



17th TechNet Conference

Panama City, Panama | October 16-19, 2023

Immunization Programmes That Leave No One Behind

www.technet-21.org

What do we know about global vaccine wastage rates?

Chair: Souleymane Kone (WHO headquarters)

Paul Colrain (consultant)

Ahmet Afsar (UNICEF Programme Group)



17th TechNet Conference

Panama City, Panama | October 16-19, 2023

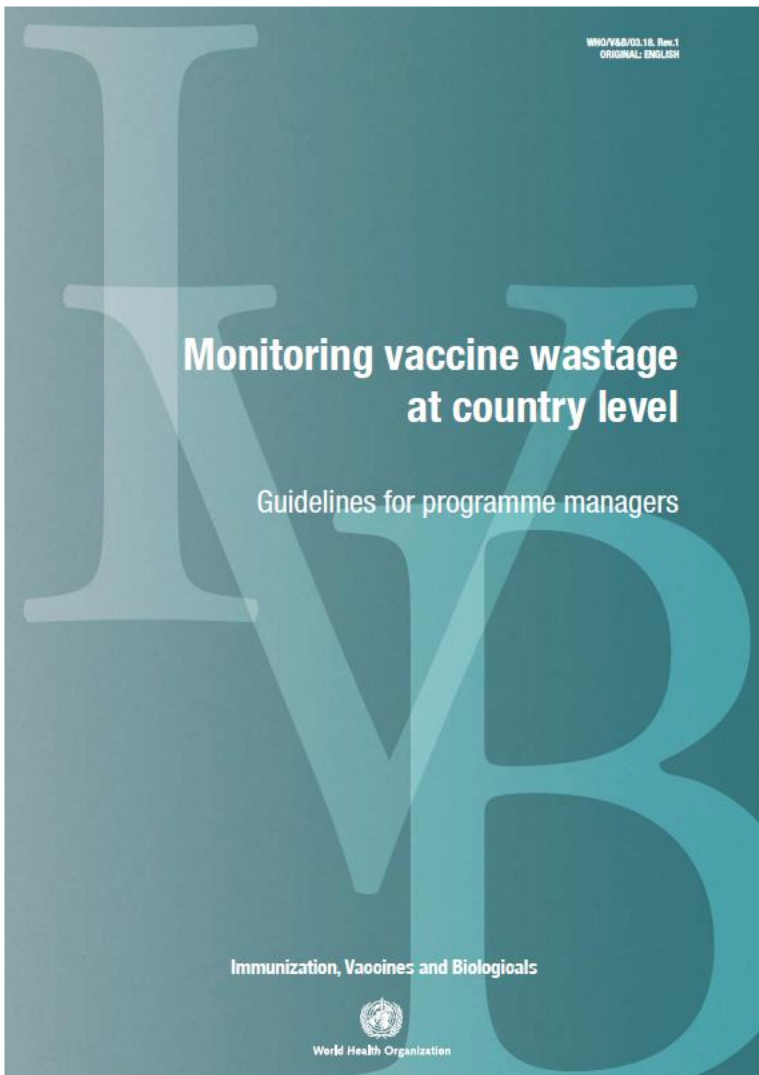
Immunization Programmes That Leave No One Behind

www.technet-21.org

Are 50% of all vaccines really wasted?

Paul Colrain (consultant)

What are global wastage rates?



The World Health Organization reports over 50% vaccine wastage around the world. Despite the availability of many tools for reducing such wastage, high wastage rates are still occurring in countries. Because of increasing EPI vaccine costs during the last two years, tightening vaccine security and the introduction of new and underused vaccines through the Global Alliance for Vaccines and Immunizations (GAVI), countries are looking more closely than before at vaccine wastage. Moreover, GAVI has requested countries to bring down vaccine wastage rates: “The country would aim for a maximum wastage rate of 25% set for the first year with a plan to gradually reduce it to 15% by the third year. For vaccine in single-dose or two-dose vials the maximum wastage allowance is 5%. No maximum limits have been set for yellow fever vaccine in multidose vials.”¹

WHO, 2005

WHO indicative opened vial wastage rates

Presentation

- single dose
- 2 or 5 doses, regardless of discard time
- 10 or 20 doses, if opened vial can be re-used in subsequent sessions
- 10 or 20 doses, if opened vial to be discarded after 6 hours

Routine	Campaign
5%	5%
10%	10%
25%	15%
40%	15%

Objectives

Ultimately:

1. To measure vaccine wastage rates for each vaccine, for different vial sizes, in each year, in each country, region, and globally.

Today:

1. To describe the data sets we have.
2. To provide some results from a preliminary analysis of the data.
3. To discuss the next steps.

