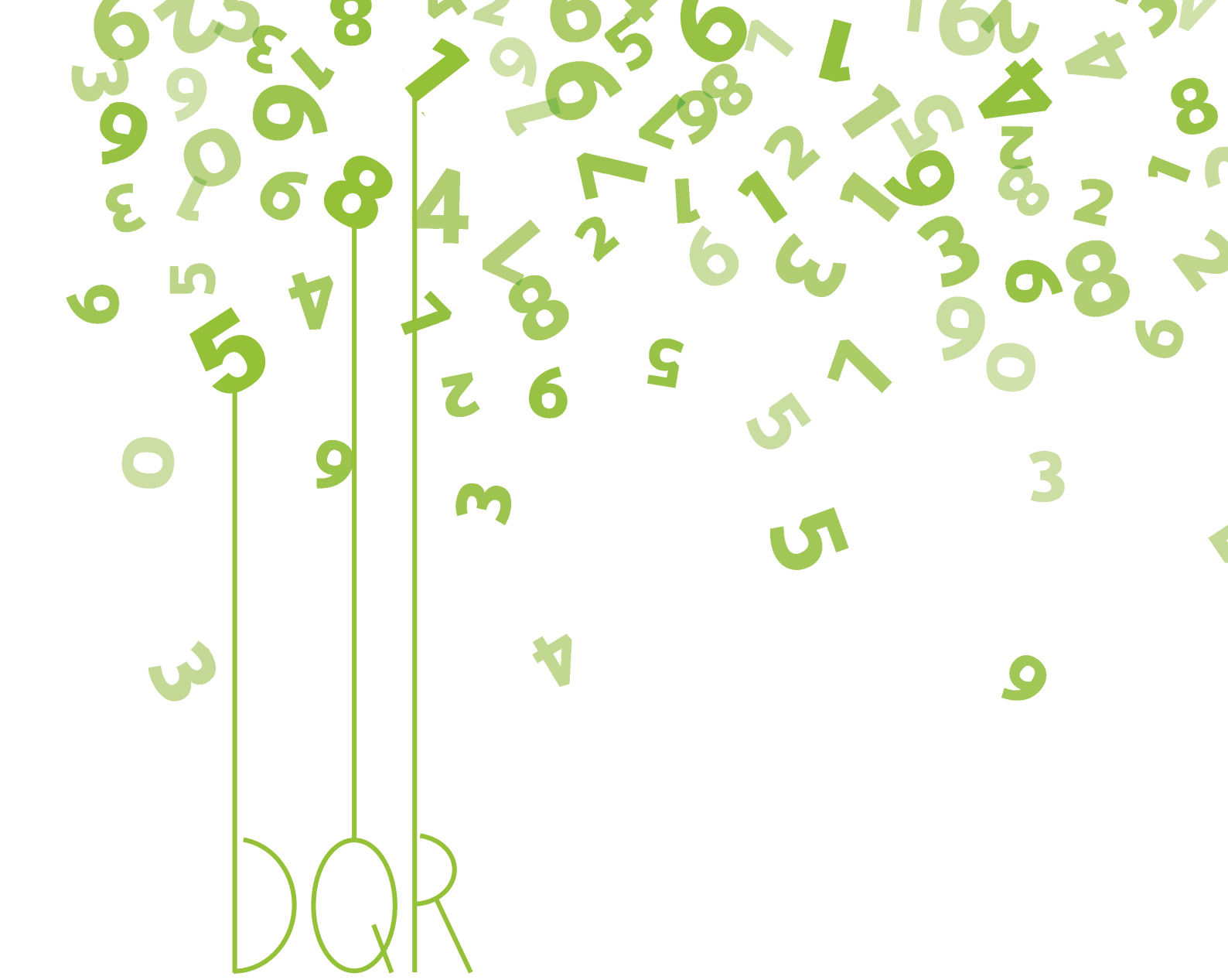

DQR

DATA QUALITY REVIEW

Module 3
Data verification and system assessment

World Health Organization · Gavi The Vaccine Alliance · The Global Fund · JSI · MEASURE Evaluation · USAID FROM THE AMERICAN PEOPLE

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Contents

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Content of the toolkit

The DQR toolkit includes guidelines and additional resources. The guidelines are presented in the three following modules. Additional resources for data collection and analysis will be made available online for downloading. Further information on additional resources are described in Module 1: Framework and metrics.

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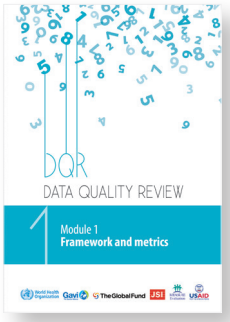
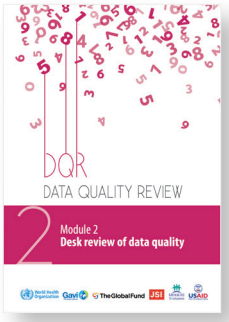


Module 1
Framework and metrics



Module 2
Desk review of data quality

Module 3
Data verification and system assessment

Abbreviations

ANC	Antenatal care
ANC1	First antenatal care visit
ART	Antiretroviral therapy
BMU	Business management unit
CSPro	Census and survey processing system
DHIS 2	Web-based, open source software used by countries chiefly as their health information system for data management and monitoring of health programmes
DQR	Data quality review
DTP	Diphtheria-tetanus-pertussis
DTP3	Diphtheria-tetanus-pertussis three-dose vaccine
DV	Data verification
Gavi	Gavi, the Vaccine Alliance
HIV	Human immunodeficiency virus
HMIS	Health management information system
IPT3	Third dose of intermittent preventive therapy
IPTp	Intermittent preventive therapy in pregnancy
MCV	Measles-containing vaccine
MDR-TB	Multidrugresistant tuberculosis
MOH	Ministry of Health
OPD	Outpatient visit
PCV	Pneumococcal conjugate vaccine
Penta	Pentavalent vaccine
PMTCT	Prevention of mother-to-child transmission
PNC	Postnatal care
RDT	Rapid diagnostic test
RR	Rifampicin-resistant
SA	system assessment
SARA	Service availability and readiness assessment
TB	Tuberculosis
The Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
TT	Tetanus toxoid vaccine
USAID	United States Agency for International Development
VF	Verification factor
WHO	World Health Organization

3.1 Overview

Measurement of data quality using facility surveys

Measuring data quality through a health facility survey provides a unique opportunity to verify the quality of data on a randomly selected sample of facilities. These results can be compared with the results produced in the desk review component of the data quality review (DQR). The analysis and recommended outputs of the data quality indicators collected through the health facility survey are presented below. As the survey is based on a representative sample of health facilities, appropriate weighting needs to be applied to obtain the correct estimates. Details on weighting are included in Annex 5.

By selecting a sample of facilities and by weighting the observations obtained during the survey, it is possible to calculate a nationwide average value of the data quality metrics (for the selected programme indicators) that is representative of all health facilities in the country. It is important to keep in mind, however, that such averages may mask variations in survey estimates due to health facility attributes, such as managing authority (e.g. public versus private for-profit), type (e.g. hospital versus health centre versus dispensary) and geographical region. For this reason, it may be necessary to perform stratified (i.e. disaggregated) analysis to calculate an estimate for each important category of the attribute (i.e. stratum). The proposed strata include facility type, managing authority and geographical region though not all will necessarily be relevant to each survey. Stratification of the sample also has the effect of increasing the sample size.

Core indicators

The same core indicators proposed for the desk review are also proposed for the facility survey. Ideally, metrics calculated from the facility survey and the desk review will provide holistic information on data quality and system issues and will allow for robust improvement mechanisms to be put in place. These core indicators are presented in Table 3.1.

While it is recommended that countries should select indicators from the core list, they may select other indicators or expand the set of indicators on the basis of their needs and the resources available. A full set of core and additional indicators is available in Annex 1.

Table 3.1 Recommended core indicators for the DQR

Recommended DQR indicators		
Programme area	**Indicator name**	**Full indicator**
Maternal health	Antenatal care 1st visit (ANC1) coverage	Number and % of pregnant women who attended at least once during their pregnancy
Immunization	DTP3/Penta3 coverage	Number and % of children < 1 year receiving three doses of DTP/ Penta vaccine
HIV	Currently on ART	Number and % of people living with HIV who are currently receiving ART
TB	TB notification rate	Number of new and relapse cases of TB that are notified per 100 000 population
Malaria	Confirmed malaria cases[1]	Confirmed malaria cases (microscopy or RDT) per 1000 persons per year

Note: ANC = antenatal care; ART = antiretroviral therapy; DTP3 = diphtheria-tetanus-pertussis three-dose vaccine; Penta = pentavalent vaccine; RDT = rapid diagnostic test; TB = tuberculosis.

Dimensions of data quality

This DQR framework examines each of the selected indicators from four perspectives, or dimensions, namely:

- Dimension 1: completeness and timeliness of data;
- Dimension 2: internal consistency of reported data;
- Dimension 3: external consistency – i.e. agreement with other sources of data such as surveys;
- Dimension 4: external comparisons of population data (a review of denominator data used to calculate rates for performance indicators).

Completeness and timeliness

The completeness of the data is assessed by measuring whether all the entities which are supposed to report actually do so. This applies to health-facility reporting to districts and to district reporting to the regional or provincial levels. Timeliness of data is assessed by measuring whether the entities which submitted reports did so before a predefined deadline. The metrics for completeness and timeliness in the DQR include:

- **Completeness and timeliness of district reporting:** these metrics measure district performance on completeness and timeliness of reporting.
- **Completeness and timeliness of facility reporting:** these metrics measure facility performance on completeness and timeliness of reporting.

[1] If the number of confirmed malaria cases is not collected, total malaria cases can be substituted.

