VPOP Toolkit

List of optimization questions

Interim version – 28 January 2026

World Health Organization

unicef

Development Catalysts

Purpose of this document

This document is designed as a comprehensive reference to support evidence-informed decision-making on vaccine optimization. This document is part of the VPOP optimization tool (link)

It compiles, by antigen, the majority of potential optimization questions that countries may face — such as changes in product, presentation, schedule, or target population. As of January 2026, 16 factsheets have been developed. Additional factsheets will be available by Q2 2026.

For each question, the document also outlines feasibility considerations and summarizes potential public health and programmatic benefits. The methodology for these assessments is referenced in the document.

In addition, it references countries where optimization has been implemented, as well as an overview of available data and evidence sources. It also recommends specific criteria for consideration based on the NVI-PST list of criteria that should be used to compare options for each optimization question.

Structured vaccine by vaccine and then question by question, the document aims to serve as both a technical resource and a practical reference for national immunization programs, NITAGs, and partners to identify, assess, and prioritize optimization opportunities in their specific contexts.

Disclaimer

The optimization questions and considerations included in this document represent a wide, but not comprehensive, set of options. The focus is on optimizing vaccines currently in use and not on the full range of vaccines eligible for new introduction. All assessments of benefits and program implications reflect expert judgment and may vary significantly by country context. They should therefore be used as indicative guidance rather than definitive predictions.

Agenda

The process should begin with a comprehensive review of the existing immunization schedule

1 Start from current portfolio

List all vaccines currently in use

- Note formulations (valency, presentation, schedule, target group)

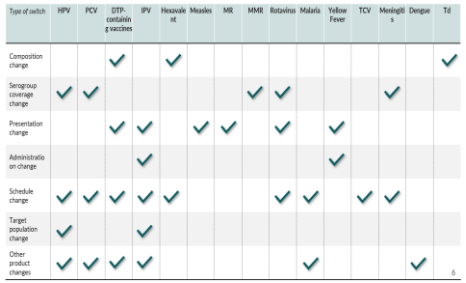
Perform fiscal / budget space analysis

- Assess holistic budget constraints
- Evaluate current global and relative value of vaccination programs

2 Use the List of Optimization questions as benchmark

Go vaccine by vaccine

- For each, check the list of possible optimization questions
- Also review expected benefits and feasibility considerations for each question



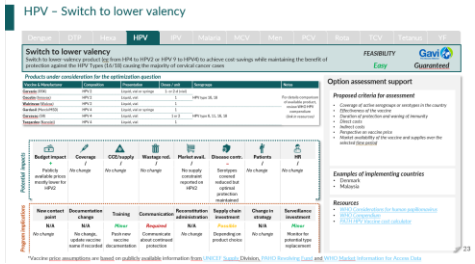
Use the List of optimization questions

3 Filter for relevance

For optimization questions, filter, before Workshop 1:

- Which questions apply to your portfolio? (for GAVI countries, which are recommended)
- Which correspond to strategic priorities (Budget impact, coverage, etc.)?
- Which are most feasible?

Filter to prepare a short (8-10 max) list of questions



Use the optimization questions factsheets

4 Select optimization questions

Select a limited number of optimization questions

- Propose the filtered list of questions to the joint NITAG + EPI audience
- Present key / summarized aspects of each optimization question
- (Best practice) Organize a vote on optimization questions to support discussions

Collectively select a maximum of 3 questions with options for appraisal

5 Select criteria

For each optimization question, select ~10 criteria

- Consult the list of criteria from the joint VPOP criteria and indicators list
- Clarify objectives of the optimization
- Select criteria as to align with stated objectives, potential impacts and program implications

Optimization questions by vaccine

Vaccines *Type of change*	**Dengue**	DTP-containing	Hexavalent	HPV	IPV	Malaria	MCV	Meningitis	PCV	Rotavirus	**TCV**	**Tetanus**	YF
Composition change		✓	✓									✓	
Serotype composition change				✓				✓	✓	✓			
Presentation change		✓			✓		✓			✓			✓
Administration change					✓								✓
Schedule change		✓	✓	✓	✓	✓		✓	✓	✓	✓		
Target population change				✓	✓	✓							
Other product changes	✓	✓		✓	✓	✓			✓				

List of available fact sheets - as of January 2026

	Vaccine	Optimization question
1	DTP-containing	Add 2YL booster
2	DTP-containing	Add adolescent booster
3	DTP-containing	Switch from 1-dose vial to 10-dose vial
4	Hexavalent	Switch from 4-dose hexavalent to 3-dose + DTP booster
5	HPV	Switch to lower valency product
6	HPV	Change schedule from 2 doses to 1 dose
7	HPV	Change product
8	IPV	Switch from Penta+IPV to Hexavalent
9	*Malaria*	*Change product**
10	*Malaria*	*Change from age-based (4 dose) to seasonal or hybrid (4 or 5 dose) schedule**
11	*Malaria*	*Change in sub-national target**
12	Measles	Switch from 10-dose vial to 5-dose vial
13	Meningitis	Switch to higher valency
14	PCV	Switch to higher valency
15	PCV	Switch to lower valency
16	PCV	Change from 3+0 doses to 1+1 doses
17	*Rotavirus*	*Switch from 3 doses to 2 doses**
18	*Yellow fever*	*Switch from 10-dose vial to 5-dose vial**

**Coming soon (31st of January 2026)*

Agenda

How to read and use optimization fact sheets

Summary
A quick description of the optimization question, potential benefits and WHO recommendations

Products under consideration
A list of product options that may be considered as part of the optimization process (limited to "post-optimization options" only).

Potential impacts
An assessment of how the optimization may affect key programmatic aspects, with further details on the assessment methodology provided in the following pages.

Program implications
A summary of potential requirements associated with implementing the proposed change. These elements directly influence feasibility (see page 12).

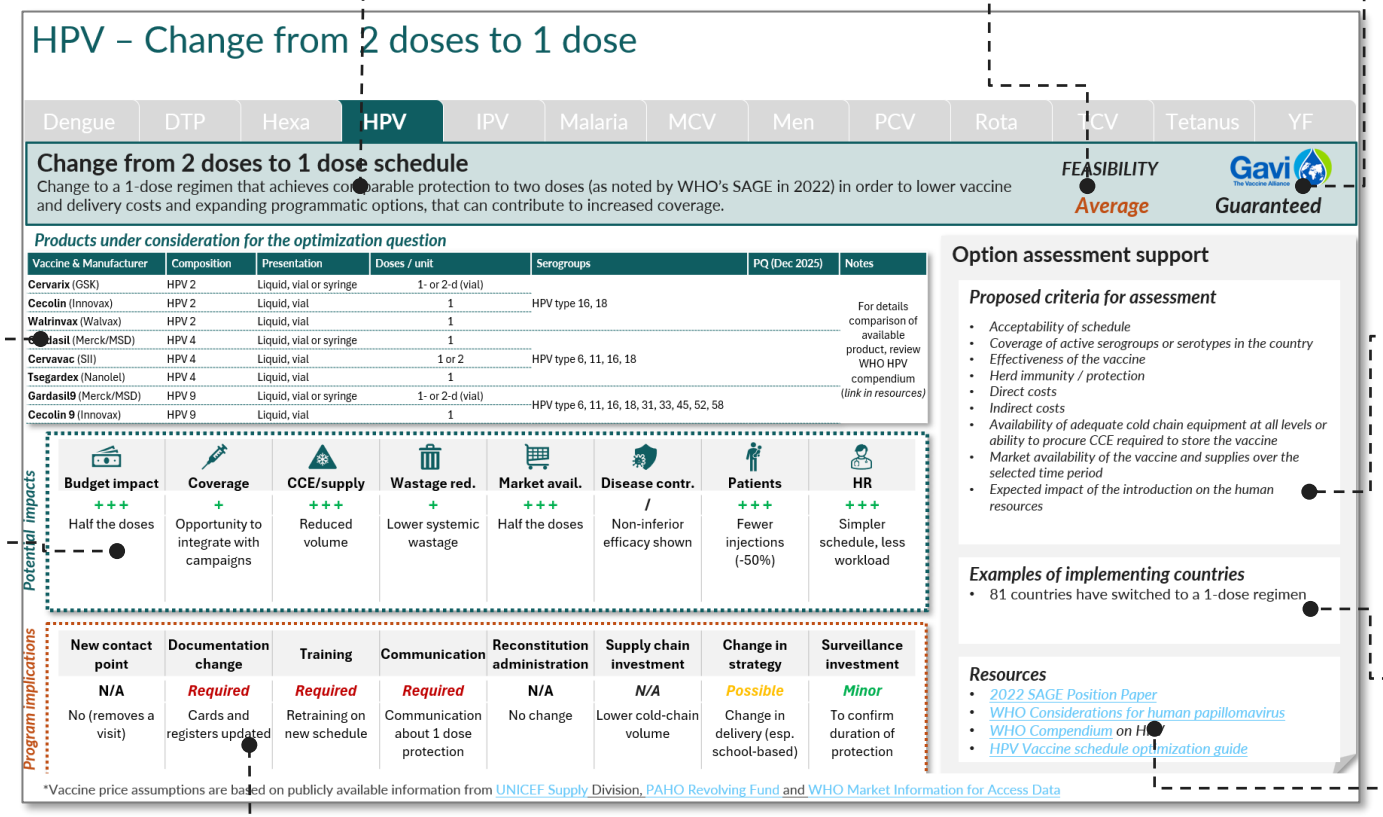
Feasibility assessment
An assessment of the feasibility level, based on program implications (see page 12)

