Data Quality Management Model (2015 Update) - Retired

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Editor's Note: This Practice Brief supersedes the July 2012 "Data Quality Management Model (Updated)," the March 1998 "Checklist to Assess Data Quality Management Efforts," and the June 1998 "Data Quality Management Model" Practice Briefs.

Healthcare leaders face many challenges today, including payment reform, the transition to ICD-10-CM/PCS, health information exchange, and value-based purchasing programs. The common thread in these challenges is ensuring that data are a trusted source that can be easily accessed, shared, and exchanged.

As electronic health record (EHR) systems have become more widely implemented in all healthcare settings, the need for information governance (IG) is greater than ever. To meet these advanced challenges, rigorous information and data governance, stewardship, management, and measurement is fundamental.

The AHIMA Information Governance Principles for Healthcare (IGPHC)™ provide the foundation of data and information governance through eight key principles:

1. **Accountability:** Designation or identification of a senior member of leadership responsible for the development and oversight of the IG program.
2. **Transparency:** Documentation of processes and activities related to IG are visible and readily available for review by stakeholders.
3. **Integrity:** Systems evidence trustworthiness in the authentication, timeliness, accuracy, and completion of information.
4. **Protection:** Program protects private and confidential information from loss, breach, and corruption.
5. **Compliance:** Program ensures compliance with local, state, and federal regulations, accrediting agencies' standards and healthcare organizations' policies and procedures and ethical practices.
6. **Availability:** Structure and accessibility of data allows for timely and efficient retrieval by authorized personnel.
7. **Retention:** Lifespan of information is defined and regulated by a schedule in compliance with legal requirements and ethical considerations.
8. **Disposition:** Process ensures the legal and ethical disposition of information including, but not limited to, record destruction and transfer.

This Practice Brief uses these eight IGPHC principles as the underpinning of a data quality management model. For this purpose, data quality management and data quality measurement are defined in the following sections.

Data Quality Management Definition

Data quality management is defined as the business processes that ensure the integrity of an organization's data during collection, application (including aggregation), warehousing, and analysis.[1] While the healthcare industry still has quite a journey ahead in order to reach the robust goal of national healthcare data standards, the following are a few sample initiatives that are a step in the right direction for data exchange and interoperability:

- C-CDA: Consolidated Clinical Document Architecture
- DEEDS: Data Elements for Emergency Department Systems
- UHDDS: Uniform Hospital Discharge Data Set
- MDS: Minimum Data Set (long-term care)
- ICD-10-CM/PCS: International Classification of Diseases, Clinical Modification/Procedure Coding Systems
- SNOMED CT: Systemized Nomenclature of Medicine—Clinical Terms
- LOINC: Logical Observation Identifiers Names and Codes
- RxNorm: Standardized nomenclature for clinical drugs

- DSM-5: Diagnostic and Statistical Manual of Mental Disorders

Data Quality Measurement Definition

A quality measure is a mechanism to assign a quantitative figure to quality of care by comparison to a criterion. Quality measurements typically focus on structures or processes of care that have a demonstrated relationship to positive health outcomes. This is evidenced by the many initiatives to capture quality/performance measurement data, including:

- The Joint Commission Core Measure Sets
- Outcome and Assessment Information Set (OASIS) for home healthcare
- National Quality Forum (NQF)
- National Committee for Quality Assurance (NCQA)
- The Healthcare Effectiveness Data and Information Set (HEDIS)
- "Meaningful Use" EHR Incentive Program (defined core and menu sets)

Establishing Information Value through Data Quality Management

Information is a fundamental resource that must be safeguarded, verified, and appropriately interpreted in healthcare to ensure the provision of safe, effective, and high quality care. With the current incentives for the adoption of health information technology, there is a need to ensure that the collected information is trustworthy. There must be integrity of all information generated or used in a healthcare organization, regardless of its source. All data must be accurate, timely, relevant, valid, and complete to ensure the reliability of the information.

