

# Effective Vaccine Management (EVM) Global Data Analysis

2009-2020



Update: WHO EVM1 database, July 2021

*EVM – setting a standard for the vaccine supply chain*



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A new improved EVM assessment package (EVM2) was released in 2019.

The following analysis includes data from EVM1 assessments only, the last of which was in 2020.

Useful EVM1 and EVM2 links:

- ❑ EVM1 resources ([https://www.who.int/teams/immunization-vaccines-and-biologicals/essential-programme-on-immunization/supply-chain/effective-vaccine-management-\(evm\)](https://www.who.int/teams/immunization-vaccines-and-biologicals/essential-programme-on-immunization/supply-chain/effective-vaccine-management-(evm)))
  - EVM1 SOPs
  - EVM1 Tools & Guidance
  - EVM1 Global Data Analysis
- ❑ EVM2 website (<https://extranet.who.int/evm2/web/Public>)
  - Registration
  - Country Portal
  - Global Insights – an interactive dashboard to replace this analysis!
- ❑ Technet-21 website (<https://www.technet-21.org/en/>; requires registration)
  - EVM Topic page includes EVM2 resources for:
    - Assessors
    - Managers
    - Improvement Planning
    - Trainers

## EVM assesses each level of the supply chain

### Primary level (PR):

Vaccine stores that receive vaccine direct from an international vaccine manufacturer or distributors or a local vaccine manufacturer.

### Sub-national level (SN):

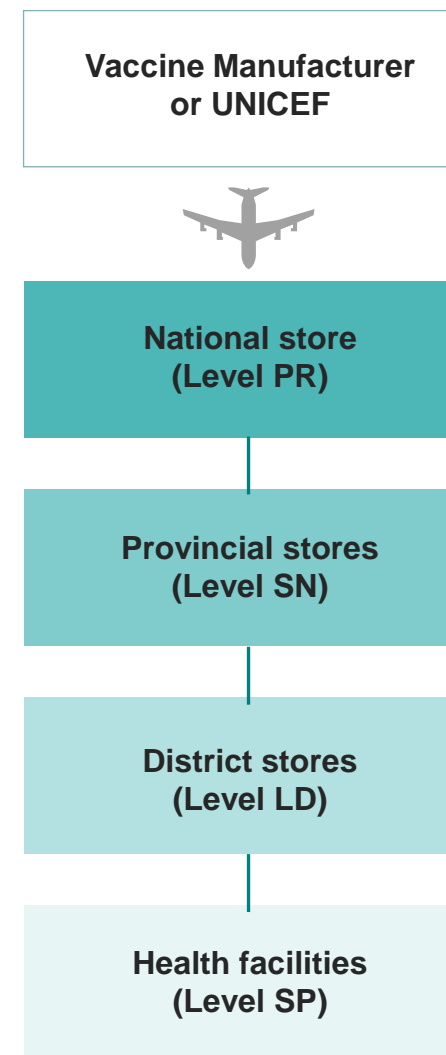
Vaccine stores that receive vaccine from a primary store or higher level sub-national store. There may be 0, 1, or more SN levels.

### Lowest distribution level (LD):

Vaccine stores that receive vaccine from a primary level or a sub-national store and supply vaccine to one or more health facilities.

### Service point level (SP):

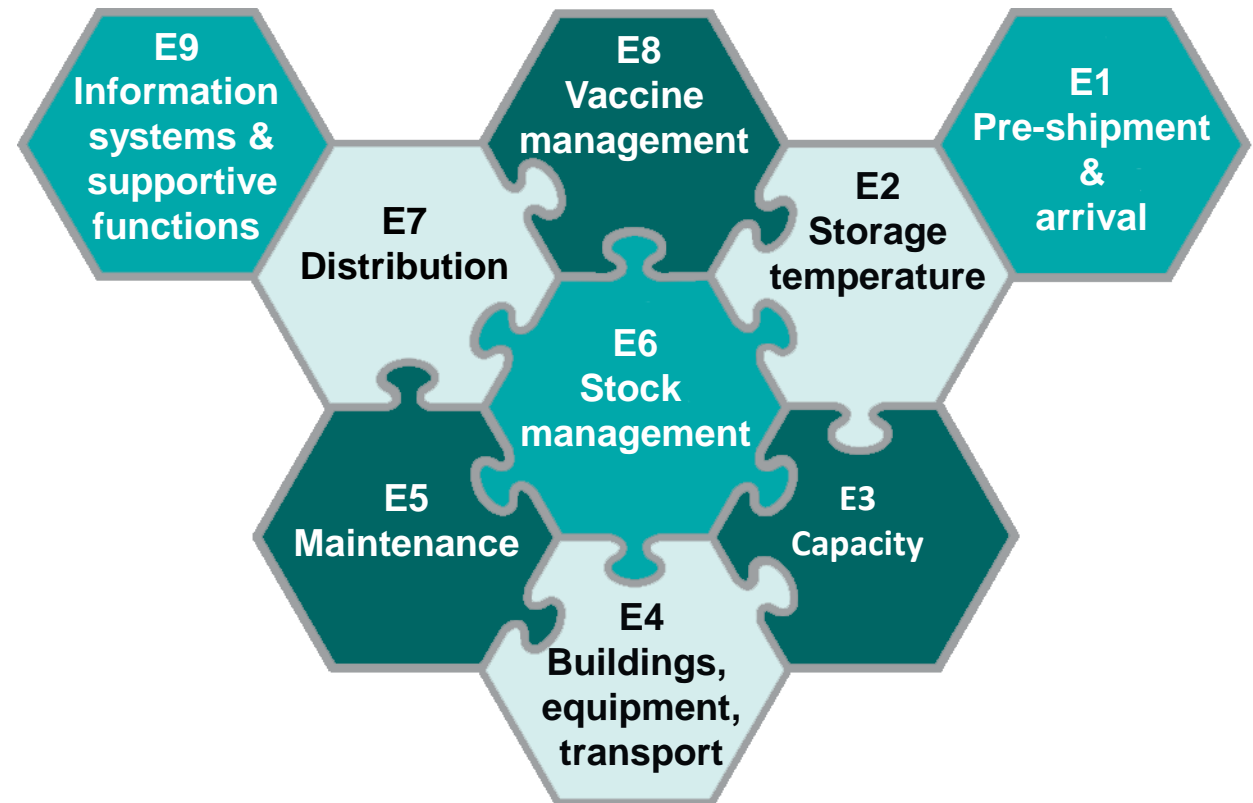
Facilities that receive vaccine from any higher level store and supply immunization services.

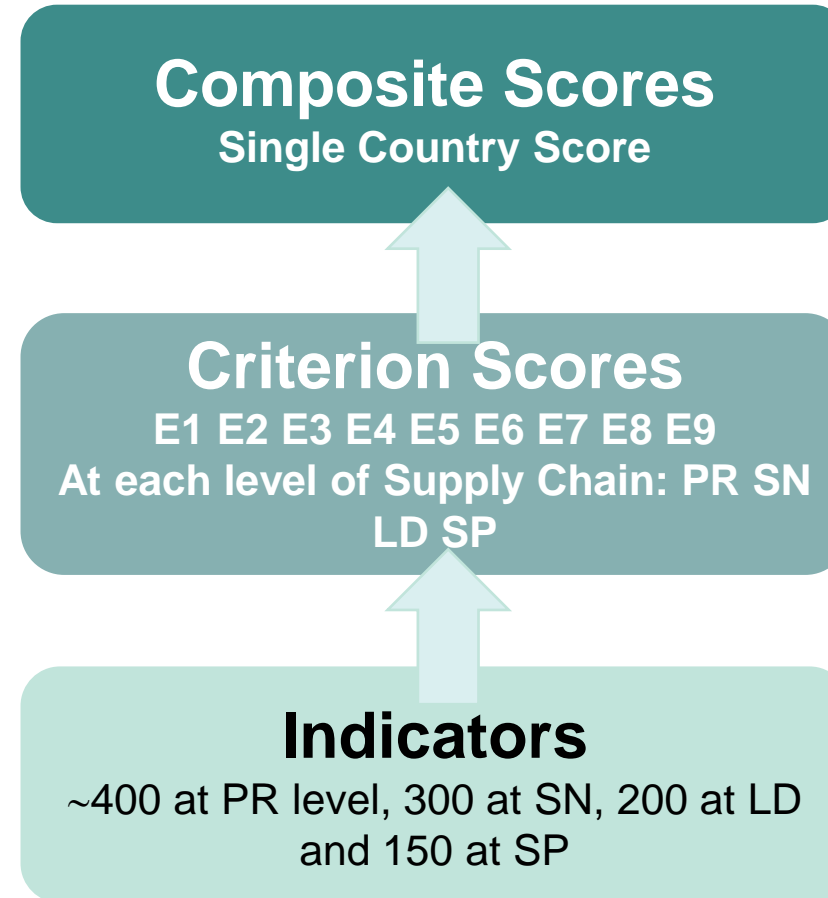


## Criterion Scores

- A representative sample of sites is selected at each level of the supply chain.
- Each of the 9 EVM Criteria is assessed at each supply chain level by observation, inspection of infrastructure and records, and by interview of staff.
- Inputs, process and performance indicators are evaluated in each of the 9 areas at each level.
- Indicator scores are combined to give criterion scores for each area at each level.
- An area of vaccine management is considered “Effective” if its criterion score is greater than or equal to 80% - the EVM standard.

## EVM assesses 9 areas of vaccine management – the 9 EVM “Criteria”







# Assessments

2009-2020

Update: WHO EVM1 database, July 2021

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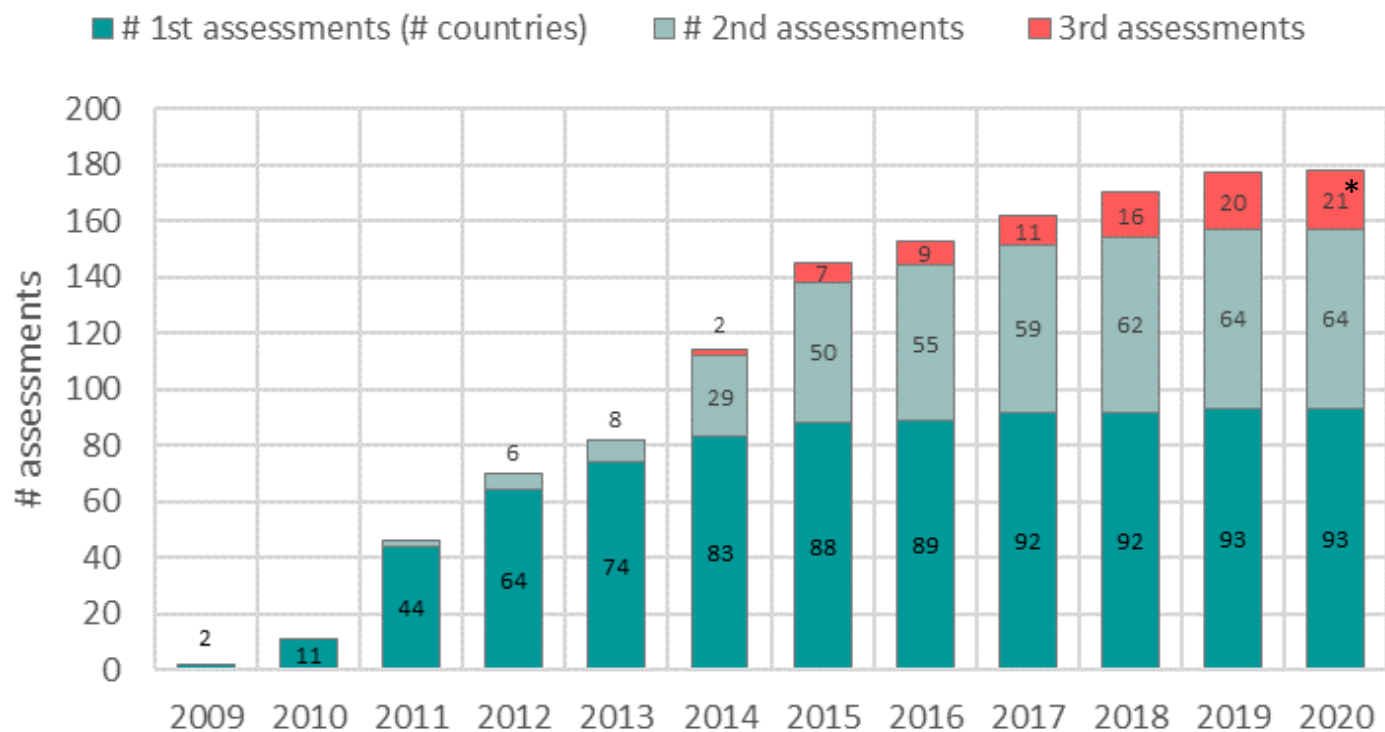


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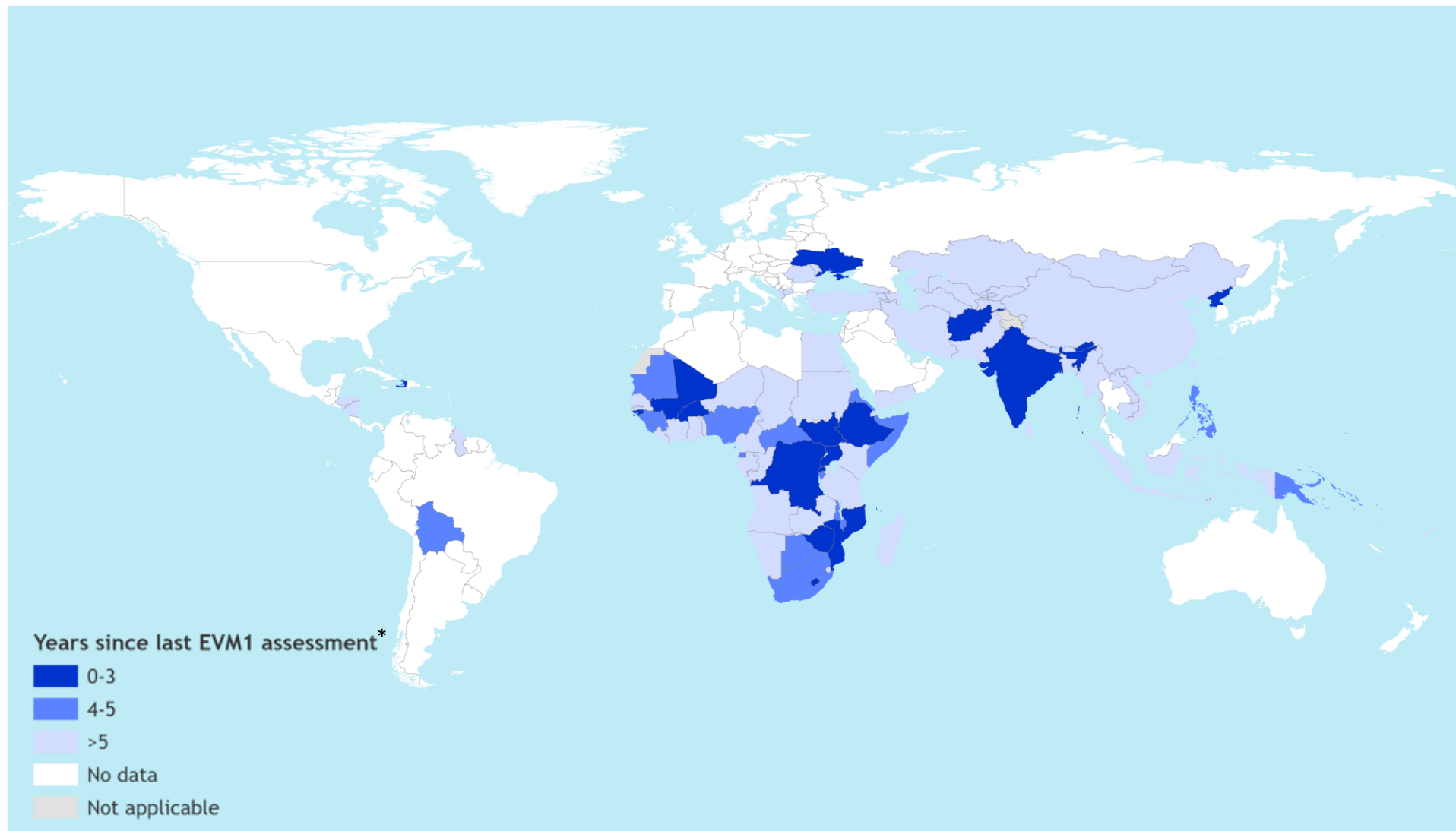
# # Assessments (2009-2020)

## Cumulative number of EVM assessments



\*The last EVM1 assessment was in 2020 and the first EVM2 assessment was in 2019 (<https://extranet.who.int/evm2/web/Public>).





**\* EVM2 Assessments:**  
 Cambodia 2020  
 Côte d'Ivoire 2021  
 Djibouti 2020  
 Indonesia 2020  
 Iraq 2019  
 Lebanon 2021  
 Madagascar 2020  
 Niger 2020  
 Pakistan 2019  
 Sudan 2020  
 Uganda 2020  
 Viet Nam 2020

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: EVM Assessments 2009-2020  
 Map Production: WHO GIS Centre for Health, DNA/DDI



# Criterion Scores

(most recent country assessments only\*)

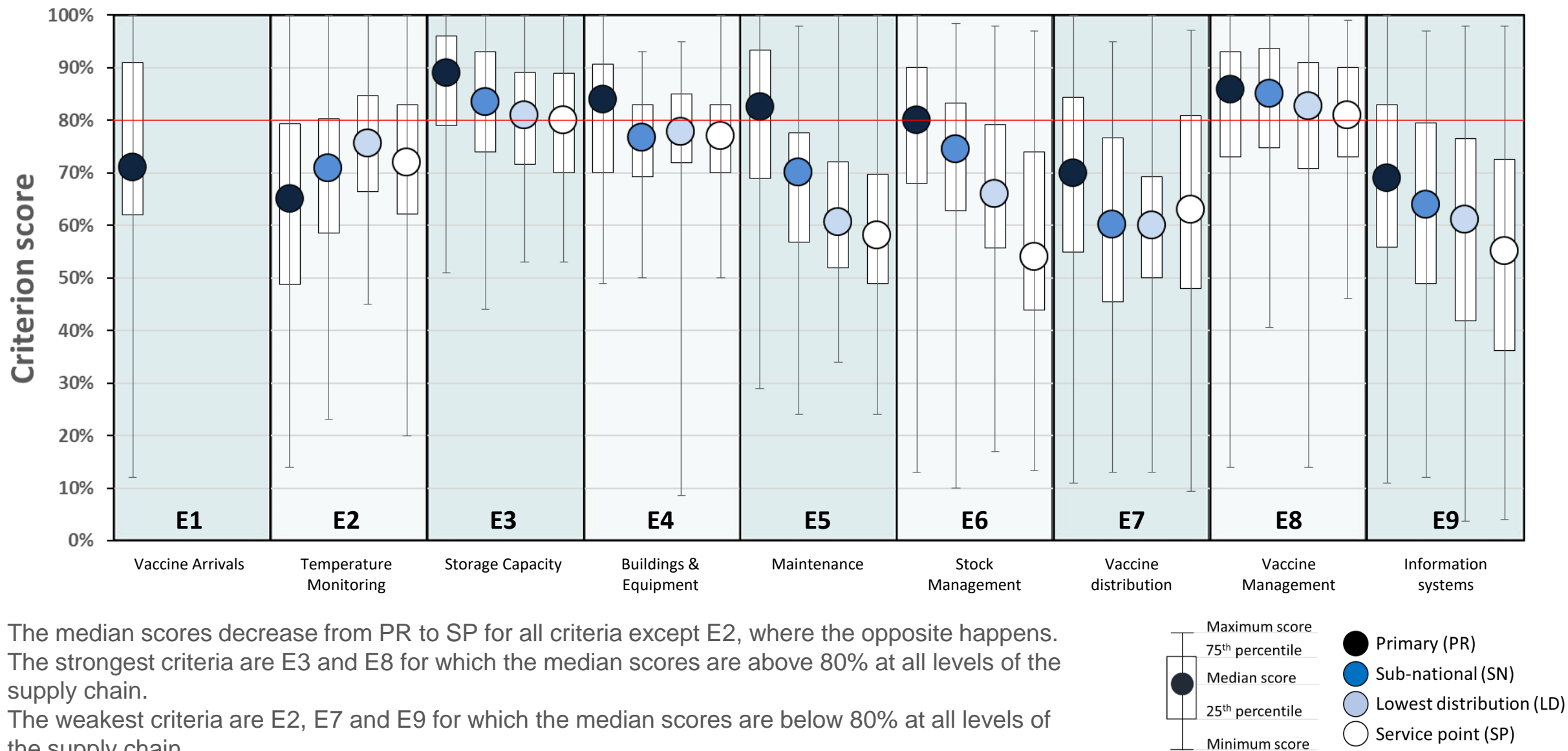
2009-2020

\*Where a country has conducted 2 or more assessments, only the most recent is included.

Update: WHO EVM1 database, July 2021

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# Criterion Scores (2009-2020)



- ❑ The median scores decrease from PR to SP for all criteria except E2, where the opposite happens.
- ❑ The strongest criteria are E3 and E8 for which the median scores are above 80% at all levels of the supply chain.
- ❑ The weakest criteria are E2, E7 and E9 for which the median scores are below 80% at all levels of the supply chain.



