



ANALYSIS AND USE OF HEALTH FACILITY DATA

# Guidance for immunization programme managers

WORKING DOCUMENT, FEBRUARY 2018



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# MODULE 6. Guidance for immunization programme managers

## LEARNING OBJECTIVES

Immunization data should be used to support:

- operational, managerial and strategic decisions at all levels; and
- monitoring and accountability.

Those in the target audience will find this section useful as they design or improve information systems, develop training materials, evaluate the monitoring system and the data it produces, or look for ways to represent and visualize immunization data in ways that support decision making. This section focuses on use of routine data. Separate guidance is under development on use of data from multiple sources (health facility surveys, population-based surveys, focused investigations in addition to the routine information system) to periodically review an immunization program or review sector-wide progress.

## AUDIENCE

This section provides guidance on the analysis and use of routine immunization data. It is aimed at:

- Ministry of health decision makers such as immunization program staff, data managers and health information system managers;
- Immunization partner staff involved with immunization or health system strengthening;
- Consultants and staff working at research institutes involved with the assessment and improvement of immunization data and information systems.

## SUGGESTED REFERENCES

- Collecting, Assessing, and Using Immunization Data: Reference guide. WHO, Geneva. Working draft of February, 2016
- Data Quality Review: A toolkit for facility data quality assessment. WHO. 2015

## KEY AUTHORS

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## Acknowledgements

This guidance document has been developed by the World Health Organization, with the support of grants from Bloomberg Philanthropies Data for Health Initiative, Gavi, the Vaccine Alliance, The Global Fund to Fight AIDS, Tuberculosis and Malaria, and The Norwegian Agency for Development Cooperation.



# 1. About the data

Routine immunization data are recorded by staff at health facilities to track the immunization status of children and pregnant women served by the health facility, any adverse events following immunization (AEFIs), vaccines and supplies used and status of the cold chain. Summary data are periodically reported to supervisors who monitor performance indicators such as immunization coverage and vaccine wastage.

The data that **are not specifically addressed** in this section are those related to:

- Data from immunization campaigns;
- Surveillance for vaccine preventable diseases;
- Case-based data from investigation of severe adverse events following immunization; and
- Financial and human resource tracking.

This guidance includes limited discussion of some closely related data:

- Immunization coverage estimates from population-based surveys;
- Estimates of target populations (e.g. surviving infants);
- Detailed data for immunization supply chain management.

In lower and middle income countries, immunization data are most often collected through a monthly aggregation-based reporting system. The main exception to this basic setup occurs when Electronic Immunization Registries (EIR) are used. In such systems, the immunization records of each person are maintained in an online electronic database, and all the data needed for monitoring can be extracted from this database, making monthly reports redundant. This section focusses on analysis and use of aggregate data whether reported monthly or periodically extracted from an EIR.

Most lower and middle income countries have integrated Health Management Information Systems (HMIS), used for the systematic reporting and storing of health data, including immunization data. An example of a commonly used system is the District Health Information System version 2 (DHIS2). Additionally, in many countries, Excel-based tools are used for the reporting and analysis of immunization data. They provide a systematic way to enter and store data and produce standardized visualizations. The District Vaccine Data Management Tool (DVDMT) is an example of his kind of tools. Locally stored databases have the advantage that data are always accessible, even where on-line access is difficult.

## 2. Data quality

All data have limitations that affect the reliability and interpretation of the data. The data routinely reported by health facilities are certainly no exception. The data cannot be interpreted without first knowing how complete they are and examining them for inconsistencies and errors. The data may need to be adjusted before they can be meaningfully analyzed. Findings from review of data quality and explanations of any adjustments to the data must be presented explicitly and transparently as part of presentation of the analytic findings.

Whether at district or higher levels, a “data desk review” can proceed with the data immediately available to the analyst without field investigations. At national level, although a desk review can be completed with the statistics aggregated to each individual district level, a more revealing review can be carried out if the fully disaggregated data (for all facilities and all months for the period of analysis) are available.

If time and resources permit, the desk review should be complemented by a “data verification survey” of a sample of districts and health facilities to determine to what extent the reported data match with the source documents (i.e. facility registers and tally sheets) and to assess the data management system.

WHO has developed a toolkit to support both a desk review and field investigations of data quality. This toolkit includes an Excel-based DQR tool which, when populated with key data from health facilities and other sources, analyzes the completeness, internal consistency and external consistency of the data. For countries using DHIS2 software to manage their routine data, WHO has also developed the Data Quality Tool, an application which can be installed on the national DHIS2 system that automatically generates findings from a data desk review at either national or sub-national level.

The remainder of this sub-section discusses the minimal data quality assessments that should be conducted as an initial step in analysis of routine immunization data.

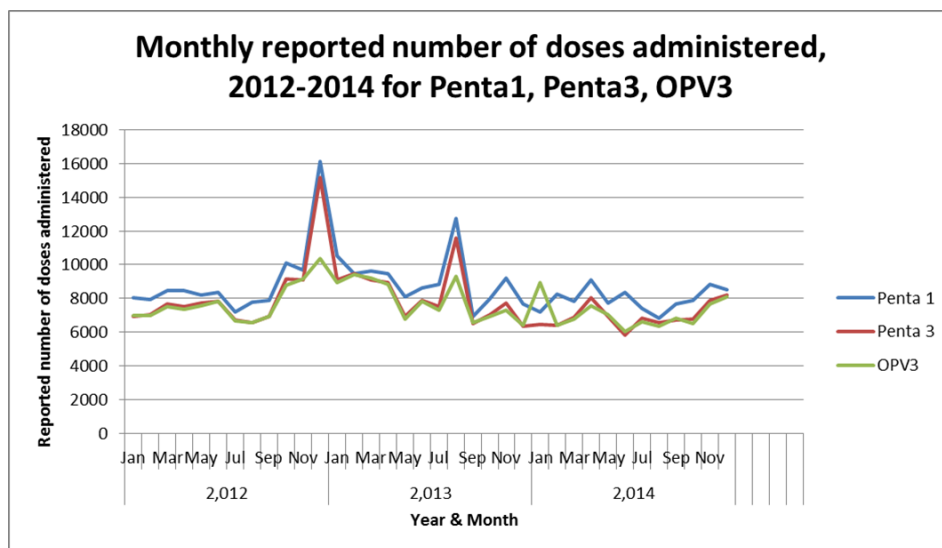
1. **Assess the completeness and timeliness** of the data. Facility-level reporting completeness is defined as the number of facility reports that were received divided by the reports that were expected. District level reporting may be complete, but do these district reports contain the reported doses from all their facilities? **Timeliness** is defined as the fraction of expected reports that were received before the specified deadline (e.g. the 5<sup>th</sup> business day of the following month).

