Measles and Measles-Rubella (MR) Vaccine Five-Dose Vial Presentation
Fact Sheet 2022 - 2023

This Fact Sheet provides an update on the availability of Measles vaccine and Measles-Rubella (MR) vaccine in both a 10-dose vial presentation and a 5-dose vial presentation for procurement through UNICEF. Research shows that the 5-dose vial presentation reduces open vial wastage and improves coverage as compared to the 10-dose presentation in country settings in which it has been evaluated. We expect these findings will be relevant to other settings in which healthcare worker (HCW) reluctance to open 10-dose vials for small immunization sessions represents a barrier to improving immunization coverage.

Key Summary Points

- Lowering the number of doses per vial can encourage HCWs to open vials more frequently, reducing wastage and improving coverage.
- In a study in Zambia (2018), HCWs were more willing to open a 5-dose vial and districts using the 5-dose vials saw an increase in coverage and reduced wastage.
- While switching to MR vaccine in a 5-dose vial would result in some increase in cold chain requirements and cost per vial, the impact of the switch on reduced wastage could offset space requirements and cost.
- Implementation of the use of 5-dose vials will need to consider country context, including settings in which switching to fewer doses per vial can be most impactful.

1. Background

EPI managers and health workers have expressed interest to access Measles/MR vaccine in a lower-dose vial presentation for use in routine immunization programmes. In many countries, one of the cited reasons for failure to vaccinate has been the reluctance of healthcare providers to open a 10-dose vial for immunization sessions with fewer than six to eight children in attendance. This is due to fear of high wastage rates, which are often used as an indicator to measure vaccinator performance, and fear of stock out for future sessions. For instance, in a 2011 CDC-led study of vaccine wastage-related knowledge and practices in Nigeria[1], healthcare providers stated they only opened Measles vaccine vials when six or more children were present and only on certain days of the week. While this practice is aimed at reducing wastage, it contributes to missed opportunities to vaccinate.

In contrast to the observed practices of waiting for more children or turning away children eligible for vaccination, World Health Organization policy[2] states that a vaccine vial should be opened anytime, irrespective of the number of doses in the vial, even if only one eligible child presents for vaccination. This

[1] Wallace AS, Willis F, Nwaze E, Dieng B, Sipilanyambe N, Daniels D, Abanida E, Gasasira A, Mahmud M, Ryman TK. Vaccine wastage in Nigeria: an assessment of wastage rates and related vaccinator knowledge, attitudes, and practices. Vaccine. 2017 Dec 4;35(48):6751-8. https://doi.org/10.1016/j.vaccine.2017.09.082

[2] World Health Organization. ((2015 Immunization in practice: a practical guide for health staff, 2015 update. World Health . .Organizationhttps://apps.who.int/iris/handle/10665/193412

policy exists to increase coverage, but health workers may often feel obliged to balance the immediate concern of vaccinating a single child with a potential stock out if available stock is consumed sooner than anticipated - e.g., when vaccine usage forecasts are based on lower wastage rates.

Measles and MR vaccines in a 5-dose vial presentation have been WHO-prequalified since 1993 and 2000, respectively. Lowering the number of doses in a vial is aimed at encouraging health workers to open vials more frequently, reducing wastage and improving coverage. In a study in Zambia in 2018, health workers were more willing to open a 5-dose vial, and districts using the 5-dose vial saw a 5 and 3.5-percentage point coverage increase for MCV1 and MCV2, respectively in addition to reduced wastage[3].

Countries procuring Measles/MR vaccine through UNICEF have had access to the 5-dose vial presentations since 2018. While demand has been growing, thus allowing a reduction in lead time, it has not yet reached sufficient levels to enable lead time equal to the one for the 10-dose vial[4].