# Composite Scores

(most recent country assessments only\*)

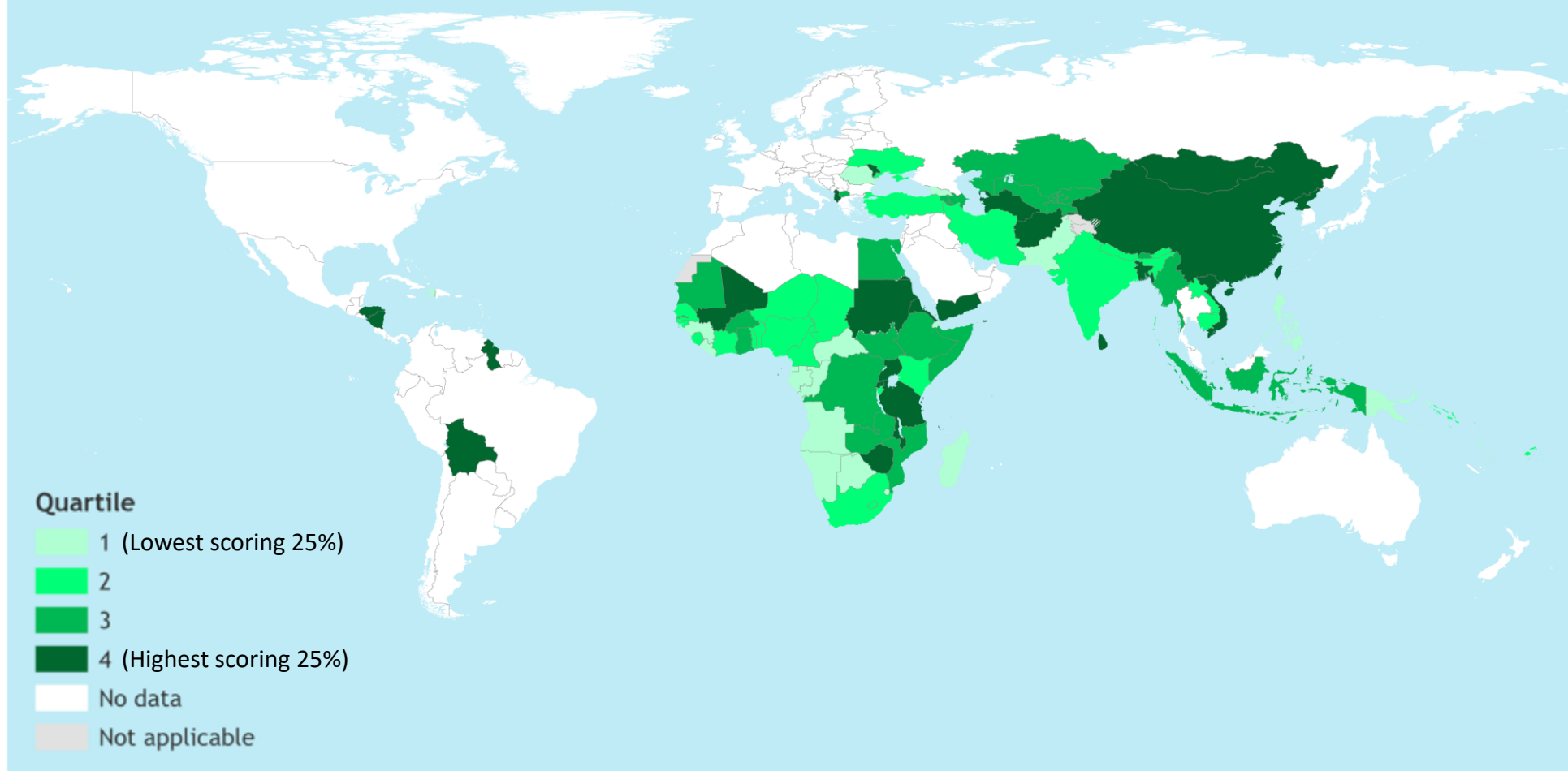
2009-2020

\*Where a country has conducted 2 or more assessments, only the most recent is included.

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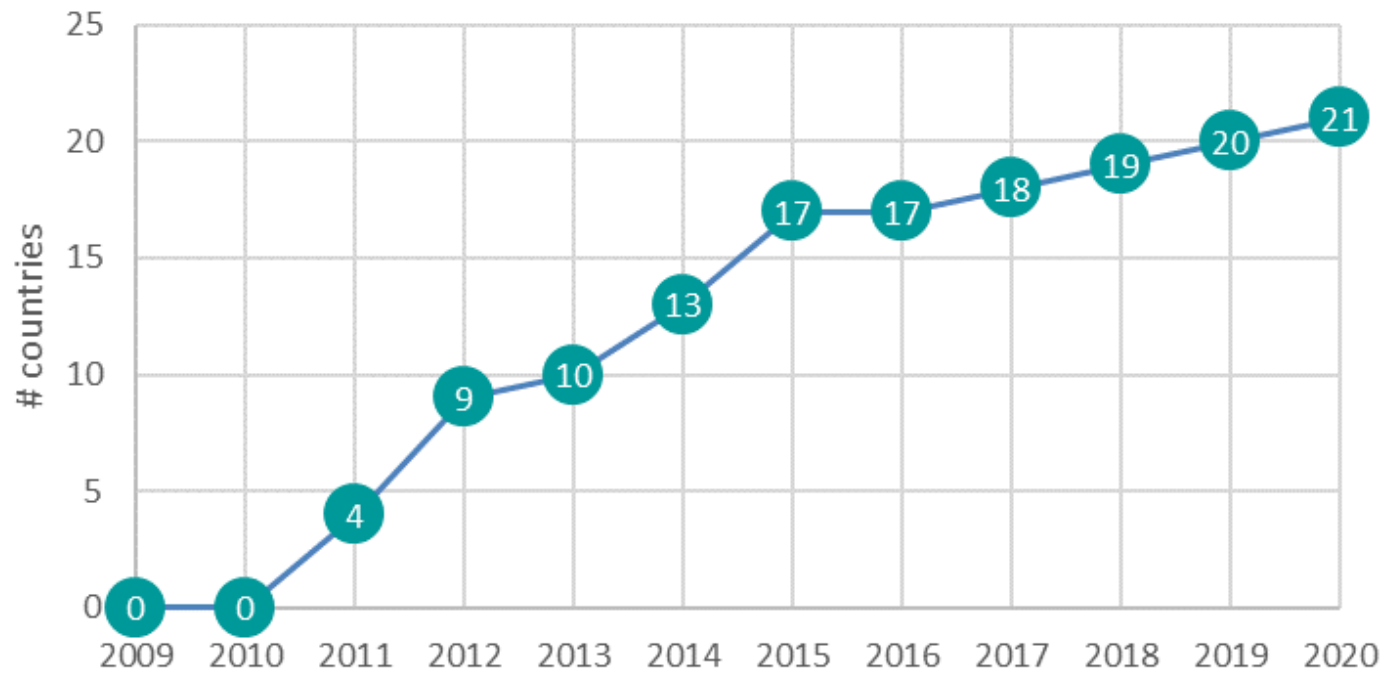
A country's composite score is the geometric mean of the 33 criterion scores of its most recent assessment.



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Data Source: EVM Assessments 2009-2020  
Map Production: WHO GIS Centre for Health, DNA/DDI

# countries with composite score > 80%  
(93 countries in total)





# Criterion Scores by Region

(most recent country assessments only)

2009-2020

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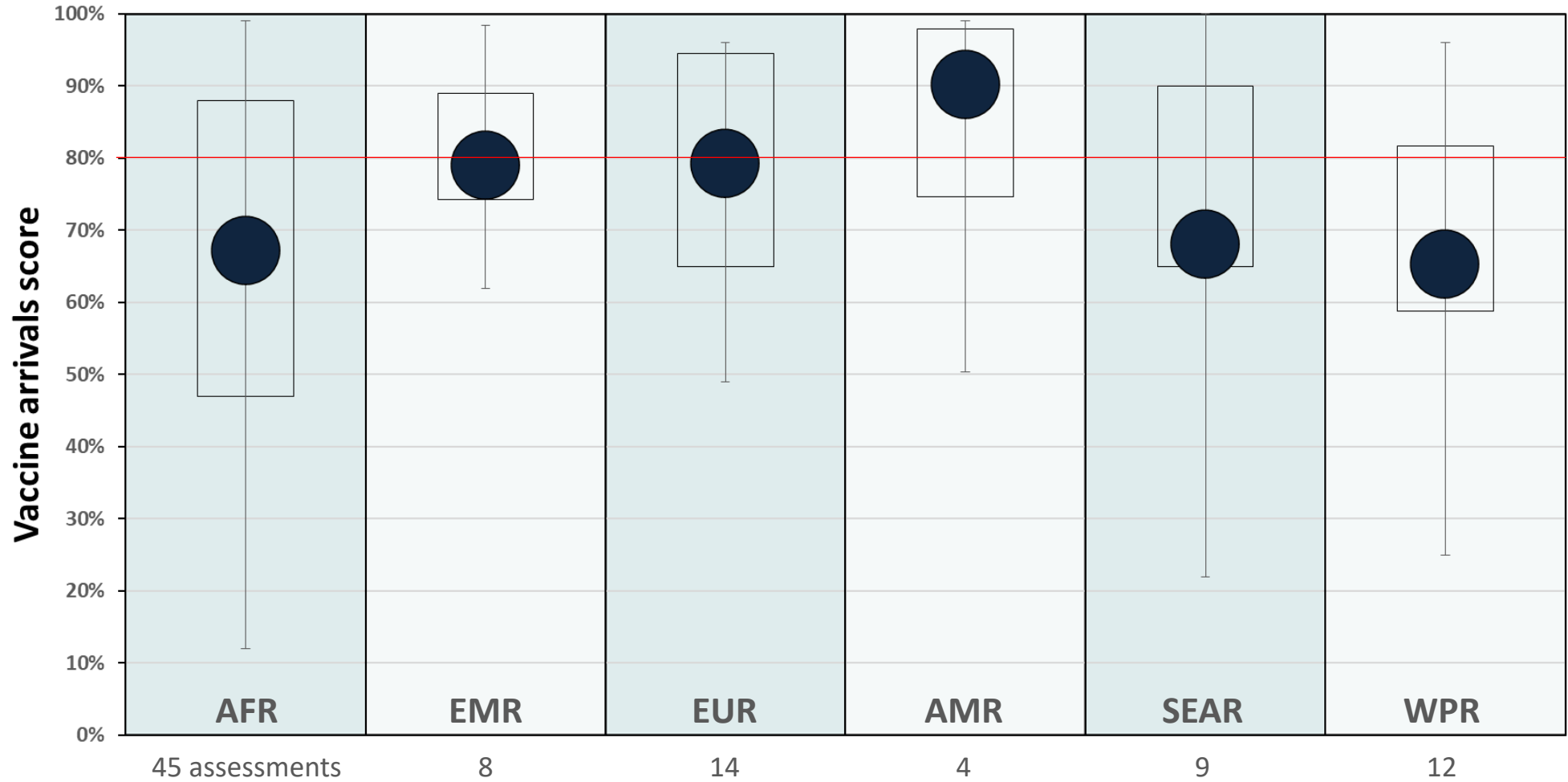
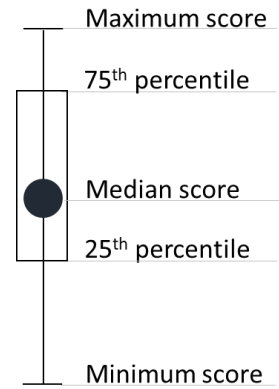


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# E1 Vaccine arrivals (2009-2020)

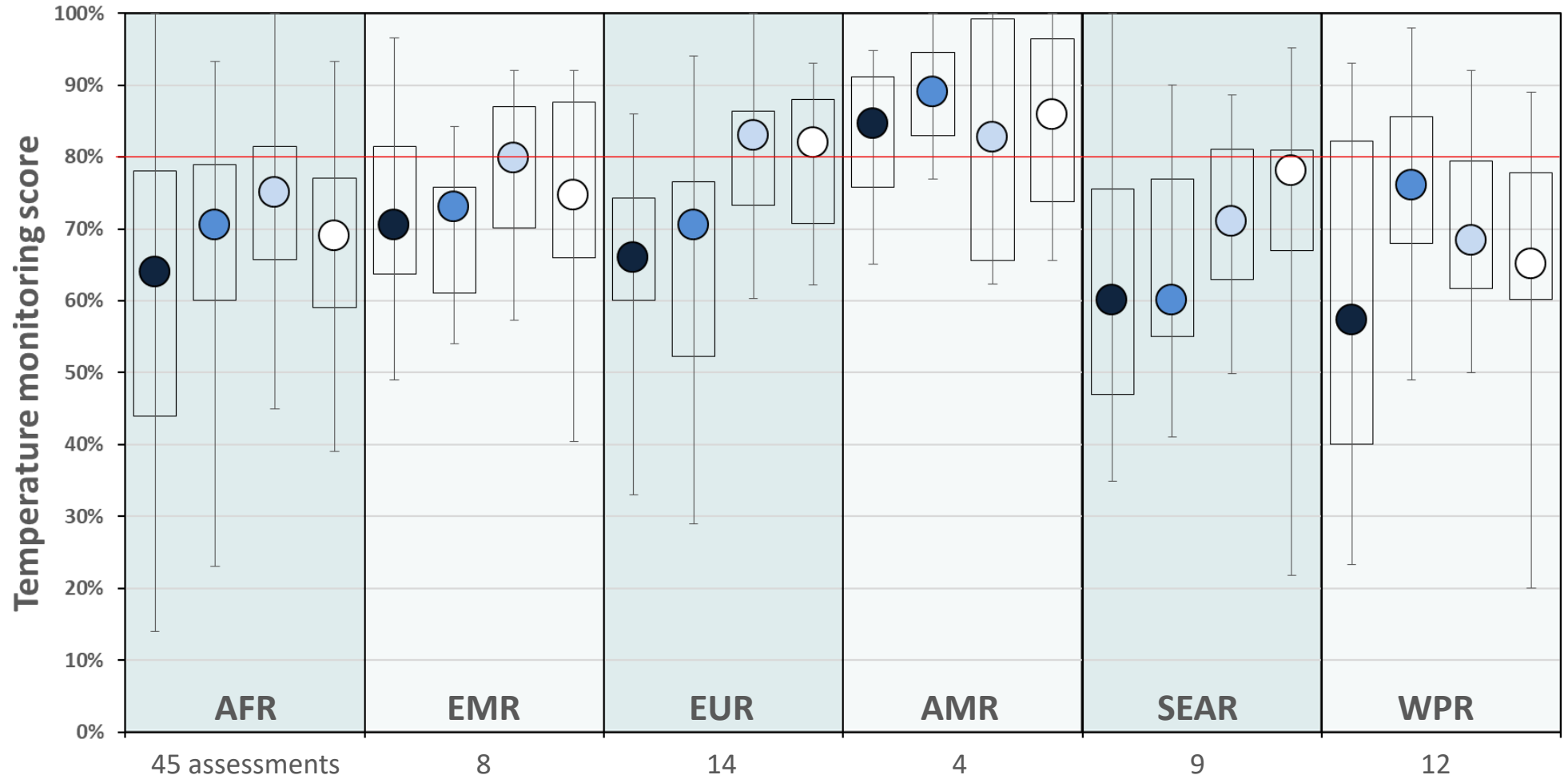
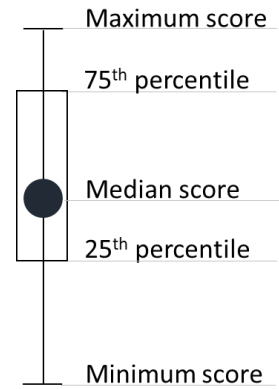
- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



- ❑ Many of the primary stores assessed in AFR, SEAR and WPR do not meet the EVM standard for vaccine arrivals.
- ❑ About half of the primary stores assessed in EMR, EUR and AMR meet the standard.

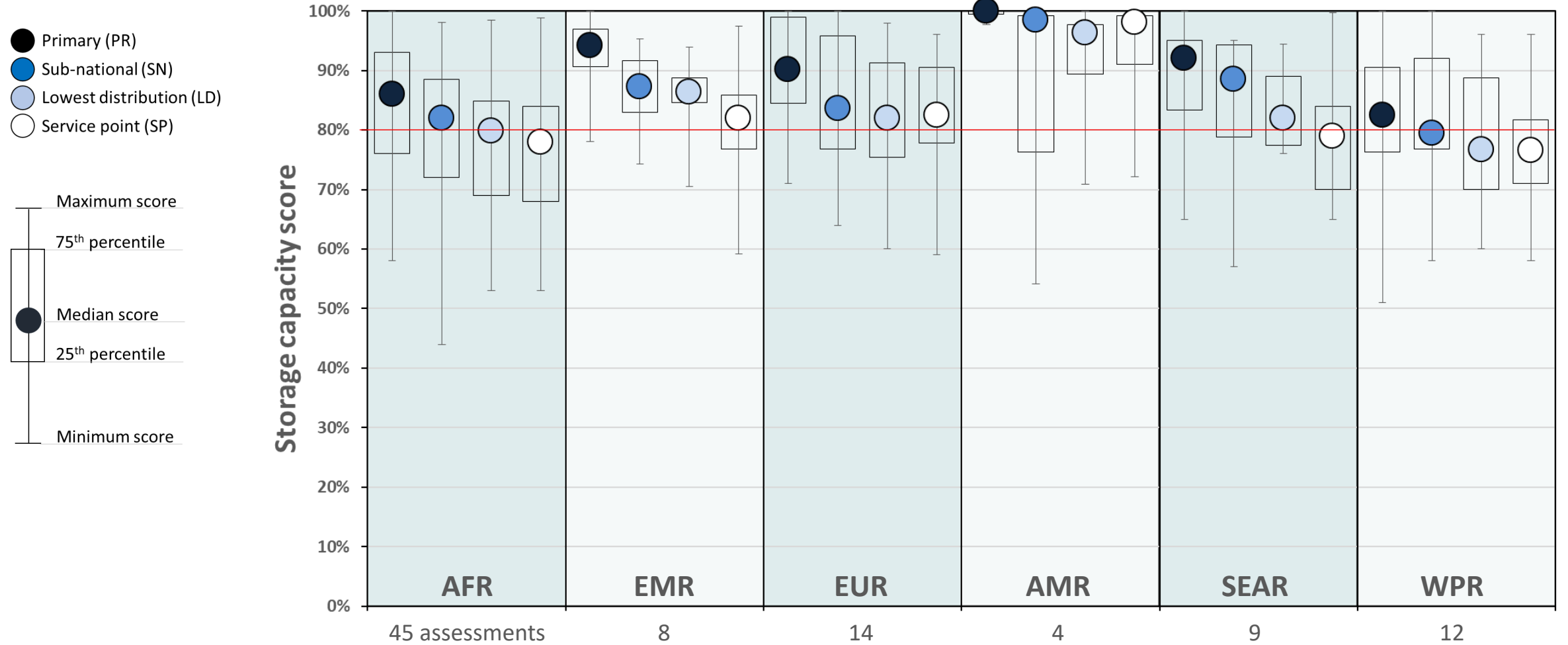
# E2 Temperature Monitoring (2009-2020)

- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



- Apart from in EUR and AMR, few countries meet the EVM standard for temperature monitoring, at any level.
- In EUR, more than 50% of the countries assessed meet the standard at LD and SP levels.
- In AMR, more than 50% of the countries assessed meet the standard at all levels.

# E3 Storage and transport capacity (2009-2020)

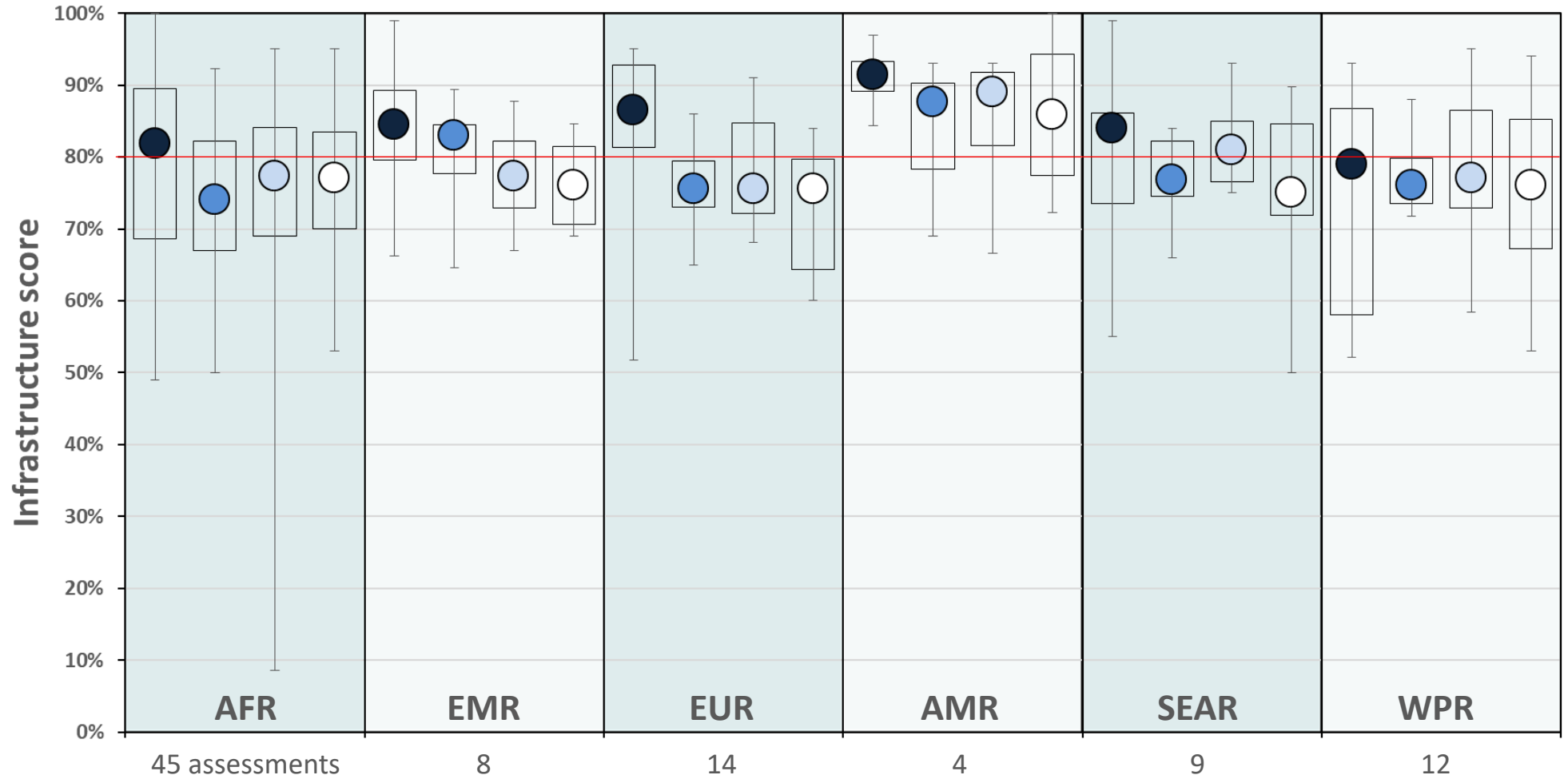
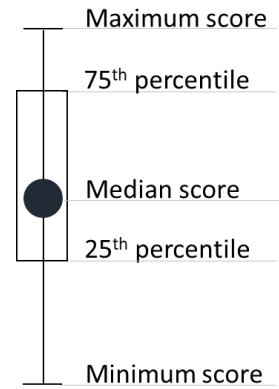


□ The median scores decrease from PR to SP in all regions.

