VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

VIPS Phase II executive summary: Microarray patches (MAPs)

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Gavi The Vaccine Alliance

World Health Organization

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Microarray patches (MAPs)

About MAPs

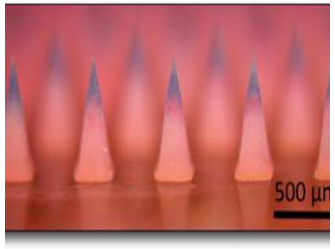
- MAPs consists of **an array of micro-projections on a patch**. The micro-projections are coated with or are composed of, vaccine in a dry formulation. When a MAP is applied to the skin, the vaccine is delivered into the dermis and/or epidermis layers.
- MAPs can be administered **without an applicator**, by applying pressure with fingers, or using **an integrated applicator.**
- Like solid-dose implants (SDIs), MAPS are sharps-free devices that could potentially be used with all injected vaccines (once they have been reformulated). However, development of MAPs is more advanced than SDIs and current MAPs do not have a separate applicator, which will likely be needed for SDIs.

Vaxxas, 15 May 2019

micronbiomedical.com [b]

Stage of development

- Various formats of MAPs are **being developed for vaccine delivery** by several different developers.
- Three developers have tested **influenza vaccine** MAPs in **phase I clinical trials**, and **preclinical development** is underway with **other vaccines, including measles-rubella (MR)**.
- MAPs for delivery of non-vaccine products, such as teriparatide (for osteoporosis) and Zolmitriptan (migraine), have been evaluated **in phase II and III trials** respectively.



WHO [c]

Summary of key insights (1/2)

VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

Potential public health impact of innovation

Applicability to vaccines

- MAPs could be used with **all or most vaccines** that are currently injected. However:
  - Vaccines that are currently adjuvanted **might need to be formulated without adjuvant** to reduce local reactogenicity and/or facilitate manufacturing.
  - MAPs have a relatively **limited payload** which might not be sufficient for use with some vaccines.

Public health benefits

- MAPs potentially offer a broad range of public health benefits for a range of vaccines including:
  - **Resistance to heat exposure** which may facilitate **use within the controlled temperature chain;**
  - **Easier to use**, allowing **lesser trained staff** to administer vaccines and potentially enabling self administration;
  - Single-dose presentation, **reducing missed opportunities** and **contamination risks** associated with multi-dose vials;
  - **Improved safety** by **avoiding reconstitution errors** and avoiding **needle-stick injuries**.
  - **Improved acceptability to caregivers/parents**;
  - Fewer components than needle and syringe (N&S) delivery **reducing the risk of stock-outs.**

Vaccine problem statements

- MAPs could potentially **address many or all of the top 5 problem statements** identified for HepB birth dose, HPV, MR, MenA, IPV, rabies, TCV, and yellow fever vaccines, particularly those related to:
  - **Heat-stability** of vaccines and **cold-chain requirements;**
  - **Reconstitution** of lyophilised vaccines and **missed opportunities** due to use of preservative-free multi-dose vials;
  - **Ease of use** and **safety.**

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Summary of key insights (2/2)

VIPS VACCINE INNOVATION PRIORITISATION STRATEGY

Barriers to realise the innovation's potential impact

Costs

- The **commodity costs** for MAPs are **unknown but are likely to be higher** than for vials and N&S.
- **Delivery and distribution costs are also unknown** and will depend on the size of the MAP and possibly the 'wear-time' of the MAP.

Technology Readiness

- Development of MAPs faces **significant technical and manufacturing challenges** including:
  - The need to develop and scale-up **novel manufacturing** processes;
  - Formulation without adjuvants (to reduce reactogenicity) **might reduce vaccine immunogenicity;**
  - Formulations need to provide vaccine stability and allow rapid and efficient delivery into the skin.

Commercial feasibility

- The **commercial feasibility** of MAPs in low to middle income countries (LMICs) is **uncertain**, especially as the cost of the devices is likely to be higher than N&S. A dual-market in high income countries (HICs) might be needed.
- There is **demonstrated interest** from countries and several MAP developers have programs supported by global health funders. There are however **no or few established commercial partnerships** between vaccine manufacturers and MAP developers.

Countries interest

- Based on the VIPS country interviews, there appears to be **strong interest in MAPs both from immunisation staff and decision makers**, with an overall ranking of **number 1** amongst the 9 tested.

