VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

VIPS Phase II executive summary: Dual-chamber delivery devices

March 2020

Gavi The Vaccine Alliance | World Health Organization | Bill & Melinda Gates foundation | PATH | unicef

Dual-chamber delivery devices

About dual-chamber delivery devices

- Dual chamber delivery devices are **prefilled with liquid and dry vaccine components,** which are mixed within the device and administered.
- They could be regarded as **alternative innovations to microarray patches (MAPs) or solid dose implants (SDIs),** and they should not have the payload restrictions of these innovations. However, they offer fewer potential benefits than MAPs or SDIs.

Stage of development

- Technologies are at various stages of development, **from early design stage through to commercial availability,** however most dual-chamber device formats are still early in development**.**
- **No liquid/dry vaccines are licensed** in dual-chamber delivery devices. Two liquid/liquid vaccine products are licensed: (ViATIM [Sanofi] & hepatyrix [GSK], both are hepatitis A plus typhoid polysaccharide vaccines).

www.pharmaceutical-networking.com [a]

Dual chamber syringe (Vetter Lyoject)

PharmaPan [b]

Dual chamber blister with frangible seal

Neopac [c]

Dual chamber blister with frangible seal

[a] https://www.pharmaceutical-networking.com/vetter-dual-chamber-delivery-systems/ [b] https://www.pharmapan.com/sites/default/files/downloads/2017-10/PHARMAPAN_Dual_Chamber_Blister_1.1.pdf
[c] https://www.webpackaging.com/en/portals/webpac/assets/11138717/neopacs-fleximed-now-in-large-format/

Summary of key insights (1/2)

Potential public health impact of innovation

Applicability to vaccines

- Dual chamber delivery devices could be **applicable to most or all vaccines that are currently lyophilised** and require reconstitution with diluent before administration.

Public health benefits

- Public health benefits from use of dual chamber devices may include:
  - **Easier to prepare/use** allowing **lesser trained staff** to administer the vaccines, as the innovation removes the need for a separate reconstitution process;
  - **Avoidance of vaccine wastage and missed opportunities** for vaccines in multi-dose vials (MDVs);
  - The devices are single component, so should **reduce risk of stock-outs;**
  - **Removing the risk of errors and contamination during reconstitution;**
  - **Reducing the risk of needle-stick injuries**.

Vaccine problem statements

- Dual chamber delivery devices could potentially address several of the top 5 problem statements identified for **MR, MenA, rabies and yellow fever vaccines**, particularly those related to:
  - **Vaccine wastage or missed opportunities** due to MDV presentations;
  - **Reconstitution-related safety issues;**
  - **Difficult preparation;**
  - **Needle-stick injuries.**
- Dual-chamber devices do not improve the heat-stability of the vaccine, unless a formulation with improved stability is used; then, **damage due to heat exposure**, and **cold-chain requirements during outreach** might also be addressed.

Summary of key insights (2/2)

VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

Barriers to realise the innovation's potential impact

Costs

- The **commodity costs** for dual chamber devices are **unknown** but are very **likely to be higher than for vials and N&S.**
- Delivery and distribution costs are also unknown, although are likely to increase because the devices are single-dose and will occupy more space in the cold-chain.

Technology Readiness

- Most dual chamber device formats are **early in development** and face **significant technical and manufacturing challenges** that include ensuring complete mixing within the device and identifying materials with the necessary barrier properties to prevent ingress of moisture.
- In addition, **new formulations and novel drying processes** (e.g. to produce powders) might be needed for **some vaccine/device combinations**.
- **Devices that can be filled with the current lyophilised formulation face fewer challenges** and might be faster to commercialise than technologies such as MAPs or SDIs.

Commercial feasibility

- The **commercial feasibility of dual chamber delivery devices is uncertain**. A dual market in high income countries (HICs) that might incentivise vaccine manufacturers is less likely for dual chamber devices compared with other innovations (such as MAPs or SDIs), as they offer fewer potential benefits for HIC settings than these alternative innovations.

Countries interest

- There appears to be **strong country-interest in dual chamber devices,** which rank 2nd amongst the 9 tested innovations in the VIPS country interviews.

