22nd Annual Consultation between the Global Polio Eradication Initiative and Poliovirus Vaccine Manufacturers, National Authorities for Containment and National Regulatory Authorities

Report of meeting, held 23 October 2023, at WHO headquarters, Geneva

WORLD HEALTH ORGANIZATION

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Abbreviations

AEFI	Adverse event following immunization
AFP	acute flaccid paralysis
bOPV	bivalent oral polio vaccine
COVID-19	coronavirus disease 2019
CCS	Poliovirus Containment Certification Scheme
cVDPV1	circulating vaccine-derived poliovirus type 1
cVDPV2	circulating vaccine-derived poliovirus type 2
cVDPV3	circulating vaccine-derived poliovirus type 3
CWG	Containment Working Group (of the GCC)
EUL	Emergency Use Listing Procedure
GAP	Global Action Plan for Poliovirus Containment
GCC	Global Certification Commission
GPEI	Global Polio Eradication Initiative
IMB	Independent Monitoring Board
IPV	inactivated poliomyelitis vaccine
mOPV1	monovalent oral polio vaccine type 1
mOPV2	monovalent oral polio vaccine type 2
mOPV3	monovalent oral polio vaccine type 3
NAC	National Authority for Containment
nOPV2	novel oral poliovirus type 2
ORPG	Outbreak Response & Preparedness Group
PCS	Post-Certification Strategy
PEF	poliovirus essential facility
polio	poliomyelitis
PQ	(WHO) prequalification
SAGE	Strategic Advisory Group of Experts
SIA	supplementary immunization activity
UNICEF	United Nations Children's Fund
VDPV	vaccine-derived poliovirus
VLP	virus-like particle
WHO	World Health Organization

Foreword

Dear colleagues and partners,

As we gathered for the first time at WHO headquarters for this crucial consultation, I am reminded of the critical nature of our collective mission in the Global Polio Eradication Initiative. This gathering of vaccine manufacturers, National Authorities for Containment, and National Regulatory Authorities represents a united front against a persistent global health challenge – the eradication of poliovirus.

This year's annual meeting, a testament to our shared commitment, highlighted the significant progress we have made and the formidable challenges that lie ahead. We confront diverse obstacles: inaccessible terrains, heightened vaccine hesitancy in the wake of the COVID-19 pandemic, and complex geopolitical landscapes. These challenges are compounded by the disturbing threats faced by our frontline workers – the brave individuals who navigate these dangers to deliver health services to the most vulnerable.

Our dedication is strong in the face of these difficulties. As we look to the future, our goals remain clear and achievable. We are on track to certify the eradication of Wild Poliovirus Type 1 (WPV1) by 2026 and to overcome the challenges posed by circulating Vaccine-Derived Poliovirus Type 2 (cVDPV2) by 2028. These objectives are underpinned by a strategic approach informed by the Independent Monitoring Board's assessments. Our focus is on ensuring a sustainable and high-quality supply of polio vaccines, crucial for increasing immunization coverage rates and controlling outbreaks.

Today, at this pivotal juncture, let us renew our resolve. The significance of our collective work cannot be overstated – it is a cornerstone of global health and a beacon of hope for future generations. Our efforts extend beyond geographical boundaries, touching lives and shaping the future of global health security.

Thank you for your unwavering dedication, for your partnership, and for the vital role you play in this historic endeavor. Together, we stand united in our mission to eradicate polio and protect every child from this debilitating disease.

With deepest gratitude and respect,

Aidan O'Leary

Director of Polio Eradication, WHO; Chair, GPEI Strategy Committee

Executive summary

Introduction

On October 23, the World Health Organization's Geneva headquarters hosted an important meeting: the Annual Consultation between the Global Polio Eradication Initiative and key partners, encompassing over 60 organizations involved in vaccine development and production, National Authorities for Containment and National Regulatory Authorities. With participation from over 200 delegates across 26 countries.

It served as a dynamic platform for stakeholders to critically assess progress, confront current challenges, and plan forward-looking eradication strategies. The consultation emphasized the importance of ongoing vaccine development innovation, strong collaboration around containment, and consistent policy across all polio vaccine security areas.

This day of deliberation underscored a collective resolve to continue contributing to end polio, showcasing the significant strides already made.

Addressing the Complexities of Polio Eradication

The Global Polio Eradication Initiative faces a range of formidable challenges in its quest to eliminate polio. Health workers must navigate difficult, often remote terrain to deliver essential high-quality vaccines. This task is crucial for increasing immunization coverage and controlling wild poliovirus-1 (WPV1) and vaccine-derived polioviruses (cVDPVs).

The COVID-19 pandemic has significantly hindered eradication efforts, particularly in areas affected by humanitarian crises or climate change. Additionally, vaccine hesitancy presents a considerable barrier, necessitating increased community engagement and trust-building. Political instability and security risks further endanger front-line workers, whose vital role in vaccinating children against polio often comes with personal risk.

The Independent Monitoring Board's mid-term report, "Closing in on zero," offers a nuanced view. While the timeline for achieving Goal 2 of the GPEI has been extended to the end of 2025, there is hope that interrupting WPV1 transmission (Goal 1) is achievable by 2026. Despite setbacks, a global decrease in polio cases highlights the effectiveness of the eradication program. However, recent cases in high-vaccination areas like London and New York City emphasize the need for ongoing vigilance in surveillance and immunization.

The presentation on the current statis of the program and its mid-term review underscored the importance of focusing on high-risk areas, particularly Afghanistan and Pakistan, where WPV1 is still transmitted, and the Democratic Republic of the Congo, Nigeria, Somalia, and Yemen, which face challenges with cVDPV. Overcoming these obstacles is crucial for the success of the eradication initiative, reaffirming a global commitment to this goal.

Polio Vaccines: Demand Estimates and Supply Forecasts

The global demand for polio vaccines was a key topic of deliberation, highlighting the intricacies of vaccine supply chain management within the polio eradication landscape.

bOPV: Although the bOPV supply appears robust on the surface, there is an underlying concern about the dependency on an increasingly limited number of suppliers. As all OPVs are scheduled to be phased out of routine immunization by 2027, following global certification of WPV eradication, the manufacturer base is expected to shrink from eight to six by 2024. This consolidation raises the stakes on supply continuity, with a single manufacturer accounting for 70% of the finished product in 2023. With bOPV being a mainstay vaccine in 137 countries, the stable annual supply of 0.8 to 1.3 billion doses masks potential underreporting issues, particularly in differentiating between routine and outbreak-driven immunization efforts.

nOPV2: nOPV2's deployment, under the WHO Emergency Use Listing Procedure since early 2021, has reached 35 countries with administration figures surpassing 820 million doses. The Global Advisory Committee on Vaccine Safety has not flagged any safety concerns, endorsing nOPV2 as a stable and effective vaccine option with a significantly reduced risk profile compared to the Sabin OPV2. However, vigilance remains paramount as the lower—but not negligible—risk of vaccine-derived poliovirus infections continues. nOPV2 is expected to receive WHO prequalification at the end of 2023.

IPV: In the realm of inactivated poliovirus vaccine (IPV), UNICEF's procurement activity reflects a market that is well-supplied, with demand estimates set at 100 million doses for 2023, scaling up to 110 million for 2024. The current tripling of IPV supply over demand portends a market that is healthy yet bracing for potential overcapacity challenges. This is especially pertinent in anticipation of the IPV-containing hexavalent vaccine's introduction, which may significantly alter demand dynamics.

The hexavalent vaccine, encompassing IPV, is set to be a game-changer in the immunization field. It combines six vaccines into one injection, promising to simplify vaccination schedules and potentially increase coverage rates. Discussions touched on the supply landscape for this vaccine, with projections indicating a staggered introduction based on prequalification schedules and demand realization. With pricing structures delineated for Gavi-eligible and self-financing countries, the hexavalent vaccine stands to reshape the cost-effectiveness and accessibility of polio immunization, particularly in lower-income regions.

Containment of Polioviruses and Global Certification of Poliovirus Eradication

Poliovirus Containment: Poliovirus containment is a foundational component of the global effort to eradicate the disease. Resolution WHA71.16 underscores the critical importance of poliovirus containment and outlines the actions required of WHO Member States. These actions include accelerating containment efforts, completing and destroying unnecessary poliovirus materials, and immediate reporting of containment breaches to the International Health Regulations (IHR) Focal Point.

The resolution further calls for the minimization of facilities retaining polioviruses, with priority given to those with critical functions. Despite delays caused by the COVID-19 pandemic, efforts have intensified to catch up on containment, with the majority of countries progressing toward compliance. A notable development is the consideration by WHO and UNICEF to make GAPIV compliance mandatory for future tender awards, underscoring the necessity of containment in the post-eradication era.

Global Certification of Poliovirus Eradication

The global certification of poliovirus eradication is contingent upon meeting specific criteria, including the absence of WPV transmission, robust global surveillance, and the containment of retained WPV in secure facilities. The requirement of a three-year absence of WPV transmission is under review, acknowledging the changing landscape of surveillance and the need for flexibility in certification criteria.

An Expert Working Group (EWG1) has recommended revised criteria for WPV certification of elimination, allowing for a flexible period of non-detection, contingent upon the quality of surveillance and other epidemiological data. These recommendations, endorsed by the Global Certification Commission (GCC), mark a pivotal shift towards a more adaptable and responsive certification framework.

Certification of elimination for cVDPVs remains a complex issue, particularly due to the potential for emergence from the use of live OPVs and the presence of chronic excreters (iVDPV). A second expert working group (EWG2) is in the process of formulating the criteria for cVDPV elimination certification.

The upcoming twenty-fourth meeting of the GCC will be an essential forum for discussing the interruption of WPV1 transmission, strategies to prevent cVDPV2 outbreaks, and the mid-term review of the Global Polio Eradication Strategy 2022–2026. These discussions will significantly inform the certification process and containment strategies, ensuring that eradication efforts are not only sustained but also fortified against future challenges.

New Developments and Innovations in Polio Vaccines and Products

Research and Product Development: the pursuit of poliovirus eradication continues to drive the need for innovative research and development (R&D) in vaccine technology and therapeutic products. Recognizing the limitations of current inactivated poliovirus vaccine (IPV) and oral polio vaccine (OPV) formulations, R&D efforts are crucial for addressing the lack of mucosal immunity induced by IPV, the occurrence of vaccine-derived polioviruses (VDPVs) from OPV vaccination, and the necessity for containment of these vaccines. Additionally, there is a significant focus on developing treatments for chronic excreters of poliovirus to eliminate virus shedding in individuals with persistent iVDPV infections.

A statement from the Strategic Advisory Group of Experts (SAGE) on Immunization in October 2022 highlights the importance of clinical research and the accelerated

development of novel OPVs, virus-like particles (VLPs), polio antivirals, and monoclonal antibodies.

Polio Antivirals and Monoclonal Antibodies: the Polio Antivirals Initiative, established in 2006, is spearheading the development of polio antivirals and monoclonal antibodies. The partnership led by PATH, with contributors including WHO and the Bill & Melinda Gates Foundation, is making strides with compounds such as pocapavir and V-7404. These antivirals have shown promising results in curbing virus excretion in various studies, though challenges such as drug resistance and regulatory hurdles for pediatric use remain. A targeted approach for compassionate use rather than full registration is currently being pursued for these antiviral treatments.