In healthcare, data are ubiquitous. Data elements will be used within organizations for continuous quality development efforts and to strategically advance patient care, in addition to benchmarking population health initiatives. Within a healthcare organization, data elements are a measure by which progress is measured and the future is calculated.

Indeed, the central initiatives of payment reform and quality measure reporting intensify an organization's data needs. The introduction of new classification and terminology systems—with their increased specificity and granularity—reinforce the importance of consistency, completeness, and accuracy as key characteristics of data quality.[1] The implementation of ICD-10 CM/PCS impacts anyone using diagnosis or inpatient procedure codes, which are pervasive throughout reimbursement systems, healthcare research and epidemiology, and public health reporting. SNOMED CT, RxNorm, and LOINC terminologies have detailed levels for a variety of healthcare needs, ranging from laboratory to pharmacy, and require a ready awareness of the underlying quality of the derived data elements.

Healthcare data serves countless purposes across numerous settings. The primary use of data continues to be the support of bedside care. New technologies such as telemedicine, remote monitoring, and mobile devices are also changing the nature of access to care and the manner in which patients and their families are interacting with caregivers. The rates of EHR adoption and development of health information exchanges (HIEs) continue to rise, which brings attention to ensuring the integrity of the data regardless of the practice setting, collection method, or system used to capture, store, and transmit data across the continuum of care.

The main outcome of data quality management (DQM) is knowledge regarding the quality of healthcare data and its fitness for applicable use in all of its intended purposes. DQM functions involve continuous quality improvement for data quality throughout the enterprise (all data in all healthcare settings) and include data application, collection, analysis, and warehousing. DQM skills and roles are not new to HIM professionals. As use of health information technology becomes widespread, however, data are shared and repurposed in new and innovative ways, thus making data quality more important than ever.

Data quality protocols must be implemented in the early stages of technological application planning. For example, data dictionaries for applications should utilize standards for definitions and acceptable values whenever possible. For additional information on this topic, please refer to the Practice Brief entitled "Managing a Data Dictionary."[3]

The quality of collected data can be affected by software design and the mechanisms for data population (automated or manual entry). Automated population of data originates from various sources—systems such as clinical lab machines and vital sign tools like blood pressure cuffs. All automated sources must be checked regularly to ensure appropriate calibration.

Likewise, any staff entering data manually should be trained to enter the data correctly and monitored for quality assurance such as registrars entering patient demographic data at the point of care.

Meaningful data analysis must be built upon high quality data. Provided that underlying data are correct, the analysis must use data in the correct context, and inferences must be limited to a comparable population. For example, many organizations do not collect external cause data if it is not required. Gunshot wounds would require external cause data, whereas slipping on a rug would not. Developing an analysis around external causes and representing it as complete would be misleading in many facilities. Additionally, the copy capabilities available as a result of electronic health data are likely to proliferate as EHR utilization expands. Readers can refer to AHIMA's Copy Functionality Toolkit for more information on this topic.[4]

Finally, with many terabytes of data generated by health information technology applications, the quality of the data in warehouses will be paramount. The following are just some of the determinations that need to be addressed to ensure a high quality data warehouse:

- Static data (date of birth, once entered correctly, should not change)
- Dynamic data (patient temperature may fluctuate throughout the day)
- Maintenance scheduling (when and how data updates)
- Versioning (DRGs and EHR systems change over time; it is important to know which DRG grouper or EHR version was used)

Consequently, the healthcare industry needs information and data governance programs to help manage the growing amount of electronic data and information. Furthermore, the collection of meaningful metrics such as offshore data transmission requires governance and procedural compliance.

Information Governance and Data Stewardship

Many healthcare professionals view data governance (DG) and information governance (IG) as the same concept. Sometimes the terms are used interchangeably. But DG and IG are not the same. There are distinctions between them in both application and scope. Data represents the facts or measurements that, when put into context, become information. Information, therefore, is data in context. Information governance cannot occur without data governance—the two are inextricably linked. Information governance provides the enterprise-wide structure and framework that is essential to support data governance.

