

Lessons Learned from Current Elimination and Eradication Initiatives

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Lessons from the Late Stages of the Global Polio Eradication Initiative

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Abstract

Given the substantial influence that the Global Polio Eradication Initiative can be expected to have on future eradication initiatives, it seems increasingly important to identify and analyze lessons from each phase of this program. The protracted “tail” of the polio eradication initiative currently appears to be disproportionately influencing discussion of, and decisions on, future eradication efforts, particularly with respect to the potential merits of a future measles eradication effort. Consequently, for the purposes of this chapter the “late stages” of the polio initiative have been analyzed, with most attention to those geographical areas that have never interrupted wild poliovirus transmission and those which have been regularly reinfected. The major lessons that have been identified might be applied earlier in future eradication initiatives, ultimately increasing the prospects for their launch, early scale-up, and successful conclusion. The most pertinent lessons identified were in assessing operational feasibility, sustaining and applying research, conducting effective advocacy at the subnational level, operating in insecure areas, and anticipating and addressing vulnerabilities in areas with especially weak health systems.

Introduction

Launched in 1988 through a resolution of the World Health Assembly, the Global Polio Eradication Initiative (GPEI) has grown to become one of the most ambitious, internationally coordinated health initiatives in history (Fine and Griffiths 2007), and certainly the largest eradication effort to date. At its peak of field operations, the program directly employed over 4000 people globally, managed an annual budget of approximately USD 1000 million, and maintained active field operations in more than 75 countries (WHO 2003a). Each year, millions of people were engaged to vaccinate hundreds of millions

of children in multiple mass vaccination campaigns with oral poliovirus vaccine (OPV).

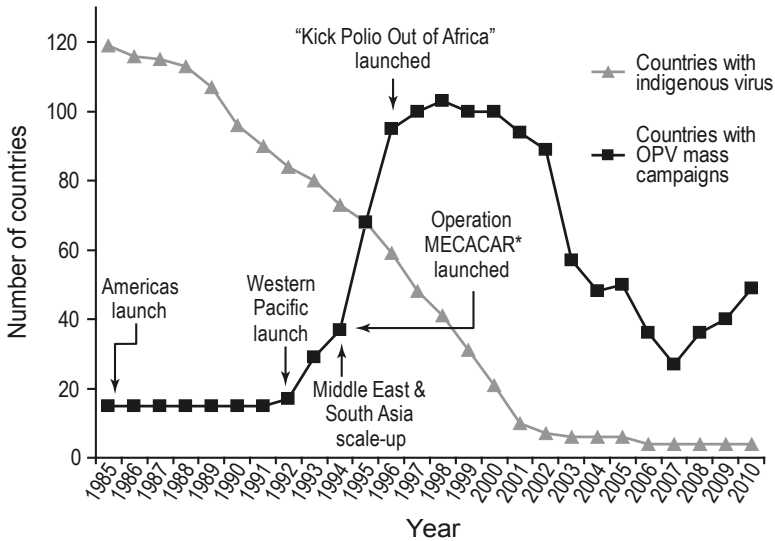
Consequently, the GPEI may offer insights to facilitate the pursuit of future eradication initiatives, particularly against widespread, highly contagious but vaccine-preventable pathogens such as the measles virus.

This article takes as its starting point the operational and technical challenges that the GPEI has faced since the year 2000, the original target date for interrupting wild poliovirus transmission globally (WHO 1988). Many of the lessons from the earlier launch and scale-up of the GPEI are either self-evident or documented elsewhere (Aylward et al. 2003; Aylward and Linkins 2005). Furthermore, lessons from the late stages of this initiative may have the greatest implications for improving the speed and efficiency of future eradication efforts, thereby avoiding the inevitable problems of fatigue and waning confidence associated with setbacks and missed milestones. This perspective also seemed most relevant to the international dialog on eradication at the end of 2010, as the GPEI's "late stage" challenges appeared to be having the greatest influence, whether consciously or unconsciously, on that debate and especially in the context of a future measles eradication effort.

