

2011	2012
Last case in India	Last cases in Angola and Dem. Rep. of the Congo
3 countries with re-established transmission	1 country with re-established transmission
11 outbreaks in 9 countries	1 outbreak
16 countries, 650 cases	5 countries, 223 cases

4.1 The World Health Assembly, the annual meeting of the Ministers of Health of all WHO Member States, first committed to polio eradication when it adopted resolution 41.28 in 1988 calling for the worldwide eradication of the disease by the year 2000. That marked the launch of the GPEI, spearheaded by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC) and UNICEF.

Since 1988, the GPEI has reduced the global incidence of polio by more than 99.9%, three of six WHO regions have been “certified” polio-free (the Region of the Americas in 1994, the Western Pacific Region in 2000 and the European Region in 2002), and one of the three WPV serotypes (type 2) has been eradicated.

In May 2012 the World Health Assembly declared the completion of polio eradication a “programmatic emergency for global public health” and called for a marked increase in the intensity of eradication activities in the poorest performing regions.

4.2 At that time, endemic WPV transmission existed in more than 125 countries and each year more than 350 000 children were paralysed for life by polio. Since 1988, the GPEI has reduced the global incidence of polio by more than 99.9%, three of six WHO regions have been “certified” polio-free (the Region of the Americas in 1994, the Western Pacific Region in 2000 and the European Region in 2002), and one of the three WPV serotypes (type 2) has been eradicated (last isolated in 1999).

4.3 Through the GPEI, more than 10 billion doses of OPV have been administered to more than 2.5 billion children worldwide; more than 10 million people are walking today who otherwise would have been paralysed; and over 1 million childhood deaths have been prevented through the administration of vitamin A during polio campaigns.⁸

4.4 In January 2012, a fourth WHO region (the South-East Asia Region) took a major step towards polio-free certification as India passed the milestone of one year without a single case. As India moved towards this milestone, however, case numbers doubled in 2011 in the three remaining polio-endemic countries: Afghanistan,

Nigeria and Pakistan. Given the increasing evidence from recent outbreaks of the terrible consequences of failing to complete polio eradication,⁹ but also the potential for success as shown by India, in May 2012 the World Health Assembly declared the completion of polio eradication a “programmatic emergency for global public health” and called for a marked increase in the intensity of eradication activities in the poorest performing regions.

⁸ An estimated 1.1 to 5.4 million childhood deaths were averted as of the end of 2010. Duintjer Tebbens RJ, Pallansch MA, Cochi SL et al. *Economic analysis of the Global Polio Eradication Initiative*. *Vaccine*, 2010, 29 (2):334-343.

⁹ Notably outbreaks in adults in the Democratic Republic of the Congo in 2010-2011 caused by wild poliovirus type 1.

4.5 In all three remaining polio-endemic countries, national Emergency Action Plans were established to overcome the remaining barriers to reaching every child with polio vaccines; in each country, oversight bodies reporting to heads of state were further extended from the national to subnational levels to intensify political and administrative accountability for the quality of key eradication activities. The core GPEI partners intensified their activities to reflect this emergency and a massive surge of technical assistance was deployed to the highest risk areas for polio to assist governments with strategy implementation. In September 2012, the Secretary-General of the United Nations hosted a high-level meeting on the polio eradication emergency during the sixty-seventh session of the United Nations General Assembly, to reinforce national and international commitment to achieving eradication and mobilizing the necessary financing. The gathering was attended by the heads of state of the three countries where the disease is endemic, the heads of the partner agencies, donors and other stakeholders.

4.6 As a direct result of emergency actions taken by GPEI partners and national governments, 2012 witnessed the lowest number of new polio cases in fewer districts of fewer countries than at any previous time in history. Globally, 223 cases were reported in 2012, a 66% decline compared with 2011. At the end of 2012, Angola and the Democratic Republic of the Congo successfully stopped transmission of re-established poliovirus and Chad was on track to do the same (its most recent case was on 14 June 2012). Five countries reported cases in 2012 compared with 16 in 2011. In two of the endemic countries, Pakistan and Afghanistan, case numbers

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Figure 3: Polio-infected districts, 2012



Table 3: Wild poliovirus cases by quarter, 2012

Quarter	GLOBAL BY QUARTER	GLOBAL BY QUARTER & TYPE			BY QUARTER AND REGION		
	Total cases	WPV 1	WPV3	Total cases	WHO Africa region	WHO Eastern Mediterranean Region	Total cases
Q1	54	44	9	54*	33	21	54
Q2	50	43	7	50	34	16	50
Q3	74	70	4	50	39	35	74
Q4	45	44	1	50	22	23	45
Total	223	201	21	223	128	95	223

* Includes one WPV1/WPV3 mixture

declined by 65% and 42% relative to 2011, respectively. In Nigeria, case numbers doubled compared with the same period in 2011, but by the end of 2012 there was strong evidence of improving programme performance in the historically worst-performing areas.