Incomplete reporting reduces the level of indicators. It introduces a bias. If completeness is roughly the same over time then the indicator can show the trends for those facilities that reported. If, however, there is significant variation over time in completeness, then trends should be interpreted with great caution.

2. **Check for internal consistency.** The second data quality assessment step is to look for “suspicious” reported values. Not all suspicious values are wrong. However, suspicious values merit further investigation.

Check for outliers – Outliers are values that differ substantially from the mean. Sometimes outliers are the result of genuine variations in program performance, for example as the result of an intensified effort or as the result of a stock out. However, in many cases they are clearly the result of some kind of a data error. The WHO Data Quality Tool for DHIS2 automatically detects values from a health facility or from a district which are more than 3 standard deviations above or below the mean value from the same health facility or district for the same year. Charting data in a time series also provides a good visual way to find outliers.

Figure 1: Chart looking at trends in doses administered to detect outliers



The peaks in the numbers of doses of Penta-1 and Penta-3 in December 2012 and August 2013 warrant investigation. Not only are they far above the usual numbers, but the number of Penta-3 also far exceeds the number of OPV-3, which is normally given at the same time (an example of inconsistency between related indicators, as discussed below). This raises suspicion on the actual number of Penta doses administered. OPV-3 in January 2014 also warrants investigation.

- i. Look for uniformity and patterns -- Too much uniformity in the data and the existence of patterns may also point to issues with data quality. If too many reported values are multiples of 5 or 10, this may indicate that they are guesses instead of reported values, or were obtained by counting vials, rather than tallying doses. Repeated numbers may point to mistakes. Whenever performance seems ‘too perfect’, it may be worth investigating more. For instance, does a district always achieve 100% coverage, month after month?
  - ii. Check for inconsistency in related indicators – An example of such inconsistency is when there is a negative dropout over a full year between the number of children receiving the first dose of DPT vaccine and the number receiving the third dose of the vaccine. Another example, as illustrated in Figure 1 above, is inconsistency between the number of children receiving DPT vaccine and the number of children receiving OPV vaccine. Yet another example is when there is a negative “wastage rate” (discussed below) -- when the number of children reported to have received a vaccine is greater than the number of doses of the vaccine reported to have been consumed.
  - iii. Check for inconsistency between reported data and data recorded on source documents -- “Data verification” requires a survey of a representative sample of health facilities to compare the data they reported for select months to data recorded on immunization registers or tally sheets for the same months. Such a data verification survey can provide evidence of either over-reporting or under-reporting or it can reveal problems with the recording and archiving of data. During such surveys, health staff at facility and district levels are usually interviewed to assess the adequacy of the system for data management and use.
- 3. Check for external consistency** -- Assessment of external consistency involves comparison of findings from two different data sources. Estimates of immunization coverage based upon routine data should be compared with estimates derived from population-based surveys such as a DHS, a MICS or an immunization coverage survey.

### 3. Core facility indicators

Core Indicators	Definition	Disaggregations
Immunization coverage rate by vaccine for each vaccine in the national schedule	$100 \times (\text{Number of children receiving the vaccine}) / (\text{Estimated number of target population (e.g. infants less than one year)})$	<ul style="list-style-type: none"> <li>By vaccine / dose of vaccine</li> <li>Age (&lt;1 year, ≥ 1 year for infant immunizations; ≤ 2 years, ≥ 2 years for toddler immunizations)</li> <li>Status (pregnant women, others) for TT</li> <li>Geographic region</li> </ul>
Dropout rate for: <ul style="list-style-type: none"> <li>first to third dose of DPT containing vaccine</li> <li>BCG to first dose of measles containing vaccine</li> <li>first to second dose of measles containing vaccine</li> </ul>	<p>DPT 1 to DPT3 dropout = <math>100 \times (\text{DPT 1 doses} - \text{DPT 3 doses}) / \text{DPT 1 doses}</math></p> <p>BCG to MCV1 dropout = <math>100 \times (\text{BCG doses} - \text{MCV1 doses}) / \text{BCG doses}</math></p> <p>MCV1 to MCV2 dropout = <math>100 \times (\text{MCV1} - \text{MCV2}) / \text{MCV1}</math></p>	<ul style="list-style-type: none"> <li>Geographic region</li> </ul>
Vial wastage rate (closed & open) by vaccine for each vaccine in the national schedule	<p>Closed vial wastage = % of doses that were spoiled due to expiry, heat exposure, freezing or breakage.</p> <p>Open vial wastage = % of doses that were discarded after vials were opened.*</p>	<ul style="list-style-type: none"> <li>By vaccine</li> <li>Type of spoilage</li> <li>Geographic region</li> </ul>
Full availability of vaccines and supplies	Percentage of health facilities with no stockouts of any tracer vaccine or injection supply when vaccination is demanded	<ul style="list-style-type: none"> <li>Geographic region</li> </ul>
Functional Status of Cold Chain Equipment	Number of functional refrigerators	<ul style="list-style-type: none"> <li>Geographic region</li> </ul>
Temperature Alarms	Number of times the temperature inside cold chain equipment exceeds or drops below a reference range.	
Serious Adverse Events Following Immunisation (AEFI)	AEFI cases	<ul style="list-style-type: none"> <li>Non-serious, serious</li> <li>Geographic region</li> </ul>
Immunisation session completion rate	$100 \times \text{number of completed immunization sessions} / \text{number of planned sessions}$	<ul style="list-style-type: none"> <li>Outreach versus fixed</li> </ul>

## 4. Core analysis

### IMMUNIZATION COVERAGE FOR EACH VACCINE IN THE NATIONAL SCHEDULE

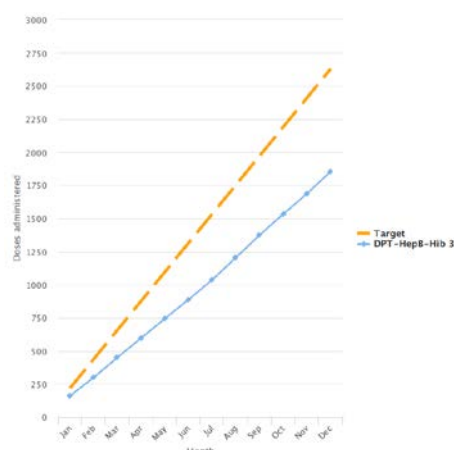
#### Purpose

Immunization coverage is the fraction of a certain target population that is vaccinated with a defined number of doses for a certain antigen or vaccine, expressed as a percentage. Coverage is the most direct measure of program performance and is monitored at national, sub-national and facility levels in order to detect performance issues and take corrective action when needed.