Context

Although the GPEI was launched in 1988, most polio-infected countries initiated eradication activities only in the mid-1990s, with the last two countries (Democratic Republic of the Congo and Sierra Leone) only beginning in 2000 (Figure 2.1). A combination of global, regional, and country-specific factors was responsible for the delays. Available financing was part of the equation, but in some areas there was simply a lack of sociopolitical "buy-in" to the global eradication goal, ranging from that of key health authorities to the broader sociopolitical environment. This reflected the lack of commitment to the fundamental eradication strategies by many public health officials and an insufficient understanding and acceptance of the enormity of the operational challenges to implement them globally (WHO 2008b). Thus the successful adaptation and implementation of the original Pan American Health Organization (PAHO) polio eradication strategies in the Western Pacific Region of the World Health Organization (WHO) was pivotal, as it provided the proof of "operational" feasibility in large population countries (China) and fragile states (Cambodia in the early 1990s) that many decision makers seemed to require.

As polio eradication efforts scaled up rapidly in other areas of the world, progress was dramatic (Figure 2.1). In contrast to the misconception that most countries have been trying to eradicate polio for over twenty years, the average time from strategy initiation to interruption of indigenous wild poliovirus was only two to three years (Figure 2.2). The few areas that remained "endemic" by the mid-2000s were the exceptions. However, it is these "exceptional" areas of



* countries of the Middle East, Caucasus, Central Asian Republics and the Russian Federation

Figure 2.1 Countries with indigenous poliovirus circulation versus the initiation of national eradication efforts, 1985–2006.

northern Nigeria, northern India, southern Afghanistan, and Pakistan, as well as the nearby countries which regularly became reinfected, which may have the most relevant lessons for future eradication efforts.

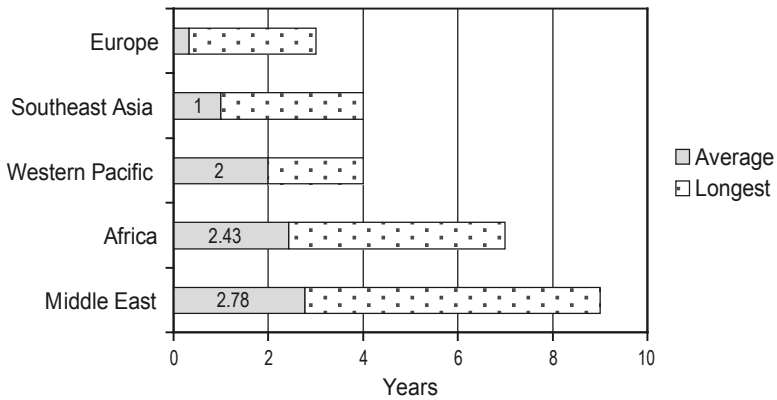


Figure 2.2 Time to interrupt indigenous wild poliovirus transmission after initiation of OPV mass campaigns, by WHO Region, excluding the Americas and currently “endemic” countries (Afghanistan, India, Nigeria, Pakistan).

Major Lessons Learned

The late stages of the GPEI offer five major lessons for consideration by future eradication initiatives.

Operational Feasibility: Establish Compelling Proof from the Outset in a Range of Difficult Settings

Three criteria are usually cited in assessing the feasibility of eradicating a human pathogen (Dowdle and Hopkins 1998; Goodman et al. 1998a). First is “biologic” feasibility: humans must be essential to the life cycle of the pathogen, there should be no chronic-carrier state, and the eradication tools/strategy should have demonstrated efficacy in diagnosing infection and interrupting transmission on a large geographical scale. The second is the “cost-benefit” criterion: it should be possible to recoup the marginal costs of moving from control to eradication within a reasonable, finite time period (e.g., 20 years). Although least understood and measurable, the third set of criteria is “societal and political”: this support should be sufficient to maintain an intensive, costly effort over the 10- to 20-year period that will probably be needed to achieve and certify eradication.

The late stages of the GPEI demonstrate that proof of technical feasibility in the Western Hemisphere (or in any single, largely homogenous area) does not necessarily equate to operational feasibility in all potential settings and conditions under which eradication strategies will need to be applied. On the contrary, while proof-of-principle in the Americas is certainly *necessary* before embarking on global eradication of a pathogen, it is probably no longer *sufficient* for marshalling the commitments needed to launch new eradication initiatives, as evidenced in part by the reticence, as of 2010, of major development agencies to embrace measles eradication (Obadairo 2010).