- **Completeness of indicator data (data element):** this indicator measures the extent to which facilities that are supposed to report data on the selected core indicators are doing so. This is different from overall reporting completeness in that it looks at completeness of specific data elements and not only at the receipt of the monthly reporting form.
- **Consistency of reporting completeness:** this indicator examines trends in reporting completeness.

Internal consistency of reported data

Internal consistency of the data relates to the coherence of the data being evaluated. Internal consistency metrics examine: 1) coherence between the same data items at different points in time, 2) coherence between related data items, and 3) comparison of data in source documents and in national databases.

Four metrics of internal consistency are included in the DQR. These are:

- **Presence of outliers:** this examines if a data value in a series of values is extreme in relation to the other values in the series.
- **Consistency over time:** the plausibility of reported results for selected programme indicators is examined in terms of the history of reporting of the indicators. Trends are evaluated to determine whether reported values are extreme in relation to other values reported during the year or over several years.
- **Consistency between indicators:** programme indicators which have a predictable relationship are examined to determine whether the expected relationship exists between those indicators. In other words, this process examines whether the observed relationship between the indicators, as depicted in the reported data, is that which is expected.
- **Consistency of reported data and original records:** this involves an assessment of the reporting accuracy for selected indicators through the review of source documents in health facilities. This element of internal consistency is measured by a data verification exercise which requires a record review to be conducted in a sample of health facilities. It is the only dimension of data quality that requires additional collection of primary data.

External consistency with other data sources

The level of agreement between two sources of data measuring the same health indicator is assessed. The two sources of data usually compared are data flowing through the HMIS or the programme-specific information system and a periodic population-based survey. The health management information system (HMIS) can also be compared to pharmacy records or other types of data to ensure that the two sources fall within a similar range.

External comparison of population data

This involves determining the adequacy of the population data used in evaluating the performance of health indicators. Population data serve as the denominator in the calculation of a rate or proportion and provide important information on coverage. This data quality measurement compares two different sources of population estimates (for which the values are calculated differently) in order to ascertain the level of congruence between the two. If the two population estimates are discrepant, the coverage estimates for a given indicator can be very different even though the programmatic result (i.e. the number of events) is the same. The higher the level of consistency between denominators from different sources, the more likely it is that the values represent the true population value.

3.2 Implementation of the data verification and system assessment component

Preparation and implementation of the health facility survey component of the DQR

Requirements for data verification and system assessment

Lists of recommended source documents and cross-checks for data verification are available in Annex 4 and Annex 5.

Sampling of health facilities

A representative sample of health facilities should be selected for data verification and for administering the system assessment module. A "master facility list" – or a list of health facilities with attribute data (e.g. management authority, facility type, location in terms of region and district) – is a prerequisite for implementing the data verification (DV) and system assessment (SA) components of the DQR. Once the objectives of the DQR are determined, the sampling methodology can be developed. For instance, health facility assessments such as the Service Availability and Readiness Assessment (SARA) typically employ list and/or area sampling, while other data quality assessments have used a modified two-stage cluster sampling methodology. If regional estimates of data accuracy, or estimates specific to certain types of health facilities (e.g. management authority or type of facility) are required, the sampling methodology must take account of these requirements. Specialty services (e.g. TB diagnosis and treatment, HIV testing and treatment) are not offered at all facilities so the sample may need to be adjusted if indicators from these programme areas are to be assessed. The technical requirements of drawing up the sample and deriving estimates from the resulting data are not trivial. Care should be taken when developing the sampling methodology according to individual country requirements. A statistician should be consulted to ensure that the sample is drawn up appropriately. Annex 5 provides more information on sampling of health facilities for the DV and SA components of the DQR.

Identifying, adapting and reproducing survey tools (paper and/or electronic)

Standardized tools have been developed for data verification and for the system assessment to assist countries in implementing the DQR at health facility and district levels. The tools were developed as modules of the SARA toolkit but can be employed as stand-alone tools when data quality assessment is the primary purpose.

The tools should be adapted to the country context prior to implementation (e.g. by specifying programme areas, indicators and source documents). If data are to be captured electronically (e.g. on a tablet computer) a database should be developed to facilitate data entry. Sampled health facilities should be prepopulated in the database, and facility database records should be made available on the tablets used in the field. Data verification and system assessment modules have been developed in CSPro 6.2 computer programme and can be obtained from WHO. As with the paper version of the survey tools, the database modules should be adapted to the country context prior to implementation of the DQR.

Organizing the training of fieldworkers (enumerators)

Fieldworkers conducting the health facility survey should be trained in the methods of data verification and in administration of the system assessment. Data verification across programme areas requires familiarity with different data collection tools (registers, patient records, tally sheets, etc.) according to the indicators and programme areas. Enumerators should ideally have experience both of recording public health data and of the data collection tools used in the field. Training of enumerators should include practice in compiling indicators for each programme area using the tools they are likely to encounter in the field.

Notifying sites and subnational authorities

Several weeks prior to implementation, the health facilities sampled for the DQR should be notified of the date of the visit of the assessment teams. The relevant data management staff and their supervisors should be present at the facility on the day of the visit in order to facilitate access to the relevant records, provide responses for the system assessment, and assist with the completion of the survey at the facility. Similarly, subnational HMIS management authorities, such as HMIS managers at district and/or regional levels, should also be informed both to satisfy potential administrative protocols and to enlist their support/cooperation in completing the survey.

Conducting the survey at the health facility

Survey teams should work in pairs to maximize efficiency and to control for quality during visits to health facilities. Up to five indicators (one per programme area) are recommended for data verification. The teams should plan to spend one complete day at each facility if combining the DV/SA components with an existing health facility assessment such as the Service Availability and Readiness Assessment. If conducting a stand-alone DV/SA modules, at least one half-day should be allocated for data collection though it may take more time to complete the survey, particularly in sites with high client volume (a large number of records to recount) and poor quality and organization of data (difficulty in retrieval and recount). The system assessment should require no more than one hour at the health facility. The ideal respondent for the system assessment is the facility data manager (or the person responsible for compiling and reporting the data).

Conducting the survey at the district level

The DQR is also implemented at district HMIS management units involved in the data flow from the sampled health facilities. At the district level the survey team will re-aggregate the district value of the selected indicators using the values submitted on the monthly reporting forms from all facilities in the district (not just the facilities in the sample). The team will also determine the completeness and timeliness of reporting at this level. The district-level system assessment module should be completed in an interview with the data manager or programme manager. Survey teams should plan to spend about half a day at the district HMIS management unit.

Oversight and quality control of the survey

Survey teams should be supervised in the field by dedicated staff. Supervisors should cover a predetermined geographical area and a specified number of survey teams. The supervisor's role is to assist the teams in the completion of the surveys (where necessary), to collect and review the completed questionnaires and to troubleshoot problems if they arise. Supervisors should revisit health facilities and verify the survey results for a small sample of facilities (e.g. 10%) to ensure that results are recorded accurately. If possible, independent monitors from national stakeholders (e.g. donors) can also play a role in monitoring implementation of the survey.

Compiling results

Survey team supervisors should deliver the completed surveys to the designated DQR data management staff at national level. A small team should be assembled from available staff at the Ministry of Health and/or at stakeholder organizations to review submitted survey forms, correct errors and enter the data into the computer programme (e.g. CSPro 6.2) to facilitate analysis. Depending on the number of facilities sampled and the number of indicators verified, it may take up to one week for team of 4–5 data managers to clean and input all the data.

3.3 Analysis and interpretation

Data quality metrics collected from the health facility surveys

While the DQR framework includes four dimensions of data quality (see section 3.1) only some metrics in the following dimensions can be examined through a health facility survey. These are:

Dimension 1: completeness and timeliness of data;

Dimension 2: internal consistency of reported data.

Completeness and timeliness

The completeness of the data is assessed by measuring whether all the entities which are supposed to report actually do report and whether they do so in a timely manner. The measures of completeness and timeliness included in the facility survey portion of the DQR include:

- **Completeness and timeliness of facility reporting:** this metric measures whether the health facilities of the representative sample in the survey have submitted their monthly reporting forms and submitted them on time.
- **Completeness of indicator data:** this metric measures whether the health facilities of the representative sample in the survey have included information on each of the selected indicators in their monthly reporting form, if they are offering the service.
- **Completeness of TB data elements in the source documents:** as part of TB standards and benchmarks B1.4[1], data for a minimum set of variables should be available for ≥ 95% of the total number of reported TB cases in the basic management unit (BMU). As erroneous conclusions may be made if the BMU data are inaccurate or incomplete, the proportion of TB cases with at least one of six variables missing (i.e. year of registration, sex, age, disease classification, type of patient, bacteriological results) is ascertained in the TB register.

Internal consistency of reported data

Internal consistency of the data is the coherence of the data being evaluated. Internal consistency metrics examine coherence between the same data items at different points in time, between related data items, and between data in source documents and national databases.

[1] Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: World Health Organization; 2014 (WHO/HTM/TB/2014.02; http://apps.who.int/iris/bitstream/10665/112673/1/9789241506724_eng.pdf?ua=1, accessed 11 June 2015).

The comparison of data in source documents to data in the national database is the measure of internal consistency that is evaluated during the health facility survey, as follows:

- Verification of reporting consistency: this involves the review of source documents in health facilities in order to assess the reporting accuracy for selected indicators. This element of internal consistency is measured through a data verification exercise which requires a record review to be conducted in a sample of health facilities. Data verification compares the total number of service outputs recorded in source documents at the health facility and the total number of service outputs reported through the reporting system (either the HMIS or programme-specific reporting system) for selected indicators. Values of selected indicators for a given reporting period are recalculated using the primary sources of data for the indicators. The recalculated value is then compared to the value that was initially reported through the system for the given reporting period. The ratio of the recounted value to the reported value is called the "verification factor" and constitutes a measure of accuracy of the indicator. This exercise should be conducted at the facility level and again at the district and provincial levels, and a verification ratio should be calculated for each level.