Available Data Sets

We have 3 data sets:

1. MI4A Vaccine Procurement Data:
2. JRF Vaccination Coverage Data:
3. JRF Vaccination Schedule Data:

Doses Procured

Doses Administered (for selected doses)

Doses per Recipient

Vaccine Wastage Rate

$$\begin{aligned} \text{wastage rate} &= \frac{\text{number of doses wasted}}{\text{number of doses consumed}} \\ &= \frac{\text{number of doses consumed} - \text{number of doses administered}}{\text{number of doses consumed}} \\ &= 1 - \frac{\text{number of doses administered}}{\text{number of doses consumed}} \\ &\stackrel{\text{IR}}{=} 1 - \frac{\text{number of doses administered}}{\text{number of doses procured}^1} \quad \begin{array}{l} \nearrow \text{JRF} \\ \searrow \text{MI4A} \end{array} \\ &= 1 - \text{utilization rate} \end{aligned}$$

¹ doses consumed = opening stock + doses procured – closing stock.

Sample

Sample after 3 filters:

Vaccine Type	count
BCG	67
DTPCV	81
PCV	49
ROTA	32

For 67 countries:

1. BCG dosesProcured > 0 in 2017, 2018, 2019, 2020, 2021
2. BCG dosesAdministered > 0 in 2017, 2018, 2019, 2020, 2021
3. BCG dosesPerRecipient is available for 2017

For 32 countries:

1. ROTA dosesProcured > 0 in 2017, 2018, 2019, 2020, 2021
2. ROTA1 dosesAdministered > 0 in 2017, 2018, 2019, 2020, 2021
3. ROTA1 dosesAdministered > 90% DTPCV1 in 2017, 2018, 2019, 2020, 2021
4. ROTA dosesPerRecipient is available for 2017

Example 1: BCG

JRF dosesAdministered

country;	year;	vaccineType;	dosesAdministered
Madagascar;	2020;	BCG;	870759

MI4A dosesProcured

Country;	year;	vaccine;	dosesPerVial;	dosesProcured
Madagascar;	2020;	BCG;	20	1356000

$$\Rightarrow \text{Madagascar-2020-BCG utilization rate} = \frac{\text{doses administered}}{\text{doses procured}} = \frac{870759}{1356000} = 64\%$$

Note:

- Madagascar only procured BCG 20-dose vials in 2020.
⇒ Madagascar-2020-BCG-**20** utilization rate = 64%.

Example 2: DTPCV

JRF dosesAdministered

country; year;	vaccineDose;	dosesAdministered
Bolivia;	2018; DTPCV1	216456
Bolivia;	2018; DTPCV3	201807

JRF dosesPerRecipient

Country; year;	vaccine;	dosesPerRecipient
Bolivia;	2018; DTAPHIBHEPB;	5

⇒

country; year;	vaccineDose;	dosesAdministered
Bolivia;	2018; DTPCV1	216456
Bolivia;	2018; DTPCV2	209132 straight line extrapolation
Bolivia;	2018; DTPCV3	201807
Bolivia;	2018; DTPCV4	194483 straight line extrapolation
Bolivia;	2018; DTPCV5	187159 straight line extrapolation

⇒

country; year;	vaccineType;	dosesAdministered
Bolivia;	2018; DTPCV	1009037 (sum of DTPCV1 to DTPCV5)

Example 2: DTPCV (continued)

MI4A dosesProcured

country; year;	vaccine;	dosesPerVial;	dosesProcured
Bolivia;	2018;	DTwP-HepB-Hib; 1;	1094767

⇒

country; year;	vaccineType;	dosesProcured
Bolivia;	2018; DTPCV;	1094767

⇒ Bolivia-2018-DTPCV utilization rate = $\frac{\text{doses administered}}{\text{doses procured}} = \frac{1009037}{1094767} = 92\%$

Note:

- Bolivia only procured DTwP-HepB-Hib 1-dose vials in 2018.
⇒ Bolivia-2018-DTPCV-1 utilization rate = 92%.
- To measure utilization rates and wastage rates **for specific vial sizes**, only one combination of vaccine+vialSize can be procured/administered in the time period. This will further reduce the sample size, especially for DTPCV.

