17th TechNet Conference

Panama City, Panama | October 16-19, 2023

Immunization Programmes That Leave No One Behind

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How we deliver vaccines into arms - Syringes, devices, packaging considerations

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October 18, 2023

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Immunization Programmes That Leave No One Behind

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Transitioning from 10-dose to 5-dose Vials for Measles Vaccination in Routine Immunization

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Heather Ferguson, Linksbridge SPC.

October 17, 2023

5-dose Vials: A Human-Centered Solution to Missed Opportunities for Vaccination

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Problem and Opportunity

Problem: Healthcare workers (HCWs) can be hesitant to open measles (M) and measles-rubella (MR) 10-dose vaccine vials due to fear of wastage or stockouts. This hesitancy results in missed opportunities to vaccinate

Opportunity: The M/MR vaccine is identical in 5-dose and 10-dose vials—with the same formulation, same reconstitution, same storage and handling, same delivery, same waste management, and same WHO PQ status

Coverage

Research conducted in Zambia found that a 5-dose vial intervention increased MCV1 by 4.9 percentage points and MCV2 coverage by 3.5 percentage points

Increased Coverage

Decreased Wastage

Wastage

In the same Zambia study, wastage was 47% lower in facilities using 5-dose vials vs. 10-dose

Significant wastage reduction was also seen in Bangladesh, Bhutan, Comoros, DRC, Niger, and Eritrea

Supply Chain

An analysis of cold chain equipment in intervention health facilities showed that there was sufficient space to accommodate the small increase; Most countries that switched did not need to invest in cold chain expansion

Supply Chain-Ready

Cost Effective

HCW-Friendly

Cost-Effective

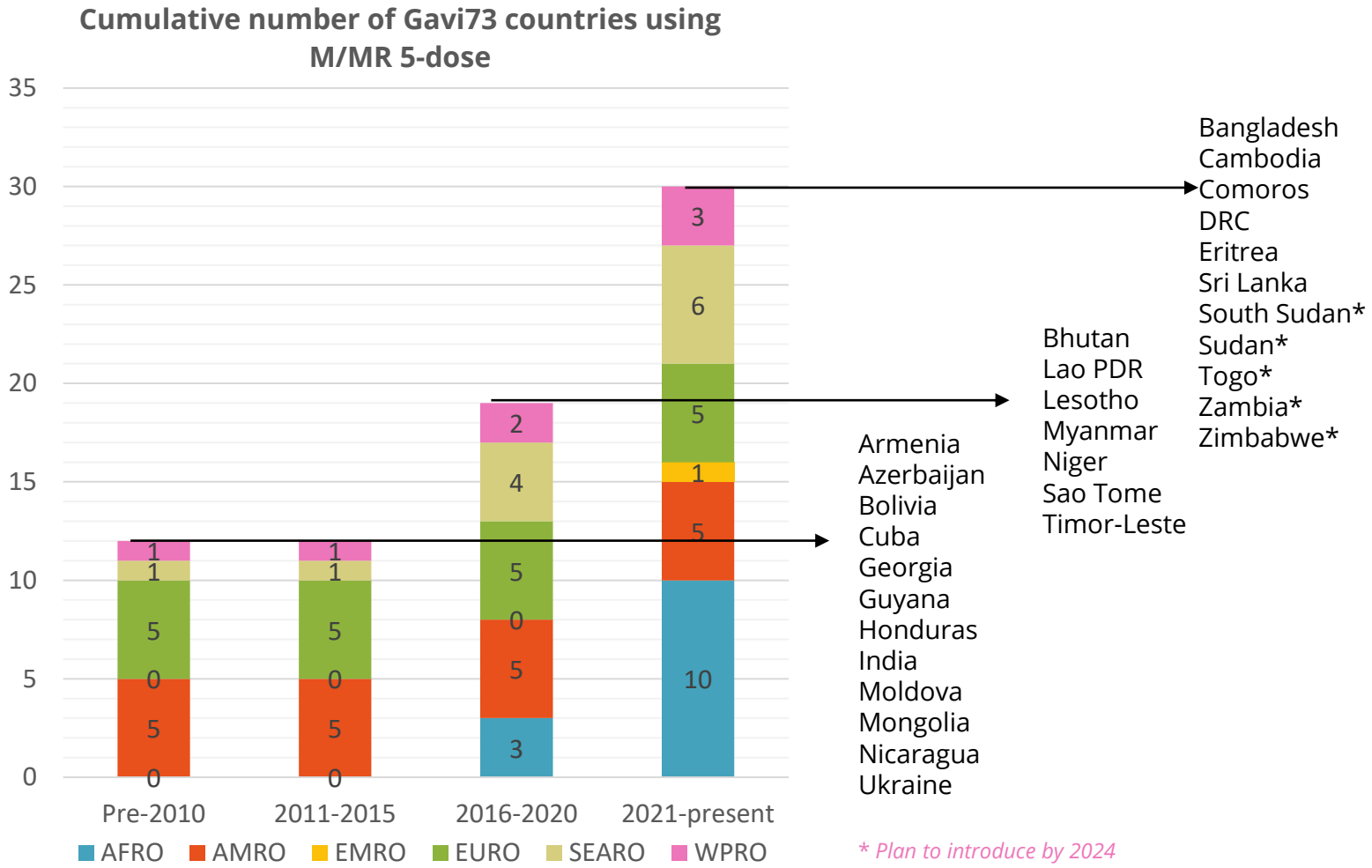
Wastage-adjusted vaccine price per MR dose was only $0.03 higher for 5-dose vials than for the 10-dose

HCW-Friendly

HCWs reported less hesitancy to open 5-dose vials and were more likely to vaccinate children for measles outside of scheduled vaccination days

Growing Global Momentum

Global demand for 5-dose vials has accelerated since 2020, especially in Africa



Bangladesh
Cambodia
Comoros
DRC
Eritrea
Sri Lanka
South Sudan*
Sudan*
Togo*
Zambia*
Zimbabwe*

Bhutan
Lao PDR
Lesotho
Myanmar
Niger
Sao Tome
Timor-Leste

Armenia
Azerbaijan
Bolivia
Cuba
Georgia
Guyana
Honduras
India
Moldova
Mongolia
Nicaragua
Ukraine

** Plan to introduce by 2024*

- Five-dose measles vaccine has been prequalified since 1993 and 5-dose MR vaccine since 2000. Despite this, **only ~18 Gavi countries used MCV 5-dose (or fewer dose) vials by 2020**. India introduced 5-dose in 1994
- In 2020, Africa's Regional Immunization Technical Advisory Group recommended the use of MCV 5-dose vials as part of a broad recovery strategy to raise coverage, reduce wastage, and avoid HCW reluctance to open 10-dose vials
- The SEAR ITAG followed suit and recommended switching to 5-dose vials for RI in 2022
- We are now seeing significant uptick in demand for 5-dose vials. **As of October 2023, there are 33 Gavi countries actively using/ordering M/MR/MMR 5-dose (or fewer dose) vials**

