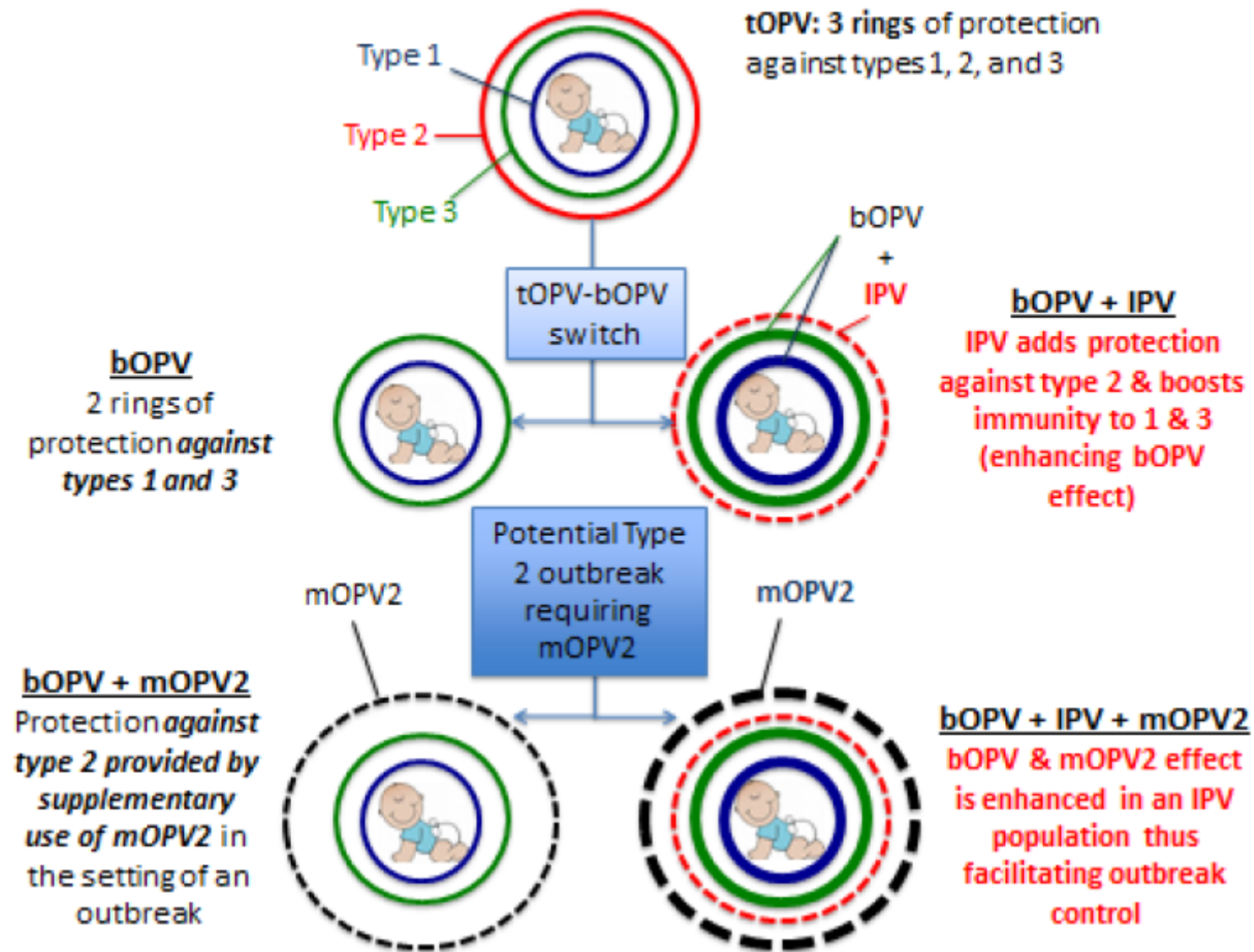
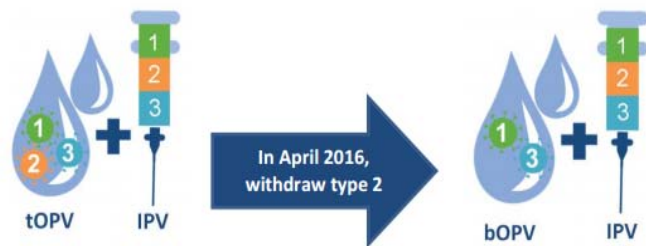