Analysis of data quality metrics and other measures collected from health facility surveys

The following sections recommend tables that are useful for presenting and interpreting indicators of data quality collected from the health facility survey component of the DQR.

General facility information

This section includes tables that describe the sample and provide context for interpretation of the data quality metrics.

Availability of services and status of reporting data

The percentage of facilities in the sample providing the specific health services, and those facilities that report data to an HMIS or other Ministry of Health reporting system, should be included in the presentation of results. This will provide information on the number of facilities on which the subsequent data verification results are based. Tables 3.2 and 3.3 show examples of how the data may be presented.

Table 3.2 Percentage of facilities in the sample providing each health service, by stratum, by indicator

		Stratum 1 (e.g. facility type)			Stratum 2 (e.g. managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.3 Percentage of facilities providing services that report data to a Ministry of Health reporting system, by stratum, by indicator

		Stratum 1 (e.g. facility type)			Stratum 2 (e.g. managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Availability of source documents and monthly reports

If a facility offers a specific service, it should also have the source documents (registers, tally sheets, etc.) and the monthly reports of the three-month verification period available for review on the day of the data verification survey. The selected programme indicators (and their related services) should have standard Ministry of Health registers, tally sheets or other documents which health facilities are expected to use to record daily activities. While it is possible that health facilities may use multiple documents to record the services provided, it is important to identify whether there is a main source document from which data are compiled for monthly reporting. Table 3.4 shows the percentage availability of these documents for all the three months. The following equation shows the percentage availability of source documents **and** monthly reports.er of facilities providing a specific service.

$$\%\ \text{availability of source documents and monthly reports for each facility} = \frac{\sum_{i=1}^{n} \textit{Available month } 1_i + \textit{Available month } 2_i + \textit{Available month } 3_i}{3n} \times 100$$

where n is the total number of facilities providing a specific service

Table 3.4 Percentage of facility-months (for facilities providing a specific service) for which all required source documents as well as the monthly report could be located by the survey team, by stratum

		Stratum 1 (e.g. facility type)			Stratum 2 (e.g. managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Match between source documents and monthly reports

The number of events recounted from the main source document should match exactly the number reported in the monthly reporting form. Table 3.5 shows the percentage match between the service outputs reported in monthly reports and the service outputs recounted in source documents for all the three months.

$$\%\ \text{match between reported and recounted service outputs} = \frac{\sum_{i=1}^{n} (\#\ \text{Facilities with exact match month\_1} + \#\ \text{Facilities with exact match month\_2} + \#\ \text{Facilities with exact match month\_3})}{3n} \times 100$$

where n is the total number of facilities providing a specific service

Table 3.5 Percentage of facility-months (for facilities providing a specific service) for which the sum of source data is exactly equal to the reported data, by stratum

		Stratum 1 (facility type)			Stratum 2 (managing authority)	
	Overall	Hospitals	Health centres	Dispensary	Government	Private-for-profit
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Data quality indicators

Facility reporting completeness

This indicator measures the percentage of monthly reports received by the district office for the facilities sampled in the health facility survey. The number of monthly reporting forms varies by country. Some countries have only one form in which all key indicators are reported while other countries have forms for different service/programme areas. The DQR is able to measure reporting completeness for multiple monthly reporting forms.

Ideally, facility reporting completeness is measured by the receipt of monthly reports at the district office. Irrespective of whether a country's health information system is electronic or paper-based, it is recommended to measure facility reporting completeness at the district level by enquiring about the receipt of monthly reports for the facilities in the survey. If, exceptionally, the district office cannot be visited, a proxy reporting completeness variable can be calculated through the availability of monthly reports at the health facility. Table 3.6 shown an example of how to present the data.

Table 3.6 Percentage of facility-months (for the sampled months, for facilities visited which provide the specific service) with monthly reports received by the district office that include the following indicators, by stratum

		Stratum 1 (e.g. facility type)			Stratum 2 (e.g. managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)						
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Timeliness of facility reporting

Managers rely on timely information. This indicator is collected at the district level to assess whether the facilities in the survey sent their reports to the district office on time (i.e. by the receipt date specified in the standard operating procedures for data management). Table 3.7 shows how to present the data.

Table 3.7 Percentage of facility-months (for the sampled months, for facilities visited which provide the specific service) with monthly reports received by the district office by the reporting deadline, by stratum

		Stratum 1 (facility type)			Stratum 2 (managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Timeliness of reporting by districts

Timeliness of reporting at the district level is measured at the destination of the district-level reporting – usually the national level. Timeliness concerns may arise both in district-level reporting and at higher aggregation levels. A chain effect can occur where incomplete/delayed reporting by facilities affects district-level reporting and reporting by other aggregation levels. Table 3.8 presents the timeliness of reporting by a higher aggregation unit (e.g. the district office). This indicator will not be calculated in countries where data are transferred only in electronic form between the district and national levels.

Table 3.8 Percentage of district monthly reports (for the selected three months, including information on the following indicators) submitted on time by the district office

		Stratum (region)		
	Overall	Region 1	Region 2	Region 3
ANC1 (n =)				
DTP3/PENTA3 (n =)	%	%	%	%
Malaria cases (n =)				
Notified cases of TB (n =)				
Currently on ART (n =)				

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Data element completeness

While high levels of facility reporting completeness are very important, it is also important to ensure that a facility that is supposed to report on an indicator has included the relevant information in its monthly reports. This indicator measures the level of data element completeness for the facilities in the sample. Table 3.9 is shown as an example of how to present the data.

Table 3.9 Percentage of facility-months (for facilities visited and providing a specific service and reporting data) that include data for the following indicators in their monthly reports, by stratum

		Stratum 1 (facility type)			Stratum 2 (managing authority)	
	Overall	Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)	%	%	%	%	%	%
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Completeness of information on a minimum set of variables for TB

TB surveillance systems require data to be reported on a minimum set of variables in order to assess TB incidence and trends adequately. This minimum set should include data for all cases on age, sex, year, bacteriological results (i.e. laboratory versus clinically confirmed), history of previous treatment (i.e. new versus previously treated), and anatomical site of disease (e.g. pulmonary versus extra-pulmonary). Completeness of data on these minimum variables is assessed to determine whether standards B1.5, B1.6 and B1.7 are met[2] as shown in Table 3.10.

Table 3.10 Frequency of missing data for selected variables in TB registers

	n	%
Total number of facilities with cases having missing data		
Cases with missing data for selected variables		
Year of registration		
Sex		
Age		
Disease classification (pulmonary versus extra-pulmonary)		
Type of patient (new versus previously treated)		
Bacteriological results		
Number of cases missing data for at least one of the following variables: year of registration, sex, age, disease classification, type of patient, or bacteriological results		

[2] Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: World Health Organization; 2014 (WHO/HTM/TB/2014.02; http://apps.who.int/iris/bitstream/10665/112673/1/9789241506724_eng.pdf?ua=1, accessed 11 June 2015).

Verification factor (VF)

Even if the reported and recounted numbers do not match exactly, it is useful to take account of the degree of disparity between the two.

For a given indicator, the VF at a facility is computed as the recounted number of events from source documents divided by the reported number of events from the HMIS.

$$\textit{Verification factor} = \frac{\text{Recounted number of events from source documents}}{\text{Reported number of events from the HMIS}}$$

A VF higher than 1 implies that there is underreporting of events in the HMIS for the verification period. If the VF is less than 1, this implies that there is over-reporting of events in the HMIS for the period chosen for the analyses. When calculating the VF for a given tracer indicator, data from facilities which do not provide the specific service are of course excluded. It should also be noted that recounted values may exceed reported values if some reports are missing and reported values may exceed recounted values if some source documents are missing. For this reason the VF is calculated only for health facilities that have both the source documents and the monthly reports; it is not calculated for facilities that have either the source data or one or more monthly reports missing. This distinguishes the assessment of the accuracy of reporting from the assessment of completeness of record-keeping and archiving.

Tables 3.11 and 3.12 present the overall national VFs calculated at the facility level, VFs by strata, and the percentage of facilities that over-report or under-report. The VF is a weighted average. Like any average, it may mask the underlying distribution of VFs of individual health facilities – some of which may have a much lower VF (greater over-reporting than is suggested by the average) and some of which may have a much higher VF (more under-reporting than is suggested by the average). It is possible to find that certain categories of health facilities (e.g. government facilities) over-report while other categories of health facilities (e.g. private-for-profit facilities) under-report. It is also worthwhile to review the distribution of VFs of individual health facilities: the % of facilities which over-reported by more than 10% (i.e. VF < 0.90), the % of facilities which under-reported by more than 10% (i.e. VF > 1.10) and the % of facilities for which source data exactly match reported data. Sample size permitting, comparisons should also be made between subnational units (i.e. regions) to determine where resources should be targeted for system strengthening.

The weighted estimates of the VFs for the assessed indicators should be compared to findings from previous data quality assessments in order to determine trends in accuracy.

Table 3.11 Facility-level verification factor for selected indicators, by strata

	National verification factor	Stratum 1 (facility type)			Stratum 2 (managing authority)	
		Type 1	Type 2	Type 3	Type 1	Type 2
ANC1 (n =)						
DTP3/PENTA3 (n =)						
Malaria cases (n =)						
Notified cases of TB (n =)						
Currently on ART (n =)						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.12 Facility-level metrics relevant for data verification

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
% of facilities providing the service and reporting data that have all required source records and reports					
% of facilities for which source data exactly match reported data	%	%	%	%	%
% of facilities that over-report by more than 10% (VF < 0.90)					
% of facilities that under-report by more than 10% (VF > 1.10)					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Verification factor for higher-level aggregating units

The data verification exercise should be conducted at all levels where health information is physically aggregated (e.g. health facility → district → province → national. In a country with an electronic health information system into which districts input all health facility data, the data verification exercise will be conducted at the health facility and district levels. In other countries, where there are multiple levels of aggregation, the data verification exercise must be carried out at all the levels. The example below in Table 3.13 presents a tabular analysis of district-level verification information. A similar exercise should be carried out for other aggregation levels in countries where required.

