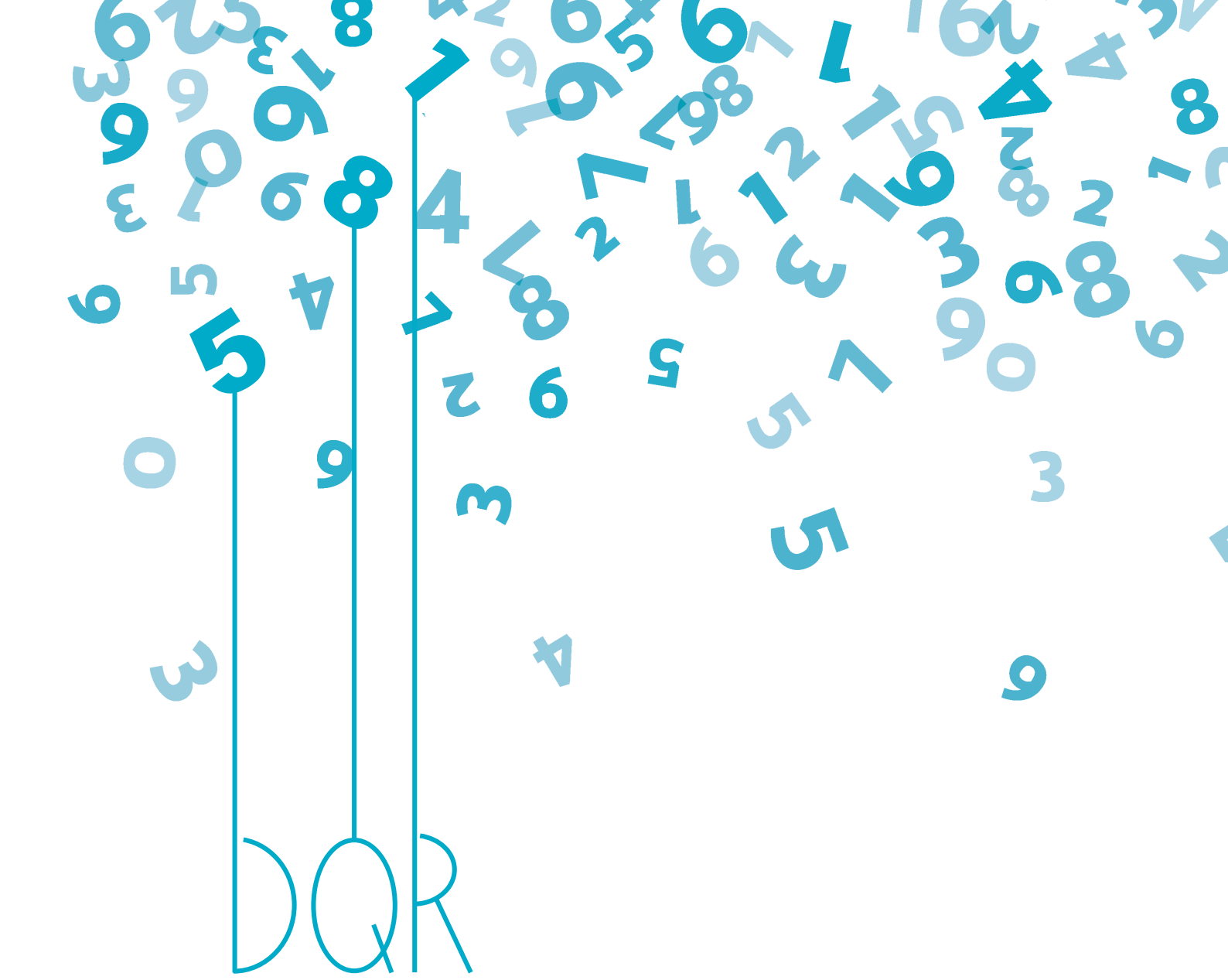

DQR

DATA QUALITY REVIEW

1

Module 1
Framework and metrics

World Health Organization

Gavi The Vaccine Alliance

The Global Fund

JSI

MEASURE Evaluation

USAID FROM THE AMERICAN PEOPLE

DATA QUALITY REVIEW

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Data quality review: a toolkit for facility data quality assessment. Module 1. Framework and metrics

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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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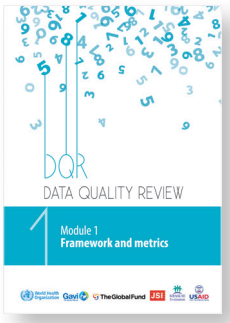
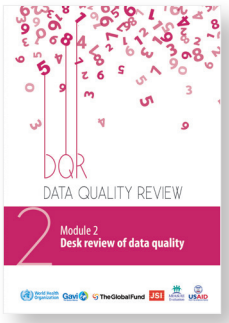


Module 1
Framework and metrics



Module 2
Desk review of data quality

Module 3
Data verification and system assessment

Abbreviations

ANC	Antenatal care
ART	Antiretroviral therapy
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
DQS	Data quality self-assessment
DTP	Diphtheria-tetanus-pertussis
DTP3	Diphtheria-tetanus-pertussis three-dose vaccine
Gavi	Gavi, the Vaccine Alliance
HCT	HIV counselling and testing
HIV	Human immunodeficiency virus
HMIS	Health management information system
HSS	Health system strengthening
IPT	Intermittent preventive therapy
MCV	Measles-containing vaccine
MDR-TB	Multidrugresistant tuberculosis
MOH	Ministry of Health
NGO	Non-governmental organization
PCV	Pneumococcal conjugate vaccine
Penta	Pentavalent vaccine
PMTCT	Prevention of mother-to-child transmission
RDQA	Routine data quality assessment tool
RDT	Rapid diagnostic test
RR	Rifampicin-resistant
SARA	Service availability and readiness assessment
SD	Standard deviation
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
WHO	World Health Organization

1.1 Background

Health data are widely used for a variety of purposes – including health sector reviews, planning, programme monitoring, quality improvement and reporting. For this reason, it is critical to have high-quality data on performance in the health sector available routinely.