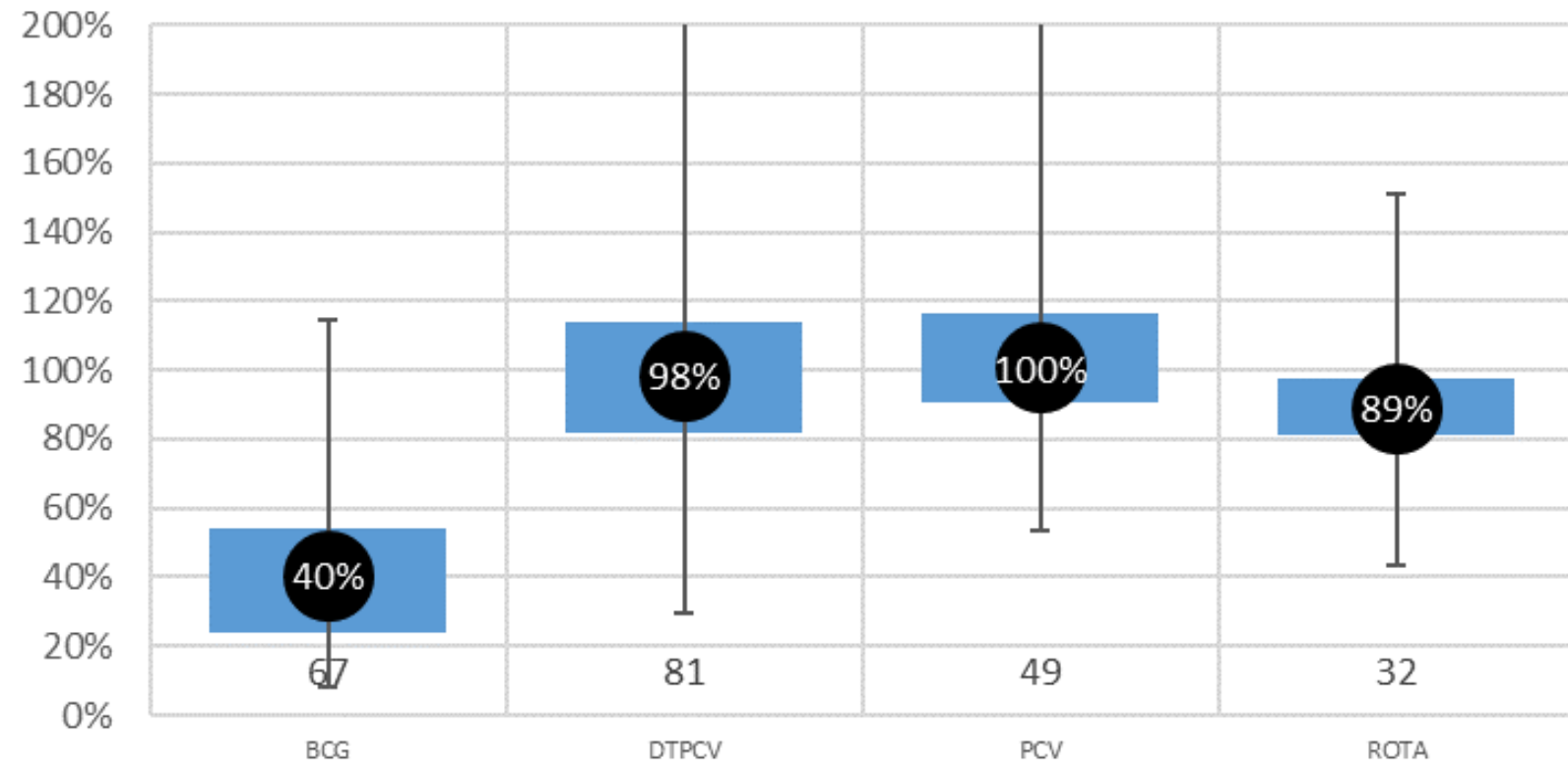
Let's look at the data ...



17th TechNet Conference
Panama City, Panama | October 16-19, 2023

Utilization rates

2017-2021 Utilization Rate Distributions



Countries with 2017-2021
utilization rate > 100% | → 1%

47%

51%

22%

Conclusion

The MI4A dataset is missing procurements

- Missing data points (country-year-vaccine-dosesPerVial-dosesProcured) \Rightarrow small sample size
- Missing data within data points \Rightarrow denominator too small \Rightarrow utilization rate > 1

We do not know when data are missing!

\Rightarrow Global wastage rates cannot be measured with confidence.

Next Steps

Retrospective analysis

- Collect missing MI4A procurement data (\Rightarrow larger sample size, correct denominator).
- Identify 0-dose data points (\Rightarrow larger sample size).
- Repeat analysis.

In future

- Improve MI4A reporting (include 0-dose reporting).
- Conduct analysis and report results annually.



Thank You!

Paul Colrain (WHO)

Souleymane Kone (WHO)



17th TechNet Conference

Panama City, Panama | October 16-19, 2023

Immunization Programmes That Leave No One Behind

www.technet-21.org

nOPV2 Campaign Wastage Study Findings, Implications & Recommendations

Ahmet Afsar (UNICEF Programme Group)

Context & Objectives

To better address the evolving risk of type 2 circulating vaccine-derived poliovirus (cVDPV2), GPEI deployed nOPV2, a novel oral polio vaccine type 2 (GPEI, n.d.).

nOPV2 is presented in a 50-dose vial for which there are no historical wastage data upon which to base wastage rate expectations. MDVP is not recommended during the campaigns to achieve 100% accountability required for OPV2.

A WR value of 40% was proposed for the initial use phase, based on the expectation that the average wastage rate in a campaign round would be ~25%, but that many districts or regions would have wastage rates significantly higher.