Table 3.13 below shows that the VF at the district level is calculated by re-aggregating the value of the selected indicators from the health facilities reporting to the district on monthly summary report forms. The re-aggregated value is divided by the value reported by the district for the reporting period in question in order to derive a district VF. The district VF is an independent assessment of the accuracy of reporting for the district HMIS or programme office. The district VF is not factored into the composite VF derived from the full sample of health facilities.

Table 3.13 District-level metrics relevant for data verification

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
% of facilities providing the service and reporting data that have all required source records and reports					
National district-level VF factor					
Number and list of districts with VF < 0.90					
Number and list of districts with VF > 1.10					
% of districts that over-report (VF < 0.90)					
% of districts that under-report (VF > 1.10)					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Reasons why data submitted in monthly reports does not match source documents

Facility level

Table 3.14 reviews reasons for discrepancy between the recounted data from source documents and data reported in monthly reports. Table 3.15 examines reasons for unavailability of monthly reports, if one or more of the monthly reports are missing. It is valuable to examine each programme separately because the results can show whether some problems are systemic or more programme-specific. Additional analyses can be conducted by facility type or ownership.

Table 3.14 Reasons for discrepancy between source data and reported data at facility level, by programme area

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
% of facilities with no discrepancy					
% of facilities with arithmetical errors					
% of facilities with transcription errors					
% of facilities where some documents were missing during report preparation					
% of facilities where some documents were missing during survey implementation					
Other reasons					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.15 Reasons for missing monthly reports, by programme area

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
% of facilities with all three monthly reports					
% of facilities with submitted report that cannot be located now					
% of facilities that do not have trained staff to report					
% of facilities where no reporting form was available					
% of facilities where there was some interruption in service delivery in one or more of the selected months					
Other reasons					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

District or higher aggregation levels

Table 3.16 presents information on whether or not the district office that deals with monthly reports that include information for the selected programme indicators has a system for monitoring completeness and timeliness of the monthly reports received from health facilities. It is possible that more than one district office is involved, especially when parallel programme reporting systems exist. In this case, this question will be asked at the programme level. However, if only one district office controls the flow of information (such as the HMIS office), the tracking of completeness and timeliness will be requested only once.

Note: depending on the sampling strategy used for the facility survey, if the district is not the primary sampling unit it will not be possible to make inferences about all districts in the country with this information. However, it is to be hoped that the information collected is illustrative and that it can be used to guide country-level discussions on district-level problems with data management. This caveat applies to all the district analyses.

Table 3.16 Availability of system for tracking completeness and timeliness, at district level

	Overall	Data elements				
		ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
% of districts with a system for tracking timeliness						
% of districts with a system for tracking completeness						

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.17 identifies reasons for discrepancy between the aggregated data from monthly reports from all health facilities and the report submitted from the district office to the next reporting level. This table disaggregates this information by programme area. If multiple district offices are involved in the data verification process, district-level analysis may show variation in the accuracy of different programme data. Even if only one district officer compiles the data, there may be relevant programme-specific information. Tables 3.18 and 3.19 examine from a district officer's perspective why health facilities in a district have not submitted the appropriate report or have not submitted it in a timely manner. It is valuable to examine each programme separately because the results can show whether discrepancies are systemic or more programme-specific. Additional analyses can be conducted by facility type or ownership.

Table 3.17 Reasons given for discrepancy between source data and reported data at district level, by programme area

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
No discrepancy					
Arithmetical or data entry errors	%	%	%	%	%
Additional facility reports received after district reporting					
Some facility reports missing after district reporting					
Other reasons					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.18 Reported cause of incompleteness of reporting, by programme area

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
100% reporting completeness					
Lack of trained staff in facilities					
Lack of reporting forms in facilities					
Difficulties with transport/communication	%	%	%	%	%
Some facilities no longer provide the service					
Some facilities do not follow guidelines					
District has an inadequate system for tracking completeness					
Other reasons					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

Table 3.19 Reported cause of late reporting, by programme area

	Data elements				
	ANC1 (n =)	DTP3/ PENTA3 (n =)	Malaria cases (n =)	Notified cases of TB (n =)	Currently on ART (n =)
100% reporting timeliness					
Difficulties with transport/communication	%	%	%	%	%
Some facilities delay completion					
District has an inadequate system for tracking timeliness					
Other reasons					

Note: ANC = antenatal care; DTP3 = Diphtheria-tetanus-pertussis vaccination; TB = tuberculosis; ART = antiretroviral therapy.

System assessment

The system assessment measures the capacity of the system to produce good-quality data. It evaluates the extent to which critical elements of the reporting system adhere to a minimum set of acceptable standards. A set of system domains examining the availability of guidelines, trained staff and data collection tools, as well as supervision and feedback on data quality, are evaluated. Annex 3 provides details on how each system domain is defined and how the domain score is calculated. Table 3.20 displays a method for presenting findings on these system domains. A similar presentation is recommended for the district level. Conditional colour formatting shows variation in performance for each item in the different strata. Please note that these numbers and estimates are purely illustrative.

Table 3.20 Percentage of facilities that reported health data to a Ministry of Health reporting system and had the following data management system domain scores, by strata

	Overall	Facility type			Ownership		Location	
		Hospital	Health center	Health post	Public	Private	Urban	Rural
	n =231	n = 85	n = 86	n = 60	n =173	n = 58	n =88	n =143
Facilities reporting service statistics to MOH (%)								
Of those offering ANC services, % of facilities reporting to an MOH reporting system	89	40	92	94	92	81	81	93
Of those offering immunization ser-vices, % of facilities reporting to an MOH reporting system	89	39	90	97	94	75	78	95
Of those offering HIV care services, % of facilities reporting to an MOH reporting system	59	91	68	22	55	71	73	52
Of those offering TB care services, % of facilities reporting to an MOH reporting system	57	86	62	35	55	64	61	55
Of those offering malaria treatment services, % of facilities reporting to an MOH reporting system	100	96	100	100	100	99	99	100
Data management system domain scores (%)								
	n = 231	n = 82	n = 86	n = 60	n = 171	n = 58	n = 88	n = 143
Availability of guidelines	57	66	63	36	54	61	69	54
Availability of trained staff	42	49	47	26	41	45	56	39
No stock-out of tally sheets, registers and reporting forms in the last 6 months	73	88	77	57	73	73	73	73
Receipt of supervision and written feedback, including on data quality	16	48	20	2	14	20	22	15
Analysis and use of data	37	45	43	20	38	47	56	33
Met all criteria	2	17	3	0	2	4	4	2
Mean of items	46	65	49	33	44	50	54	44
Overall score	35	30	44	17	37	32	38	34

Overall score is the percentage of facilities reporting to any Ministry of Health reporting system multiplied by its mean score.
Note: ANC = antenatal care; MOH = Ministry of Health; TB = tuberculosis.

Additional simple analyses can examine a significant association (such as with a chi-square test of independence) between these items (both individually and as an index) on data quality (i.e. the VF). Table 3.21 presents an example of a tabulation between the availability of a single item – receipt of training by staff who enter/compile data – on the data VF. Similar tables can be constructed for other items. An analysis such as this, while not indicating causation, is definitely helpful in prioritizing the next steps for improving the status of some of these physical attributes. Other analyses, such as regressions, can be conducted to assess the relationship between the availability of the system assessment indicators and data quality (i.e. data VF).

Table 3.21 Differences in average data verification factor based on receipt of training for staff who compile/enter data, overall and by strata

	Overall average verification factor	Stratum 1 (e.g. facility type)			Stratum 2 (e.g. managing authority)	
		Type 1	Type 2	Type 3	Type 1	Type 2
Yes – stock-outs						
No – stock-outs						

Annex 1: Recommended indicators

Core indicators

Recommended DQR indicators		
Programme area	**Indicator name**	**Full indicator**
Maternal health	Antenatal care 1st visit (ANC1) coverage	Number (%) of pregnant women who attended at least once during their pregnancy
Immunization	DTP3/Penta3 coverage	Number (%) of children < 1 year receiving three doses of DTP/Penta vaccine
HIV	Currently on ART	Number and % of people living with HIV who are currently re-ceiving ART
TB	TB notification rate	Number of new and relapse cases of TB that are notified per 100,000 population
Malaria	Total confirmed malaria cases[1]	Confirmed malaria cases (microscopy or RDT) per 1000 persons per year

Note: ANC = antenatal care; ART = antiretroviral therapy; DTP3 = diphtheria-tetanus-pertussis three-dose vaccine; Penta = pentavalent vaccine; RDT = rapid diagnostic test.

Additional indicators

Additional DQR indicators		
Programme area	**Indicator name**	**Full indicator**
General	Service utilization	Number of outpatient department visits per person per year
Maternal health	Antenatal care 4th visit (ANC4)	Number (%) of women aged 15–49 years with a live birth in a given time period who received antenatal care, four times or more
	Institutional delivery coverage	Number and % of deliveries which took place in a health facility
	Postpartum care coverage	Number (%) of mothers and babies who received postpartum care within two days of childbirth (regardless of place of delivery)
	Tetanus toxoid 1st dose coverage	Number (%) of pregnant women who received the 1st dose of tetanus-toxoid vaccine
Immunization	DTP1-3/Penta1-3 coverage	Number (%) of children < 1 year receiving 1st dose, 2nd dose, 3rd dose of DTP/Penta vaccines
	MCV1 coverage	Number (%) of infants who have received at least one dose of measles-containing vaccine (MCV) by age 1 year
	PCV 1-3[2] coverage	Number (%) of children < 1 year receiving 1st dose, 2nd dose, 3rd dose of pneumococcal vaccines

[1] If the number of confirmed malaria cases is not collected, total malaria cases can be substituted.
[2] If this vaccine is not used in country, substitute with another vaccine used in the national programme.