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MAPs have a broad applicability to vaccines

Applicability to vaccines

	VIPS Phase II vaccines	Vaccine Type	Presentation	Route
Vaccines **technically compatible** with MAPs and analysed in Phase II.				
Licensed vaccines	**Hepatitis B** (birth dose)	Adjuvanted sub-unit	Liquid	IM[1]
	HPV	Adjuvanted sub-unit	Liquid	IM
	MR (or MCV)	Live attenuated,	Lyophilised	SC[2]
	N. Men A (or N. Men A,C,W,Y,X)	Polysaccharide-protein conjugate, adjuvant in diluent	Lyophilised	IM
	Polio, IPV	Whole inactivated	Liquid	IM or ID[3]
	Rabies	Whole inactivated	Lyophilised	IM or ID
	Typhoid, conjugate (TCV)	Polysaccharide-protein conjugate	Liquid	IM
	Yellow fever (YF)	Live attenuated	Lyophilised	SC
Pipeline vaccines	**Ebola** (rVSV-ZEBOV)[7]	Live vector	Liquid (FROZEN)	IM
	HIV (ALVAC prime only)[8]	Live recombinant virus	Lyophilised	IM
	Influenza (pandemic,VAL-506440)	Lipid nanoparticle, modified RNA	Liquid	IM
	MTb (next gen.,VPM1002)	Live recombinant BCG	Lyophilised	ID
	RSV (Pre-F)	Recombinant protein	Lyophilised	IM
Vaccines **not technically compatible** with MAPs & not analysed in Phase II	**Penta** (or DTP containing)	Adjuvanted inactivated subunit plus polysaccharide-protein conjugate	Liquid	IM
	Rotavirus (Oral)	Live attenuated virus	Liquid	Oral
	ETEC (ETVAX)	Whole inactivated organism	Liquid vaccine, lyophilised buffer and adjuvant	Oral
	HIV (bivalent subtype C gp120 boost only) [8]	Adjuvanted recombinant protein	Liquid	IM
	Malaria (RTS,S)	Adjuvanted recombinant protein	Lyophilised, liquid adjuvant	IM

13 vaccines (out of 17 in scope) are technically compatible with MAPs and have therefore been assessed in Phase II.

Vaccine applicability:

- **Most or all parenteral vaccines are candidates for use with MAPs.**
- Vaccines **with adjuvants** are likely to have a **more challenging** development pathway. Some of these have been excluded as they are likely to be particularly challenging.
- 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:

To assess innovations against both 'best practice' and 'current practice', comparators were defined as:

- **Single dose vial (SDV)[4] presentation** and auto-disable (AD) N&S[5],
- If available, the **MDV[6] presentation** commonly procured by LMICs.

[1] Intramuscular; [2] Subcutaneous; [3] Intradermal; [4] Single-dose presentation; [5] Auto-disable needle & syringe; [6] Multi-dose presentation; [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.

Beyond the 17 vaccines analysed through VIPS, MAPs should be compatible with a range of other vaccines

**Pipeline vaccines*

Applicability to vaccines

VIPS vaccines compatible with MAPs	Vaccine type	Other vaccines likely to be compatible with MAPs
HepB	Subunit, liquid, adjuvant	dT; TT; DTwP; DTaP; hexavalent; *non-replicating rotavirus; GAS; next generation malaria; CEPI vaccine platform (clamp); Shigella; ETEC*
HPV	VLP or inactivated virus, liquid, adjuvant	JE (inactivated); hepA; *non-replicating rotavirus; RSV*; *improved or universal influenza; influenza (pandemic)*
IPV	Inactivated virus, liquid	Influenza (seasonal); *RSV*
Men A	Polysaccharide-protein conjugate, lyophilised	Men ACWY(X)
MR; YF; *HIV (ALVAC prime)*	Live attenuated virus, lyophilised	MCVs; JE (live atten.); dengue; influenza (seasonal); *CEPI vaccine platforms (live recombinant vectors); chikungunya, HSV; next generation malaria; RSV*
Rabies	Inactivated virus, lyophilised	*R&D Blueprint vaccines*
Typhoid	Polysaccharide-protein conjugate, liquid	Pneumococcal conjugate vaccine; Hib, Men ACWY (liquid); *GBS*; *Shigella*
Ebola	Live vector, liquid	*CEPI vaccine platforms (rVSV); R&D Blueprint vaccines; HSV; next generation malaria; RSV*
Flu (pandemic)	Nucleic acid, liquid	*CEPI vaccine platforms (DNA, RNA), HSV*
RSV	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 MAPs public health benefits based on Phase II analysis