□ The median scores are above 80% at each supply chain level in all regions except at SP levels in AFR and WPR, and at LD in WPR.

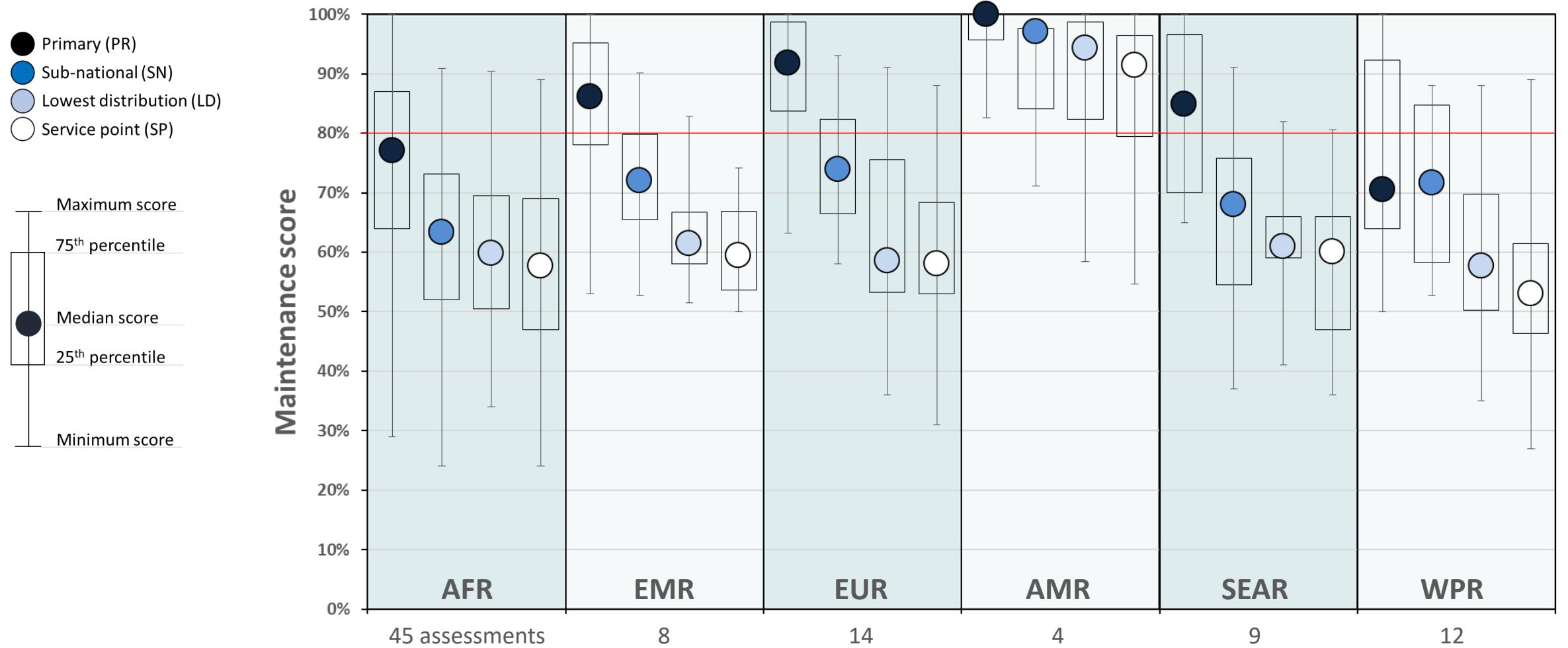
# E4 Infrastructure (2009-2020)

- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



There is relatively little variation in E4 scores across regions and supply chain levels – the median score is consistently close to 80%.

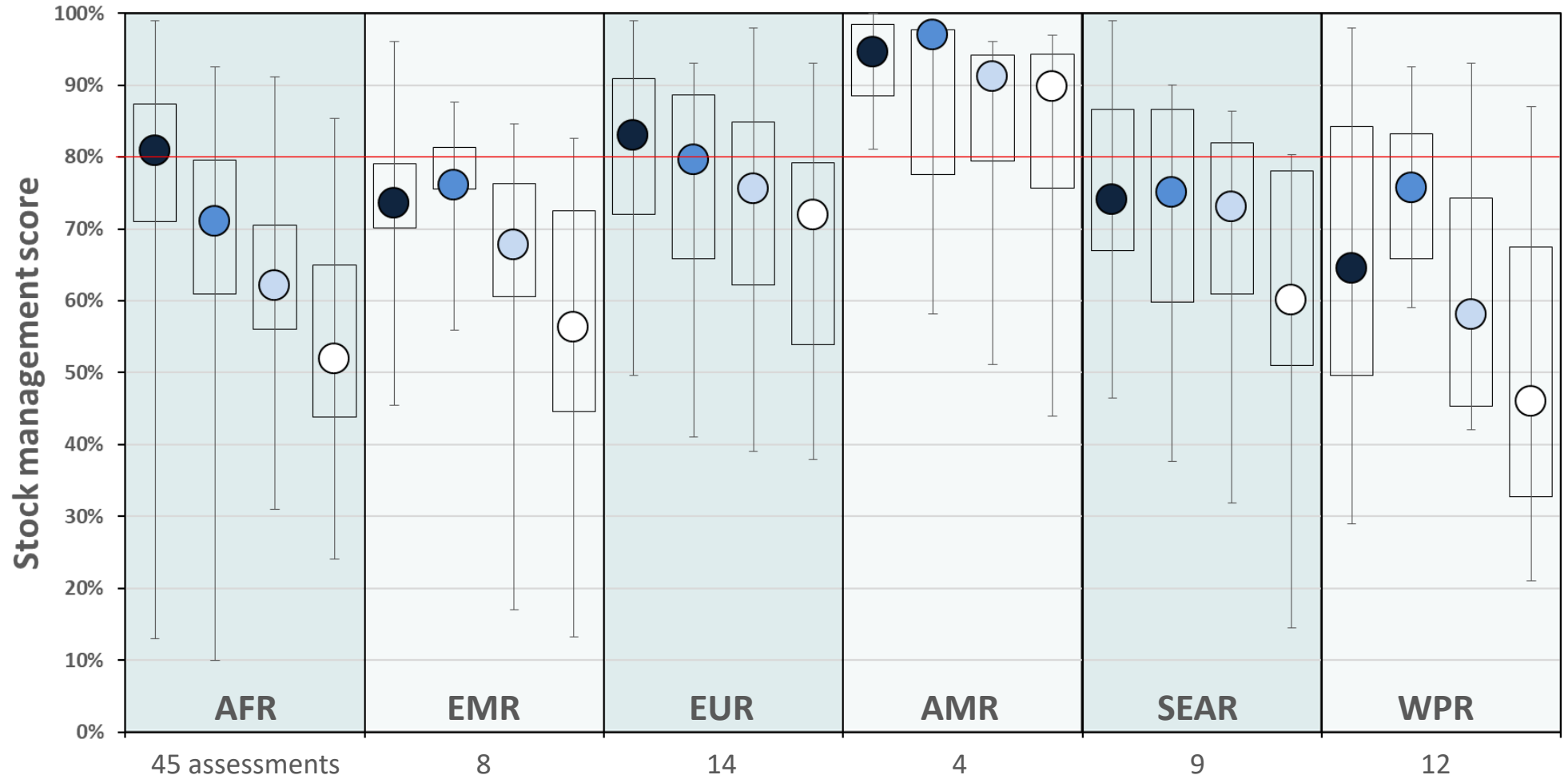
# E5 Preventive maintenance (2009-2020)



- ❑ The median E5 score decreases from PR to SP in all regions.
- ❑ The median E5 score at PR level is above 80% in all regions except WPR.
- ❑ The median E5 scores at SN, LD & SP are below 80% in all regions except AMR which performs well at all levels.

# E6 Stock management (2009-2020)

- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)

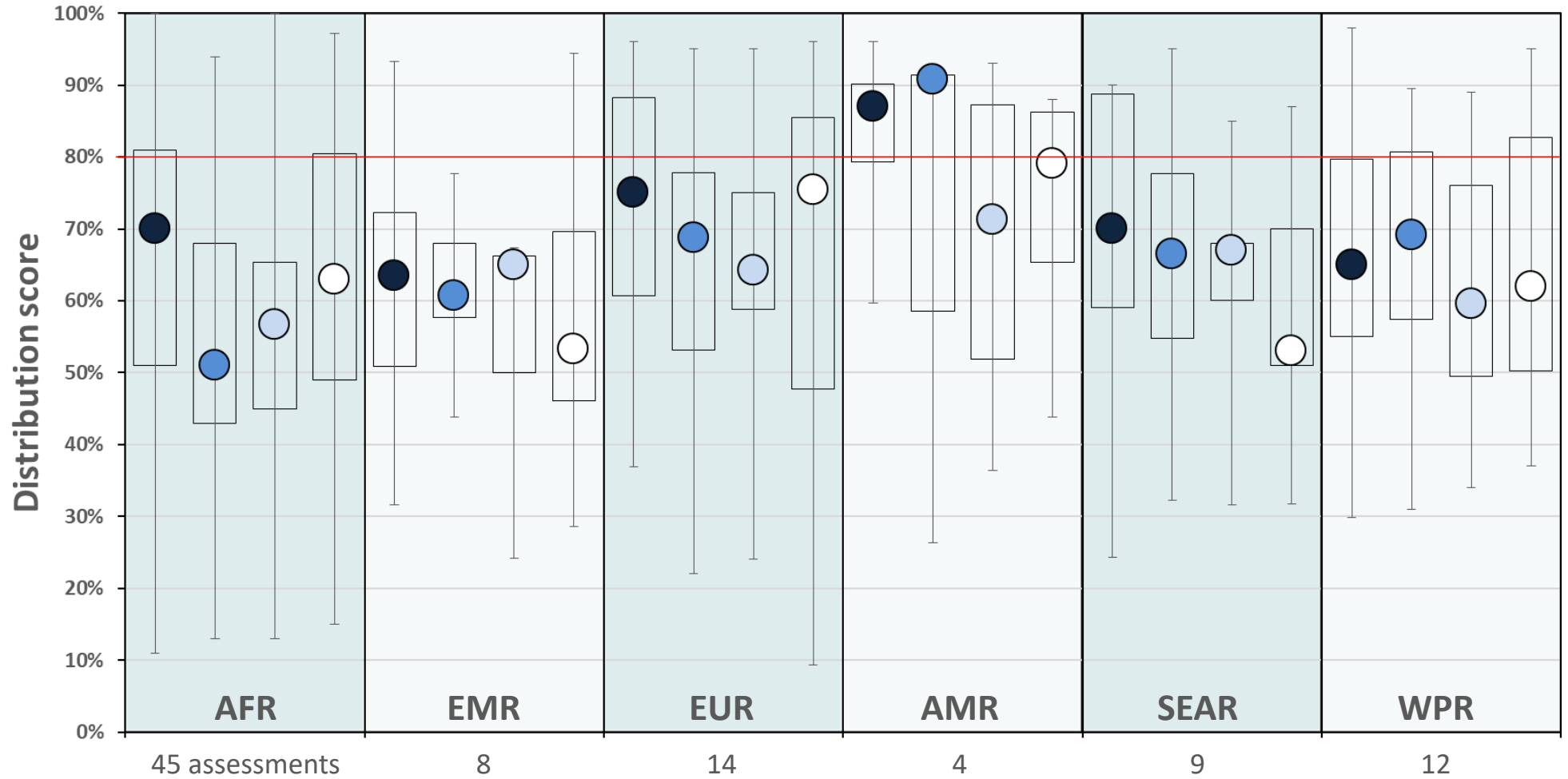
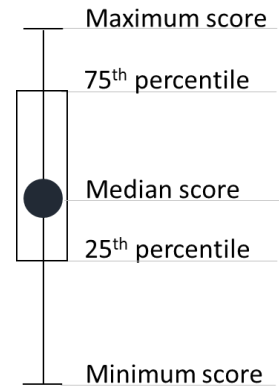


□ The median E6 score decreases from PR to SP in all regions.

□ The median scores are below 80% at all levels in all regions except at PR level in AFR and EUR, and all levels in AMR.

# E7 Vaccine distribution (2009-2020)

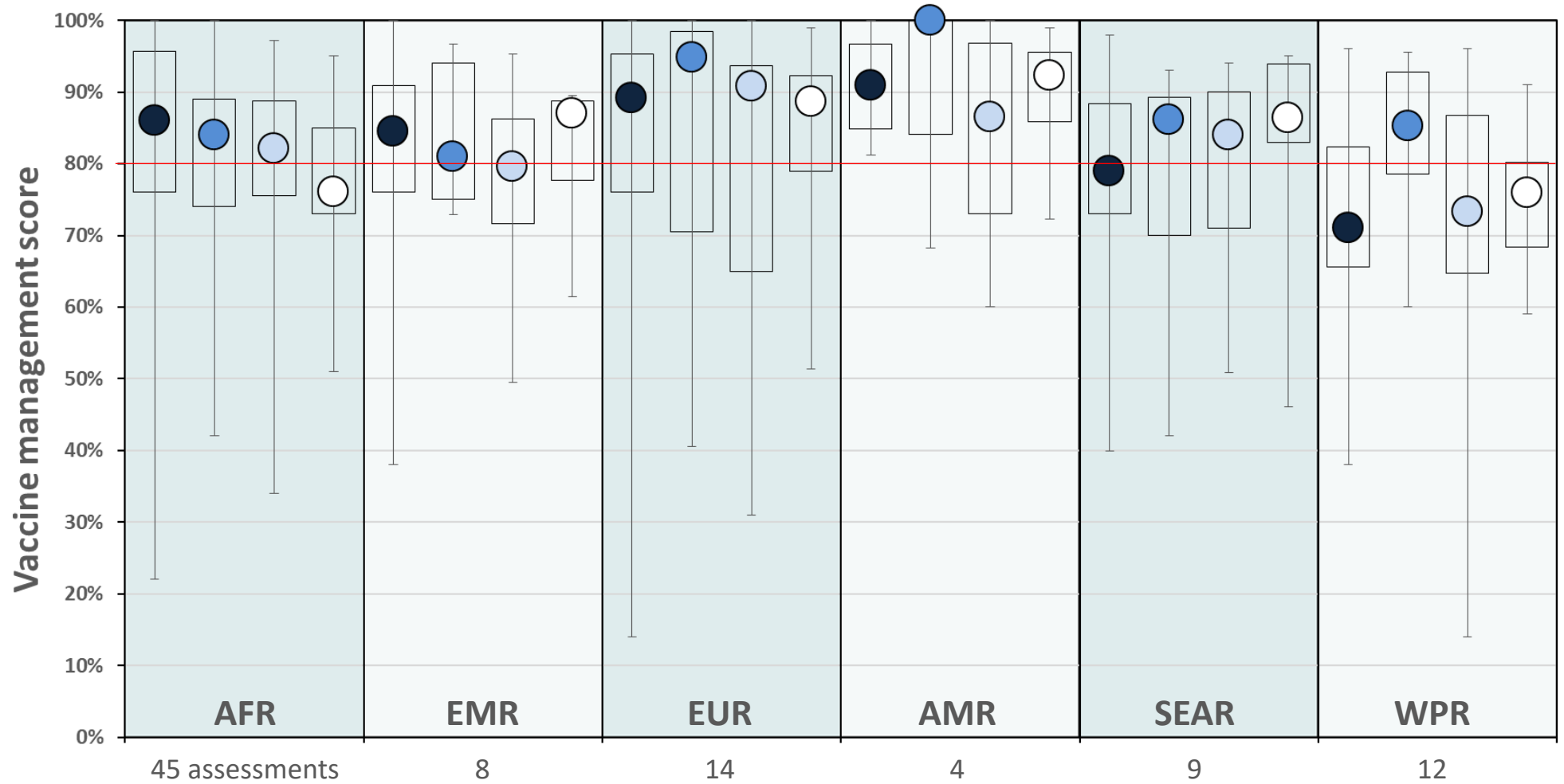
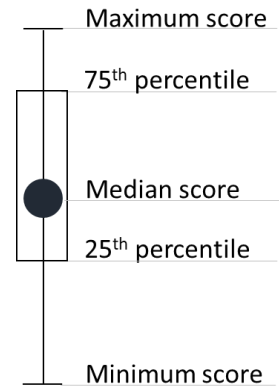
- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



- There is a broad range of scores at all levels in all regions.
- The median E7 scores are below 80% at all levels in all regions except at PR and SN in AMR.

# E8 Vaccine management (2009-2020)

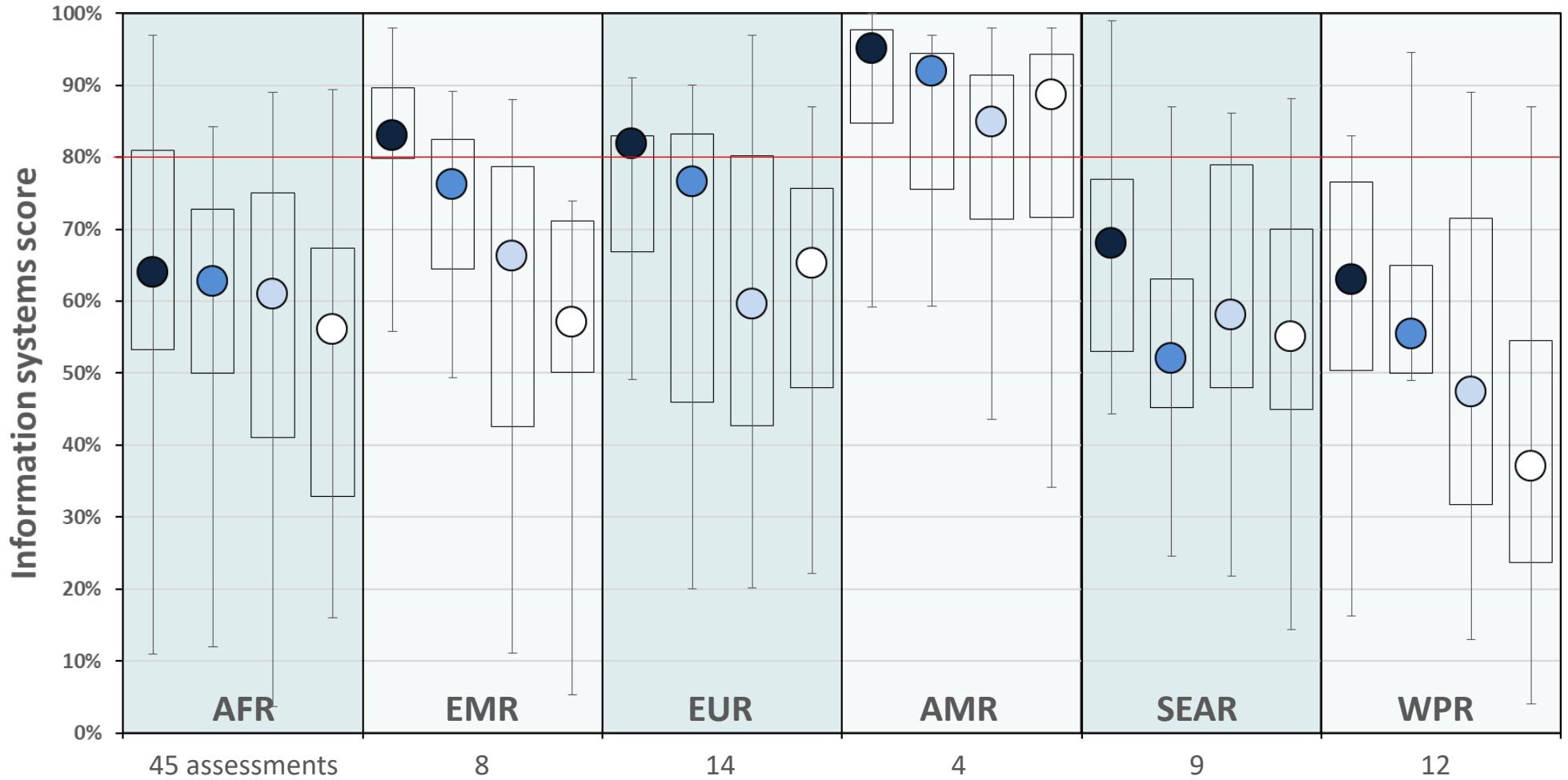
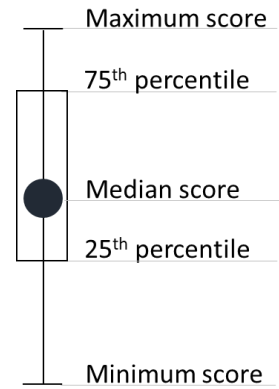
- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



□ The median E8 scores are above 80% at all levels in all regions except at SP in AFR and at most levels in WPR.

# E9 Information systems (2009-2020)

- Primary (PR)
- Sub-national (SN)
- Lowest distribution (LD)
- Service point (SP)



- The median E9 scores decrease from PR to SP in each region.
- The median E9 score is below 80% at all levels in all regions except at PR in EMR and at all levels in AMR.



