NATIONAL QUALITY FORUM

Quality Data Model (QDM)

Overview Document

National Quality Forum

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QUALITY DATA MODEL (QDM): OVERVIEW

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National Quality Forum: Overview and Goals

The National Quality Forum (NQF) is a nonprofit organization that operates under a three-part mission to improve the quality of American healthcare by:

- building consensus on national priorities and goals for performance improvement and working in partnership to achieve them;
- endorsing national consensus standards for measuring and publicly reporting on performance; and
- promoting the attainment of national goals through education and outreach programs.

NQF drives improvements in care by rigorously endorsing evidence-based measures of performance—focusing on measurement for accountability and quality improvement.

Measurement has the greatest impact on quality when it supports transparency and public reporting, but it also provides information to help clinicians make improvements in care delivery. To date, quality measurement and public reporting have been thought of as secondary data uses rather than as drivers of care. By setting standardized performance measures and properly designing and building health IT, however, it will now be possible to capture performance data as part of the care process and provide immediate information feedback and clinical decision support to clinicians to improve care.

Designing and building health IT to support performance improvement requires close collaboration between the quality and health IT communities. NQF plays a key role in the quality community as the national standard-endorsing body for performance measures and as a neutral convener of multiple stakeholders to set National Priorities for improvement and drive quality improvement.

Performance Measurement: Information Needs and the Quality Data Model

Collecting and reporting accurate, comparative healthcare performance data is a complex and largely time-consuming and manual process. Much of the information required to measure performance is collected in the process of routine clinical care and is available in electronic health records (EHRs) and other clinical data sources. It has not, however, been routinely available for export and use for reporting or performance measurement. Performance measures are most frequently developed based on routinely available sources of data and therefore are often based on claims and clinically enriched administrative data. Taking advantage of comprehensive clinical data contained in EHRs and other clinical applications, including personal health records (PHRs) requires that measures are specified to account for the way data are expressed in such products.

NQF, through the Health Information Technology Expert Panel (HITEP), a committee of health IT industry experts, established the Quality Data Model (QDM) to enable such expression of data criteria for measurement to address data that are available in EHRs and other clinical information sources. QDM's development was based on a request by the American Health Information Community (AHIC) and the Office of the National Coordinator for Health Information Technology (ONC), with funding from the Agency for Healthcare Research and Quality (AHRQ).

The QDM (formerly referred to as the Quality Data Set, or QDS) is an "information model" that clearly defines concepts used in quality measures and clinical care and is intended to enable automation of structured data capture in EHRs, PHRs, and other clinical applications. It provides a way to describe clinical concepts in a standardized format so individuals (i.e., providers, researchers, or measure developers) monitoring clinical performance and outcomes can clearly and concisely communicate necessary information. The QDM also describes information so EHR and other clinical electronic system vendors can consistently interpret and easily locate the data required.

The QDM provides the potential for more precisely defined, universally adopted electronic quality measures to automate measurement and compare and improve quality using electronic health information. Use of the QDM will enable more standardized, less-burdensome quality measurement and reporting and more consistent use and communication of EHRs for direct patient care.

The QDM is described in detail in the *Health Information Technology Expert Panel Report: Recommended Common Data Types and Prioritized Performance Measures for Electronic Healthcare Information Systems*. The model was further clarified and described in a second report, *Health Information Technology Automation of Quality Measurement: Quality Data Set and Data Flow*.

Electronic Measures (eMeasures) and QDM's Role

During the last 18 months, NQF and many measure stewards have been involved in efforts to rapidly convert, or "retool," existing measures for use on an electronic platform. As part of the Department of Health and Human Services (HHS) contract, NQF has worked with measure stewards to retool an initial set of more than 100 performance measures.Many of these are being used for the Health Information Technology for Economic and Clinical Health Act (HITECH) incentive payments linked to meaningful use of EHRs. In a recent child health quality measures project, NQF received, for the first time, measures submitted with EHR specifications.