Evidence that a new eradication initiative meets an additional, explicit criterion of “operational feasibility” should enhance its prospects for both success and support. The specifics for concluding whether “operational feasibility” has been established will differ by pathogen. For widespread, highly contagious pathogens such as polio, the GPEI suggests operational feasibility might prove most convincing if achieved in areas with particularly weak health systems, fragile or failed states, high-population density areas, large federated republics and, ideally, places with a combination of these characteristics. For vaccine-preventable diseases, this can be visualized as the areas where the immunity threshold for interrupting transmission is highest and areas where the difference between the threshold and current population immunity levels is greatest (Figure 2.3).

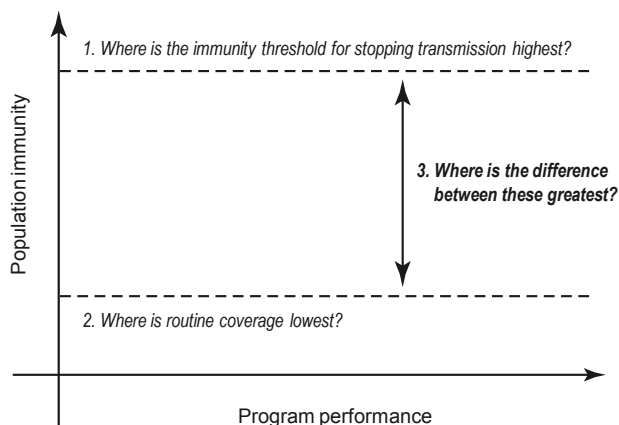


Figure 2.3 Schematic for identifying areas where demonstration of the *operational feasibility* of eradication may be most compelling.

Subnational Leaders: Establish Robust Mechanisms to Understand and Engage Them

Meeting the logistical challenges of OPV mass campaigns that cover an entire country in a very short period of time requires resources (e.g., human, transport, communications) far beyond those of the health sector. Consequently, the GPEI's advocacy efforts were initially focused on engaging national leaders, especially in countries with very weak health systems, to access complementary systems and ensure the accountability needed to reach most children during each OPV mass campaign.

While this strategy was largely successful, it was simply inadequate in large, federated republics, where subnational leaders controlled such resources (e.g., Nigeria, Pakistan, and India). Unfortunately, engaging directly with subnational leaders, beyond technical or operational issues, can be problematic for agencies whose official dealings are at the national level. However, such leaders may ultimately control the fate of a global eradication effort, as was demonstrated most famously by the prolonged suspension of polio vaccination in one state of northern Nigeria in 2003 (Kaufmann and Feldbaum 2009).

Recognizing this reality, future eradication initiatives would benefit greatly by establishing from the outset strategies, advocates, and processes to systematically access and engage subnational leaders in key countries. In the GPEI, this work was greatly facilitated by the decision of Rotary International, one of the four spearheading partners, to establish “National *PolioPlus* Committees” in most polio-infected countries. With 1.2 million members worldwide, often leading figures in their communities, Rotarians have played a central role in the GPEI's subnational advocacy, working in close collaboration with technical counterparts in WHO and UNICEF.

Research: Sustain an Intensive Program of Work throughout the Initiative

Contrary to one of the more intractable myths about the GPEI, the initiative has, since its inception, pursued an active research agenda across a wide range of issues, though with varying intensity and focus depending on the challenges it faced or anticipated at any given time. Curiously, the GPEI often found itself having to defend such investments, as some enthusiasts argued that proof of principle had long been established and success was simply a matter of implementing standard strategies.

Such an attitude failed to appreciate the case for ongoing research, part of which can be illustrated with GPEI examples. First, it is simply not possible to anticipate the obstacles that may be encountered when applying strategies developed in one geographic area of the world to global contexts and cultures. Research is needed to optimize application (e.g., the problem of lower OPV efficacy in northern India) (Grassly et al. 2006). Second, given that an eradication initiative can take decades to complete, an active research agenda is key to ensuring major developments are exploited in areas such as diagnostics, vaccinology, and cold-chain technology to enhance program effectiveness and reduce cost (e.g., vaccine vial monitors, real-time PCR). Third, an active research agenda allows an eradication program to investigate and adapt to aspects of the pathogen or its control that were unrecognized at the outset (e.g., circulating vaccine-derived polioviruses) (Kew et al. 2005).