4.7 Throughout the global polio eradication effort, viruses from endemic areas, particularly India and Nigeria, have regularly reinfected polio-free areas, leading to importation-associated outbreaks and, in four previously polio-free countries, the re-establishment of persistent transmission. Although international spread was limited to only one event in 2012 in Niger resulting from a virus genetically linked to transmission in Nigeria, importations will remain a significant and constant threat until all WPV transmission is interrupted globally.

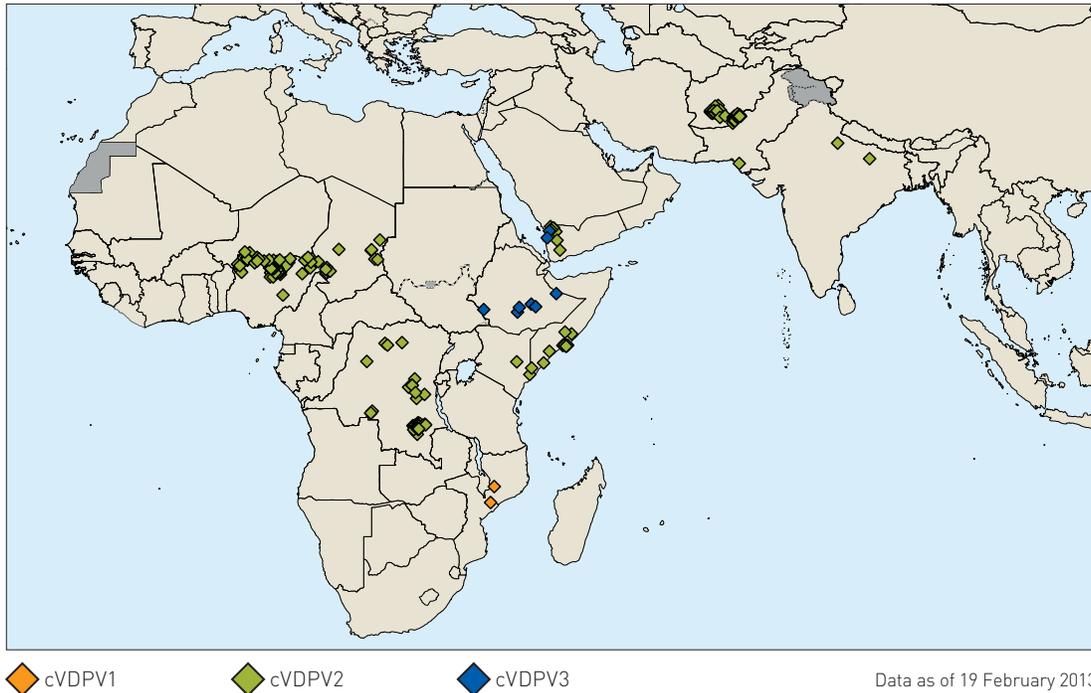
4.8 In January 2013, the WHO Executive Board reinforced the importance of full OPV vaccination of travellers, per the recommendations of WHO publication *International travel and health*.

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Although in 2012, more countries suffered a polio outbreak due to a cVDPV than due to a wild poliovirus, the development of new tools and implementation of new strategies enable this risk to be addressed in parallel with wild poliovirus eradication.

4.9 As the GPEI has worked to eradicate WPVs globally, it has come to better understand the risks that vaccine-related polioviruses pose to a polio-free world. Vaccine-associated paralytic poliomyelitis (VAPP) was well documented prior to the launch of the eradication effort and it was understood that VAPP could eventually be eliminated by stopping the use of OPV globally after wild virus eradication. Only in 1999-2000, however, was it proven that VDPVs could regain the capacity to cause polio outbreaks (i.e. become circulating VDPVs or cVDPVs). It is now understood that VDPVs can also, very rarely, result in chronic infection (i.e. immunodeficiency-associated vaccine-derived poliovirus) in individuals with certain congenital immunodeficiency syndromes.

4.10 In 2012, for the first time ever, more countries suffered a polio outbreak due to a cVDPV (primarily as the result of a type 2 virus) than due to a WPV, reaffirming the importance of rapidly addressing this risk (Figure 4). Fortunately, the substantial body of knowledge built since the first detection of a cVDPV in 1999-2000 has now

Figure 4: Circulating vaccine-derived poliovirus cases by type, 2010-2012

culminated in the tools and strategies needed to eliminate VDPVs in parallel with WPV eradication during the 2013-2018 period.