Dual-chamber delivery devices apply only to dry vaccines requiring reconstitution

Applicability to vaccines

	VIPS Phase II analysed vaccines	Vaccine Type	Presentation	Route
Vaccines **technically compatible** with dual-chamber delivery devices and analysed in Phase II.	**Licensed vaccines**			
	MR (or MCV)	Live attenuated	Lyophilised	SC[5]
	N. Men A (or N. Men A,C,W,Y,X)	Conjugate, adjuvant in diluent	Lyophilised	IM[2]
	Rabies	Whole inactivated	Lyophilised	IM or ID[6]
	Yellow fever (YF)	Live attenuated	Lyophilised	SC
	Pipeline vaccines			
	ETEC (ETVAX)	Whole inactivated organism	Liquid vaccine, lyophilised buffer and adjuvant	Oral
	HIV (ALVAC prime only)[8]	Live recombinant virus	Lyophilised	IM
	Malaria (RTS,S)	Adjuvanted recombinant protein	Lyophilised, liquid adjuvant	IM
	MTb (next gen.,VPM1002)	Live recombinant BCG	Lyophilised	ID
	RSV (Pre-F)	Recombinant protein	Lyophilised	IM
Vaccines **not technically compatible** with dual-chamber delivery devices & not analysed in Phase II	**Ebola (rVSV-ZEBOV)**[7]	Live vector	Liquid (FROZEN)	IM
	Penta (or DTP containing)	Adjuvanted inactivated subunit plus polysaccharide-protein conjugate	Liquid	IM
	Hepatitis B (birth dose)	Adjuvanted sub-unit	Liquid	IM
	HPV	Adjuvanted sub-unit	Liquid	IM
	Polio, IPV	Whole inactivated	Liquid	IM or ID
	Rota (Oral)	Live attenuated virus	Liquid	Oral
	Typhoid, conjugate (TCV)	Polysaccharide-protein conjugate	Liquid	IM
	HIV (bivalent subtype C gp120 boost only) [8]	Adjuvanted recombinant protein	Liquid	IM
	Influenza (pandemic,VAL-506440)	Lipid nanoparticle, modified RNA	Liquid	IM

8 vaccines are technically compatible and have therefore been assessed with dual-chamber delivery devices (out of 17 in scope) in Phase II.

Vaccine applicability:

- **All dry vaccine presentations** that **require reconstitution with a diluent,** or other multicomponent vaccines that require mixing.
- Particularly useful for l**yophilised vaccines delivered through campaigns/outreach,** as they might enable task-shifting to lesser trained personnel.
- Technical feasibility was assessed based on data, when available, and expert opinion. Key considerations included the natural route of infection, vaccine type, use of adjuvants and preservatives, and context of use.

Comparators:

[1]To assess innovations against both ‘best practice’ and ‘current practice’, comparators were defined as:

- **SDV[3] presentation** and **AD N&S[4],**
- If available, the **MDV[9] presentation** commonly procured by LMICs.

[2] Intramuscular; [3] Single-dose presentation; [4] Auto-disable needle & syringe; [5] Subcutaneous; [6] Intradermal. [7] At the time of the assessment, Ebola vaccine was not yet licensed and has been analysed as a pipeline vaccine.[8] HIV vaccine consists of two different components: a virus vector for priming doses and a subunit protein plus adjuvant. The prime and boost were therefore assessed separately. [9] Multi-dose presentation;

Beyond the 17 vaccines analysed through VIPS, dual chamber devices are likely to be compatible with other lyophilised vaccines

Applicability to vaccines

**Pipeline vaccines*

VIPS vaccines assessed to be compatible with dual-chamber delivery devices	Vaccine type	Other vaccines likely to be compatible with dual chamber delivery devices
Men A	Polysaccharide-protein conjugate, lyophilised	Men ACWY(X)
MR; YF; *HIV (ALVAC viral vector prime)*	Live attenuated virus, lyophilised	MCVs; JE (live attenuated); dengue; influenza (seasonal); *CEPI vaccine platforms (live recombinant vectors); chikungunya, HSV; next generation malaria; RSV*
Rabies	Inactivated virus, lyophilised	*R&D Blueprint vaccines*
ETEC (ETVAX)	Inactivated (liquid) vaccine, lyophilised buffer, lyophilised adjuvant (oral)	Rotavirus (live attenuated, oral)
RSV; Malaria (RTS,S)	Subunit, lyophilised, +/- adjuvant	*Mtb (next generation, M72)*
Mtb (next generation)	Live attenuated, lyophilised, ID admin	BCG, other vaccines for ID administration e.g. IPV, rabies