The national health management information system (HMIS) and health and disease programme-specific reporting systems (where they exist) collect data on routine health services and health problems that are reported from health facilities in the national health-care system. These health-facility data are a primary source for assessing health sector performance – i.e. the Ministry of Health compiles the data on a regular basis to report on achievements and trends in key health performance indicators. However, HMIS data often exhibit problems of quality, and many users do not trust these data.

All data are subject to quality limitations such as missing values, bias, measurement error, and human errors in data entry and computation. Data quality assessments should be undertaken to understand how much confidence can be placed in the health data that are used to assess health sector performance and to understand the relative strengths and weaknesses of the data sources. In particular, it is important to know the reliability of national coverage estimates and other results derived from health-facility data.

Various data quality assessment mechanisms are used by national authorities and partner organizations to examine the quality of health-facility data. In addition, computer software applications used by health information systems can build in checks of data quality. However, the different tools and approaches have certain limitations, including:

- National health and disease-specific programmes carry out data quality assessments independently, making it difficult to assess the capacity of health facilities comprehensively. Data concerns often cut across programmes and it is more efficient (and less burdensome to staff at the periphery) to examine them holistically.
- Because data quality assessment efforts have often been ad hoc and uncoordinated, the results are not always available when needed (e.g. for a health sector review). Also, these assessments often use non-standardized methodologies, making results difficult to generalize or compare.
- The sample size of these assessments is often too small to be representative of all health facilities, thus making it difficult to reach broad conclusions about reporting accuracy. Small sample sizes can also reduce the precision of estimates derived from the sample.
- This toolkit represents a collaborative effort of WHO, The Global Fund, Gavi and USAID/ MEASURE Evaluation to promote a harmonized approach to assessing the quality of data reported from the level of health facilities to the national level.

This data quality review (DQR) methodology builds on existing data quality assurance mechanisms. The methodology and indicators have been developed and selected on the basis of broad consultation with international health programme experts from leading donor and technical assistance agencies. It is expected that individual health and disease programmes will use the findings of a completed DQR to inform their respective detailed assessments of data quality and programme-specific information systems. The goal of the DQR is to contribute to the improvement of the quality of data used by countries for reviews of progress and performance – such as annual health sector reviews, programme planning, and monitoring and evaluation – in order to facilitate decision-making.

1.2 Overview

Sound decisions are based on sound data; therefore it is essential to ensure that the data are of good quality. Health-facility data constitute a primary data source for assessing the performance of the health sector. Ministries of Health therefore compile data regularly to track progress towards goals and objectives, to plan for future needs, and to set priorities for the health system. However, data of poor quality result in a lack of trust among users.

A comprehensive and holistic review of the quality of data collected from health facilities requires a multi-pronged approach. The DQR framework includes:

- routine and regular (i.e. monthly) reviews of data quality built into a system of checks of the HMIS or other programme reporting systems as part of a feedback cycle that identifies errors in near real-time so they can be corrected as they occur;
- an annual independent assessment of a core set of tracer indicators in order to identify gaps and errors in reporting and the plausibility of trends in health-facility data reported during the previous year; and
- periodic in-depth programme-specific reviews of data quality that focus on a single disease/programme area and are timed to meet the planning needs of the specific programmes (e.g. prior to programme reviews).

Scope of the DQR

The scope of the DQR is to support routine, annual and periodic independent assessments of facility-reported data. The periodicity depends on the focus of the review – i.e. whether to make course correction to data routinely, whether to look at common cross-cutting data quality issues that must be addressed when preparing annual health analytical reports, or whether is to look in greater depth at a specific health or disease programme in advance of programme reviews.

A comprehensive overview of the quality of routine data reported by health facilities should be conducted annually as part of the process of data consolidation for annual statistical reports or health sector performance reports. When determining funding levels for programmes and priority areas of the health system, health planners need to know what level of trust they can place in the data. Planners also need to know what investments they must make to strengthen data quality and reporting systems. Assessment results should be disseminated widely within the Ministry of Health and to development partners and other stakeholders to make known the strengths and limitations of the data. Poor-quality data can undermine demonstrations of progress towards health sector objectives and may hinder annual planning processes by

providing misleading results. It is therefore crucial to discuss any problems of data quality, to identify measures to improve quality, and to develop action plans to implement such measures. This also applies to in-depth DQRs, with the results included in the programme review or annual health sector review.

The DQR metrics can be incorporated into routine internal checks and controls of data quality. Work is underway to incorporate DQR metrics into the DHIS 2 software.[1] For countries that utilize the DHIS 2 software to help manage their HMIS, this addition will greatly facilitate regular data quality checks. In addition, there are other tools that can be used for routine data quality assessment, such as the WHO/IVB Immunization Data Quality Self-Assessment (DQS)[2] and the MEASURE Evaluation Routine Data Quality Assessment Tool (RDQA).[3]

Objectives

The DQR is designed to assess the quality of data generated by information system(s) based in health facilities. The objectives of the DQR are:

- to institutionalize a system for assessing quality of data, including routine monitoring of data, independent annual data quality reviews and periodic in-depth assessments of priority health programmes;
- to identify weaknesses in the data management system and interventions for system strengthening; and
- to monitor the performance of data quality over time and the capacity to produce good-quality data.