GAVI type of program
Whether the program is "guaranteed" or "discretionary" in GAVI 6.0

Proposed criteria
A list of suggested criteria from the VPOP Criteria & indicator list, to compare options for this specific question. The list serves as a basis for discussion but can be augmented/modified during workshop 1

Country examples
Example of countries which have already implemented the optimization change

Resources
Links and resources that can be used to appraise the different options and support the decision-making



HPV – Change from 2 doses to 1 dose

Dengue | DTP | Hexa | **HPV** | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Change from 2 doses to 1 dose schedule
Change to a 1-dose regimen that achieves comparable protection to two doses (as noted by WHO's SAGE in 2022) in order to lower vaccine and delivery costs and expanding programmatic options, that can contribute to increased coverage.

FEASIBILITY: *Average* | Gavi: *Guaranteed*

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	PQ (Dec 2025)	Notes
Cervarix (GSK)	HPV 2	Liquid, vial or syringe	1- or 2-d (vial)			
Cecolin (Innovax)	HPV 2	Liquid, vial	1	HPV type 16, 18		
Walrinvax (Walvax)	HPV 2	Liquid, vial	1			
Gardasil (Merck/MSD)	HPV 4	Liquid, vial or syringe	1			For details comparison of available product, review WHO HPV compendium (*link in resources*)
Cervavac (SII)	HPV 4	Liquid, vial	1 or 2	HPV type 6, 11, 16, 18		
Tsegardex (Nanolel)	HPV 4	Liquid, vial	1			
Gardasil9 (Merck/MSD)	HPV 9	Liquid, vial or syringe	1- or 2-d (vial)	HPV type 6, 11, 16, 18, 31, 33, 45, 52, 58		
Cecolin 9 (Innovax)	HPV 9	Liquid, vial	1			

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+++	+	+++	+	+++	/	+++	+++
Half the doses	Opportunity to integrate with campaigns	Reduced volume	Lower systemic wastage	Half the doses	Non-inferior efficacy shown	Fewer injections (-50%)	Simpler schedule, less workload

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	*Required*	*Required*	*Required*	N/A	*N/A*	*Possible*	*Minor*
No (removes a visit)	Cards and registers updated	Retraining on new schedule	Communication about 1 dose protection	No change	Lower cold-chain volume	Change in delivery (esp. school-based)	To confirm duration of protection

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Option assessment support

Proposed criteria for assessment
- *Acceptability of schedule*
- *Coverage of active serogroups or serotypes in the country*
- *Effectiveness of the vaccine*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries
- 81 countries have switched to a 1-dose regimen

Resources
- 2022 SAGE Position Paper
- WHO Considerations for human papillomavirus
- WHO Compendium on H
- HPV Vaccine schedule optimization guide

Optimization questions can impact several aspects of the program – selected criteria should reflect intended benefits of the optimization (1/2)

Benefits	**Budget impact**	**Coverage & equity**	**Cold-chain / supply chain**	**Wastage reduction**
Description	Expected effect on total program costs, including direct savings (e.g., lower price per dose, reduced procurement volume) and indirect savings (e.g., lower wastage)	Expected effect on immunization coverage and equity, through easier delivery, increased acceptability, reduced missed opportunities, or improved access	Expected strain or relief on the cold chain and supply chain, including changes in storage volume, transport needs, temperature requirements, and distribution complexity	Expected change in vaccine wastage levels and the program's ability to maintain wastage rates within acceptable limits
Potential criteria for assessment	• Direct costs • Indirect costs • Perspective on vaccine price* • Net present cost benefit ratios	• Accessibility of the target population • Ease of the considered immunization strategies • Administration strategy • Feasibility of the program delivery strategy • Burden inequity • Ethical, market and diplomatic issues that may affect acceptability of the vaccine to stakeholders • Perception of the target population on the desirable and undesirable effects of the vaccine • Acceptability of schedule (e.g. multiple injections, additional visits)	• Ease of conservation (volume & cold chain requirements) • Shelf life of the vaccine • Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine • Readiness of the existing distribution channels in the country	• Indicative wastage rate • Ability to maintain wastage at expected levels • Ability to manage waste

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Optimization questions can impact several aspects of the program – selected criteria should reflect intended benefits of the optimization (2/2)

Benefits	**Market availability**	**Disease Control**	**Patients experience**	**Human Resource experience**
Description	Expected impact on vaccine availability, considering demand-side (procurement volumes), and supply-side (risk of shortages, resilience)	Expected effect on population-level disease control, through improved program performance (e.g., higher coverage) or product-specific advantages (e.g., higher VE)	Expected impact on the experience of patients and caregivers, including AEFI profile, visit burden, waiting time, acceptability of the product/presentation, missed opportunities	Expected impact on health worker workload, administrative tasks, ease of delivery, safety or confidence in using the product, and overall workflow complexity
Potential criteria for assessment	• Market availability of the vaccine and supplies over the selected time period • Sustainability of the market availability of the vaccine and supplies in the longer term • Ease of procurement of the vaccine	• Coverage of active serogroups or serotypes in the country • Effectiveness of the vaccine including in different populations/age groups/cohorts • Efficacy and immunogenicity of the vaccine in target population • Duration of protection and waning of immunity • Number needed to vaccinate to prevent a case • Impact on AMR • Herd immunity / protection • Effect of the vaccine on transmission • Feasibility of the program delivery strategy • Acceptability of schedule (e.g. multiple injections, additional visits) • Interference with other vaccines regarding immunity/protection	• Acceptability of schedule (e.g. multiple injections, additional visits) • Perception of the target population on the desirable and undesirable effects of the vaccine • Risk at individual level (AEFI) • Contraindications and precautions for vaccination • Ease of preparation, reconstitution & administration (open-vial policy, CTC)	• Ease of preparation, reconstitution & administration (open-vial policy, CTC) • Expected impact of the introduction on the human resources • Impact on existing immunization services or other health sectors - risk of overload

Methodology Benefits ranking

- For each optimization question, the expected impact was assessed across eight key program performance dimensions, along with an indicative estimate of impact magnitude
- These assessments are **preliminary** and **context-dependent**; they should be interpreted with caution. They provide a rapid first filter to identify which optimization options a country may wish to explore, with more detailed, country-specific analysis required during the full review process