# Selected Indicator Scores

Most recent country assessments only

**2009-2020**

Update: WHO EVM1 database, July 2021

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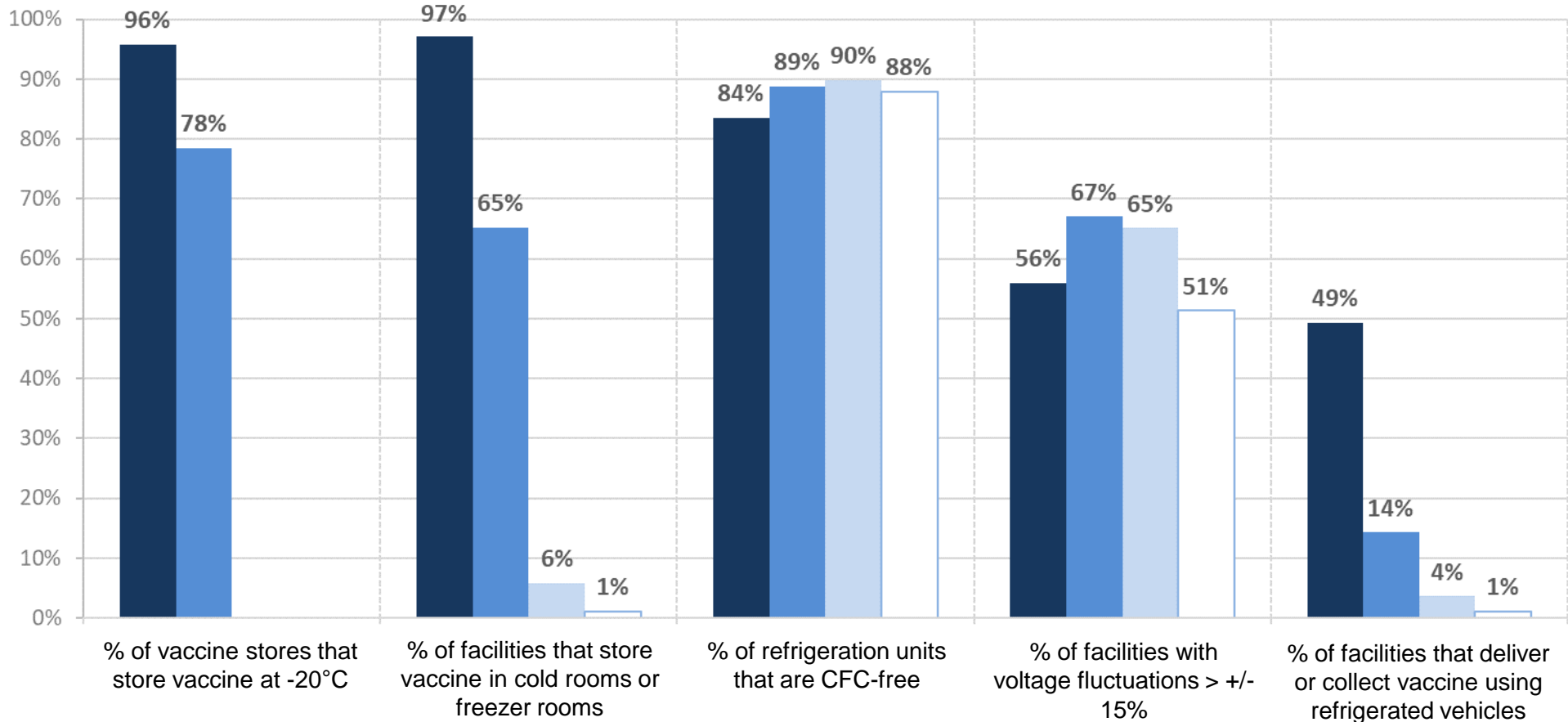


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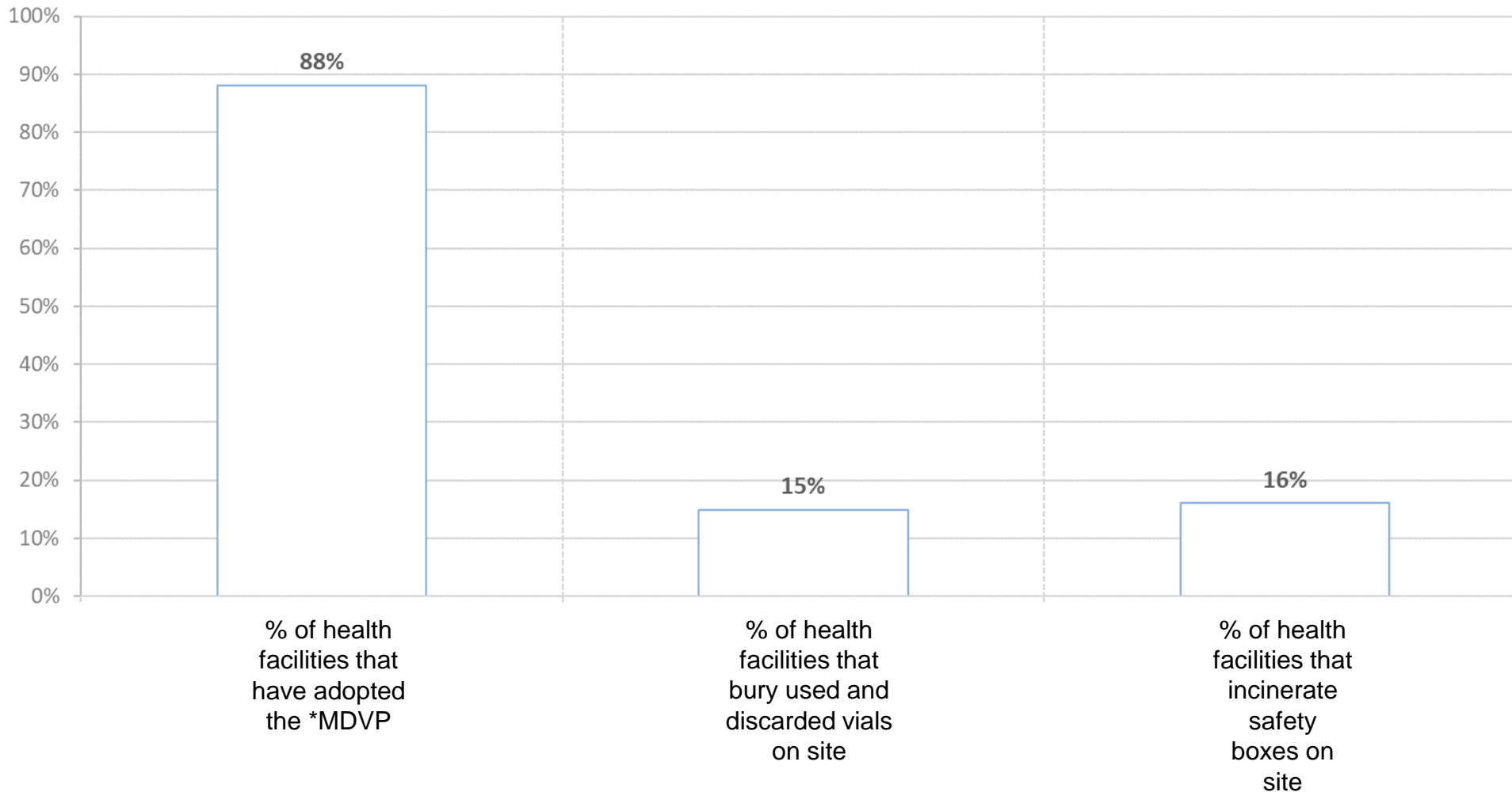
## Explanatory note:

- ❑ There are ~400 indicators at PR level, 300 at SN, 200 at LD and 150 at SP.
- ❑ Some indicators assess availability of required inputs (Eg. % of cold rooms with continuous temperature monitoring).
- ❑ Some indicators measure outputs (Eg. % of facilities with accurate stock records).
- ❑ Some indicators describe the context (Eg. % of stores that store vaccine at -20°C).
  - Such “context” indicators are not scored, but are used to customize the questionnaire – they turn OFF non-applicable indicators.
- ❑ The following slides present global results for selected indicators.
  - The first 3 slides show results for selected “context” indicators.
  - The remaining slides present results for selected scoring indicators.
- ❑ The scoring indicators are grouped into 3 categories:
  - **Availability:** those indicators likely to have a direct impact on the availability of vaccine at the service delivery level.
  - **Quality:** those indicators likely to have a direct impact on the quality (potency) of vaccine at the service delivery level.
  - **Efficiency:** those indicators likely to have an impact on the operational cost of the immunization supply chain.
- ❑ Indicator data exist for 86 countries:
  - 144 primary stores
  - 970 sub-national stores
  - 1974 lowest distribution stores
  - 2678 immunization service facilities.



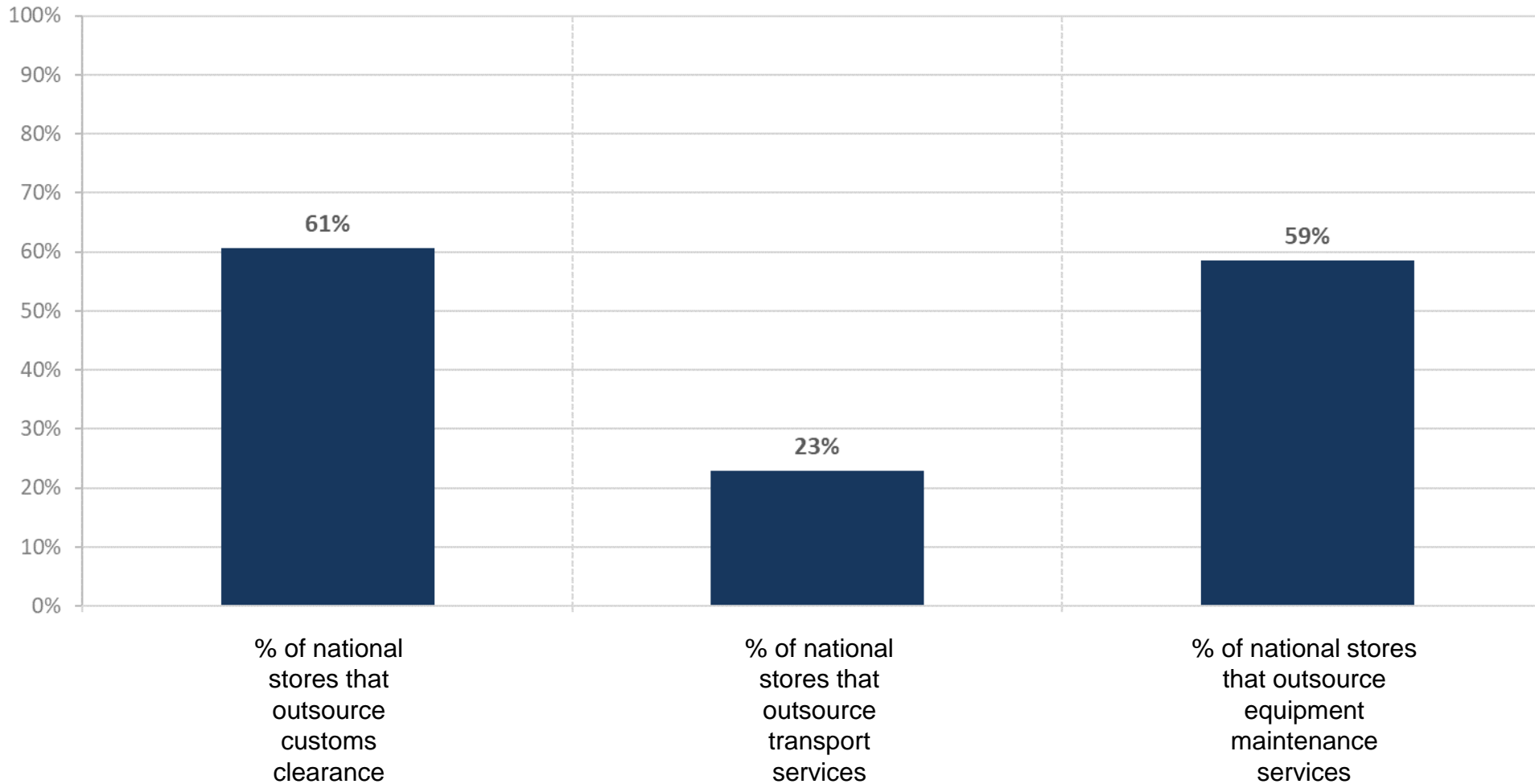
## Key observations:

- Refrigerated vehicles are used to transport vaccines from the national store in about 50% of countries.
- More than 50% of countries experience significant voltage fluctuations.
- About 90% of refrigerators are CFC-free.



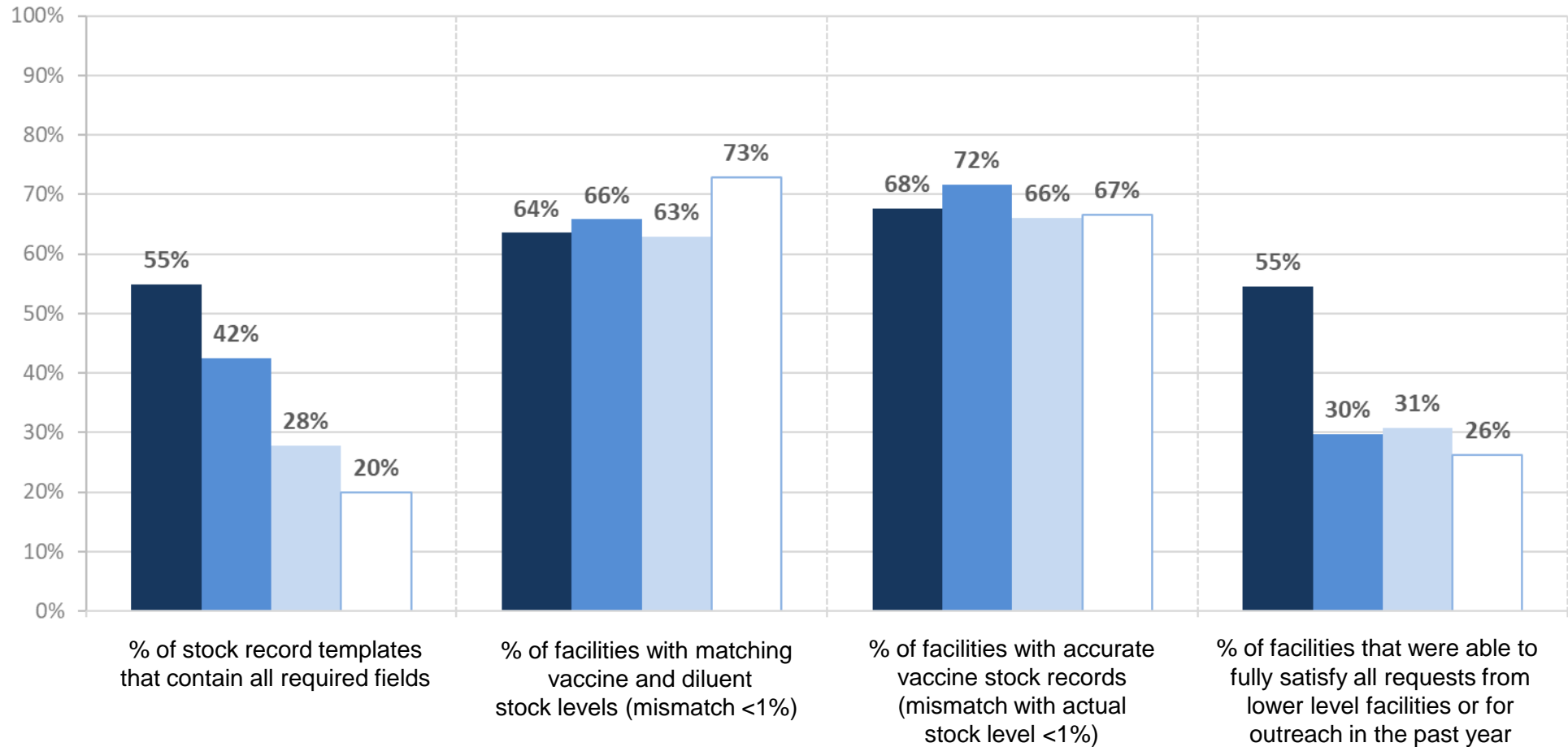
## Key observations:

- The multi dose vial policy has been implemented in almost 90% of health facilities.



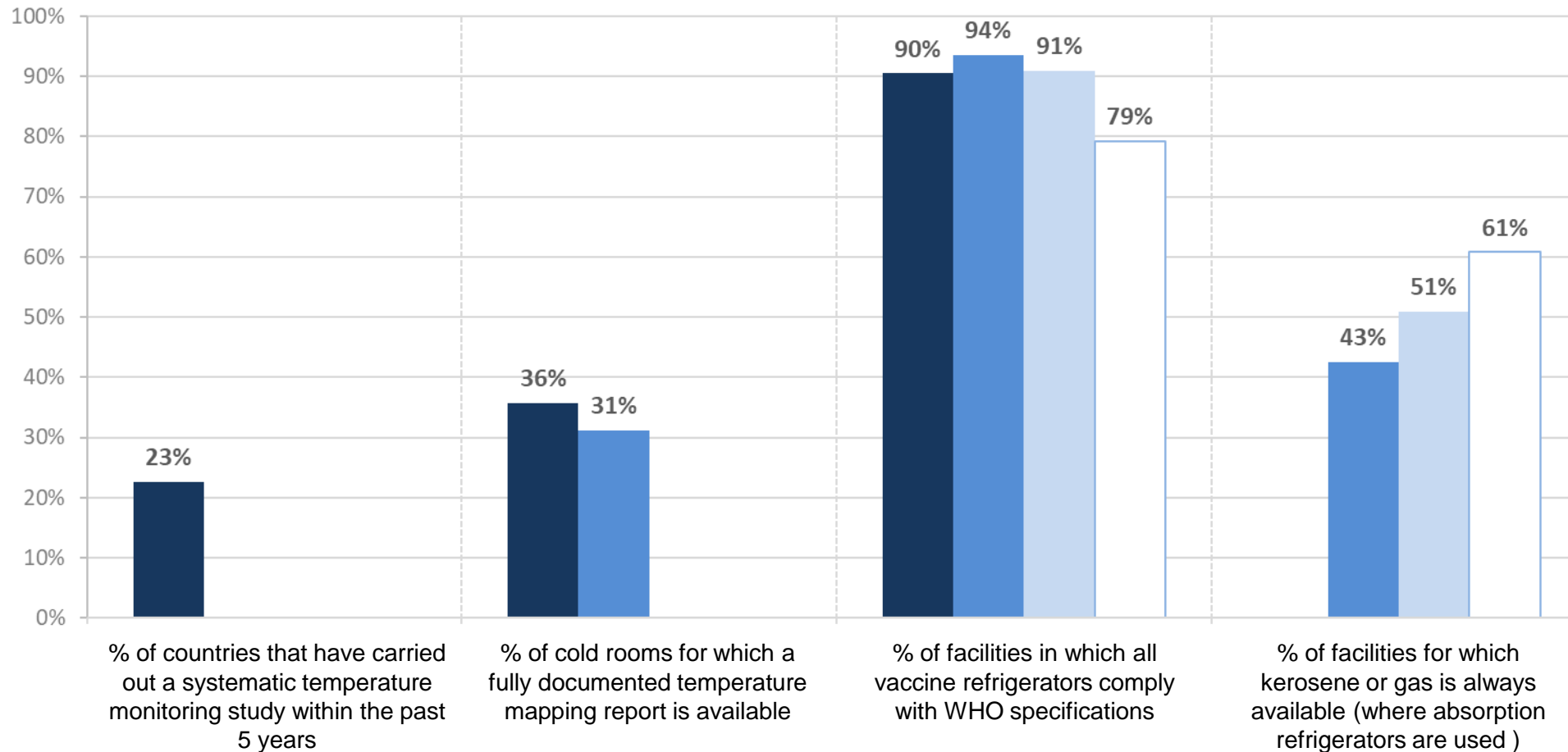
## Key observations:

- ❑ Many countries outsource services such as customs clearance and equipment maintenance.



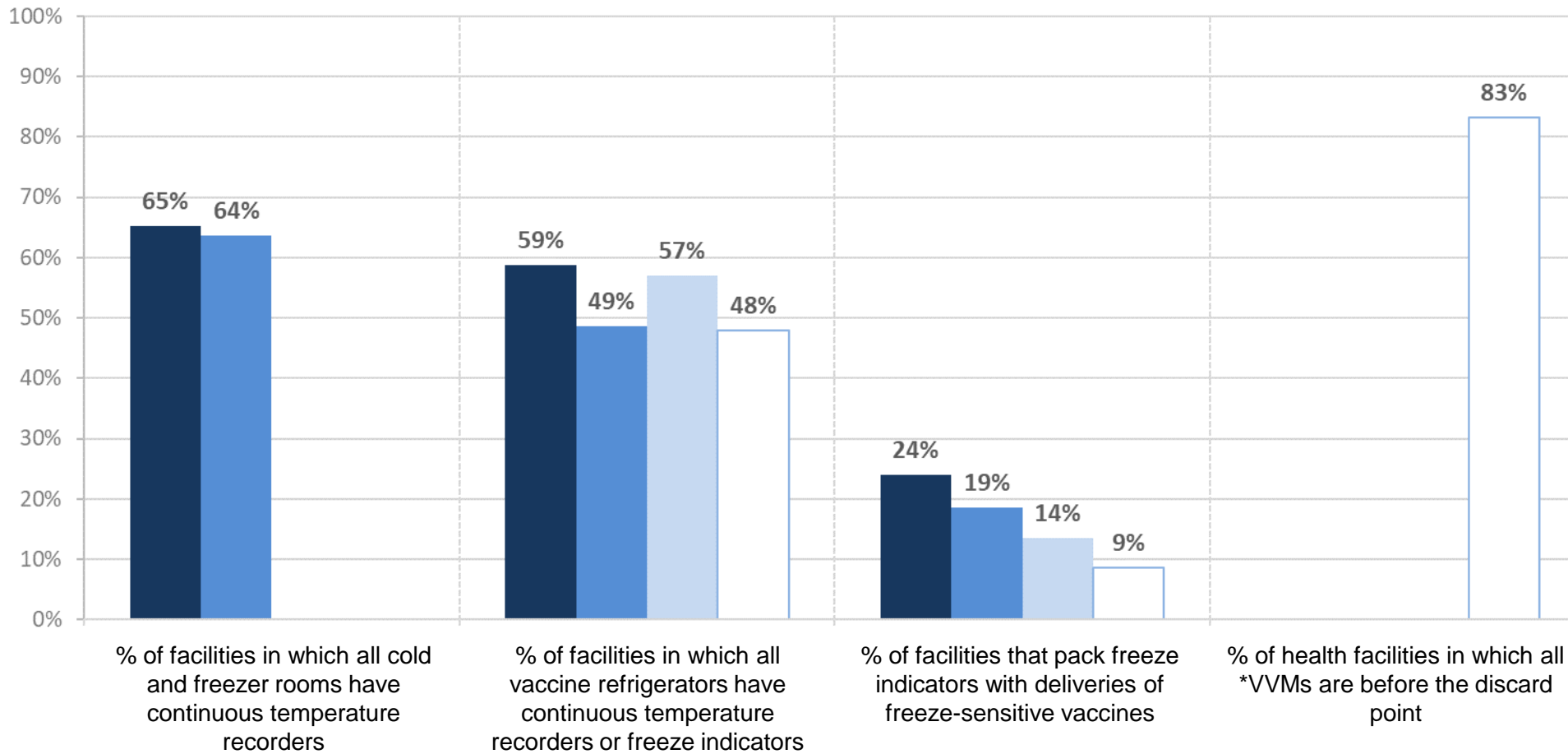
## Key observations:

- Most of the stock record templates in use do not contain all of the recommended fields.
- A third of stores and facilities at each level of the supply chain have inaccurate stock records.
- Vaccine and diluent stock levels match in about two thirds of stores and facilities.
- Most stores and facilities have been unable to meet demand on at least one occasion in the year preceding assessment.