Figure 6: Schematic description of technical rationale for use of at least one dose of IPV as part of the Endgame Strategy



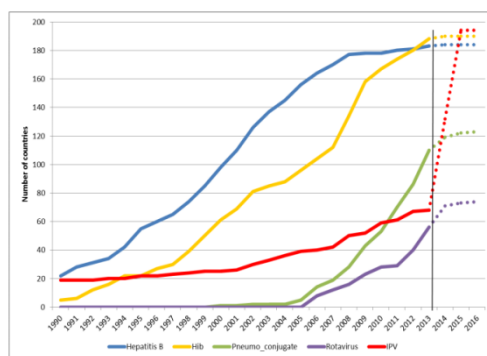


Switch planning summary guide

<i>Phase 1</i> PLAN	By end June 2015
<i>Phase 2</i> PREPARE	From July 2015
<i>Phase 3</i> IMPLEMENT	2 weeks BEFORE the switch day
NATIONAL SWITCH DAY	April 2016
<i>Phase 4</i> VALIDATION	2 weeks AFTER the switch day
NATIONAL VALIDATION DAY	

Immunization schedule uptake

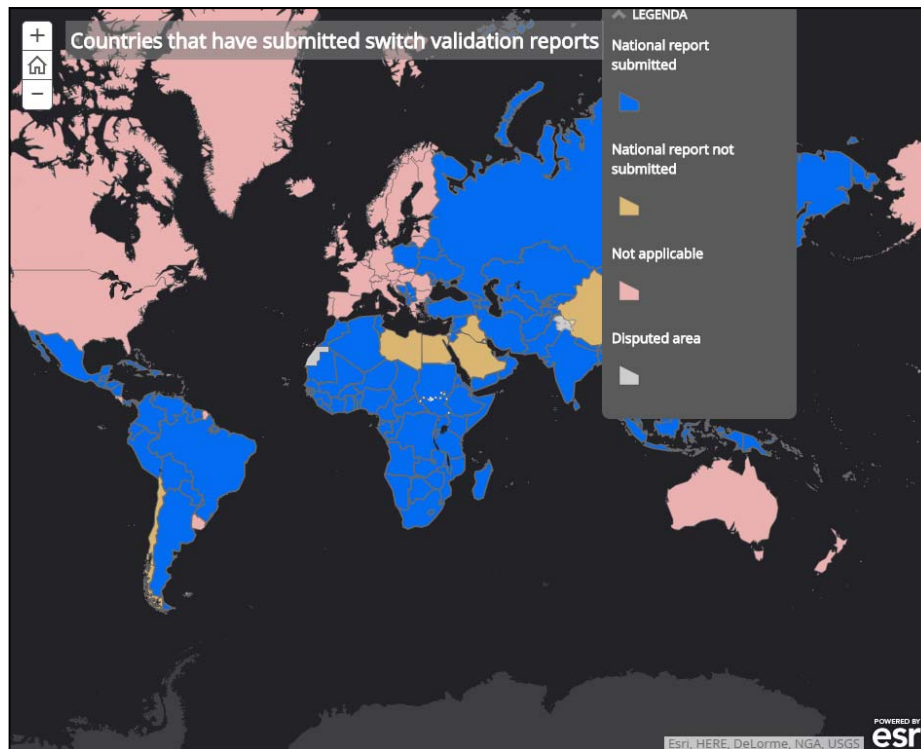
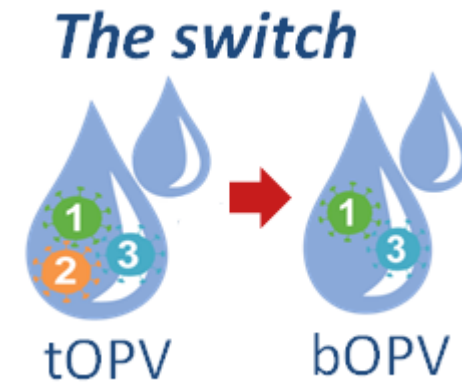
overview 1991-2013 of introduction status and 2014-2016 projections



