Commentary

The Global Polio Eradication Initiative has done well to introduce 3 doses of the Inactivated Poliovirus Vaccine in Afghanistan

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Smallpox eradication illustrated the critical importance of high vaccine efficacy (VE) of the smallpox vaccine in rich and poor countries. Polio eradication was made possible with the inactivated poliovirus vaccine (IPV), as it also exhibits high VE in rich and poor countries.

Oral polio vaccine (OPV), with very low VE in tropical low/middle income countries (LMICs), was an inferior tool. Nevertheless, the global polio eradication initiative (GPEI) used trivalent OPV (tOPV) exclusively in LMICs from 1988, when the World Health Organisation (WHO) resolved to eradicate polio by 2000. The VE of tOPV was highest against type 2 and lowest against type 1 polio. Unsurprisingly, wild poliovirus (WPV) type 2 polio was eradicated in 11 years (1999) and type 3 polio in 24 years (2012). To date, type 1 remains endemic in Afghanistan and Pakistan, despite many dozens of supplementary immunisation campaigns.

In 2025, GPEI and the Government of Afghanistan introduced fractional doses of IPV in each of three campaign rounds in one large region, using needle-free intradermal inoculation devices. This was reportedly well-received by health staff and the community. The realisation that IPV is the right tool opens the door to move rapidly towards elimination of wild type 1 polio in Afghanistan and Pakistan, as well as for stopping use of OPV and its attenuated version of novel OPV, both of which evolve into circulating vaccine-derived poliovirus (VDPV) that causes polio outbreaks. However, the needle-free intradermal device is expensive and not required for subcutaneous and intramuscular inoculations with other vaccines, making this tactic not scalable in all of Afghanistan or replicable in Pakistan. Currently polio is caused by WPV, VDPV and OPV directly as vaccine-associated paralytic polio. We recommend routine use of three full doses of IPV given as a combination product with the currently

used pentavalent vaccine, i.e., hexavalent vaccine to avoid giving extra injections, so that GPEI can use it to stop all polio in all LMICs.

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Introduction

One of the contributing factors, biologically the critical one, to the eradication of smallpox was the high vaccine efficacy (VE) of the smallpox vaccine. All vaccinated persons were predictably protected from disease when exposed to infection, in all regions of the world, rich and poor.

The promise of Salk's inactivated poliovirus vaccine (IPV), showing similarly high VE in all regions of the world, was the global eradication of polio.

In contrast, Sabin's live virus oral polio vaccine (OPV) has widely variable VE – ranging from very low VE in tropical low/middle income countries (LMICs) to high VE in temperate zone rich countries.[1] [2] Therefore, it was not the right tool for polio elimination in tropical LMICs, attested by global experience from 1988 when it was chosen exclusively for global polio eradication under the World Health Organization's (WHO's) global polio eradication initiative (GPEI).[3]

Trivalent OPV (tOPV), used exclusively for polio eradication by GPEI from 1988 till mid-2016 but withdrawn from use in 2016, was a balanced mixture of vaccine virus types 1, 2 and 3. In LMICs, the VE against type 2 was the highest, and against type 1 the lowest, an observation which has never been fully explained.[4] For example, in Vellore, India, five doses of tOPV resulted in near-100 per cent seroconversion for type 2, while it required 14 doses for the same effect in the case of type 1. [4] Unsurprisingly, wild poliovirus type 2 (WPV-2) was eradicated globally in 1999 (last case in India) and WPV-3 was eradicated in 2012 (last case in Nigeria). It is noteworthy that Afghanistan and Pakistan, the two countries that have not yet eliminated WPV-1, were not the last countries to eliminate WPV-2 and WPV-3, meaning thereby that tOPV coverage was sufficiently high in both countries to eliminate WPV-2 and WPV-3 ahead of India and Nigeria.

A new setback in Afghanistan and Pakistan

The pattern changed starting in 2012. WPV-1 was last seen in 2011 in India and 2016 in Nigeria, but it remains endemic in Pakistan and Afghanistan.[5][6] Thus, regarding WPV-1, the 'Achilles' heel that has led

to failure to eliminate WPV-1 in its last bastion is the very low VE of OPV, as mentioned above, compounded by the inability to sustain sufficiently high vaccination coverage.

Ten years have passed since Nigeria eliminated WPV-1 but progress had stalled in Pakistan and Afghanistan. A new problem began showing its ugly head in December 2012, when violence against vaccinators conducting OPV campaigns resulted in loss of life of campaign staff.[7] Unfortunately, therefore, tOPV coverage (with multiple supplementary doses through repeated campaigns) slipped in Pakistan and Afghanistan because of militant opposition to repeated OPV campaigns.[8] Inadequate multi-dose coverage of OPV and the low VE, together, have led to the failure of WPV-1 elimination.

By contrast, the absence of opposition to any vaccine routinely delivered in immunization clinics is worth noting. Because of very low VE, OPV has to be given repeatedly without an upper limit of number of doses, for which community campaigns and even house-to-house campaigns were necessary, presenting a “catch 22” problem.