A wastage study has been conducted to gather empirical wastage rate data to inform future campaign rounds. The objectives of the study are:

- To measure nOPV2 campaign wastage rates (unavoidable and avoidable rates) for different countries, settings (rural, urban), strategies (fixed site, house-to-house, transit, mobile), rounds, days within a round, and at the national, district and session level.
- To collect daily target and session size data from different countries, settings, strategies, rounds, days within a round.
- To understand (model) nOPV2 wastage rates with a view to informing global guidance on vaccine wastage rates, needs forecasting, microplanning, buffer stocks and wastage monitoring.

What is a Quality Campaign?

'A high-quality campaign must aim for coverage of more than 90% for SIA1 and SIA2 with no persistently missed children.'

Low quality campaigns are not likely to stop the outbreak.'

For the study, we defined a *Quality Campaign* as one in which:

1. the coverage rate in each round is greater than 90%,
2. the 0-dose rate of the campaign (2 rounds) is less than 1%.

The image shows the cover of a document titled "STANDARD OPERATING PROCEDURES RESPONDING TO A POLIOVIRUS EVENT OR OUTBREAK". At the top left is the "POLIO GLOBAL ERADICATION INITIATIVE" logo, and at the top right is the "World Health Organization" logo. Below the title, it says "Version 4" and "March 2022". The cover features four photographs: a man in a blue shirt handing a container to a woman, a woman in a headscarf using a megaphone from a car, a group of people sitting on a red patterned rug indoors, and two women walking on a dirt path, one carrying a blue box. At the bottom, there are logos for the World Health Organization, UNICEF, Rotary, CDC, Bill & Melinda Gates Foundation, and Gavi.

Types of Vaccine Wastage

Given only the number of doses administered in a *session* and the number of vials used in a *session*, we are able to calculate the 3 components of vaccine wastage:

1. **Avoidable Unopened Vial Wastage**

This type of wastage is due to the loss of sealed (unopened) vials. Specific sources include:

- Expiry
- Heat exposure (eg. VVM reaches discard point)
- Breakage or damage (eg. loss of label)
- Missing inventory
- Discard after outreach

2. **Avoidable Opened Vial Wastage**

This type of wastage is due primarily to the practice of immunization workers. Specific sources include:

- Administering more than two drops
- Leakage due to a loose dropper cap
- Heat exposure during a session (eg. VVM reaches discard point)
- Breakage during a session
- **Having more than one vial unfinished opened at the end of a session**

3. **Unavoidable Opened Vial Wastage**

This type of wastage is due to the discard of unused doses in multi-dose vials after the discard time. Such wastage is determined by the vial size, the discard time (eg. 6 hours, 28 days), and the distribution of session sizes.

Example: 50-dose vial, session size = 40 \Rightarrow unavoidable opened vial wastage rate = $10/50 = 20\%$, independent of the number of vials opened.

For a 50-dose vial, and assuming that unfinished opened vials are discarded 6 hours after opening or at the end of the session, unavoidable opened vial wastage is expected to be the dominant source of wastage, even in a campaign setting.

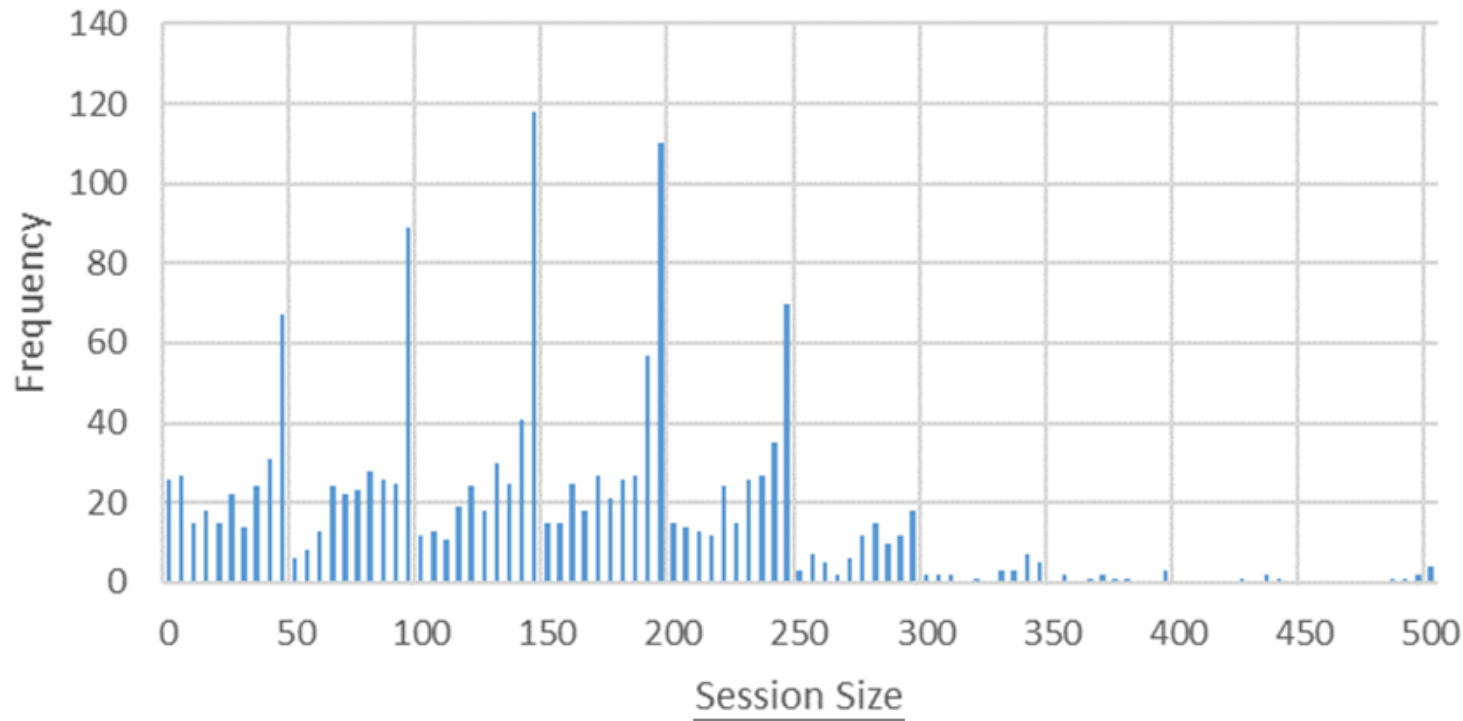
Findings:



17th TechNet Conference
Panama City, Panama | October 16-19, 2023

Session Sizes

Session Size Distribution - OBR1



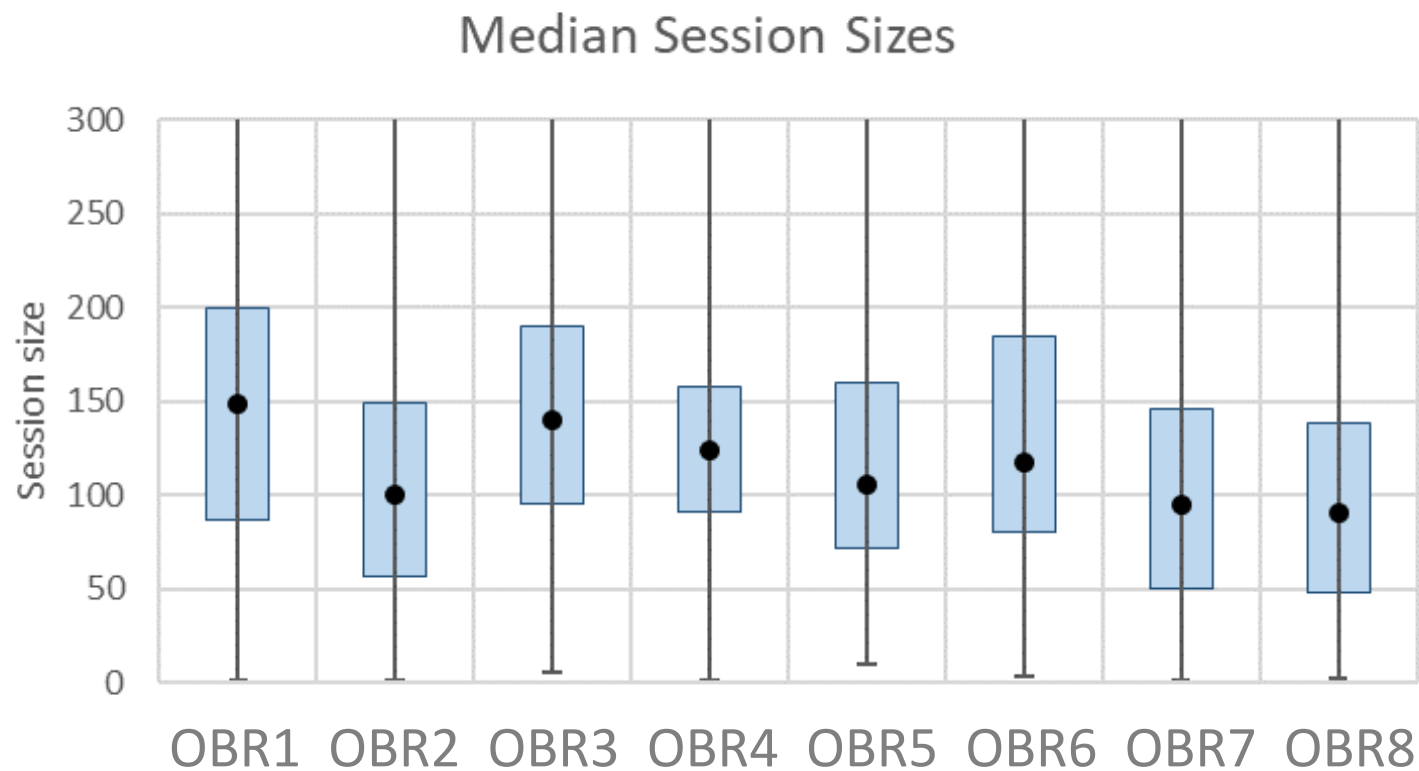
Why does the session size peak at 50, 100, 150, 200, ... ?