The toolkit

The DQR toolkit includes guidelines and tools that lay the basis for a common understanding of data quality so that a regular mechanism for data quality assessments can be institutionalized in the country. The toolkit enables countries to conduct regular data quality assessments in accordance with the following structure:

Module 1: Framework and metrics (current document)

Module 2: Desk review of data quality

Module 3: Data verification and system assessment

[1] DHIS 2 is a web-based, open source software that is used by countries chiefly as their health information system for data management and monitoring of health programmes. It has also been used for logistics management, mobile tracking and facility registers. More information can be found at: https://www.dhis2.org/ (accessed 29 May 2015).

[2] See: http://apps.who.int/iris/bitstream/10665/69034/1/WHO_IVB_05.04.pdf (accessed 20 November 2016).

[3] See: http://www.cpc.unc.edu/measure/our-work/data-quality (accessed 20 November 2016).

Additional resources in the toolkit are:

- a tool developed in Microsoft Excel that will automate analyses of data quality metrics (for countries that do not have DHIS 2);
- a WHO data quality app developed in DHIS 2 for annual and routine monitoring of data;
- DQR data collection instruments for the facility survey module;
- electronic data-collection forms (in CSPro);[4]
- an automated analysis tool in Microsoft Excel to calculate relevant metrics collected through the facility survey;
- Programme-specific in-depth modules.

[4] For information about the Census and Survey Processing System (CSPro), including free download, see: http://www.census.gov/population/international/software/cspro/ (accessed 29 May 2015).

1.3 Methodology

The DQR methodology comprises two separate processes that can be used jointly or separately, namely:

- a desk review of the data that have been reported to national level whereby the quality of aggregate reported data for recommended programme indicators is examined using standardized data quality metrics;
- health facility assessment to conduct data verification and an evaluation of the adequacy of the information system to produce quality data (system assessment).

Desk review

The desk review examines data quality across four dimensions: **completeness, internal consistency, external comparisons and external consistency of population data**. Further, the desk review examines a core set of tracer indicators selected across programme areas in relation to these dimensions. The desk review requires monthly or quarterly data by subnational administrative area for the most recent reporting year and annual aggregated data for the selected indicators for the last three reporting years.

This cross-cutting analysis of the recommended programme indicators across quality dimensions quantifies problems of data completeness, accuracy and consistency according to individual programme areas but also provides valuable information on the overall adequacy of health-facility data to support planning and annual monitoring. WHO recommends that the desk review component of the DQR be conducted annually.

The desk review compares the performance of the country information system with recommended benchmarks for quality, and flags for further review any subnational administrative units which fail to attain the benchmark. User-defined benchmarks can be established at the discretion of assessment planners.

The desk review has two levels of data quality assessment:

- an assessment of each indicator aggregated to the national level;
- the performance of subnational units (e.g. districts or provinces/regions) for the selected indicators.

Facility assessment (site visit to sampled facilities)

Verification of data quality

The assessment of data quality at the facility level includes a verification of indicator values for specific reporting periods, as sent from the facility to the next reporting level, as well as an evaluation of the completeness of reporting and required data collection.

The objective of data verification is to measure the extent to which the information in the source documents has been transmitted accurately to the next level of reporting; the verification applies to each level of the reporting hierarchy (from the health-facility level to the national level). This allows systematic errors that occur in the reporting of data to be identified and, for specific indicators, gives an estimate of the degree of over-reporting or under-reporting in the system at national level.

For data verification, data from source documents (registers and tally sheets) are compared to data reported through the HMIS in order to determine the proportion of reported results that can be verified from the source documents. The values for selected indicators from specific reporting periods are recounted using the relevant source document at the facility and are then compared to the value reported by the facility for the same reporting period. A standardized data collection instrument is available in both paper and electronic formats.

In addition to verifying the consistency between source data and what has been reported, the facility survey also collects information on the completeness of reporting. This information can be used to compare to the reporting completeness found through the desk review. It is essential to use a sound probability-based sampling methodology so that the results of the data verification are representative of all the health facilities. A nationally representative health-facility assessment usually has a sample of more than 100 health facilities, which constitutes a sufficient sample for verification of data quality. The primary data collection can be conducted as part of a larger health-facility assessment, such as a Service Availability and Readiness Assessment (SARA), or as a discrete event.

It is recommended that the verification of data quality be conducted annually along with the desk review, if possible as part of a harmonized health-facility assessment plan.

System assessment

The system assessment is contained in an additional module of a health-facility survey and can be conducted at the same time as the verification of data at health-facility and district levels. 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 set of minimum acceptable standards. The elements of the reporting system that are evaluated in the system assessment are as follows:

- trained staff;
- guidelines;
- stock-out of tools and reporting forms;
- supervision and feedback;
- analysis and data use.

The system assessment is included in this toolkit because it provides information that will potentially enable managers to determine the causes of data quality problems. Consequently, it is recommended that the system assessment should be implemented with the data verification module. While the system assessment can be a conducted as a discrete activity in conjunction with the data verification exercise, it is recommended that it be part of a larger health-facility assessment.

1.4 Data quality metrics

The DQR examines a set of standard indicators that are routinely reported through facility information systems and quantifies problems of data completeness, timeliness, consistency and accuracy in order to ascertain the extent to which the health-facility data are fit for purpose. For example:

- Quality data should be complete and timely – i.e. there is sufficient information available when required to make decisions about the health of the population and to target resources to improve health-system coverage, efficiency and quality.
- Quality data should be consistent and reliable – i.e. data are plausible in view of what has previously been reported. Reliable data are those which remain consistent on repeated measurement.
- Quality data should be accurate – i.e. data faithfully reflect the actual level of service delivery that was conducted in the health facility.