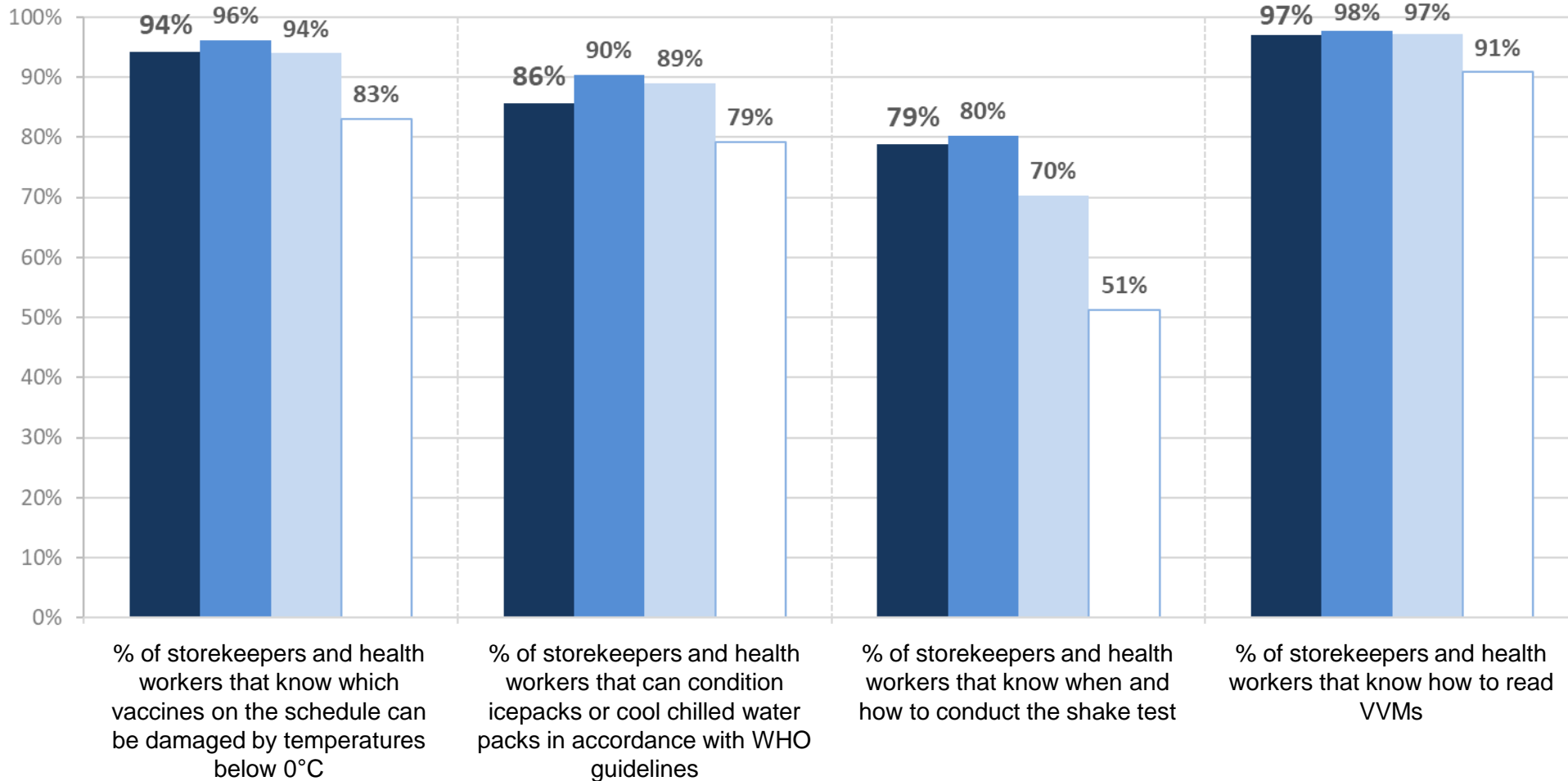
## Key observations:

- Only a quarter of countries have conducted a temperature monitoring study in the past 5 years.
- Only about 20% of cold rooms have been temperature mapped.
- On the plus side, almost all vaccine refrigerators comply with WHO specifications.



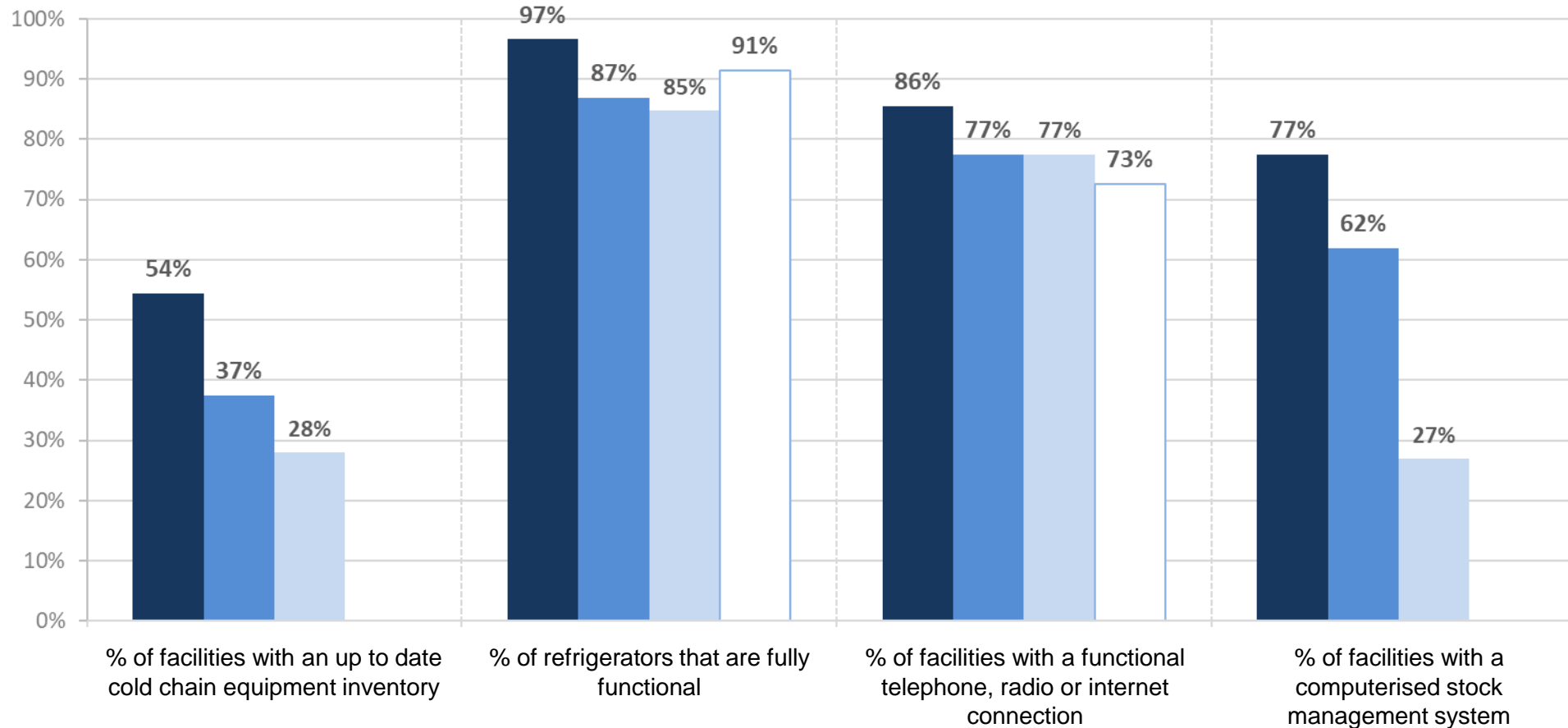
## Key observations:

- A third of all cold rooms and refrigerators do not have the recommended temperature monitoring equipment.
- Very few stores or facilities monitor the exposure to freezing temperatures during transport in passive containers with conditioned ice-packs.



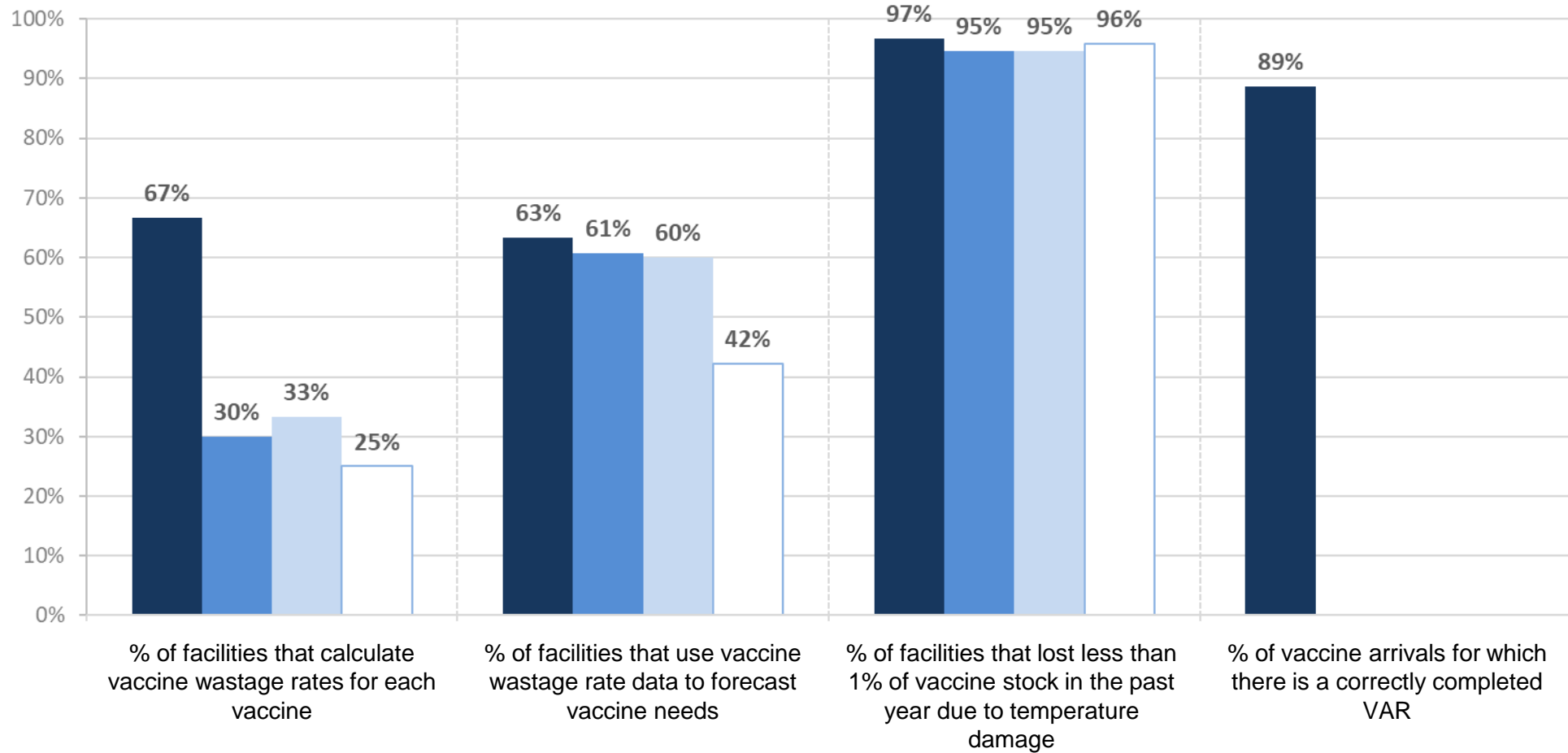
## Key observations:

- ❑ There is a high level (~90%) of health worker and store manager knowledge and understanding of:
  - vaccine temperature sensitivities
  - recommended vaccine storage temperatures
  - use of VVMs
- ❑ The shake test is however not well understood by many, especially by health workers at the service delivery level (40%).



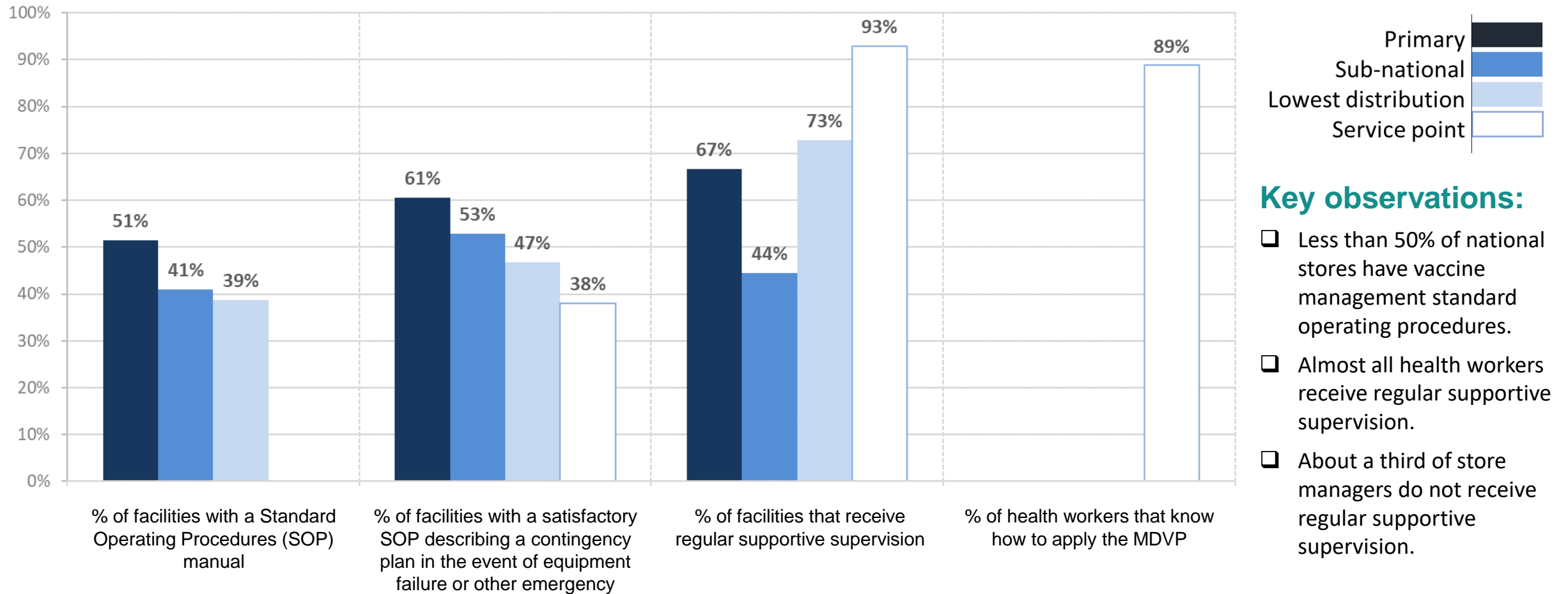
## Key observations:

- ❑ Most countries do not have an up-to-date cold chain equipment inventory.
- ❑ About 25% and 40% of national and sub-national stores respectively still use paper-based stock management systems.



## Key observations:

- ❑ More than a half of vaccine storage facilities do not monitor vaccine wastage.
- ❑ One in 20 stores and facilities have lost vaccine in the past 12 months due to temperature damage.



## Key observations:

- Less than 50% of national stores have vaccine management standard operating procedures.
- Almost all health workers receive regular supportive supervision.
- About a third of store managers do not receive regular supportive supervision.



# Criterion Scores

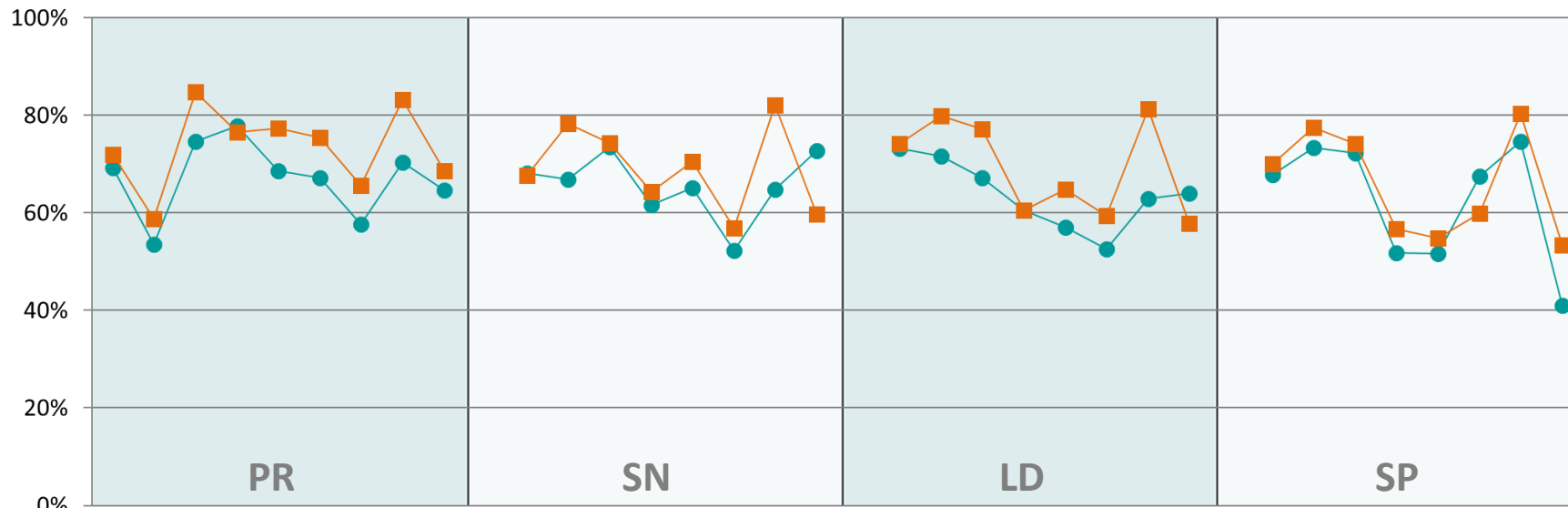
1<sup>st</sup> assessment versus  
last assessment (44 countries)

**2009-2020**

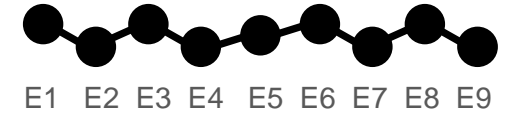
Update: WHO EVM1 database, July 2021

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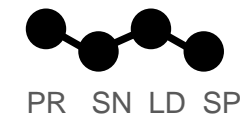
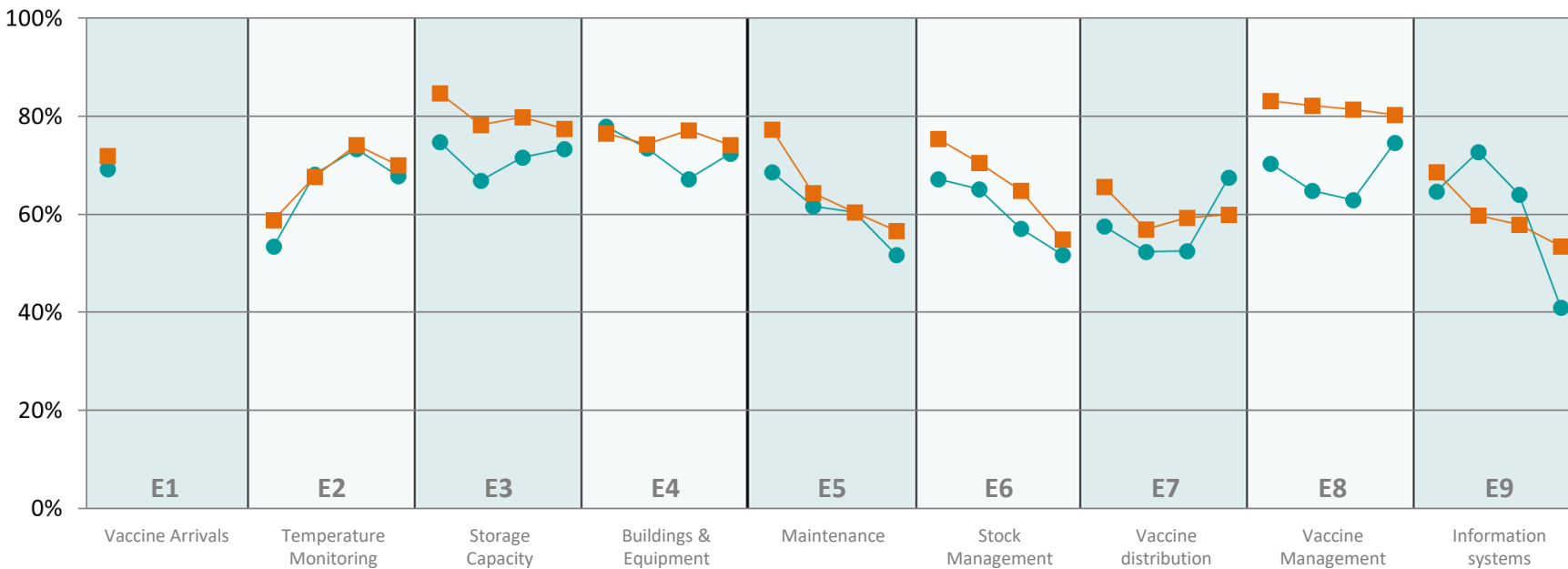
# Mean criterion scores (64 countries)



● 1<sup>st</sup> Assessments  
 ■ Last Assessments



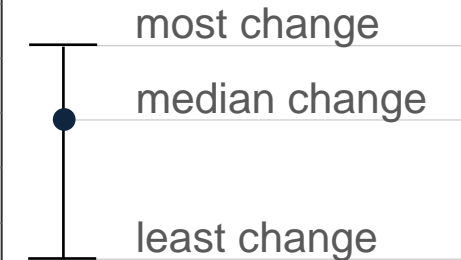
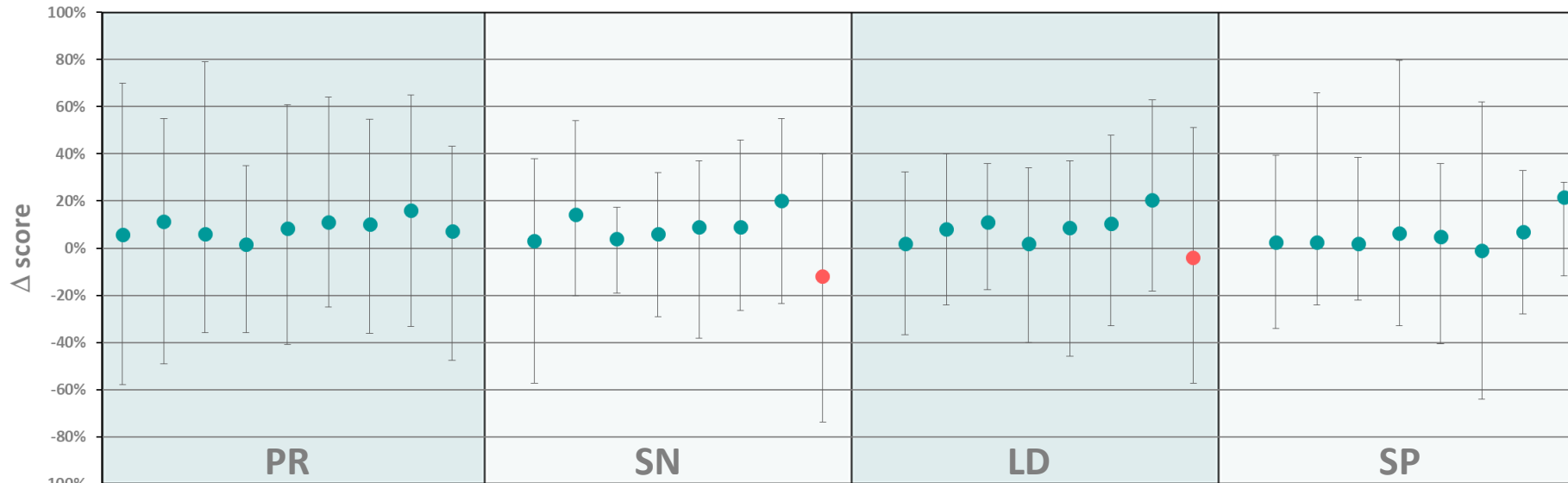
- Moderate improvement at PR, SN and LD levels.
- Little or no improvement at SP level.