4.2 ACKNOWLEDGING THE PAST – LESSONS LEARNT

4.11 Since the launch of the GPEI, three major deadlines were established: interruption of transmission by 2000, certification of eradication in 2005 and, most recently, interruption of transmission by the end of 2012. Consequently, as part of this Plan's development, the GPEI embarked on a critical review of the programme to assess:

- how lessons from past successes and failures should inform future strategy;
- whether the remaining endemic countries are on a trajectory to complete eradication;
- the strength of the case for completing eradication, taking into account the new resources required through 2018.

4.12 The combination of these evaluations has provided the GPEI with a better understanding of why past deadlines were missed, how close the remaining endemic countries are to achieving their goals and how critical this global eradication effort continues to be.

Lesson 1: One size does not fit all

Three major deadlines missed prompted a critical review of the programme:

- **Interruption of transmission by 2000**
- **Certification of eradication in 2005**
- **Interruption of transmission by 2012**

4.13 The GPEI missed its first target date of 2000 for interrupting WPV transmission globally. This was due in part to the late launch of OPV campaigns in key geographies, including some plagued by high case rates and intense transmission. At that time, interruption of transmission in any particular country was expected to occur within two to three years of the launch of National Immunization Days (NIDs). The launch of these campaign activities as late as 1999-2000 in countries such as the Democratic Republic of the Congo and Sierra Leone meant that a 2000 deadline was poorly planned, inadequately financed and impossible to achieve. Equipped with a better understanding of the critical importance of OPV campaigns in interrupting transmission, the GPEI doubled the number of supplementary immunization activities (SIAs) conducted in the period from 2000 to 2005. This was supported by a tenfold increase in technical support staff and the introduction of house-to-house vaccination. By

2005, six endemic countries remained – down from more than 20 in 2000. Although only six remaining endemic countries globally marked an improvement, the target of certification of eradication by 2005 had not been achieved. Moreover, the programme retained its existing approaches, merely intensifying them, thereby missing opportunities to truly innovate, refine tactics to the specific country context or improve immunization systems.

Three key lessons:

- One size does not fit all
- Technological innovation cannot overcome failings in management and community engagement
- A combination of innovations can succeed in the hardest settings

Lesson 2: Technological innovation cannot overcome gaps in programme management and community

engagement

4.14 In the mid-2000s, the GPEI recognized that some areas posed exceptional challenges to stopping poliovirus transmission due to high population density, poor sanitation and a very high force of infection. This complicated the situation in India and Egypt in particular because, unlike the other infected areas at that time, where the main issue was a failure to reach children, both countries had high levels of vaccination coverage but were not achieving high enough serological conversion and mucosal immunity levels to interrupt transmission.

4.15 In 2005, monovalent OPV vaccines (mOPV1, mOPV3), which provided higher per dose seroconversion rates but tackled only one poliovirus serotype at a time, were developed and introduced as a means to address this issue. Egypt stopped transmission within six months of the introduction of mOPV1, leading many to believe that intensive use of mOPV could overcome persistent transmission in other areas. India introduced mOPV1 and mOPV3 in 2005 but – over the course of the next five years – veered between alternating type 1 and 3 outbreaks. Other endemic countries, particularly Nigeria and Pakistan, continued to have widespread transmission. This demonstrated that in the remaining endemic countries, which faced challenges of basic management and community engagement, technological solutions alone were not sufficient. By 2010, although only four countries still remained endemic, many more had suffered major importation-associated outbreaks due to weak immunization systems.

THE GPEI LEARNT THAT

- due to underlying factors that affect poliovirus transmission, all countries will not respond to OPV campaigns and stop transmission with similar speed
- in some contexts, it is necessary to tackle issues and focus interventions at a micro level to achieve coverage levels
- programme performance data are often not accurate enough to guide programme planning and corrective action
- technical solutions cannot compensate for basic management and accountability issues, nor political, societal and cultural factors strong immunization systems are essential to prevent reinfection and outbreaks

Lesson 3: A combination of innovations tailored to the country context can deliver success in even the most challenging conditions

4.16 To rapidly drive immunity levels above the thresholds needed to interrupt poliovirus transmission in the remaining four endemic countries, the GPEI needed to develop more effective tactics and tools both to reach the remaining missed children and to more effectively seroconvert them, especially in areas with a high enteric disease burden due to extremely poor sanitary conditions. It was necessary to more systematically identify who these children were and how they could be reached. Furthermore, the GPEI had to consider how to more accurately monitor the success of these efforts. This represented a substantial departure from previous approaches that were mainly focused on technical solutions with insufficient attention to operational tactics or societal issues.