Evidence to Support the Switch from 5-dose Implementing Countries in Africa

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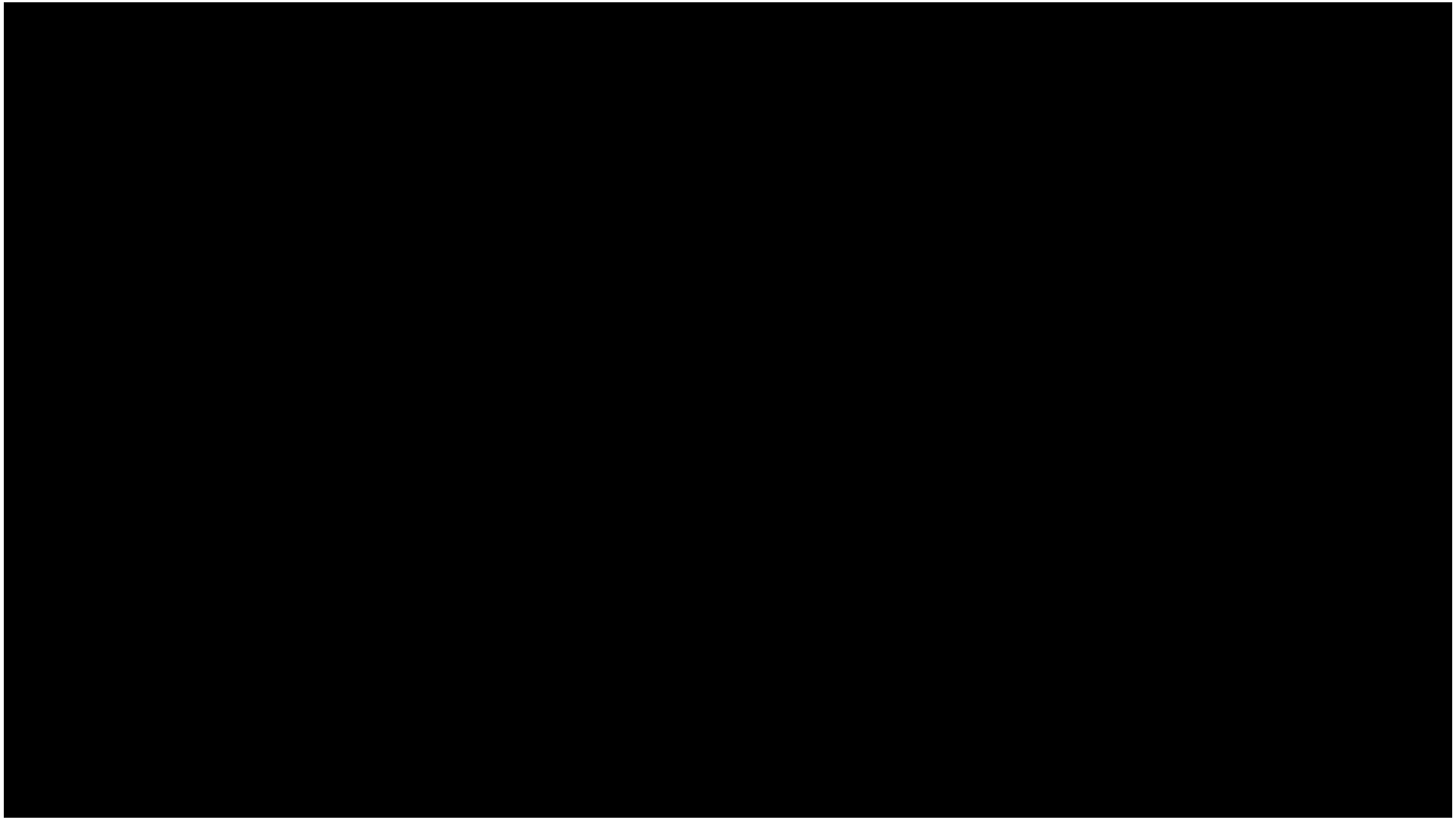
MCV 5-dose and EPI Manager Interviews



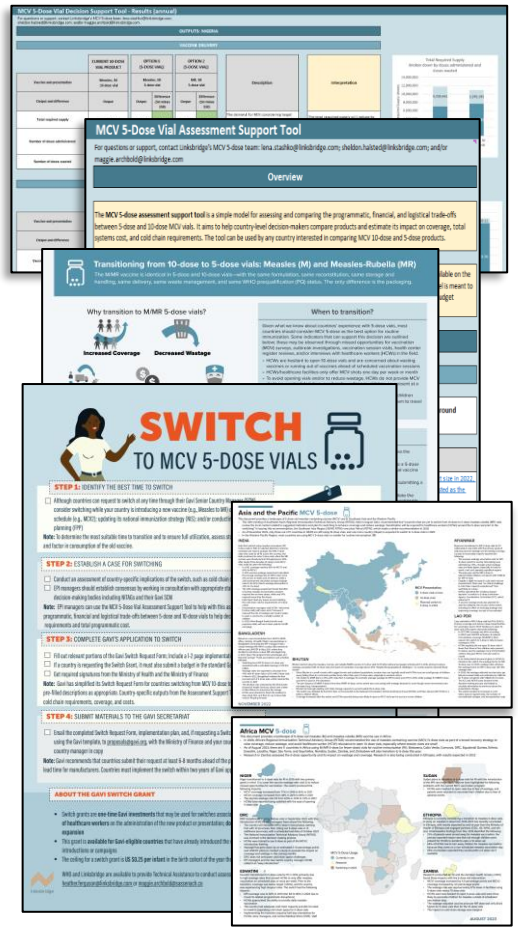
Resources to Learn More and Make the Switch

MCV 5-dose Resources

To access the resources below, join the **MCV 5-dose Implementation Group on TechNet**, or view the files at this public Dropbox link. Many materials are available in French and Portuguese

Resource	Description
UNICEF-WHO Fact Sheet	• Provides an overview of MCV 5-dose, including comparison of vaccine options provided via UNICEF and guidance on how to implement the switch • It was **updated in 2022** to reflect the latest data
Gavi Guidance	• Gavi countries are eligible for a switch grant when switching from MCV 10-dose to 5-dose vials • Gavi switch guidance was **updated in 2023** and the process to switch to MCV 5-dose has been streamlines
Decision-Making Country Assessment Tool	• **Excel-based country-level assessment tool** that enables users to assess 5-dose switch impact on cold chain, coverage, wastage, costs, etc.
Research and Documentation of Country Experience	• Overview of lessons learned, impact, barriers, successes, etc. from countries currently using 5-dose vials • **Landscape** available for **Africa and Asia Pacific**, as well as deep dive on India's 5-dose experience • A study conducted in **Zambia (2019)** found 5-dose vials increased MCV1 coverage by 4.9 percentage points and MCV2 by 3.5 percentage points • A study conducted in **Ethiopia** is to be published in 2023, and a study on 5-dose in **Lao PDR** is ongoing
More…	• **MCV 5-dose One-Pager**: High-level, easy-to-digest overview of 5-dose opportunity i.e., why consider transition, when to consider transition, and how to consider transition • **How To Switch Guide**: A step-by-step guide detailing the switch process from country-level assessments and alignment, to Gavi approval • **M&E Tools**: Tools and example guidance for countries to track the impact of switching on at service delivery points

MCV 5-dose Library Dropbox



Thank You!

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Challenges and considerations for autodisable syringe supply chains

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AD syringe quick facts

Autodisable (AD) syringe:

- Automatically disables after a single use to prevent disease transmission.
- Fixed dose (single-dose marker printed on syringe barrel with no graduation lines) to reduce risk of dosing errors.
- Fixed needle.

Example: BD SoloShot™ Mini
Source: WHO PQS Devices Catalogue

- **Widely adopted:** More than 100 countries use AD syringes for immunization due to their unique safety features.
- **Proven effectiveness:** Study found AD syringes and safe injection initiatives resulted in an 86% reduction in rate of unsafe injections between 2000 and 2010.[a]
- **Policy implications:** AD syringes are the only type of syringe supplied by UNICEF for immunizations.