The GPEI's capacity to maintain an active research program was greatly facilitated by the U.S. Centers for Disease Control and Prevention (CDC), another of the four spearheading partners, which brought its epidemiologic and virological expertise to the program. Grants from the Bill & Melinda Gates Foundation (BMGF) and the Global Alliance for Vaccines and Immunization (GAVI) both played important roles in financing major research projects, particularly in the areas of new vaccine development and testing (El-Sayed et al. 2008; Sutter et al. 2010). Perhaps most important was establishing a dedicated research and product development team within the Polio Eradication Initiative at WHO headquarters in Geneva. This team was fundamental to the successful coordination of the network of vaccine manufacturers, academic research institutions, not-for-profit research groups, public health laboratories, and regulatory agencies worldwide that facilitated the often fast-track development, testing and licensing of new vaccines, diagnostics and related technologies, as well as operations research. That said, a key research area that has yet to be optimized is the area of social science research: future initiatives should also recognize from the outset the need for strong capacity to rapidly conduct or commission such work.

Insecurity and Conflict: Ensure Program Capacity to Study and Adapt in Each Setting

The GPEI is often cited for its success in implementing strategies in conflict-affected areas (Hull 2007; Bush 2000). In fact, this experience is frequently held up as evidence that “polio can be eradicated anywhere,” with the allure of tactics such as “Days of Tranquillity” capturing the imagination of supporters. While this may be broadly true, such statements fail to capture the complexity of conflict and the constant need to adapt tactics to operate with at least some degree of safety in such settings. For example, the conflict-related challenges the GPEI faces in southern Afghanistan and the Federally Administered Tribal Areas of Pakistan in the late stages of the global initiative are substantively different from those it had to address earlier in areas such as Somalia and the Democratic Republic of the Congo (Tangermann et al. 2000).

In reality, success in eradicating polio from one conflict-affected or insecure area did not “prove” the overall feasibility of the global task; it did, however, provide invaluable experience that could be brought to the next such challenge. Common principles exist, particularly that people living in conflict-affected areas are highly motivated to improve their children’s futures and can be readily engaged in the delivery of basic health services. Similarly, major humanitarian actors (e.g., the International Committee of the Red Cross) can provide invaluable assistance in negotiating access and vetting potential local collaborators. Working from such fundamentals, a range of tactics were developed and employed to access children and boost immunity more rapidly in these areas, including Days of Tranquillity, “access negotiators,” and OPV “Short Interval Additional Dose” campaigns to exploit brief windows of opportunity. Just as important were the more mundane lessons learned on how to establish and sustain administrative processes to contract services and move resources in such settings.

Recognizing that insecurity and conflict will be a continuing challenge in the future, new eradication initiatives should from the outset:

- Recruit individuals with expertise in conflict, political mapping, and associated skills.
- Build the capacity to support teams and workers in conflict-affected areas.
- Identify and engage nontraditional partners and decision makers.
- Refine tactics and technologies to simplify work in such settings (e.g., hand-held jet injectors for administering vaccines).

As of the end of 2010, there is no evidence that, with the appropriate investments and attention, conflict should pose an insurmountable barrier to achieving an eradication goal.

Weak Health Systems: Sustain Gains by Addressing System Vulnerabilities

The stalling of polio eradication progress during the period 2004–2008 in the last four “endemic” countries soon led to a second major problem for the GPEI: the recurrent reinfection of previously polio-free areas (Figure 2.4) (WHO 2010f). Although OPV mass campaigns could rapidly interrupt indigenous poliovirus in areas with very weak health systems, campaigns were less effective in preventing new outbreaks following virus importations. Multiple factors contributed to this problem, especially the drop in OPV campaign quality that was often observed once transmission had been interrupted. In addition, the impact of the original campaigns in these settings may have been augmented by the contribution that circulating indigenous viruses had made to population immunity.