4.17 The GPEI built on the technical innovations that had contributed to success in Egypt and focused on improvements in operations, monitoring and social mobilization. This included the development of a set of new tactics and tools including, but not limited to, strategies for “underserved” populations, the Short Interval Additional Dose (SIAD) strategy,¹⁰ seroprevalence surveys and modelling, universal finger-marking, migrant and transit strategies, independent monitoring and Lot Quality Assurance Sampling (LQAS)¹¹ surveys. At the same time, the GPEI pursued the rapid development and licensure of a new bivalent formulation of OPV (bOPV), which maximized the impact of each contact with a child by tackling both of the remaining WPV serotypes with a new vaccine that achieved an efficacy close to that of each of the monovalent vaccines.

4.18 These approaches were first and most systematically applied in India. By 2010, over 95% of children in India were being reached in OPV campaigns, but the large birth cohort (26 million children per year) meant that the small percentage of children being missed still represented a population sufficient to maintain transmission. These missed children existed mostly in underserved populations, outside the usual health systems – nomads, slum dwellers, children of construction and brick kiln workers, or other mobile and migrant groups. Armed with the new bivalent vaccine and a more thorough understanding of its underserved and at-risk populations, India intensively applied a range of new tactics for reaching and protecting these

Armed with a new bivalent vaccine and applying new tactics to reach its underserved children, India recorded its last case of polio in January 2011.

¹⁰ The SIAD approach involves administering two doses of monovalent OPV over the course of one or two weeks.

¹¹ The Lot Quality Assurance Sampling (LQAS) method classifies areas of interest corresponding to “lots” as having acceptable or unacceptable levels of vaccine coverage. This method detects pockets of low vaccine coverage and therefore directs focused vaccination efforts.

children. On 13 January 2011, India finally recorded its last case of polio due to an indigenous virus in a two-year-old girl near Kolkata. Translating these approaches to the remaining endemic areas and instituting the requisite accountability mechanisms to substantially enhance the quality of vaccination campaigns is a core goal of the Plan.

India was able to interrupt transmission because of its ability to apply a comprehensive set of tactics and tools to reach and immunize all children. Innovations were introduced in:

- microplanning
- operations
- monitoring and accountability
- technology (e.g. bOPV)
- social mobilization
- surge support

4.3 NEW EVIDENCE THAT WPV TRANSMISSION CAN BE INTERRUPTED BY THE END OF 2014

4.19 Lessons learnt from more than 20 years of successes and failures in polio eradication have informed the national Emergency Action Plans of the three remaining endemic countries. The full implementation of these plans and the intensification of necessary approaches to identify, access and immunize at-risk children who have been persistently missed are key components of the GPEI's strategy to interrupt poliovirus transmission globally (outlined in detail under Objective 1). New evidence from each of the remaining endemic countries strongly suggests that their polio eradication programmes showed marked improvements in reaching and vaccinating chronically missed children in 2012. While interruption cannot be guaranteed by a particular date and various factors could intervene, the remaining endemic countries are now on a trajectory to interrupt transmission by the end of 2014.

New evidence of progress from each of the remaining endemic countries suggests they are on a trajectory to interrupt wild poliovirus transmission by end-2014.

