

# Estimated Effect of Inactivated Poliovirus Vaccine Campaigns, Nigeria and Pakistan, January 2014–April 2016

## Technical Appendix

**Technical Appendix Table 1.** Incidence of poliomyelitis associated with cVDPV2 and prevalence of this virus in environmental samples in Nigeria in the 90-d period before and after campaigns with different vaccine types\*

Vaccine type(s) and state	No. campaigns†	Poliomyelitis incidence (no. cases/100,000 child-years)‡				Virus prevalence in environment, % (no. positive samples/no. tested)			
		Before campaign	After campaign	IRR (95% CI)§	p value	Before campaign	After campaign	PR (95% CI)§	p value
<b>IPV + tOPV</b>									
All	55	0.82 (12/14.59)	0.14 (2/14.59)	0.17 (0.039–0.783)	0.023	13.2 (7/53)	1.9 (1/53)	0.16 (0.019–1.334)	0.09
Adamawa	0	-	-			-	-		
Borno	27	1.94 (11/5.67)	0.18 (1/5.67)			25.0 (3/12)	0.0 (0/10)		
FCT, Abuja	0	-	-			-	-		
Jigawa	0	-	-			-	-		
Kaduna	2	0.00 (0/1.01)	0.00 (0/1.01)			12.5 (1/8)	0.0 (0/8)		
Kano	8	0.00 (0/4.22)	0.00 (0/4.22)			0.0 (0/13)	0.0 (0/13)		
Katsina	0	-	-			-	-		
Kebbi	0	-	-			-	-		
Lagos	0	-	-			-	-		
Sokoto	3	0.00 (0/0.90)	0.00 (0/0.90)			15.8 (3/20)	0.0 (0/19)		
Yobe	15	0.36 (1/2.79)	0.36 (1/2.79)			-	33.3 (1/3)		
<b>tOPV</b>									
All	2759	0.01 (7/639.85)	0.01 (4/555.62)	0.59 (0.18–1.97)	0.391	4.5 (18/397)	2.5 (9/353)	0.45 (0.21–0.95)	0.036
Adamawa	97	0.00 (0/17.84)	0.00 (0/14.66)			0 (0/20)	0 (0/14)		
Borno	90	0.00 (0/16.60)	0.00 (0/15.42)			0 (0/33)	2.4 (1/42)		
FCT, Abuja	24	0.00 (0/6.73)	0.16 (1/6.29)			0 (0/20)	0 (0/19)		
Jigawa	108	0.09 (2/21.96)	0.00 (0/18.83)			0 (0/27)	4 (1/25)		
Kaduna	96	0.00 (0/29.77)	0.00 (0/26.56)			18.2 (6/33)	9.1 (3/33)		
Kano	176	0.09 (4/45.29)	0.05 (2/39.97)			21.9 (7/32)	7.1 (2/28)		
Katsina	136	0.03 (1/29.61)	0.00 (0/25.47)			0 (0/39)	0 (0/25)		
Kebbi	84	0.00 (0/16.87)	0.00 (0/14.42)			0 (0/39)	0 (0/29)		
Lagos	54	0.00 (0/38.46)	0.00 (0/32.64)			0 (0/53)	0 (0/42)		
Sokoto	102	0.00 (0/18.88)	0.00 (0/16.61)			6.4 (5/78)	2.7 (2/73)		
Yobe	56	0.00 (0/8.66)	0.12 (1/8.16)			0 (0/23)	0 (0/23)		
<b>bOPV</b>									
All	838	0.04 (3/84.82)	0.04 (3/71.09)	1.14 (0.23–5.62)	0.868	12.5 (9/72)	25.4 (16/63)	1.76 (0.82–3.78)	0.145