Additional indicators, continued

Recommended DQR indicators		
Programme area	**Indicator name**	**Full indicator**
HIV	People living with HIV who have been diagnosed	Number (%) of people living with HIV who have been diagnosed
	HIV care coverage	Number (%) of people living with HIV who are receiving HIV care (including ART)
	PMTCT ART coverage	Number (%) of HIV-positive pregnant women who received ART during pregnancy
	ART retention	Number (%) of people living with HIV and on ART who are retained on ART 12 months after initiation (and 24, 36, 48, and 60 months)
	Viral suppression	Number (%) of people on ART who have suppressed viral load
TB	Notified cases of all forms of TB	Number of new and relapse cases of TB that are notified per 100 000 population – *Assess if quarterly case notification report blocks 1 and 2[1] are correct as per standards and benchmarks (B1.4) for paper-based systems[2]*
	TB treatment success rate	Number (%) of TB cases successfully treated (cured plus treatment completed) among TB cases notified to the national health authorities during a specified period – *Assess if quarterly treatment outcome report block 1 is correct as per standards and benchmarks (B.14) for paper-based systems*
	Second-line TB treatment success rate	Number (%) of TB cases successfully treated (cured plus treatment completed) among all confirmed RR-TB/MDR-TB cases started on second-line treatment during the period of assessment
TB-HIV	Proportion of registered new and relapse TB patients with documented HIV status	Number of new and relapse TB patients who had an HIV test result recorded in the TB register, expressed as a percentage of the number registered during the reporting period
	Proportion of HIV-positive new and relapse TB patients on ART during TB treatment	Number of HIV-positive new and relapse TB patients who received ART during TB treatment expressed as a percentage of those registered during the reporting period
Malaria	Malaria diagnostic testing rate	Number (%) of all suspected malaria cases that received a parasitological test [= Number tested / (number tested + number presumed)]
	Confirmed malaria cases receiving treatment	Number (%) of confirmed malaria cases treated that received first-line antimalarial treatment according to national policy at public-sector facilities
	Malaria cases (suspected and confirmed) receiving treatment	Number (%) of malaria cases (presumed and confirmed) that received first-line antimalarial treatment
	IPTp3	Number (%) of pregnant women attending antenatal clinics who received three or more doses of intermittent preventive treatment for malaria

Note: ANC = antenatal care; ART = antiretroviral therapy; DTP = diphtheria-tetanus-pertussis; MCV = measles-containing vaccine; MDR-TB = multidrug-resistant tuberculosis; PCV = pneumococcal conjugate vaccine; PMTCT = Prevention of mother-to-child transmission; RR = rifampicin-resistant.

[1] Definitions and reporting framework for tuberculosis – 2013 revision. Geneva: World Health Organization; 2013 (WHO/HTM/TB/2013.2; http://apps.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf?ua=1, accessed 11 June 2015).

[2] Standards and benchmarks for tuberculosis surveillance and vital registration systems: checklist and user guide. Geneva: World Health Organization; 2014 (WHO/HTM/TB/2014.02; http://apps.who.int/iris/bitstream/10665/112673/1/9789241506724_eng.pdf?ua=1, accessed 11 June 2015).

Annex 2: Calculation of data quality metrics from the health facility survey

Table A2.1 Data quality metrics from health facility survey

Data quality metric	Analysis description for facility level	Analysis description for district level
(a) Facility reporting completeness % of expected reports archived (for the three selected months) for the facilities in the survey sample DVD_123a=1 – Report *observed* for Month 1 for ANC DVD_124a=1 – Report *observed* for Month 2 for ANC DVD_125a=1 – Report *observed* for Month 3 for ANC	**Example for ANC** *Overall score for all facility-months:* $\frac{\sum_{i=1}^{n} DVD\_123a_i + DVD\_124a_i + DVD\_125a_i}{3n} \times 100$[1] *where n is the total number of facilities in the sample expected to report ANC (DVD_121=1 and DVD_122=1)* The same logic applies for measuring reporting completeness for other indicators. If a country information system collects all indicators in one reporting form, the reporting completeness will be same for all indicators. However, if indicator information is collected on different reporting forms, the reporting completeness will vary by indicator.	**N/A**
(b) Timeliness of reporting % of facility reports archived that were received on time (for the three selected months) for the facilities in the survey sample DVD_123b=1, DVD_124b=1, DVD_125b=1 – Reports *received* on time for Month 1, 2, 3, respectively, for ANC DVD_132 = Number of reports *submitted* on time *by* the district	**Example for ANC** $\frac{\sum_{i=1}^{n} DVD\_123b_i + DVD\_124b_i + DVD\_125b_i}{3n} \times 100$[2] *where n is the total number of facilities in sample expected to report ANC (DVD_121=1 and DVD_122=1)* The same logic applies for measuring timeliness of reporting for other programme indicators.	**Example for ANC** $\frac{\sum_{i=1}^{n} DVD\_132_i}{n * 12} \times 100$ *where n is the total number of districts*

[1] Assuming that these variables have a value of 1 if the archived report is observed by the survey team and a value of 0 if it is not observed.
[2] Assuming that: a) the variables in the denominator have a value of 1 if the archived report is observed by the survey team and a value of 0 if it is not observed; and the variables in the numerator have a value of 1 if the report was on time and a value of 0 if the report was not on time.

Table A2.1, continued

Data quality metric	Analysis description for facility level	Analysis description for district level
(c) Data element completeness % of expected monthly reports archived that contain information on the programme indicator of interest (for the three selected months) for the facilities in the survey sample DVD_123c=ANC service outputs reported for Month 1 DVD_124c=ANC service outputs reported for Month 2 DVD_125c=ANC service outputs reported for Month 3	**Example for ANC** [Count(DVD_123c≠missing + DVD124c≠missing + DVD125c≠missing) / 3n] × 100 *where n is the total number of facilities in sample expected to report ANC (DVD_121=1 and DVD_122=1)* Same logic applies for measuring data element completeness of reporting for other programme indicators.	

[1] Assuming that these variables have a value of 1 if the archived report is observed by the survey team and a value of 0 if it is not observed.
[3] Variables = 1. Age or age group; 2. sex; 3. year of registration; 4. bacteriological results; 5. history of previous treatment; 6. anatomical site of disease.

Table A2.1, continued

Data quality metric	Analysis description for facility level	Analysis description for district level
(d) Completeness of information on TB minimum set of variables • % of facilities that have missing information on any of the variables in the minimum variable set[1] for the selected quarter DV_406_07 = Number of cases missing data on any of the variables in the minimum variable set DV_405 = Total number of TB cases in the source document minus the transferred-in cases • % of cases that have missing information on a specific required data element for the selected quarter DV_406_01 = Number of cases with missing information for year or registration • % of cases that have missing information on at least one required data element for the selected quarter	Where n = the number of facilities expected to report TB (DV_400 =1 and DV_401 = 1) [Count(DV_406_07≠0)/ n] × 100 % of cases with missing data on a specific required data element (e.g. year of registration) $\frac{\sum_{i=1}^{n} DV\_406\_01_i}{\sum_{i=1}^{n} DV\_405_i} \times 100$ The same logic applies for measuring data element completeness of reporting for other required data elements (sex, age, disease classification, history of TB, bacteriological result). % of cases with missing information on at least one required data element: $\frac{\sum_{i=1}^{n} DV\_406\_07_i}{\sum_{i=1}^{n} DV\_405_i} \times 100$	

[1] Variables = 1. Age or age group; 2. sex; 3. year of registration; 4. bacteriological results; 5. history of previous treatment; 6. anatomical site of disease.
[2] Assuming that these variables have a value of 1 if the archived report is observed by the survey team and a value of 0 if it is not observed

Table A2.1, continued

Data quality metric	Analysis description for facility level	Analysis description for district level
(d) Data verification % of agreement between data in sampled facility records and national records for the same facilities DV_103_01_B, DV_103_02_B, DV_103_03_B = Recount of ANC in the source document for Months 1, 2, 3, respectively DV_104_01_B, DV_104_02_B, DV_104_03_B = Reported ANC in monthly report for Months 1, 2, 3, respectively DVD_126_a, DVD_126_b, DVD_126_c = Sum of reported ANC visits to district office for Month 1, 2, 3, respectively DVD_127_a, DVD_127_b, DVD_127_c = ANC visits reported from district office to higher level	**Example for ANC** $\frac{\sum_{i=1}^{n} DV\_103\_01B_i + DV\_103\_02B_i + DV\_103\_03B_i}{\sum_{i=1}^{n} DV\_104\_01B_i + DV\_104\_02B_i + DV\_104\_03B_i} \times 100^{1}$ *where n is the total number of facilities in sample with all required source documents and all required reports (DV_103_01_A = 1 and DV_103_02_A = 1 and DV_103_03_A = 1 and DV_104_01_A = 1 and DV_104_02_A = 1 and DV_104_03_A = 1)*	**Example for ANC** ((DVD_126__a + DVD_126_b + DVD_126_c) / (DVD_127_a + DVD_127_b + DVD_127_c))

Annex 3: Calculation of data quality metrics from the health facility survey

Table A3.1 Calculation of data management system domain scores[1,2]