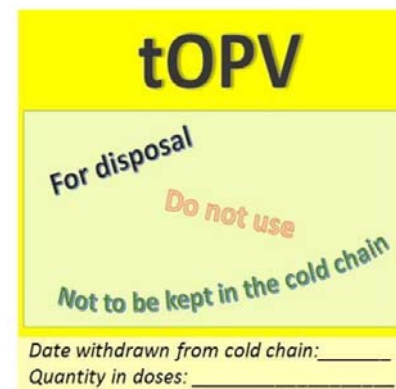
Source: WHO/IVB Database as at 18 October 2013
Date of slide: 18 October 2013

Global switch in oral polio vaccines Situation report

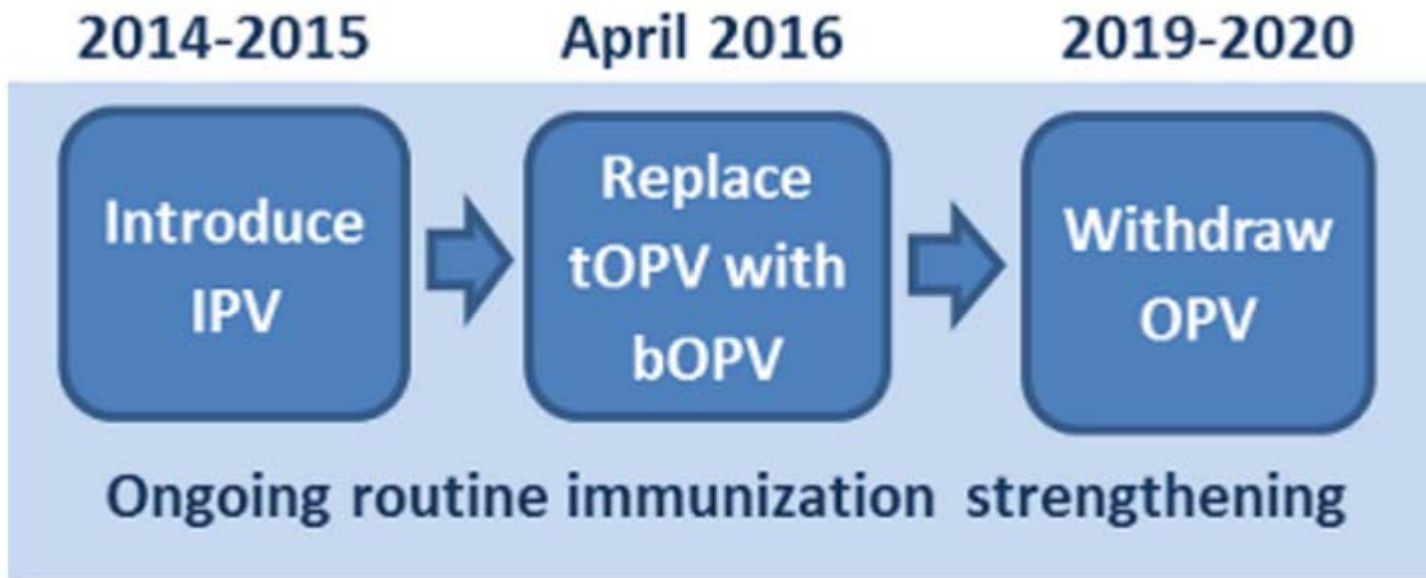
**Total countries and territories
confirmed as no longer using tOPV:
155 / 155 (as of 18 May)**



*Total countries and territories
that have submitted a switch validation report:
149 / 155 (as of 07/06/2016)*



Any remaining trivalent OPV stock must be collected and destroyed according to national guidance

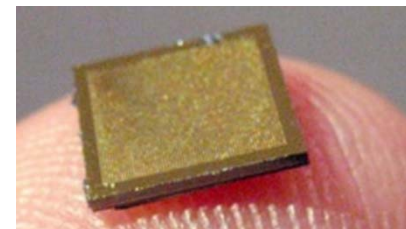


•To meet this objective, the Global Polio Eradication Initiative is pursuing a multi-pronged research agenda:

- dose-reduction strategy using intradermal administration of fractional IPV doses
- schedule requiring fewer doses (for example, two doses given six months apart)
- adjuvant use to reduce the quantity of antigen required in the vaccine
- IPV production processes to facilitate manufacture in low-cost sites.