Comparator: MDV

Public health benefits

Vaccine with an elimination agenda

VIPS Criteria	Indicators	Hep B BD	HPV	MR	Men A	IPV	Rabies	TCV	YF	Ebola	HIV[6]	Influ-enza[5]	M. Tb[7]	RSV[8]
Primary criteria	Health impact	Vaccine efficacy	No data	No data	No data	No data	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	No data	No data	No data	No data
		Ability of the vaccine presentation to withstand heat exposure	No data	Better	Better	No data	Better	No data	No data	No data	No data	No data	No data	No data	No data
		Ability of the vaccine presentation to withstand freeze exposure	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
	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	No data	No data	No data	No data
		Ease of use: clinical perspective based on product attributes	Better	Better	C. better	C. better	Better	C. better	Better	C. better	Better	C. better	Mixed	C. better	C. better
		Ease of use: ability of a lesser trainer personnel to admin. / self-admin.	Better	C. better	C. better	C. better	Better	C. better	C. better	C. better	C. better	C. better	C. better	Better	C. better
		Ability to facilitate dose sparing	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
		Avoid missed opportunities and reduce vaccine wastage[1]	Better	C. better	C. better	C. better	Better	C. better	C. better	C. better	Neutral	Neutral	Neutral	C. better	Neutral
		Acceptability of the vaccine presentation and schedule[2]	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better
		Potential to reduce stock outs[3]	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better
	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	No data	No data	No data	No data
		Likelihood of contamination and reconstitution errors	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better
		Likelihood of needle stick injury	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better	Better
	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	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	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	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	Better	Better	Better	Better

[1] Based on availability of the innovation in a single-dose presentation or multi-dose with preservative. 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] VAL 506440; [6] ALVAC prime; [7] VPM 1002; [8] Pre-fusion F protein

Phase II confirms MAPs' broad potential public health benefits for a range of compatible vaccines

Public health benefits

Based on the assessment using VIPS primary indicators applied to MAPs with specific vaccines, MAPs can **potentially address many immunisation challenges for a range of compatible vaccines.**

- **Resistance to heat exposure** and facilitating **use within the controlled temperature chain** assuming the MAP formulation confers sufficient heat stability – *data supporting this have been obtained to date with HPV, MR and IPV*.
- **Easier to prepare/use** allowing **lesser trained staff** to administer the vaccines. MAPs score considerably better for vaccines that can be given to adolescents/adults because they **should also enable self administration**. *This includes HPV, RSV and vaccines used in campaigns.*
- Appear painless and safer than N&S to recipients (based on product attributes) so should have **higher acceptance**. Recipients of a non-VIPS vaccine (seasonal influenza) preferred MAPs to N&S injection.
- Single-dose presentation, with the potential to **reduce missed opportunities** due to reluctance to open a multi-dose vial. *Particularly relevant for vaccines with preservative-free multi-dose presentations such as HPV, MR, MenA, rabies, and YF.*
- Do not require reconstitution, so the **risks of reconstitution-related errors and contamination are reduced.** *This is relevant for all lyophilised vaccines, such as MR, MenA, rabies, and YF.*
- Single component, so should **reduce risk of stock-outs** *for all vaccines, liquid or lyophilised.*
- Needle-free, **avoiding needle-stick injuries and simplifying waste disposal** *for all vaccines.*

Overview of the ability of MAPs to address vaccine specific problems identified in the VIPS Phase II country consultations[1]

Vaccine problem statements

Vaccine with an elimination agenda

	Hep B BD	HPV	MR	Men A	IPV	Rabies	TCV	YF	Ebola	HIV[3]	Influ-enza[4]	M. Tb[5]	RSV[6]
Vaccine ineffectiveness/wastage due to **heat exposure**	2	4	1	3	2	2	1						
Vaccine ineffectiveness/wastage due to **freeze exposure**	1	1			1		5	3					
Cold chain requirements during outreach[2]	3	3	4	2	3								
Vaccine wastage or missed opportunities due to **multi-dose vial**[2]			2	1		4	2	1					
Reconstitution related **safety issues**[2]			3	4				2					
Reduced acceptability due to painful administration[2]	5	2			4	3							
Difficult preparation requiring trained personnel[2]	4	5				1	4						
Negative impact on the environment due to waste disposal practices[2]					5			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]							3						