The COVID-19 pandemic introduced challenges to AD syringe supply chains that threatened safe injection practices

The pandemic put immense pressure on syringe manufacturers to increase supply

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Supply

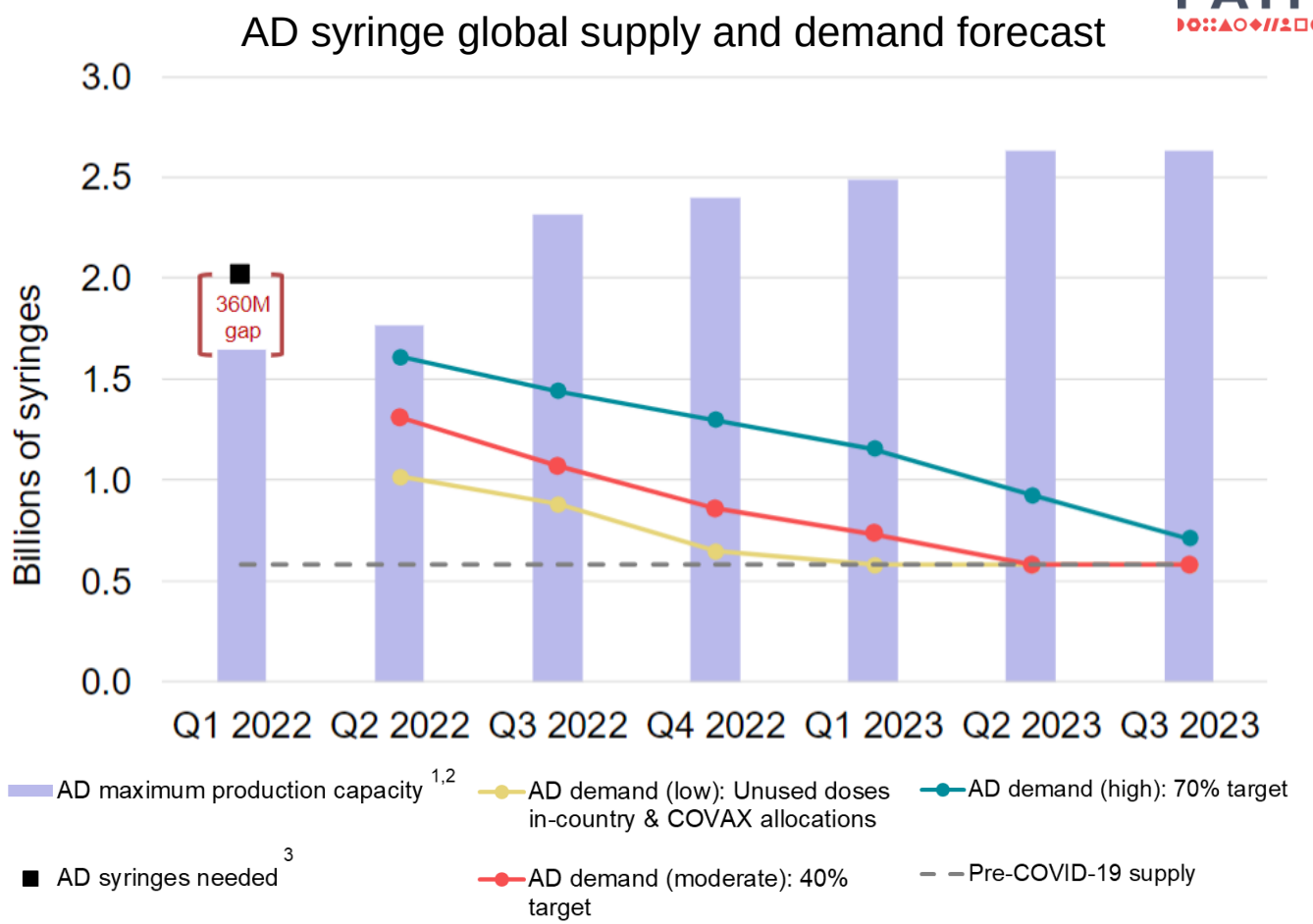
Supply constraints

Pre-COVID-19:

- Supply was adequate to meet demand.

During COVID-19:

- The pandemic created large strains on production capacity.
- Even with manufacturers tripling their capacity to meet increased demand, PATH estimates supply was 360 million units short in early 2022.[b]



[1] Maximum production capacity is based on capacity reported by manufacturers. Manufacturers may not be able to produce at maximum capacity if orders are not received with sufficient lead times. [2] Production capacity is shifted ahead 1 quarter to reflect typical lead times for sea transport. [3] Estimated AD syringes needed based on non-COVID-19 syringe demand and reported COVID-19 vaccinations in countries that use AD syringes, assuming 10% syringe wastage rate and 60% AD use in countries that use AD syringes non-exclusively.

Source: PATH analysis, June 2022

Nonstandard dose volumes were introduced for some COVID-19 vaccines

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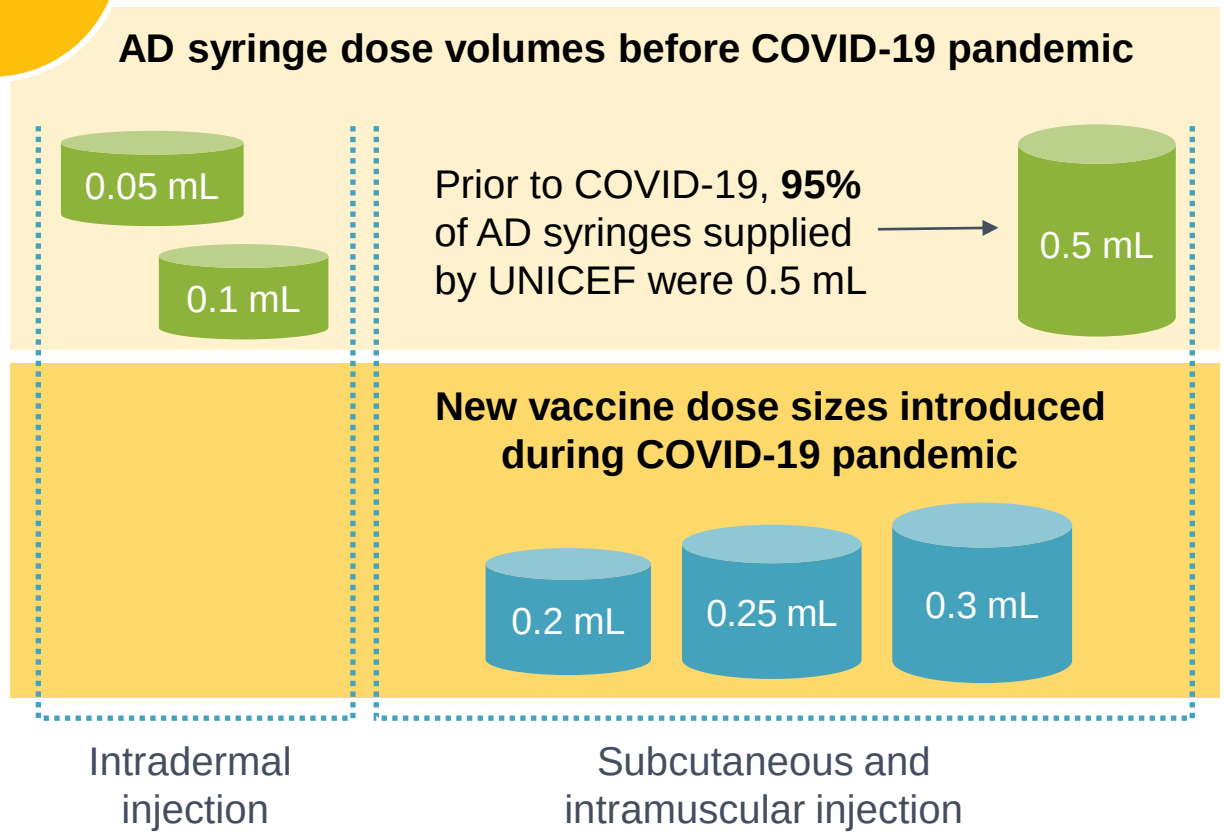
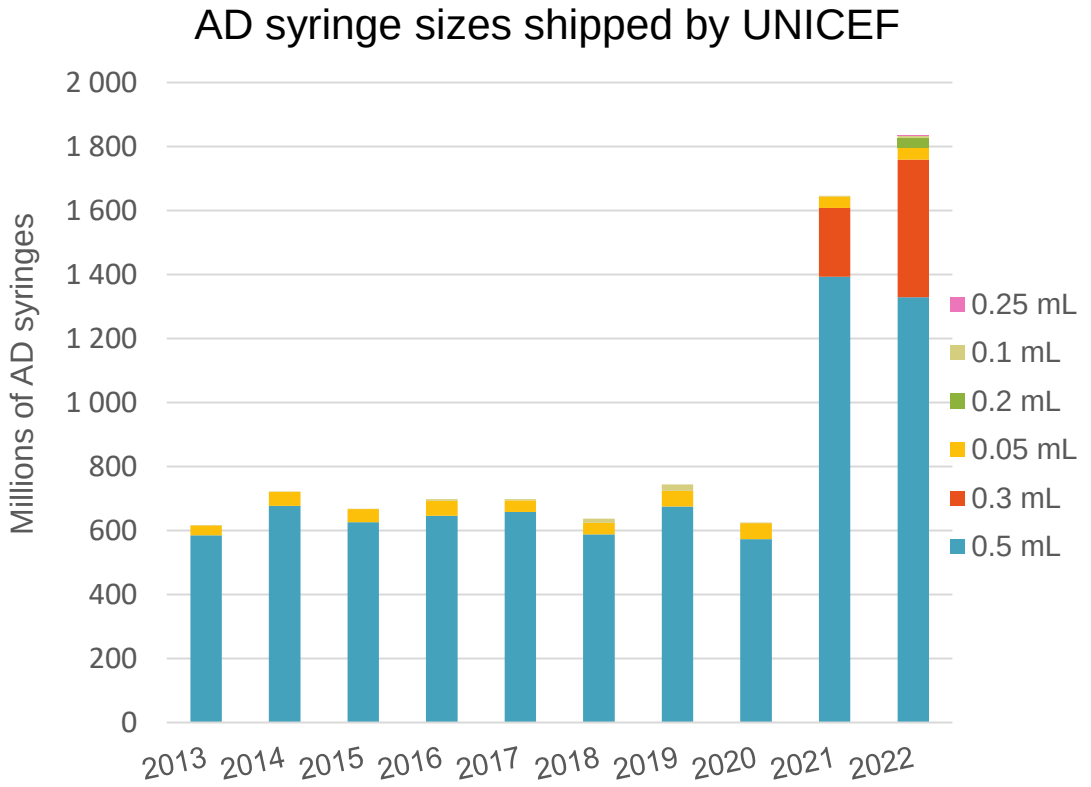
Dose volumes