(Sabin-IPV)
ongoing research

IPV nanopatch



Surveillance

Acute Flaccid Paralysis (AFP) surveillance

Nationwide AFP (acute flaccid paralysis) surveillance is the gold standard for detecting cases of poliomyelitis. The four steps of surveillance are:

1. *finding and reporting children with acute flaccid paralysis (AFP)*
2. *transporting stool samples for analysis*
3. *isolating and identifying poliovirus in the laboratory*
4. *mapping the virus to determine the origin of the virus strain.*

Environmental surveillance



© WHO/L.Dore

Explaining Environmental Surveillance

Eradicating polio is a particularly unforgiving task. While the virus remains anywhere in the world, it has the potential to spread around the globe to any vulnerable child or community. As the Global Polio Eradication Initiative (GPEI) zeros in on polio, it becomes more important than ever that every last virus is found and rapidly stopped in its tracks.

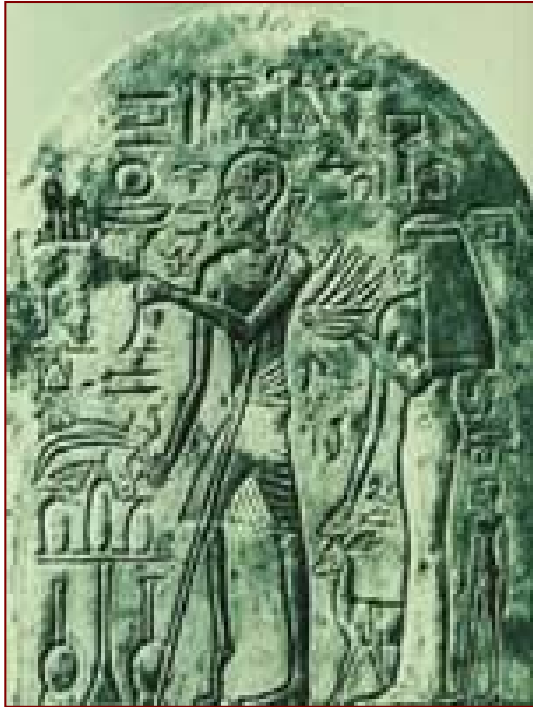
[Jan Felix Drexler, et al. Proc Natl Acad Sci U S A. 2014](#)

Robustness against serum neutralization of a poliovirus type 1 from a lethal epidemic of poliomyelitis in the Republic of Congo in 2010

A wild poliovirus 1 (WPV1) isolated from a fatal case (termed PV1-RC2010) showed a previously unknown combination of amino acid exchanges in critical antigenic site 2 (AgS2, VP1 capsid protein positions 221SAAL→221PADL). These exchanges were also detected in an additional 11 WPV1 strains from fatal cases. PV1-RC2010 escaped neutralization by three different mAbs relevant for AgS2

The six regions of the World Health Organisation



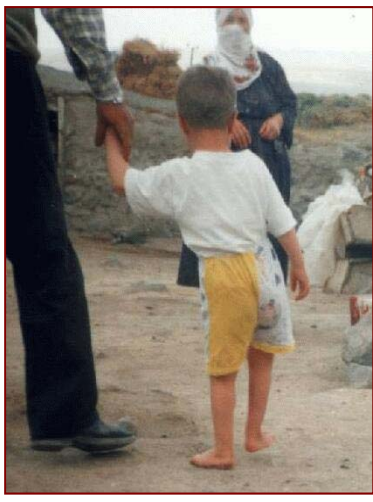


Americas Region
Luis Fermin Tenorio
Peru 1991



South East Asia
Rukhsar Khatoon
India 2011

Western Pacific Region
Mum Chanty
Cambodia 1997



European Region
Melik Minas
Turkey 1998

WHO Region of the Americas: declared polio free in September 1994



VAPP in the Postelimination Era in Latin America and the Caribbean, 1992–2011

72 VAPP in vaccine recipients
119 VAPP in contacts

[Morbidity & Mortality Weekly Report 2005](#)