The DQR examines the quality of data of a selected number of indicators covering the different programme areas that are reported through routine facility information systems. The DQR may be implemented as a holistic review across several programme areas or as an in-depth assessment of a particular programme area.

Core indicators

The core indicators were selected on the basis of their importance for programme monitoring and evaluation. They include "tracer" indicators (i.e. ability to trace results from the source to the national level, and indicative of data quality for all indicators within a programme area) on antenatal care (ANC), immunization, human immunodeficiency virus (HIV), tuberculosis (TB) and malaria. Table 1.1 lists the core indicators recommended for a regular DQR.

Table 1.1 Recommended core indicators for the DQR

Recommended DQR indicators		
Programme area	**Abbreviated name**	**Indicator name**
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.

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. It is important to note, however, that the greater the number of indicators that are selected, the more time-consuming and costly the exercise will be. This is particularly relevant to the selection of indicators for the data verification component. A guiding principle is that a team of data collectors should not spend more than one day in each facility. Thus it is recommended that no more than 4–5 indicators should be included for any given survey for the data verification exercise.

If other priority indicators are not included in the core or additional lists, they can be selected (cautiously) to replace one or more of the core indicators. It should also be noted that not all data quality metrics apply to all indicators. For example, it might be difficult to obtain denominators at the subnational level or to make comparisons with measures of the indicator from other sources for some of the core and additional indicators (e.g. in HIV). In this case, the data quality checks can be performed only on the numerator data (the metrics for which are included in the DQR dimensions 1 and 2).

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

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.
- **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 data from a periodic population-based survey. The 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.

Definitions and benchmarks

It is also useful to establish a benchmark that reflects the desired or acceptable level for each of the metrics for each of the core indicators. The DQR Toolkit includes recommended benchmarks for quality but, ultimately, benchmarks will depend on the country that is implementing the DQR. For instance, a reporting rate of 80% might be acceptable in a country with historically low reporting performance but will not be acceptable in others which have more mature systems and reporting rates closer to 100%. Benchmarks for quality can vary across programme areas for certain data quality metrics. For instance, the recommended threshold of quality for completeness of indicator data in maternal health might be 90%, but for immunization it could be 67% since immunization service delivery often varies from month to month and it is not unusual to find zero values (or missing values). Similarly, the threshold for TB might be 75% since TB is a relatively rare event in the population, particularly in sparsely populated subnational administrative areas.

Countries with mature information systems, with standardized indicators and tools and a well-trained workforce, should expect to have more stringent thresholds for quality than countries without.

Table 1.2 shows the different metrics that are included in each of the four dimensions of data quality. The quality of data of recommended core indicators is examined against these standard metrics. The benchmarks for measuring quality are also shown. These recommended benchmarks should be tailored to the country context.

Table 1.2 Data quality dimension, metrics and standard benchmarks

DIMENSION 1: COMPLETENESS OF REPORTING An assessment of each dimension should be conducted for each of the recommended core indicators: antenatal care, immunization, HIV, TB and malaria. Additional indicators can be selected according to the priority and focus of the data quality assessment.			
Data quality metric	**Definition**		
	National level		Subnational level
Completeness of district reporting	% of expected district monthly reports (previous 1 year) that are actually received		Number and % of districts that submitted: 1) at least 9 out of 12 expected monthly reports; 2) 100% of expected monthly reports
Timeliness of district reporting	% of submitted district monthly reports (previous 1 year) that are received on time (i.e. by the deadline for reporting)		Number and % of districts that submitted on time at least 75% of the monthly reports received at national level from the district
Completeness of facility reporting	% of expected facility monthly reports (previous 1 year) that are actually received		Number and % of districts with at least 9 out of 12 monthly facility reports received
			Number and % of facilities that submitted 100% of expected monthly reports
Timeliness of facility reporting	% of submitted facility monthly reports (previous 1 year) that are received on time (i.e. by the deadline for reporting)		Number and % of districts that received on time at least 75% of monthly facility reports that were submitted
Completeness of indicator data (% of data elements that are non-zero values, % of data elements that are non-missing values) Carry out each analysis separately	ANC first visit		Number and % of districts with < 90% 1) non-zero values; 2) non-missing values
	3rd dose DTP-containing vaccine		Number and % of districts with < 67% 1) non-zero values; 2) non-missing values
	Currently on ART		Number and % of districts with < 90% 1) non-zero values; 2) non-missing values
	Notified cases of all forms of TB		Number and % of districts with < 75% 1) non-zero values; 2) non-missing values
	Confirmed malaria cases		Number and % of districts with < 90% 1) non-zero values; 2) non-missing values
Consistency of reporting completeness	Each information system	Evaluate the trend in completeness of reporting from district to national level over the past 3 years	Evaluate the trend in completeness from facility to district level over the past 3 years

Note: ANC = antenatal care; ART = antiretroviral therapy ; DTP = diphtheria-tetanus-pertussis.
[1] Denominator is reports received (not expected).
[2] Immunization programmes expect some months to have zero values for vaccination indicators.
[3] TB reporting generally takes place quarterly.