NQF has been laying the groundwork for the endorsement of eMeasures for some time. The Testing Task Force Report released in 2011 specifies requirements for testing new and retooled e-measures. The QDM is an essential building block of both performance measures and EHRs.

With support from HHS, NQF subcontracted with the IFMC to develop a Measure Authoring Tool that will help developers generate specifications for eMeasures in a consistent fashion. The tool is expected to be publicly available to measure developers starting in fall 2011.

Quality Data Model: Status and the Public Comment Process

To ensure QDM's continued value and use, NQF will enhance and update it as needed in response to evolving quality measurement needs. The QDM Version 2.1 was published for public comment in September 2010. The current version, QDM 3.0, contains updates based on feedback from the comment period as well as from information learned in applying the QDM to retooling more than 100 measures in 2010.

This new version has a number of modifications, including:

1. A more hierarchical structure has been implemented.
2. A more detailed set of information about each QDM element has been included to allow a more complete description of information required.
3. A method for describing data relationships enabling more expressive measure criteria has been employed.
4. Standard categories are now referred to as "concepts."
5. "States" are subdivided into "states of action" or "states of being." (States of action are present-tense verbs, and states of being are nouns.)
6. The terminology and definitions of some concepts, states, and attributes has shifted in some cases to make these components more applicable and reusable. For example, allergy is now a concept to allow clearer description of information requirements rather than its prior use as a context of medications or substances. A new concept has also been added to enable measurement of the use of health IT as part of care coordination, the *health record component*. This new concept is derived from the Health IT Assessment Framework published in 2010.[1]
7. "Data type" previously was used to combine a concept (referred to as "standard category") and its context of use. For example, the data type "Diagnostic study order" now is referenced by the *concept* "Diagnostic study"' and the state in which it is expected, for example, "order." This change allows states to be more interchangeable.
8. Data types context components are now referred to as "states."
9. Each concept has a defined list of states (*states of action* and/or *states of being*) that can be used to describe how it is used within a measure statement. To see the full list of

[1] NQF, Expert Panel Report: *Driving Quality: A Health IT Assessment Framework for Measurement, 2010*, Washington, DC: NQF; 2010. Available at: http://www.qualityforum.org/Publications/2010/12/Driving_Quality_-_A_Health_IT_Assessment_Framework_for_Measurement.aspx. Last accessed April 2011.

concepts and states, refer to the list below and more complete detail in the Appendix under *QDM Concepts and States.*

Individuals can submit public comments on the most current QDM version on a continual basis. NQF will use relevant elements of its Consensus Development Process to receive and review comments on the most current version of the QDM. NQF's Health Information Technology Advisory Committee (HITAC), in collaboration with NQF staff, will regularly review public comments on the QDM. Based on the findings and HITAC recommendations, the QDM will be updated and new versions released as needed. Each new version of the QDM will be posted to the NQF website and will then be available for public comment.

The next version of the QDM will be posted for public comment at the end of April 2011 and released in early summer.

Quality Data Model: The Full Description, Specificity, and Technical Detail

The QDM is a model of information used to express patient, clinical, and community characteristics as well as the basic logic required to express quality measure criteria. Measure specifications include population, denominator, numerator, exclusion, and optionally risk adjustment criteria. The QDM describes the data elements and the states, or contexts in which the data elements are expected to exist in clinical information systems (see Figure 1, below). As such, coordination with standards is required to ensure the information is clear, unambiguous, consistent, and accurate. Readers interested in understanding more of QDM's technical details and specifications (e.g., expression language, relative timing) should refer to the companion document, *QDM Technical Specification.*