Consequently, countries with a combination of weak health systems and strong trade, cultural, and other links with polio endemic areas suffered a disproportionate number of polio importations and outbreaks, particularly in West and Central Africa and the Horn of Africa (WHO 2010f; O’Reilly et al., submitted). The subsequent human and financial costs were enormous, with thousands of children paralyzed and hundreds of millions of dollars expended in outbreak response activities. Clearly, the most important lesson from this experience is the importance of coordinating global eradication efforts to minimize the risk of reinfesting pathogen-free areas. However, as there will always be delays in some countries, it is essential to (a) plan and budget for sustained, intensive activities (e.g., OPV campaigns) in areas with a combination of weak

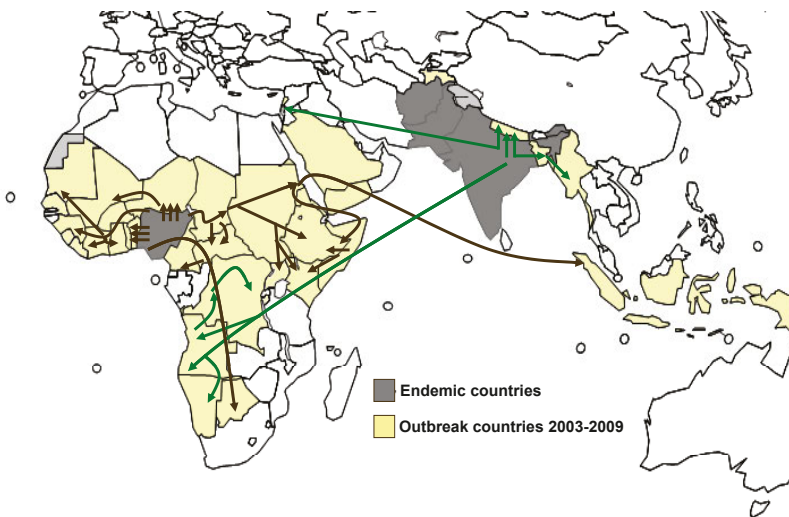


Figure 2.4 International spread of wild polioviruses into previously polio-free areas, 2003–2009.

health systems and a high risk of reinfection due to strong links with an endemic area (O'Reilly et al., submitted), and (b) establish from the outset specific plans, responsibilities, and accountabilities for strengthening the underlying health systems, starting with highest risk countries and areas.

Recognizing that health systems strengthening is generally a long-term agenda of work, eradication programs need to map and engage *all* of the local systems (e.g., education, defense, transport, information) that can be exploited to access populations in countries with particularly weak health systems and a high risk of reinfection. This sometimes requires an attitude shift to appreciate the invaluable complementary role of such systems, and to refocus the health system on the mobilization and management of those complementary systems to facilitate service delivery, rather than rely solely on the infrastructure of the health system (Aylward and Linkins 2005).

Looking Forward: How Best to Exploit the Lessons Learned?

The GPEI's late stage challenges have shattered any illusions that the implementation and success of future eradication efforts will be straightforward and largely predictable once the classical "feasibility" criteria have been met. However, just as with the lessons from smallpox eradication (Fenner et al. 1988), the lessons from the GPEI will have variable utility for most future eradication initiatives, depending on the nature of those efforts and the periods in which they are pursued (Cochi et al. 1998). Furthermore, much of the wealth of the GPEI's lessons will never be captured in textbooks or academic articles because many of the details, especially with regard to what didn't work, will survive only in the knowledge and experience of the thousands of individuals who worked at the various levels of this global initiative, often for more than a decade. Such "soft" or "tacit" knowledge will eventually dissipate as quickly as the GPEI's hard, physical resources will deteriorate in the tropical climates where they are concentrated. Consequently, the opportunity to exploit these lessons fully may be both time-limited and initiative-specific.