Overview of dual-chamber delivery devices public health benefits based on Phase II analysis

Comparator: MDV

Vaccine with an elimination agenda

Public health benefits

VIPS Criteria	Indicators	MR	Men A	Rabies	YF	ETEC	HIV[5]	Malaria (RTS,S)	M. Tb[6]	RSV[7]
Primary criteria – Health impact	Vaccine efficacy	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Vaccine effectiveness	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Ability of the vaccine presentation to withstand heat exposure	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
	Ability of the vaccine presentation to withstand freeze exposure	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Primary criteria – Coverage & Equity impact	Number of fully or partially immunised (relative to target population)	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Ease of use: clinical perspective based on product attributes	Better	Better	Better	Better	Better	Better	Better	Better	Better
	Ease of use: ability of a lesser trainer personnel to admin. / self-admin.	Better	Better	Better	Better	Better	Better	Better	Better	Better
	Ability to facilitate dose sparing	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
	Avoid missed opportunities and reduce vaccine wastage[1]	Better	Better	Better	Better	Neutral	Neutral	Better	Better	Neutral
	Acceptability of the vaccine presentation and schedule[2]	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
	Potential to reduce stock outs[3]	Better	Better	Better	Better	Better	Better	Better	Better	Better
Primary criteria – Safety impact	Number of vaccine product-related AEFIs	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Likelihood of contamination and reconstitution errors	Better	Better	Better	Better	Better	Better	Better	Better	Better
	Likelihood of needle stick injury	Better	Better	Better	Better	Neutral	Better	Better	Better	Better
Primary criteria – Economic costs	Commodity costs of the vaccine regimen[4]	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Delivery costs of the vaccine regimen[4]	No data	No data	No data	No data	No data	No data	No data	No data	No data
	Introduction & recurrent costs of the vaccine regimen[4]	Worse	Worse	Worse	Worse	Worse	Worse	Worse	Worse	Worse
Environmental impact	Waste disposal of the vaccine regimen[4] and delivery system	Better	Better	Better	Better	Better	Better	Better	Better	Better

[1] Based on availability of the innovation in a single-dose presentation compared to a MDV the score would be neutral for all vaccines if the comparator was a SDV; [2] To patients/caregivers; [3] Based on the number of separate components necessary to deliver the vaccine or improved ability to track vaccine commodities; [4] per person vaccinated; ; [5] ALVAC prime; [6] VPM 1002; [7] Pre-fusion F protein

Phase II confirms dual-chamber delivery devices' potential public health benefits for lyophilised vaccines

Public health benefits

Based on the assessment using VIPS primary indicators applied to dual chamber devices with specific vaccines, these innovations can **potentially address several immunisation challenges for lyophilised vaccines.**

- **Easier to prepare/use** allowing **lesser trained staff** to administer the vaccines, based on product attributes. *This applies to all the vaccines assessed as the innovation removes the need for a separate reconstitution process.*
- Dual-chamber devices are single-dose format, so **avoid vaccine wastage and missed opportunities** for lyophilised vaccines in multi-dose vial (MDV) presentations such as: *MR, Men A, rabies, yellow fever. RTS,S and VPM 1002 (next generation MTb) are also expected to have MDV presentations*.
- The devices are single component, so should **reduce risk of stock-outs** *compared to standard lyophilised vaccines.*
- By avoiding 'manual reconstitution', dual chamber devices should **remove the risk of reconstitution errors (such as use of the wrong diluent) and contamination**. *This should be a benefit for all lyophilised vaccines.*
- Dual chamber delivery devices still include needles. The risk of **needle stick injury should be slightly reduced** as there are fewer steps and needles compared to the usual reconstitution process. *This should be a benefit for all lyophilised vaccines.*
- **Waste disposal should be improved** as there are fewer components in dual-chamber delivery devices.
- The devices **will not improve the heat-stability** of vaccines, but some of the benefits above **might be particularly beneficial to dry vaccines used in the controlled temperature chain (CTC)** used in outreach settings, such as Men A vaccine. Vaccines in dual chamber devices will have a greater volume per dose however, than in a MDV presentation.