[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 challenges identified by countries 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 the VIPS WG. [2] Scoring based on product attributes. [3] ALVAC prime; [4] VAL-506440; [5] VPM1002; [6] Pre-fusion F protein

No data available for assessment | Mixed | Better than the comparator | Considerably better than the comparator

MAPs have the potential to address many or all, of the countries' top 5 vaccine problem statements for the applicable vaccines

Vaccine problem statements

The overlay of the top 5 problem statements by vaccines with the VIPS primary indicators assessment shows that **MAPs have the potential to address most of the top 5 vaccine problem statements for a broad range of vaccines:**

- **Resistance to heat exposure** and facilitating **use within the controlled temperature chain** – assuming the MAP formulation confers improved heat stability. *Identified as an important problem for the **majority of the 13 vaccines** assessed.*
- Single-dose presentation, potentially **reducing missed opportunities** due to vaccine wastage or reluctance to open a multi-dose vial. *Identified as an important problem for **vaccines in multi-dose presentations like MR, MenA and YF,** as well as **rabies and TCV**.*
- No need for reconstitution, therefore **avoiding reconstitution errors.** *An important problem for **lyophilised vaccines (MR, MenA and YF)**.*
- **Easier to prepare/use**, saving time and allowing for **lesser trained staff** to administer the vaccines. *Identified as an important problem for **rabies, HepB, TCV, and HPV.***
- MAPs are sharps-free, so **needle-stick injuries should be reduced,** *identified as the problem ranked number 5 for **MR, MenA, rabies** and number 4 for **YF*** and **waste-disposal** should be **simple**r*, also the problem ranked number 5 for **IPV and YF***.
- MAPs have been **perceived** as being safer and less painful based on the appearance of the device**,** which might improve acceptability. Limited data, obtained with a non-VIPS vaccine (seasonal influenza), have not found a significant difference in reported pain compared with N&S.

MAPs will likely have a higher cost than single-dose vial (SDV) and multi-dose vial (MDV) alternatives

Costs

Commodity costs[1, 2]

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

- **There are no data on the cost of goods (COGS)** or purchase price of a MAP.
- However, it is **likely that both will be higher than for vaccines in SDVs and MDVs.**
- 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 increase in 'vaccine + MAP' price is likely to outweigh savings in other commodity costs components.**

Delivery costs[1, 3]

Unknown. This will depend on the MAP's volume in the cold chain and vaccinator time for preparing and administering the vaccine:

- The **costs for storage and transport in the cold chain are unknown** because of no volume data for MAPs; but it is most likely larger than a MDV. This will be device-specific.
- The **impact on the vaccinator time costs is unknown** as the **wear time of MAPs is unknown** (and device-specific) and it is not clear whether the vaccinator will have to continue to monitor the vaccines during this time.

Introduction and recurrent costs[1]

Introduction costs due to training needs:

- Training would be required to introduce MAPs as would be required with any innovation.
- There are no upfront costs, recurrent or ongoing costs for MAPs.

[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;

MAP development faces significant challenges that will require substantial time, effort and investment to be overcome[1]

Technology Readiness

VIPS Criteria	Indicators	Hep B BD	HPV	MR	Men A	IPV	Rabies	TCV	YF	Ebola	HIV[2]	Influenza[3]	M. Tb[4]	RSV[5]
Secondary criteria	Technology readiness[1]													
	Clinical development pathway complexity	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	High	Low	High	Moderate
	Technical development challenges	Moderate/ High	High	Moderate	Moderate	Moderate	Moderate /High	Moderate	Moderate /High	Moderate /High	Moderate	Moderate /High	High	Moderate
	Complexity of manufacturing the innovation	High												
	Robustness: multiple developers of the technology	Moderate	Not robust	Moderate	No data	Moderate	Not robust	No data	No data	No data	No data	No data	No data	No data
	Robustness: multiple suppliers/manufacturers of the vaccine	High	Moderate	Moderate	Moderate	Not robust	Moderate	Not robust	Moderate	Not robust	Not robust	Moderate	Not robust	Moderate

- MAPs have been evaluated in several clinical trials, but there are **significant challenges** facing the **technical development** and **manufacturing** of MAPs. Some issues are vaccine-specific, but some, particularly manufacturing issues, apply to the platform overall.
- Demonstrating that MAPs can be manufactured at a **pilot scale** (e.g. 1/5 commercial scale) for phase II/III trials is on the **critical path for first vaccine-MAP combination** approval. Establishing a pilot production line will require significant investments (**possibly tens of millions of dollars**).
- The **number** of existing MAP developer – vaccine manufacturer **partnerships is low** (not robust). Vaccine manufacturers have been hesitant to partner with MAPs developers.