- Significant improvement in E3 and E8.
- Moderate improvement in E1, E6 and E7.
- No improvement in E2 and E5.

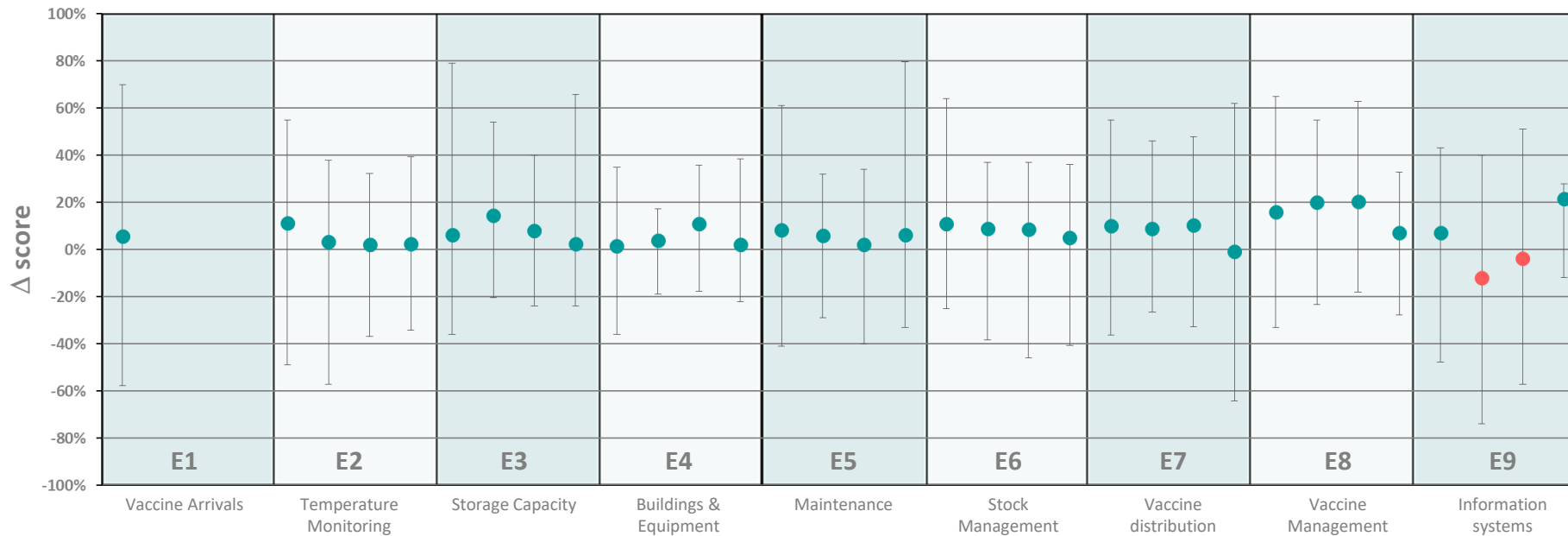
\*The E2 and E9 standards were set higher in 2012.

# Change in criterion scores (64 countries)



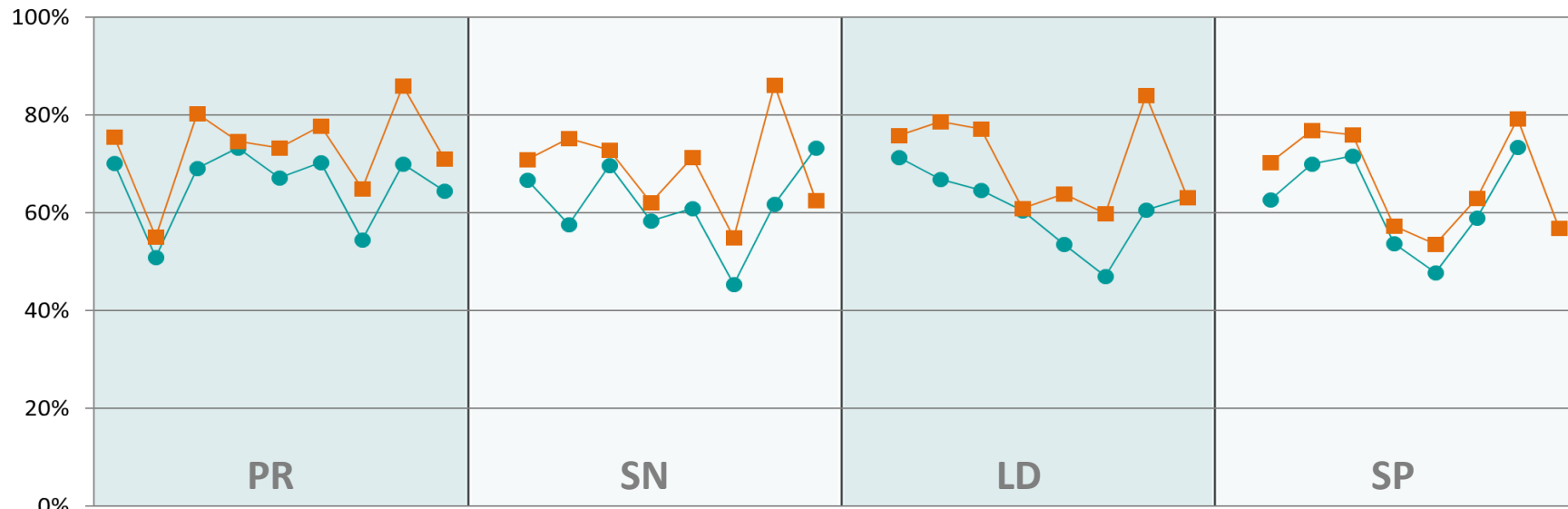
## Key observations:

- ❑ The median change is positive for all criteria at all levels, except for E9 at SN and LD.
- ❑ The median change across all countries, levels and criteria is +5% (percentage points).
- ❑ Most improvements are seen in E8 at PR, SN and LD (median change ~20%) .
- ❑ There is little or no progress at SP level in any criteria except E9.

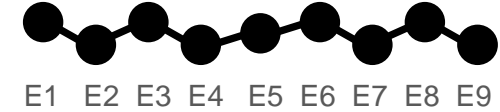


\*The E2 and E9 standards were set higher in 2012.

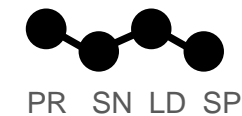
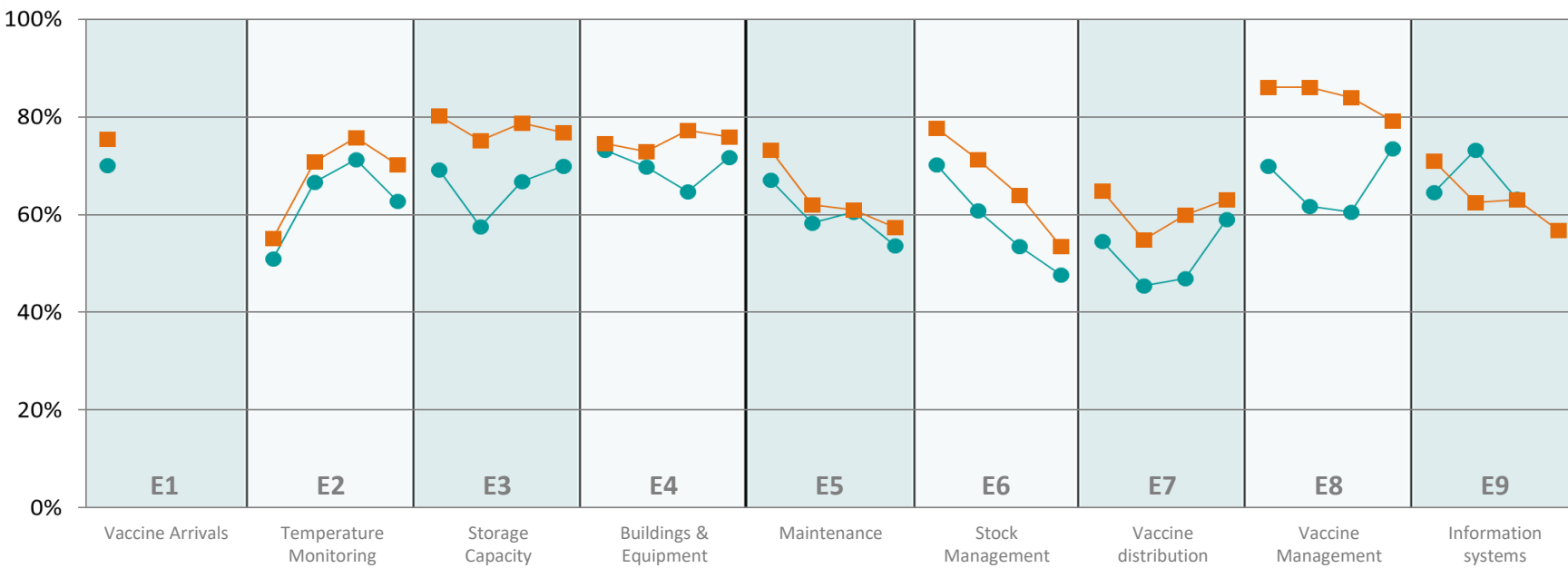
# AFR mean criterion scores (36 countries)



● 1<sup>st</sup> Assessments  
 ■ Last Assessments

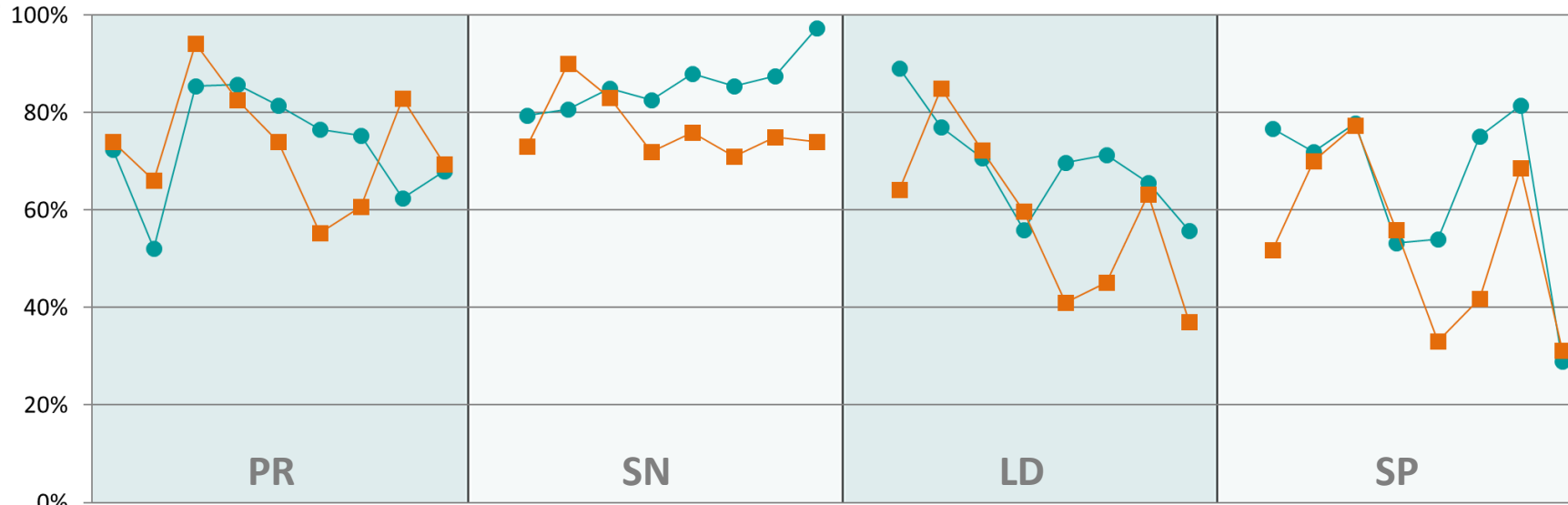


☐ Consistent improvement at all levels.

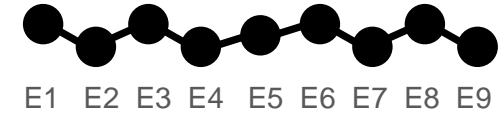


☐ Significant improvement in all criteria.

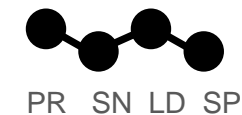
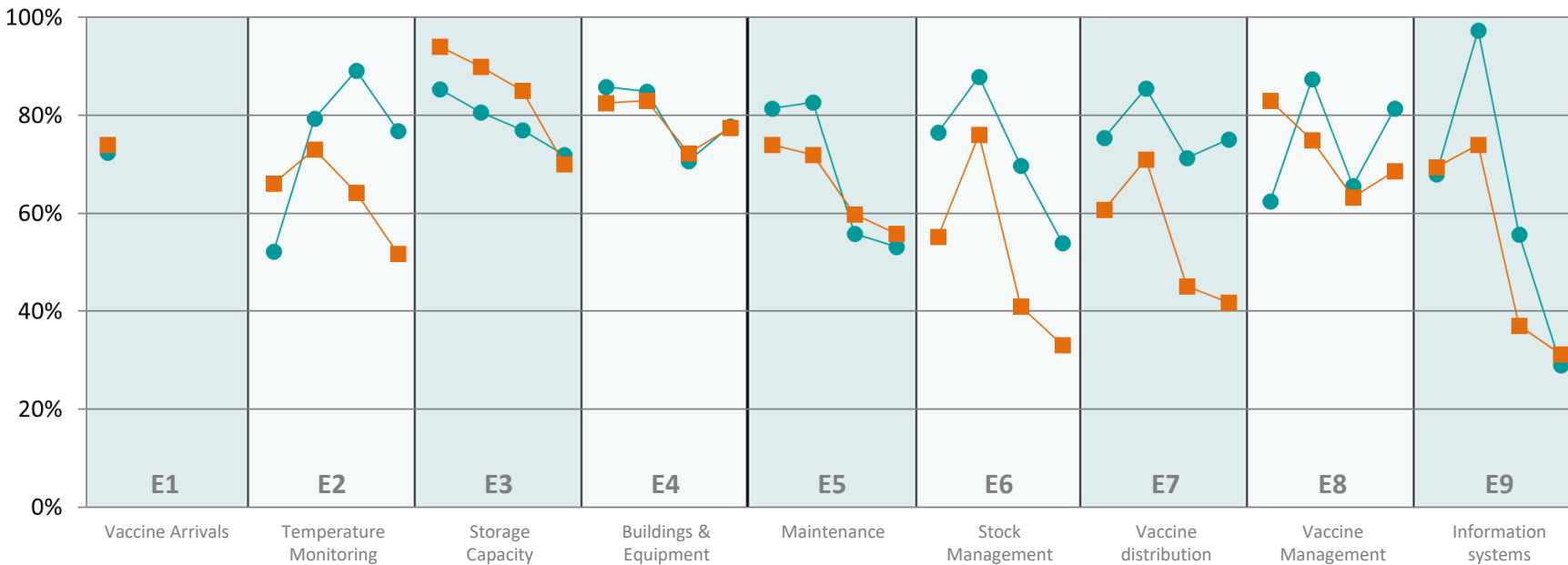
# EMR mean criterion scores (3 countries)



● 1<sup>st</sup> Assessments  
 ■ Last Assessments

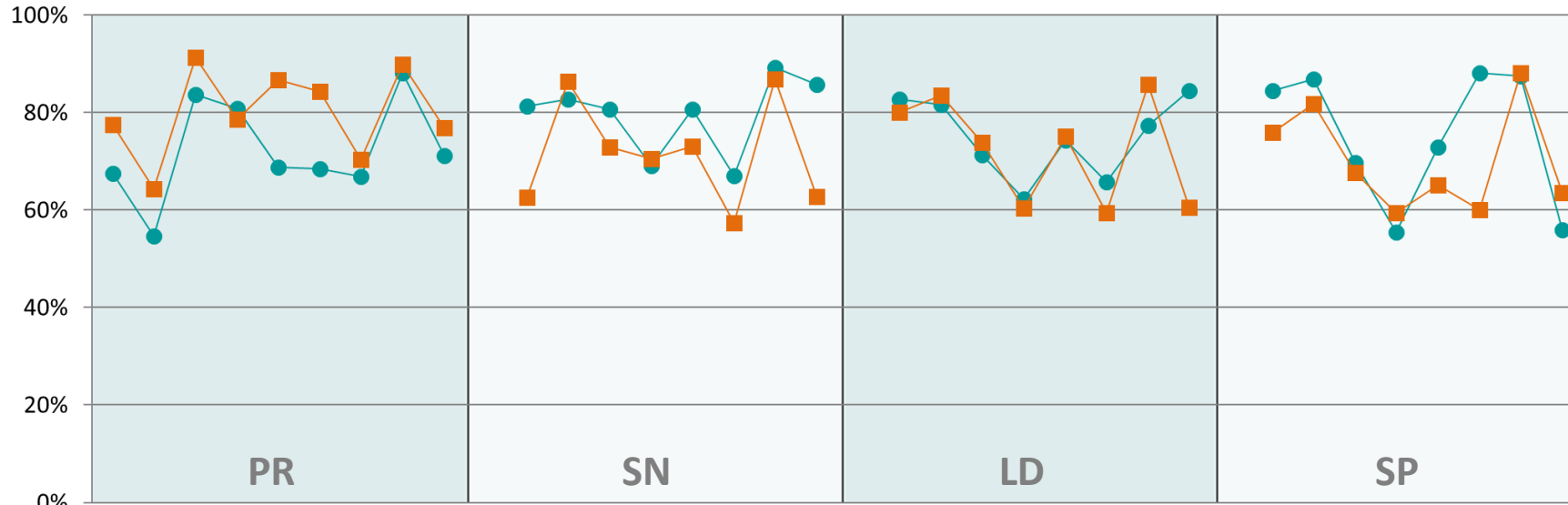


□ Deterioration across most criteria at SN level.

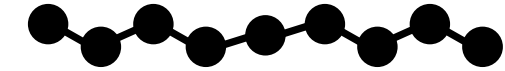


□ Improvement in E3 at PR, SN and LD.  
 □ Deterioration in E2, E6 and E7.