Research on monoclonal antibody 9H2, which exhibits strong neutralizing activity against all three poliovirus serotypes in vitro, is ongoing. Its development is in the early stages, with potential clinical trials and subsequent results expected in the latter part of this decade.

Poliovirus Virus-Like Particles (VLPs): VLPs represent a significant advancement in the quest to create a vaccine devoid of live virus, eliminating the need for containment post-eradication. A consortium led by the University of Leeds, funded by the Bill & Melinda Gates Foundation, is propelling the industrial production of recombinant poliovirus sVLPs. Promising immunogenicity results from rat studies have led to ongoing discussions with commercial entities for further development.

Update on Planning for OPV Cessation

The cessation of OPV use is a strategic step in the polio eradication initiative, necessitated by the incompatibility of live poliovirus vaccines with the eradication goal. The Framework for OPV cessation, embedded within the Polio Post-Certification Strategy, outlines the steps towards withdrawal of bOPV from routine immunization programs, anticipated after the certification of WPV1 eradication. The cessation team, including stakeholders from the GPEI and beyond, has delineated a workplan with milestones and activities divided into two phases leading up to bOPV cessation.

Phase 1 focuses on policy development for bOPV cessation, including epidemiological reviews and lessons from the 2016 switch from trivalent OPV to bOPV. The goal is to present policy options to the SAGE working group and secure SAGE recommendations by April 2024.

Phase 2 encompasses the planning and implementation of cessation activities, such as aligning vaccine supply with SAGE-approved policies and supporting regions and countries in preparation for cessation.

Development of a Long-Term Polio Vaccine Security Framework

Sessions V and VI of the meeting were dedicated to discussing the foundational elements of the polio vaccine security framework that is critical both for achievement of the goals

of the Global Polio Eradication program goals and for safeguarding its achievements in the post eradication period.

The primary objective of the polio vaccine security framework is to ensure **timely, sustained, uninterrupted supply of the right types of affordable polio vaccines of assured quality**. The framework strives to ensure vaccine availability aligns with eradication milestones and post-eradication needs, thereby cementing the gains made against polio and averting the risk of its resurgence.

The framework seeks to bring together stakeholders around a shared vision for the next two decades and possibly beyound, defining the desired state of polio vaccine security and establishing clear targets for its assessment.

The framework acknowledges the varied perspectives of stakeholders regarding the vaccine mix, regulatory adherence, quality control, and containment protocols. It aims to address challenges raised by them, incorporating insights from the Independent Monitoring Board (IMB) and Transition IMB (TIMB) on strategic vaccine supply planning, risk mitigation, and the imperative of international cooperation to ensure continuity and consistency in vaccine supply.

Interactive Breakout Group Discussions

Participants engaged in focused discussions on the challenges and solutions pertinent to long-term polio vaccine security. Deliberations underscored the need for clarity, transparency, and certainty in vaccine forecasts, access to resources, including financing, containment prerequisites, and overarching policies guiding the endgame and post-eradication strategy.

Key Discussion Outcomes

1. **Goals & Objectives:** A clear consensus emerged on the necessity for greater clarity and predictability in vaccine demand forecasts, financial planning, containment mandates, and the policy landscape that steers the polio eradication initiative's future direction.
2. **Identifying Challenges and Priorities:** Emphasis was placed on the importance of information sharing and coordination among stakeholders, regulatory challenges related to new vaccine production, and the management of vaccine oversupply.
3. **Tools, Mechanisms, and Governance:** The need for long-term planning frameworks that provide visibility into funding and market-shaping activities was highlighted, advocating for extended tender durations to aid manufacturing decisions.
4. **Implementing the Framework:** Participants called for agility in implementing the framework, addressing the need for alignment between eradication, bOPV cessation, and containment timelines. Clear communication on the enduring nature of polio immunization was seen as crucial to avoid immunity gaps.

Next Steps The meeting's outcome includes a set of actionable steps tailored to strengthen the collective response to polio. Key among these is the establishment of a transparent communication channel for regular updates on vaccine supply, ensuring that all stakeholders are synchronized in their efforts.

In the coming months, GPEI and its partners will focus on implementing the priority actions agreed during the consultation, with a particular emphasis on the integration of stakeholder feedback into and development of vaccine security framework. The consultation has set the stage for a more organized and coherent actions across polio vaccine development and research, production and supply as well as containment, with the next annual meeting anticipated to reflect on the progress made and adjust the course as needed.

Participants of the 21st Annual Consultation Meeting gathered in person, WHO headquarters, October 23, 2023,

Opening remarks and orientation

In October 2023, the Global Polio Eradication Initiative (GPEI) held its annual consultation with polio vaccine manufacturers, National Authorities for Containment (NACs) and National Regulatory Authorities (NRAs). In addition to the annual proceedings of vaccine production and demand forecasts, new research and development (R&D), and containment milestones, participants were requested to add their feedback about the polio vaccine security framework which the GPEI is currently developing.

Mr Aidan O'Leary, Director, Polio Eradication Department, World Health Organization (WHO), opened the meeting by welcoming participants both virtually and in-person at WHO headquarters in Geneva, Switzerland. He hoped the meeting would also provide stakeholders with opportunities for bilateral discussions.

Annex 1 contains the meeting agenda[1] and list of participating organizations.

Objectives of the meeting

- Update stakeholders on mid-term review of the Polio Eradication Strategy.
- Consult with stakeholders on the goals, objectives and strategies to facilitate polio vaccine security.
- Brief stakeholders on the planning for the cessation of OPV use (after the global certification of eradication).
- Brief stakeholders on new vaccine technologies, regulatory pathways for the licensing of poliovirus vaccines and containment updates.

Session 1: update on stopping transmission and the mid-term strategy review.

Front-line workers are the face of the GPEI programme; they actualize the immunization policies in place to achieve poliovirus eradication in some of the most challenging physical and politically delicate terrains in the world, such as Afghanistan, Nigeria and Pakistan. Since 2022, more than 20 polio frontline workers have been killed worldwide, and recently an additional 13 have been abducted in Nigeria while conducting immunization activities (only three of whom had been released at the time of the meeting). Immunization efforts of these workers is integral to reaching every child and achieving polio eradication. GPEI commends front-line workers for their efforts today and every day, and strongly advocates for the safe release of the workers still held against their will in Nigeria.

Front-line workers' efforts have not been in vain. Despite the dips in immunization coverage due to the coronavirus disease 2019 (COVID-19) pandemic, front-line workers and other colleagues in GPEI have redoubled their efforts to eradicate poliovirus; the result is that the

[1] The order of presentations during the meeting differed slightly from the agenda to accommodate presenters attending virtually in time zones different from Central European Summer Time.

world is closer than ever before in achieving this goal. This progress is reflected in the title of the 22nd report and mid-term review of the Independent Monitoring Board (IMB): *Closing in on zero. Adapting to complexity and risk on the path to end polio*[2] (hereafter referred to as *Closing in on zero*). This title reflects just how far the global community has come in eradicating polio – titles of reports published in the past have focused on the challenges still to overcome. That said, progress has been slower than hoped due specifically to security and instability in key geographies, among other challenges such as vaccine hesitancy and natural disasters; the timelines of meeting Goal 1 and Goal 2 of the GPEI programme are therefore off track. Those goals are:

1. Permanently interrupt all poliovirus transmission in endemic countries.
2. Stop cVDPV transmission and prevent outbreaks in non-endemic countries.[3]

However, *Closing in on zero* did note that certification of wild poliovirus-1 (WPV1) can still be achieved by 2026 – and all stakeholders aim to ensure it is. GPEI believes that interruption can be achieved by the end of 2025 through intensified outbreak response activities, realizing certification of eradication by 2028. IMB recommendations from *Closing in on zero* are shown in Fig. 1. While GPEI agrees with all the recommendations in Fig. 1, it will focus first on those classified as high priority. GPEI fully supports recommendation 14, the development of an Afghan health system, but it cannot lead it because it is the responsibility of the Afghan Ministry of Health and would involve numerous other partners.

[2] Closing in on zero. Adapting to complexity and risk on the path to end polio. Geneva: Global Polio Eradication Initiative; 2023 (https://polioeradication.org/wp-content/uploads/2023/09/22nd-Report-of-The-Independent-Monitoring-Board-IMB.pdf, accessed 30 October 2023).

[3] Polio eradication strategy 2022–2026: delivering on a promise. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/9789240031937, accessed 27 October 2023).

Fig. 1. IMB recommendations ranked by priority and likely impact on polio eradication efforts

	No.	Priority	Recommended action	Notes
Goal 1	6	High	Continue working closely with provincial chief secretaries in Pakistan	• Agree; will continue to do so
	12	High	Undertake advocacy with provincial governors in Afghanistan	• Agree; pursuing all relevant opportunities
	5	Medium	Increase the number of campaigns planned in the endemics in 2023	• Agree in principle; adhering to existing campaigns and following epi
	9	Medium	New EMRO regional director should prioritize the regional subcommittee	• Agree and should happen in natural course; POB engaging
	7	Low	Order an independent audit in eastern Afghanistan	• Agree would be interesting, but lower priority and poses challenges
	8	Low	Carry out a serology study in eastern and southern Afghanistan	• Agree in principle; inaccessibility remains key issue
	14	Low	Convene a high-level meeting on developing a health system in Afghanistan	• Agree in principle; beyond GPEI's remit; willing to contribute
Goal 2	3	High	Extinguish cVDPV1 in Africa	• Agree
	2	Medium	Carry out budgetary review	• Agree in principle and is underway
	4	Medium	Immediately introduce direct detection technologies	• Agree in principle; studies underway and approval timelines remain TBC
	10	Low	Reconvene presidential task force in Nigeria	• Agree; and has already been done
	13	Low	Organize a high-level summit on strengthening Nigerian primary health care	• Agree in principle; must be country-driven
Cross-cutting	15	High	Support integrated immunization campaigns	• Agree and several integrated campaigns recently completed
	1	High	Review IMB's list of risks and set out action being taken to resolve or mitigate each	• Done; see GPEI response to IMB's 22nd Report and Mid-Term Review
	11	Medium	Prepare polio resilience plans	• Agree in principle; underway at regional level and GPEI can support

In addition, the IMB identified 20 risks to achieving polio eradication, to which GPEI was applying mitigating actions to lessen their impact. Of particular note are the following risks: re-establishment of WPV in Kandahar province (risk 1.9 from *Closing in on zero*); large outbreaks of circulating vaccine-derived poliovirus type 1 (cVDPV1) (risk 2.5); and cross-border transmission of poliovirus between Afghanistan and Pakistan (risk 1.12).

Poliovirus cases worldwide[4]

Discussion of the current risks and mitigating actions to poliovirus eradication focused on review of the global cases of WPV1, circulating vaccine-derived poliovirus type 2 (cVDPV2) and cVDPV1 in the consequential geographies[5] related to polio eradication. In Afghanistan six WPV1 cases have been discovered, all from Nangarhar province, where intensive efforts to interrupt persistent local transmission included subnational immunization days in May and July 2023. In Pakistan three cases of WPV1 were found in Bannu district of Khyber Pakhtunkhwa, but one case was just discovered outside the endemic zone. This province continues to be the focus of intensive efforts to stop remaining endemic WPV1 transmission. In non-endemic areas there have been no WPV1 cases detected this year, following cases in Malawi (one case in 2021) and Mozambique (eight cases in 2022). Africa has had 14 months without detected WPV1 transmission.