Despite the diversity in the healthcare industry, information across the various types of organizations can be governed using the eight aforementioned common principles of accountability, transparency, integrity, protection, compliance, availability, retention, and disposition. These IGPHC principles can be adopted in any organization within the healthcare industry regardless of size or type and are grounded in the following data quality management functions and characteristics of data quality (which are discussed below).

Information governance provides the foundation for the other data-driven functions in AHIMA's HIM Core Model by providing parameters based on organizational and compliance policies, processes, decision rights, and responsibilities. Governance functions and stewardship ensure that the use and management of health information is compliant with jurisdictional law, regulations, standards, and organizational policies. To ensure data quality management, data should employ security controls to provide protection for data. Through confidential agreements with trusted partners, data ought to be protected at rest as well as in storage and back-up environments, and transmissions should be tracked using a secure audit trail. To facilitate this, employees should be educated on privacy and security policies, in addition to role-based security that restricts access contingent on user needs to perform his or her role. Device security should be promoted through appropriate tracking and encryption, and protected with security measures. As the stewards of health information, HIM professionals strive to protect and ensure the ethical use of health information.[5]

Assessing Data Quality Management Efforts

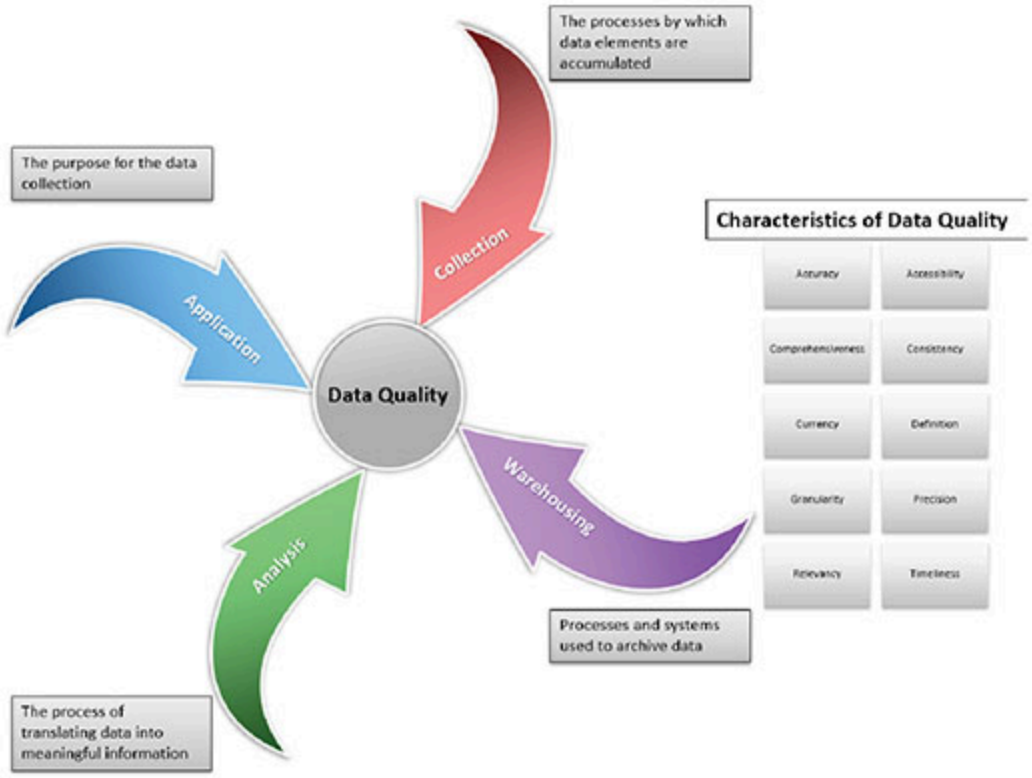
Healthcare data quality practices are evolving from paper records to department-based systems and to large enterprise systems. These practices now utilize electronic searches, comparative and shared databases, data repositories, and continuous quality improvement (CQI).