Domain and tracer items	Analysis description for facility level	Analysis description for district level
Availability of trained staff		
Availability of designated staff for data entry/compilation: DV_600=1 – facility DVD_103=1 - district	Domain score per **facility** for trained staff = mean score of items as a percentage *Overall score for all facilities:* $\frac{\sum_{i=1}^{n} DV\_600_i + 601_i + 602_i + 603_i}{4n} \times 100$ *where n is the total number of facilities in sample that report health data (DV_599 = 1)*	Domain score per **district** for trained staff = mean score of items as percentage *Overall score for all districts:* $\frac{\sum_{i=1}^{n} DVD\_103_i + 104_i + 105_i + 106_i}{4n} \times 100$ *where n is the total number of districts in sample* If multiple district offices are visited, this calculation will need to be done for each district office and the question numbers will need to be adjusted accordingly
Availability of designated staff for reviewing data quality prior to submission: DV_601=1 - facility DVD_104=1- district		
Receipt of training for staff on data entry/compilation: DV_602=1 - facility DVD_105=1 - district		
Receipt of training for staff on data review and control: DV_603=1 – facility DVD_106=1 - district		
Availability of guidelines		
Availability of guidelines at facility level: DV_604=1	Domain score per **facility** for availability of guidelines = score as percentage *Overall score for all facilities:* $\frac{\sum_{i=1}^{n} DV\_604_i}{n} \times 100$ *where n is the total number of facilities in sample that report health data (DV_599 = 1)*	
Availability of guidelines for data entry/compilation at district level: DVD_107		Domain score per **district** for trained staff = mean score of items as percentage *Overall score for all facilities:* $\frac{\sum_{i=1}^{n} DVD\_107_i + DVD\_108_i + DVD\_109_i}{3n} \times 100$ *where n is the total number of districts in sample* If multiple district offices are visited, this calculation will need to be done for each district office and the question numbers will need to be adjusted accordingly
Availability of guidelines for data review and control at district level: DVD_108=1		
Availability of guidelines on RHIS information display and feedback at district level: DVD_109=1		

[1] Domain scores should be calculated for each stratum (type of facility, managing authority, +/- geographical region).
[2] Calculations assume that the variables have a score of 1 if Yes, observed and 0 otherwise.

Table A3.1, continued

Domain and tracer items	Analysis description for facility level	Analysis description for district level
Stock-outs		
No stock-out of tally sheets, registers and reporting forms in the last 6 months: DV_605=2 (facility) DVD_111=2 (district)	$\frac{\sum_{i=1}^{n} DV\_605_i}{n} \times 100$ *where n is the total number of facilities in sample that report health data (DV_599 = 1)* To calculate the score for this domain, the values of DV_605 are replaced so that DV_605 = 1 if there has been no stock-out and DV_605 = 0 if there has been a stock-out	$\frac{\sum_{i=1}^{n} DVD\_111_i}{n} \times 100$ *where n is the total number of districts in sample which supply health facilities with tally sheets, registers and forms (DVD_110 = 1)* To calculate the score for this domain, the values of DVD_111 are replaced so that DVD_111 = 1 if there has been no stock-out and DVD_111 = 0 if there has been a stock-out If multiple district offices are visited, this calculation will need to be done for each district office and the question numbers will need to be adjusted accordingly
Supervision and feedback		
Any supervisory visit in last 3 months: DV_606≠6 Written feedback received on data quality: DV_607=1 (facility)	$\frac{\sum_{i=1}^{n} DV\_606_i + DV\_607_i}{2n} \times 100$ *where n is the total number of facilities in sample that report health data* (DV_599 = 1)	
Written feedback provided on data quality DVD_113=1 (district) Written feedback provided on service performance DVD_114=1 (district)		$\frac{\sum_{i=1}^{n} DVD\_113_i + DVD\_114_i}{2n} \times 100$ *where n is the total number of districts in sample* To calculate the score for this domain, the values of DVD_113 and DVD_114 are replaced to give them a value of 1 if the relevant type of written feedback was observed and a value of 0 if it was not observed. If multiple district offices are visited, this calculation will need to be done for each district office and the question numbers will need to be adjusted accordingly

Table A3.1, continued

Domain and tracer items	Analysis description for facility level	Analysis description for district level
Analysis and use of data		
Having any visuals (paper or electronic) available in facility: DV_608=1	Domain score per **facility** for data use = mean score of items as percentage $\frac{\sum_{i=1}^{n} DV\_608_i + DV\_609_i + DV\_610_i + DV\_611_i}{4n} \times 100$ *where n is the total number of facilities in sample that report health data (DV_599 = 1)* To calculate the score for this domain, the values of *DV_608*, *DV_609*, *DV_110* and *DV_111* are replaced to give them a value of 1 if the relevant evidence of data analysis and is observed and a value of 0 if it was not observed.	
Having data visualizations in addition to immunization: DV_609 = 1 if (DV_609_03=1 & (DV_609_01=1 or DV_609_02=1 or DV_609_04=1 or DV609_05=1))		
Use of data for performance review: DV_610=1		
Use of data for planning: DV_611=1		
Having any visuals (paper or electronic) available in facility: DVD_115=1		Domain score per **district** for data use = mean score of items as percentage $\frac{\sum_{i=1}^{n} DVD\_115_i + 116_i + 117_i + 118_i + 119_i}{5n} \times 100$ *where n is the total number of districts in sample* If multiple district offices are visited, this calculation will need to be done for each district office and the question numbers will need to be adjusted accordingly
Production of report/bulletin based on RHIS data: DVD_116=1		
Documented example of follow-up action: DVD_117		
Use of data for performance review: DVD_118=1		
Use of data for planning: DVD_119=1		
Other items of interest		
System for tracking timeliness of reporting DVD_102=1		$\frac{\sum_{i=1}^{n} DVD\_102_i}{n} \times 100$ *where n is the total number of districts in sample* If multiple district offices are visited, this calcultion will need to be done for each district office

Table A3.1, continued

Domain and tracer items	Analysis description for facility level	Analysis description for district level
Summary scores		
% with all tracer items	Countif (DV_600=1 and _601=1 and _602=1 and _603=1 and _604=1 and _605=1 and _606=1 and _607=1 and _608=1 and _609=1 and _610=1 and _611=1)*100/n *where n is the total number of facilities in sample that report health data (DV_599 = 1)* DV_609 = 1 if (DV_609_03=1 & (DV_609_01=1 or DV_609_02=1 or DV_609_04=1 or DV609_05=1))	Countif (DVD_102=1 and _103=1 and _104=1 and _105=1 and _106=1 and _107=1 and _108=1 and _109=1 and _110=1 and _111=1 and _112=1 and _113=1 and _114=1 and _115=1 and _116=1 and_117=1 and _118=1 and _119=1)*100/n *where n is the total number of districts in sample*
Mean of tracer items	Average (DV_600, _601, _602,_603,_604,_605, _606,_607,_608,_609,_610,_611)*100 *where the value of each tracer = 1 if present and observed and = 0 if not*	Average (DVD_102,_103,_104,_105,_106, _107,_108,_109,_110,_111,_112,_113,_114, _115,_116,_117,_118,_119)*100 *where the value of each tracer = 1 if present and observed and = 0 if not.*
Overall score	$\frac{\sum_{i=1}^{n} DV\_599_i}{n} \times$ mean of tracer items	

Annex 4: Recommended source documents and cross-/spot-checks for data verification

Table A4.1 below shows the core and additional indicators with data sources and relevant cross-checks that can be implemented during data verification. However, it is recommended that these cross-checks be conducted during in-depth DQRs.

Table A4.1 Cross-checks and spot-checks for verification of data

Programme	Indicator	Data source	Cross-checks and spot-checks
General service statistics	• Service utilization	• OPD register	
Maternal health	• ANC 1st visit • ANC 4th visit • Institutional deliveries • PNC1 • TT1	• Labour and delivery facility register • ANC register • PNC register	• ANC/PNC registers can be cross-checked with the patient cards if those are kept at the health facility. • Speak with patients at the facility at the time of data verification and ask about the services they received. Check against the relevant register to see whether the services and treatments given have been captured correctly.
Immunization	• DTP1–3 /Penta 1–3 • MCV1 • PCV 1–3[1]	• Tally sheets	• Immunization registers can be cross-checked with the number of doses of vaccine used (keeping in mind that some vaccines come in batches of 10-dose vials and one batch may be used for fewer than 10 children). • Records of vaccination on a sample of child vaccination cards can be verified against the immunization register for children in the health facility on the day of the verification visit.
HIV[2]	• Currently on ART • HIV coverage • PMTCT ART coverage • ART retention • Viral suppression	• Programme records (ART register, ART patient cards) • Facility-based ART registers • Health facility data aggregated from patient monitoring system	• ART registers can be cross-checked against pharmacy records. • Patient files can be cross-checked against the information in the patient database (if a database exists at the facility). • Spot-checks: patients at the facility at the time of verification can be asked about the services they received. Confidentiality should be paramount; if the confidentiality of the patient cannot be guaranteed, the spot-check should not be conducted.

Table A4.1, continued

Programme	Indicator	Data source	Cross-checks and spot-checks
TB[3]	• Notified cases of **all** forms of TB • TB treatment success rate • Second-line TB treatment success • Proportion of registered new and relapse TB patients with documented HIV status • Proportion of HIV-positive new and relapse TB patients on ART during TB treatment	• TB unit registers	Cross-check: TB cases detected (from laboratory registers) checked against TB cases notified (initial defaulters) • The TB unit register can be cross-checked against the TB treatment cards. • The TB unit register can be cross-checked against the laboratory register to verify that those diagnosed are actually reported (if diagnosis is being conducted at the facility). • The TB unit register can be cross-checked against the pharmacy records.
Malaria	• Total confirmed malaria cases • Malara diagnostic testing rate • Confirmed malaria cases receiving treatment • Malaria cases (suspected and confirmed) receiving treatment • IPTp3	• Facility register • Facility laboratory register	• The facility register can be cross-checked against the laboratory register (for microscopy and RDT) for suspected cases receiving a parasitological test. • The facility register can be cross-checked against the pharmacy records for treatments given. • The ANC register can be cross-checked against patient cards for IPT if the patient cards are kept at the health facility. • The HMIS report can be cross-checked against the malaria programme report if data are reported through these separate reports.