There have been 219 cases of cVDPV2 as of the date of the meeting. Since January 2022, cVDPV2 cases in the Democratic Republic of the Congo, Nigeria, Somalia and Yemen have accounted for over 70% of global cases. However, the number of districts with cVDPV2 transmission is declining year on year.

[4] The data presented in the report reflects the situation as of the annual consultation meeting held on October 23, 2023.

[5] "Consequential geographies" is the term applied to countries, provinces and sometimes only districts where poliovirus transmission is still occurring, either endemically or through importation.

In 2023, 95 cVDPV1 cases have been reported across three countries: the Democratic Republic of the Congo, Madagascar and Mozambique. In the Democratic Republic of the Congo, cases came from island communities where vaccine efforts continue but historically have lagged due to being difficult to access. In countries experiencing cVDPV1 outbreaks, poor coverage of bivalent oral polio vaccine (bOPV) and inactivated poliovirus (IPV) from routine immunization, and the de-prioritization of bOPV preventive campaigns have negatively affected population immunity.

These consequential geographies remain engines of poliovirus transmission. In addition to the risks named in *Closing in on zero*, are those related to insecurity, inaccessibility and political challenges. For example, in Afghanistan, the lack of rights by women and girls has led to a steep reduction in foreign aid, which has led to millions more people becoming food-insecure. Floods have displaced 33 million people in Pakistan, and up to 50 000 children are also missed with supplementary immunization activities (SIAs). In Nigeria, local banditry in parts of the country require district-by-district advocacy to reach the approximately 3.9 million children who have been underserved with poliovirus vaccine. A significant positive development in Nigeria has come from the recent appointment of Dr Pate as health minister, who has already re-established a presidential task force on polio eradication and essential immunization.

Integration activities

GPEI will focus on six countries – Afghanistan, Democratic Republic of the Congo, Nigeria, Pakistan, Somalia and Yemen – as it closes in on zero, with ad hoc efforts in countries with outbreaks beyond those six. GPEI has launched an effort to develop its integration function collaborating with Gavi, the Vaccine Alliance (Gavi) and the WHO Essential Programme on Immunization (EPI), as well as with partners involved in health emergency response.

In addition to the work to stop poliovirus transmission and certify its eradication, GPEI is also planning for the post-certification world, when GPEI will stop and its activities will be transferred elsewhere. Work envisioning the transition has already begun.[6] The Post-2023 Strategic Framework, which is currently being updated, was also discussed. This framework will provide a clear direction and align efforts to operationalize, establish roles and responsibilities, and determine accountability for the activities to sustain the gains of the polio eradication programme. Transition will utilize the infrastructure developed by GPEI to strengthen broader health under the leadership of national authorities.

Solutions will be tailored to each region and country – there is no one "formula" for transition across disparate geographies. An M&E framework will measure performance and progress throughout transition and beyond. A remaining question as the world progresses towards polio eradication is who will be accountable and responsible for polio-essential functions.

The remaining work to reach zero cases and determine how best to utilize the infrastructure remaining after GPEI is stopped continue to need resources, both human and financial. These

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[6] Stakeholders Commit to a Renewed Strategic Framework on Polio Transition [website]. Geneva: World Health Organization; 2023 (]https://www.who.int/news-room/feature-stories/detail/stakeholders-commit-to-a-renewed-strategic-framework-on-polio-transition, accessed 9 November 2023).

challenges require ongoing commitment within and beyond GPEI. GPEI's annual budget is approximately US$ 960 million, which is part of the 2022–2026 budget of US$ 4.8 billion; current pledges of US$ 3.3 billion have been confirmed. Recently an innovative financing agreement has been reached with the European Union, which will lead to an additional € 500 million pledged, making the budget shortfall approximately US$ 1 billion.

Discussion

Meeting participants posed several questions and comments about supply of vaccines and countries targeted with vaccine campaigns.

In northern Nigeria, for example, immunization rates are between 5 and 10% due to inaccessible locations, and there are pockets of the world where children are persistently missed with vaccination. Polio will not be stopped until these pockets are immunized – as recent cases of imported poliovirus in London, New York City and in Israel demonstrate. Alongside immunization, surveillance is critical, such as wastewater surveillance, which is increasingly being done in countries with wastewater streams to track COVID-19. The addition of poliovirus surveillance to such schemes could relatively easily be done; where applicable, this could also assist in environmental surveillance requirements around poliovirus containment.

In Yemen, some anti-vaccine sentiment in the country, coupled with the health emergency there since 2015 mean vaccination campaigns have lagged. When GPEI finally did secure the authorization to vaccinate in January 2023, this was rescinded weeks later. GPEI continues to advocate regional actors who can also advocate the authorities in-country. In addition, GPEI is in talks with the main anti-vaccination lobby in Yemen, which are ongoing. Advocacy with local leaders in the country will also help build momentum towards vaccine acceptance.

Annual consultations, such as the present meeting, help with vaccine forecasting, supply and demand and logistical challenges – and they also provide a space for bilateral discussions to occur. GPEI aims to be as transparent as possible about vaccine demand and supply requirements with all stakeholders involved. The consultative process of developing the polio vaccine security framework is a reflection of this commitment.

Session II: breakdown of the demand estimates and forecasts per vaccine.

Following the discussion of poliovirus epidemiology and polio eradication strategy, the focus shifted to polio vaccine demand estimates and forecasts.

OPV: projected demand estimates

OPV estimates were shared for bivalent OPV (bOPV) and novel oral poliovirus vaccine (nOPV2). Data from countries that self-reported using the WHO/UNICEF Joint Reporting Form in 2022 were used to inform the historic figures; however, the data may not fully incorporate outbreak response doses provided by GPEI; thus, it should be used for a high-level overview only.

bOPV

While at the aggregate level it appears that the supply market for bOPV is a healthy market, there is a strong dependency on a limited supplier base which is declining.

After certification of WPV1 eradication, the logical next step is to discontinue the use of bOPV in routine immunization, which is currently expected to take place for the end of 2027. In this regard, the manufacturer landscape is rapidly changing, with multiple manufacturers planning to discontinue production of bOPV. This includes several WHO-prequalified manufacturers. Out of eight manufacturers of WHO-prequalified bOPV, only six manufacturers will continue after 2024. Furthermore, a small number of manufacturers are only producing for domestic markets. Drug substance suppliers are also declining since 2022 – from four to three – with reliance on a single source for 70% of bulk in 2023. bOPV is used in 137 countries worldwide: 18 high-income, 40 upper-middle-income, 53 lower-middle-income and 26 low-income;[7] it remains the backbone of eradication activities, and stakeholders must anticipate and mitigate the risks associated with the upcoming withdrawal.

Prices of bOPV have remained stable over time. Global demand has been approximately 0.8 to 1.3 billion doses per year, over the past four years (this is likely an underestimation as country reporting does not differentiate between doses for routine immunization and outbreak response); Fig. 2 shows supply by country income grouping and WHO region.

The United Nations Children's Fund (UNICEF) aims through its procurement and engagement with the supply market to assure the sufficiency of supply of bOPV despite a declining supplier base until the bOPV cessation. In 2023, UNICEF procured bOPV on behalf of 80 countries, with an estimated 840 million doses to be procured by end of year across 10- and 20-dose vials, of which most of the demand is for the latter. Approximately 70% of bOPV bulk vaccine for this year were sourced from a single manufacturer, indicating a high-risk market profile. The doses are paid for through country funding for routine activities and case response and GPEI funding for outbreak response.

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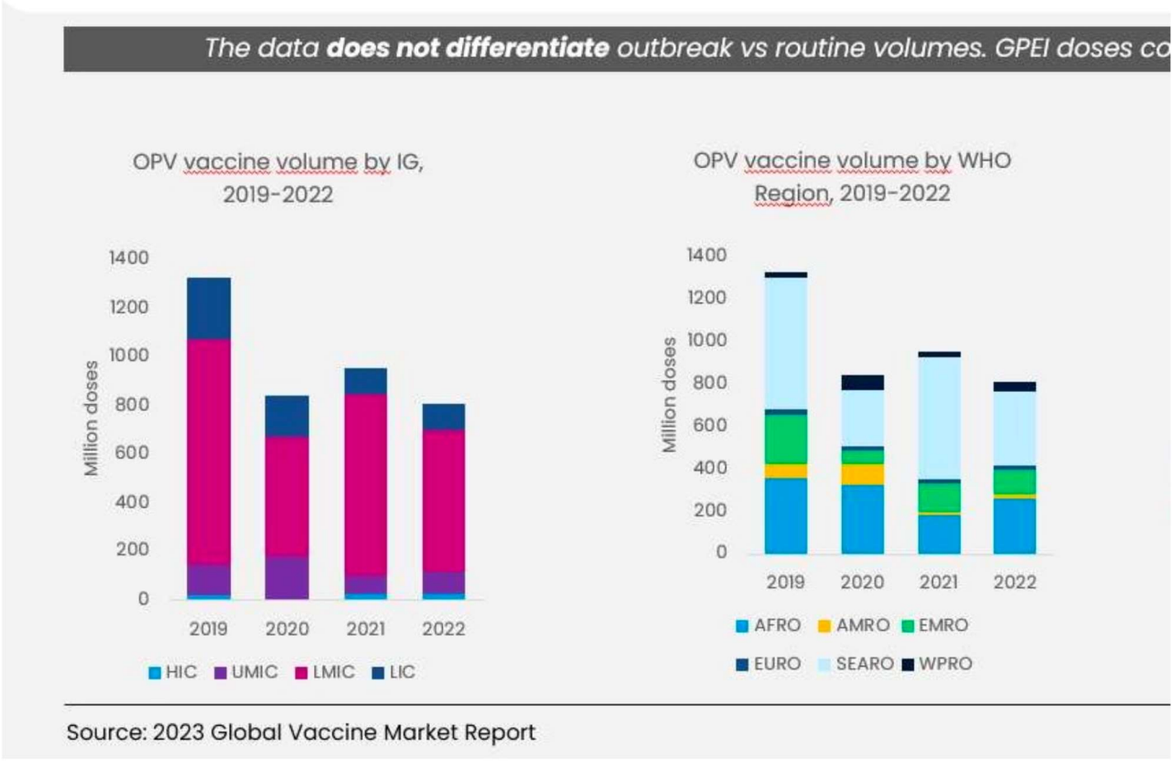
[7] Country income groupings of low, lower-middle, upper-middle and high are determined by the World Bank based on gross national income per capita: The world by income and region [website]. Washington (DC): World Bank (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups, accessed 31 October 2023).

More than 200 million doses in 20-dose vials are now projected to be required only for year 2024.

Fig. 2. Historical volumes of bOPV



Plans for bOPV use in SIAs over the coming four years are shown below. These plans do not factor in vaccines for routine immunization.