DIMENSION 2: INTERNAL CONSISTENCY OF REPORTED DATA		
Data quality metric	**Definition**	
	National level	Subnational level
Outliers[1] Complete for each of 5 indicators: • ANC 1st visit • 3rd dose DTP-containing vaccine • ART coverage • notified cases of all forms of TB • confirmed malaria cases	**Extreme:** % of monthly subnational unit values that are extreme outliers (at least 3 SD from the mean)	Number and % of subnational units in which 1 or more of the monthly subnational unit values over the course of 1 year is an extreme outlier
	Moderate: % of subnational unit values that are moderate outliers (±2–3 SD from the mean or > 3.5 on modified z-score method).	Number and % of subnational units in which 2 or more of the monthly subnational unit values for the indicator over the course of 1 year are moderate outliers
Consistency over time Complete for each of 5 indicators: • ANC 1st visit • 3rd dose DTP-containing vaccine • ART coverage • notified cases of all forms of TB • confirmed malaria cases tested	Conduct one of the following based on the expected trend of the indicator: • comparison of current year to the value predicted from the trend in the 3 preceding years (for indicators or programmes with expected growth), or • comparison of current year to the average of the 3 preceding years (for indicators or programmes expected to remain constant)	Number and % of districts whose current year-to-predicted-value ratio (or current year to the average of the preceding three years) is at least ±33% different from the national ratio
	Graphic depiction of trend to determine plausibility based on programmatic knowledge	
Consistency between related indicators	**Maternal health:** ANC1 – IPT1 or TT1 (should be roughly equal)	Number and % of subnational units where there is an extreme difference (≥ ±10%)
	Immunization: DTP3 dropout rate: (DTP1 – DTP3) / DTP1 – should not be negative	Number and % of subnational units with the number of DTP3 immunizations higher than DTP1 immunizations (negative dropout)
	HIV: ART coverage – HIV care coverage (ratio should be less than 1)[2]	Number and % of subnational units where there is an extreme difference (≥ ±10%)
	TB: TB cases notified – TB cases put on treatment (in the past year) (should be roughly equal)	Number and % of subnational units where there is an extreme difference (≥ ±10%)
	Malaria: Number of confirmed malaria cases reported – proportion of confirmed cases receiving first-line treatment (should be roughly equal)	Number and % of subnational units where there is an extreme difference (≥ ±10%)
Verification of reporting consistency through facility survey	% agreement between verified counts for selected indicators in sampled facility records, and reported values for the same facilities	**Maternal health:** ANC 1st visit
		Immunization: Penta/DTP 1–3 in children < 1 year
		HIV: HIV coverage
		TB[3]**:** Notified cases of all forms of TB
		Malaria: Suspected malaria cases tested

Note: ANC = antenatal care; ART = antiretroviral therapy; SD = standard deviation; DTP1 = diphtheria-tetanus-pertussis vaccine first dose DTP3 = diphtheria-tetanus-pertussis vaccine third dose; IPT = intermittent preventive therapy; TT = tetanus toxoid vaccine; Penta = pentavalent vaccine.

[1] For programmes with inconsistent levels of service delivery and for which outliers are common (e.g. immunization), a customized threshold can be set on the basis of programmatic knowledge. Data that have high variability from month to month can also be evaluated for outliers using the modified z-score method (see section 3.1) which is based on the median and has higher tolerance for extreme values than does the standard deviation method.

[2] The extent of difference between the two indicators depends on the national treatment guidelines and when people living with HIV are eligible for ART.

[3] Sampling of health facilities requires stratification by facility type to ensure that an adequate number of facilities provide TB services.

DIMENSION 3: EXTERNAL COMPARISON (Comparison of routine data with population-based survey values from the same period)[1]		
Indicator	**Definition**	
	National level	Subnational level
ANC 1st visit	Ratio of facility ANC1 coverage rates to survey ANC1 coverage rates	Number and % of aggregation units used for the most recent population-based survey (such as a province/state/region) whose ANC1 facility-based coverage rates and survey coverage rates show at least 33% difference
3rd dose DTP-containing vaccine	Ratio of DTP3 coverage rates from routine data to survey DTP3 coverage rates	Number and % of aggregation units used for the most recent population-based survey (such as a province/state/region) whose DTP3 facility-based coverage rates and survey coverage rates show at least 33% difference
HIV	—	—
TB[2]	—	—
Malaria IPT		
Comparison between programme and HMIS values	For selected indicators, compare the value aggregated for 12 months from the HMIS with the programme data	For selected indicators, compare the subnational unit values aggregated over 12 months for number and % of districts with > 10% difference in annual values between the HMIS and programme data

Note: ANC = antenatal care; ART = antiretroviral therapy; DTP3 = diphtheria-tetanus-pertussis three-dose vaccine; HMIS = health management information system IPT = intermittent protective therapy.

DIMENSION 4: EXTERNAL CONSISTENCY OF POPULATION DATA (Evaluation of adequacy of denominators used for calculating performance indicators)		
Indicator	**Definition**	
	National level	Subnational level
Consistency of population projections	Ratio of population projection of live births from the Country Census Bureau/Bureau of Statistics to a United Nations projection of live births for the country	—
Consistency of denominator between programme data and official government population statistics	Ratio of population projection for selected indicator(s) from the census to values used by programmes	Number and % of subnational units where there is an extreme difference (e.g. ± 10%) between the two denominators
Consistency of population trend	Ratio of population values for selected indicator(s) from the current year to the predicted value from the trend in population values up to 3 preceding years	Number and % of subnational units where there is an extreme difference (e.g. ± 10%) between the two denominators

[1] Complete for each programme area (if sufficient recent survey data are available). Administrative data should preferably be from the same year as the survey value. Denominators used for coverage estimates from administrative data may need adjustment to make them comparable to survey values (e.g. women attending ANC at public facilities).

[2] No viable survey indicator for TB.

1.5 Governance and coordination

Different governance and coordination mechanisms come into play in the implementation of an annual/in-depth DQR as opposed to more routine data quality monitoring conducted by collectors and users of data such as the HMIS departments, programmes, etc. The following section focuses on the coordination required for the implementation of an annual DQR followed by some of the requirements for routine monitoring of data quality.