HIM professionals are experts in collecting and classifying data to support a variety of needs such as severity of illness, meaningful use, pay for performance, data registries, and data mapping. Further, HIM professionals encourage and foster the use of data by ensuring its timely availability, coordinating its collection, and analyzing and reporting collected data. To support these efforts, please refer to Appendix B, "Checklist to Assess Data Quality Management Efforts," which provides four domains and outlines the basic tenets for data quality management.

Many HIM professionals are expanding their responsibilities to include information governance, data governance, and stewardship. Leadership, management skills, and information technology (IT) knowledge are all required for expansion into these areas.

Roles such as clinical data manager, terminology asset manager, and health data analyst positions will continue to evolve into opportunities for those ready to upgrade their expertise to keep pace with changing practice. For a full description of HIM career opportunities, visit AHIMA's Career Map online at http://hicareers.com/careermap/.

Table 1. Data Quality Functions and Characteristics



Source: AHIMA. *Pocket Glossary of Health Information Management and Technology*, Third Edition. Chicago, IL: AHIMA Press, 2012.

Overview of the Data Quality Model

The DQM model was originally developed to illustrate the different data quality challenges that healthcare professionals face. Table 1 above shows a graphic of the DQM domains as they relate to the characteristics of data integrity. Please refer to Appendix A for detailed examples of each characteristic.

Similar to AHIMA's IGPHC, this model is generic and adaptable to any care setting and for any application. The tool expands beyond the EHR to include data quality across the healthcare continuum. It is a tool or a model for all healthcare professionals to assist in the transition to enterprise-wide DQM roles. The tool can be applied to all data in the organization, and expands to encompass both clinical and non-clinical areas.

As demonstrated in the table on page 63, data quality management functions include:

- **Application:** The purpose for the data collection
- **Collection:** The processes by which data elements are accumulated
- **Warehousing:** Processes and systems used to archive data
- **Analysis:** The process of translating data into meaningful information

Also demonstrated in the table on page 63 are characteristics of data quality, which include:

- **Data Accuracy:** The extent to which the data are free of identifiable errors
- **Data Accessibility:** The level of ease and efficiency at which data are legally obtainable, within a well protected and controlled environment
- **Data Comprehensiveness:** The extent to which all required data within the entire scope are collected, documenting intended exclusions
- **Data Consistency:** The extent to which the healthcare data are reliable, identical, and reproducible by different users across applications
- **Data Currency:** The extent to which data are up-to-date; a datum value is up-to-date if it is current for a specific point in time, and it is outdated if it was current at a preceding time but incorrect at a later time
- **Data Definition:** The specific meaning of a healthcare-related data element
- **Data Granularity:** The level of detail at which the attributes and characteristics of data quality in healthcare data are defined
- **Data Precision:** The degree to which measures support their purpose, and/or the closeness of two or more measures to each other
- **Data Relevancy:** The extent to which healthcare-related data are useful for the purposes for which they were collected
- **Data Timeliness:** The availability of up-to-date data within the useful, operative, or indicated time

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Appendix A: Data Quality Management Model Domains and Characteristics

Characteristic	Application	Collection	Warehousing	Analysis
Data Accuracy The extent to which the data are free of identifiable errors.	To facilitate accuracy, determine the application's purpose, the question to be answered, or the aim for collecting the data element. Standard acceptable values should be used where available. Where possible, value flags such as dosages, drug interactions, allergies, and constraints should be implemented.	Ensuring accuracy involves appropriate education and training along with timely and appropriate communication of data definitions to those who collect data. Data definitions require continuous revisions and validations to stay current. The applications should constrain entry to allowable values where possible. For example, data accuracy will help ensure that a patient height cannot be entered erroneously as five inches when it is in	To warehouse data, appropriate edits should be in place to ensure accuracy, such as basic field length checks. Also, error reports are generated related to transfers to and from the warehouse. All warehouses should have a correction and change management policy to track any changes.	To accurately analyze data, ensure that database architecture, relationships, algorithms, formulas, programming, and translation systems are correct. For example, ensure that the encoder assigns correct codes and that the appropriate Diagnosis Related Group DRG is assigned for the codes entered.