Performance dimension	**Budget impact***	**Coverage & equity**	**Cold-chain / supply chain**	**Wastage reduction**	**Market availability**	**Disease Control**	**Patients experience**	**Human Resource experience**
Details	Expected effect on total program costs, including direct savings (e.g., lower price per dose, reduced procurement volume) and indirect savings (e.g., lower wastage)	Expected effect on immunization coverage and equity, through easier delivery, increased acceptability, reduced missed opportunities, or improved access	Expected strain or relief on the cold chain and supply chain, including changes in storage volume, transport needs, temperature requirements, and distribution complexity	Expected change in vaccine wastage levels and the program's ability to maintain wastage rates within acceptable limits	Expected impact on vaccine and supply availability, considering demand-side (procurement volumes), and supply-side (risk of shortages, resilience)	Expected effect on population-level disease control, through improved program performance (e.g., higher coverage) or product-specific advantages (e.g., higher VE)	Expected impact on the experience of patients and caregivers, including AEFI profile, visit burden, waiting time, acceptability of the product/presentation, missed opportunities	Expected impact on health worker workload, administrative tasks, ease of delivery, safety or confidence in using the product, and overall workflow complexity
+ + + *(strong positive impact)*	Large reduction on budget need (lower price, major volume reduction, etc.)	Clear coverage gains through fewer visits or easier delivery	Major reduction in storage/transport volume	Large and sustained reduction in wastage (e.g., vial size drop)	Major volume reduction, stable and sufficient supply	Higher VE, better schedule, or major coverage gains	Far better experience (much fewer visits, fewer AEFIs, shorter stay)	Major workload reduction; easier delivery & confidence
+ + *(positive impact)*	Budget reduction: lower # of doses, reduced wastage, or lower priced product	Improvement linked to simplified schedule or supply reliability	Meaningful cold-chain savings; easier distribution	Meaningful reduction, improving supply efficiency	Good availability; reduced risk of stockouts	Noticeable improvement in disease reduction or VE	Better experience (fewer injections, noticeable comfort gains)	Noticeable reduction in administrative or clinical burden
+ *(minor positive impact)*	Small impact on budget; marginal efficiencies	Small, context-dependent improvement	Small decrease in volume or handling complexity	Slight wastage decrease	Slight improvement in supply stability	Small improvement (timeliness or slight VE benefit)	Slight improvement in convenience (e.g. fewer AEFIs)	Slight ease of use improvements
/ *(no impact)*	No change on budget	Coverage unchanged	No change	Wastage unchanged	No impact on supply	No change	No impact on patient experience	No change in workload or processes
– *(minor negative impact)*	Increased budget need (training, minor increased in price)	Slight increase in missed opportunities or access barriers	Small extra burden on storage or logistics	Slight increase in wastage risk	Slight risk of shortages	Slight reduction in protection (e.g., coverage risk)	Small added inconvenience or discomfort	Small additional workload or complexity
– – *(negative impact)*	Clear budget increase (higher price, volumes)	Noticeable coverage risk (more visits, complexity)	Noticeable increase in volume or complexity	Clear increase in expected wastage	Volume increase, supply risk	Clear drop in expected disease control	Meaningful increase in complexity, pain, waiting	Clear workload increase or training burden
– – – *(major negative impact)*	Major budget increase; high ongoing costs	Major coverage reduction expected	Severe strain on CCE; may exceed capacity	Very high wastage risk; major inefficiency	Large volume increase, high stockout risk	Major decline in population protection	Major patient burden (extra visits, high AEFIs)	Major strain on staff; complex delivery

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Methodology Program implications ranking

- For each optimization question, the factsheet provides perspective on the expected program implications as well as their magnitude
- These assessments are **preliminary** and **context-dependent**; they should be interpreted with caution. Optimization implementation may require a more detailed, country-specific analysis required following decision. **Suggested levels of complexity refers to the need for appropriate planning for implementation.**

Program adjustment / *Details*	**New contact point**	**Documentation change**	**Training**	**Communication**	**Reconstitution & administration**	**Supply chain investment**	**Change in delivery strategy**	**Surveillance investment**
Required	New contact point with patients needed (incl. new target population)	Need to update vacc. cards and registers	Need for in-person HW training	Need for a proper public communication campaign	Needed adjustments in reconstitution or administration procedures	Need for investment in CCE or supply chain	Delivery platform change (e.g. schools)	Need for additional investment in surveillance (e.g. serotypes)
Possible	Depending on schedule decision	Depending on schedule decision	Depending on product/schedule choice		Depending on product choice	Depending on product choice	Depending on delivery platform decision	
Minor		Change in product name, valency if recorded in documentation	No need for in-person training, but new written guidelines needed	Communication about improved protection (not mandatory)				Required attention on some disease control variables, but no strong investment

Based on this assessment, optimization questions have been given a feasibility grade:

- If a new contact point is required and/or 6+ program adjustments are **required**, the optimization is considered ***More complex***
- If a new contact point is required and/or 5 program adjustments are **required**, the optimization is considered ***Complex***
- If 3-4 of these program adjustments are **required**, the optimization is considered **Average**
- If only 1-2 of these program adjustments is **required**, the optimization is considered **Easy**
- If 0 of these program adjustments are **required**, the optimization is considered ***Very Easy***

Agenda

Potential DTP-containing vaccine optimization questions

Dengue | **DTP** | Hexa | HPV | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Type of question	**Composition**	**Schedule**	**Schedule**	**Schedule**	**Schedule**	**Presentation**	**Product**
Details	From acellular to whole-cell pertussis	Add 2YL booster dose	Add childhood booster dose	Add adolescent booster dose	Change adolescent age of administration	Switch from 1-dose vial to 10-dose vial	Change product
Implementation	Average	Average	Complex	Average or Complex	Average or Complex	Average	Very easy
Country examples		Yes		Yes		Yes	
GAVI programme type	**Guaranteed**	**Discretionary**	**Discretionary**	**N/A**	**N/A**	**Guaranteed**	**Guaranteed**
Expected benefits							
Budget impact	✓					✓	✓
Coverage & equity					✓		
CCE/supply						✓	
Wastage reduct.		*Minor*	*Minor*	*Minor*			
Market availability		*Minor*					
Disease control		✓	✓	✓			
Patient experience					✓		
HR experience							

WHO recommended schedule for DTP-containing vaccines

	Primary Series	Booster 1	Booster 2	Booster 3
Recommended Age[1]	**3 doses (from 6w-)**	**2YL (12-23 months)**	**4-7 years**	**9-15 years**
Recommended vaccine[2]	3 doses of DTP-containing vaccine	DTP-containing vaccine	DT/Td- containing vaccine (with or without pertussis)	Td-containing-vaccine (with or without pertussis)
Product options[3]	• DTwP or DTaP • Quadrivalent combos • **Pentavalent* (DTP-Hib-HepB,** DTP-Hib-IPV) • **Hexavalent* (DTP-Hib-HepB-IPV)**	• **DTwP*** or DTaP • Quadrivalent combos • **Pentavalent* (DTP-Hib-HepB**, DTP-Hib-IPV) • Hexavalent (DTP-Hib-HepB-IPV)	• Td (from ≥4yrs) or DT (if <7yrs) • DTP, TdaP	• Td • TdaP

Gavi-supported option

1. Depending on local epidemiology; For WHO recommended schedules see: www.who.int/teams/immunization-vaccines-and-biologicals/policies/who-recommendations-for-routine-immunization---summary-tables
2. WHO recommends a tetanus-diphtheria-pertussis-containing combination vaccine for the 2YL booster, plus 2 additional tetanus-diphtheria-containing boosters
3. **Countries currently using whole-cell pertussis vaccine (wP) for the primary series should continue to do so.**

For up-to-date product information prequalified by WHO always check: https://extranet.who.int/prequal/vaccines/prequalified-vaccines .