GPEI’s vaccine choice was not science-supported

The GPEI was confident that OPV was the right intervention tool to eradicate polio, probably because, firstly smallpox was eradicated using the live virus smallpox vaccine and secondly many virologists had believed that live virus vaccines were necessary against virus diseases. Only those who were closely watching the global vaccinology scenario knew that the paradigm had shifted, as demonstrated with three inactivated virus vaccines that had shown high VE, namely, Semple’s rabies vaccine (1912), Salk’s influenza vaccine (1945) and Salk’s poliovirus vaccine IPV (1955). Believing that live virus polio vaccine was required for polio eradication, GPEI had overlooked the fatal flaw of the very low VE of OPV.

Furthermore, OPV has the inherent problems of undesirable transmissibility in some community settings and genetic reversion to wild-like genotype and virulence during such transmission.[9] The festering problems of polio outbreaks in dozens of LMICs due to circulating vaccine-derived polioviruses (cVDPVs) since 2000 could have been and should have been avoided, if the public health experts in charge of GPEI had weighed the science-based pros and cons of both vaccines.[9][10] Since 2012, the militant opposition to frequent OPV campaigns made it well-nigh impossible to stop WPV-1 polio in Afghanistan and Pakistan. GPEI has now responded positively to this impasse in Afghanistan.

A step in the right direction

During August to October 2025, the GPEI and the Ministry of Health in Afghanistan have conducted a three-dose IPV (fractional dose) campaign, using a needle-free injection device, in the eastern region of Afghanistan, covering 1.2 million children up to 5 years.[11] Apparently, IPV given in campaign mode was both to induce immunity in children rapidly and test its feasibility and acceptability by the vaccinators and the community. The response on all counts was very positive.

Giving primary immunization with 3 doses of IPV (full intramuscular doses or at least fractional intradermal doses) during infancy is the right intervention for polio elimination. It makes the high VE operative from early infancy, which could never have been achieved using OPV. With documented high acceptance rate of the fractional dose IPV series in this geographic region, we anticipate successful elimination of WPV circulation and complete protection of all children from polio caused by any paralytogenic poliovirus, namely vaccine polioviruses in OPV, non-circulating vaccine-derived poliovirus, cVDPV and WPV.

Therefore, the introduction of a three-dose IPV schedule in Afghanistan is an excellent step forward, signaling the willingness to wean away from exclusive dependence on OPV for stopping polio. Both the bold action and the change of heart that led to it are worthy of appreciation and endorsement by public health experts globally.

Practical suggestions for the way forward

It is unclear whether the mass campaign of 3 rounds of fractional intradermal IPV inoculations, using jet injectors conducted in one region with 1.2 million pre-school age children, is intended to be up-scaled in the entire country with an estimated under-five population of 8-9 million, given its labor-intensive nature and the need for massive numbers of the expensive jet injectors that are not required for intramuscular and subcutaneous inoculation with other vaccines.

A simpler and sustainable way is to use conventional non-reusable syringes and needles to introduce full dose IPV in combination with the pentavalent (DPT-Hib-HBV) vaccine as the hexavalent vaccine. This approach can be scaled up in all of Afghanistan, replicated in Pakistan, and implemented in all countries using OPV and remaining at risk of cVDPV outbreaks. In Afghanistan, genuine efforts to increase coverage among infants with all vaccines as part of the long-standing Expanded/Essential Programme

on Immunization (EPI), are required. The current 3-dose DPT coverage by age 12 months is estimated at ~60%.[12]

Alternatively, the needle-free injection device may be supplied to all immunization clinics in Afghanistan, and one fractional dose of IPV given concurrent with each of the three pentavalent vaccine doses that are at present routinely given. However, this approach may not be easily replicated in all countries using OPV because of the high cost of the injection device. If hexavalent vaccine is given the conventional way, the IPV-specific injection is avoided.

The working goal now in Afghanistan must be to bolster the immunization system in order to reach at least 80% 3-dose IPV coverage during infancy. The ultimate goal must be the withdrawal of all OPV, once IPV 3-dose infant coverage stabilises at and over 80%, so that Afghanistan can eliminate polio, catching up with all countries using IPV exclusively and remaining totally polio-free.

Global implications of the new tactic

The WHO, as the major force behind GPEI, could do well to apply these same principles in all other countries that are still using OPV. Sabin OPV's later attenuated iteration, the novel OPV (nOPV), is also unsafe by having already been shown to revert to neurovirulence.[13] Moreover nOPV does not address the very low VE of OPV in tropical LMICs.

Once live poliovirus is no longer introduced in the community, the global eradication of polio can predictably be achieved and sustained under high IPV coverage through EPI. Eradication can be confirmed by quality surveillance of acute flaccid paralysis, as was done in the twentieth century, before cVDPVs were allowed to emerge and spread. Environmental surveillance can be phased out – first it can be simplified without characterizing poliovirus isolates as vaccine-like or wild-like by molecular methods, since any detected poliovirus signals its unacceptable transmission. After one year under exclusive IPV vaccination, GPEI can discontinue it as a surveillance tool, reducing the overall cost of global polio eradication.

Statements and Declarations

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Potential competing interests

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