Vaccine type(s) and state	No. campaigns†	Poliomyelitis incidence (no. cases/100,000 child-years)‡			p value	Virus prevalence in environment, % (no. positive samples/no. tested)			
		Before campaign	After campaign	IRR (95% CI)§		Before campaign	After campaign	PR (95% CI)§	p value
Adamawa	21	0.00 (0/0.05)	-			0 (0/1)	-		
Borno	51	0.00 (0/4.99)	0.47 (2/4.25)			60 (3/5)	78 (7/9)		
FCT, Abuja	0	-	-			-	-		
Jigawa	79	0.00 (0/7.26)	0.00 (0/6.91)			-	-		
Kaduna	72	0.00 (0/11.36)	0.00 (0/8.94)			20 (3/15)	0.0 (0/8)		
Kano	133	0.20 (3/14.93)	0.07 (1/14.37)			18 (2/11)	30 (3/10)		
Katsina	107	0.00 (0/10.97)	0.00 (0/7.73)			13 (1/8)	14 (1/7)		
Kebbi	66	0.00 (0/5.39)	0.00 (0/3.94)			0 (0/13)	0.0 (0/4)		
Lagos	0	-	-			-	-		
Sokoto	61	0.00 (0/4.53)	0.00 (0/5.23)			0 (0/19)	20 (5/25)		
Yobe	49	0.00 (0/3.64)	0.00 (0/3.25)			-	-		

\*bOPV, bivalent oral poliovirus vaccine; FCT, Federal Capital Territory; IPV, inactivated poliovirus vaccine; IRR, incidence rate ratio; PR, prevalence ratio; tOPV, trivalent oral poliovirus vaccine; -, indicate no district-campaign observations for that vaccine type and state.

†Campaigns in each district were counted separately.

‡Children 0–14 y of age, corresponding to the age range for acute flaccid paralysis surveillance.

§By mixed-effects regression.

**Technical Appendix Table 2.** Sensitivity analysis of incidence rate and prevalence ratios estimated from clinical and environmental data from Nigeria to the period of time considered before and after each campaign\*

Ratio and vaccine type	Time period				
	30 d	60 d	90 d	120 d	150 d
IRR (95% CI)					
IPV+tOPV	0.85 (0.13–5.64)	0.27 (0.056–1.28)	0.17 (0.039–0.78)	0.16 (0.036–0.72)	0.22 (0.063–0.770)
tOPV	2.18 (0.41–11.6)	1.40 (0.42–4.69)	0.59 (0.18–1.97)	1.11 (0.40–3.11)	0.55 (0.17–1.82)
bOPV	1.86 (0.78–4.47)	4.12 (0.96–17.70)	1.14 (0.23–5.62)	12.3 (0.57–265)	NA
PR (95% CI)					
IPV+tOPV	1.29 (0.13–12.5)	0.38 (0.046–3.19)	0.16 (0.019–1.33)	NA	0.052 (0.006–0.424)
tOPV	0.73 (0.32–1.69)	0.47 (0.22–1.00)	0.45 (0.21–0.95)	NA	0.37 (0.18–0.76)
bOPV	1.36 (0.75–2.46)	1.59 (0.83–3.02)	1.76 (0.82–3.78)	NA	NA

\*bOPV, bivalent oral poliovirus vaccine; IPV, inactivated poliovirus vaccine; IRR, incidence rate ratio; NA, regression estimate did not converge; PR, prevalence ratio; tOPV, trivalent oral poliovirus vaccine.

**Technical Appendix Table 3.** Incidence of poliomyelitis associated with serotype-1 wild-type poliovirus and prevalence of this virus in environmental samples before and after vaccination campaigns with different poliovirus vaccine, Pakistan, January 2014–April 2016\*

Vaccine type(s), Pakistan state	No. campaigns†	No. cases/100,000 child-years‡				p value	Environmental prevalence, % (no. positive samples/total no. tested)			
		Before campaign	After campaign	IRR (95% CI)§	Before campaign		After campaign	PR (95% CI)§	p value	
IPV+tOPV										
All	133	0.15 (19/122.65)	0.16 (14/87.44)	1.01 (0.50–2.02)	0.979	23.0 (34/148)	21.2 (22/104)	0.88 (0.56–1.38)	0.574	
Balochistan	11	1.44 (10/6.96)	0.48 (3/6.21)			33.3 (12/36)	31.3 (10/32)			
FATA	4	0.48 (1/2.10)	3.07 (6/1.95)			-	-			
Islamabad	0	-	-			-	-			
Khyber	59	0.15 (7/48.06)	0.20 (5/25.46)			23.5 (8/34)	11.8 (2/17)			
Pakhtunkhwa										
Punjab	8	0.00 (0/22.34)	0.00 (0/22.34)			6.3 (1/16)	21.4 (3/14)			
Sindh	51	0.02 (1/43.20)	0.00 (0/31.48)			21.0 (13/62)	17.1 (7/41)			