Annual data quality review

Step 1. Establish a DQR coordinating group at national level

Bringing country stakeholders together is a critical first step towards successful implementation of a DQR. One of the first activities is to identify and establish a group of core stakeholders at country level to oversee, coordinate and facilitate the planning and implementation of the DQR and the dissemination and use of the DQR findings.

The DQR coordinating group should comprise technical focal points among health-sector stakeholders from government (including the different programme stakeholders), development partners and multinational organizations such as WHO, Gavi and The Global Fund. Monitoring and evaluation technical working groups or health information system governance boards, which already exist in many countries, can serve as the DQR coordinating team. Development and technical partners, who can greatly contribute to the success of efforts to improve data quality, should agree on a standardized set of data quality indicators.

The role of the DQR coordinating group is to:

- develop a harmonized plan for data quality assessments;
- identify technical support requirements for implementation and quality assurance;
- identify funding sources;
- oversee the selection of core indicators and the establishment of benchmarks;
- monitor implementation of the DQR;
- ensure promotion and dissemination of the findings.

Step 2. Develop a harmonized plan for data quality assessments

The DQR coordinating group creates a DQR schedule linked to the annual planning cycles of the Ministry of Health. The results of the DQR should be available in advance of the planning so that stakeholders will understand the strengths and limitations of the data used for planning.

A harmonized plan for data quality assessments should ideally include:

- an annual desk review of data quality[1] of the core indicators and a verification of data quality on a sample of facilities – where possible, timed so that the results can be used to prepare the annual statistical reports/analytical performance reviews;
- periodic independent assessments of programme-specific data from health facilities (every 3–5 years) to support programme reviews;
- development and monitoring of data quality improvement plans.

Step 3. Develop an implementation plan and budget

In order for the results to be available for the health sector review, the DQR should be conducted well in advance to allow time to correct data or fill gaps if necessary. Depending on whether the DQR is integrated into a more comprehensive health facility survey or is conducted as a stand-alone exercise, planning and implementation may require up to 6 months, or up to 3 months, respectively. If a country undertakes only the desk review and does not conduct primary data collection for data verification and the system assessment, the DQR can be completed in around 1 month.

An implementation plan should be based on the purpose and components of the DQR being considered. The DQR coordinating group should decide on the mechanisms for implementation. The DQR has two components (a national-level desk review and a health facility survey), so implementation mechanisms should be considered for both. As data quality is important to many donors, the DQR coordinating group should explore whether in-country partners can support the process. Partners often have funds allocated to mechanisms for data quality assurance and may be willing to assist with implementation. For instance, if funds have been allocated in the Gavi health system strengthening support for a health facility survey or for data quality assessment, the DQR coordinating group should explore whether these funds can be used for a DQR. The identification of potential funding mechanisms is made easier if the DQR coordinating group is a multistakeholder committee comprising persons from the Ministry of Health, donors, multilateral agencies, etc. The cost of the DQR ultimately depends on the scope of the assessment (i.e. if a health facility assessment component is included and, if so, the sample size required).

[1] An element of independence in the annual DQR is important as it shows that the government is not evaluating itself, or at least not entirely. This element of independence can be achieved by having a private-sector entity, a university or the National Statistics Bureau involved in planning and oversight, if not implementation

Resource implications for the desk review

It is recommended that the desk review be conducted with the support of an independent entity such as a national institute or consultant to help ensure unbiased evaluation of data quality. The desk-review component of the DQR requires compilation of HMIS data for the relevant indicators in a specified format. This means obtaining data from the HMIS and/or programmes for the selected indicators. It is recommended that a national consultant or national institute should work with Ministry of Health focal points to prepare the data for the selected core indicators.

In general, for the preparation of the data, a time frame of about 1.5–2 weeks (8–10 person-days) is necessary, in addition to a further 1–1.5 weeks for the analysis and reporting. In total, about 20 person-days are required for the desk review. The level of effort may be more or less, depending on the number of indicators the country chooses to include in the assessment.

Resource implications for the facility assessment (data verification and system assessment)

The level of effort required for data verification depends on the number of facilities to be assessed (i.e. the sample size), the number of indicators included in the data verification exercise, the volume and organization of the data at the health facilities, and the complexity of the reporting system. To ensure quality in the verification of the data it is recommended that data verifiers work in pairs.

Data verification and the system assessment at small facilities generally requires 3–4 hours for an assessment of 4–5 indicators. Larger facilities or hospitals will require more time as the volume of service provision (and of records of service provision) is greater. In general, for a sample of 100 health facilities, 10 data collection teams (with two persons in each) will take 8–10 working days, depending on the factors noted above. This amounts to 160–200 person-days. Depending on whether the data collection is conducted using paper or electronic versions of the questionnaire (or both), several days may be required for data entry and checking prior to analysis.

It is recommended that the health facility survey component of the DQR should be conducted in conjunction with a larger health facility survey.[2] (This component is currently administered as one module of the Service Availability and Readiness Assessment, or SARA.) Combination with an existing survey will greatly minimize the need to identify separate funds for the data verification. However, the health facility survey component of the DQR may also be administered as a stand-alone survey.

[2] Planning and budgeting for the SARA are provided in SARA reference documents at the following website: http://www.who.int/healthinfo/systems/sara_introduction/en/ (accessed 8 June 2015).

Step 4. Select core indicators and establish benchmarks

The DQR can be implemented as a holistic review across several programme areas or as an in-depth assessment of a particular programme area. The indicators selected should align with the purpose of the assessment and the intended use of the results.