- 2024: There is some budget for preventive SIA campaigns this year. Budget-approved, operational bOPV volumes are in place to respond to existing cVDPV1 outbreaks. Outbreak response needs to adapt to failure/success of outbreak control efforts.
- 2025–2026: GPEI will return to SIAs in the WHO African Region and Eastern Mediterranean Region. Prevention is risk-stratified, subnational triaging of immunity gaps based on deficits in routine immunization and/or SIAs, rather than bulk catch-up. Over these years the historically consistent SIA calendar/volumes for Afghanistan and Pakistan will be maintained.
- 2027: Budget and supply will remain flexible to conduct surge SIAs where most needed (based on risk stratification) to induce high immunity for young age groups prior to bOPV withdrawal. Over this year, the historically consistent SIA calendar/volumes for Afghanistan and Pakistan will be maintained up to the point of OPV withdrawal.

nOPV2

nOPV2 has been used for polio outbreak response under a WHO Emergency Use Listing Procedure (EUL) since early 2021 (it is currently the vaccine of choice for outbreak response,

used 92% of the time in this context in 2022). Since that time, 820 million doses have been administered in 35 countries.

Use of the vaccine under an EUL requires close surveillance, which provides data for further use and ultimately WHO prequalification (hereafter referred to as prequalification). The Global Advisory Committee on Vaccine Safety (GACVS) has to-date reviewed the safety data from over 544 million doses administered across 28 countries and concluded there were no safety concerns associated with nOPV2. The data also suggests that nOPV2 elicits a comparable immune response to mOPV2 in infants, children and adults and that it is comparable to mOPV2 in field effectiveness, and retains its enhanced genetic stability over time with a substantially lower rate of reversions of public health importance compared to mOPV2.

While nOPV2 usage carries some risk of vaccine-derived poliovirus infections, its safety profile is notably better than that of Sabin OPV2. In 2023, there were 10 reported cases of polio associated with nOPV2 across several countries, including four in the Democratic Republic of the Congo, two in the Central African Republic, and one each in Botswana, Cameroon, Egypt, and Nigeria. However, compared to Sabin OPV2, nOPV2 has resulted in significantly fewer vaccine-derived polioviruses. Based on the extent of nOPV2's use in the WHO regions of Africa, the Eastern Mediterranean, and Europe, 66 cVDPV2 emergences would have been anticipated if nOPV2 had the same rate of seeding new emergences as Sabin OPV2. This data underscores that, despite not being flawless, nOPV2 substantially reduces the risk of new cVDPV2 emergences.

Another risk in relation to nOPV2 is the reliance on a single manufacturer. Major supply interruptions from August 2022 to March 2023 required GPEI to prioritize shipments between countries for outbreak responses based on a risk assessment. A second manufacturer is expected to begin producing nOPV2 in 2024 following submission of its dossier for prequalification evaluation. It is hoped that the current nOPV2 will receive WHO prequalification in December 2023.

In October 2023, the Strategic Advisory Group of Experts (SAGE) expressed concerns about the continued detection of circulating vaccine-derived poliovirus (cVDPV) type 2 (cVDPV2) in Africa and increasing detection of cVDPV type 1 in several countries and stressed the need for efforts to improve routine immunization coverage. SAGE further recommended that to minimize the risk of seeding new cVDPV2 outbreaks, the novel oral poliovirus vaccine type 2 (nOPV2) should be used in high-quality campaigns with a **maximum interval of four weeks between SIA campaign rounds –** this would further minimize the risk of seeding new cVDPV2 outbreaks. Finally, SAGE recommended that in areas of type 1 and 2 poliovirus co-circulation, sequential vaccination campaigns with nOPV2 and bOPV should be implemented; short intervals between homologous vaccines should be considered.

Per SAGE guidance and endorsement by the World Health Assembly, nOPV2 is being supplied to countries through a global stockpile, where the needs of all countries can be met while keeping risks of inadvertent reintroduction of type 2 vaccine low. Supply projection for 2024 is 619 million doses based on the maximum capacity from one manufacturer currently producing vaccine. Estimates from the second manufacturer are not included. The expected opening stock of nOPV2 in 2024 is approximately 200 million doses. The Outbreak Response & Preparedness Group (ORPG) detailed three nOPV2 demand scenarios for 2024:

- high – 566 million doses
- medium – 486 million doses
- low – 410 million doses.

Under all demand scenarios the stockpile is projected to be sufficient to cover demand through the maximum capacity of the sole manufacturer.

IPV: projected demand estimates

Standalone IPV supply has remained constant over the past four years at about 150 to 200 million doses annually; the vaccine is used in 157 countries: 37 high income, 40 upper-middle income, 54 lower-middle-income and 26 low incomes.

UNICEF is procuring on behalf of 82 countries annually, and demand from these in 2023 is estimated at 100 million doses; for 2024, demand is estimated at 110 million doses. Approximately 90% of the awarded quantities will be utilized by end 2023. Four manufacturers will supply IPV to UNICEF in 2024. There are seven manufacturers of WHO-prequalified IPV worldwide.

The supply of stand-alone IPV vaccine in 2023 is estimated to be three times higher than the demand processed through UNICEF. This situation indicates a robust market with a geographically diverse supplier base, albeit nearing overcapacity. The future introduction of an IPV-containing hexavalent vaccine could potentially double this demand. Currently, the available supply is adequate for all countries using IPV to administer a second dose and for catch-up immunization campaigns in nations that have experienced intermittent access to IPV since the 2016 switch. UNICEF remains actively engaged with partners to address potential IPV demand to respond to polio outbreaks, particularly in countries with IPV-only schedules or those opting for IPV use as per the SAGE recommendation in areas of persistent transmission following OPV SIAs.

Given the change in the IPV market, and to support the WHO poliovirus containment requirements, WHO and UNICEF are considering making compliance to the WHO Global Action Plan for Poliovirus Containment (GAP) III/IV a mandatory requirement for awarding in the next tender.

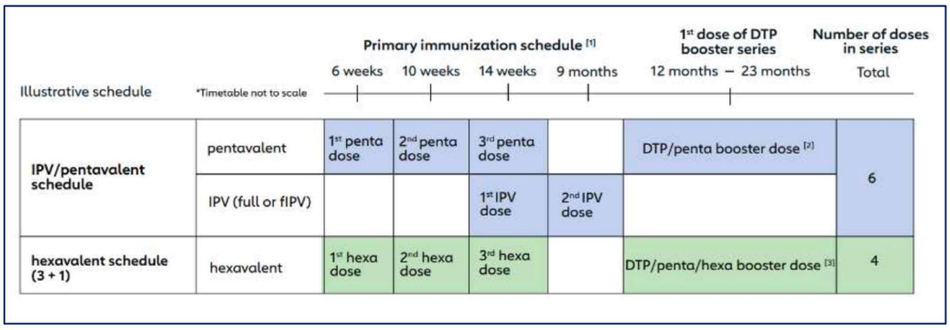
The current tender covers a three-year period (2023 to 2025) with an option of a 12-month extension. During the first half of 2024, UNICEF will consult with manufacturers regarding extending the current long-term agreements for 12 months and, if agreed, under what terms and conditions. UNICEF will then review and evaluate responses to the request and will either extend long-term agreements to cover the 2026 demand in full (or partially), and/or issue a new tender for demand for 2026.

The intent would be to ensure that any contract extensions are agreed by quarter four 2024. If a new tender is needed for 2026 this will be issued during the second half of 2024. The period for the next tender will be decided in consultation with manufacturers.

IPV programme update

A general IPV vaccination schedule was shared with meeting participants (Fig. 3).

Fig. 3. Recommended immunization schedules with IPV



Note: IPV must be administered with bOPV (IPV + bOPV schedule)

[1] This is an illustrative schedule used in many countries, and in most Gavi-supported countries. Other WHO-recommended schedules are possible (i.e. IPV at 6 and 14 weeks, sequential schedules,...)

Pentavalent and hexavalent primary series can be administered starting at 6 weeks, with a minimum interval of 4 weeks between doses. Common schedules include: 6/10/14 weeks, 2/3/4 months or 2/4/6 months.

[2] Most Gavi-eligible countries have not introduced a DTP-booster yet, but it is now supported by Gavi.

[3] A hexavalent booster is needed in countries that begin the primary series at 6 weeks.

In 2022, immunization coverage with the first dose of Inactivated Polio Vaccine (IPV1) in infants remained below 50% in six countries, a slight improvement from nine countries in 2020. However, 40 countries still fell short of the 80% coverage target. Notably, IPV1 administration has achieved parity with the third dose of DTP (DTP3) in recent years, but this trend is predominantly seen in high-income countries. Efforts are continuously being made to enhance IPV1 coverage rates globally.

In 2023, a series of decisions regarding the hexavalent vaccine culminated in Gavi's resolution to establish a funding mechanism for it in the third quarter of the year. This decision set the stage for in-depth discussions about the hexavalent vaccine supply landscape, encompassing aspects like ongoing vaccine development, available supplies, and anticipated pricing. The first hexavalent vaccine is expected to receive WHO prequalification in the fourth quarter of 2023.

- Two additional vaccines are expected to receive WHO prequalification in 2024, and early 2025; this will be followed by an additional two prequalified vaccines expected in 2026 and early 2027.
- Supply availability will be gradual, and is expected to start in Q2 2024, subject to prequalification of first vaccine and materialization of demand.
- Demand will drive supply in the early years of the hexavalent programme.
- Price will be US$ 2.85 per dose for Gavi-eligible countries, and US$ 3.00 per dose for fully self-financing countries (both for the 10-dose presentation). UNICEF and partners will work to meet the demand to ensure there is a sustainable balance of demand and supply and ensure the long-term health of the pentavalent and IPV markets.

The guidelines[8] for hexavalent vaccine funding were officially launched on September 29, 2023. An application portal for countries seeking funding for the hexavalent vaccine is anticipated to become operational in November 2023[9]. To aid countries in evaluating introduction of this vaccine, the World Health Organization (WHO) will provide a decision-support tool. This tool will enable stakeholders in various countries to weigh the pros and cons of hexavalent and pentavalent vaccines in the context of their specific national circumstances.

Discussion

Before starting the discussion with meeting participants, the GPEI programme requested manufacturers indicate if they would like to continue to receive regular programme updates from GPEI. Response from the manufacturers in the meeting was that yes, such biannual updates are useful – particularly for new manufacturers.

Questions addressed the updates of each vaccine formulation presented: bOPV, monovalent oral polio vaccine type 2 (mOPV2), nOPV2 and IPV.

One question related to containment requirements being applied to nOPV and the facility producing it. It was noted that nOPV is currently being used for polio outbreak responses under the EUL; even after the vaccine receives WHO prequalification, this will remain its use case – unless the epidemiological data suggest other uses would be beneficial. nOPV2 production continues under the temporary containment waiver from GAPIV.[10] After production all nOPV2 doses must be accounted for; reverse logistics is used to account for used doses, vials, destruction of doses in the field and the equipment to administer them, to ensure there is no loss or wild escape.

Given nOPV2 is now the preferred vaccine for outbreak response, monovalent oral polio vaccine type 2 (mOPV2) is no longer produced. However, GPEI requests that manufacturers holding stockpiles of this vaccine maintain them until the vaccine expiry dates are reached; this provides GPEI a backup plan for immunization given the current dependency on a single source of supplies of nOPV2. As long as risks of outbreaks of cVDPVs remain, stockpiles of OPV2-containing vaccine will be strategically important.