DTP-containing – Add 2YL booster dose

Add a second-year-of-life booster dose

Adding a 2-year-old DTP-containing booster to strengthen long-term protection

FEASIBILITY

Average

Discretionary

Products under consideration for the optimization question *- non exhaustive (additional vaccines can be found in the WHO Full Product List)*

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Prequalification (Dec25)
Shan5 (SII / Shantha)	DTwP-HepB-Hib	Liquid, vial	10-dose	**Not PQ**
Pentabio (PT Bio Farma)	DTwP-HepB-Hib	Liquid, vial	5- or 10- dose	**2014**
ComVac5 (Bharat Biotech)	DTwP-HepB-Hib	Liquid, vial	10-dose	**Not PQ**
Pentavac (Biological E)	DTwP-HepB-Hib	Liquid, vial / PFS	1-dose, 10-dose	**2010**
EasyFive-TT (Panacea Biotec)	DTwP-HepB-Hib	Liquid, vial	1-dose, 10-dose	**2013**
Vaxtar5 (Indian Imm.)	DTwP-HepB-Hib	Liquid, vial	1-dose, 10-dose	**Not PQ**
ComBE Five (Biological E)	DTwP-HepB-Hib	Liquid, vial	1-dose	**2011**
Quinvaxem (Janssen)	DTwP-HepB-Hib	Liquid, vial	1-dose	**2006**
Heberpenta	DTwP-HepB-Hib	Liquid, vial	1-dose	**Not PQ**
Eupenta (LG Chem)	DTwP-HepB-Hib	Liquid, vial	1-dose, 10-dose	**2016**

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
– –	/	–	+	/	+ +	–	–
Increased# of procured doses (+33%) and potential additi. delivery costs	*No change*	Increased required volume (+33%)	Lower risk of open vial wastage	*No change*	Prolongs immunity (esp. pertussis,dipht.), improves herd effects	Extra-visit or extra-injection if clustered with other contact	Added workload (more injections)

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
Possible	***Required***	***Required***	***Required***	***N/A***	***Required***	**N/A**	**N/A**
Depending on clustering with other contacts	Cards and registers updated	Train staff on new schedule	Emphasize that 4 doses are required instead of 3		Moderate increase in CCE / transport capacity		

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule*
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries

- Zimbabwe (DTwP @18 months)
- Eswatini (Penta @18 months)
- Burundi (DTwP @18 months)

Resources

- *DTP-containing vaccine resources*
- *UNICEF SD price list*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

DTP-containing – Add adolescent booster dose

Dengue | **DTP** | Hexa | HPV | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Add an adolescent booster dose

Adding a DT(P)*-containing booster in adolescence to strengthen long-term protection
*WHO recommends diphtheria- and tetanus-containing vaccine booster at this age; pertussis component optional.

FEASIBILITY

Average

Gavi The Vaccine Alliance

N/A

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Prequalification (Dec25)	Note
Pentabio (PT Bio Farma)	DTwP-HepB-Hib	Liquid, vial	5- or 10- dose	**2014**	*For space purpose, only PQ products are displayed, full list available at this link*
Pentavac (Biological E)	DTwP-HepB-Hib	Liquid, vial / PFS	1-dose, 10-dose	**2010**	
EasyFive-TT (Panacea Biotec)	DTwP-HepB-Hib	Liquid, vial	1-dose, 10-dose	**2013**	
ComBE Five (Biological E)	DTwP-HepB-Hib	Liquid, vial	1-dose	**2011**	
Quinvaxem (Janssen)	DTwP-HepB-Hib	Liquid, vial	1-dose	**2006**	
Eupenta (LG Chem)	DTwP-HepB-Hib	Liquid, vial	1-dose, 10-dose	**2016**	
DTP-Hib Conjugate (SII)	DTwP-Hib	Liquid, vial + ampoule	1-dose	**2010**	
Adacel (Sanofi Pasteur)	DTaP	Liquid, vial	1-dose	**2017**	
Boostrix (GSK)	DTaP	Liquid, vial	1-dose	**2013**	
DTP-VaccineAbsorbed (SII)	DTwP	Liquid, vial or ampoule	1- 10- or 20-dose	**1995**	
DTP Vaccine (PT Biopharma)	DTwP	Liquid, vial	10-dose	**2001**	
TripVac (Biological E)	DTwP	Liquid, vial	1- or 10-dose	**2014**	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
– –	/	–	+	/	+ +	–	–
Increased procured doses and delivery costs	*No change*	Increased required volume	Lower risk of open vial wastage (if joined with 1YL/2YL sess.)	*No change*	Prolongs immunity (esp. diphtheria), improves herd effects	Extra-visit or extra-injection if clustered with other contact	Added workload (more injections)

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
Possible	***Required***	***Required***	***Required***	***N/A***	***Required***	**N/A**	**N/A**
Depending on co-admin w/HPV (girls); new contact for boys	Cards and registers updated	Train staff on new schedule	Important to ensure sustained protection (waning)		Moderate increase in CCE / transport capacity		

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule*
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries

- Zimbabwe (Td @ 10years)

Resources

- *DTP-containing vaccine resources*
- *UNICEF SD price list*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

DTP-containing (wp Pentavalent)– Switch from 1-dose vial to 10-dose vial

Dengue | **DTP** | Hexa | HPV | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Switch from Penta 1-dose vial to 10-dose vial

Move to multi-dose presentation for pentavalent vaccine with whole-cell pertussis to reduce procurement costs.

FEASIBILITY

Average — ***Guaranteed***

Products under consideration for the optimization question - *non exhaustive (additional vaccines can be found in the WHO Full Product List)*

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Cold chain volume (per dose)	Notes
Shan5 (SII)	DTwP–HepB–Hib (Pentavalent)	Liquid, 10-dose vial	10	2.11 cm^3	
ComBE Five (Bio E)	DTwP–HepB–Hib (Pentavalent)	Liquid, 10-dose vial	10	2.90 cm^3	
EasyFive-TT (Panacea Biotec)	DTwP–HepB–Hib (Pentavalent)	Liquid, 10-dose vial	10	3.20 cm^3	
Eupenta	DTwP–HepB–Hib (Pentavalent)	Liquid, 10-dose vial	10	3.06 cm^3	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+	/	+++	–	/	/	/	–
Public prices are lower for 10-dose vial presentation	*No change*	Volume per dose divided by 5-7 vs. 1-dose vial	Slightly increased (open-vial wastage)	*No significant change*	*No change*	*No change*	More reconstitution steps

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	N/A	***Required***	N/A	***Required***	*N/A*	N/A	N/A
No change	*No change*	Training on open-vial policy	*No impact on public*	Change in reconstitution step	*Lower cold-chain volume*	*No change*	*No change*

Option assessment support

Proposed criteria for assessment

- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*
- *Indicative wastage rate*
- *Ability to maintain wastage at expected levels*

Examples of implementing countries

- Pakistan (switched in 2025)

Resources

- *DTP-containing vaccine resources*
- *UNICEF SD price list*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Agenda

1. Introduction: how to use and list of potential questions
2. Methodology: how to read fact sheets
3. Dengue
4. DTP-containing vaccines
5. **Hexavalent**
6. HPV
7. IPV
8. Malaria vaccines
9. Measles-containing vaccines (MCV)
10. Meningitis vaccines
11. PCV
12. Rotavirus vaccines
13. TCV
14. Tetanus vaccines (pregnant women)
15. Yellow Fever vaccines

X. Appendix: grading scales

Potential Hexavalent-related optimization questions

Dengue | DTP | **Hexa** | HPV | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Type of question	**Combination**	**Composition**	**Composition**	**Schedule**	**Schedule**
Details	Switch from Hexavalent to Penta + IPV	Switch from whole-cell to aCellular	Switch from aCellular to whole-cell	Switch from Hexa 4 doses to Hexa 3 doses + DTP booster	Switch from DTP booster to Hexa 4 doses
Implementation	**Complex**	**Easy**	**Average**	**Easy**	**Easy**
Country examples				No	
GAVI programme type	**Guaranteed**	N/A	N/A	**Guaranteed**	**Discretionary**
Expected benefits					
Budget impact	✓		✓	✓	
Coverage & equity					
CCE/supply		*Minor*			
Wastage reduct.					*Minor*
Market availability	✓				
Disease control				✓	
Patient experience		✓			
HR experience		✓			