[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-HIV + bivalent Subtype C gp120; [3] VAL-506440; [4] VPM1002; [5] pre-fusion F protein

MAPs are highly novel devices with ‘unique’ challenges; scaling up cGMP manufacturing is possibly the most critical issue

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. • **Removal of adjuvant** means the vaccine may be considered as “new” from a regulatory point of view. • **Usability studies** might be required, particularly if depth of delivery or wear-time of the MAP is critical.	• **Delivery of antigen:** MAPs will need to be worn for seconds-to-minutes to transfer antigen to the skin, which might be difficult in LMIC settings. Transfer into the skin will need to be reproducible and efficient. • **Quantity of vaccine required:** Only limited amounts of antigen can be loaded onto a MAP. This might be insufficient for some vaccines. • **Immunogenicity vs. reactogenicity:** MAPs initiate immune responses just below the skin surface, so local reactogenicity is expected. It might be necessary to remove adjuvants for this to be acceptable, which might reduce immunogenicity.	• **Developing a cGMP manufacturing process:** Aseptic manufacture will likely be required. The manufacturing processes (incl. assembly and packaging) will be novel and unique and need to be developed, tested at pilot scale and scaled up. • **Bulk antigen:** Only small volumes of vaccine can be loaded onto MAPs, therefore bulk antigen will be required at higher than usual concentration. • **Quality control:** Novel methods for in-process controls and process validation will be required, and possibly novel assays for product release. • **Manufacturing time per unit:** The process will need to operate at commercial scale and be competitive with the process for other delivery methods, e.g. vials and N&S.	• **‘Best’ vaccines** from a development/manufacturing perspective may be **MR, MenA, TCV or IPV** due to no adjuvant, amount of antigen needed, and low valency. • **Hep B birth dose** is formulated with adjuvant which might need to be removed. MAPs would be used in neonatal skin, which is physiologically different in some respects to infants and adults. • **HPV** is adjuvanted & relatively complex, 2-, 4- or 9-valent. • **Lyophilised vaccines** might be suitable, but new formulations often with reduced amounts of excipients will be needed.

The commercial opportunity for MAPs in LMICs is uncertain and developers and manufacturers will need an upside to create partnerships

Commercial feasibility

VIPS Criteria	Indicators	Hep B BD	HPV	MR	Men A	IPV	Rabies	TCV	YF	Ebola	HIV[2]	Influenza[1]	M. Tb[3]	RSV[4]
Secondary criteria: Commercial feasibility	Country stakeholders' interest based on evidence from existing data	No data		Mixed interest	No data									
	Potential breadth of the target market	Large	Large	Large	Moderate	Moderate	Small/ Moderate	Small/ Moderate	Moderate	Small	Large	Small	Large	Large
	Existence of partnerships to support development and commercialisation	Mixed interest	Mixed interest	Mixed interest	No known interest	Moderate interest	Mixed 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	No data												

- Published data show **stakeholder interest** in MAPs for use with **MR** in Benin, Nepal and Vietnam.
- **Market potential and uptake for MAPs in LMICs** is **uncertain** and will likely need to be driven by a **dual-market in HICs**:
  - Financial attractiveness of MAPs to vaccine manufacturers is likely to be determined by the **value proposition in HICs.**
  - **Higher cost of goods** for MAPs (vs. N&S), at least initially, may drive the selection of the first use case for MAPs in LMICs (e.g. targeted to hard to reach populations vs. broader campaign or routine use, to justify a price-premium).
  - There is potential to leverage **MAPs as a manufacturing platform** to develop a portfolio of vaccines across HICs and LMICs.
- **Partnerships to support development and commercialisation will be required:**
  - To provide **investment in manufacturing scale up**; this could include donors/funders.
  - **Agreement between vaccine manufacturers and MAP developers** will be needed regarding responsibility for release of the final combination product, royalty sharing and liability during clinical testing.