A question about catch-up campaign funding was posed. It is expected that this topic will be addressed during the Gavi Board meeting 5–7 December 2023.

To a question regarding estimation of IPV2 (the second dose of Inactivated Polio Vaccine) coverage, it was clarified that currently, global coverage estimates do not include IPV2 data. Although calculating IPV2 estimates is straightforward, incorporating them into the existing framework of vaccine coverages could complicate interpretations due to the diversity of vaccination schedules, vaccines, and their combinations. Presently, OPV3 (the third dose of any

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[8] Gavi Support Guidelines https://www.gavi.org/our-support/guidelines.

[9] For more information on Gavi's funding for hexavalent vaccine: https://www.gavi.org/our-support/guidelines/hexavalent-vaccine-programme-information.

[10] Waivers are time-limited, conditional to the specified usages only and temporarily waived from the biorisk management requirements for the handling of Sabin polioviruses described in GAPIV.

polio vaccine) and IPV1 are the primary measures. In some countries, measuring IPV2 may not be feasible or relevant, and such data might not be reported. Therefore, the Global Polio Eradication Initiative (GPEI) is in discussions to determine what should be monitored in countries to further program goals.

Another consideration is the supply of hexavalent vaccine by 2030 and its adequacy for immunizing birth cohorts in all countries. GPEI anticipates a gradual increase in vaccine supply, which is unlikely to meet the needs of the entire birth cohort in all Gavi-eligible countries immediately. This is partly because not all these countries are expected to transition to hexavalent formulations due to higher costs compared to the pentavalent formulation plus IPV. Furthermore, the use of fractional IPV in numerous countries adds to the expense of switching to hexavalent vaccines.

Session III: Containment and certification

Update on global poliovirus containment

There can be no certification of polio eradication without adequate poliovirus containment. WHO Member States have stressed this point as well, formalized in resolution WHA71.16. The resolution urges all Member States to:

- intensify efforts to accelerate the progress of poliovirus containment certification.
- complete inventories for type 2 polioviruses, destroy unneeded type 2 materials and to begin inventories and destruction of unneeded type 1 and 3 materials in accordance with the latest available published WHO guidance; and
- ensure that any confirmed event associated with a breach in poliovirus containment is immediately reported to the National International Health Regulations (IHR) Focal Point.

In addition, the resolution urges all Member States retaining polioviruses to:

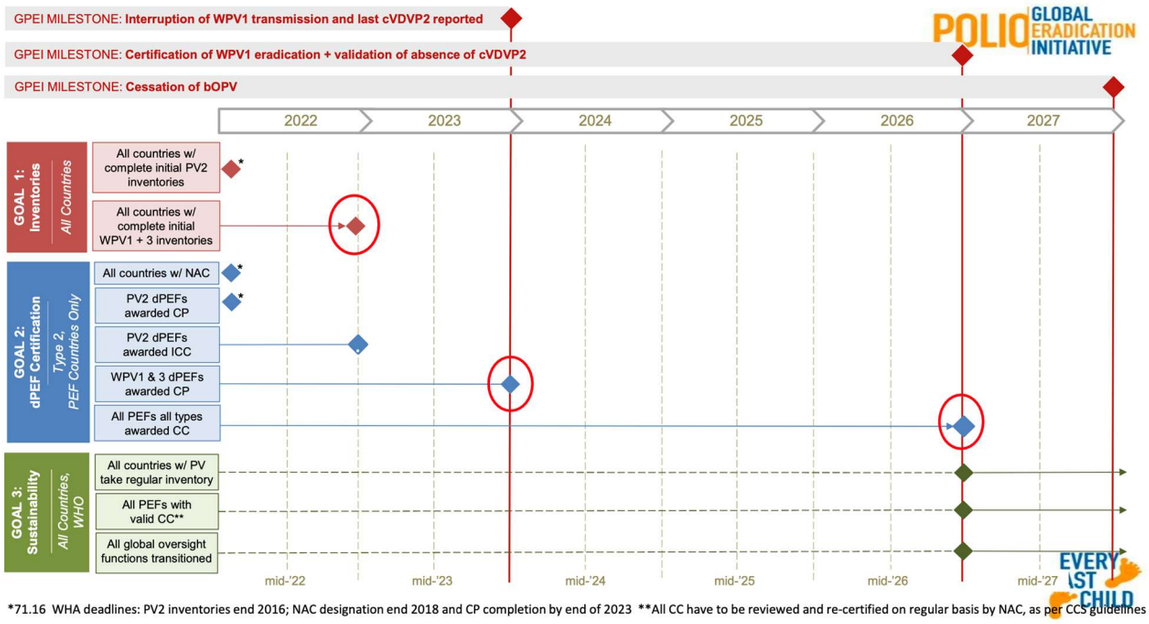
- reduce to a minimum the number of facilities designated for the retention of polioviruses, prioritizing facilities performing critical national or international functions.
- appoint, as soon as possible and no later than the end of 2018, a competent NAC; and
- request facilities designated to retain poliovirus type 2 to formally engage in the Containment Certification Scheme by submitting to their NAC their applications for participation, which is the first step of the global certification process, as soon as possible and no later than 31 December 2019.

While the COVID-19 pandemic has challenged these timelines, post-pandemic efforts to catch-up on containment are now increasing in momentum. For example, there remain just two countries retaining poliovirus that to-date do not have a NAC: China and Romania. WHO developed GAPIII[11] to meet the goals in WHA71.16, which have been updated to GAPIV. Importantly, WHO and UNICEF are considering making compliance with GAPIV requirements mandatory for awarding in the next tender round.

Mapping of live virus is essential to know where virus stocks exist worldwide. Despite this being a provision in resolution WHA71.16, five countries have not yet completed their initial poliovirus type 2 inventories (due end 2016), and 28 have not yet completed their initial poliovirus type 1 and 3 inventories (due end 2022; see Fig. 4).

[11] Containment certification scheme to support the WHO global action plan for poliovirus containment: GAPIII–CCS. Geneva: World Health Organization; 2017 (https://iris.who.int/handle/10665/279988?search-result=true&query=Global+Action+Plan+for+Poliovirus+Containment&scope=%2F&rpp=10&sort_by=score&order=desc, accessed 3 November 2023).

Fig. 4. Timeline of poliovirus containment activities in the context of GPEI activities



Containment certification falls within the mandate of the Global Certification Commission (GCC) and is detailed in the Containment Certification Scheme (CCS) of GAPIV. Broadly speaking, this requires that a poliovirus essential facility (PEF)[12] apply to its NAC for certificates showing they are compliant with GAPIV and can demonstrate that each has the appropriate biosafety and biosecurity measures in place to minimize risks of a containment breach. Each certificate is awarded by the NAC, and duly validated by the Containment Working Group of the GCC.

- The **certificate of participation** (CP) is the first certificate awarded to a PEF; it is obtained following submission of existing inventories of polioviruses, current containment conditions, and a time-bound action plan which demonstrates the intent of the PEF to secure its polioviruses.
- The **interim certificate of containment** (ICC) is the next step towards securing polioviruses retained by a PEF; it shows the PEF has had an audit of its biosafety and biosecurity provisions, in alignment with the requirements of GAPIV, as well as an assessment of immunization and environmental safeguards to identify non-conformities which, if left unaddressed, could lead to a containment breach.
- A **certificate of containment** (CC) is the final step in containment: it shows that the PEF has been found to have adequate biosafety and biosecurity measures in place to prevent a containment breach and includes continuous monitoring of the facility and processes therein to manage poliovirus containment in perpetuity.

[12] That is, facilities retaining poliovirus.

There are 70 PEFs in 21[13] countries worldwide that intend to retain polioviruses after eradication. Currently CPs have been awarded to all facilities in 12 countries, and to some facilities in an additional five countries. Only facilities in three countries have begun the application process for an ICC. No facilities have yet been awarded a CC.

Containment requires strong national and international collaboration and commitment. Eradication will only occur when all stakeholders work together to achieve high immunization coverage and high-quality surveillance and ensure biosafety and biosecurity of facilities retaining polioviruses are met. The issue of containment cannot be put off until the proverbial "last minute"; if it is, eradication efforts will also be delayed.

Discussion

Questions and comments from online meeting participants provided discussion points following the presentation on containment.

Would GCC consider solely the paperwork received from NACs to certify containment, or would it also consider assessments done by the group of global and regional external experts, such as the WHO prequalification inspection team? The containment working group of the GCC (CWG) relies on the documentation submitted from the NACs and PEFs; it has no regulatory function and does not inspect facilities.

There was a question about the timing of the update of the CCS. The aim is to have the updated CCS published by January 2024.

The S-19 polio strain is being handled outside the GAPIV containment requirements. Will containment requirements be based on strain of poliovirus, or will they apply to all polioviruses? At present, S-19 polioviruses and some other less-infectious polioviruses may be handled outside of containment. This is subject to ongoing review by the Containment Advisory Group.

How is WHO going to weigh environmental risks of polio outbreaks with those related to containment breaches from facilities retaining polioviruses? Along with the required facility safeguards, immunization and environmental safeguards are critical ways of preventing transmission of polioviruses in the event of a containment breach. These three levels of safeguards are all considered when applications for ICCs are reviewed by the CWG.

It also was noted that a CP application for a PEF in the Islamic Republic of Iran has been submitted to the GCC working group, the CWG.

Update on the regional and global status of the certification of polio eradication

A review of the requirements to meet certification of eradication agreed upon in 2018 prefaced the discussion on certification of polio eradication. These are:

1. no WPV transmission detected from any population source for the previous three years.
2. adequate global poliovirus surveillance.

[13] Pakistan currently retains poliovirus but the government has declared it will not retain these after poliovirus eradication.

3. safe and secure containment of WPV retained in facilities, such as laboratories and vaccine manufacturing facilities.[14]

The validity of the first point, the three-year timespan for certification was formally questioned. An expert working group (EWG1) was formed to determine if there was a scientific basis to the timespan. It was found that the three-year rule came about from a two-year time span used for smallpox, with an extra year added because of the asymptomatic cases seen with polio. Further, modelling[15] has supported the idea that the three-year rule was not absolute, and shorter periods could be justifiable, noting that this was highly dependent on the quality of surveillance in use.

Surveillance has changed since the first WHO region was certified, especially with the widespread use of environmental surveillance. With hindsight, EWG1 considers that the certification of five WHO regions previously certified was correctly done, and that the process provided valuable lessons learned.

The EWG1 discussed the two options put forward by the chair – to advise the Regional and Global Certification Commissions to: i) maintain the current criteria, or ii) alter the existing certification criteria to remove a fixed three-year period of non-detection of WPV. There was unanimous support for the second option above. The GCC accepted and endorsed the recommendations of EWG1. This led to revised criteria (in **bold** below) of certification of elimination for both WPV and cVDPV, as follows:

- For Goal 1: revised criteria for WPV global certification of elimination
  - No WPV transmission detected from any population source for a **flexible period, but not less than two years**, taking into account the quality of surveillance in **endemic** countries, the risk in subpopulation groups poorly or not reached by surveillance, and other data such as molecular analysis of the last chains of transmission.
  - Adequate **global** poliovirus surveillance.
  - Safe and secure containment of WPV retained in facilities, such as laboratories and vaccine manufacturing facilities.