Vaccine type(s), Pakistan state	No. campaigns†	No. cases/100,000 child-years‡				Environmental prevalence, %, (no. positive samples/total no. tested)			
		Before campaign	After campaign	IRR (95% CI)§	p value	Before campaign	After campaign	PR (95% CI)§	p value
<b>tOPV</b>									
All	590	0.31 (173/553.00)	0.24 (134/547.16)	0.79 (0.63–0.99)	0.039	23.6 (70/296)	22.8 (73/320)	0.93 (0.71–1.22)	0.586
Balochistan	117	0.28 (7/24.79)	0.41 (10/24.31)			40.0 (6/15)	28.0 (7/25)		
FATA	61	6.69 (115/17.19)	4.42 (69/15.63)			–	–		
Islamabad	10	0.00 (0/7.10)	0.00 (0/7.41)			18.2 (2/11)	0.0 (0/12)		
Khyber Pakhtunkhwa	67	0.58 (32/55.31)	0.54 (36/66.66)			27.6 (8/29)	27.1 (13/48)		
Punjab	141	0.01 (3/330.27)	0.00 (1/314.73)			13.4 (21/157)	15.0 (22/147)		
Sindh	126	0.15 (16/105.38)	0.17 (18/106.04)			39.3 (33/84)	35.2 (31/88)		
<b>bOPV</b>									
All	421	0.07 (12/174.80)	0.08 (7/85.10)	1.02 (0.41–2.58)	0.963	29.3 (17/58)	27.7 (13/47)	0.98 (0.58–1.67)	0.954
Balochistan	71	0.28 (2/7.26)	0.37 (1/2.73)			40.0 (4/10)	20.0 (1/5)		
FATA	21	0.00 (0/0.49)	0.00 (0/0.03)			–	–		
Islamabad	2	0.00 (0/0.02)	–			–	–		
Khyber Pakhtunkhwa	66	0.20 (5/24.39)	0.06 (1/17.27)			16.7 (2/12)	15.4 (2/13)		
Punjab	92	0.01 (1/100.50)	0.02 (1/42.76)			0.0 (0/16)	7.7 (1/13)		
Sindh	125	0.11 (4/36.73)	0.19 (4/21.10)			55.0 (11/20)	56.3 (9/16)		

\*Data are for the 90-d period before and after the campaigns. bOPV, bivalent oral poliovirus vaccine; FATA, Federally Administered Tribal Areas; IPV, inactivated poliovirus vaccine; IRR, incidence rate ratio; PR, prevalence ratio; tOPV, trivalent oral poliovirus vaccine; –, indicate no district-campaign observations for that vaccine type and state.

†Campaigns in each district were counted separately.

‡Children 0–14 y of age, corresponding to the age range for acute flaccid paralysis surveillance.

§By mixed-effects regression.

**Technical Appendix Table 4.** Sensitivity analysis of incidence rate and prevalence ratios estimated from clinical and environmental data from Pakistan to the period of time considered before and after each poliovirus vaccination campaign\*

Ratio and vaccine type	Time period				
	30 d	60 d	90 d	120 d	150 d
<b>IRR (95% CI)</b>					
IPV+tOPV	2.12 (0.64,7.10)	0.82 (0.34,1.97)	1.01 (0.50,2.02)	0.75 (0.39,1.42)	0.56 (0.33,0.95)
tOPV	0.75 (0.52,1.06)	0.88 (0.69,1.14)	0.79 (0.63,0.99)	0.80 (0.64,1.00)	0.67 (0.53,0.86)
bOPV	0.56 (0.38,0.84)	0.91 (0.51,1.63)	1.02 (0.41,2.58)	NA	0.49 (0.039,6.293)
<b>PR (95% CI)</b>					
IPV+tOPV	0.50 (0.21,1.20)	0.75 (0.44,1.28)	0.88 (0.56,1.38)	0.71 (0.46,1.10)	0.85 (0.59,1.23)
tOPV	1.00 (0.67,1.48)	0.94 (0.71,1.26)	0.93 (0.71,1.22)	1.01 (0.78,1.32)	1.00 (0.76,1.30)
bOPV	0.77 (0.55,1.08)	0.93 (0.59,1.48)	0.98 (0.58,1.67)	1.00 (0.41,2.43)	0.61 (0.087,4.332)

\*bOPV, bivalent oral poliovirus vaccine; IPV, inactivated poliovirus vaccine; IRR, incidence rate ratio; NA, regression estimate did not converge; PR, prevalence ratio; tOPV, trivalent oral poliovirus vaccine.