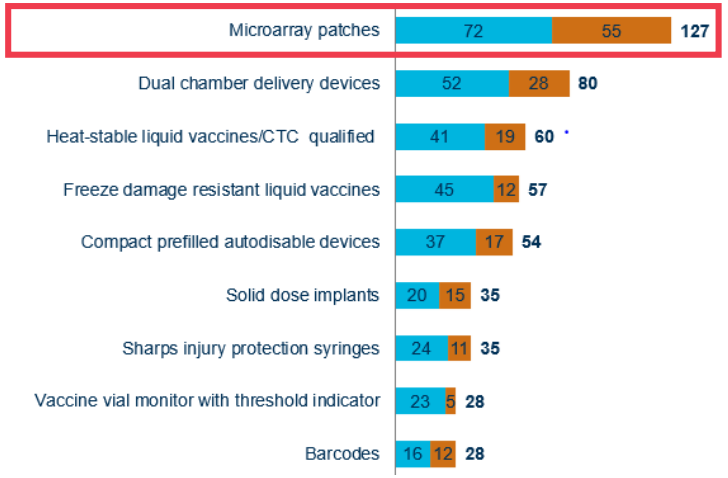
[1] VAL 506440; [2] ALVAC prime; [3] VPM 1002; [4] Pre-fusion F protein

Based on VIPS country feedback[1], there is strong interest in MAPs

Countries interest

Feedback from in-person country interviews

Innovations' ranking



- MAPs are rated by both immunisation staff and decision makers as the **#1 innovation amongst the 9 tested**, i.e. with the greatest potential impact in helping address their immunisation programme's current challenges.

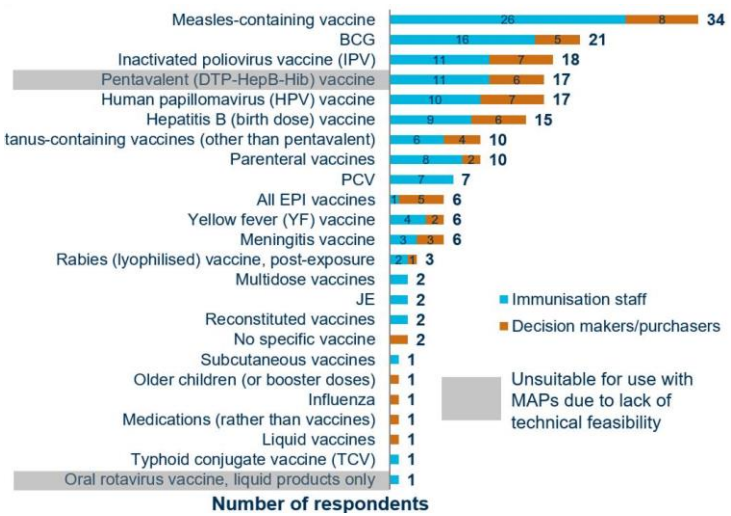
Perceived benefits

- Make **preparation** and **administration** of vaccines **easier and faster, save health care workers time;**
- **Increase acceptability;**
- **Improve safety**, i.e. reducing needle-stick injuries, contamination or use of wrong diluents;
- Improve coverage & **decrease vaccine wastage;**
- Make delivery **outside health facility easier & enable lesser trained personnel to deliver** vaccines.

Perceived challenges

- **Need for community sensitisation** to manage acceptability among patients/caregivers;
- **Cold chain volume**;
- HCWs : **time required** to use MAPs**; complexity** of the technology; **possibility of skin reaction** or different absorption by skin type; **no indication that the vaccine has been delivered;**
- Decision makers: **overall cost** and **training needs.**

Vaccines' ranking for MAPs



[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 MAPs development for LMICs	Risks of not prioritising MAPs through VIPS
If MAPs were prioritised by VIPS, **stakeholder inputs would be sought** to identify follow-up activities that would have the **greatest impact on accelerating MAP development**. These could include: • **The creation of partnerships** between developers, manufacturers and donors/funders to facilitate access to vaccines. • **Push funding (possibly),** e.g. to support pilot-scale manufacturing. • Developing an **innovative pull-funding mechanism** (possibly). • **Country and cost analyses** to provide clarity on use-case scenarios in LMICs.	• There **might not be any immediate downside** of VIPS not prioritising MAPs, beyond a perception that the Alliance does not value MAPs. MAPs **developers might continue as planned**, but they might **not favour products for LMICs**, which **might not be developed or take longer to develop**. • Vaccine **manufacturers might de-prioritise working with MAP developers**, reducing developers' access to vaccines and delaying programmes.

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