If transmission is interrupted in the coming low season in Afghanistan and Pakistan, global certification of WPV eradication could still take place in 2026.

- Goal 2: certification of elimination of cVDPV
  - Certification of the elimination of cVDPV is complicated by the fact that as long as live OPV is used, emergence of new cVDPV cannot be ruled out.
  - Furthermore, the occurrence of chronic excreters among immunodeficient persons (iVDPV) poses further (unknown but likely small) risk of seeding new outbreaks of cVDPV.

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[14] All facilities retaining WPVs should have a CC or an ICC. In addition, at the time of global WPV certification, the GCC will consider the status of biorisk management of potentially infectious materials and readiness to respond to containment breaches.

[15] The modelling reviewed pertained to the Afghanistan and Pakistan epidemiological situation, and did not apply to the risk of importation, and, as such, did not consider the recent Malawi importation.

- The GCC has formed a second expert working group (EWG2) to support the GCC in formulating the criteria for certification of the elimination of cVDPVs; these are still being finalized.
- Based on the advice of the expert working group, the GCC will deliberate and define the criteria for certification of elimination of cVDPVs.

It is unlikely certification of elimination of cVDPV will be possible in 2026 due to the ongoing number of outbreaks.

Agenda points to be discussed at the twenty-fourth meeting of the GCC (to be held on 22–23 November 2023) were shared. These include progress towards interrupting WPV1 and stopping and preventing cVPDV2 outbreaks. The former will include members from the Eastern Mediterranean Regional Certification Commission (RCC) and WHO polio country team leaders; and the latter will include review of the report of EWG2 on certification of elimination of cVDPVs and updating of the criteria mentioned above. Also to be discussed are the outcomes of the mid-term review of the Global Polio Eradication Strategy 2022–2026, which will be used to make recommendations for certification of poliomyelitis eradication and finally progress on containment of polioviruses, specifically the established timelines for facilities (shown in Fig. 4).

Session IV: New developments and innovations in polio vaccines and products

Research and product development: update on current GPEI priorities and new developments

Continued research and development (R&D) of new products is essential in the fight against poliovirus. This ongoing R&D is critical to overcome the limitations of current vaccines, such as the Inactivated Polio Vaccine (IPV) and Oral Polio Vaccine (OPV). The IPV lacks the ability to induce mucosal immunity, while the OPV can lead to the occurrence of vaccine-derived polioviruses (VDPVs) and requires stringent containment measures. Additionally, R&D efforts are needed to address the issue of chronic poliovirus excreters, particularly those with persistent and chronic iVDPV (immunodeficiency-associated vaccine-derived poliovirus) infections, to halt virus shedding. This research is vital until the cessation of oral polio vaccine use. The importance of R&D in eradicating poliovirus was emphasized in a SAGE (Strategic Advisory Group of Experts) statement from October 2022:

> *SAGE recognized the importance of clinical research and product development and encouraged accelerated efforts to develop, license and commercialize novel OPVs, VLP and other non-infectiously manufactured IPV-like vaccines, polio antivirals and monoclonal antibodies.*

Pocapavir and V-7404

In 2006 the Polio Antivirals Initiative was founded. Polio antivirals and monoclonal antibodies development is currently being led by PATH, with many international partners, among them WHO, the Bill & Melinda Gates Foundation, the Task Force for Global Health. Antivirals being researched through this partnership include pocapavir (viral capsid inhibitor) and V-7404 (irreversible viral protease inhibitor). Antiviral pocapavir demonstrated ability to stop excretion in mOPV challenge study and compassionate use patients (iVDPV and NPEV). However, drug resistance development has been observed (OPV challenge study and 1 iVDPV confirmed/2 suspected). V-7404 has synergistic antiviral activity with pocapavir (in vitro) and reduces potential for resistance frequency by >4 logs (in vitro). Phase I single- and multi-dose study with both candidates have been completed. Combination was well tolerated, and pharmacokinetics were as expected.

Due to cost and projected development timeline, the coalition of partners have decided to focus on compassionate use of pocapavir/V-7404 as a mechanism for treating iVDPV excreters rather than on full registration, which was originally planned. Challenges with this focus will be establishing safety in paediatric populations, among other regulatory challenges (such as restrictions on compassionate use). A regulatory paediatric plan that includes a clinical study protocol of pocapavir/V-7404 is being prepared.

Polio monoclonal antibodies

The monoclonal antibody 9H2 has demonstrated significant in vitro neutralizing activity against poliovirus serotypes 1, 2, and 3. However, substantial work is required to evaluate its potential as a human therapeutic, including lead optimization, which is still pending. If progress leads to a viable drug candidate, pharmacokinetic studies in mice are anticipated around 2025. Assuming the feasibility of advancing to Phase I and IIa clinical trials, preliminary

results could be expected by the end of 2028 at the earliest. Discussions regarding funding for this development work are ongoing with the Bill & Melinda Gates Foundation.

Polio virus-like particles (VLPs)

A VLP vaccine candidate offers the potential to produce vaccines without the need for live viruses, eliminating the requirement for containment in Inactivated Polio Vaccine (IPV) production during the post-eradication phase of poliovirus. Ideally, this candidate would eventually supplant IPV manufactured with wild polioviruses, given the risks of unintentional releases. In 2011, the World Health Organization (WHO) established an R&D consortium led by the University of Leeds in the United Kingdom, with funding from the Bill & Melinda Gates Foundation. Research indicates that VLPs, when combined with simple aluminium-based adjuvants, have immunogenicity in rats that is comparable to or better than IPV, among other encouraging findings.

The consortium's current focus is on facilitating the industrial production of recombinant poliovirus sVLPs. In 2019, WHO issued a call for expressions of interest in the commercialization of VLPs, attracting significant attention. Three primary candidates emerged, with the University of Leeds forming contractual agreements (CDA/MTA) with commercial entities. These entities received VLPs for rat immunogenicity testing to assess reproducibility, with promising initial results. Discussions with all involved commercial parties continue, coordinated by WHO. On May 1, 2023, a key meeting between the Bill & Melinda Gates Foundation and the VLP consortium was held. Subsequently, the Bill & Melinda Gates Foundation requested proposals for the complete development of stand-alone VLPs from selected entities, which are currently under review.

Additional therapeutic options

Additional iVDPV therapeutic options, such as small molecules and nanobodies, are being studied. A Phase I clinical trial has been completed for the small molecule PI4KB inhibitor, for example. However it is considered unlikely that this and other therapeutic options will receive stringent regulatory authority before 2029.

Update from the WHO Vaccine Prequalification Team

The WHO assessment process for prequalification and risk-benefit assessment performed by the Vaccines Prequalification Team to ensure access of vaccines at global level was highlighted. This included the post-monitoring activities of recommended vaccines and the process for release of vaccines into WHO stockpiles. An overview was shared of the vaccines currently prequalified and those being used under an EUL (Fig. 5).

Fig. 5. Overview of poliovirus vaccines in use and expected.

Vaccine	Process	Current	Under evaluation	Expected
combinations	PQ	1 (1 presentation)	1	2
IPV	PQ	5 (11 presentations)	-	1
sIPV	PQ	3 (4 presentations)	1	-
mOPV1	PQ	3 (4 presentations)	2	-
mOPV2	PQ	3 (4 presentations)	-	-
mOPV3	PQ	1 (2 presentations)	1	-
bOPV	PQ	8 (13 presentations)	-	1
tOPV	PQ	1 (1 presentation)	-	-
nOPV2	PQ	-	-	1
nOPV2	EUL	1 (1 presentation)	-	-

The process for the emergency use listing of nOPV2, the first vaccine recommended under EUL was highlighted. The WHO EUL is a time-limited recommendation based on risk- benefit assessment to ensure access of vaccines for public health emergencies of international concern. Manufacturers need to continue generation of data to allow marketing authorization by the relevant authority and prequalification. WHO PQ performs continuous monitoring of this vaccine. The Vaccines Prequalification Team is currently working on the transition to prequalification, expected by end of 2023.

Another nOPV2 produced by a second manufacturer will be submitted in 2024 for prequalification evaluation. Increasing the supply base of this vaccine will represent important public health benefits. WHO is currently reviewing all options to facilitate expedited review and availability of other novel OPV vaccines, particularly nOPV1 and nOPV3.

Update on planning underway for the cessation of OPV use

OPV cessation involves the withdrawal of bOPV from routine immunization programmes worldwide following certification of WPV1 eradication as the use of live poliovirus vaccines is incompatible with poliovirus eradication. As briefly described above, cessation of bOPV will occur after eradication of WPV1 (certification a minimum of two years after last detection with withdrawal currently expected 2027), as described in the Framework for OPV cessation published in the *Polio Post-Certification Strategy*.[16] Risks of re-emergence of poliovirus post-

[16] Polio Post-Certification Strategy. Geneva: Global Polio Eradication Initiative; 2018 (https://polioeradication.org/polio-today/preparing-for-a-polio-free-world/transition-planning/polio-post-certification-strategy/, accessed 7 November 2023).]

eradication remain significant, given the VDPV emergences leading to cVDPV outbreaks and community spread already witnessed.

In 2022 SAGE endorsed the establishment of a bOPV cessation team, to be assisted by the SAGE Polio Working Group, in order to ensure maximum mitigation of this risk. The switch in 2016 from tOPV to bOPV to mitigate some risk of cVDPV outbreaks did not go as planned as can be seen with the high number of cVDVP2 cases; it did, however, provide important lessons which will be considered in the preparations for cessation of OPV, and which are being detailed in the 2024 revision of the Polio Post-Certification Strategy. This revision will focus on key pre-certification, pre-cessation and post-cessation strategies and activities to facilitate a smooth transition of polio-essential functions from the GPEI to global and national health programmes. Included in the Post-Certification Strategy will be a framework to detail the appropriate governance and financing of the functions related to OPV cessation, such as surveillance, containment, vaccine supply including stockpiles, outbreak response and essential immunization.

This cessation team is time-limited and includes stakeholders from GPEI and beyond. It has developed a workplan that sets milestones and activities in two phases on the path towards the OPV cessation goal. These are shown below.

Phase 1 includes setting the policy/triggers/prerequisites for bOPV cessation (2023–Q2 2024):

- review of epidemiology and modelling analysis (Q2-Q3 2023)
- evaluation of lessons learned from tOPV to bOPV switch in 2016 (Q3–Q4 2023)
- development of cessation policy based on inputs from modelling, review of lessons learned from the switch and epidemiological analysis (Q3–Q4 2023).

Milestones for phase 1 include:

- present policy options to SAGE working group for discussion (February 2024)
- ask SAGE to recommend pre-cessation requirements, triggers and overall policy approach (April 2024).

Phase 2 consists of planning and implementation (Q2 2024–2027):

- agreement with vaccine manufacturers on vaccine supply based on SAGE-approved policy decisions (Q2 2024)
- support regions and countries on post-bOPV polio vaccination schedules (Q3 2024–2027)
- support regions and countries on cessation preparation (Q3 2024–2027).

Milestones for phase 2 include:

- World Health Assembly resolution on bOPV cessation (2025 or 2026)
- certification of WPV1 eradication (2026).

Discussion

Several questions and points were noted relating to all the presentations in Session IV. These are summarized below.