Reminder: WHO recommendations on Hexavalent vaccines

March 2025 SAGE report

World Health Organization

Topic	**WHO Recommendation**
General recommendation	**WHO supports use of hexavalent combination vaccines** (diphtheria, tetanus, pertussis, hepatitis B, Hib and IPV) as an efficient option in routine infant immunization to simplify schedules and reduce injections while maintaining protective responses for all components
Schedule	**Primary series schedule:** WHO recommends a **primary series of three doses** starting ~6 weeks of age with minimum 4 week intervals, aligned with existing DTP containing vaccine schedules
	Booster dose: A **DTP containing booster in the second year of life** is recommended. Where hexavalent vaccines are used, they may fulfil this booster role
Replacement	Hexavalent vaccine can **replace separate pentavalent + IPV** doses, streamlining delivery and improving IPV coverage in settings transitioning away from separate IPV injections
Safety & efficacy	WHO's vaccine safety advisory group (GACVS) has reviewed hexavalent vaccines and found **no evidence of safety concerns** such as association with sudden unexplained death, supporting their continued use where licensed

Hexavalent – Switch from 4-dose hexavalent to 3-dose + DTP booster

Switch from 4-dose Hexavalent to 3-dose + DTP booster

Reduce one hexavalent dose by replacing it with a later DTP booster to decrease cost while maintaining protection aligned with WHO recommended booster in second year of life

FEASIBILITY

Easy

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Prequalification (Dec 2025)	Notes
Quinvaxem (formerly Crucell / Janssen)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	1	**2006**	For details comparison of available product, review WHO compendium on Hexavalent Vaccines
Pentavac / Pentavac PFS (SII)	**Penta** (DTwP–HepB–Hib)	Liquid, vial or syringe	1, 10 or 20	**2010**	
ComBE Five (Biological E.)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	1 or 10	**2011**	
EasyFive-TT (Panacea Biotec)	**Penta** (DTwP–HepB–Hib)	Liquid, vial or syringe	1 or 10	**2013**	
Shan5 (Shantha / Sanofi Pasteur)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	1 or 10	**2014**	
Pentabio (PT Bio Farma/Persero)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	5 or 10	**2014**	
ComVac5 (Bharat)	**Penta** (DTwP–HepB–Hib)	Liquid, vial or syringe	1, 5 or 10	*No PQ*	
Eupenta (LG Chem)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	1 or 10	**2016**	
Vaxtar (Indian Immunological)	**Penta** (DTwP–HepB–Hib)	Liquid, vial	1 or 10	*No PQ*	
HeberPenta (CIGB)	**Penta** (DTwP–HepB–Hib)	Liquid, vial or syringe	1	*No PQ*	
Infanrix Hexa (GSK)	**Hexa** (DT3aP-HepB-Hib-IPV)	Powder & suspension	1	*No PQ*	
Hexaxim (Sanofi)	**Hexa** (DT2aP-HepB-Hib-IPV)	Liquid, vial or syringe	1	**2014**	
Vaxelis (MCM, MSD/Sanofi)	**Hexa** (DT5aP-HepB-Hib-IPV)	Liquid, syringe	1	*No PQ*	
Hexaxil (SII)	**Hexa** (DTwP-HepB-Hib-IPV)	Liquid, vial	1 or 10	**2024**	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+ +	/	/	–	+ /	/	/	–
Less doses procured	*No change if DTP booster given at same age as Hexa 4*	*Similar volume for Penta and Hexa for a given manufacturer*	Less injections of the same vaccine per session	Slightly lower risk of hexa shortage	Non-inferior efficacy for both DTP and Polio	*No change if DTP booster given at same age as Hexa 4*	Coexistence of Penta and Hexa can create confusion

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
Possible	*Required*	*Required*	*Minor*	N/A	*N/A*	*N/A*	*N/A*
Depending on booster timing	Cards and registers updated	Retraining on new schedule	Limited communication to public	*No change*	*No expected change*	*No change*	*No change*

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule*
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Indicative Wastage Rate*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries

Resources

- WHO Compendium for Hexavalent vaccines

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

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11. PCV
12. Rotavirus vaccines
13. TCV
14. Tetanus vaccines (pregnant women)
15. Yellow Fever vaccines

X. Appendix: grading scales

Potential HPV-related optimization questions

Dengue | DTP | Hexa | **HPV** | IPV | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Type of question	**Serotype composition**	**Serotype composition**	**Schedule**	**Schedule**	**Target population**	**Target population**	**Product**
Details	Switch to higher valency (4 or 9)	Switch to lower valency (2 or 4)	Change from 2 doses to 1 dose	Add booster doses	Change from girls only to girls and boys	Extend eligibility to older age group	Change product
Switch Implementation	**Easy**	**Easy**	**Average**	**Complex**	**More complex**	**More complex**	**Very easy**
Country examples	Yes	Yes	Yes	Yes	Yes	Yes	No
GAVI programme type	**Guaranteed**	**Guaranteed**	**Guaranteed**	**N/A**	**N/A**	**N/A**	**Guaranteed**
Expected benefits							
Budget impact		✓	✓				✓
Coverage & equity			✓		✓	✓	
CCE/supply			✓				✓
Wastage reduct.				*Minor*	*Minor*		
Market availability		✓	✓				✓
Disease control	✓			✓	✓	✓	
Patient experience			✓				
HR experience			✓				

Reminder: WHO HPV recommendations

SAGE Position Paper (2022)

World Health Organization

Topic	**WHO Recommendation**
Primary target	Vaccinate **girls aged 9–14 years** before sexual debut (highest public-health priority).
Schedule	**Single-dose HPV vaccination is acceptable and recommended** for girls 9–14 and for females 15–20; two doses remain an option.
	Older age groups: **women ≥21 years should receive two doses** (6-month interval) if vaccinated.
	Immunocompromised (incl. HIV): **Give at least two doses**, and three doses if feasible, at any eligible age. Immunocompromised individual are a priority target
Products	**Any WHO-prequalified HPV vaccine can be used**; all are effective for cervical cancer prevention.
Target population expansion	**Vaccination of older girls, women as well as boys and men is recommended where feasible** and affordable, It should not divert resources from the primary target population or effective cervical cancer screening programmes.
Catch-up	Catch-up vaccination for older adolescents and young women (up to at least 18 years) is recommended if resources allow.

HPV – Switch to lower valency

Switch to lower valency product

Switch to a lower-valency product (eg from HP4 to HPV2 or HPV 9 to HPV4) to achieve cost-savings while maintaining the benefit of protection against the HPV Types (16/18) causing the majority of cervical cancer cases

FEASIBILITY

Easy

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	Notes
Cervarix (GSK)	HPV 2	Liquid, vial or syringe	1- or 2-d (vial)		
Cecolin (Innovax)	HPV 2	Liquid, vial	1	HPV type 16, 18	For details comparison of available product, review WHO HPV compendium (*link in resources*)
Walrinvax (Walvax)	HPV 2	Liquid, vial	1		
Gardasil (Merck/MSD)	HPV 4	Liquid, vial or syringe	1		
Cervavac (SII)	HPV 4	Liquid, vial	1 or 2	HPV type 6, 11, 16, 18	
Tsegardex (Nanolel)	HPV 4	Liquid, vial	1		

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+	/	/	/	/	–	/	/
Publicly available prices mostly lower for HPV2	*No change*	*No change*	*No change*	No supply constraint reported on HPV2	Serotypes covered reduced but optimal protection maintained	*No change*	*No change*

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	N/A	*Minor*	*Possible*	N/A	*Possible*	N/A	N/A
No change	No change, update vaccine name if recorded	*Limited to new vaccine documentation*	Communicate about continued protection	*No change*	Depending on product choice	*No change*	

Option assessment support

Proposed criteria for assessment

- *Coverage of active serogroups or serotypes in the country*
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Market availability of the vaccine and supplies over the selected time period*

Examples of implementing countries

- Denmark
- Malaysia

Resources

- *WHO Considerations for human papillomavirus*
- *WHO Compendium*
- *PATH HPV Vaccine cost calculator*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

HPV – Change from 2 doses to 1 dose

Change from 2 doses to 1 dose schedule

Change to a 1-dose regimen that achieves comparable protection to two doses (as noted by WHO's SAGE in 2022) in order to lower vaccine and delivery costs and expanding programmatic options, that can contribute to increased coverage.