In an effort to control wastage, sessions are being terminated when a vial is finished. We call this *wastage reduction behaviour*.

Similar distributions are found in all 9 OBRs, in 5 different countries, for all strategies & settings, and for each day of each round.

number of doses administered by one vaccination team on one day

Session Sizes by OBR



Individual session sizes range from ~0 to more than 300 in each of the 9 rounds studied.

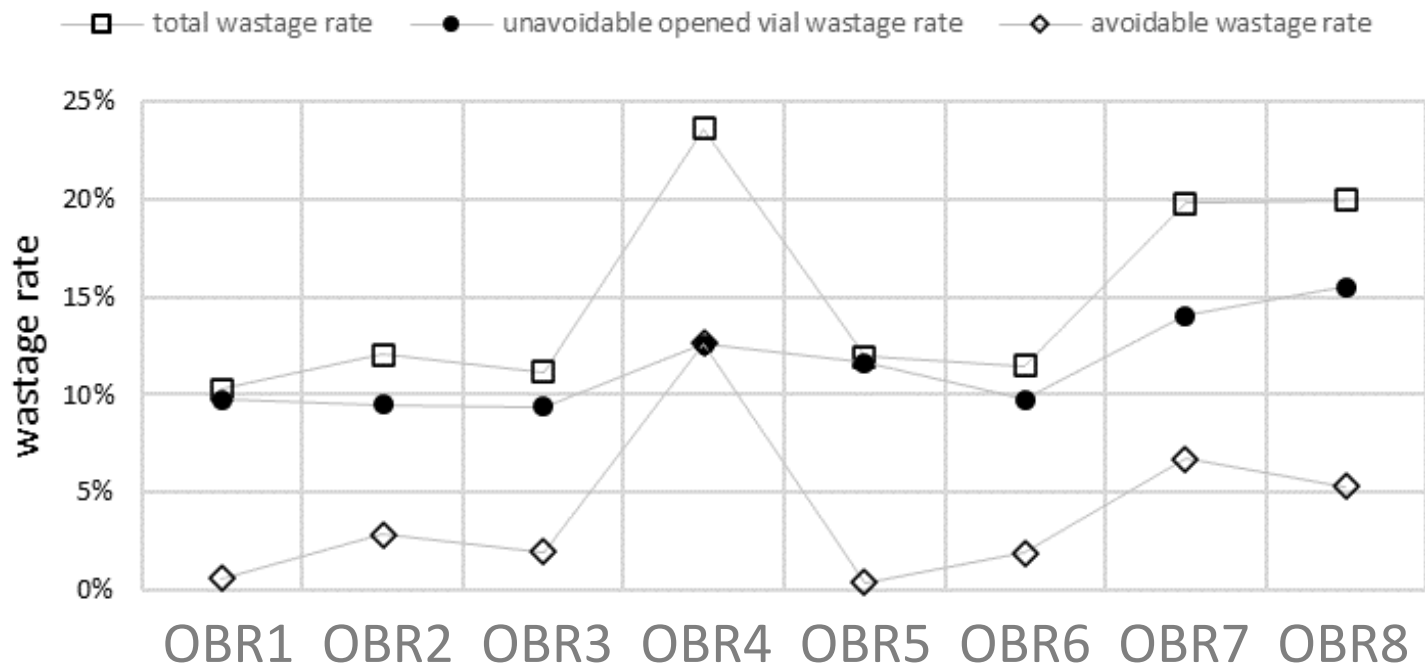
Median session sizes range from 90 to 150, across 9 rounds in 5 countries.

Very similar distributions are found for rural and urban settings in each country.

There is no discernible difference between the median session sizes in urban and rural settings.