Imported Vaccine-Associated Paralytic Poliomyelitis

Circulating vaccine-derived poliovirus (cVDPV)

2000-2001 DoR/Haiti

2005: 5 cases of polio in Amish group

2009: Transmission of imported vaccine-derived poliovirus in an undervaccinated community in Minnesota

Wild poliovirus

On 18 June 2014, the National IHR Focal Point for Brazil reported the isolation of wild poliovirus type 1 (WPV1) from sewage samples collected in March 2014 at Viracopos International Airport, in Campinas municipality in the State of São Paulo

On October 29, 2000, the Regional Commission for the Certification of Poliomyelitis Eradication certified that the **Western Pacific Region (WPR)** of the World Health Organization (WHO) is free of indigenous wild poliovirus transmission.



CHINA *polio free since 1999*

July - October 2011: China experienced an outbreak caused by imported wild poliovirus type 1 from Pakistan

The outbreak affected 10 young children and 11 adults, and resulted in 2 deaths

China adopted four core strategies

- high routine immunization coverage with three doses of poliovirus vaccine
- supplementary doses of OPV to all children mainly under five years of age during SIAs, with some SIAs in expanded age-groups according to epidemiological evidences
- surveillance for wild poliovirus
- targeted “mop-up” campaigns

3 cVDPV type 1 cases in the Philippines during 2001

2 cVDPV type 1 in the China in 2004 and 2 type 2 cases in 2012

11 cVDPV type 1 cases in Laos during 2015- 16

WHO in South-East Asia

Bangladesh

Bhutan

Democratic People's Republic of Korea

India

Indonesia

Maldives

Myanmar

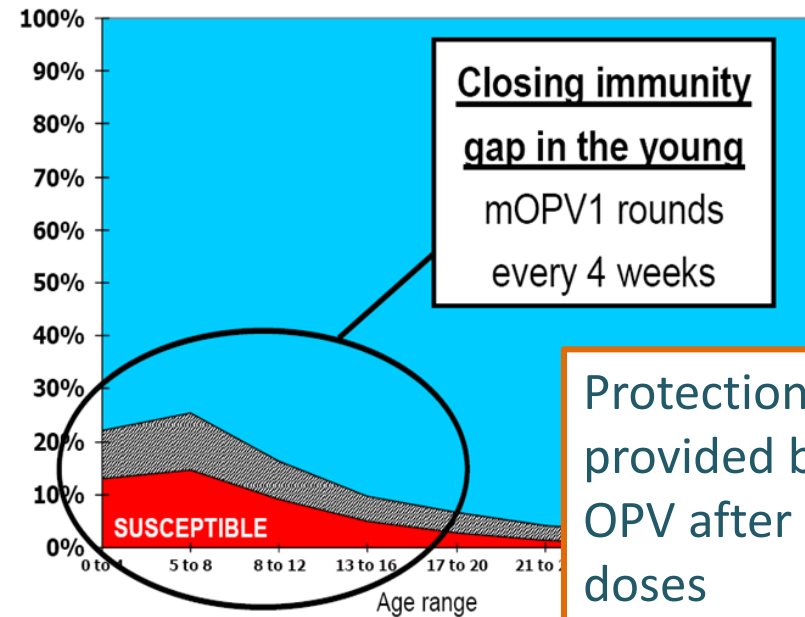
Nepal

Sri Lanka

Thailand

Timor-Leste

New 'Accelerated' Strategy, India



Polio-free certification: WHO South-East Asia

7th Meeting of the South-East Asia Regional Certification Commission for Polio Eradication (SEA-RCCPE) - New Delhi, India, 27 March 2014

The WHO South-East Asia Region has been maintaining its polio-free status for the last 3 years. After the last wild polio case was reported from India on 13 January 2011, the Region is firmly on track for polio-free certification in March 2014.