FEASIBILITY

Average

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	1-dose schedule	PQ (Dec 2025)	Notes
Cervarix (GSK)	HPV 2	Liquid, vial or syringe	1- or 2-d (vial)	HPV type 16, 18	Yes	**2009**	For details comparison of available product, review WHO HPV compendium (*link in resources*)
Cecolin (Innovax)	HPV 2	Liquid, vial	1		Yes	**2021**	
Walrinvax (Walvax)	HPV 2	Liquid, vial	1			**2024**	
Gardasil (Merck/MSD)	HPV 4	Liquid, vial or syringe	1	HPV type 6, 11, 16, 18	Yes	**2009**	
Cervavac (SII)	HPV 4	Liquid, vial	1 or 2			*pending PQ*	
Tsegardex (Nanolel)	HPV 4	Liquid, vial	1			*No PQ*	
Gardasil9 (Merck/MSD)	HPV 9	Liquid, vial or syringe	1- or 2-d (vial)	HPV type 6, 11, 16, 18, 31, 33, 45, 52, 58	Yes	**2018**	
Cecolin 9 (Innovax)	HPV 9	Liquid, vial	1		Yes	*No PQ*	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+++	+	+++	+	+++	/	+++	+++
Half the doses	Opportunity to integrate with campaigns	Reduced volume	Lower systemic wastage	Half the doses	Non-inferior efficacy shown	Fewer injections (-50%)	Simpler schedule, less workload

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	***Required***	***Required***	***Required***	**N/A**	***N/A***	***Possible***	***Minor***
No (removes a visit)	Cards and registers updated	Retraining on new schedule	Communication about 1 dose protection	No change	Lower cold-chain volume	Change in delivery (esp. school-based)	To confirm duration of protection

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule*
- *Coverage of active serogroups or serotypes in the country*
- *Effectiveness of the vaccine*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries

- 81 countries have switched to a 1-dose regimen

Resources

- *2022 SAGE Position Paper*
- *WHO Considerations for human papillomavirus*
- *WHO Compendium on HPV*
- *HPV Vaccine schedule optimization guide*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

HPV – Change product

Change product

Switch between similar HPV product - keeping the same valency - to achieve potential cost-saving benefits

FEASIBILITY

Very easy

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	PQ (Dec 2025)	Notes
Cervarix (GSK)	HPV 2	Liquid, vial or syringe	1- or 2-d (vial)	HPV type 16, 18	**2009**	For details comparison of available product, review WHO HPV compendium (*link in resources)*
Cecolin (Innovax)	HPV 2	Liquid, vial	1		**2021**	
Walrinvax (Walvax)	HPV 2	Liquid, vial	1		**2024**	
Gardasil (Merck/MSD)	HPV 4	Liquid, vial or syringe	1	HPV type 6, 11, 16, 18	**2009**	
Cervavac (SII)	HPV 4	Liquid, vial	1 or 2		*pending PQ*	
Tsegardex (Nanolel)	HPV 4	Liquid, vial	1		*No PQ*	
Gardasil9 (Merck/MSD)	HPV 9	Liquid, vial or syringe	1- or 2-d (vial)	HPV type 6, 11, 16, 18, 31, 33, 45, 52, 58	**2018**	
Cecolin9 (Innovax)	HPV 9	Liquid, vial	1		*No PQ*	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+ +	/	+ or –	/	+	/	/	/
Publicly available prices indicate lower price or DCVMN and independent manufacturers	*No change*	Depends on products	*No change, unless change in vial size*	Change in product can achieve higher supply flexibility	*No change*	*No change*	*No change*

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	N/A	***Minor***	N/A	N/A	***Possible***	N/A	N/A
No change	*No change, update vaccine name if recorded*	*Limited to new vaccine documentation*	*Limited to no communication needed*	*No change if presentation unchanged*	*Depending on product choice*	*No change*	*No change*

Option assessment support

Proposed criteria for assessment

- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Risk at individual level*
- *Indicative wastage rate*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Market availability of the vaccine and supplies over the selected time period*

Examples of implementing countries

- TBC

Resources

- *WHO Considerations for human papillomavirus*
- *WHO Compendium*
- *PATH HPV Vaccine cost calculator*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

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6. HPV
7. **IPV**
8. Malaria vaccines
9. Measles-containing vaccines (MCV)
10. Meningitis vaccines
11. PCV
12. Rotavirus vaccines
13. TCV
14. Tetanus vaccines (pregnant women)
15. Yellow Fever vaccines

X. Appendix: grading scales

Potential IPV-related optimization questions

Dengue | DTP | Hexa | HPV | **IPV** | Malaria | MCV | Men | PCV | Rota | TCV | Tetanus | YF

Type of question	**Combination**	**Schedule**	**Schedule**	**Target population**	**Administration**	**Administration**	**Product**
Details	Switch from Penta + IPV to Hexavalent	Switch from 1-dose to 2-dose IPV schedule	Switch from 2-dose to 3-dose IPV schedule	Change in age of administration	Switch from fractional to full dose IPV or Hexa	Switch from full dose to fractional dose	Change product
Implementation	**Easy**	**Complex**	**Complex**	**Average**	**Average**	**Average**	**Very easy**
Country examples	Yes						
GAVI programme type	**Guaranteed**	**Guaranteed**	**N/A**	**N/A**	**Guaranteed**	**Guaranteed**	**Guaranteed**
Expected benefits							
Budget impact	*Possible*					✓	✓
Coverage & equity	✓			✓			
CCE/supply	✓					✓	
Wastage reduct.					*Minor*		
Market availability						✓	✓
Disease control	✓	✓	✓		✓		
Patient experience	*Minor*						
HR experience	✓				✓		

Reminder: WHO recommendations for IPV vaccines

March 2025 SAGE report

World Health Organization

Topic	**WHO Recommendation**
General recommendation	**WHO supports use of hexavalent combination vaccines** (diphtheria, tetanus, pertussis, hepatitis B, Hib and IPV) as an efficient option in routine infant immunization to simplify schedules and reduce injections while maintaining protective responses for all components

WHO recommended schedules for Penta+IPV vs Hexa

Ilustrative schedule		Primary Immunization schedule[1]				1st dose of DTP booster series[2]	Number of injections in series
		6 weeks	10 weeks	14 weeks	9 months	12-23 months	Total
Pentavalent/ IPV schedule	Pentavalent	1st dose	2nd dose	3rd dose		DTP/ Pentavalent	6
	IPV (full or fIPV)			1st dose	2nd dose		
Hexavalent schedule		1st dose	2nd dose	3rd dose		DTP/ Pentavalent	4

As of 6 June 2025, the WHO SAGE does not recommend the administration of IPV booster (i.e., hexa 4th dose)

IPV – Switch from Penta+IPV to Hexavalent

Switch from Penta+IPV to Hexavalent

Combine IPV and Pentavalent in one shot to reduce injection burden and improve IPV protection

FEASIBILITY

Easy

Gavi The Vaccine Alliance

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Prequalification (Dec 2025)
Hexaxim (Sanofi)	DTaP–IPV–HepB–Hib (acellular)	Liquid (ready to use, no reconstitution)	1	2014
Hexaxil (Serum Institute of India)	wP–IPV–HepB–Hib (whole-cell)	Liquid, vial	1 or 10	2024
Infanrix Hexa (GSK)	DT3aP-HepB-Hib-IPV (acellular)	Lyophilized	1	No
Vaxelis (MCM)	DT5aP-HepB-Hib-IPV (acellular)	Liquid, vial or PFS	1	No

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+ / –	+	+ +	/	/	+	+ +	+ +
Higher vaccine cost but delivery/logistics savings*	Improved for IPV	Reduced volume (~30%)	*Limited change*	*No significant change*	Higher IPV uptake and number of doses	Fewer injections / potentially fewer contacts	Easier administration, fewer injections

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	***Required***	***Required***	N/A	*N/A*	*N/A*	N/A	N/A
Potentially fewer contact points	Cards and registers updated	Limited (similar to penta)	*Not impact on public*	Only if lyophilized hexavalent	Lower volume	*No change*	*No change*

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule (e.g. multiple injections, additional visits)*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*
- *Vaccine effectiveness*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*