Note: ANC = antenatal care; ART = antiretroviral therapy; DTP = diphtheria-tetanus-pertussis; IPTp = intermittent preventive treatment in pregnancy; MCV = measles-containing vaccine; OPD = Outpatient visit; TB = tuberculosis; PCV = pneumococcal conjugate vaccine; PMTCT = Prevention of mother-to-child transmission; PNC = postnatal care; RDT = rapid diagnostic test; TT = tetanus toxoid vaccine.

[1] If this vaccine is not used in the country, substitute with another vaccine used in the national programme.
[2] Sampling of health facilities requires stratification by facility type in order to ensure an adequate number of facilities providing HIV/AIDS services.
[3] Sampling of health facilities requires stratification by facility type to ensure an adequate number of facilities providing TB services.

Annex 5: Sampling methods and concerns

Sample size calculation

The sample size will depend on the desired precision of the key estimates of interest of the health facility survey (including data accuracy) and the acceptable margin of error. Other considerations include the availability of resources and the desired level of application of the estimates (N.B. provincial-level estimates require a greater sample size than estimates for the national level). The DQR coordination team will need to work with a survey statistician and the health facility survey organizers to determine the appropriate sample size for the health facility survey on the basis of the country's priorities with regard to level of application of the estimates, available resources and the precision desired for the estimates.

Provided below is a brief guidance on key considerations necessary to calculate sample sizes for either a standalone data verification exercise or for conducting a data verification with another health facility survey. The aim is to determine the sample size that can achieve statistical power or precision of estimation which means deciding on the minimum number of facilities necessary to obtain a statistically significant result or a confidence interval with a fine enough width to judge the level of agreement.

Most of the estimates described in this guidance involve "agreement" between recounts from source documents and those found in monthly reports. Here agreement is a product of i) a marginal prevalence (i.e. the chance of finding both the source document and monthly report), and (ii) the expected proportion of agreement in the counts for the key service outputs being verified (e.g. Penta3, ANC1, confirmed malaria cases, etc.) from the source document and monthly reports. Hence, it is imperative to ensure a minimum sample size to support a robust measure of agreement (in this instant termed "kappa") beyond what is expected by chance alone. Kappa (ranging from 0 to 1) is a measure of the chance-corrected agreement calculated from the overall percent agreement and expected agreement by chance[1]. Table A5.1 provides a selection of sample sizes calculated relative to 3 scenarios of the marginal prevalence and the **permissible** range of the necessary 2 levels of percentage agreement (minimum acceptable agreement ($\mathbf{P_0}$), vs. the expected agreement by the study ($\mathbf{P_A}$)), and their corresponding adjusted kappa values.

[1] Hyunsook Hong, Yunhee Choi, Seokyung Hahn , Sue Kyung Park Byung-Joo Park (2014). Nomogram for sample size calculation on a straightforward basis for the kappa statistic. Annals of Epidemiology 24 (2014) 673e680

In scenario A, the DQR coordination team may not have enough knowledge of the situation concerning the availability of both source and monthly report documents, then the marginal prevalence value of 0.3 is appropriate to consider (i.e. 30% chance of finding both documents) . Similarly, the team requires an indication of the minimum acceptable agreement level between the two document counts which advisably needs to be at least 70%. Hence, with 70% minimum agreement (i.e. $\mathbf{P_0}$ = 0.70) and a conservative better than expected agreement level of 80% (i.e. $\mathbf{P_A}$ = 0.80), the minimum national sample size of n= 144 facilities is needed that provides 80% power and 95% C.I. for all key estimates based on the sample as necessary. In addition, the sample provides inter-observer reliability (given recounts using source documents vs counts reported in monthly reports) and a fair measure of agreement (kappa is between 0.29 to 0.52) that is beyond chance alone.

In scenario B, the DQR coordination team may have a fair knowledge of the chances to find both source and monthly report documents, then the marginal prevalence value of 0.5 is appropriate to consider (that is 50% chance of both documents being available). Then the team need to discuss and choose the minimum acceptable agreement level between the two counts presented in the documents – for example at 80% (i.e. $\mathbf{P_0}$ = 0.80) and a better than expected agreement level of 90% (i.e. $\mathbf{P_A}$ = 0.90). With those considerations, then a minimum national sample size of n= 126 facilities that also provides inter-observer reliability and a substantial measure of agreement (kappa is between 0.60 to 0.80) that is beyond chance alone. If the DQR coordinating team lacks enough knowledge to assert the minimum acceptable agreement level, then the lowest advisable value to consider is 70% (i.e. $\mathbf{P_0}$ = 0.70) as indicated in Table A5.1, with a conservative "better than expected" agreement level of 80% (i.e. $\mathbf{P_A}$ = 0.8) and thus a minimum national sample size of n= 165 facilities that also guarantee a moderate kappa estimate between 0.4 and 0.6.

In scenario C, the DQR coordination team may have substantial knowledge of the possibility to find both source and monthly report documents, then the marginal prevalence value of 0.80 is appropriate to consider. Equivalently, if the DQR coordination team anticipates a high degree of agreement between counts in source and monthly documents then the minimum acceptable agreement level can be 80% (i.e. $\mathbf{P_0}$ = 0.80) and a better than expected agreement level of 90% (i.e. $\mathbf{P_A}$ = 0.90). With those considerations, then a minimum national sample size of n= 100 facilities is sufficient (with a close to moderate estimate of kappa between 0.38 to 0.53).

Finally, taking a closer view of Table A5.1, two extra points are worth mentioning:

- The sample size increases when the difference between the minimum acceptable level of agreement and that expected from the study is smaller (e.g. when the marginal prevalence is 50% (or 0.5) choosing $\mathbf{P_0}$ = 0.80 and $\mathbf{P_A}$ = 0.85 , the difference is 5% and requires a sample size of n=502, compared to when $\mathbf{P_A}$ = 0.90, the difference is 10% and requires a sample size of n= 126);

- The sample size calculation can also be applied in settings where a subnational-level representation of the DQR sample is necessary. For example, in a country where considerable inter-regional variability may exist in the expected availability of source documents and monthly reports, the DQR coordination team can choose a conservative marginal prevalence of 30% a minimum acceptable level of agreement of 75% ($P_0 = 0.75$) to a wider expected agreement level ($P_A = 0.95$) and there a minimum sample size of n=37 facilities per region is suitable.

Table A5.1 Selective sample size calculations with a range of marginal prevalence values, percent agreement and corresponding kappa values

Scenario	Marginal prevalence	Percent agreement		Kappa*	Location	N**
		P_0	P_A	Under the minimum agreement P_0	Under the expected agreement P_A	
A	0.3	0.90	0.95	0.76	0.88	276
	0.3	0.85	0.95	0.64	0.88	96
	0.3	0.80	0.90	0.52	0.76	118
	0.3	0.80	0.85	0.52	0.64	471
	0.3	0.75	0.95	0.40	0.88	33
	0.3	**0.75**	**0.85**	**0.40**	**0.64**	**134**
	0.3	0.75	0.80	0.40	0.52	535
	0.3	**0.70**	**0.80**	**0.29**	**0.52**	**144**
B	0.5	0.90	0.95	0.80	0.90	283
	0.5	**0.80**	**0.90**	**0.60**	**0.80**	**126**
	0.5	0.80	0.85	0.60	0.70	502
	0.5	0.75	0.95	0.50	0.90	37
	0.5	0.75	0.85	0.50	0.70	147
	0.5	0.75	0.80	0.50	0.60	589
	0.5	**0.70**	**0.80**	**0.40**	**0.60**	**165**
C	0.8	0.90	0.95	0.69	0.84	262
	0.8	0.85	0.90	0.53	0.69	348
	0.8	0.80	0.90	0.38	0.69	100
	0.8	0.80	0.85	0.38	0.53	400
	0.8	0.75	0.80	0.22	0.38	408
	0.8	0.75	0.85	0.22	0.53	102
	0.8	**0.75**	**0.95**	**0.22**	**0.84**	**25**

* kappa statistic: 0.21 - .40: fair, 0.41- .60: moderate, 0.61- 0.80: substantial.
** Sample size calculated for positive kappa value (type 1 error=5%, power=80%).

Weighting of data verification estimates

Data verification estimates based on the sample of health facilities must be weighted to adjust for discrepancies between the sample and the sample frame in the distribution of the number of health interventions of interest (e.g. births attended by skilled health personnel). If the sample is stratified, the stratum-specific estimates of data accuracy should be weighted. In general, the weights for each stratum for a given indicator are computed as the number of events in the stratum in the population divided by the number of events in the stratum in the sample. Since the number of events measured for the sample and in the population (i.e. in the HMIS) will be different for each indicator reviewed, the weighting of the estimates will need to be conducted separately for each indicator.

This is a form of post-stratification weighting. For example, consider the setting where not all facilities in the sample provided immunization services, and among those who provided the service, not all are currently reporting or provided a monthly report to the HMIS. In this situation, two corrections are necessary; (i) for non-coverage, and, (ii) for non-response which affect the overall national estimate of each indicator of interest.

Table A5.2a details a hypothetical example of Country A, where the total number of facilities is N=900 distributed amongst 4 strata (facility types) – in each stratum a sample of about 35% was drawn for national representation. **Column C** displays a varying count of facilities providing the vaccination services across strata, and amongst those, **Column D** gives the count of facilities for which both source documents and report are available in "Month X", respectively. **Column F,** summarises the sampling weight for each facility by stratum type; and **Column G** and **Column H** are the necessary correction factors for non-coverage and non-response, respectively, by stratum. For example, for the stratum "General Hospitals" the correction factor adjustment for non-coverage = 1.12 (i.e. 65 / 48), and for non-response = 1.208 (i.e. 58/48), respectively. It is important to note that in both cases of non-coverage and non-response, the information missing or unmeasurable is assumed to be randomly missing and non-informative missing.