# EUR mean criterion scores (8 countries)

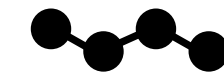
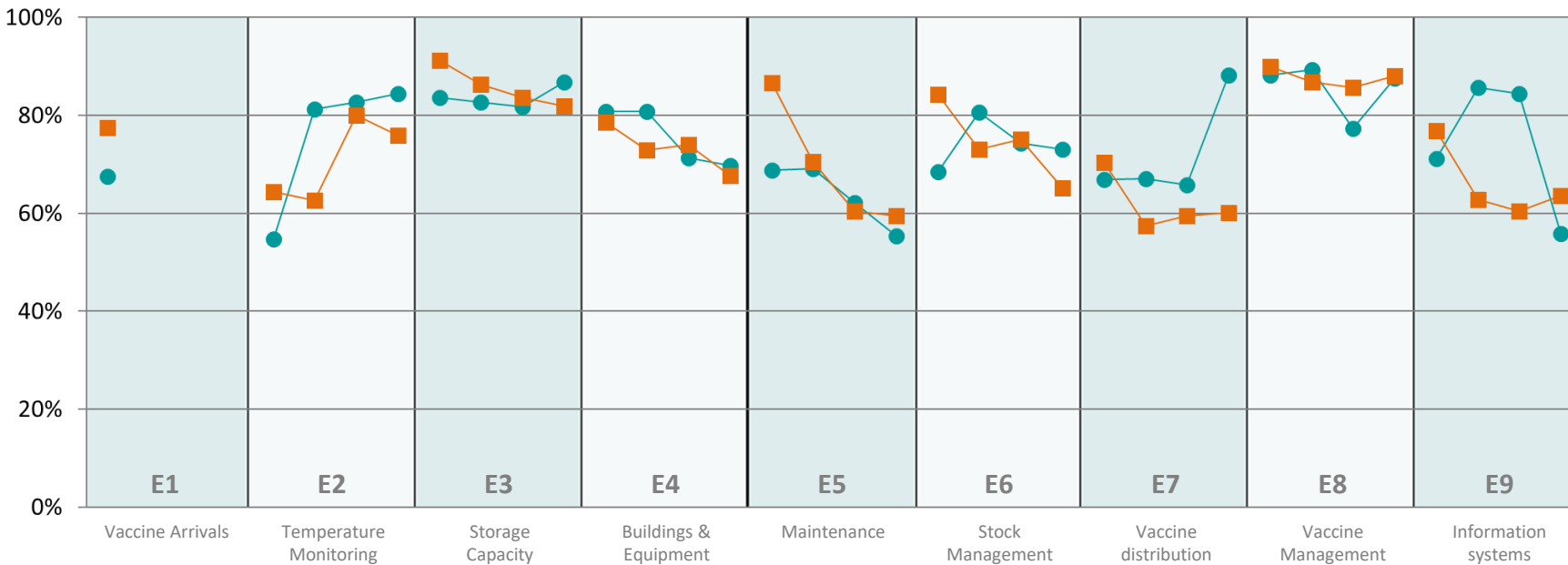


● 1<sup>st</sup> Assessments  
 ■ Last Assessments



E1 E2 E3 E4 E5 E6 E7 E8 E9

□ Little change at all levels.

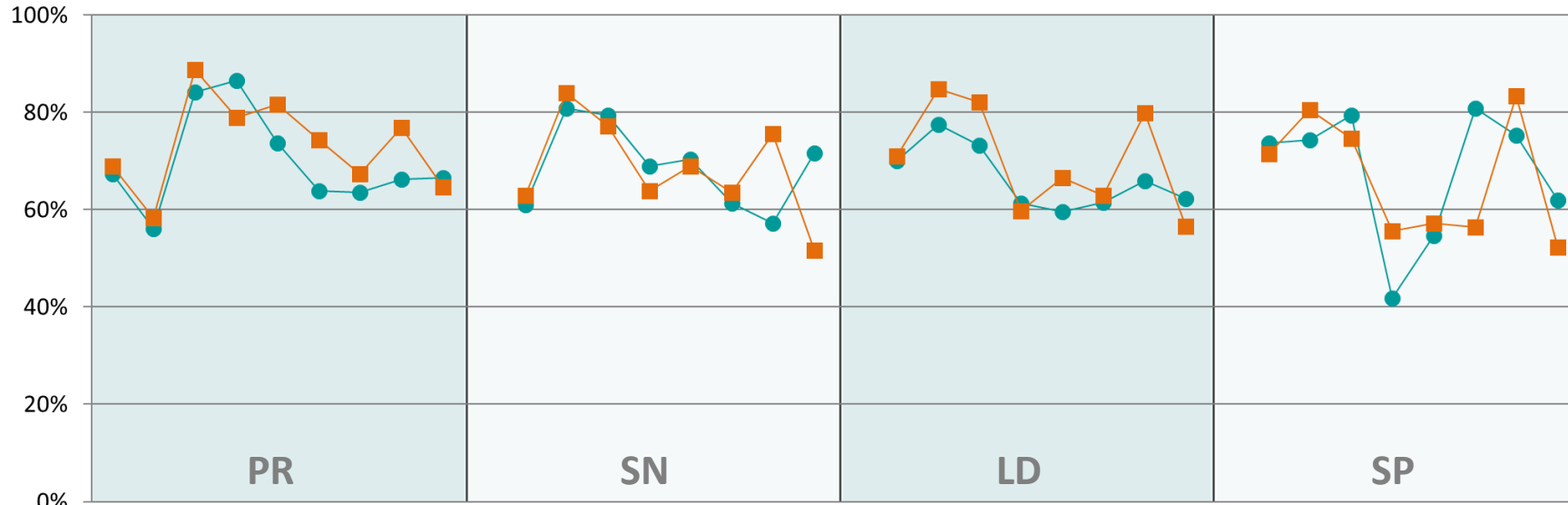


PR SN LD SP

□ Improvement in E1, E5 and E6 at PR.

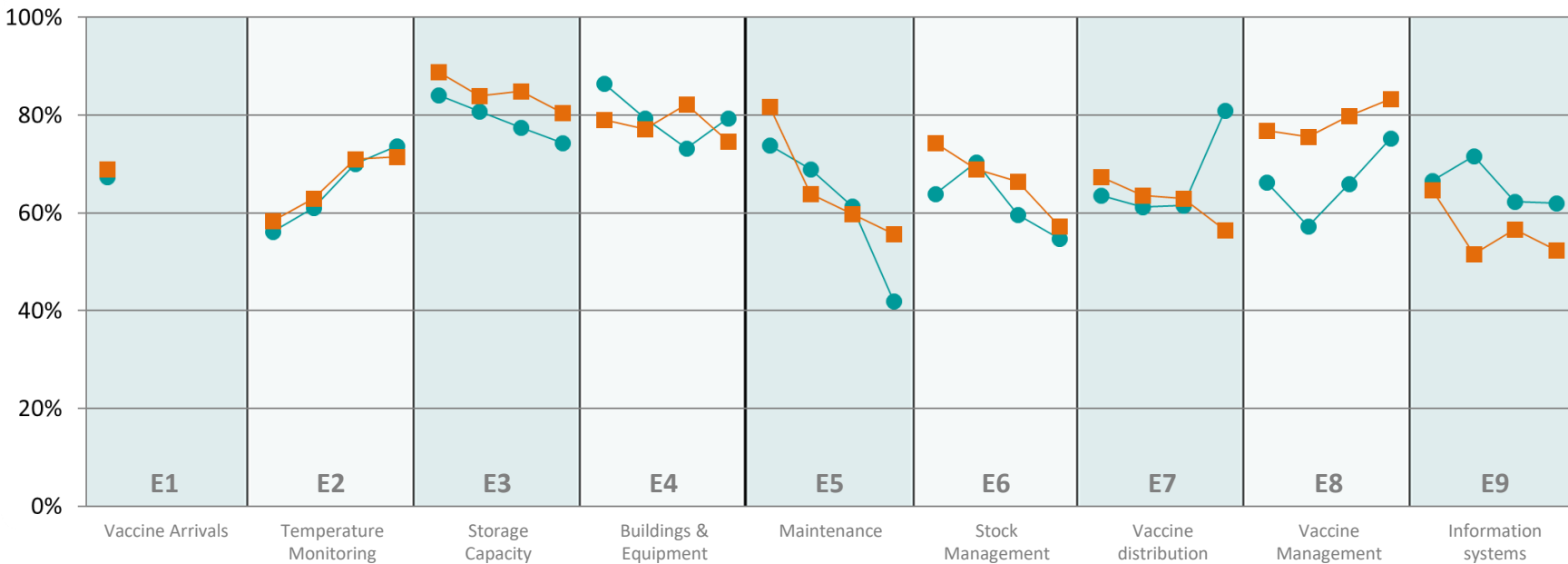
□ Deterioration in E7 at lower levels.

# SEAR mean criterion scores (9 countries)



● 1<sup>st</sup> Assessments  
 ■ Last Assessments

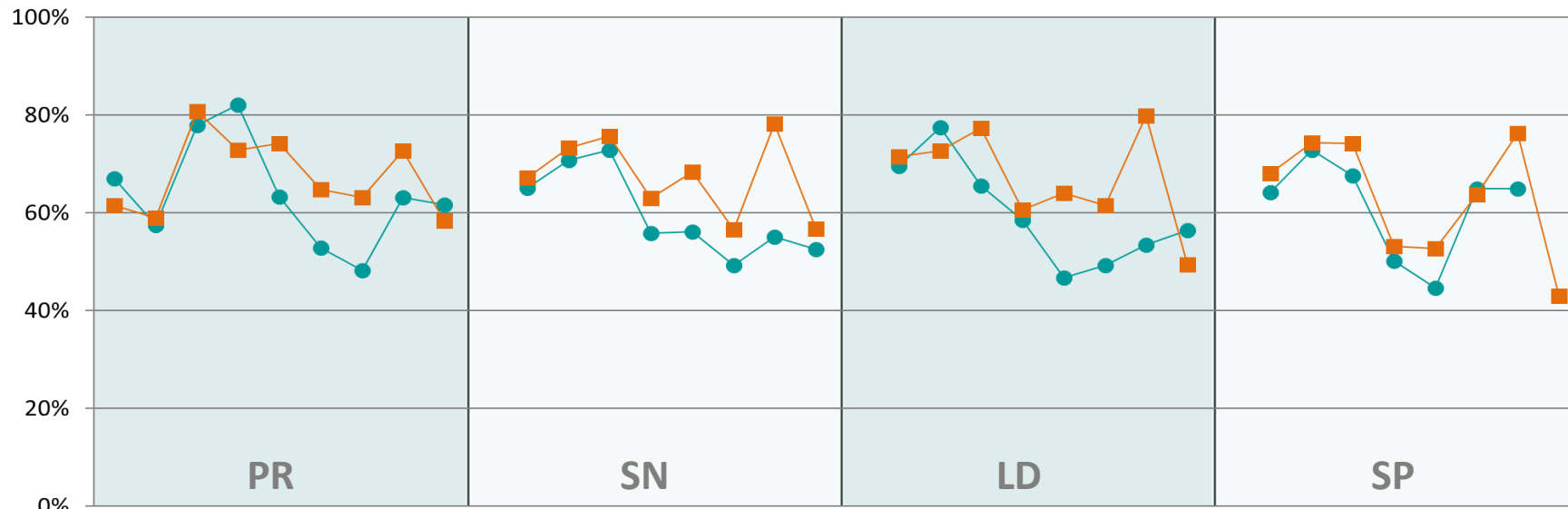
● E1 E2 E3 E4 E5 E6 E7 E8 E9  
 □ Little change at any level.



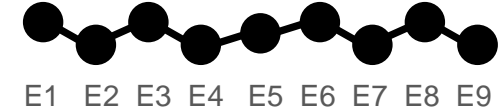
● PR SN LD SP

□ Improvement in E3 and E8 at all levels.  
 □ Deterioration in E9 at lower levels.

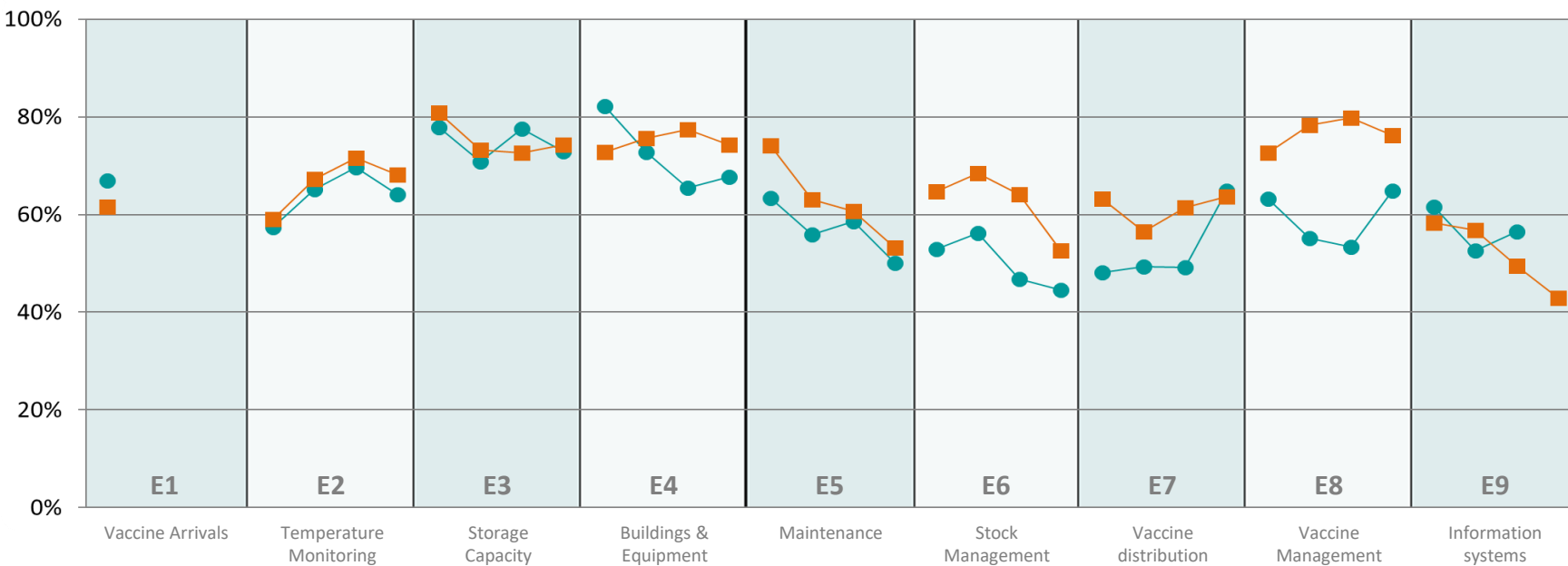
# WPR mean criterion scores (7 countries)



● 1<sup>st</sup> Assessments  
 ■ Last Assessments



□ Some improvement at all levels.



□ Significant improvement in E4, E5, E6, E7 and E8.



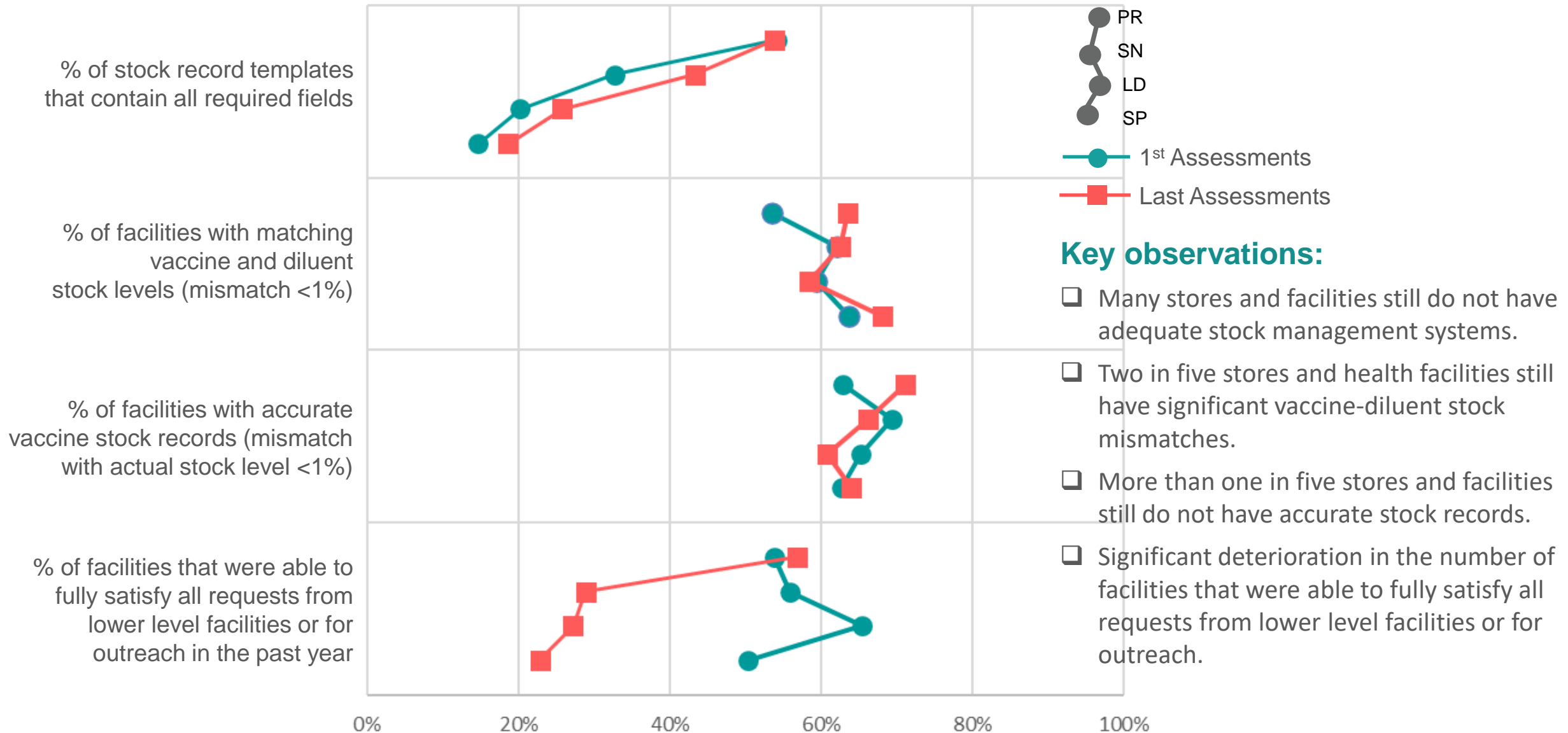
# Selected Indicator Scores

1<sup>st</sup> assessment versus  
last assessment (64 countries)

**2009-2020**

Update: WHO EVM1 database, July 2021

*EVM – setting a standard for the vaccine supply chain*



## Key observations:

- Many stores and facilities still do not have adequate stock management systems.
- Two in five stores and health facilities still have significant vaccine-diluent stock mismatches.
- More than one in five stores and facilities still do not have accurate stock records.
- Significant deterioration in the number of facilities that were able to fully satisfy all requests from lower level facilities or for outreach.

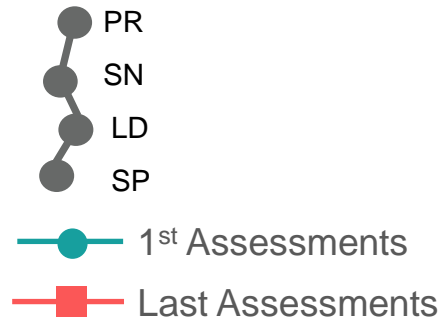
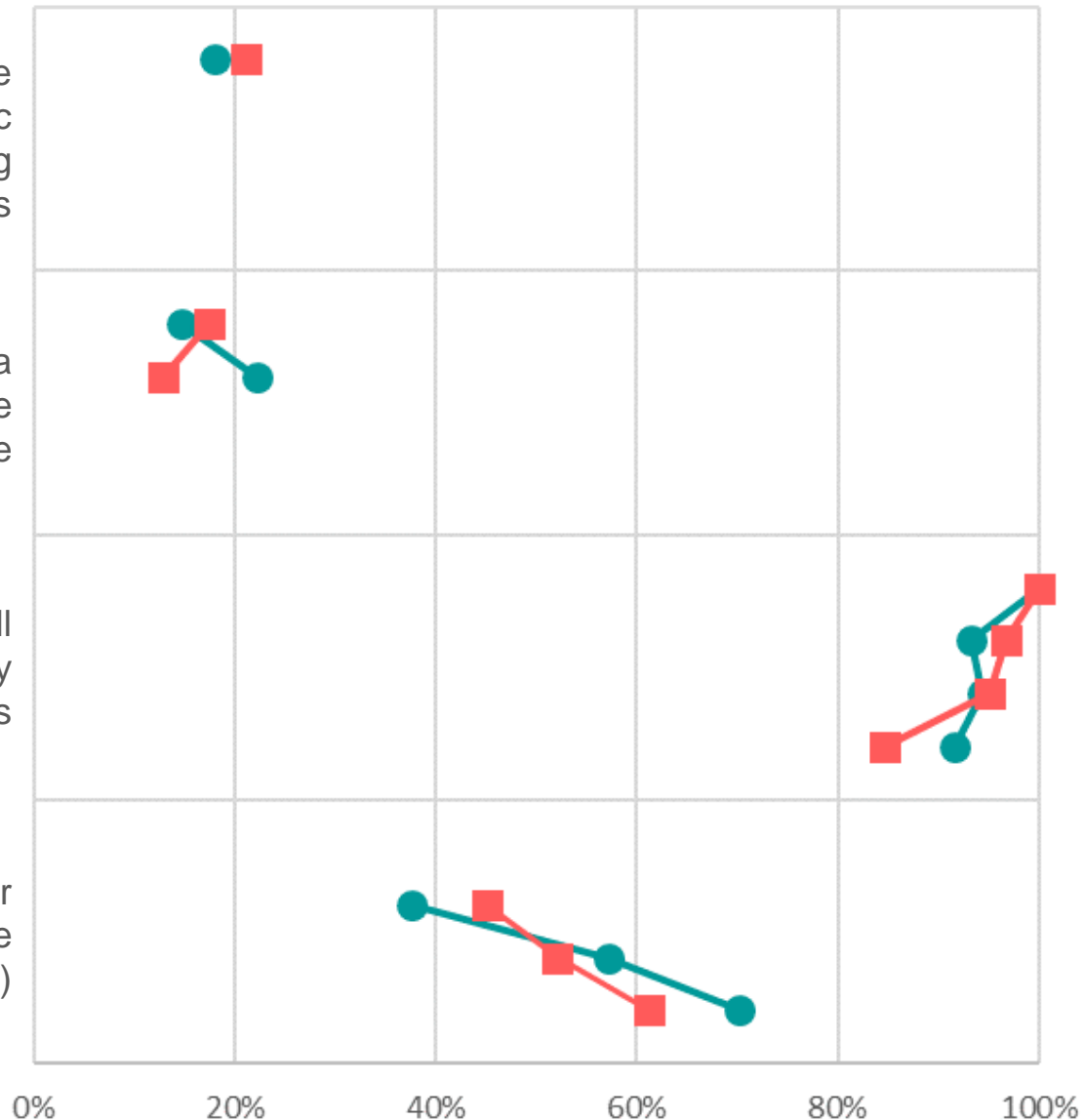
# Quality indicators 1 of 3 (64 countries)

% of countries that have carried out a systematic temperature monitoring study within the past 5 years

% of cold rooms for which a fully documented temperature mapping report is available

% of facilities in which all vaccine refrigerators comply with WHO specifications