Examples of implementing countries

- Mauritania
- Senegal

Resources

- *WHO Hexavalent compendium comparison table*
- *2024 WHO Polio position paper*
- *2025 UNICEF/WHO FAQ on Hexavalent vaccines*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Agenda

Potential MCV-related* optimization questions

Dengue	DTP	Hexa	HPV	IPV	Malaria	**MCV**	Men	PCV	Rota	TCV	Tetanus	YF

Type of question	**Presentation**
Details	Switch from 10-dose vial to 5-dose vial
Implementation	**Easy**
Country examples	Yes
GAVI programme type	**Guaranteed**
Expected benefits	
Budget impact	
Coverage & equity	✓
CCE/supply	
Wastage reduct.	✓
Market availability	
Disease control	✓
Patient experience	✓
HR experience	✓

** Switches from M to MR and MR to MMR are not included in this list, for they are actually prioritization questions (new antigen) not optimization*

Measles Containing– Switch from 10-dose vial to 5-dose vial

Dengue | DTP | Hexa | HPV | IPV | Malaria | **MCV** | Men | PCV | Rota | TCV | Tetanus | YF

Switch from 10-dose vial to 5-dose vial

Switch to smaller vial to reduce open vial wastage in low-volume sessions and create incentive to open vials

FEASIBILITY

Easy

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Prequalification	Notes
Measles vaccine (SII)	Measles (live attenuated)	Lyophilized + diluent	10-dose, 5-dose	**2009**	
Measles vaccine (PT Bio Farma)	Measles (live attenuated)	Lyophilized + diluent	10-dose, 5-dose	**2013**	
Measles vaccine (Zydus L)	Measles (live attenuated)	Lyophilized + diluent	5-dose, 10-dose	**2018**	
Measles-Rubella (MR) – SII	Measles + Rubella (live att.)	Lyophilized + diluent	10-dose, 5-dose	**2013**	
Measles-Rubella (MR) – Bio Farma	Measles + Rubella	Lyophilized + diluent	10-dose	**2016**	
MMR (SII)	Measles + Mumps + Rubella	Lyophilized + diluent	5-dose	**2020**	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+/ –	**+ +**	**– –**	**+ + +**	**/**	**+ +**	**+ +**	**+**
Slightly higher price per dose but fewer wasted doses	Improved (less missed opportunities)	Increased volume per dose (+100%) but reduced wastage	Strongly reduced wastage	*No significant change*	Improved (less missed opportunities)	Increased session reliability	Improves confidence in opening vials

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	**N/A**	***Minor***	**N/A**	**N/A**	***Possible***	**N/A**	**N/A**
No change	*No change*	New presentation / wastage thresholds	*No impact on public*	*No change*	*Increased vaccine volume*	*No change*	*No change*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Option assessment support

Proposed criteria for assessment

- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Indicative wastage rate*
- *Ability to maintain wastage at expected levels*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*
- *Ease of the considered immunization strategies to reach desired coverage*

Examples of implementing countries

- 20+ countries in the AFRO region (see this infographic)

Resources

- *5-dose MCV resource hub on Technet21*

Agenda

Potential Meningitis-related optimization questions

Dengue | DTP | Hexa | HPV | IPV | Malaria | MCV | **Men** | PCV | Rota | TCV | Tetanus | YF

Type of question	**Serotype composition**
Details	Switch to higher valency (from A to ACWXY)
Implementation	**Easy**
Country examples	Yes
GAVI programme type	**Discretionary**
Expected benefits	
Budget impact	
Coverage & equity	
CCE/supply	
Wastage reduct.	✓
Market availability	
Disease control	✓
Patient experience	
HR experience	

Reminder: WHO recommendations on Meningococcal vaccines

SAGE position paper (2024)

World Health Organization

Topic	**WHO Recommendation**
General recommendation	All countries in the African meningitis belt should introduce a pentavalent meningococcal ACWYX conjugate vaccine (Men5CV) into their routine immunization programmes. Countries that have already introduced MenACV into their routine immunization programmes should switch to use of Men5CV
Schedule	The recommended schedule is a single-dose schedule at 9-18 months
Strategy	Meningitis risk assessment should be conducted to inform the Men5CV introduction strategy.
Campaigns	**In high-risk countries/districts,** a one-off Men5CV mass preventive campaign (1-19 years old population) should also be conducted at the time of introduction, to achieve more rapid and greater population impact through direct and indirect (herd) protection effects

Meningitis – Switch to higher valency

Dengue | DTP | Hexa | HPV | IPV | Malaria | MCV | **Men** | PCV | Rota | TCV | Tetanus | YF

Switch to higher valency

Upgrade monovalent MenACV programs to pentavalent meningococcal ACWXY conjugate vaccines (Men5CV). Preventive campaigns in high-risk areas (to be informed by meningitis risk assessment).

FEASIBILITY

Easy

Discretionary

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	Prequalification	Notes
Men5CV / MenACWYX (Serum Institute of India)	ACWYX-TT	Lyophilized, vial	1 or 5	A, C, W, Y, X	**2023**	

Note : Quadrivalent meningococcal conjugate vaccines (ACWY), that are significantly more expensive, are not considered. Additional information can be found the *WHO Full Product List)*

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
– –	/	–	+	/	+ +	/	/
Significantly incremental cost (Men5) but downward trend.	*No change*	Increment for Men5 (higher volume but lower wastage)	Smaller vial for Men5 vs. MenA leading to lower wastage	*No supply constraint for Men5, second supplier soon*	Much larger protection with target to eliminate meningitis epidemics	Can decrease no of injections during 1YL if pushed to 2YL	*No change*

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	*Minor*	*Minor*	*Minor*	N/A	*Possible*	*Possible*	N/A
No change	Product name and valency / required if dose moved to 2YL	New vaccine documentation	Communicate about improved protection	*No change*	Depending on product choice and campaigns (likely minor)	Depending of year of administration (2YL)	Maintain to monitor impact

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Option assessment support

Proposed criteria for assessment

- *Coverage of active serogroups or serotypes in the country*
- *Effectiveness of the vaccine (incl. on outbreaks)*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Market availability of the vaccine and supplies*
- *Indicative wastage rate*
- *Impact on delivery*
- *Net present cost benefit ratios*
- *Long-term complications of disease*
- *Impact on existing immunization services or other health sectors (e.g. MCV2)*
- *Contribution to national/regional/global goals (e.g., elimination)*

Externalities

- *Impact on delivery*
- *Impact on existing immunization services or other health sectors*

Examples of implementing countries

- Niger

Resources

- *WHO 2024 Meningitis position paper*
- *Defeating meningitis by 2030 global road map*

Agenda

Potential PCV-related optimization questions

Dengue | DTP | Hexa | HPV | IPV | Malaria | MCV | Men | **PCV** | Rota | TCV | Tetanus | YF

Type of question	**Serotype composition**	**Serotype composition**	**Schedule**	**Schedule**	**Schedule**	Schedule	**Product**
Details	Switch to higher valency (13/14/15/20)	Switch to lower valency (10/13/15)	Change from 3+0 doses 2+1 doses	Change from 3+0 doses to 1+1 doses	Change from 2+1 doses to 1+1 doses	Switch from full to fractional dose	Change product
Implementation	**Easy**	**Easy**	**Complex**	**Complex**	**Average**	**More complex**	**Very easy**
Country examples	Yes	Yes	Yes	Yes	No	No	No
GAVI programme type	**Guaranteed***	**Guaranteed***	**Guaranteed**	**Guaranteed**	**Guaranteed**	N/A	**Guaranteed**
Expected benefits							
Budget impact		✓		✓	✓	✓	✓
Coverage & equity							
CCE/supply		*Minor*		✓	✓		✓
Wastage reduct.							
Market availability		✓		✓	✓		✓
Disease control	✓						
Patient experience			✓	✓	✓		
HR experience			Possible	✓	✓		

*Only PCV 10 & 13 prequalified and available in the GAVI menu

Reminder: WHO recommendations on Pneumococcal conjugate vaccines

SAGE Position Paper (2025)