	Use of structured data is important to enable the sharing and exchange of health information with HIEs and other organizations. The system of data entry for lab values, such as temperature or blood pressure, must maintain a consistent integer format. Any deviation, to free text for example, might cause the loss or misinterpretation of data.	fact 50 inches. In addition to a primary data error, this would impact any calculated fields such as Body Mass Index (BMI).		Continual data validation is important to ensure that each record or entry within the database is correct.
Data Accessibility Data items that are easily obtainable and legal to access with strong protections and controls built into the process.	The application and legal, financial, process, and other boundaries determine which data to collect. Ensure that collected data are legal to collect for the application and are based on well-defined privacy and content standards For example, recording the date of birth and race in the EHR is appropriate and should only occur once with verification. Subsequently, the values should roll forward.	When developing the data collection instrument, explore methods to access needed data and ensure that the best, least costly method is selected. The amount of accessible data may be increased through system interfaces and integration of systems. For example, the best and easiest method to obtain demographic information may be to obtain it from an existing system. Another method may be to assign data collection by the expertise of each team member. For example, the admission staff collects demographic data, the nursing staff collects symptoms, and the HIM staff assigns codes. Data entry should undergo a cost-benefit analysis process to determine which method provides the best data most efficiently.	Technology and hardware impact accessibility. Establish data ownership and guidelines for who may access or modify data and/or systems. Inventory data to facilitate access. In the EHR it may be advisable to establish data ownership or governance at the data element level, especially data which are reused. For example, allergies are recorded by many different clinicians and come in many forms. Who defines what an allergy is? How does this impact the use of allergies in the EHR, especially for clinical decision support?	Access to complete, current data will better ensure accurate analysis and data mining. Otherwise results and conclusions may be inaccurate or inappropriate. For example, use of the Medicare case mix index (CMI) alone does not accurately reflect total hospital CMI. Consequently, strategic planning based solely on Medicare CMI may not be appropriate.

Data Comprehensiveness All required data items are included. Ensures that the entire scope of the data is collected with intentional limitations documented.	Clarify how the data will be used and identify end users to ensure complete data are collected for the application. Include a problem statement and cost-benefit or impact study when collected data are increased. For example, in addition to outcome it may be important to gather data that impact outcomes.	Cost-effective comprehensive data collection may be achieved via interface to or download from other automated systems. Data definition and data precision impact comprehensive data collection (see these characteristics below).	Warehousing includes managing relationships of data owners, data collectors, and data end-users to ensure that all are aware of the available data in the inventory and accessible systems. This also helps to reduce redundant data collection.	Ensure that all pertinent data impacting the application are analyzed in concert. This is especially important when EHR clinical decision support is utilized. Incomplete data can result in underreporting a numerator or denominator.
Data Consistency The extent to which the healthcare data are reliable and the same across applications.	Data consistency adds to the integrity of data. Data are consistent when the value of the data is the same across applications and systems, such as the patient's medical record number. In addition, related data items should agree. For example, drug dosing.	The use of data definitions, extensive training, standardized data collection (procedures, rules, edits, and process) and integrated/interfaced systems facilitate consistency. Static data should be moved between users. For example, once date of birth has been definitively established, age at the time of treatment should be calculated, not entered by a user who might make an error.	Warehousing employs edits or conversion tables to ensure consistency. Coordinate edits and tables with data definition changes or data definition differences across systems. Document edits data relationships and linkages.	Analyze data under reproducible circumstances by using standard formulas, scientific equations, programming, variance calculations, and other methods. Compare "apples to apples." Any manipulation of data, aggregating or otherwise, should be documented thoroughly to identify data sources, types, codes, and calculations. For example, how is BMI calculated and has the formula been checked?
Data Currency The extent to which data are up-to-date; a datum value is up-to-date if it is current for a specific	The appropriateness or parameters or value within an application changes over time. Currency	Data definitions change or are modified over time. These should be documented so that current and future users know what the data mean. These	To ensure current data are available, warehousing involves continually validating systems, tables, and databases. The dates	The lack of availability of current data impacts the data quality. .