Overview of the ability of dual-chamber delivery devices to address vaccine specific problems identified in the VIPS Phase II country online survey[1]

Vaccine problem statements

Vaccine with an elimination agenda

	MR	Men A	Rabies	YF[6]	ETEC	HIV[3]	Malaria (RTS,S)	M. Tb[4]	RSV[5]
Vaccine ineffectiveness/wastage due to **heat exposure**	1	3	2						
Vaccine ineffectiveness/wastage due to **freeze exposure**				3					
Cold chain requirements during outreach[2]	4	2							
Vaccine wastage or missed opportunities due to **multi-dose vial**[2]	2	1	4	1					
Reconstitution related **safety issues**[2]	3	4		2					
Reduced acceptability due to painful administration[2]			3						
Difficult preparation requiring trained personnel[2]			1						
Negative impact on the environment due to waste disposal practices[2]				5					
Needle-stick injuries[2]	5	5	5	4					
Contamination risk due to multi-dose vial[2]									
Difficult to deliver vaccine to correct injection depth[2]									

[1] Based on an online survey with 209 global experts and country-level stakeholders across 54 countries conducted in Q4 2019 – Q1 2020, top 5 reported challenges per licensed vaccine were selected as 'vaccine problem statements' to be specifically analysed. Numbers in the table refer to the ranking order of top 1 to 5 problem statements. For pipeline vaccines, problem statements were defined by VIPS WG. [2] Scoring based on product attributes. [3] ALVAC prime; [4] VPM 1002; [5] Pre-fusion F protein, [6] Respondents reported freeze sensitivity as a problem for YF, however, vaccine is not freeze sensitive.

No difference with the comparator | Better than the comparator

Dual-chamber delivery devices have the potential to address several of the countries' top 5 vaccine problem statements

Vaccine problem statements

The overlay of the top 5 problem statements by vaccines with the VIPS primary indicators assessment shows that dual-chamber deliver devices **have the potential to address several of the top 5 vaccine problem statements for lyophilised vaccines:**

- **Vaccine wastage or missed opportunities due to a MDV presentation** will be avoided as the devices are single-dose presentations. *This was identified as the first or second most important problem for **MR, MenA and YF** vaccines. It was the 4th ranked problem for **rabies** vaccine.*
- **Reconstitution related safety-issues, and difficult preparation regarding trained personnel** should be avoided due to the integrated reconstitution process. *These were identified as a problem for **MR, MenA, and YF** vaccine.*
- **Needle-stick injuries should be reduced** as the devices remove the need for the reconstitution syringe and needle, so few sharps and steps are involved in the process of vaccine administration. *NSIs were the 5th ranked problem for **MR, MenA and rabies** and the #4 problem for **YF** vaccine.*
- The problems above could be **especially significant for vaccines used in the CTC** (such as MenA) **and/or outreach settings** by allowing task-shifting to lesser-trained personnel**.** However, even if the vaccine can be used in the CTC, the volume per dose will be higher in dual-chamber devices compared with MDVs, which might offset some of the benefits.
- **Vaccine wastage/ineffectiveness due to heat or freeze exposure** were *identified as important problems for **MR, MenA, rabies and YF** vaccines.* Dual-chamber delivery devices **will not address these issues** themselves. However, if new formulations and/or drying processes are required in order to use a vaccine with a dual chamber device, this would be an opportunity to develop a product with enhanced heat stability that could be used in the CTC and that would address additional problem statements such as **damage due to heat exposure** and **cold-chain requirements during outreach**.