The DQR coordinating group should oversee the selection of indicators and benchmarks. As a general rule, the recommended core indicators (antenatal care, immunization, HIV, TB, malaria) should be examined on an annual basis.

It is important to note that the indicators that are selected for the desk review should also be selected for the data verification. Because of the time involved in data verification, it is recommended that no more than 4–5 indicators are selected for this exercise.

Variations often exist between countries in the naming and definition of indicators, as well as in the services available. Some indicators may not be relevant or appropriate in some countries. Ultimately, the DQR coordinating group should determine what is appropriate, worthwhile and manageable in the country concerned.

Step 5. Identify the implementing agency and quality assurance

The DQR coordinating group should determine the mechanisms for implementation of the DQR. As the DQR has two components (national-level desk review and health facility survey), the mechanisms for implementation should be considered for both.

To build technical capacities and ensure objectivity for a DQR, links should be forged with national statistics agencies, academic institutions and technical/development partners. Selection of an external agency or institution to support the Ministry of Health in the implementation of the DQR, or to provide quality assurance, will also enhance objectivity. The DQR should be conducted in a spirit of openness and transparency and should include regular feedback to data producers at the health-facility and district levels.

Step 6. Training requirements

The DQR requires advanced planning not only for the implementation of the desk review and the health-facility-based data verification but also for training the various personnel who will take part in the process. Data verifiers will be re-compiling indicator values at health facilities for indicators from up to five programme areas. Each programme area is likely to have a separate set of tally sheets and registers, and different protocols for aggregating service outputs to derive facility-level indicator values. The exercise is complicated and requires great attention to detail. Prior to undertaking the verification of data, data verifiers should be familiar with the different data collection tools and protocols for indicator compilation. Thus, the training requirements for data verification are significant and sufficient time should be allowed to build this capacity among the assessment teams prior to implementation.

A training plan should be developed and budgeted as part of the overall DQR planning and budgeting. All personnel should be identified, recruited and trained well before the start of the DQR.

Training needs will differ according to the type of personnel and the tasks performed.

Routine checks of data quality

Routine checks of data quality should be governed by the standard operating procedures of the country's HMIS. The standard operating procedures for routine health-facility data are country-specific and define the roles and responsibilities of the users and administrators of data. More broadly, they should include the processes for performing routine data quality assurance and corrective action, including when the quality checks are performed, what quality checks are conducted, who performs them and how to follow through with subsequent corrective action. While routine data quality checks can and should be performed at all levels of the health system, its most important role lies to the closest users of data – at the district level. This is an area that requires sustained work and support to build up.

1.6 Dissemination and use of the DQR results

A report presenting the findings of the DQR should be prepared along with an interpretation by programme managers and recommendations for system strengthening. The report should be disseminated to all staff who are expected to participate in health-sector planning initiatives (e.g. health sector review) several weeks prior to the planning event. Other stakeholders – such as donors, technical assistance organizations, relevant national and international non-governmental organizations (NGOs), private-sector bodies (e.g. universities, civil society organizations), and concerned ministries – should receive copies of the report.[1]

On the basis of the findings of the DQR, the coordination team should lead the development of the Data Quality Improvement Plan and should ensure that all relevant internal stakeholders (both public, such as the Ministry of Health and the National Statistics Office, and private, such as public health institutes) and external stakeholders (bilateral and multilateral donors and technical assistance agencies such as WHO) are involved.

A separate document on remedial measures to improve the quality of data should also be prepared. The Data Quality Improvement Plan should identify the data quality concern and the measure needed to strengthen the system and resolve the problem. The plan should include a responsible organization with appropriate staff, a timeline for implementation, and identified resources to ensure completion of the necessary measures. If resources for strengthening the system are not available through the current budget, the DQR coordinating group should carry out advocacy among the donor community to raise the necessary resources. Measures for system strengthening should be prioritized so that measures with the highest likelihood of success, and those making the greatest impact on overall data quality, should be implemented first. See Table 3.5 for a sample Data Quality Improvement Plan.

The Data Quality Improvement Plan should seek to identify and address the root causes of data quality problems revealed by the DQR. The actions outlined in the plan should be specific, time-bound and costed. The agency or entity responsible for implementation should be identified. The DQR coordinating group is responsible for monitoring the improvement plan regularly to ensure its implementation.

Data quality concerns should be categorized by functional area of the reporting system (e.g. data collection tools/reporting forms, use of data for decision-making, demographic information, etc.) and should be prioritized for action. Simple, low-cost solutions may be available for some

[1] It is recommended that the report includes the explanation of statistical methods used for the calculation of the verification factor.

problems, while others may cost more and/or be more time-consuming. Priority should be given to remedial measures that have a large effect on improving data quality but are relatively less costly. Adding a data quality check to supervisory visits to health facilities is an example of a low-cost intervention that could produce big gains in improved data quality. Upgrading computers at the district level is an example of a high-cost measure.

Sometimes the solution to data quality problems may be simple but prohibitively costly. For instance, ensuring a regular supply of updated blank source documents goes a long way towards improving data quality but may be beyond a country's available budget. Health facility registers are expensive to produce so they tend to be printed in large quantities every five years or so because money is saved by printing several years' worth of registers at one time. A country's budget may not extend to printing the registers more frequently but the problem is that the indicators collected on these registers often change more frequently than every five years. The point to note is that recommendations for system strengthening should be manageable within the constraints that exist in each country.