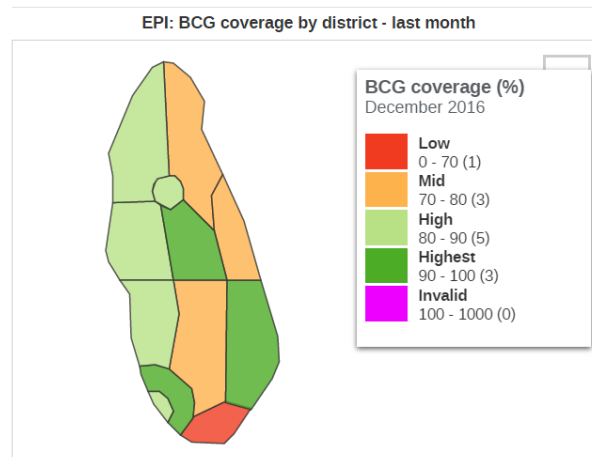
#### Analysis

Monitor vaccine doses administered and immunization coverage

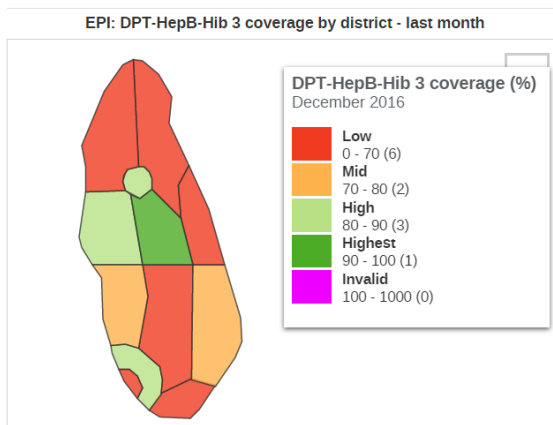
- 1) Each health facility can use a cumulative coverage chart to monitor progress towards immunizing their target population



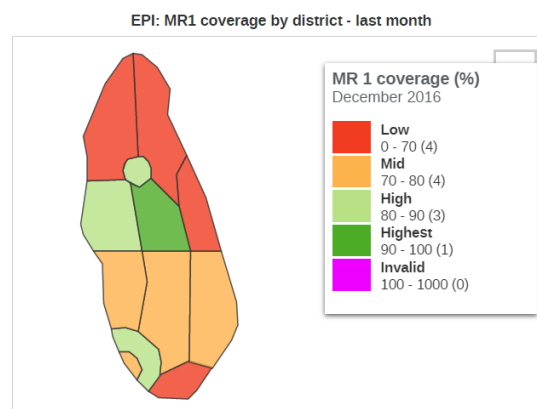
- 2) A map of last month's BCG coverage by district shows the most recent performance with a vaccine that is ideally delivered at birth



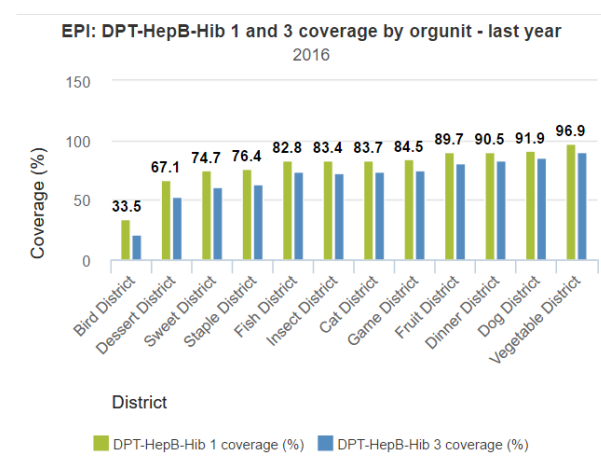
- 3) A map of last month's Penta 3 coverage by district shows the most recent performance with a vaccine that is ideally delivered at 14 weeks of age



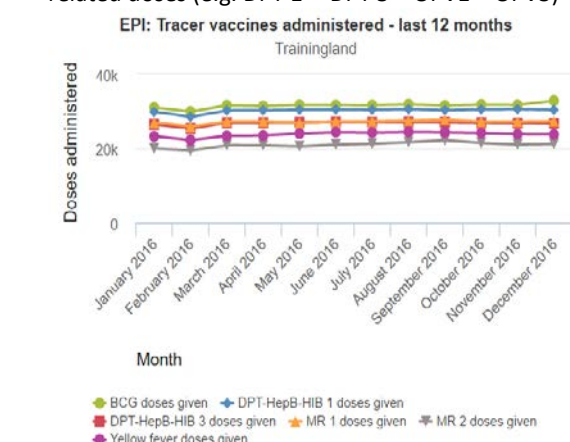
- 4) A map of last month's MCV1<sup>[\*]</sup> coverage by district shows the most recent performance with a vaccine that is ideally delivered at around 9 months of age.



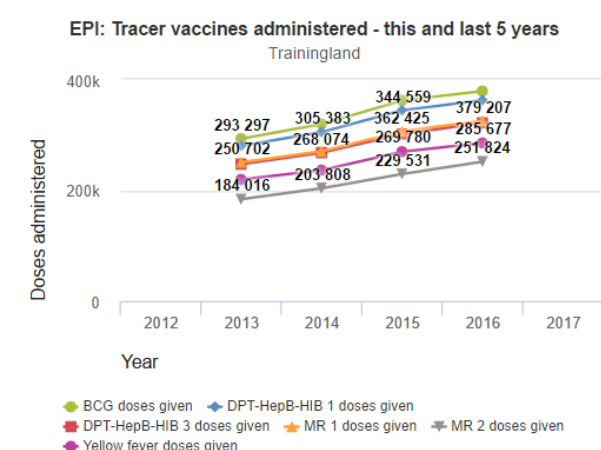
- 5) Ranking of districts by Penta 1 and Penta 3 coverage shows relative performance and dropout



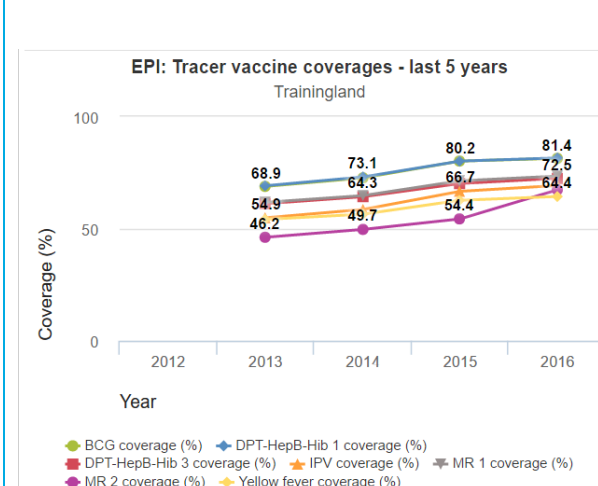
- 6) Doses administered by month show fluctuations in reported services as well as the consistency between related doses (e.g. DPT 1 -- DPT 3 -- OPV1 -- OPV3)