Dual chamber delivery devices will likely have a higher cost than SDV and MDV alternatives and potential delivery cost savings will depend on device volume

Costs

Commodity costs[1, 2]

Unknown, however likely to be higher than for SDV or MDV:

- There are **no data on the COGS or purchase price** of dual-chamber delivery devices.
- For **combination products like dual-chamber delivery devices, it is likely that the COGS & procurement price will be greater than for SDV and MDV**.
- Previous costing studies have shown that for the comparators, the 'vaccine + vial' price is larger than the combined cost of delivery devices and safety boxes. Therefore, the **expected increase in 'vaccine + device' price will outweigh the savings in other commodity costs** components.

Delivery costs[1, 3]

Unknown – will likely depend on the balance between the likely increase in device volume in the cold chain against the reduction in time taken to prepare and administer the vaccine.

- The costs for storage and transport in the cold chain is unknown because of a **wide range of potential volumes for dual chamber delivery devices;** but it is **most likely larger** on a per dose basis **than a MDV.**
- The **costs of storage and transport of separate auto-disable and re-use prevention syringes out of the cold chain would be reduced**.
- The impact on the **vaccinator time costs is unknown** but is likely to be reduced as there is no reconstitution step.

Introduction and recurrent costs[1]

Introduction costs due to training needs:

- Training would be required to introduce dual chamber delivery devices as would be required with any innovation.
- No upfront, recurrent or ongoing costs.

[1] Of a vaccine regimen (per person vaccinated); [2] Includes the purchase cost of a vaccine regimen and delivery devices (injection syringes or other components needed for vaccine preparation and administration) accounting for wastage, and safety box costs; [3] Includes costs of in and out of cold chain storage and transport for a vaccine regimen including delivery technology(ies), time spent by vaccinators when preparing and administering the vaccine and by staff involved in stock management;

Dual chamber delivery devices development are still early and faces significant challenges that will require substantial time, effort and investment to be overcome

Technology Readiness

Vaccine with an elimination agenda

VIPS Criteria		Indicators	MR	Men A	Rabies	YF	ETEC	HIV[2]	Malaria (RTS,S)	M. Tb[3]	RSV[4]
Secondary criteria	Technology readiness [1]	Clinical development pathway complexity	Low	Low	Low	Low	High	High	High	High	Moderate
		Technical development challenges : Syringe-and cartridge-based devices	Low								
		Technical development challenges : Frangible seal-based devices	High	High	High	High	Moderate	High	High	High	High
		Complexity of manufacturing the innovation : Syringe-and cartridge-based devices	Low								
		Complexity of manufacturing the innovation : Frangible seal-based devices	Very high	Very high	Very high	Very high	Moderate	Very high	Very high	Very high	Very high
		Robustness: multiple developers of the technology	Moderate[5]	No data	No data	No data	No data	No data	No data	No data	No data
		Robustness: multiple suppliers/manufacturers of the vaccine	Moderate	Not robust	Moderate	Moderate	Not robust	Not robust	Not robust	Not robust	Moderate

- **Syringe-based dual chamber devices are on the market for pharmaceuticals**, indicating technical and manufacturing feasibility**,** but they may lack auto-disable and other **features needed to be suitable for LMIC use.**
- **Frangible seal-based devices are at an early stage of development**. Proof of concept has been established for oral delivery, but not yet for parenteral delivery. There are very significant development and manufacturing challenges including developing suitable aseptic processes for vaccine drying, reconstitution mechanisms that ensure adequate mixing within the device, and identifying material with the necessary barrier properties to prevent ingress of moisture.
- There are **no known** device developer – vaccine manufacturer **partnerships** (i.e. the pipeline is not robust).

[1] VIPS assessment of the Technology Readiness criteria was informed by consultations with the WHO/PATH Delivery Technology - WG, as well as with regulators. .
[2] ALVAC prime; [3] VPM 1002; [4] Pre-fusion F protein [5] Work with MR uses devices and excipients, but without active vaccine

Dual chamber devices face major development challenges particularly if novel drying processes are needed