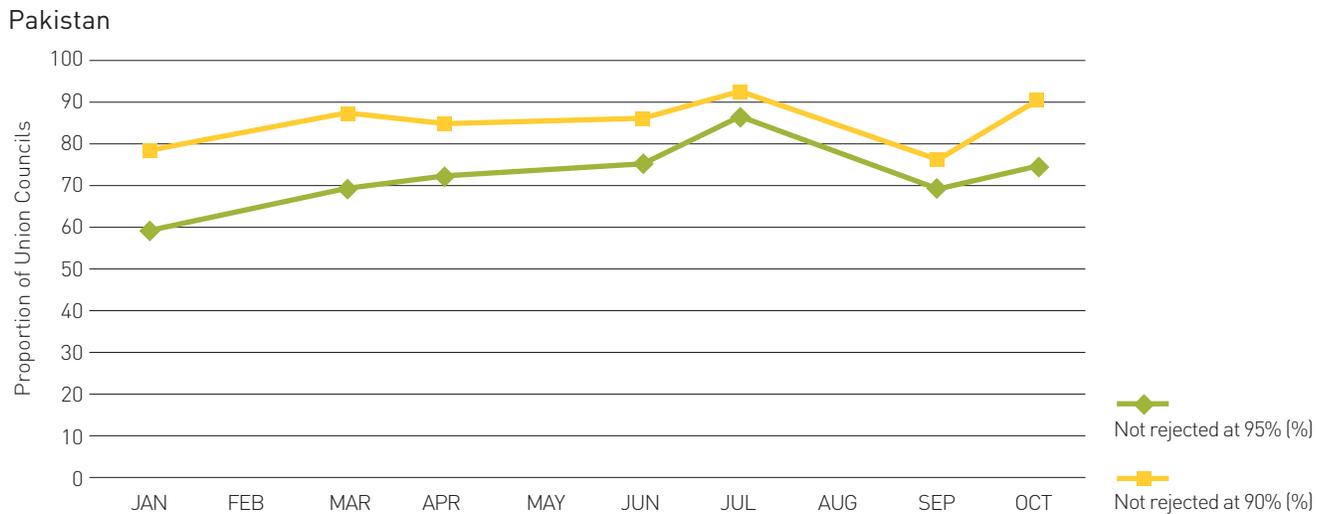
Evidence of progress

4.20 The most critical challenge to interrupting WPV transmission in the last poliovirus reservoirs is boosting OPV coverage to exceed the immunity levels needed to interrupt transmission. Accessing certain at-risk populations – particularly those children that have persistently been missed – has been the key challenge.

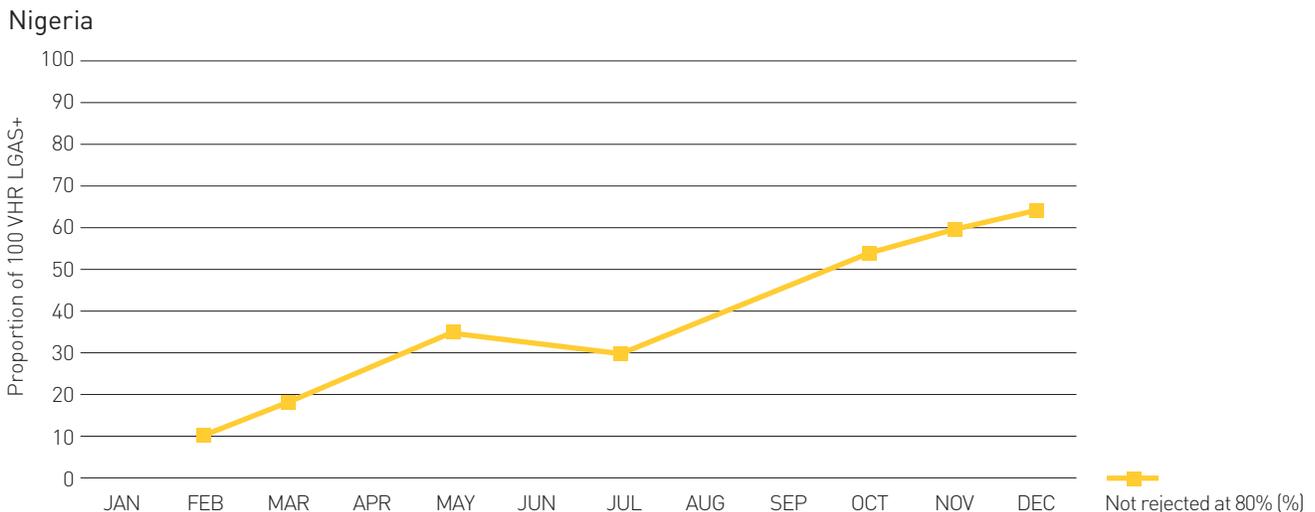
4.21 The year 2012 saw major breakthroughs in both SIA quality and access to missed children in most of the key poliovirus reservoir areas of each endemic country. In Nigeria, the proportion of very high-risk Local Government Areas in which vaccine coverage reached the estimated target threshold of 80% for stopping poliovirus transmission in that setting increased (Figure 5) from 10% in February 2012 to 70% in February 2013. In Pakistan, the proportion of highest-risk districts achieving the estimated target threshold of 95% in that setting increased from 59% in January 2012 to a peak of 74% in October; increasing insecurity in late 2012 compromised the capability to collect similar monitoring data through January

2013. In the 11 lowest performing districts in Southern Region of Afghanistan at highest risk for persistent transmission of polioviruses, the number of children inaccessible during the OPV campaigns declined from more than 60 000 in mid-2012 to some 15 000 by December 2012 (Figure 6).