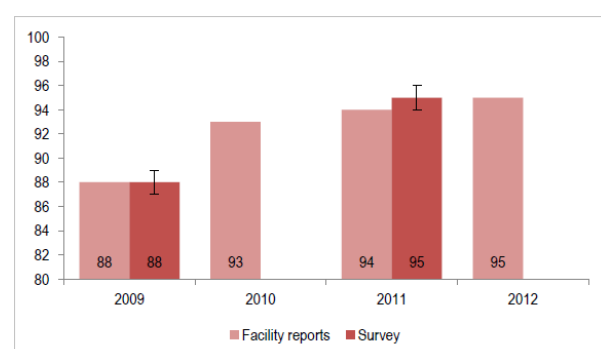
- 7) Doses administered by year show trends and consistency over time without reference to targets



- 8) Coverage by year shows progress towards targets for each dose in the immunization schedule



- 9) For DPT3 and or MCV1, compare the routine estimate of immunization coverage nationwide to the survey estimate



## Considerations/issues for interpretation

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### Necessary dis-aggregations

Data should be disaggregated by vaccine, dose, and age group of the children that received them (e.g.  $<1$ ,  $\geq 1$ ).

### Monitoring access

Coverage for early doses in the immunization schedule, like BCG or Penta-1, are indicative of access to immunization services. High first dose coverage indicates that health services cover a high proportion of the population and that people also seem to accept vaccination.

### Monitoring overall performance of immunization services

Immunization program managers and health officials sometimes want to use routine data to monitor full immunization coverage. It is difficult to set up an aggregate reporting system that reliably reports on the number of children that are fully immunized. To do this, those aggregating the data at facility level must reliably scan all immunizations provided to the child to date to determine whether they are fully immunized. Furthermore, with more and more vaccinations being scheduled for children and adults of higher ages, one might question how to define “fully immunized” exactly. Therefore overall performance is most often measured through the use of a tracer vaccine and dose. Typically, this tracer is the third dose of DTP-containing vaccine, such as DTP3.

### Misclassification

Children given their first or second doses of DPT vaccine can be misclassified as receiving their third dose of DPT. If this happens frequently enough, the health facility can report DTP3 greater than DTP1 (i.e. a “negative dropout rate” – discussed below), sometimes for an entire year overall.

### Monitoring coverage with all vaccines in the schedule

Coverage for all other vaccines in the national schedule should also be monitored, as vaccine specific uptake or programmatic issues may arise and need to be detected as soon as possible. After a new vaccine introduction, it is recommended to specifically monitor coverage of that vaccine to make sure it reaches levels in line with established vaccines.

### Age dis-aggregations

To determine whether children are protected as early as possible, childhood immunization data should be disaggregated by age. In this way it is possible to monitor “timely coverage” versus “delayed coverage”. With the possible exception of the first dose of measles containing vaccine (MCV1), timely coverage is the percentage of children immunized before 12 month of age while delayed coverage is the percentage of children immunized at 12 months or older. Some countries choose to define timely coverage with MCV1 as the percentage of children immunized before their second birthday (MCV1 $<2$ ) rather than before their first birthday (MCV1 $<1$ ). In either case, since the second dose of measles containing vaccine (MCV2) is recommended to be given between 15 and 18 months, timely coverage with MCV2 is the percentage of children delivered before the second birthday (MCV2 $<2$ ) whereas delayed coverage is provided after the second birthday (MCV2 $\geq 2$ ).

### Unnecessary dis-aggregations

Sometimes the administered doses are further disaggregated, for example by sex of the child, or the strategy that was used to vaccinate it (i.e. fixed versus outreach), or whether or not the child lives within the catchment area of the health facility. These additional dis-aggregations are not recommended as there is scant evidence that reliable data disaggregated in these ways can be collected or meaningfully used. Moreover, the recording and reporting workload doubles every time a new level of disaggregation is introduced. Therefore the decision to further disaggregate immunization data needs to be weighed carefully against the benefit of the use that will be given to the collected



data. Those designing routine reporting forms should aim to limit the number of cells and rely upon findings from household surveys to more reliably answer many questions. The analyst can help promote streamlining of reporting forms by identifying problems with the completeness and consistency of the separate data elements and bringing such findings to the attention of those managing the health facility reporting system.

### Denominators

For all vaccines in the first year of life other than birth doses (i.e. BCG, OPV 0, hepatitis B vaccine 0), the target population for calculating coverage is the number of surviving infants (= live births minus infant deaths). For most countries, official census-derived population estimates are the best source of denominator data, because they are most likely established using rigorous statistical methods, and are collected independently from the health system. The use of region-specific demographic estimates of the crude birth rate and infant mortality rate, is preferable to the use of national averages. They are however not always available for the lowest administrative levels, and the use of uncertain or outdated population estimates is a major source of error for coverage estimation, especially at the subnational level. In some cases, local enumeration is used to estimate the size of the target population. Such an approach can provide good operational targets for health workers at local levels. However, local enumeration is not recommended for coverage monitoring at national level, as it lacks independence, and it is likely that the same children that are missed for immunization are also missed by local enumerations. Coverage in excess of 100% can either indicate an under-estimation of the denominator (which, at the level of an individual health facility or district can be in part due to mobile populations seeking services outside of their area of residence) or over-reporting of vaccines administered.

### Year-to-year fluctuations in the denominator

Abrupt year-to-year increases or decreases in coverage estimates are sometimes the result of adjustments made to estimates of the target population when findings become available from a new census. To reveal the influence of such denominator adjustments, instead of graphing coverage by year (see graph 8), it is revealing to graph numerators by year (see graph 7) and denominators by year (graph not shown).

### When reliable denominator estimates are lacking there are several options for monitoring performance:

- Monitor trends in the absolute numbers of vaccinated children (see graph 7) rather than coverage (graph 8);
- Monitor dropout rates (see the following graphs) as they can be calculated without estimates of the target population;
- Nationwide and provincial/regional coverage can be assessed with coverage evaluation surveys

### Time series (see graphs 6, 7, 8)

While often showing trends in the performance of an immunization program, can also be used to assess the consistency of the data. Erratic fluctuations may suggest a problem with data quality or, as just discussed, adjustments to denominator estimates. For this reason, it is useful to review the trend in doses administered (see graph 7) as well as the coverage estimates (graph 8).