point in time. It is outdated if it was current at a preceding time yet incorrect at a later time.	preservation is essential. Within an EHR, it is imperative that guidelines and algorithms are consistent and up-to-date. For example, acceptable blood pressure ranges have lowered, as have target HbA1C levels.	changes should be made in accordance with information and data governance policies and practices. Further, they must be communicated in a timely manner to those collecting data and to the end users.	of warehousing events should be documented as well as challenges with memory and storage limitations.	Clinically, issues such as the lack of a patient's most current lab values, medications or a new diagnoses can impact another application which may be abstracting such data necessary in tracking disease outbreak or for biosurveillance purposes. Validating data from various fiscal and calendar years should also be considered.
Data Definition The specific meaning of a healthcare related data element.	The application's purpose, the question to be answered, or the aim for collecting the data element must be clarified to ensure appropriate and complete data definitions. For example, the distinction between ethnicity and race should be understood and consistently applied during the registration process. Selection options for these fields should be limited to choices that are in adherence with the data dictionary	Clear, concise and consistent data definitions facilitate accurate data collection. Inconsistent data definitions are problematic and affect patient care such as not being able to correctly identify a patient. A data dictionary provides a descriptive list of names, definitions, and attributes of data elements to be captured in an information system or database and offers a base for data not to be misinterpreted.	Warehousing includes archiving documentation and data. Consequently, data ownership documentation and definitions should be maintained over time and clearly communicate to staff. Inventory maintenance activities (purging, updates, and others), purpose for collecting data, collection policies, information management policies, and data sources should be maintained over time also.	For appropriate analysis, display data needs to reflect the purpose for which the data were collected. Appropriate comparisons, relationships, and linkages need to be shown visually.
Data Granularity The level of detail at which the attributes and values of healthcare data are defined.	A single application may require varying levels of detail or granularity. For example, census statistics may be	Collect data at the appropriate level of detail or granularity. For example, the temperature of 100° may be recorded. The	Warehouse data at the appropriate level of detail or granularity. For example, exception or error reports reflect granularity based on	Appropriate analysis reflects the level of detail or granularity of the data collected.

	utilized daily, weekly, or monthly depending upon the application. Census is needed daily to ensure adequate staffing and food service. However, the monthly trend is needed for long-range planning. Similarly, lab test results may be trended at various levels of detail.	granularity for recording outdoor temperatures is different from recording patient temperatures. If patient Jane Doe's temperature is 100°, does that mean 99.6° or 100.4°? Appropriate granularity for this application dictates that the data need to be recorded to the first decimal point while appropriate granularity for recording outdoor temperatures may not require it.	the application. A spike (exception) in the daily census may show little or no impact on the month-to-date or monthly reports.	For example, a spike (exception) in the daily census resulting in immediate action to ensure adequate food service and staffing may have had no impact on analysis of the census for long-range planning. Of particular note for analysis is the impact of any rounding which might be done for numerical data.
Data Precision Data values should be strictly stated to support the purpose.	The application's purpose, the question to be answered, or the aim for collecting the data element must be clarified to ensure data precision. What level of detail is needed for the data collection purpose? Are age ranges or four U.S. regions sufficient?	To collect data precise enough for the application, define acceptable values or value ranges for each data item. For example, limit values for gender to male, female, and unknown; or collect information by age ranges or allow more detailed collection to fully meet the needs.	Are warehouses receiving and storing all data elements being transferred from the source system?	If the precision of the data has been altered in the analysis, is the process understood and well documented? For example, analyzing a blood pressure value before and after the initiation of anti-hypertensive medication will not be precise unless the purpose is clearly stated and data values are clearly defined as the before anti-hypertensive and after anti-hypertensive blood pressure values