Micro-cessation activities after each OPV2 (SIA) campaign have been done in the past and have provided useful lessons that could be applied to cessation efforts overall.

A point was made that, based on the lessons learned from the previous switch, the current timelines are flexible and will be based on the epidemiological data that is produced over the coming years.

The change from a three-year to a two-year time frame for detection of absence of poliovirus was questioned, as poliovirus can circulate undetected for five to six years. What is the justification for the change in time frame? The change is not a requirement, but a consideration; the goal of the change was to enhance flexibility rather than to dictate a reduction in the time frame. The two-year time frame will apply to Afghanistan and Pakistan only, both of which have very robust polio surveillance.

Given many countries have stopped using OPV, how would cessation efforts be executed? That is, region by region? Countries can always choose to switch from OPV to IPV, but a global synchronized approach is the best option, given that polio cases in London and New York City over the past year show that importation remains a risk of re-starting poliovirus circulation in countries using IPV only.

VLPs do not require containment, but supply and demand issues will be important to consider once VLPs are introduced and policies around VLPs are recommended by SAGE. GPEI will be supporting vaccine manufacturers to develop VLP vaccines, but clinical trials in humans have yet to start to show that they work in humans and can be brought to the market. Therefore, results from human trials will need to be assessed before VLPs become a manufacturing concern. Once clinical trials are completed and successful, and in the best case, VLPS could enter the market in 2028, GPEI will leverage its considerable resources and stakeholder coalition in these efforts. As mentioned before, policies around Polio VLPs will be developed at an adequate timepoint.

A study[17] has shown that a treatment with remdesivir for SARS-CoV-2 infection in a man in the United Kingdom – the Birmingham man – in 2021 has potentially interrupted his chronic excretion since decades of poliovirus. Should this be proved, it could portend an important method to stop virus shedding from chronic excreters of poliovirus.

[17] Bermingham WH, Canning B, Wilton T, Kidd M, Klapsa D, Majumdar M, et al. Case report: clearance of longstanding, immune-deficiency-associated, vaccine-derived polio virus infection following remdesivir therapy for chronic SARS-CoV-2 infection. Front. Immunol. 2023; 14:1135834. doi:10.3389/fimmu.2023.1135834 (https://www.frontiersin.org/articles/10.3389/fimmu.2023.1135834, accessed 8 November 2023).

Session V: briefing on the development of a polio vaccine security framework

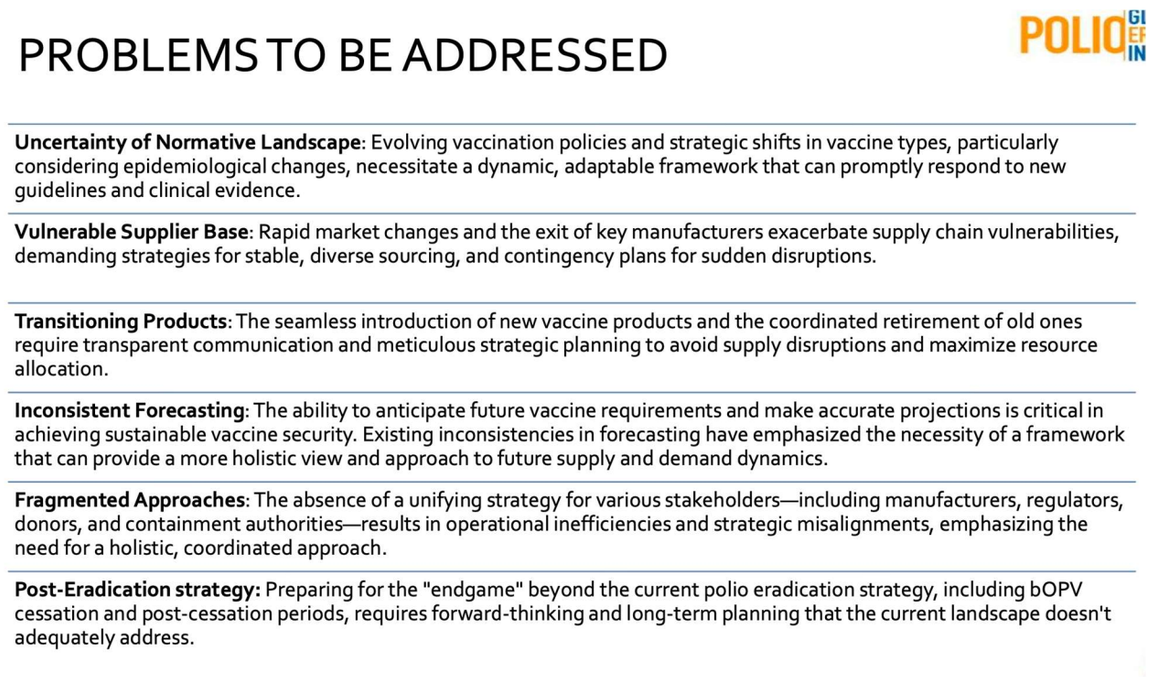
The final two sessions of the meeting focused on developing a comprehensive polio vaccine security framework. Session V provided an in-depth overview of the rationale behind, objectives of, and the process for developing this long-term framework. Session VI opened the floor to contributions from participants, emphasizing the consultative nature of the process and the need for input from a diverse array of stakeholders, including national authorities, vaccine manufacturers, policymakers, and donors.

The overall goal of a polio vaccine security framework is to establish and maintain a secure, sustainable and affordable supply of the right types polio vaccines of assured quality. This involves guaranteeing timely access to the appropriate vaccines in the necessary locations. The successful implementation of this framework is crucial for the ongoing global polio eradication efforts and to protect against the potential resurgence or reintroduction of the virus.

This framework is being developed to foster consensus among stakeholders on a shared vision for polio vaccine security over the next two decades and beyond. It aims to clearly define the desired state of vaccine security, establish measurable targets, and agree on a strategic path, including specific actions, decision points, and processes to achieve these goals.

Given the variety of stakeholders involved, there are numerous perspectives to consider regarding polio vaccine security. These include ensuring an adequate mix and quantity of vaccines, adhering to regulatory standards, guaranteeing quality assurance, and addressing containment issues. Figure 6 in the report details the main challenges that the framework intends to address. The Independent Monitoring Board (IMB) and Transition Independent Monitoring Board (TIMB) have recently underscored the necessity of strategic, long-term planning concerning vaccine supply. They stress the importance of synchronizing timelines, mitigating risks, and the crucial role of international collaboration. Aligning goals, methods, and timelines among countries, international organizations, and vaccine manufacturers is vital to maintain a consistent vaccine supply. This collaborative approach is essential for overcoming the complexities and achieving a sustainable, secure vaccine supply chain for the future.

Fig. 6. Challenges to poliovirus eradication to be addressed through the framework



The challenges shown in Fig. 6 were also considered during the next and final session. In that session participants were split into three groups and asked to discuss challenges and potential solutions to long-term polio vaccine security; a template of points was shared with each group to facilitate the discussion. The results of those discussions are summarized in the next session.

Session VI: polio vaccine security – interactive breakout groups

What follows are the main points expressed by participants in each group, which were shared when participants reconvened in plenary. Responses were grouped loosely into four categories. As several participants noted during the meeting, some topics were germane to multiple categories.

1. Goals & objectives
2. Identifying challenges and priorities
3. Tools, mechanisms and governance
4. Implementing the framework.

Goals & objectives

An overarching theme in the responses from meeting participants was the need for more clarity, transparency and certainty around vaccine forecasts, financing, containment requirements, policies and policy drivers, and the GPEI endgame and post-eradication plans. For example, several representatives from manufacturers indicated that while forecasts for vaccine needs are almost always incorrect, the GPEI and UNICEF *assumptions* underlying those forecasts would help manufacturers make better-informed decisions. Additional specific points raised included the following.

- Clarity on containment requirements – in order to comply with these requirements poliovirus vaccine manufacturers will need to make capital investment decisions, which can require long lead times and planning to upgrade facilities.
- Transparency on (regulatory) process of new products –new products, such as VLPs, will need to be registered, the facilities must get prequalification to produce, etc; such work takes time, and human and financial resources.
- Sharing access to global resources and networks with NACs and manufacturers, such as the Global Polio Laboratory Network.
- Transparency on funding/financing of vaccines, both dedicated funding for vaccines and other available funding that could be used for vaccines.
- Insofar as possible, sharing *committed* demand for vaccine with manufacturers rather than just estimates of demand; this will assist them with planning decisions.
- Longer-term forecasting and clarity on planning, for example bOPV cessation needs, IPV approaches, duration of use by GPEI of specific vaccines or formulations of vaccines (such as S-19 and the use of VLPs).

Identifying challenges and priorities

The points above relating to clarity and transparency around accurate vaccine forecasting should be considered under this category as well. Information exchange and coordination among various stakeholders (e.g. those involved in vaccine development and NACs) was also considered a priority, something that would facilitate transparency of planning horizons. Additional specific points raised included the following.

- Regulatory aspects of phasing-in new production would be a major task and cost for manufacturers. Do not underestimate the manufacturer workload to comply with regulations associated with new vaccine.
- Managing over supply:
  - accept a no-regrets approach to vaccine supply. Hold to initial intentions and accept in doing so that some vaccine, such as (portions of) stockpiles or funding will not be needed;
  - coordinate requests to manufacturers, so that multiple parties do not fulfil the same request, leading to oversupply.
- Clarity on policy recommendations, e.g. how long will WHO recommend to continue vaccinating after eradication? Who will make the decisions about vaccinating and for how long (who will decide these priorities)? Combination vaccines – will this be a way to guarantee that polio vaccination continues? Should vaccination post-eradication remain a focus?
- Mapping of different scenarios possible over the next 20 years, with potential capacity plans reflective of the scenarios most likely to occur for the entire period.
- Forecasting/policy guidance should focus not only on vaccines used for eradication but also consider other vaccines developed for other markets (e.g. for travellers, acellular pertussis (aP) combination vaccines, other schedules).

- Addressing uncertainty: to the greatest extent possible address those inherent in polio eradication plans, such as meeting containment requirements while continuing to produce vaccine, uncertainty around future OPV use and vaccine production, the feasibility of stockpiling various vaccines and the time frame of their production and storage.
- Ensuring coordination, flexibility and support for containment:
  - ensure that containment can be flexible so as to be an enabling function rather than a limitation (containment requirements can be a rigid framework that limits national initiatives on research, etc.);
  - address concerns that containment requirements can potentially be in conflict with supply, particularly as production currently under containment is ongoing prior to eradication;
  - coordinate with NACs: NACs need to be apprised of novel vaccine development, its funding etc. in order to be supportive and active collaborators;
  - understand that limiting the number of PEFs could undermine the serosurveillance and research capacity in certain countries. Research projects, for example, would have to be conducted at PEFs with an ICC or CC.
  - understand that there will be costs associated with applying containment requirements too quickly. Diagnostic laboratories will need to be able to continue working within the context of containment requirements;
  - ensure support and resources of small vaccine manufacturers to implement containment requirements.