### Trends

Trends must be interpreted with great caution if the reporting completeness has changed from year to year. For example, if the national completeness of facility reporting was 65% in 2015 then completeness rose to 85% in 2016, no trend should be presented unless “imputations” can be made. Imputation involves making assumptions about missing or invalid data. Such assumptions should be based upon a good understanding, after conferring with local staff, of why the data is missing or invalid (Was staffing or supply interrupted?; Were staff not yet oriented to a new reporting system?) and



whether the affected facilities or affected months are similar to other facilities or other months for which valid data were reported.

### Comparison with survey estimates

Coverage surveys are often seen as the gold standards for coverage estimation. But while they can be very useful, it is worth pointing out that they also have inherent limitations and risks:

- Delay in measurement: There is typically a lag of a couple of years between when immunizations are provided and when survey estimates becomes available.
- Limited geographic disaggregation: Survey estimates are not commonly available for the district level, and the estimates are more uncertain even at provincial/regional levels, given the smaller sample sizes.
- Quality: Not all surveys are conducted with the same quality and adherence to strict sampling and interview protocols. It is also not always easy to establish the immunization status of a child, especially if no vaccination card is available, or if the card is incompletely or incorrectly filled out, and the parent doesn't remember all the vaccines that the child might have received. DHS and MICS surveys report the confidence intervals of survey estimates of immunization coverage. These confidence intervals estimate the effect of sampling error, which declines with sample size. However, surveys are also subject to non-sampling errors such as that due to selection bias or recall bias. The direction and size of the non-sampling error of a survey can seldom be estimated although it can well exceed the sampling error.

## DROPOUTS – CHILDREN WHO START BUT DON'T COMPLETE THE IMMUNIZATION SCHEDULE

### Purpose

The drop-out rates between early and later doses, for example between DTP1 and DTP3, are defined as the percentage of children that started a course, but didn't finish it for some reason. Low drop-out rates are indicative of good utilization and therefore of good service quality. The MCV1 to MCV2 dropout rate assesses the ability of the program to vaccinate beyond the first year of life.

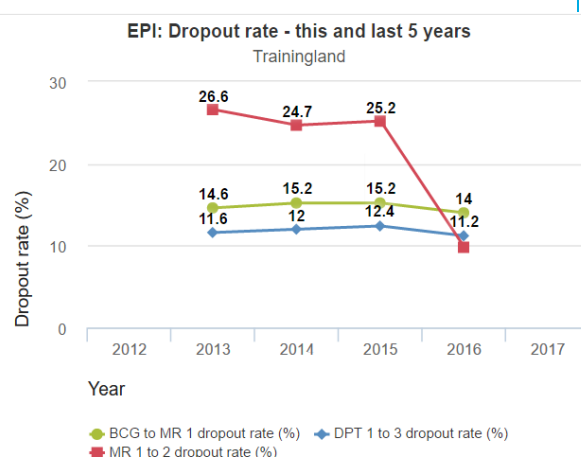
### Analysis

#### Monitor “drop out”

- 10) A table presents year-to-year trends in dropout rates

EPI: Dropout rates - this and last 5 years						
Trainingland						
Data / Period	2012	2013	2014	2015	2016	2017
BCG to MR 1 dropout rate (%)		14.6	15.2	15.2	14	
DPT 1 to 3 dropout rate (%)		11.6	12	12.4	11.2	
MR 1 to 2 dropout rate (%)		26.6	24.7	25.2	9.8	

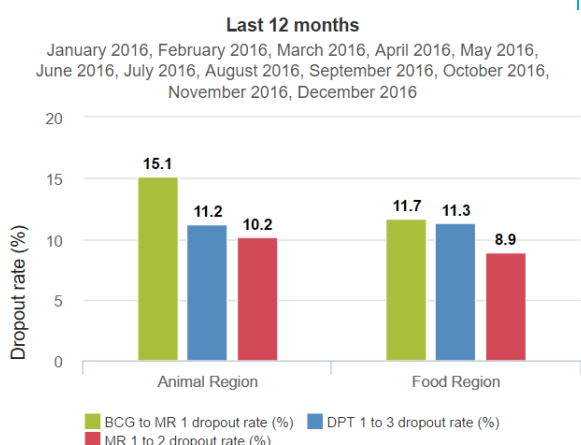
- 11) The same dropout trends are presented graphically



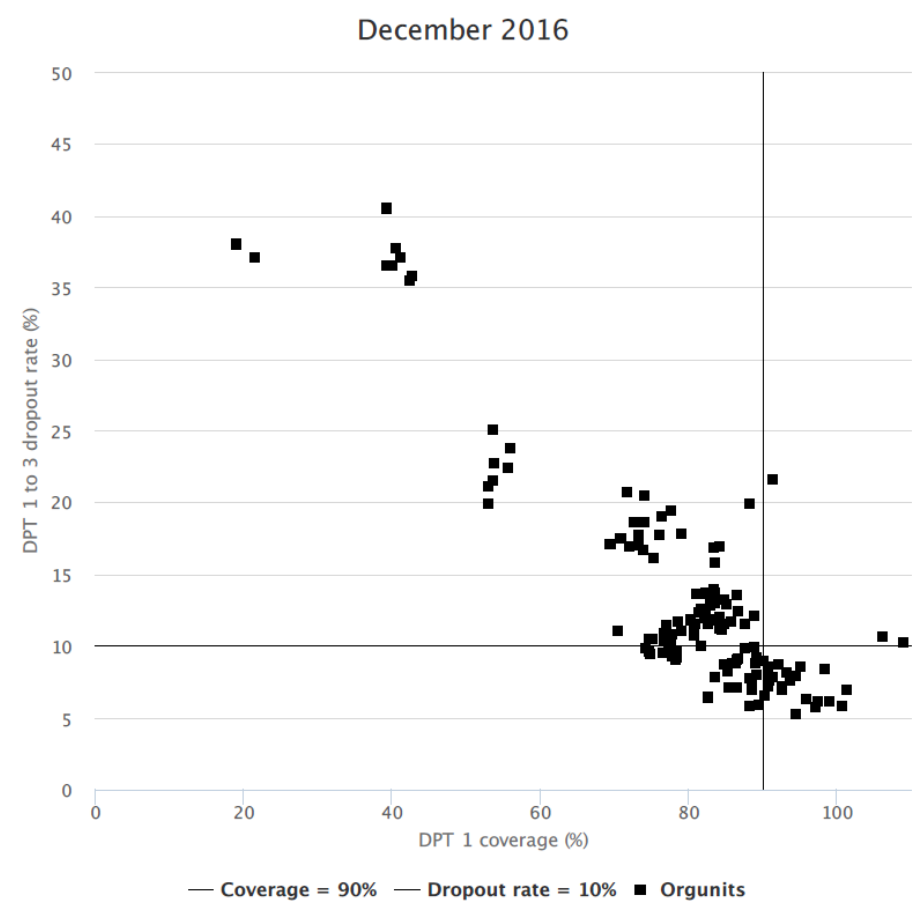
- 12) A table presents dropout rates for the last 12 months, by region