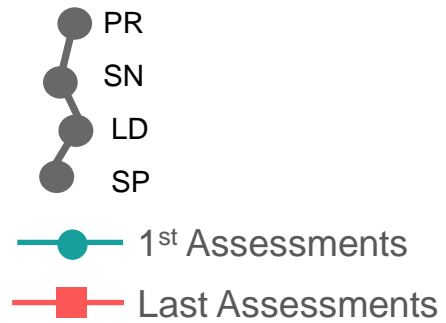
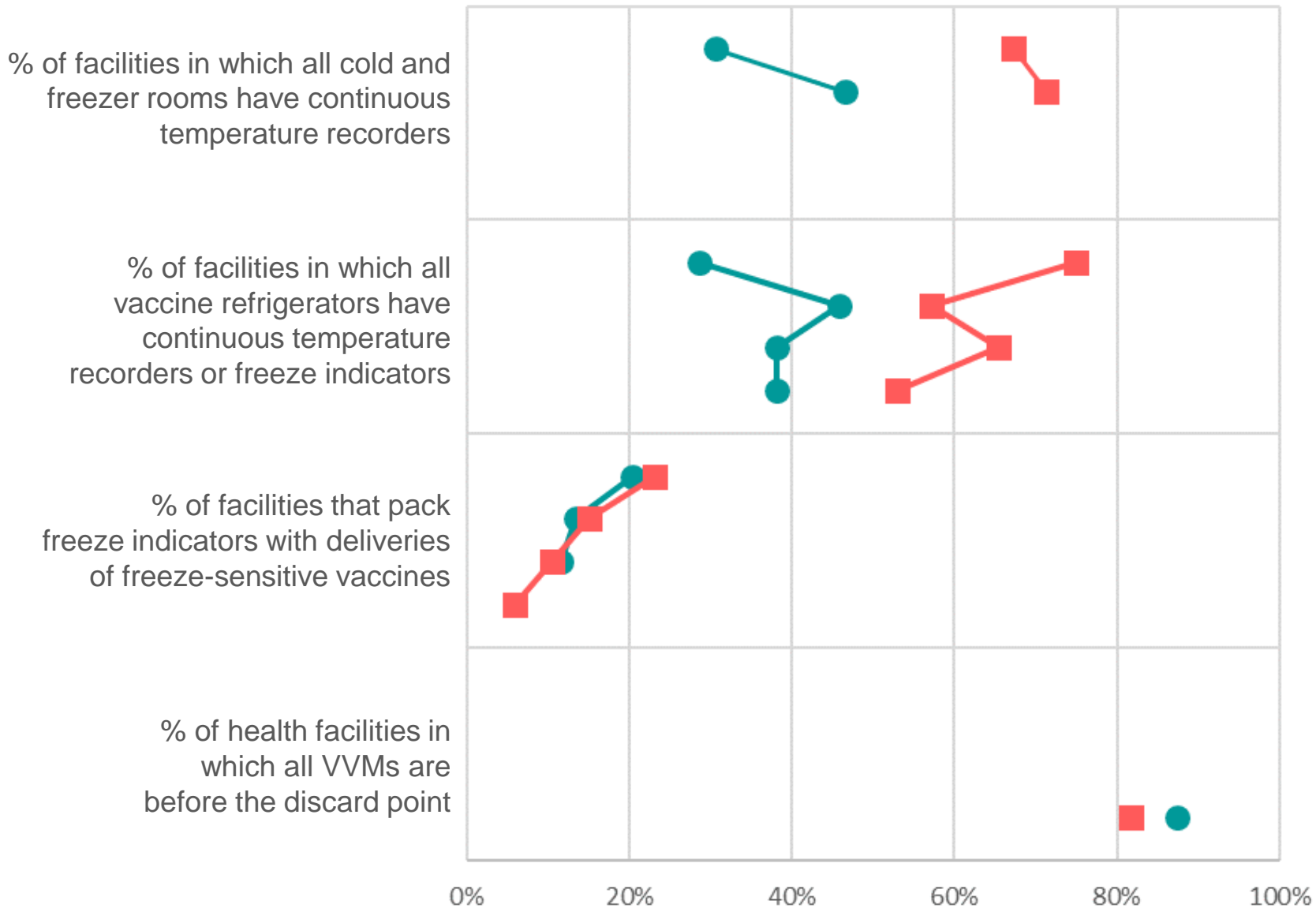
% of facilities for which kerosene or gas is always available (where absorption refrigerators are used)



## Key observations:

- Less than one in five countries have conducted a temperature monitoring study in the past 5 years.
- A higher % of national store cold rooms have been mapped recently.
- The % of refrigerators complying with WHO specifications remains high at all levels.
- Supply of kerosene for absorption refrigerators remains insecure.

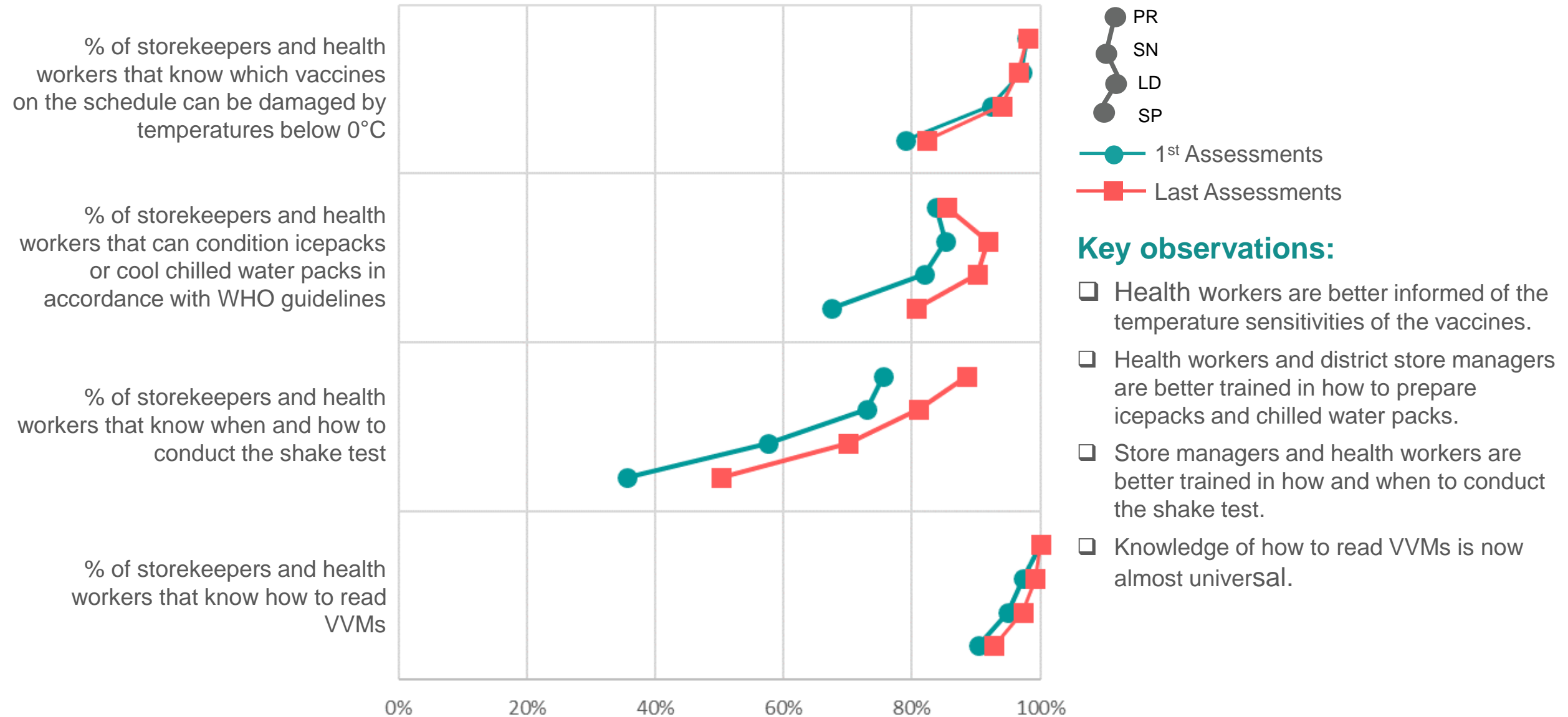
# Quality indicators 2 of 3 (64 countries)

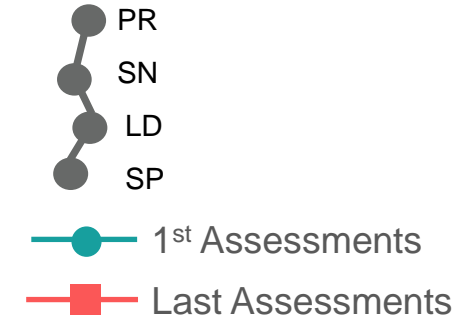
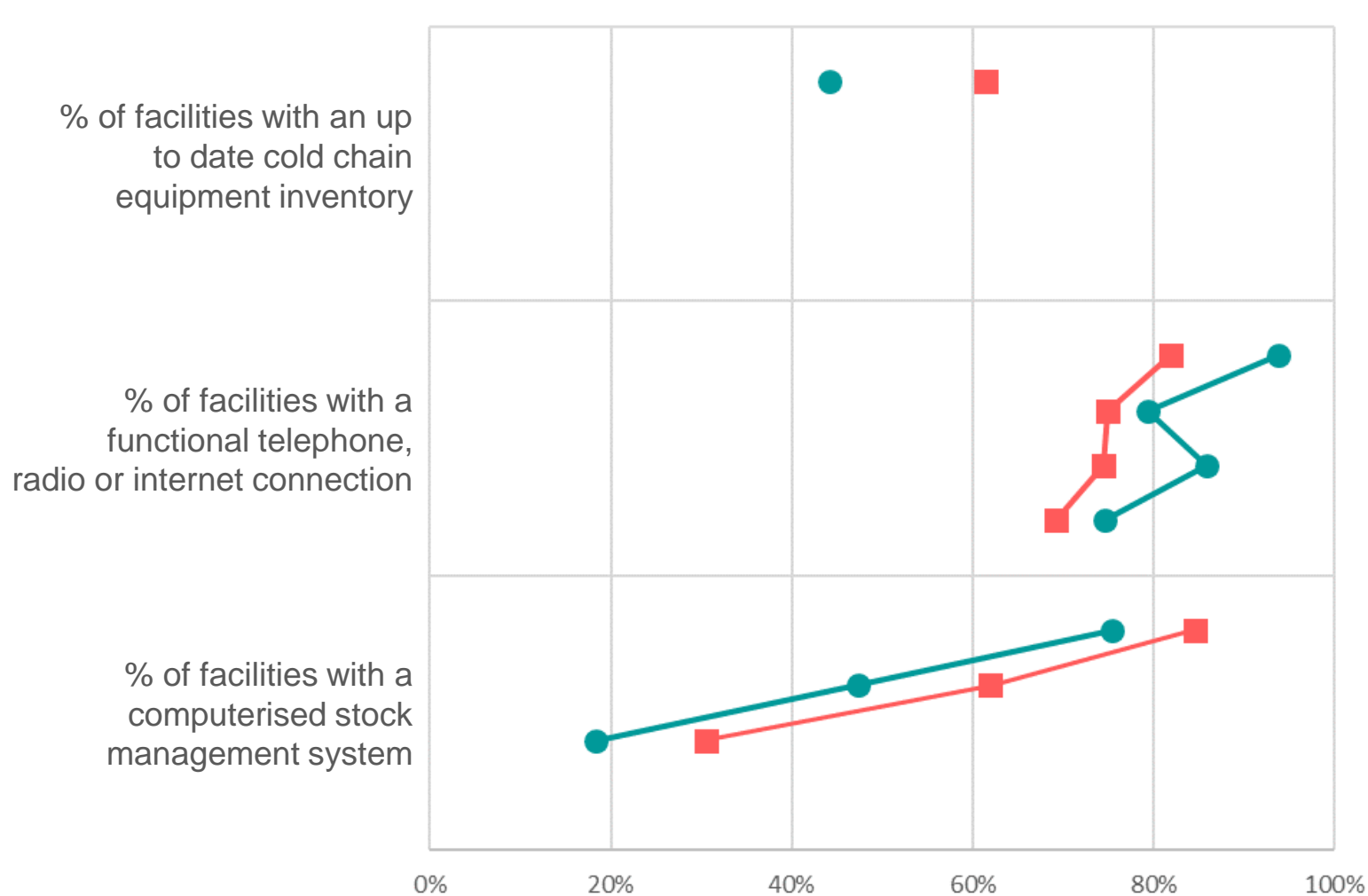


## Key observations:

- More cold rooms are being equipped with continuous temperature monitoring systems.
- Countries are equipping refrigerators with 30DTRs at all levels of the supply chain.
- Freeze indicators are still not being routinely packed with freeze sensitive vaccine when transported with conditioned ice-packs.
- A slight increase in the number of VVMs beyond the discard point at health facilities.

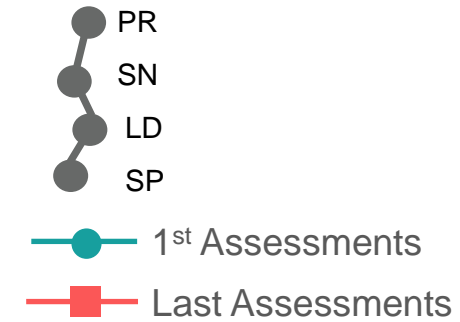
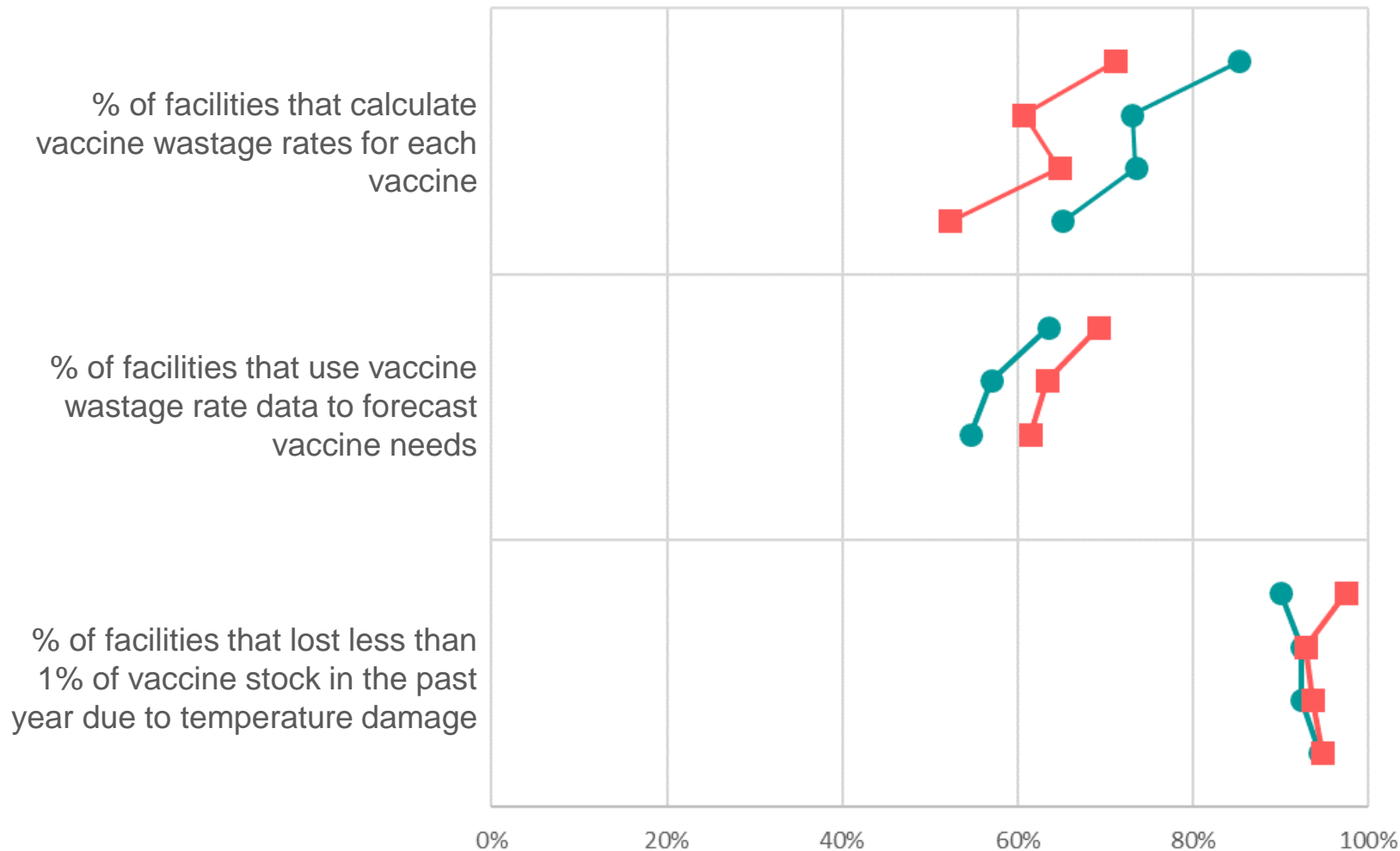
# Quality indicators 3 of 3 (64 countries)





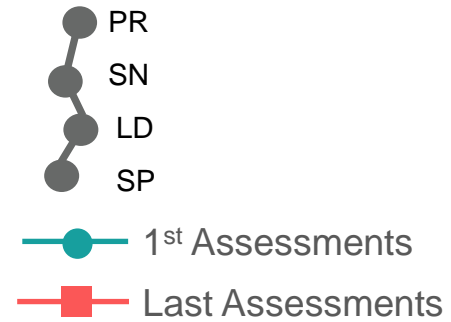
### Key observations:

- A significant increase in the number of national stores with up-to-date cold chain equipment inventories.
- The number of health facilities with a functional landline telephone or internet connection has decreased.
- Increase at all levels in the percentage of facilities with computerised stock management systems.



### Key observations:

- Less stores and health facilities are calculating vaccine wastage.
- More stores are using vaccine wastage data to inform vaccine needs forecasts.



### Key observations:

- 60% of vaccine stores still do not have adequate vaccine management SOPs.
- Vaccine stores are much better prepared for power loss or equipment failure, but more than 40% still do not have adequate contingency plans..
- 40% of store staff and health workers still do not receive regular supportive supervision.
- The number of health workers that know how to apply the MDVP is approaching 100%



Thank

You

Update: WHO EVM1 database, July 2021

*EVM – setting a standard for the vaccine supply chain*



World Health  
Organization

unicef 

The UNICEF logo, which consists of a stylized figure of a mother holding a child, enclosed within a laurel wreath.

# Additional Notes

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## Slide 2

Each criterion is assessed at each level by observation, inspection and interview:

- Inspection of cold chain equipment, transport vehicles and buildings
- Inspection of records (temperature, stock, wastage, ...) for the previous 12 months
- Interview of responsible staff to assess knowledge, understanding and practice

Note that E1 is assessed at the Primary level only, and E9 was not assessed at the Service Point level in the original version of the questionnaire (version 1.0), but is in the new questionnaire (version 2.1)

Indicators are evaluated in each of the 9 EVM criterias at each level.

- ~400 indicators at PR level, 300 at SN, 200 at LD, 150 at SP
- “Critical” indicators are given a weight of 5, non-critical indicators are given a weight of 1

Each criterion at each level is scored out of 100%. Each criterion score is the weighted average of its constituent indicator scores

## Slide 10

Countries are assessed in 9 areas of vaccine management, the 9 EVM criteria: E1 Vaccine arrivals, E2 Temperature monitoring, E3 Storage and transport capacity, E4 Buildings and equipment, E5 Maintenance, E6 Stock management, E7 Vaccine distribution, E8 Vaccine management, E9 Information systems. Note that E1 is assessed at the Primary level only

Criterion score data is available for 86 of the 89 countries that have conducted at least one assessment. There are 84 assessment scores in the PR distributions, 85 in the LD and SP distributions, and 59 in the SN distributions because 24 of the national supply chains assessed have only 3 levels.

The box and whisker plot shows the median scores, the inter-quartile range (the range of scores of the central half) and the maximum and minimum scores. Consider the E1 PR box and whisker for example: the median score is about 72%, the central half of countries have scores between about 64% and 82%, slightly less than a quarter of the countries have scores above the target score of 80%, a quarter have scores below 64%. At least one country scored 100% (maximum), and the lowest score was about 23% (minimum).

## Slide 12

A country's EVM composite score is defined as the geometric mean of the country's 32 individual criterion scores (PR E1, PR E2, ..., SP E9). The EVM composite score is used to represent the overall strength of a country's immunization supply chain. In the understanding that an immunization supply chain is "only as strong as its weakest link", the geometric mean is preferred to the arithmetic mean, as low criterion scores have a stronger effect on the geometric mean (weak links have a more significant effect on the strength of the overall chain).

This map presents the overall distribution of countries' EVM composite scores by quartiles. The bottom 25% are the poorest performing relative to other countries who have conducted EVM assessments over the period 2010-2013, while the top 25% can be considered those countries who have the highest performing immunisation supply chain systems relative to other countries.

If a country has completed more than one assessment, the score of the most recent assessment is used.

16 countries (Afghanistan, Albania, Bangladesh, China, Democratic Republic of Korea, Honduras, Guyana, Malawi, Moldova, Nicaragua, Rwanda, Sudan, Tanzania, Turkmenistan, Viet Nam, Yemen) have country composite scores above the target score of 80%.

## Slide 15

AFR = Africa Region, EMR = Eastern Mediterranean Region, EUR = Europe Region, AMR = Americas Region, SEAR = South East Asia Region, WPR = Western Pacific Region.

The assessment of vaccine arrivals procedures applies to the primary level only.

## Slide 16

There are more stringent temperature monitoring requirements at the PR level than at the lower levels due to the higher volume of vaccine stored at that level. This partially explains the relatively low scores at the PR level compared to the other levels.

## Slide 22

The SP level has stricter requirements in vaccine management than the other levels, given that vaccines are administered at this level.

## Slide 23

54 of the 60 countries were assessed using the new questionnaire (version 2.1), in which E9 is assessed at SP level.

## Slides 26-35

The data was collected between 2010 and 2016 in 86 countries in 6 WHO regions (4AFR, 8 EMR, 13 EUR, 4 AMR, 9 SEAR, 11 WPR).

Results are based on 144 primary stores, 970 sub-national stores, 1974 lowest distribution stores, and 2678 immunization service facilities.