Data Relevancy The extent to which healthcare-related data are useful for the purposes for which they were collected.	The application's purpose and the rational for collecting the data element must be clarified to ensure data relevancy.	To better ensure relevancy, complete a pilot of the data collection instrument to validate its use. A "parallel" test may also be appropriate, completing the new or revised instrument and the current process simultaneously. Communicate results to those collecting data and to the end users. Facilitate or negotiate changes as needed across disciplines or users.	Establish appropriate retention schedules to ensure availability of relevant data. Relevancy is defined by the application. It may be appropriate for warehouses to subset data related to its relevancy for certain uses.	For appropriate analysis, display data to reflect the purpose for which the data were collected as defined by the application. Demonstrate appropriate comparisons, relationships, and linkages to establish relevancy.
Data Timeliness Concept of data quality that involves whether the data is up-to-date and available within a useful time frame. Timeliness is determined by how the data are being used and their context.	Timeliness is defined by the application. For example, patient census is needed daily to provide sufficient day-to-day operations staffing, such as nursing and food service. However, annual or monthly patient census data are needed for the organization's strategic planning. In the EHR, vitals may be taken once per visit for ambulatory care patients, but every 15 minutes or more often for critically ill patients.	Timely data collection is a function of the process and collection instrument. In the EHR, system performance plays an important role in data timeliness. Data display should be sub-second and data entry should occur instantaneously.	Warehousing ensures that data are available per information management policy and retention schedules. For EHR or clinical data warehouses, is the data updated concurrently or does it occur in a batch process?	Timely data analysis allows for the initiation of action to avoid adverse impacts. For some applications, such as allergy-drug or drug-drug interactions, timely may be seconds. For others, such as the prevalence of a disease over time, it may be years.

Appendix B: Checklist to Assess Data Quality Management (DQM) Efforts

Use the Data Quality Model Functions checklist below to assess overall data quality management efforts.

Application

The purpose for data collection.

- The application's purpose, the question to be answered, or the aim for collecting the data is clear
- Boundaries or limitations of data collected are known and communicated
- Complete data are collected for the application
- Value of the data is identical across applications and systems
- The application is of value and is appropriate for the intent
- Timely data are available

Collection

The process by which data elements are accumulated.

- Education and training is effective and timely
- Communication of data definitions is timely and appropriate
- Data source provides most accurate, most timely, and least costly data
- Data collection is standardized
- Data standards exist
- Updates and changes are communicated appropriately and on a timely basis
- Data definitions are clear and concise
- Data are collected at the appropriate level of detail or granularity
- Acceptable values or value ranges for each data element are defined; edits are determined
- The data collection instrument is validated
- Quality (i.e., accuracy) is routinely monitored
- Meaningful use is achieved via the evaluation of EHR data

Warehousing and Interoperability

Processes and systems used to archive data.

- Appropriate edits are in place
- Data ownership is established
- Guidelines for access to data and/or systems are in place
- Data inventory is maintained
- Relationships of data owners, data collectors, and data end users are managed
- Appropriate conversion tables are in place
- Systems, tables, and databases are updated appropriately
- Current data are available
- Data (data definitions, data ownership, policies, data sources, etc.) are appropriately archived, purged, and retained
- Data are warehoused at the appropriate level of detail or granularity
- Appropriate retention schedules are established
- Data are available on a timely basis
- Health information exchange is achieved as a result of interoperability

Analysis

The process of translating data into meaningful information.

- Algorithms, formulas, and translation systems are valid and accurate
- Complete and current data is available
- Data impacting the application are analyzed in context
- Data are analyzed under reproducible circumstances
- Appropriate data comparisons, relationships, and linkages are displayed
- Data are analyzed at the appropriate level of detail or granularity

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Notes

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