Figure 5: Improvement in SIA quality for select Pakistan districts^a and Nigeria Local Government Areas,^b 2012^c

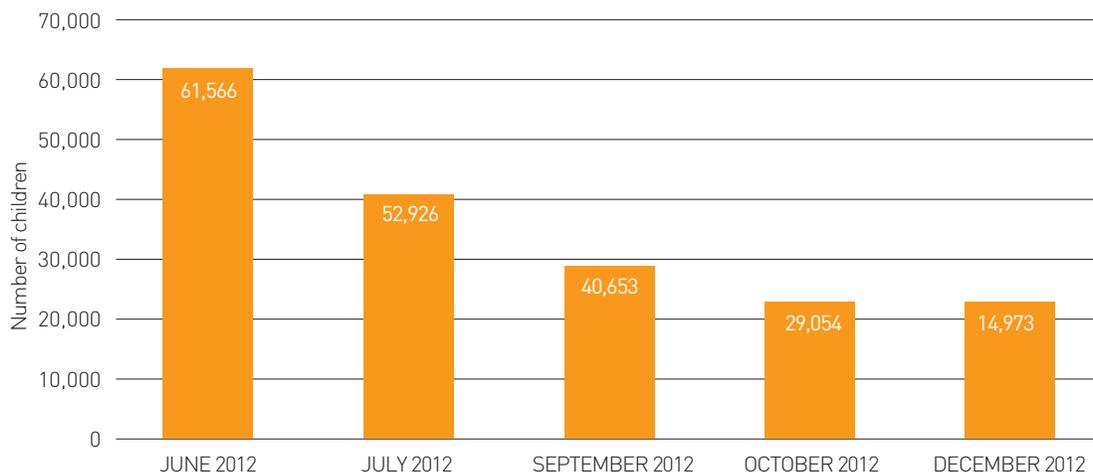


^a Data based on past LQAS methodology, which has been updated per new global guidelines.
^b December 2012. Nigeria using latest LQAS methodology.
^c Trends based on data generated with LQAS.
 NB: November and December 2012 data are not represented as LQAS was not conducted in Karachi and Khyber Pakhtunkhwa province due to insecurity.



+ Very high-risk Local Government Areas.
 Source: WHO.

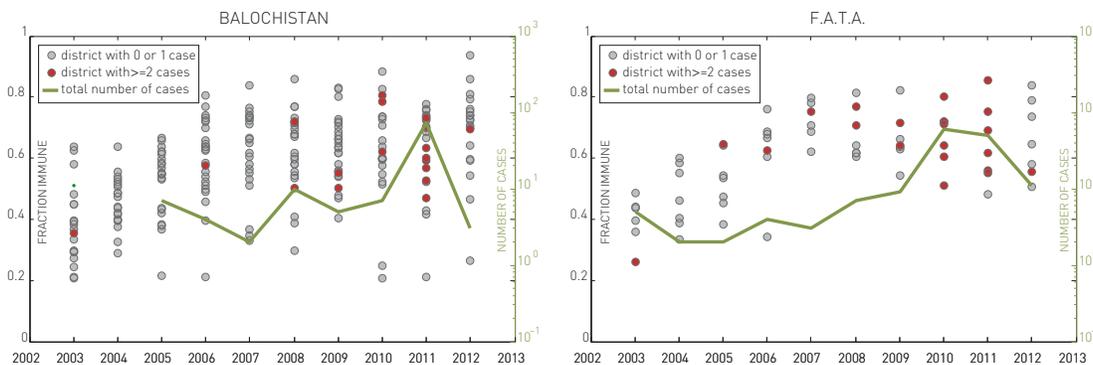
Figure 6: Reduction in inaccessible children in 11 low-performing districts in Southern Region Afghanistan, ^a June 2012-December 2012



^a Government of Afghanistan data. Surveys not conducted every month.

4.22 As a result of improved SIA quality, population immunity is rising. Past experience and trend line statistical evidence suggests the threshold for interrupting poliovirus transmission is 80% immunity in Nigeria and Afghanistan, and 90% immunity in Pakistan. Based on an analysis of the number of OPV doses children were receiving in each country by the end of 2012, estimates suggest the proportions of immune children are approaching these benchmarks (Figures 7 and 8).