Session Wastage Rates by OBR

Mean Session Wastage Rates

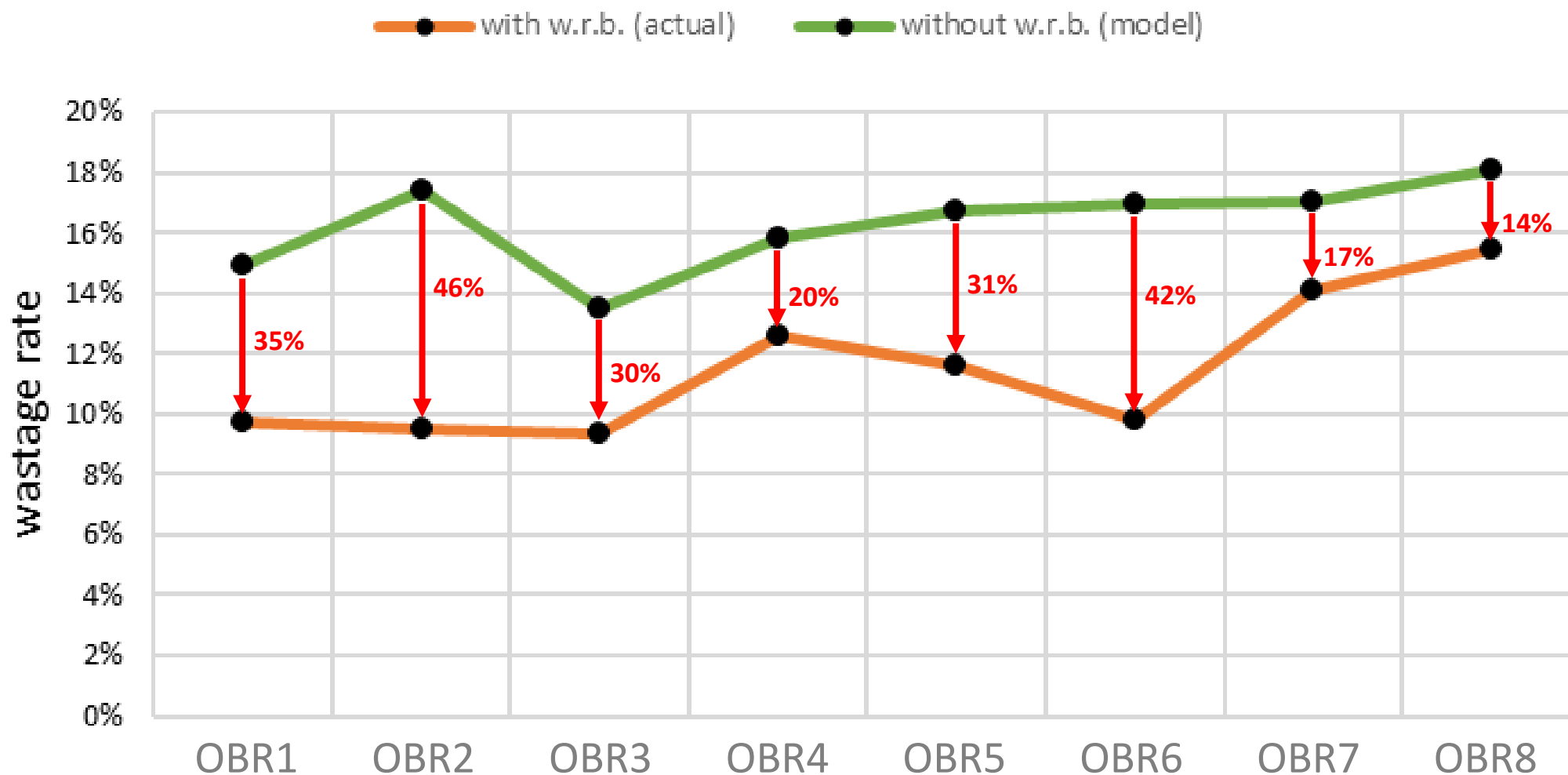


Unavoidable opened vial wastage rates are significantly lower than would be expected based on median session sizes alone.

This is solely due to *wastage reduction behaviour*.

Wastage Reduction Behaviour and Wastage Rates

Wastage Reduction Behaviour (w.r.b.)