The statistics of interest are the number of vaccinations in "Month X" displayed in **Column I** (those recounted in the DV process) and **Column J** (those reported) totalled by stratum. **Column VF** displays the crude national verification factor calculated by the division of the recounted vaccinations by the reported ones (**Column I** / **Column J**) i.e. 10,150/11,750=**0.864**. To adjust for the stratified weighted sampling, non-coverage and non-response, **Column K** and **Column L** provide the adjusted vaccinations numbers, and subsequently the adjusted national verification factor is 47,438/55,567=**0.854**.

In some settings, it might be more representative **to adjust national estimates by service outputs** (i.e. where outputs are typically higher in some stratum types more than other, e.g. hospitals versus health centers). **This is a form of analytical weighting**, and the example above is extended in representation by table A.5.2b. Here, **Column A** represents the number of

vaccinations in "**Month X**" from all facilities in the country that reported to the HMIS per stratum. Here the analytical weight (**Column E**) is the total number of reported vaccinations in "Month X" divided by those reported by the sample survey facilities (**Column A** / **Column C**). The analytical weight is multiplied by the adjusted verification factor of each stratum (**Column D** x **Column E**) and shown in Column F. Then, the national estimate of the adjusted verification factor (weighted by the HMIS reported counts) is obtained by dividing the sum of **Column F** by the sum of **Column E** = 3.227/ 3.510= **0.919**.

In summary, in Country A, the crude verification factor of "Month X" vaccination numbers is **0.864**, which attenuates slightly to **0.854** (adjusting for sampling and post-stratification weighting). Additionally, the estimate increases to **0.919** if service outputs by stratum are taken into consideration.

NOTE:
The DQR coordination team may encounter a situation during the data verification exercise for certain metrics or indicators where the service in question is only available in a sub-set of facilities within the sample – for example tuberculosis services. In this situation, the expected service coverage falls below 80% (i.e. **Column F** adjustment factor in Table 5.2a will be greater than 1.20). Another situation might be that a fewer than expected facilities providing a certain service have responded to the HMIS reporting in Month "X" making the response rate from facilities fall below 80% (i.e. **Column G** adjustment factor in Table 5.2a will be greater than 1.20). If either or both of these situations occur then the DQR team is advised:

- To use the crude verification factor (i.e. **Column VF** in Table 5.2a) as calculated by the actual vaccinations numbers recounted and reported (values in **Columns I** and **J** in table A5.2a).
- And if required, to further adjust the crude verification by the analytical weighting using the nationally reported service outputs to the HMIS. Thus, using the same calculations detailed above for Table 5.2b, the crude verification factor **0.864** will adjust to **0.897**.

Depending on the type of sampling used to select facilities for the survey component of the DQR, district values might or might not have sampling weights. Currently, the most common method for conducting the facility survey component of the DQR is to do so with another health facility assessment, such as the SARA. The SARA most commonly uses a stratified sampling method for selecting health facilities where the primary sampling unit is the facility and not the district. Consequently, the district estimates presented are unweighted.

If a two-stage cluster sampling method is employed to select health facilities, the cluster-specific (usually districts) verification factor is weighted on the volume of service in the cluster. An adjustment factor is applied to each cluster – i.e. the ratio of the district value found in the district office and the value for the district found at national level. A weighted average of the adjusted cluster-specific verification factors is then calculated to obtain the national-level estimate of accuracy on the basis of the sample.

Table A5.2a Tabular summary of a representative sample survey of facilities (n=310)

Stratum	Facilities in the country (A)	Facilities in the survey sample (B)	Facilities in the survey sample providing vaccination service coverage (C)	Facilities in the sample providing vaccination services & responding to the HMIS (both source and monthly report are available in "Month X") (D)	Probability of sampling each facility by facility type (E= n/N or B/A)	Sampling weight of each facility by facility type (F=1/E)
General hospitals	185	65	58	48	0.351	2.849
Reference health centres	175	65	56	52	0.371	2.695
Health centres	400	130	120	100	0.325	3.077
Health posts	140	50	50	45	0.357	2.801
Total	900	310	284	245		

N=900; n=310.
*For example the weighted number 10,214 = average recounts per facility in the stratum (2650/48) times the sampling weight of each facility in the stratum (2.849) times the number of responsive facilities in the stratum (n=48) times the non-coverage adjustment factor (1.121), times the non-response adjustment factor (1.208)= (2650/48) x 2.849 x 48 x 1.121 x 1.208.

Factor adjusting for non-coverage of vaccination services (G=B/C)	Factor adjusting for non-response (H=C/D)	Number of vaccinations in "Month X" (excluding vaccinations for months for which either the source document or the report were not available)		Weighted number of vaccinations in "Month X" (adjusted for non-coverage & non-response)		Crude verification factor (VF=I/J)	Weighted verification factor (adjusted for non-coverage & non-response) (VFadj=K/L)
		Recounted in sample (I)	Reported (J)	Recounted in sample (K)	Reported (L)		
1.121	1.208	2650	3300	10 214	12 719	0.803	0.803
1.161	1.077	2650	3300	8918	11 106	0.803	0.803
1.083	1.200	3250	3800	13 000	15 200	0.855	0.855
1.000	1.111	1600	1350	4978	4200	1.185	1.185
		10 150	11 750	37 110	43 225	0.864	0.859
		Crude verification factor = 10150/11750 =	0.864				

Table A5.2b Calculation of the data verification factor and weighting by the HMIS reported service outputs

Stratum	Total Number of vaccinations reported counts in HMIS in "Month X" (A)	Weighted number of vaccinations in "Month X" (adjusted for non-coverage and non-response)		Adjusted verification factor (VFadj = D=B/C)	Analytical weight (E=A/C)	Weight factor by HMIS counts (F=D x E)
		Recounted (B)	Reported (C)			
General hospitals	16 170	10 214	12 719	0.803	1.270	1.020
Reference health centres	13 860	8918	11 106	0.803	1.247	1.001
Health centres	11 550	13 000	15 200	0.855	0.760	0.650
Health posts	4620	4978	4200	1.185	1.100	1.304
Total	46 200	37 132	43 225	0.859	4.377	3.975
		Adjusted verification factor	0.859	Adjusted verification factor weighted by HMIS reported counts [F/E]	0.908	

Annex 6: Data collection instruments and analysis tools

The data collection tools include the data verification component and the system assessment tool at facility and district levels. Current work is underway to incorporate the DQR into the DHIS 2 software, which will benefit countries that are using this software. A Microsoft Excel tool has been developed to facilitate the annual data quality analysis for countries using another software system or a paper-based system. In addition, an analysis tool for the data verification and system assessment data is being developed in Microsoft Excel. The data collection instruments and the Microsoft Excel tools are not included in this document; they are part of the toolkit and will accompany this guidance document as separate attachments.

Notes

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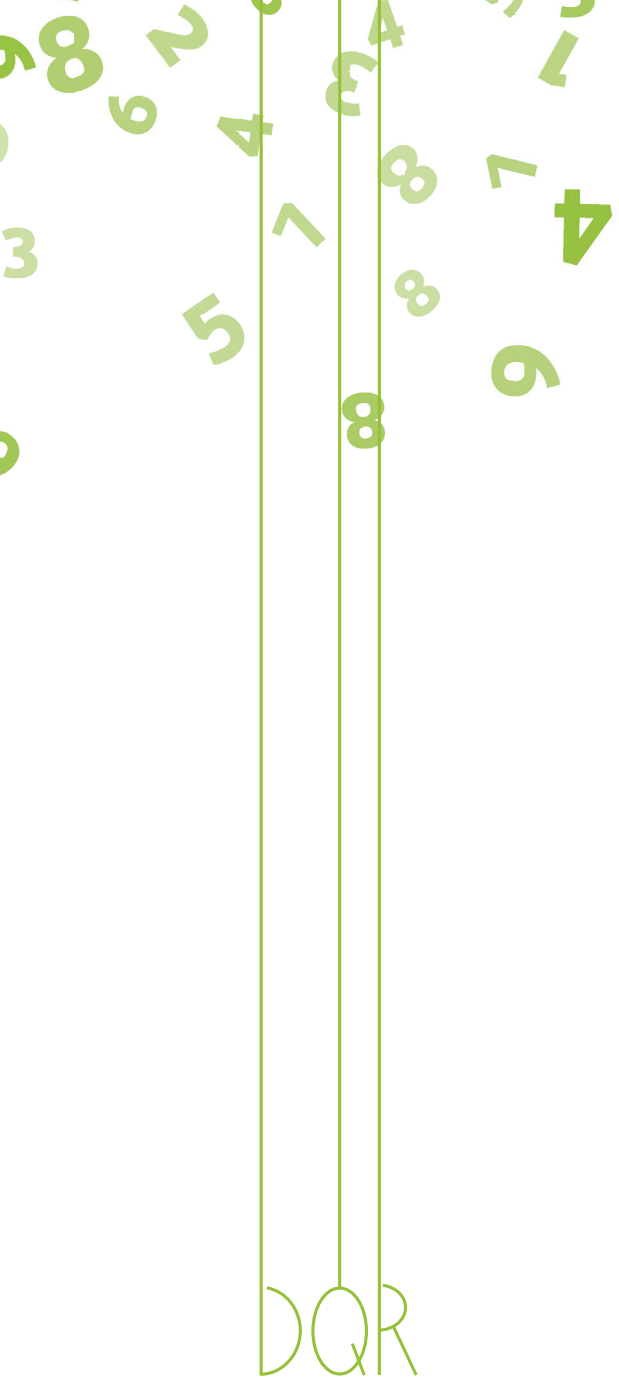

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