Figure 7: Type 1 immunity changes over time for two key areas of Pakistan, ^a 2002-2013



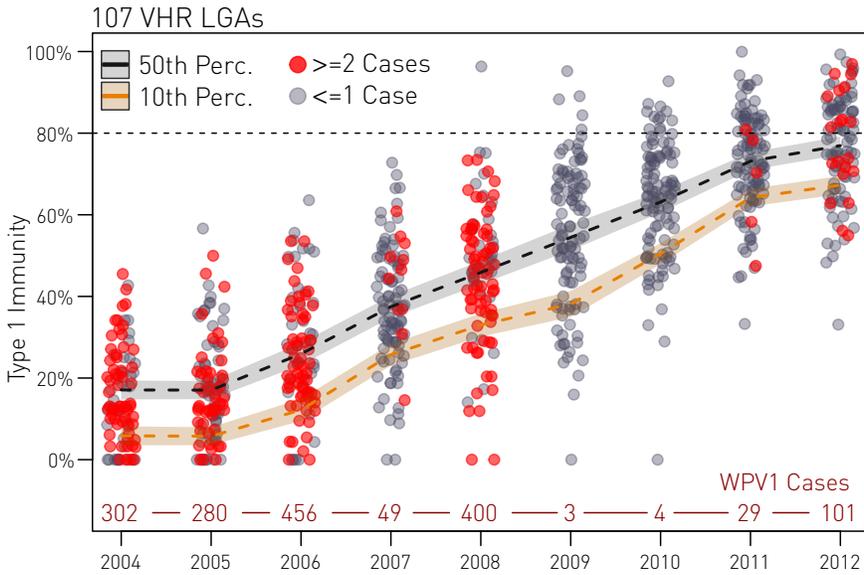
^a Government of Pakistan data.

NB: In the column of each year, a dot appears for each district in the state: red for 2+ cases and gray for 1 or 0 cases in that year. The height of each dot indicates estimated immunity based on non-polio acute flaccid paralysis (left y-axis). The total annual incidence of WPV1 cases in the state is shown by the green trace (right y-axis).

Any breaks in the green trace are years of zero cases.

Source: Global Good analysis, 2013.

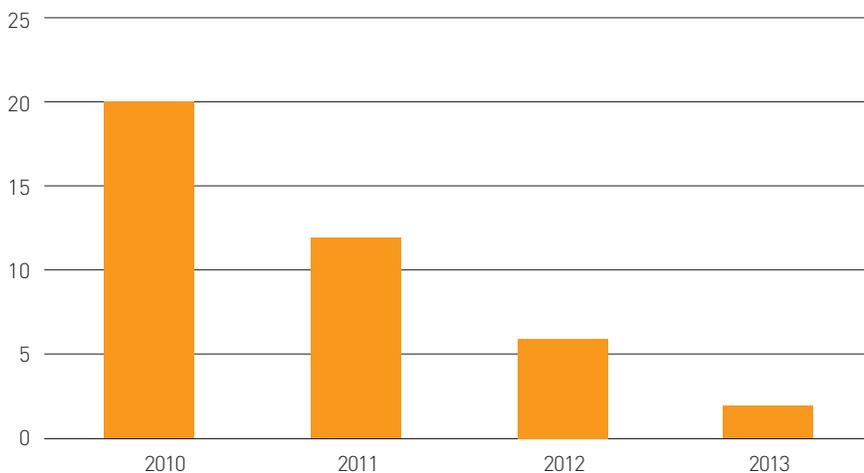
Figure 8: Type 1 immunity changes over time in very high-risk Local Government Areas of northern Nigeria,^a 2004-2012



^a Nigeria data analysis and modelling report, March 2013, EMOD polio team, Global Good fund
Source: Global Good analysis, 2013.

4.23 Most significantly, these improvements in OPV campaign performance and population immunity result in a substantial decrease in poliovirus genetic diversity and geographic extent, particularly in Afghanistan and Pakistan. In 2012, the number of WPV genetic clusters in these countries decreased markedly (Figure 9) and increasingly focused transmission concentrated in limited geographic areas, or reservoirs.

Figure 9: Decline in wild poliovirus genetic clusters in Pakistan and Afghanistan, 2010-2013



AFP, Acute flaccid paralysis.

Source: WHO.

4.4 THE CASE FOR COMPLETING POLIO ERADICATION

4.24 The benefits of reaching eradication continue to substantially outweigh the costs, even if there is a delay in interrupting the remaining WPV transmission in one or more countries.

It has been projected that failure to complete eradication would result in at least 200,000 cases annually in low-income countries, with consequent strain on health systems.

Completing eradication will generate net benefits of at least US\$ 40-50 billion, mostly in low- and low-middle-income countries.

Direct benefits of eradication and risks of polio reintroduction

4.25 The public health consequences of failing to complete polio eradication are dire. Research indicates that in a world where polio control (versus eradication) was the aim – and high-level population immunity waned as a result of the discontinuation of SIAs – taking into account current immunization levels, polio cases would be expected to increase rapidly to at least 200 000 cases annually in low-income countries, a rate comparable to the situation in 1998.¹² Not only would this generate significant public health and individual costs but it would place enormous strain on country health systems in managing large-scale polio outbreaks and epidemics.