Source: PATH analysis of UNICEF procurement data, Sep 2023

Geographic imbalance of supply against demand required longer lead times for devices

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Lead times

Longer lead times

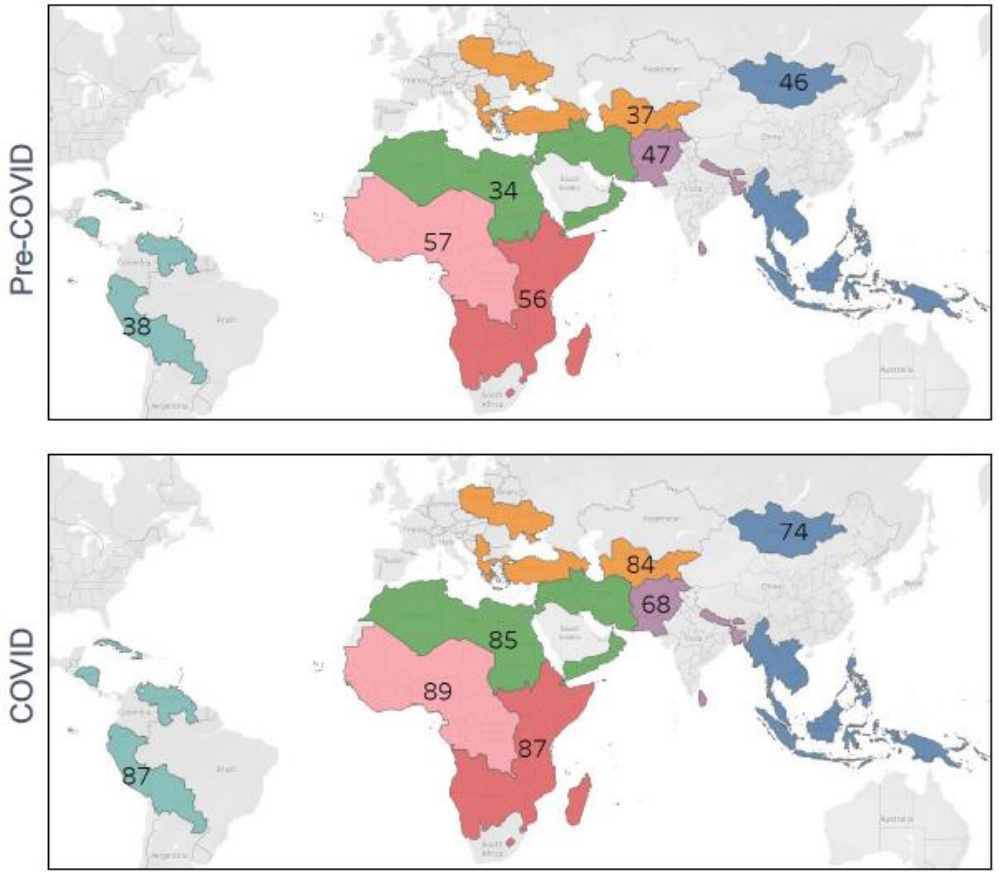
Pre-COVID-19:

- Geographic diversity of the WHO pre-qualified supplier base existed, but was not aligned with the demand profile, so shipping times were long.
- More than 50% of demand was in sub-Saharan Africa, while almost 90% of the production capacity was in Asia.
- Syringes were shipped by sea 2–3 months ahead of vaccines, which ship by air.
- Lead times were relatively predictable.

During COVID-19:

- Average shipping and booking times for syringes by region increased between 50 and 150% during COVID, when rapid response was a high priority.
- Lead times for both sea and air became more variable.

Average sea shipping and booking times (days)



Source: PATH analysis of UNICEF procurement data, Jan 2023

Air shipments were often required to provide syringes on time at high cost

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Freight costs

Higher freight costs

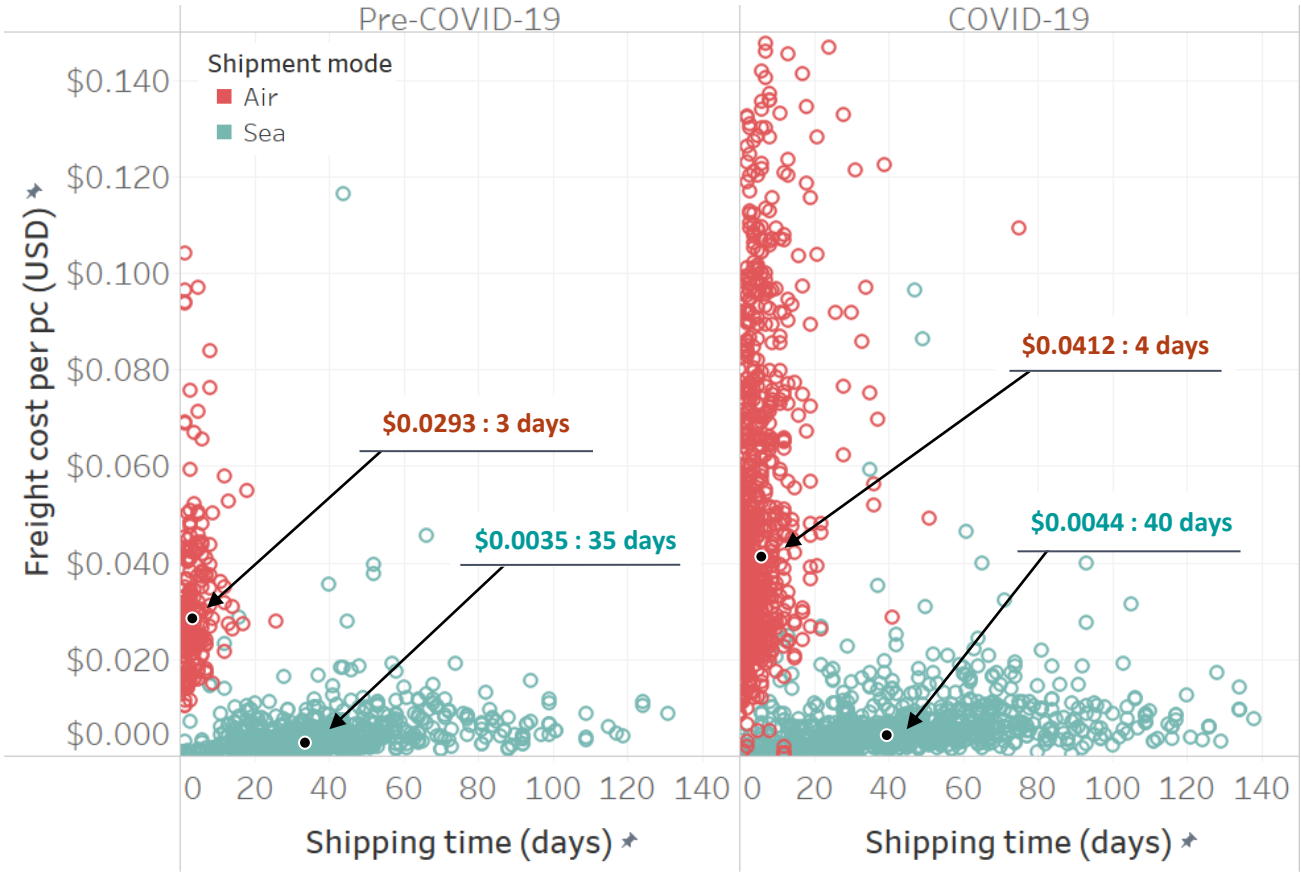
Pre-COVID-19:

- Over 95% of AD syringes shipped by UNICEF between 2013-2019 were shipped by sea.
- Sea shipments cost approximately 10 times less per syringe than air shipments.

During COVID-19:

- Variations in vaccine dose volumes, rapidly changing allocations, and global logistics challenges required expensive air freight for about 50% of UNICEF's syringe shipments from 2021 through 2022.

UNICEF AD syringe shipping lead times



Legend
Median freight cost per piece : Median shipping time

Source: PATH analysis of UNICEF procurement data, Feb 2023

Product prices increased dramatically as a combined result of market challenges

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Product costs

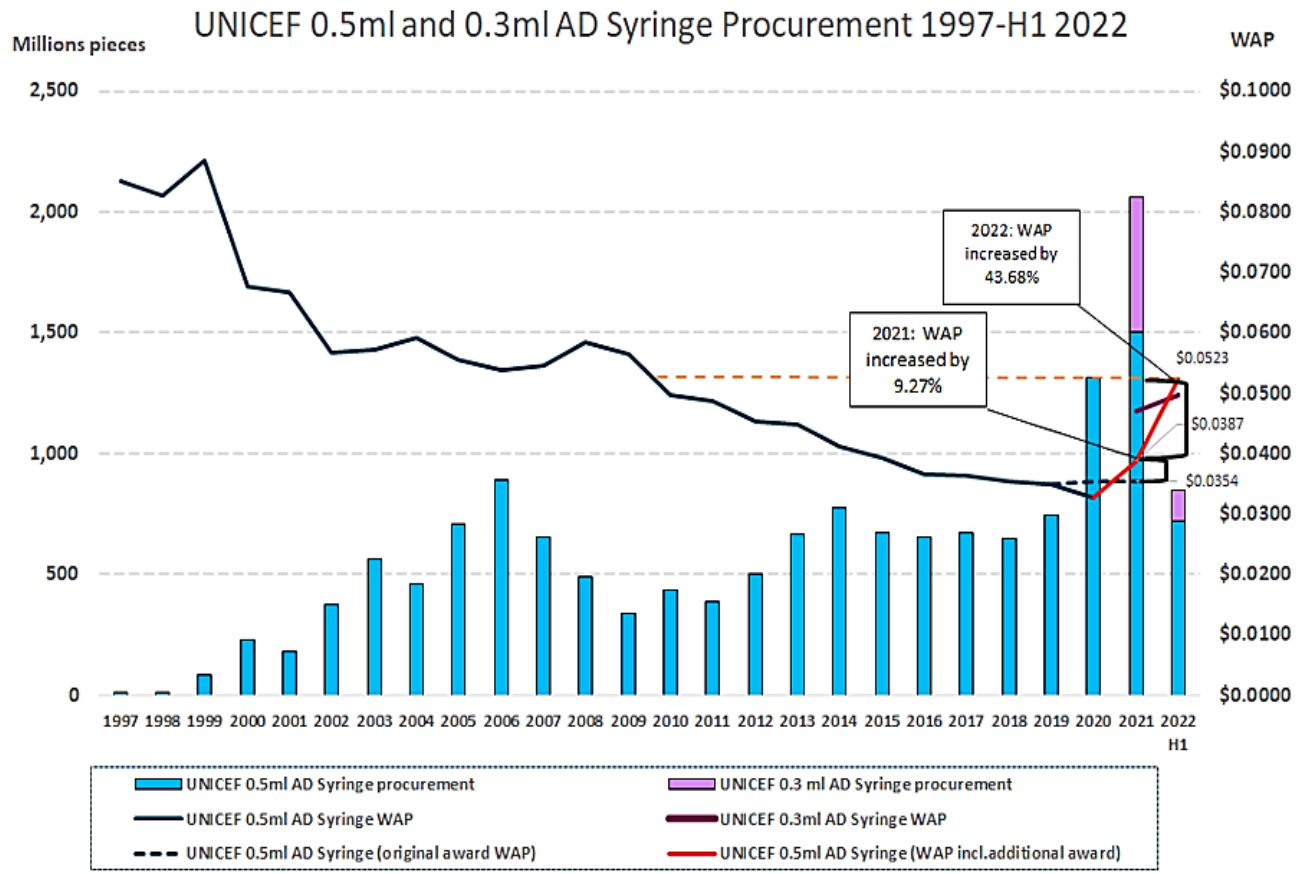
Increased product costs

Pre-COVID-19:

- UNICEF's weighted average purchase price consistently trended downward between 1999 and 2019, reducing by over 50%.
- The number of vendors supplying AD syringes to UNICEF ranged between four and six each year from 2013 through 2020.

During COVID-19:

- UNICEF's weighted average purchase price increased by 48% from 2019 through 2022, partially due to emergency contracts with new suppliers.
- The number of vendors supplying AD syringes to UNICEF jumped to 12 in 2022 due to large surges in demand.



Source: UNICEF

Opportunity to maintain AD syringe market gains made in the face of COVID-19

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Addressing challenges

- UNICEF stockpiled 520 million 0.5-mL AD syringes in 2020.[c]
- 0.5-mL syringes were pre-positioned by UNICEF in countries ahead of vaccine allocations based on population size.
- PATH forecasted global AD syringe supply and demand and shared this market intelligence with manufacturers regularly.
- WHO released guidelines on the safest alternatives to AD syringes in the case of a shortage.[d]
- Gates Foundation invested in a Kenyan AD syringe manufacturer to diversify the supply base.[e]

Looking forward

- A coordinated group of global organizations, established during the pandemic, will continue to closely monitor the AD syringe market for any risks to accessibility.

Key takeaways:

- For vaccine developers: Importance of standardizing dose volumes.
- For immunization planning: Consideration of longer syringe shipping times when planning vaccine delivery.

New areas of focus:

- Building a more responsive and resilient syringe market in the case of future demand surges or supply disruptions.
- Improving environmental impacts of syringe production, transport, and disposal.

Thank You!