Table 1: Characteristics of WHO-prequalified Measles/MR vaccines in 10-dose and 5-dose vials[5]

	Measles vaccine			Measles-Rubella (MR) vaccine			
Presentation	10-dose vial	10-dose vial	5-dose vial	10-dose vial	5-dose vial	10-dose vial	5-dose vial
Manufacturer(s)	PT Bio Farma (Persero)	Serum Institute of India Pvt. Ltd.		Serum Institute of India Pvt. Ltd.		Biological E. Limited	
Commercial name	Measles vaccine	Measles Vaccine, Live, Attenuated		Measles and Rubella Vaccine, Live, Attenuated		Measles and Rubella Vaccine (Live) (Attenuated, Freeze Dried)	
Shelf life at 2^0-8^0 C	36 months	30 months				24 months	
Serotypes covered	CAM 70	Edmonston-Zagreb		Edmonston-Zagreb Wistar RA 27/3		CAM-70 Wistar RA 27/3	
Preservative	None						
WHO-prequalified	Yes						
Schedule	2 doses						
Primary packaging	Vial + Ampoule						
Pharmaceutical form	Lyophilized active component to be reconstituted with excipient diluent before use						
Storage temperature	2^0-8^0 C						
Vaccine Vial Monitor	VVM14						
Handling of open multi—dose vials [6]	Open vials should be discarded at the end of the immunization session, or within six hours after opening, whichever comes first.						

[3] Krudwig, Kirstin et al. "The effects of switching from 10 to 5-dose vials of MR vaccine on vaccination coverage and wastage: A mixed-method study in Zambia." Vaccine vol. 38,37 (2020): 5905-5913. doi:10.1016/j.vaccine.2020.07.012

[4] The standard lead time for Measles/MR vaccine in a 10-dose vial presentation procured through UNICEF Supply Division is 6-8 weeks for forecasted quantities for routine immunization. It is 12-16 weeks for the 5-dose vial presentation, depending on required volume.

[5] WHO-prequalified YF vaccines in 10-dose and 5-dose vials available for procurement through UNICEF

[6] World Health Organization, *WHO Policy Statement: Multi-dose Vial Policy (MDVP) Revision 2014*, WHO, Geneva, 2014

2. Main differences between the two presentations

Cold chain requirements. Replacing the 10-dose vial with the 5-dose one will result in an increase in cold chain space requirements. The table below presents the per-dose volume for each product.

Table 2: Cold chain requirements for of M/MR vaccine by vial size

Vaccine/Presentation	Vaccine (cm^3/dose)	Diluent (cm^3/dose)
Measles 10-dose vial	2.11 – 3.30	2.53 – 3.14
Measles 5-dose vial*	3.16	5.48
MR 10-dose vial	1.78 – 2.11	2.12 – 3.14
MR 5-dose vial[7]	2.67 – 3.16	3.25 – 5.48

* *Cold chain requirements for Serum Institute of India Pvt. Ltd. only*

Without adjusting for a reduced wastage rate, and all other things held equal, switching to MR vaccine in a 5-dose vial would result in an average increase in cold chain requirements per fully immunized child of between 4% and 11%, depending on vaccine source.

However, data from the Zambia study showed that the wastage-adjusted difference between 5- and 10-dose vials in net cold chain per immunized child was marginal. Despite the higher cold chain volume per dose for 5-dose vials, the effects of lower wastage on reducing the total supply required, helps to offset cold chain requirements such that the 5-dose vials had a minimal impact on the cold chain requirements in practice. All health facilities were able to accommodate 5-dose within existing cold chain capacity.

Wastage rate. The estimated average wastage rate in routine immunization activities when using the 10-dose vial is 40 per cent, compared to 30 per cent for the 5-dose vial. However, national wastage rate estimates for both presentations need to consider size of the target population and vaccination session per service point, frequency of sessions, etc. Wastage rates will vary for urban and rural settings and between service points. For reference, the Zambia study found that baseline MR 10-dose vial wastage was 30.5% and wastage dropped to 16.2% with the MR 5-dose intervention[8].