Technology Readiness

Regulatory	Technical	Manufacturing	Vaccines
• **Clinical development**. For licensed vaccines, phase III non-inferiority or bridging studies with immunogenicity endpoints are expected to be sufficient. However, for novel vaccines, the same (clinical) endpoints would be required as for N&S or other delivery methods. • **Stability** of the vaccine in the new primary container will need to be demonstrated, even if the drying process is unchanged, particularly as preventing moisture ingress is a significant challenge**.**	• **Vaccine drying:** Some devices require alternative vaccine drying and powder filling processes, and others can be compatible with *in situ* lyophilisation. These processes must be developed and validated for each vaccine. • **Barrier properties:** Materials and designs must be identified that provide sufficient moisture and gas vapor barriers, which is particularly challenging for polymer-based squeezable materials. • **Reconstitution:** The mechanism must result in reliable and complete reconstitution. For parenteral vaccines, visualisation of completeness of mixing may be a requirement.	• **Fill/finish equipment:** Commodity components and filling equipment may be leveraged for syringe-based devices, but additional stopper insertion, filling, and lyophilisation steps are needed. Novel fill/finish equipment will be needed for frangible-seal devices. • **Drying/powder filling:** Work is underway to assess feasibility of *in situ* lyophilisation in frangible seal devices, but alternative vaccine drying processes and equipment are likely to be needed for some designs. • **Quality control:** Novel methods for in-process controls and process validation will be required. • **Pilot scale lines:** A pilot line for an oral vaccine frangible seal device has been established, but pilot lines or CMOs for other types are needed.	• **All lyophilised vaccines** might be suitable. It would be advantageous if the formulation and drying processes used for already licensed vaccines could be applied to the new devices. • **Oral vaccines** may be the easiest candidates for proof of concept and an **initial product** due to availability of a prototype design with demonstrated feasibility and programmatic suitability in LMICs and an available pilot line for testing. • Dual chamber delivery devices might be best applied to **new, more expensive vaccines** that require a dry formulation e.g. ETEC or HIV (prime), to avoid reformulation and repeating development of existing vaccines.

The commercial opportunity for dual-chamber delivery devices in LMICs is highly uncertain and developers and manufacturers will need an upside to create partnerships

Commercial feasibility

Vaccine with an elimination agenda

VIPS Criteria	Indicators	MR	Men A	Rabies	YF	ETEC	HIV[1]	Malaria (RTS,S)	M. Tb[2]	RSV[3]
Secondary criteria: Commercial feasibility	Country stakeholders' interest based on evidence from existing data	No data								
	Potential breadth of the target market	Large	Moderate/ Large	Small/ Moderate	Moderate	Moderate	Large	Moderate	Large	Large
	Existence of partnerships to support development and commercialisation	Mixed interest	No known interest	No known interest	No known interest	No known interest	No known interest	No known interest	No known interest	No known interest
	Known barriers to global access to the innovation	Mixed								

- **Market potential and uptake for dual chamber delivery devices in LMICs** is **highly uncertain**:
  - The **cost of goods** compared with N&S & vials is **unknown** but is likely to be higher for dual chamber devices. This may limit the use case for uptake of dual chamber delivery devices in LMICs.
  - The **market** for dual-chamber devices in **HICs is very uncertain,** likely to be focused on high value pharmaceuticals, and may not be sufficient to support development of devices for use in LMICs.
- **Partnerships to support development and commercialisation will be required:**
  - To provide **investment in device development and manufacturability assessment**; this could include donors/funders.
  - **Clarification of the value proposition for dual chamber delivery devices** will be needed to facilitate partnership between vaccine manufacturers and developers to advance testing.

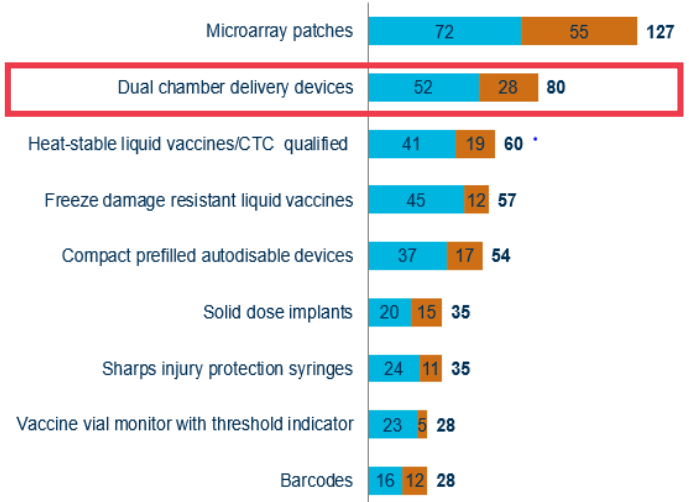
[1] ALVAC prime; [2] VPM 1002; [3] Pre-fusion F protein