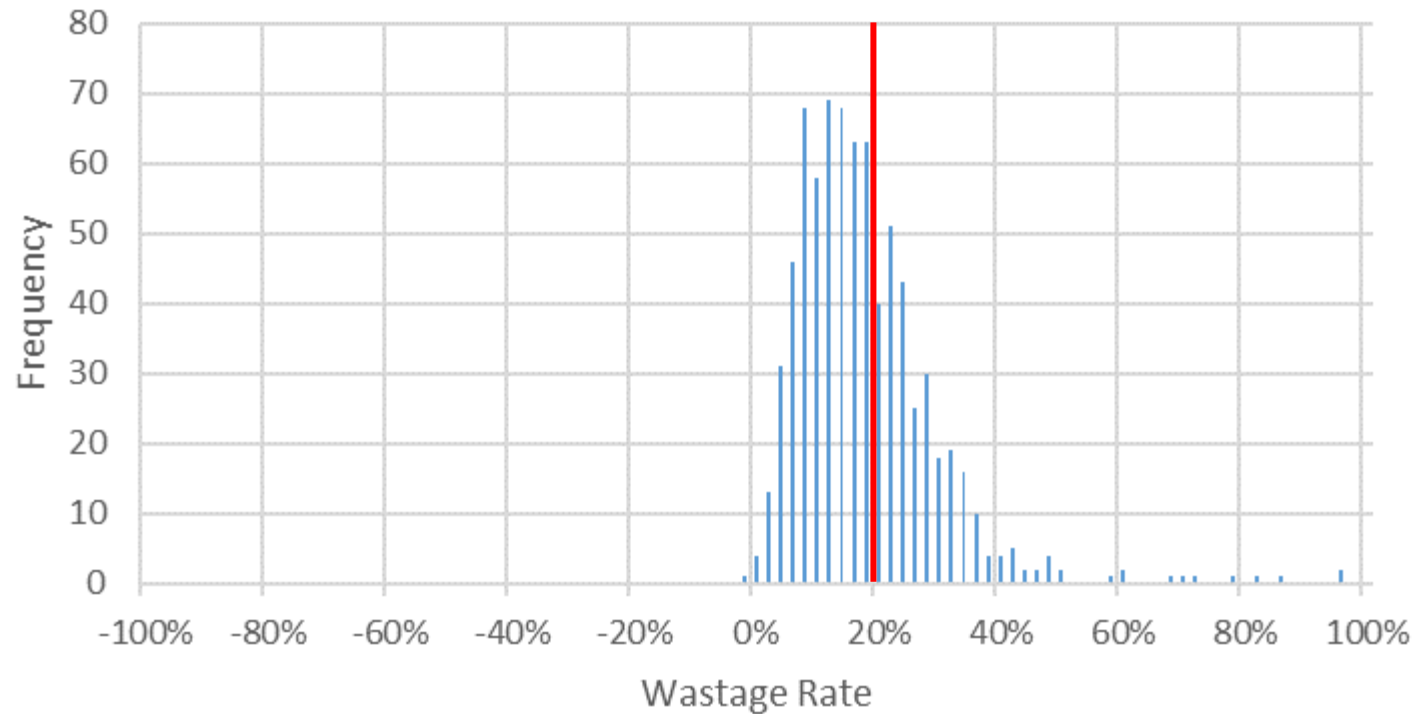


Wastage reduction behaviour reduces unavoidable opened vial wastage by 20-30% on average.

¹Unavoidable opened vial wastage rate.

District Wastage Rates

District Wastage Rates (All Rounds)



Even when vaccinators engage in wastage reduction behaviour to the extent observed:

- **the aggregate wastage rate** over all 767 districts in 5 countries **is 19%**,
- the district wastage rate is greater than 20% in 286 (**37%**) of the 767 districts,
- **Districts with wastage rates > 20% will stockout before the end of the round.**
- Some of the target population will not be vaccinated.

Note, that at the time of this study, GPEI used a wastage rate of 40%.stock out

Key Findings

1. Wastage reduction behaviour

- Some vaccinators sometimes do not open vials if they expect to administer only a few doses from the vials.
- This *wastage reduction behaviour* will reduce wastage.
- **This wastage reduction behaviour will also reduce coverage.**

2. District stockouts

- Many districts have wastage rates greater than 20%.
- Unless all districts are always resupplied when stock levels are critically low, some districts will stockout before the end of the round.
- **This will reduce coverage.**

Campaign Quality Implications and Solutions

Implications

- Both wastage reduction behaviour and district stockouts **have serious implications for campaign quality.**

Solutions

- **Wastage reduction behaviour can be eliminated by clearly instructing all supervisors and vaccinators to never refuse to open a vial to reduce vaccine wastage.** That this is possible and is demonstrated by one of the countries, where the wastage reduction behaviour is minimal. Vaccine wastage should not be the concern of vaccinators.
- District stockouts can be effectively eliminated by using a wastage rate of 40% when forecasting vaccine needs.

Recommendations



17th TechNet Conference
Panama City, Panama | October 16-19, 2023

Recommendations

Plan for high coverage

- Use a wastage rate of 40% to forecast vaccine needs for a campaign round. This will greatly reduce the number of districts stocking out before the end of the round, and thus increase coverage.
- Put in place the necessary reverse logistics and stock sharing to minimize unopened vial wastage from over-stocking.

Vaccinate for high coverage

- Instruct vaccinators to never miss an opportunity to vaccinate a child – to always open a new vial, even for one child.

Plan for low wastage

- Where practical, plan for daily target groups of a multiple of the vial size (50) or just less (e.g. 25-50, 75-100, 125-150, 175-200, etc.).
- Do not set indicative daily targets such as 125 for rural and 250 for urban (for reasons other than global budget plans), as suggested in the GPEI budget template. Such targets have little or no functional value.
- Set daily targets based on values from previous rounds if available.

Monitor wastage

- Digitize and aggregate daily data to facilitate analysis (e.g. wastage monitoring).
- Sample-based wastage monitoring should be a standard component of all SIAs (cf. IM and LQAS).

Use a 20-dose vial/smaller vial

- A 20-dose vial will reduce wastage reduction behaviour.
- A 20-dose vial reduces required buffer (if each team is supplied with one vial more than they are expected to consume).



Thank You!

Dr. Ahmet Afsar, UNICEF/Polio

Paul Colrain

Discussion



17th TechNet Conference
Panama City, Panama | October 16-19, 2023