Table 3.5 Example of a Data Quality Improvement Plan

Data quality finding	Evidence of finding (interpretation)	Remedial measures	Scope	Timeline	Responsible	Resources
Domain: Indicator definitions and reporting guidelines						
Lack of nderstanding of indicator compilation techniques at health-facility level for PMTCT/ HCT Pregnant women are not disaggregated from HCT results	Systematic over-counting of HCT indicator values in some districts (as revealed by data verification)	Improved supervision and mentoring in affected districts Emphasis on indicator compilation during preservice and in-service training Ensure that printed copies of indicator definitions and compilation procedures are available in health facilities	Regions 2, 7, 10	One year (2015), then re-evaluate	District health information officers or their designates (whoever is conducting supervision at the facility) Pre-service and in-service curriculum design team (HMIS unit at national level)	District health information budgets HMIS training budget (2015 allocation) MOH nurse training (2015 budget) Global Fund Round 9 HSS grant
Domain: Data maintenance and confidentiality						
Source documents are not available for data verification	A significant proportion of service delivery for malaria could not be verified because of non-availability of source documents Poor record-keeping/ archiving of reported results	Districts should work with affected health facilities to develop sound storage areas (closet or cabinet with locking mechanism in a cool, dry place) Shelves should be built using locally-available materials	Identified health facilities in Region 2 (districts 4 and 6) and Region 9 (districts 27 and 34)	One year (2015), then re-evaluate	District health management teams; facility in charge; Regional Health Authority (facilities management unit)	2015 Facilities Management Budget Global Fund Round 9 HSS grant

Note: HCT = HIV counselling and testing; HMIS = health management information system; HSS = health system strengthening; MOH = Ministry of Health; PMTCT = Prevention of mother-to-child transmission.

Annex 1: Recommended indicators

Core indicators

Recommended DQR indicators		
Programme area	**Abbreviated name**	**Indicator name**
Maternal health	Antenatal care 1st visit (ANC1)	Number (%) of pregnant women attended at least once during their pregnancy
Immunization	DTP3/Penta3	Number (%) of children < 1 year receiving three doses of DTP/Penta vaccine
HIV/AIDS	ART coverage	Number and % of people living with HIV who are currently receiving ART
TB	Notified cases of all forms of TB	Number of new and relapse cases of TB that are notified per 100 000 population
Malaria	Total malaria confirmed 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

Recommended DQR indicators		
Programme area	**Abbreviated name**	**Indicator name**
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	Number (%) of women who delivered 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	Number (%) of pregnant women who received the 1st dose of tetanus-toxoid vaccine
Immunization	DTP1-3/Penta1–3	Number (%) of children < 1 year receiving 1st dose, 2nd dose, 3rd dose of DTP/Penta vaccines
	MCV1	Number (%) of infants who have received at least one dose of measles-containing vaccine (MCV) by age 1 year
	PCV 1–3[2]	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 available, use all malaria cases
[2] If this vaccine is not used in country, substitute with another vaccine used in the national programme.

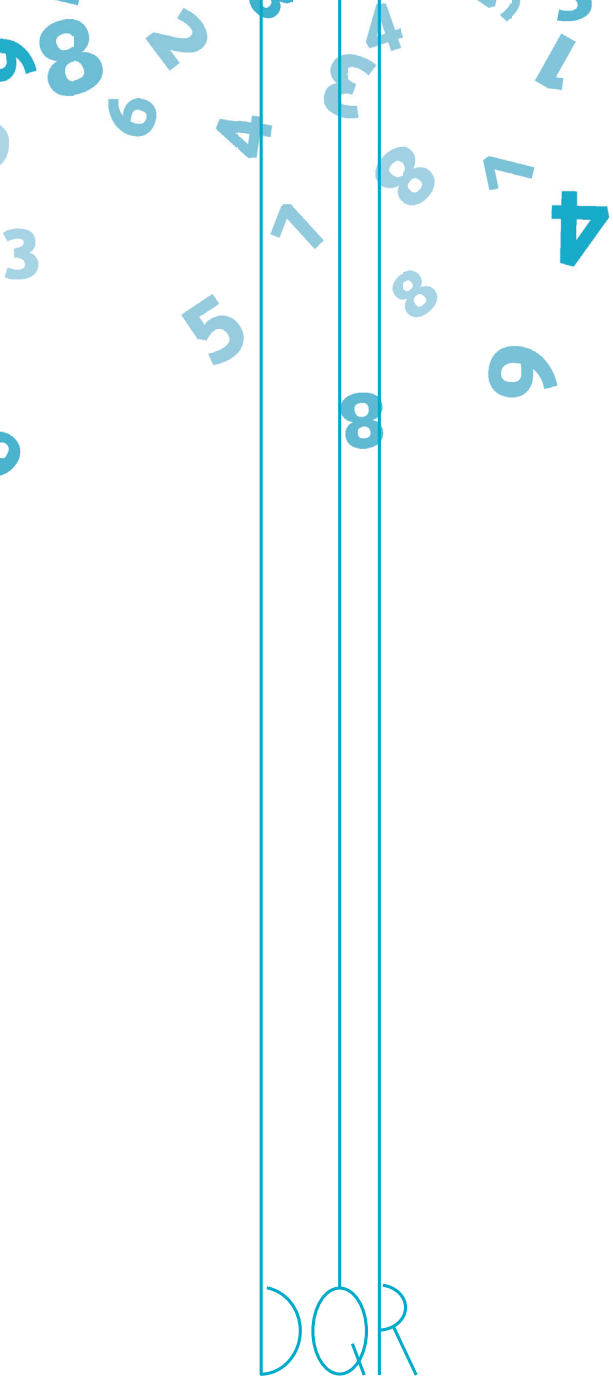
Additional indicators, continued

Recommended DQR indicators		
Programme area	**Abbreviated name**	**Indicator name**
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).



DQR

DATA QUALITY REVIEW

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