WHO African Region

Friday, September 25, 2015

WHO Removes Nigeria from Polio Endemic List

Nigeria

- No wild poliovirus type 1 (WPV1) cases have been reported in 2016. No cases were reported in 2015.
- No new environmental samples of type 2 circulating vaccine-derived poliovirus (cVDPV2) were reported this week. The most recent positive sample was collected 23 March 2016.

A second campaign using monovalent oral polio vaccine type 2 will take place in the north east of Nigeria on 13 – 18 June. The Director General of the World Health Organization has authorized the vaccine release from the global stock pile.



West Africa

National Immunization Days (NIDs) are planned in August in Côte d'Ivoire, Guinea and Sierra Leone and Subnational Immunization Days (SNIDs) in Niger in September. In October, NIDs are planned in Benin, Guinea, Liberia, Mali and Sierra Leone, and SNIDs in Mauritania.

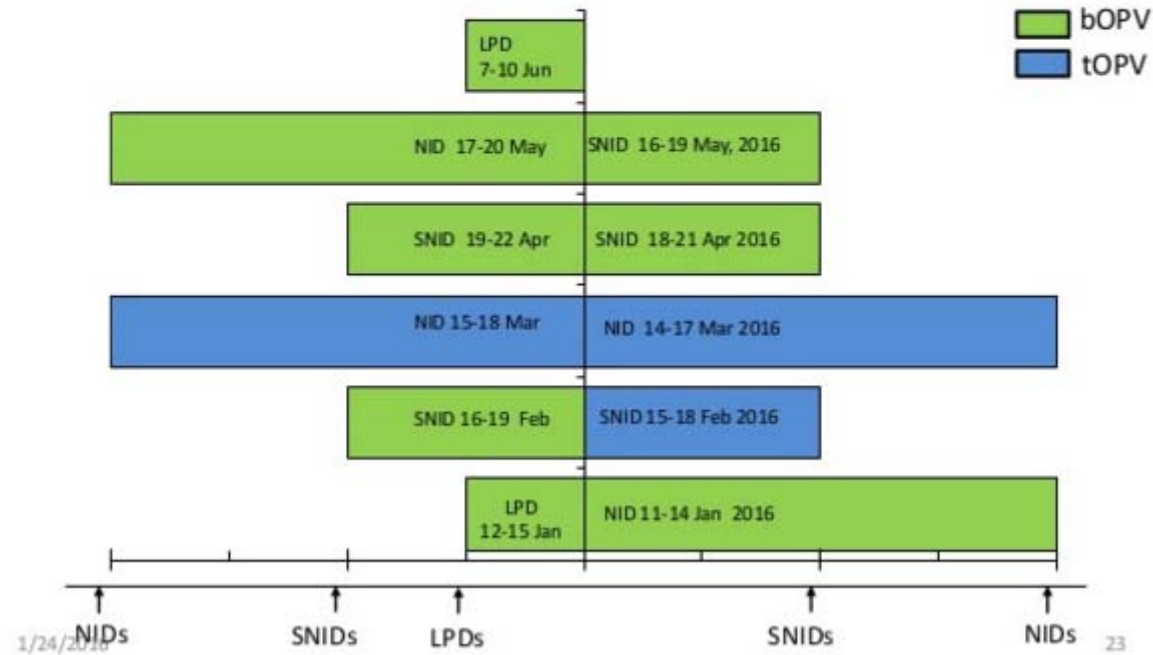
SIA schedule AFG & PAK, 1st semester 2016

Clip slide



AFGHANISTAN

PAKISTAN



The polio program has driven major impact on children's lives and the global economy since 1988.



What happens if we do not act now

More than 400 million children currently receive the necessary immunization every year to prevent polio. If the international community changes course and divests in polio eradication, large numbers of children will no longer be immunized and new cases of polio will spread. **There could be as many as 200,000 cases within 10 years, every single year, all over the world.**

Michel Zaffran, Director, Polio Eradication, WHO