EPI: Dropout rates by orgunit - last 12 months cumulative			
January 2016, February 2016, March 2016, April 2016, May 2016, June 2016, July 2016, August 2016, September 2016, October 2016, November 2016, December 2016			
Organisation unit / Data	BCG to MR 1 dropout rate (%)	DPT 1 to 3 dropout rate (%)	MR 1 to 2 dropout rate (%)
Animal Region	15.1	11.2	10.2
Food Region	11.7	11.3	8.9

- 13) The same dropout rates are presented graphically



14) Classification of regions based upon Key Performance Indicators : DPT1 coverage and the DPT1 to DPT3 dropout rate



## Considerations/issues for interpretation

### Classification of districts/provinces based upon Key Performance Indicators

Figure 14 shows how districts or geographic regions can be classified based upon two Key Performance Indicators: DPT1 coverage ( $<90\%$ ;  $\geq 90\%$ ;  $> 100\%$ ) and DPT1 to DPT3 dropout rate ( $<10\%$ ;  $\geq 10\%$ ; negative).

## MANAGEMENT OF VACCINE STOCKS

### Purpose

Effective supply and cold storage of vaccines is essential for good coverage and efficient use of expensive vaccines. This sub-section covers only the small subset of stock management indicators for which aggregated data can be reported monthly by each health facility.

### Analysis

#### Monitor availability of vaccines and injection supplies

- 15) Percentage of health facilities with “full availability” during the month, by month of the last 12 months, by geographic region

% of HF in the district with full availability for the reporting month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
District A	50%	50%	60%	70%	70%	80%	80%					
District B	67%	67%	73%	67%	60%	67%	60%					
District C	77%	85%	85%	77%	92%	92%	100%					
District D	25%	38%	25%	38%	13%	25%	25%					
District E	86%	57%	71%	71%	86%	57%	43%					
District F	64%	71%	79%	71%	79%	86%	86%					
District G	100%	93%	87%	93%	87%	93%	87%					

#### Monitor vaccine wastage

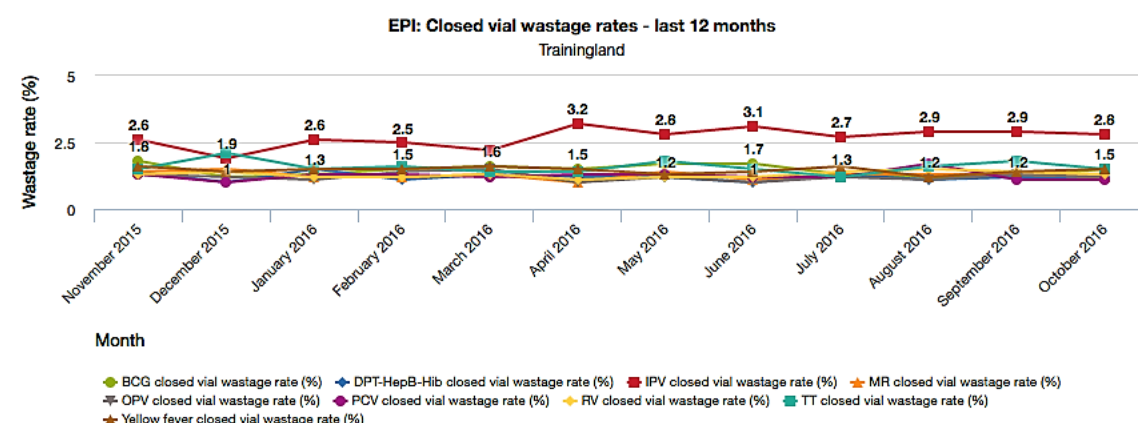
- 16) Closed vial wastage, by vaccine for this year and last 5 years

EPI: Closed vial wastage rate by orgunit - last 12 months cumulative								
November 2015, December 2015, January 2016, February 2016, March 2016, April 2016, 2016, July 2016, August 2016, September 2016, October 2016								
Organisation unit / Data	BCG closed vial wastage rate (%)	DPT-HepB-Hib closed vial wastage rate (%)	IPV closed vial wastage rate (%)	MR closed vial wastage rate (%)	OPV closed vial wastage rate (%)	PCV closed vial wastage rate (%)	RV closed vial wastage rate (%)	
Animal Region	1.4	1.2	2.7	1.3	1.2	1.2	1.3	
Food Region	1.5	1.2	2.6	1.2	1.2	1.3	1.4	

- 17) Closed vial wastage, by vaccine for this year and last 5 years

EPI: Closed vial wastage rate - this and last 5 years						
Trainingland						
Data / Period	2014	2014	2015	2015	2016	2016
BCG closed vial wastage rate (%)			1.6	1.6	1.5	1.5
DPT-HepB-Hib closed vial wastage rate (%)			1.2	1.2	1.3	1.2
IPV closed vial wastage rate (%)			3	2.8	2.7	2.8
MR closed vial wastage rate (%)			1.5	1.4	1.3	1.2
OPV closed vial wastage rate (%)			1.3	1.2	1.3	1.2
PCV closed vial wastage rate (%)			1.2	1.3	1.3	1.3
RV closed vial wastage rate (%)			1.5	1.4	1.4	1.3
TT closed vial wastage rate (%)			1.5	1.6	1.5	1.5
Yellow fever closed vial wastage rate (%)			1.5	1.4	1.5	1.5

- 18) Closed vial wastage rates for each vaccine for each month of the last 12 months



- 19) Open vial wastage rate by vaccine by region for the last 12 months

**EPI: Open vial wastage rate by orgunit - last 12 months cumulative**

Organisation unit / Data	November 2015, December 2015, January 2016, February 2016, March 2016, April 2016, 2016, July 2016, August 2016, September 2016, October 2016						
	BCG open vial wastage rate (%)	DPT-HepB-Hib open vial wastage rate (%)	IPV open vial wastage rate (%)	MR open vial wastage rate (%)	OPV open vial wastage rate (%)	PCV open vial wastage rate (%)	RV open vial wastage rate (%)
Animal Region	5.8	4.1	-20.1		6.4	6	6.3
Food Region	6.4	4.6	20.4		6.4	6.7	5.9