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References

a. Hayashi T, Hutin YJ, Bulterys M, Altaf A, Allegranzi B. Injection practices in 2011–2015: a review using data from the demographic and health surveys (DHS). *BMC Health Serv Res*. 2019;19(1):600. doi:10.1186/s12913-019-4366-9.

b. PATH. *Autodisable Syringe Gap Analysis*. Seattle: PATH; June 2022. https://www.path.org/resources/autodisable-syringe-gap-analysis/#:~:text=The%20current%20forecast%20indicates%20that,vaccination%20uptake%20than%20targeted%20timelines.

c. Ferguson, Sarah. *UNICEF Stockpiling 520M Syringes for Global COVID-19 Vaccination.* UNICEF; 2020. https://www.unicefusa.org/stories/unicef-stockpiling-520m-syringes-global-covid-19-vaccination.

d. World Health Organization (WHO). *Injection Safety in the Context of Coronavirus Disease (COVID-19) Vaccination: Addendum to Policy Brief*. WHO; April 5, 2022.

e. Rajaram, Surabhi. *Amid Surging Demand for Syringes, a New Investment Supports Long-term Supply on the African Continent*. Bill & Melinda Gates Foundation; November 3, 2021. https://www.gatesfoundation.org/ideas/articles/syringe-vaccine-distribution-in-africa.

Assessment of the programmatic suitability and user acceptability of packaging and delivery devices for the prevention of respiratory syncytial virus in infants

Manjari Quintanar-Solares, PATH, USA

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Background and objectives

RSV is the world's top cause of severe respiratory infections and hospitalizations in infants and young children, with most deaths occurring in LMICs.

Products to prevent RSV infection were recently approved or are in development, including long-acting mAb for newborns that are in a single-dose presentation with non-standard dose volume.

Objectives:

- To inform product development efforts of infant single-dose RSV mAb products.
- To assess the programmatic suitability and user acceptability of potential delivery devices and packaging for use of such mAb products in LMICs.

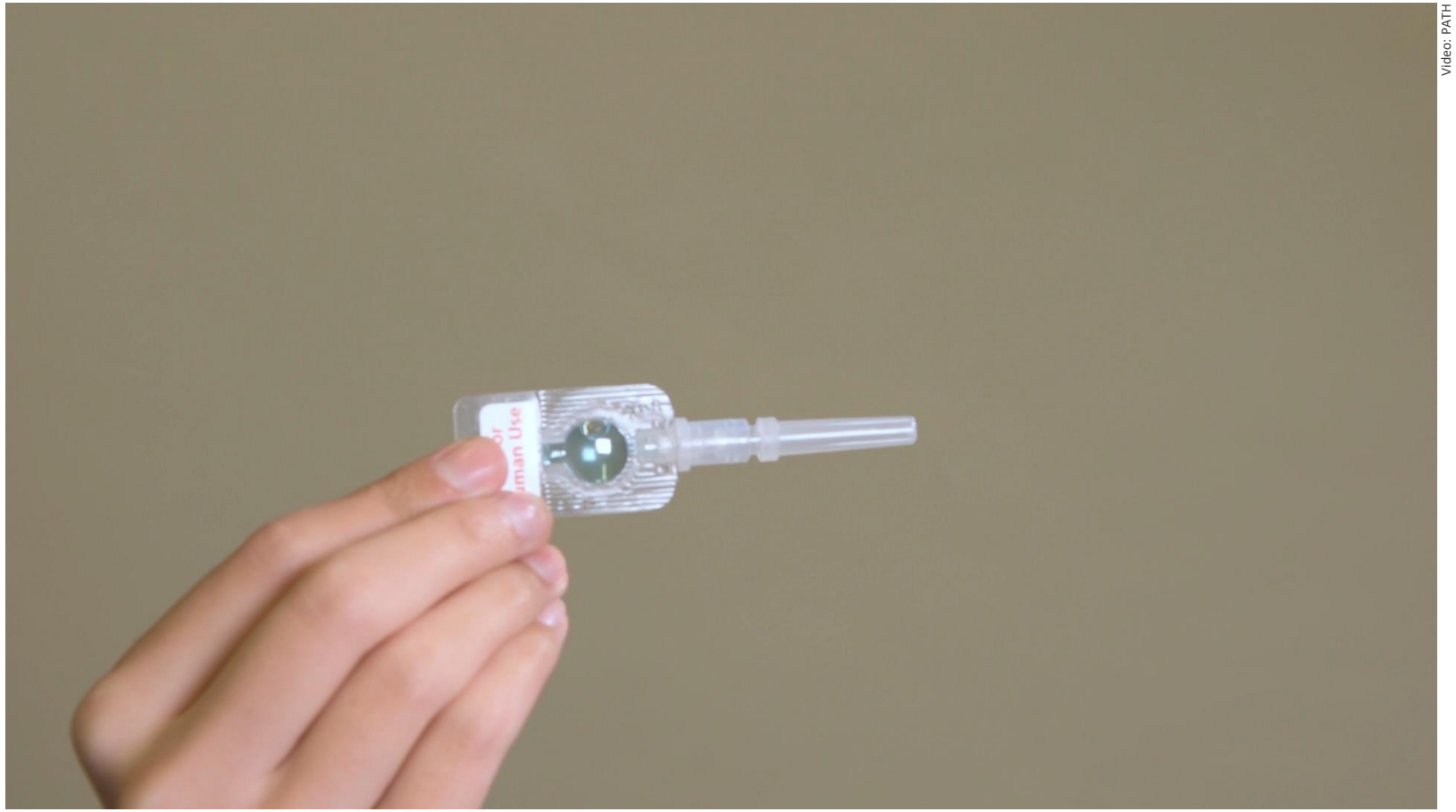
Abbreviations: LMIC, low- and middle-income countries; mAb, monoclonal antibodies; RSV, respiratory syncytial virus.

Overview of RSV mAb device options—**all single-dose**

	Primary container/device		Separate delivery device	
Prefilled	BD Uniject™ injection system		None, needle is integrated	
Prefilled	Injecto easyject™		None, needle is integrated	
Non-prefilled	Single-dose blow-fill-seal (BFS) ampoule		Custom autodisable (AD) syringe 	1-mL or 2-mL re-use prevention (RUP) syringe 
Non-prefilled	Single-dose BFS vial			
Non-prefilled	Single-dose glass vial			

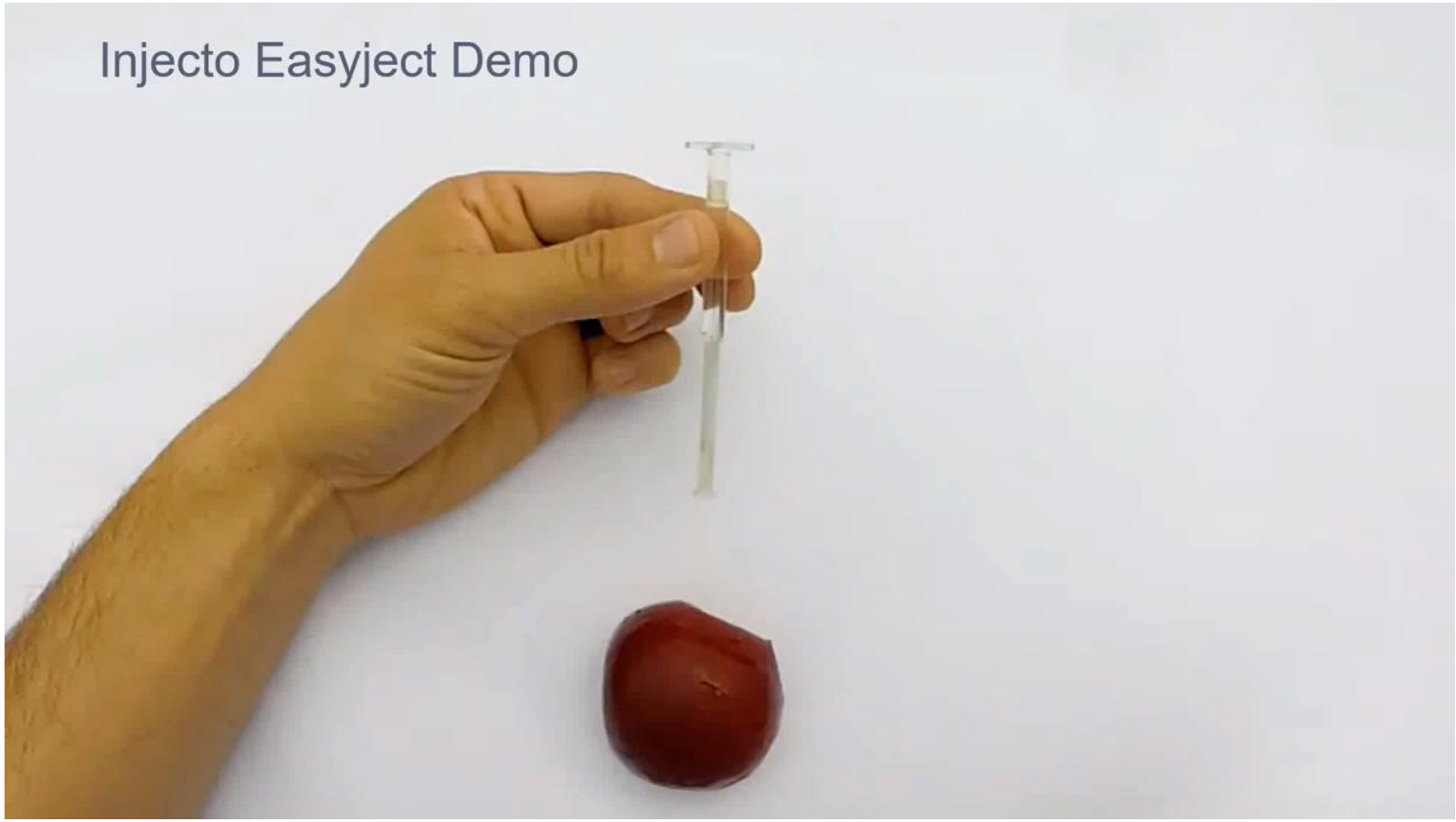
Uniject is a trademark of BD.