4.26 From an economic perspective, completing polio eradication continues to provide significant benefit. A 2010 analysis of the long-term impact of the GPEI estimates that achieving eradication will generate net benefits of at least US\$ 40-50 billion, mostly in low- and low-middle-income countries, from 1988 to 2035.¹³ This study also finds that GPEI efforts disproportionately benefit low-income countries, with more than 85% of the net benefits experienced there. These findings hold even when taking into account rising programme costs and varying the assumptions on programme effectiveness. Other studies on the benefits of eradication have similarly found the health and net benefits to substantially exceed the financial costs of polio eradication efforts.¹⁴

Indirect and intangible benefits of eradication efforts

4.27 The impact of the GPEI extends beyond polio, benefiting other global and country health priorities. Support to measles campaigns, the distribution of vitamin A supplements and enhanced global surveillance and response capacity for epidemic-prone diseases are just three areas that have benefited from polio eradication staff and infrastructure and delivered clear public health dividends. Conservative estimates peg the value of the GPEI's coordination with other health initiatives at US\$ 17-90 billion in benefits associated with¹⁵ the distribution of vitamin A supplements and an estimated 1.1 (conservative) to 5.4 (maximum) million childhood deaths averted as of the end of 2010.¹⁶ Looking ahead, a well-organized and supported legacy plan that builds on relevant aspects of the polio network's lessons and infrastructure would drive gains across other health priorities. The GPEI infrastructure can provide a strong platform for addressing other vaccine-preventable diseases (VPDs) and support national health systems. Exploring this potential forms a core part of the Plan.

4.28 The significant and incalculable “intangible” impact of the global eradication programme cannot be disregarded. The programme’s size and scope have required collaboration and cooperation across countries and institutions, and between the public and private sectors. New relationships, communication channels and processes have been developed that can benefit global health more broadly. Vulnerable populations, including those in insecure areas, have been reached as never before. Achieving eradication can provide further momentum for similarly ambitious mortality and morbidity reduction goals (e.g. measles elimination) and demonstrate the impact that coordinated and concentrated action can achieve.

4.29 The GPEI has developed this comprehensive Plan to address all aspects of polio eradication, exploit the unique opportunity to stop all polio disease once and for all, and complete the initiative. The Plan builds on new tactics and progress in interrupting WPV transmission and the development of new tools and strategies for managing the risks of vaccine-derived poliovirus. This Plan provides the best ever opportunity for completing polio eradication and capitalizing on the huge national and international investments in this initiative that have been made to date.

The impact of the GPEI extends beyond polio, benefitting other health priorities:

- Measles campaigns
- Distribution of Vitamin A supplements
- Enhanced disease surveillance and response

Achieving eradication can provide further momentum for similarly ambitious mortality and morbidity reduction goals and demonstrate the impact that coordinated and concentrated action can achieve.

¹² Thompson K, Duintjer Tebbens RJ. Eradication versus control for poliomyelitis: an economic analysis. *The Lancet*, 2007, 369 (9570): 1363-1371.

¹³ Duintjer Tebbens RJ, Pallansch MA, Cochi SL et al. Economic analysis of the Global Polio Eradication Initiative. *Vaccine*, 2010, 29 (2):334-343.

¹⁴ Thompson K, Duintjer Tebbens RJ. Eradication versus control for poliomyelitis: an economic analysis. *The Lancet*, 2007, 369 (9570): 1363-1371; Musgrove, P. Is polio eradication in the Americas economically justified? *Bulletin of the Pan American Health Organization*, 1988, 22 (1):1-16; Bart KJ, Foulds J, Patriarca P. Global eradication of poliomyelitis: benefit–cost analysis. *Bulletin of the World Health Organization*, 1996, 74 (1):35-45; Kahn MM, Ehreth J. Costs and benefits of polio eradication: a long-run global perspective. *Vaccine*, 2003, 21 (7-8): 702-705; Aylward B, Acharya A et al. Global public goods for health. In: Smith RD, Beaglehole R, Woodward D, Drager N, eds. *Global public goods for health: Health economic and public health perspective*. Oxford, Oxford University Press, 2003:33-54.

¹⁵ Duintjer Tebbens RJ, Pallansch MA, Cochi SL et al. Economic analysis of the Global Polio Eradication Initiative. *Vaccine*, 2010, 29 (2):334-343.

¹⁶ *Ibid.*