Table 3: Estimated wastage rates for of M/MR vaccine by vial size

Estimated wastage rate (%)		
Vaccine/Presentation	**Routine Immunization**	**Supplementary Immunization Activities**
Measles 10-dose vial	40	10
Measles 5-dose vial	30 (TBC)	10 (TBC)
MR 10-dose vial	40	10
MR 5-dose vial	30 (TBC)	10 (TBC)

[7] This reflects Serum Institute of India's improved 5-dose vial size, which is approximately 30% smaller than its previous one.
[8] There is also an ongoing study being conducted in Ethiopia to assess the 5-dose opportunity, in collaboration with Ethiopian Ministry of Health, CDC, WHO and JSI. Results are expected in 2022.

Price per dose[9]. In 2022, Measles vaccine is available through UNICEF at a price of US$ 0.385 per dose in a 10-dose vial and US$ 0.476 per dose in a 5-dose vial. For MR vaccine, prices are US$ 0.793 per dose in a 10-dose vial and US$ 0.992 per dose in a 5-dose vial. The total cost implications of each presentation depend on the reduction in wastage rate that can be achieved in country-specific context. The table below provides the maximum price for each presentation without considering the wastage rate.

Table 4: Price per dose of M/MR vaccine by vial size (as of 2022/2023)

Vaccine/Presentation	2022 price/dose	2023 price/dose
Measles 10-dose vial	US$ 0.385	US$ 0.423
Measles 5-dose vial	US$ 0.476	US$ 0.522
MR 10-dose vial	US$ 0.793	US$ 0.873
MR 5-dose vial	US$ 0.992	US$ 1.090

At the 2022 prices of MR vaccine listed above, the price per administered dose from a 5-dose vial will become equal to the price per administered dose from a 10-dose vial if the switch to a 5-dose vial reduces the wastage rate to 25 per cent, and lower if the wastage rate is reduced further.

The Zambia study, which took wastage rate reduction into account, found that the per-dose cost differential between the vial sizes was negligible[10].

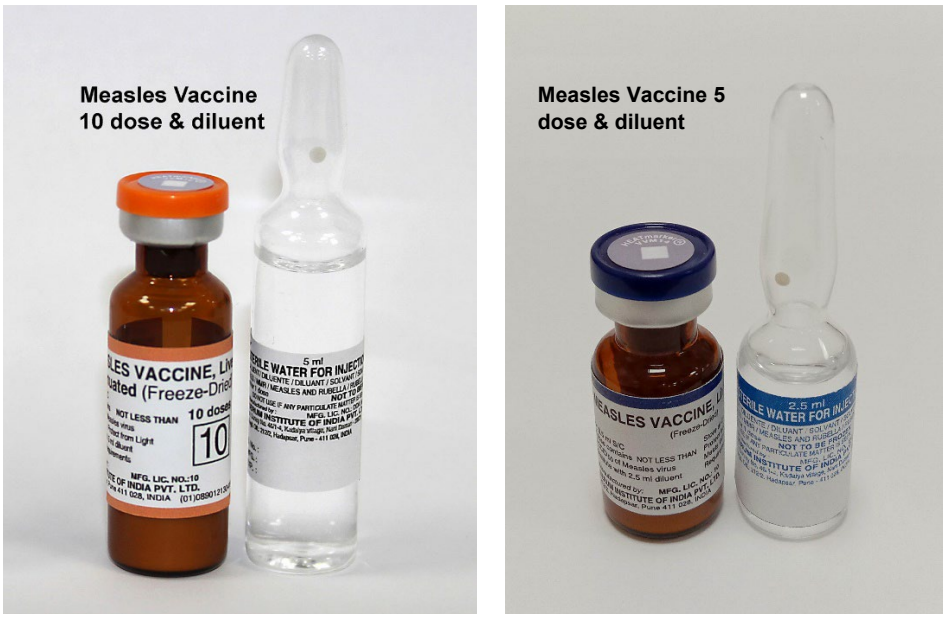
3. Visual differentiation between the 5-dose and 10-dose vials

Vaccine manufacturers have developed different visual appearances for the 5-dose and 10-dose vials to ensure that the two are easily distinguished. The current artwork (Figures 1-3) for each product is presented below and can also be found on WHO's list of prequalified vaccines.