For these reasons, as well as the potential for cost-sharing, cost reductions, and efficiencies, it has been argued that the final phase of the GPEI should be merged or overlapped with a measles eradication initiative. This, it is argued, could exploit the GPEI's extensive human and physical infrastructure and ensure the hard lessons recently learned through the GPEI, especially in operations management, are optimally and effectively utilized. At the end of 2010, however, other commentators were arguing equally vociferously that the GPEI must be completed (successfully) before deciding on, let alone launching, a new eradication effort. While this perspective also has real merit, if there is to be a measles eradication initiative at some point in the future, it could be appropriate to consider merging or overlapping it with the final phase of the GPEI

so as to avoid inadvertently increasing the costs and reducing the program's efficiency.

Whether a case can be made for concurrent eradication initiatives in the future will depend a great deal on the nature of each effort. In the case of measles and polio, however, the real choice may be whether to merge a measles eradication effort with the final phase of the GPEI or to risk foregoing measles eradication altogether, at least in the foreseeable future. The “win-win” rationale for combining these particular initiatives is rather straightforward:

First, once the GPEI interrupts wild poliovirus transmission globally, it will still need to sustain much of its core human and physical infrastructure for at least 6–8 years to facilitate certification of eradication, coordinate the eventual cessation of OPV use globally, and then verify the elimination of any residual vaccine-derived polioviruses (Aylward et al. 2006) (Figure 2.5).

Second, due to the reduced frequency of OPV campaigns during this period, there will be substantial excess capacity in this infrastructure which has most of the skills, knowledge, and geographic coverage needed for a measles eradication effort.

Third, once wild poliovirus transmission is interrupted, it may be easier to sustain GPEI financing and support, especially for resource-poor areas, if integrated with another initiative to address an important cause of childhood morbidity and, in the case of measles, mortality.

Finally, even if a measles eradication initiative were to ultimately prove unsuccessful, an intensified immunization and surveillance effort against the disease, integrated with the final phase of the GPEI, should be highly cost-effective in itself, especially as the use of the GPEI's infrastructure might reduce costs by as much as 30%.

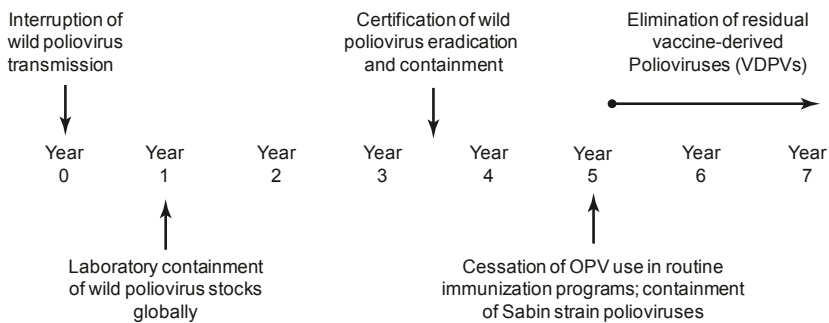


Figure 2.5 Timeline for the management of residual poliovirus risks following the eradication of wild type viruses globally.

Conclusions

Having existed for more than twenty years, the GPEI offers myriad lessons, both positive and negative, for the launch, scale-up, maintenance, and successful conclusion of future eradication initiatives. However, it is the late stages of the GPEI that seem to be most influencing, consciously or unconsciously, the debate on if, when, and how to pursue the eradication of other pathogens. While some of the lessons learned late in the GPEI are fairly specific to polio (WHO 2010c), others seem relevant to future eradication initiatives in general:

- Establish at the outset compelling proof of operational feasibility in a range of difficult settings.
- Ensure mechanisms to identify and engage subnational leaders in key countries, especially large, federated republics.
- Sustain a broad-based and intensive research agenda.
- Establish capacity to understand and adapt to settings with large-scale insecurity and conflict.
- Secure the necessary resources to sustain gains in areas at highest risk of reinfection where the health system is particularly weak.

Just as with the lessons from smallpox eradication, however, these GPEI lessons will have variable utility for future eradication initiatives, depending on the nature of those efforts and the periods in which they are pursued. However, the temporal overlap of the GPEI with large-scale regional measles elimination efforts, and the similarity of the strategic approaches to both, suggests that if there is to be a future measles eradication initiative, careful consideration should be given to the potential merits of merging it with the final phase of the polio eradication initiative.