Based on VIPS country feedback[1], there appears to be strong interest in dual-chamber delivery devices

Countries interest

Feedback from in-person country interviews

Innovations' ranking



- Dual-chamber delivery devices are rated by both immunisation staff and decision makers as the **#2 innovation amongst the 9 tested**, i.e. have significant potential impact in helping address their immunisation programme's current challenges (based on weighted scores).

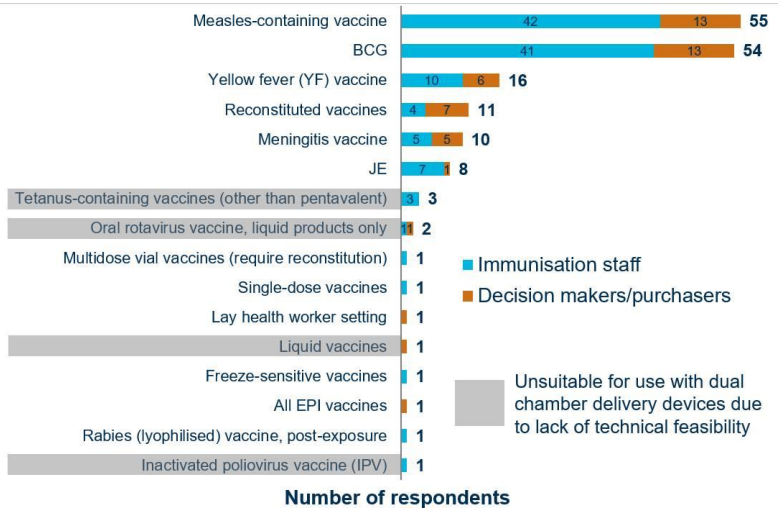
Perceived benefits

- Improve **ease of use/easier to prepare** and **make logistics easier;**
- Potential to **decrease vaccine wastage;**
- Potential to **reduce risk of contamination** and **save health care workers time;**
- Improve **delivery of the correct dose amount**;
- Reduce **missed opportunities** and **more acceptable.**

Perceived challenges

- **Cold chain volume** and **cost and price per dose**;
- Immunisation staff: **complexity** of the technology use**, time required** to use the technology/mixing the dose**, need community sensitisation, packaging/ integrity of the product seals;**
- Decision makers: **training required.**

Vaccines' ranking for dual chamber delivery devices



[1] Based on in-person interviews conducted in Q4 2019-Q1 2020 with 55 immunisation staff and 29 decision makers across 6 countries to gather feedback on the 9 innovations under final evaluation

Potential impact of VIPS prioritisation

VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

What could VIPS do to accelerate dual chamber devices development for LMICs

- Dual chamber delivery devices are **alternative** innovations to MAPs and SDIs. They offer fewer potential benefits, but **some formats are more mature,** and they **overcome some of the** risks and drawbacks of MAPs and some SDIs, **e.g. payload**.
- VIPS endorsement and subsequent activities might be needed to **advance the use of this 'available' technology with vaccines. Further consultation is needed,** but activities could include:
  - **Understanding the value proposition** for dual chamber devices overall in general and for the different types; syringe-type vs. frangible seal.
  - **Push funding (possibly) to accelerate development and clinical testing** of lead applications, potentially oral vaccines.
  - **Country and cost analyses** to provide clarity on use-case scenarios in LMICs.
  - **Understand how the Alliance could incentivise** vaccine manufacturers to adopt the technology for priority vaccines.

Risks of not prioritising dual chamber devices through VIPS

- **Without incentivisation, vaccine manufacturers are likely to be reluctant to adopt the technology due to complexity and costs of development**. In the absence of a commercially appealing market in HICs, dual-chamber delivery devices **might not be developed for LMICs.**

Gavi The Vaccine Alliance · World Health Organization · Bill & Melinda Gates foundation · PATH · unicef