World Health Organization

Topic	**WHO Recommendation**
Routine inclusion	WHO recommends **inclusion of PCVs in national childhood immunization programmes** to prevent pneumococcal disease in infants and young children under 5 years.
Schedule	A **3-dose PCV schedule (either 3p+0 or 2p+1) beginning as early as 6 weeks of age is recommended**; the choice depends on local programme considerations

	Consideration of a reduced-dose PCV schedule (1 primary dose + 1 booster: **"1p+1") as an off-label alternative** to standard 3-dose schedules in settings with mature high coverage and strong surveillance, given clear criteria:
	• **Well-established population immunity in children under 5 indicated by one of the following:**
	  ○ having a mature 3-dose PCV programme with average PCV3 coverage of ≥80% in previous 5 years
	  ○ a recent multi-age cohort PCV campaign, with ≥80% coverage among children under 5 years
	  ○ having low levels of VT carriage or disease, as indicated by high-quality surveillance or carriage surveys
	• **Capacity to administer vaccination between 9 and 18 months of age** (e.g. PCV booster, MCV, YF, IPV2) with average coverage of ≥80% in previous 5 years

	Children with certain medical conditions (e.g., HIV) may require tailored additional or booster doses beyond the primary schedule
Products	**Both PCV10 and PCV13** (or equivalent WHO-approved PCVs) **are effective**; selection should be based on serotype prevalence, logistics and cost at the national level
Catch-up	For unvaccinated children aged 1–5 years, catch-up vaccination is recommended

PCV – Switch to higher valency

Dengue | DTP | Hexa | HPV | IPV | Malaria | MCV | Men | **PCV** | Rota | TCV | Tetanus | YF

Switch to higher valency

Switch from a lower-valency pneumococcal conjugate vaccine to a broader-coverage (13/14/15/20) option to improve serotype protection

FEASIBILITY

Easy

Gavi The Vaccine Alliance

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	PQ (Dec2025)	Notes
Prevenar 13 – Pfizer	Conjugate	Liquid, vial or syringe	1 or 4-d vial	1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F	**2010**	For details comparison of available product, review WHO PCV compendium (*link in resources*)
Prevenar 13 – Sinergium	Conjugate	Liquid, syringe	1-d syringe		*No PQ*	
Weuphoria – Walvax	Conjugate	Liquid, vial or syringe	1-d vial		*No PQ*	
Pnemotex 13 – Nanolek	Conjugate	Liquid, vial	1-d vial		*No PQ*	
Pneubevax 14 – Biological E	Conjugate	Liquid, vial	1 or 5-d vial	Same as PCV13, –6A and + 22F + 33F	**2025**	
Vaxneuvance 15 – Merck/MSD	Conjugate	Liquid, syringe	1-d syringe	Same as PCV13 +22F +33F	*No PQ*	
Prevenar 20 – Pfizer	Conjugate	Liquid, syringe	1-d syringe	Same as PCV13 +8 +10A + 11A +12F + 15B/C + 22F +33F	*No PQ*	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
–	/	/	/	/	+ (+)	/	/
Publicly available prices are higher for higher valency products	*No change*	*No change, depends on product*	*No change*	No supply constraint reported on PCV13/14/15/20	Larger protection	*No change*	*No change*

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	*Minor*	*Minor*	*Minor*	N/A	*Possible*	N/A	*Required*
No change	Product name and valency	New vaccine documentation	Communicate about improved protection	*No change*	*Depending on product choice*	*No change*	Monitor for potential type replacement

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Option assessment support

Proposed criteria for assessment

- ***Coverage of active serogroups or serotypes in the country***
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Market availability of the vaccine and supplies over the selected time period*

Examples of implementing countries

- Switch to PCV15: Luxembourg, Sweden, Austria

Resources

- *WHO PCV position paper*
- *WHO Considerations for PCV product choice*
- *WHO Compendium on PCV*
- *PATH PCV cost calculator for MICs*
- *PATH PCV cost calculator for GAVI countries*

PCV – Switch to lower valency

Switch to lower valency

Switch to 10-valent to achieve potential cost-savings while maintaining comparable protection in most settings. Two PCV10 products available with comparable performance and difference in presentation, cost and supply dynamics.

FEASIBILITY

Easy

Gavi The Vaccine Alliance

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	Notes
Synflorix (GSK)	10-valent pneumococcal conjugate vaccine (protein D carrier)	Liquid, single-dose vial or PFS	1 or 4	1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F	For details comparison of available product, review WHO PCV compendium (*link in resources)*
Pneumosil (SII)	10-valent pneumococcal conjugate vaccine (CRM197 carrier)	Liquid, 5-dose vial	1 or 5	1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+ +	/	/	/	/	/ –	/	/
Publicly available prices are lower for PCV10	*No change*	*No change*	*No change*	Requires careful planning	Comparable protection	*No change*	*No change*

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
N/A	***Minor***	***Minor***	***Minor***	**N/A**	***Possible***	**N/A**	***Required***
No change	*No change, update vaccine name if recorded*	New vaccine documentation	Communicate about continued protection	*No change*	*Depending on product choice*	*No change*	Monitor for potential type replacement

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data

Option assessment support

Proposed criteria for assessment

- ***Coverage of active serogroups or serotypes in the country***
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Perspective on vaccine price*
- *Market availability of the vaccine and supplies over the selected time period*

Examples of implementing countries

- South Africa
- India

Resources

- *WHO Considerations for PCV product choice*
- *WHO Compendium*
- *PATH PCV cost calculator for MICs*
- *PATH PCV cost calculator for GAVI countries*

PCV – Change from 3+0 doses to 1+1 doses

Change from 3- (3+0) to 2- (1+1) dose schedule

Move from 3-dose primary to 1+1 schedule, though off-label, this schedule could be considered to reduce program costs and injection burden, only when countries meet certain criteria

FEASIBILITY

Complex

Gavi The Vaccine Alliance

Guaranteed

Products under consideration for the optimization question

Vaccine & Manufacturer	Composition	Presentation	Doses / unit	Serogroups	Notes
Prevnar 13 (Pfizer)	13-valent pneumococcal conjugate vaccine (CRM197 carrier)	Liquid, single-dose vial or PFS	1 or 4	1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F	For details comparison of available product, review WHO HPV compendium (*link in resources*)
Synflorix (GSK)	10-valent pneumococcal conjugate vaccine (protein D carrier)	Liquid, single-dose vial or PFS	1 or 4	1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F	
Pneumosil (SII)	10-valent pneumococcal conjugate vaccine (CRM197 carrier)	Liquid, 5-dose vial	1 or 5	1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F	

Potential impacts

Budget impact	Coverage	CCE/supply	Wastage red.	Market avail.	Disease contr.	Patients	HR
+ +	+	+ +	/	+ +	?	+ +	+
30% fewer doses needed	Simpler schedule depending on delivery touch point	30% fewer doses needed + lower volume per dose for some products	*No change*	30% fewer doses needed	Risk of compromising protection ag. transmission to younger age children	Fewer injections, lighter 1YL schedule	Reduced session time

Program implications

New contact point	Documentation change	Training	Communication	Reconstitution administration	Supply chain investment	Change in strategy	Surveillance investment
Required	***Required***	***Required***	***Required***	**N/A**	***N/A***	**N/A**	***Required***
Adds a visit and remove one	Cards and registers updated	Train HR on new schedule	Explain new schedule and continued protection	*No change*	*Lower cold-chain volume*	*No change*	Continue / invest in carriage surveys

Option assessment support

Proposed criteria for assessment

- *Acceptability of schedule*
- *Coverage of active serogroups or serotypes in the country*
- *Effectiveness of the vaccine*
- *Duration of protection and waning of immunity*
- *Herd immunity / protection*
- *Direct costs*
- *Indirect costs*
- *Availability of adequate cold chain equipment at all levels or ability to procure CCE required to store the vaccine*
- *Market availability of the vaccine and supplies over the selected time period*
- *Expected impact of the introduction on the human resources*

Examples of implementing countries

- UK

Resources

- *WHO 2025 PCV Position Paper*
- *IVAC Viewhub on PCV*
- *WHO Compendium*

*Vaccine price assumptions are based on publicly available information from UNICEF Supply Division, PAHO Revolving Fund and WHO Market Information for Access Data