Tools, mechanisms and governance

Long-term planning time frames were noted as a challenge in the previous category, given their length and the assumptions underlying them so far into the future. Participants, noted however, that such planning could work as a tool as well; for example, if such planning included visibility on downstream funding, such as from Gavi, and upstream funding, such as for vaccine development, capacity expansion, manufacturers could use such information in their production plans and limit over supply. Increasing the length of tenders, as well, would provide more visibility for manufacturers and other stakeholders. Additional specific points raised included the following.

- Clarify and provide foresight on policy recommendations, particularly concerning future adjustments to vaccination schedules and types of vaccines, with a specific focus on changes in Inactivated Polio Vaccine (IPV) schedules.
- Offer, as far as possible, optimal policy recommendations – those that are not constrained by current limitations. Clear communication of these ideal recommendations to all relevant stakeholders is crucial to achieve consensus on the best-case scenario and its prerequisites. Presently, some policy recommendations are influenced by factors like supply, funding, and pricing; it is vital that National

Authorities for Containment (NACs) actively support manufacturers in overcoming production and supply challenges to foster a robust market.

- Enhance transparency in market-shaping activities, ensuring that manufacturers have comprehensive insight into the Global Polio Eradication Initiative's (GPEI) strategies and plans. This visibility is essential for manufacturers to align their production and supply capabilities with the evolving needs and objectives of the GPEI..

Implementing the framework

Discussion made it clear that alignment between eradication/cessation and containment timelines, including clarity on the industry requirements around GAPIV, was very important for participants. This point follows from those made above about enhancing communication, transparency and clarity of activities and timelines. Additional specific points raised included the following.

- Ensure clarity regarding the final output of the vaccine security framework, including its formal structure and presentation.
- The implementation of the framework should be flexible and adaptive, acknowledging the evolving landscape and uncertainties highlighted during the meeting, rather than being overly rigid or prescriptive.
- Provide clear guidance on how countries will sustain their polio immunization programs. Explore opportunities for optimizing data sharing and informing government policy decisions.
- Facilitate increased direct engagement, alignment, and information exchange between the Global Polio Eradication Initiative (GPEI), WHO headquarters, and containment actors, including the Global Certification Commission (GCC) and National Authorities for Containment (NACs). This should encompass funding considerations, extending beyond vaccine procurement to include resources necessary for achieving containment objectives.
- Involve key manufacturer associations (like the International Federation of Pharmaceutical Manufacturers and Traders, Developing Countries Vaccine Manufacturers Network) and regional regulatory agencies (such as the European Medicines Agency) as integral stakeholders in the implementation of the framework.
- Communicate a clear and unequivocal message that polio immunization efforts will persist, emphasizing the importance of avoiding gaps in immunity in any country. The messaging should reinforce the commitment to ongoing, indefinite vaccination against polio.

Conclusion and next steps

The meeting concluded with a summary of key points, highlighting the perception that containment requirements present challenges for various stakeholders. A containment breach in Europe in the fourth quarter of 2022 underscored the reality of these risks. Emphasis was placed on improving transparency regarding containment requirements and offering support to National Authorities for Containment (NACs) and manufacturers for compliance. This approach aims to transform the perception of containment from a limiting factor to a standard of excellence.

The Global Polio Eradication Initiative (GPEI) budget has been projected through 2026, and by the end of 2024, projections through 2028 will be finalized. GPEI is committed to enhancing transparency concerning its budget and exploring additional funding avenues.

Responding to feedback from meeting participants and polio stakeholders, GPEI will incorporate a mid-term update in its communication strategy, in addition to the annual in-person consultation. This update will provide timely information, particularly relevant with several upcoming milestones, including the GCC meeting in late November, discussions on the International Health Regulations (IHR) and their evolution, and the potential interruption of WPV1 transmission in Afghanistan and Pakistan.

GPEI plans to devote more attention to bOPV cessation activities and their transparency. In the 2024 meetings with the Strategic Advisory Group of Experts (SAGE), GPEI will clarify its cessation strategy and share this information with stakeholders, marking another crucial milestone.

GPEI encourages feedback from meeting participants and all polio stakeholders on specific topics for deeper coverage, fostering regular engagement between GPEI and its stakeholders. The aim is to maintain utmost transparency, with additional updates facilitating this goal.

The need for agility, expressed during breakout sessions, was also addressed. GPEI is dedicated to remaining agile and transparent while focusing on interrupting WPV1 and eliminating cVDPV1 transmission, preparing for the certification of polio eradication, and addressing long-term post-certification planning.

This year's consultation brought together over 200 participants, both in-person and online, enabling a rich exchange of insights and collaborative dialogue. The engagement level and feedback on the polio vaccine security framework were particularly valuable, advancing GPEI towards a comprehensive and inclusive framework.

Mr. O'Leary concluded the meeting by thanking GPEI staff for organizing the event and all participants for their dedication and collaboration towards poliovirus eradication. This includes vaccine manufacturers, R&D organizations, national containment and regulatory authorities, whose contributions greatly enriched the discussions and advanced efforts to ensure a continuous, affordable supply of high-quality polio vaccines.

Annex 1. Meeting agenda and list of participating organizations

Annual Consultation between the GPEI and Poliovirus Vaccine Manufacturers, NACS & NRAS

23 October 2023 | 09.00-17.45 (CET / Geneva time)

WHO Headquarters (Auditorium, B Building) & online (Zoom)

Chair Aidan O'Leary (Director of Polio Eradication, WHO; Chair, GPEI Strategy Committee).

Goal Enable the attainment of polio vaccine security up to the eradication of the virus and beyond.

Objectives

1. Update the stakeholders on mid-term review of the Polio Eradication Strategy.
2. Consult with the stakeholders on the goals, objectives and strategies to facilitate polio vaccine security.
3. Brief the stakeholders on the planning for the cessation of OPV use (after the global certification of eradication).
4. Ensure the stakeholders are briefed on new vaccine technologies, regulatory pathways for the licensing of poliovirus vaccines, and Containment updates.

Monday, 23 October		
09.00-09.20	**Opening remarks and orientation**	
Welcome and opening remarks		Aidan O'Leary (WHO)
Introduction and orientation		David Woods (WHO)
09.20-10.20	**SESSION I: Update on stopping transmission and the mid-term strategy review**	
Update on stopping transmission and the mid-term review of the GPEI's strategy *Develop a shared understanding of the status of the programme towards stopping transmission, and the mid-term review of the 2022-26 Polio Eradication Strategy*		Aidan O'Leary (WHO)
10.20-10.30	*Break*	
10.30-11.50	**SESSION II: Breakdown of the demand estimates and forecasts per vaccine**	

Update on OPVs *Present the supply and demand landscape at the global and regional levels, and the activities of GPEI partners in OPV*	Ann Ottosen & Ian Lewis (UNICEF), Hil Lyons (BMGF), Georgios Stathopoulos & Simona Zipursky (WHO)
Update on IPV *Present the supply and demand landscape at the global and regional levels, and the activities of GPEI partners in IPV*	Ian Lewis (UNICEF), Alejandro Ramirez Gonzalez & Georgios Stathopoulos (WHO), Elie Akiki (Gavi)
11.50-12.30 **SESSION III: Containment and certification**	
Update on global containment certification *Update on notable developments in containment*	Arlene King (Global Certification Commission)
Update on the regional and global status of the certification of polio eradication *Update on the status of certification*	Graham Tallis (WHO)
12.30-13.30 Lunch	
13.30-15.00 **SESSION IV: New developments and innovations in polio vaccines and products**	
Research and product development: Update on GPEI's current priorities and new developments *Enable manufacturers to plan their R&D and production*	Martin Eisenhawer (WHO)
Update from Vaccine Prequalification Team on polio-related activities *Brief on key regulatory developments in polio vaccines*	Carmen Rodriguez Hernandez (WHO)
Update on planning underway for the cessation of OPV use *Ensure manufacturers are briefed on the status of planning for the cessation of OPV use (currently focused on bOPV)*	Conception Estivariz (CDC)
15.00-15.30 **SESSION V: Development of the Polio Vaccine Security Framework**	

Briefing on the development of the Polio Vaccine Security Framework *Brief the attendees of the development of the framework, and the potential timelines and parameters – forms the basis for the Interactive Breakout Group sessions*	Vachagan Harutyunyan (WHO), Ann Ottosen (UNICEF) & Tim Petersen (BMGF)
15.30-15.45 *Moving to the breakout rooms / coffee*	
15.45-17.30 **SESSION VI: Interactive Breakout Groups** *(running in parallel)*	
Interactive breakout groups (60 minutes each) on polio vaccine security *Discuss specified challenges and potential solutions to polio vaccine security*	Vachagan Harutyunyan & David Woods (WHO), Ann Ottosen & Ian Lewis (UNICEF), Tim Petersen (BMGF) & Meredith Shirey (independent)
Return to plenary: Facilitators report back (for 10 minutes each) on their group	Facilitators
17.30-17.45 **Wrap-up**	
Summary comments and wrap-up	Aidan O'Leary (WHO)

Participating organization	Country
AJ Vaccines	Denmark
BATAVIA Biosciences	The Netherlands
Beijing Bio-Institute Biological Products Co., Ltd.	China
Beijing Minhai Biotechnology Company	China
Belgium NAC	Belgium
Bharat Biotech International Limited	India
BIKEN	Japan
Bill & Melinda Gates Foundation	United States
Bilthoven Biologicals B.V.	The Netherlands
Biological E	India
Biomanguinhos	Brazil
Bio-Net Asia	Thailand
Canada NAC	Canada
CanSinoBIO	Switzerland
United States CDC	United States
Center for research and production of vaccine and biological (POLYVAC)	Viet Nam
Central Institute for Experimental Animals	Japan
China NAC	China
China National Biotec Group Company Limited	China
China NRA	China
Chumakov FSC R&D IBP RAS	Russian Federation
Clean Cells	France
CWG	Canada
Denmark NAC	Denmark
Food and Drug Administration	United States

France NAC	France
France NRA	France
GAVI Alliance	Switzerland
George Washington University	United States
GlaxoSmithKline Vaccines	Belgium
Gryphon Scientific	United States
Health Canada	Canada
Hungary NAC	Hungary
India NAC	India
India NRA	India
Indonesia NAC	Indonesia
Indonesia NRA	Indonesia
Institute of Medical Biology, Chinese Academy of Medical Sciences	China
Intravacc	The Netherlands
Iran NAC/NRA	Iran
Janssen Vaccines	The Netherlands
Japan NAC	Japan
Kid Risk. INC	United States
KM Biologics Co. Ltd	Japan
LG Chem Ltd	Republic of Korea
Naobios	France
NIBSC	United Kingdom
Panacea Biotec Ltd.	India
PATH	United States
Pharmajet, Inc.	United States
Poonwala	The Netherlands

PT Bio Farma	Indonesia
Reliance	India
Republic of Korea NAC	Republic of Korea
Riskren	Singapore
Romania NAC	Romania
Rotary International	Germany
Russian Federation NAC	Russian Federation
Russian Federation NRA	Russian Federation
Sanofi Pasteur SA	France
Serum Instiute of India	India
Sinovac Biotech Co Ltd	China
South Africa NAC	South Africa
The Netherlands NAC	The Netherlands
UNICEF	Various
United Kingdom NAC	United Kingdom
United States NAC	United States
University of Leeds	United Kingdom
Viroclinics	The Netherlands
WHO	Various