- 20) Open vial wastage rate by vaccine, nationwide for the this and the last 5 years

**EPI: Open vial wastage rate - this and last 5 years**

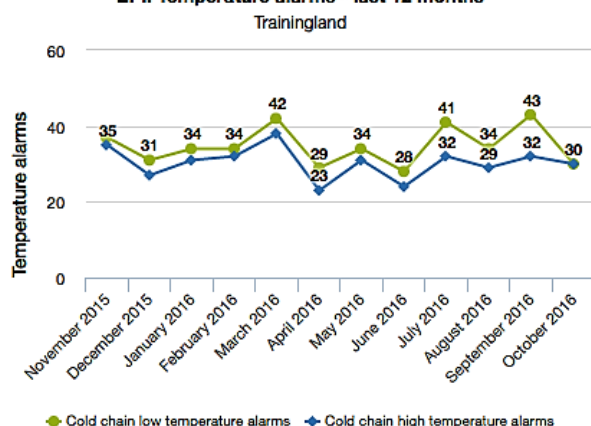
Trainingland						
Data / Period	2014	2015	2016	2017	2018	2019
BCG open vial wastage rate (%)			5.9	6.5	5.9	5.9
DPT-HepB-Hib open vial wastage rate (%)			4.5	4.5	4.7	4.1
IPV open vial wastage rate (%)			19.9	14.7	3	-4
MR open vial wastage rate (%)						
OPV open vial wastage rate (%)			6	6.2	6.6	6.3
PCV open vial wastage rate (%)			5.7	6.4	6.2	6.3
RV open vial wastage rate (%)			6.1	6.3	5.9	6.4
TT open vial wastage rate (%)			5.9	5.7	5.8	6.3
Yellow fever open vial wastage rate (%)						

## Monitor cold chain equipment

### Monitor vaccine wastage

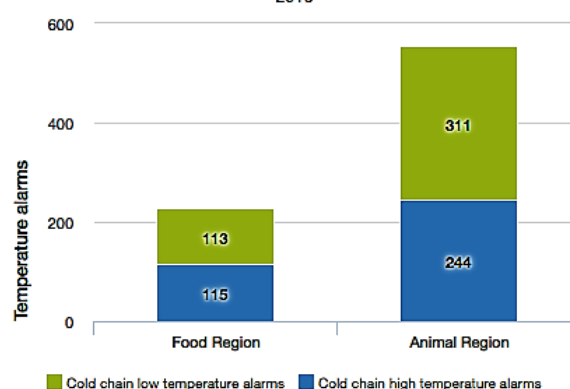
- 21) Number of high temperature alarms and number of low temperature alarms by month by region for the last 12 months

**EPI: Temperature alarms - last 12 months**



- 22) Number of high temperature alarms and number of low temperature alarms by region for 2016

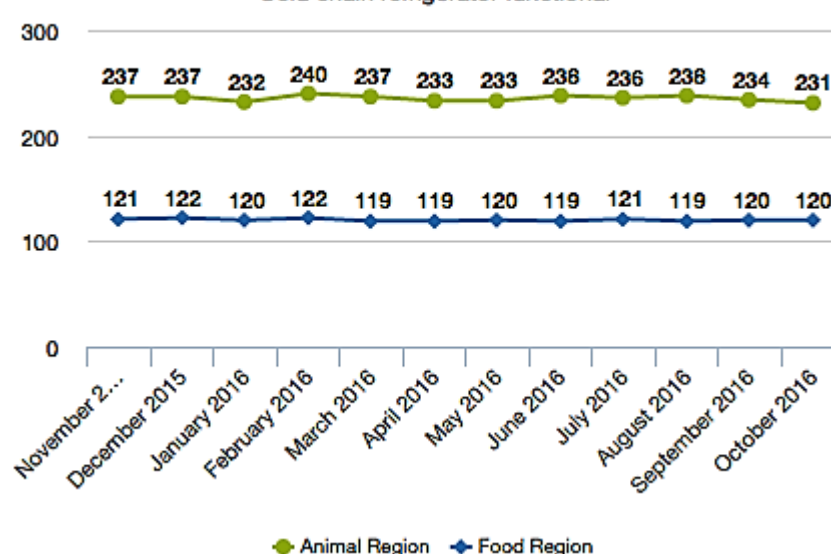
**EPI: Temperature alarms by orgunit - this year 2016**



- 23) Number of functional refrigerators by month by region for the last 12 months

**EPI: Functional refrigerators by orgunit - last 12 months**

Cold chain refrigerator functional



## Considerations/issues for interpretation

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### Monitoring for full availability

Full availability means that all demand could be met. Data on unmet demand are hard to come by. How do we know for sure that no children were turned away because of a stock out, or that some of them only received half of the vaccines they were due for? It is not enough to know whether there were stocks at the end of the month. Health staff must track this continuously whenever immunizations are demanded.

### Monitoring closed vial wastage

Closed vial wastage is the percentage of doses of vaccine that were spoiled during a reporting period due to expiry, heat exposure, freezing or breakage. Closed vial wastage is a good performance indicator because it can be avoided if the right management practices are in place. It is best practice to keep track of closed vial wastage by reason code, which would allow managers to identify specific shortcomings in the system. For example, unacceptably high wastage because of heat exposure as indicated by turned VVM's, would point to deficient storage or transport conditions. However, it is hard to obtain reliable wastage data by reason.

### Monitoring open vial wastage

Open vial wastage =  $(\text{Doses used} - \text{doses administered}) / (\text{Doses used})$ . Doses administered are the same as the number of children reported to have received the vaccine. Doses used = Starting balance + addition doses supplied during the period – ending balance. If the number of children reported to have received the vaccine during the period is greater than the number of doses used then the wastage rate is negative. This indicates a problem with data quality – either doses administered was over-reported or doses used was under-reported.

### Monitoring vaccine temperature alarms

If digital temperature recorders are being used, then the number of high alarms and the number of low alarms generated by these devices over the period provide a good indication of the working status of cold chain equipment and the conditions in which vaccines are being kept.

### Monitoring the number of functional refrigerators

The number of functional refrigerators provides a crude indication of cold chain capacity.