[9] Valid for delivery to country before December 31 of the respective year. More details on prices are available at https://www.unicef.org/supply/vaccines-pricing-data.

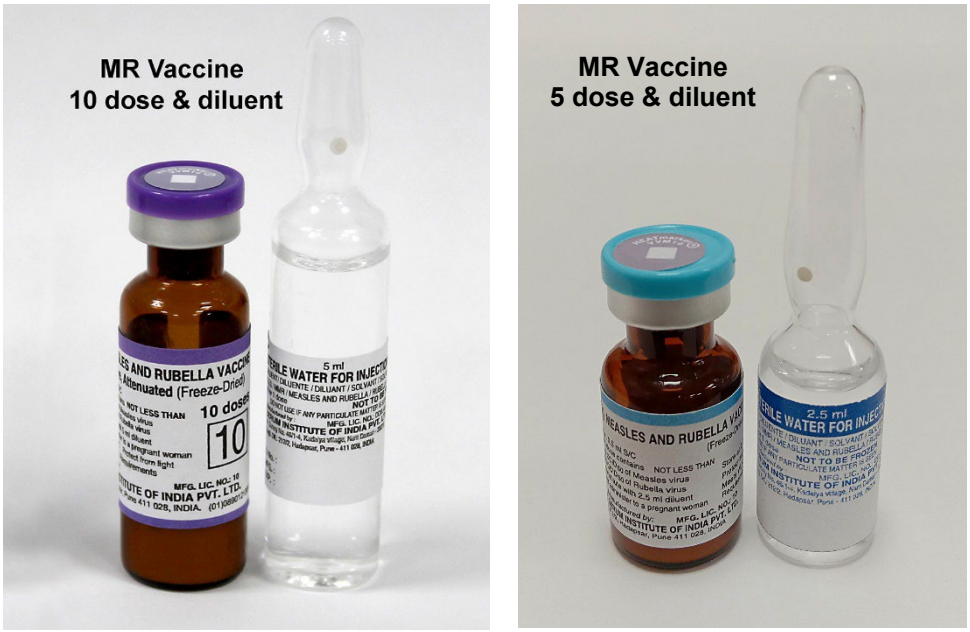
[10] The difference in wastage-adjusted price per dose through UNICEF for Measles and MR vaccine in 5-dose versus 10-dose vials was only US$ 0.016 and US$ 0.032, respectively.

Figure 1: Measles vaccine, Serum Institute of India



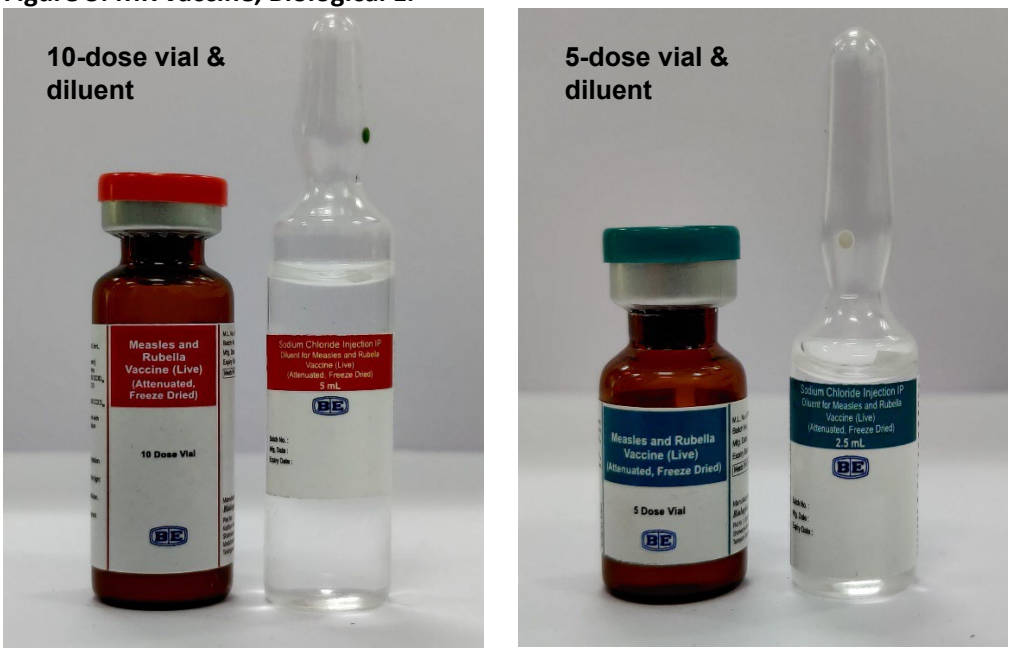
Source: WHO list of prequalified vaccines. Sizes not to scale, for illustrative purposes only.