Video of Uniject use



Video: PATH

Video of easyject use



Video: PATH

Methods

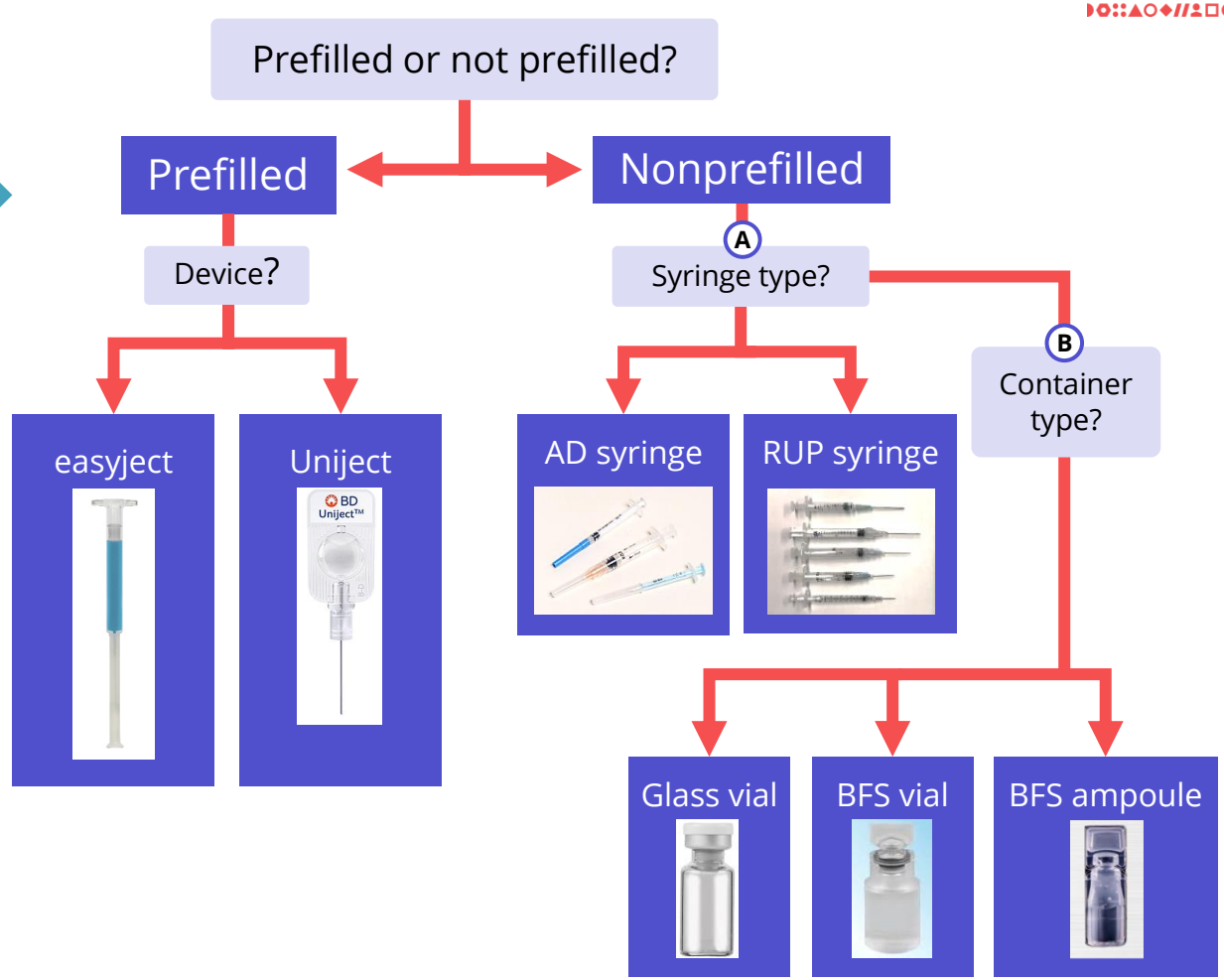
- Qualitative study with multimethods approach and purposive sampling
- Data collection in two phases (2021 and 2023)

Participant characteristics (n= 106)

Stakeholder interviews ***(n = 62)***	• Global stakeholders (GAVI, UNICEF, WHO, others) • Country decision-makers from Ethiopia, Kenya, Lebanon, Senegal, South Africa, Vietnam, Zambia
Focus groups ***(n = 39)***	• Country end users in Ethiopia and Kenya
Online survey ***(n = 5)***	• Global stakeholder • Country decision-makers from Ghana and India