## ADVERSE EVENTS FOLLOWING IMMUNIZATIONS

### Purpose

AEFI should be monitored in two different ways:

- Aggregate reporting systems should be set up to monitor the total number of AEFI recorded in any health facility or district. These should be classified as either mild or severe AEFI.
- Case reporting forms should be filled out for all severe cases, and each of these cases should be properly investigated, including an analysis whether the AEFI was a direct result of the vaccination or not. Serious cases are defined as those severe cases that involved hospitalization, disability, or death, and the investigation of a serious case might lead to the withdrawal of a vaccine batch from the market.

### Analysis

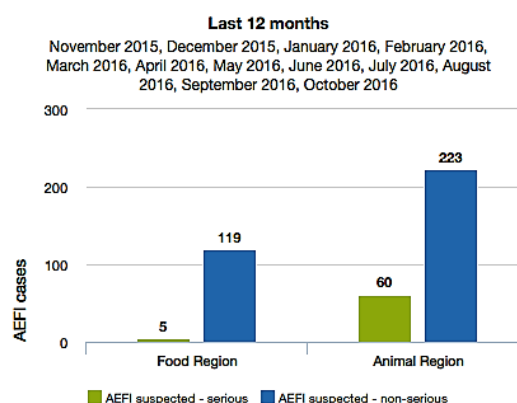
#### Monitor AEFIs

- 24) Non-serious and serious AEFI's by region, by year for this and the last 5 years

**EPI: AEFI cases - this and last 5 years**

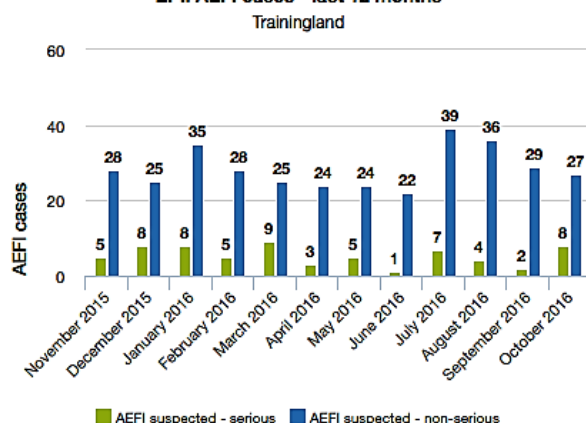
Trainingland						
Data / Period	2014	2015	2016	2017	2018	2019
AEFI suspected - non-serious			335	361	352	342
AEFI suspected - serious			51	72	80	62
Total			386	433	432	404

- 25) Non-serious and serious AEFIs by region for 2016



- 26) Non-serious and serious AEFI's by region, month for the last 12 months

**EPI: AEFI cases - last 12 months**



### Considerations/issues for interpretation

#### Sensitivity of AEFI surveillance

If fewer than 10 AEFI's are reported per year per 100,000 surviving infants, this could indicate that AEFI surveillance is not sufficiently sensitive.

## IMMUNIZATION SESSIONS

### Purpose

This indicator enables supervisors to follow up on the implementation of micro plans. Reporting the number of sessions held versus planned might give an indication of planning, operational, or budget issues at the reporting facility

### Analysis

#### Monitor completion of planned immunization sessions

27) Completion of planned sessions

**EPI: Outreach immunization sessions completion by orgunit - this and last**

Data	5 years					
	Outreach Immunization sessions conducted (%)					
Organisation unit / Period	2013	2014	2015	2016	2017	2018
Trainingland			0	0	0	0
Animal Region			0	0	0	0
Food Region			0	0	0	0



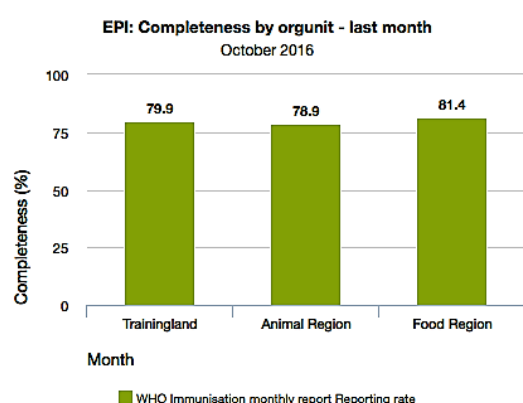
## COMPLETENESS OF REPORTING

### Purpose

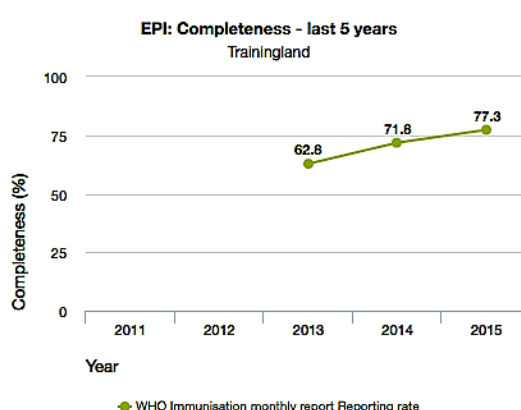
Complete reporting is required if all routine immunization data are to be compiled and analyzed. Understanding of trends in completeness of reporting is especially important when interpreting trends in coverage.

### Analysis

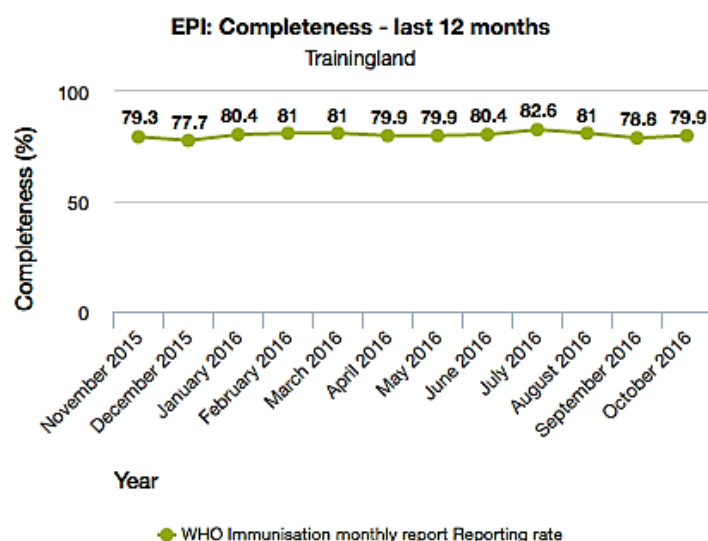
28) Completeness 1



29) Completeness 2



30) Completeness 3



### Considerations/issues for interpretation

#### Assess facility reporting completeness

District level reporting may be complete, but do these district reports contain the reported doses from all their facilities?

#### Disaggregation of reporting completeness

Examine regional differences in completeness before analyzing regional disparities in immunization coverage.

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