Figure 2: MR vaccine, Serum Institute of India



Source: WHO list of prequalified vaccines. Sizes not to scale, for illustrative purposes only.

Figure 3: MR vaccine, Biological E.



Source: WHO list of prequalified vaccines. Sizes not to scale, for illustrative purposes only.

4. Countries supported by Gavi

Countries supported by Gavi, the Vaccine Alliance for their routine MCV (Measles or MR) may request to switch from a 10-dose vial presentation to a 5-dose vial presentation with Gavi support.

Countries must submit a formal request for a switch and are requested to do so through Gavi's Country Portal as part of the annual vaccine renewal request. However, in exceptional cases, a country can request a switch any other time during the year, by submitting a standard switch request form to Gavi's Secretariat. The switch form is vaccine-specific and used to collect essential information for the implementation of the switch.

Gavi may provide support, in the form of a "switch grant" to facilitate the safe and effective transition to a new product, presentation, or use, and intends to cover a portion of the one-time investments associated with a switch (e.g., training, document production and printing, procurement of cold boxes, stock monitoring, and retrieval of stock). Please refer to the Guidelines on Reporting and Renewal of Gavi Support for additional information on Gavi processes and requirements.

5. Actions to take when proposing a switch from 10-dose to 5-dose vial

- Present the justification for the change to Inter-agency Coordinating Committee (ICC) or equivalent forum.
- Hold advocacy and consensus meetings at national and sub-national levels.
- Assess cold chain and cold store capacity requirements.
- Secure funding for preparations for the switch.

- Determine and address programmatic implications and challenges related to the use of different presentations “side by side” for routine immunization and campaigns.
- For countries co-administering MCV with other antigens (e.g., yellow fever vaccine), assess the possible need for switching vial presentation for those other antigens to align with MCV vial presentation.

6. Activities in preparation for implementing a switch from 10-dose to 5-dose vial

- Assess cold chain and storage capacity at all levels based on the new requirements.
- Carry out a vaccine inventory review – to identify the stock level of the M/MR 10-dose vial.
- Forecast the quantity of vaccine in 5-dose vials to be procured, including buffer stock requirements.
- Revise/develop vaccine shipment and distribution plans at all levels.
- Revise, print, and distribute all vaccine monitoring, reporting, and registration tools/forms.
- Amend immunization guides, plans, comprehensive multi-year plans (cMYP), etc. to reflect the changes.
- Conduct orientation/ training of health workers on the changes in vaccine vial presentations and their implications.
- Develop, print, and distribute a simple guide for health workers for the 5-dose vial, in the major local language(s) with illustrations, as needed.

7. Resources

- **Monitoring vaccine wastage at country level:** http://apps.who.int/iris/bitstream/handle/10665/68463/WHO_VB_03.18.Rev.1_eng.pdf;jsessionid=4BDAC570B8C78C604B00A1B15406DD6C?sequence=1
- **Immunization tools to help the dose per container decision:** https://www.jsi.com/JSIInternet/Inc/Common/_download_pub.cfm?id=19420&lid=3

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