Methods

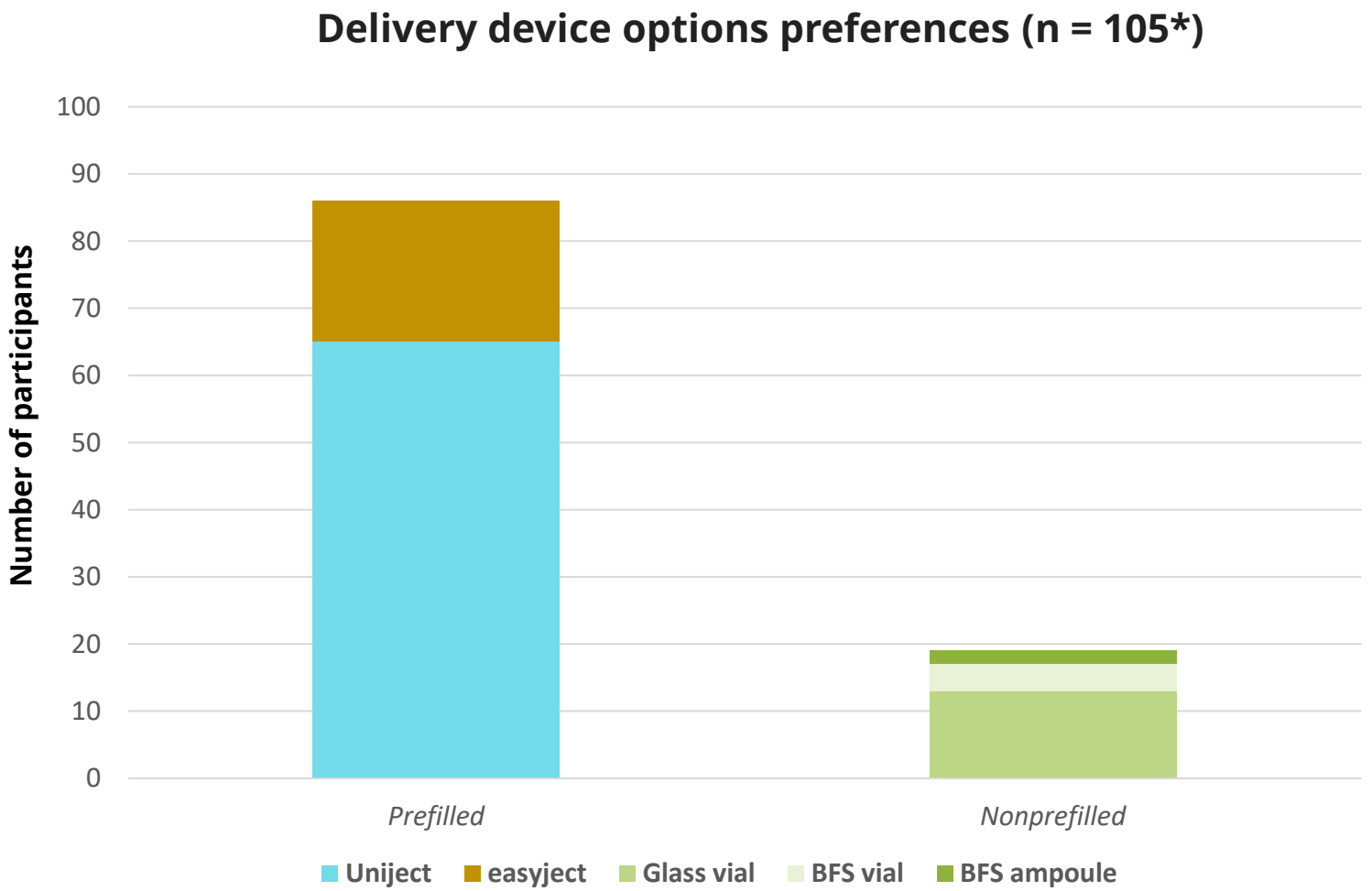
1. **Stakeholder interviews**
2. **Focus groups**
3. **Online survey**



Topics covered:

- Overview of all delivery options (only focus group participants were provided with real devices to handle)
- Delivery option preference
- Attribute ranking
- Advantages/disadvantages of delivery options
- Logistical implications and other impacts of delivery options

Results: Delivery device options preferences



Prefilled devices were preferred by 87% of stakeholders, and most health care providers were willing to use both prefilled options.

*One global stakeholder preferred prefilled options but felt he could not make a recommendation between the two prefilled options.

Results: Prefilled device considerations

easyject

Unject

POTENTIAL BENEFITS

Usability:
- Easy to administer, particularly during outreach activities.
- Ready to use; saves time since no preparation or drawing of dose needed.
- Can be used by midwives who are less experienced in vaccine delivery.
- Ease of use can lead to increased coverage.
- Ensures accuracy of dosage (fewer errors).

Supply chain/cold chain storage:
- Eases procurement (one item, no bundling challenges).
- Saves storage space (one vs. two items).
- Lighter to transport compared to glass vials.
- Does not require other supplies like syringes, which might be out of stock.

Injection safety:
- Reduces likelihood of contamination.
- Reduces likelihood of needlestick injury by avoiding drawing of dose and changing of needle.
- Prevents re-use.

Wastage/waste management:
- No wastage of dose, preloaded.
- Plastic material enables easy disposal by burning.
- Generates less waste than nonprefilled options (one vs. two items, no shattered glass, no locked AD syringes).

Acceptability:
- Can increase acceptability by caregivers and increase quality of service delivery.

CHALLENGES

Implementation:
- Staff will need to be trained and supervised on the use of the new device.
- There may be some ergonomic challenges with both designs (repetitive fatigue, manipulation of separate parts).

Manufacturing:
- Risk of stockout if no secured manufacturing capacity of single supplier.
- Risk of user confusion if more than one manufacturer is available but with different dose volumes.

Cost:
- Perception that prefilled devices would be more costly. However, for products with relatively high drug substance cost, some prefilled devices may reduce cost of goods sold due to lower amount of overfill required.

Results: Nonprefilled device considerations

DEVICE	CHALLENGES	POTENTIAL BENEFITS
 **Custom AD syringe**	• Complicated procurement/bundling of custom size (as during COVID-19 vaccination campaigns) • Risk of underdosing if using existing 0.5-mL AD syringe • Competing demands for syringe manufacturers • Stockouts if limited supply	• Familiarity • Dose accuracy (if custom) • AD feature aligns with current LMIC vaccine policies/procedures
 **RUP syringe**	• Policy misalignment • Procurement challenge for specific graduations • Administration errors	• Familiarity • Adjustable dose • Existing availability in some countries • Manufacturing flexibility
 **Glass vial**	• Complicated procurement/bundling with corresponding custom-sized syringe • Prone to breakage • Heavier for transportation • Difficult to dispose of in low-level facilities (cannot be burned) • Time-consuming to withdraw and administer dose (compared to prefilled options)	• Health care providers are already actively familiar with this container • Most other immunization products are in this container so consistency can prevent confusion • Glass is clear

Additional stakeholder recommendations

- To increase uptake during mAb introduction, building RSV awareness should start now, as many health care providers, country decision-makers, caregivers, and community health workers in LMICs are currently not aware of its burden.
- Vaccine vial monitors should be included in primary containers of mAb products to ensure safety and quality, prevent wastage and ease distribution.
- Individual packaging should be compact and flexible to occupy little space within refrigerators, while providing sufficient protection during transportation.
- Consistent manufacturing capacity of prefilled devices needs to be ensured to avoid stockouts.

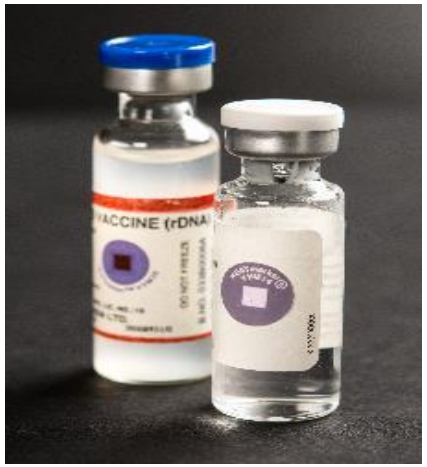


Photo: PATH/Patrick McKern

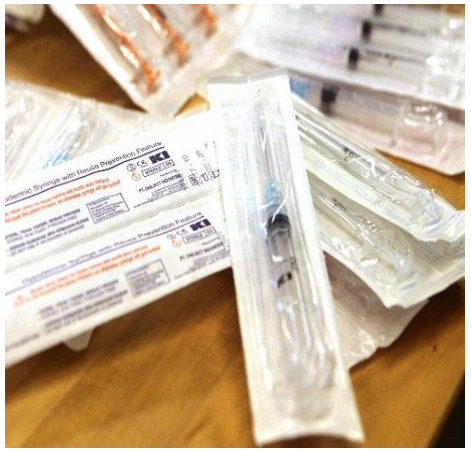


Photo: PATH/Tom Furtwangler

Conclusions

- Our results suggest that prefilled delivery devices are preferred for infant single-dose RSV mAb use in LMICs. They offer multiple advantages—in particular, ease of use and simplification of the supply chain.
- If a single-dose vial is used, attention must be paid to the need for a custom-sized AD syringe. Nonstandard dose volumes pose significant procurement and bundling challenges for LMIC immunization programs since the available AD syringes cannot be used.
- Developers should consider stakeholder input, manufacturing feasibility, global/national policy implications, cost of goods sold, and total cost of delivery when selecting a delivery system.

Abbreviations: AD, auto disable; LMIC, low- and middle-income country; mAb, monoclonal antibody; RSV, respiratory syncytial virus.

Thank You!

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Q & A

Thank You!

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