Quality Data Model: QDM Element Structure

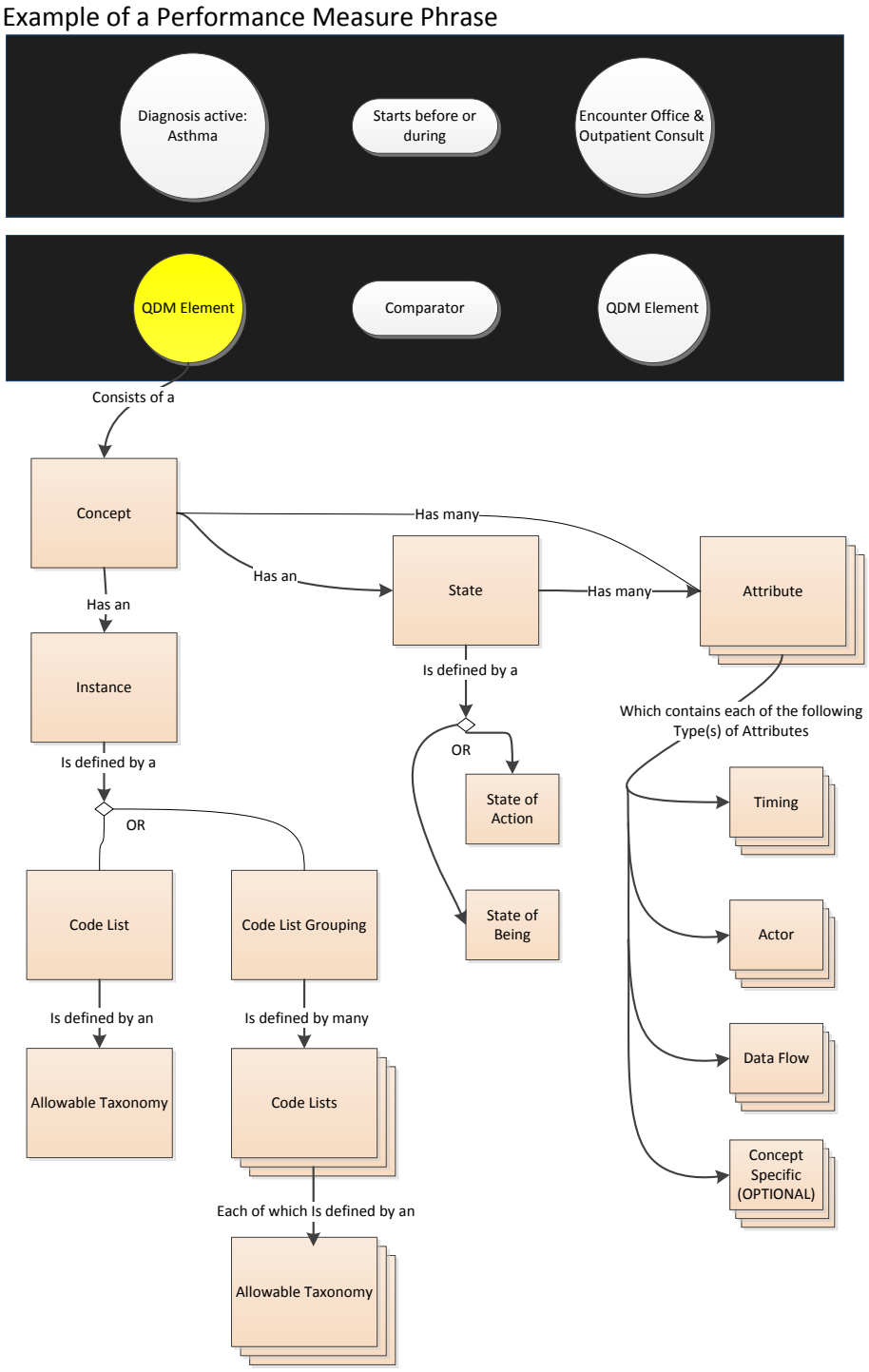

Figure 1. QDM Composition Diagram—The diagram depicts the direction and interrelationship between the various QDM element components (i.e., concepts, states, and attributes.) The left side of the diagram shows the definition of a QDM element**.** This begins with defining a *concept* for which each use

has an *instance* (or specific use), which in turn is defined by a *value set*. Value sets may be individual or comprised of *child* value sets. An example of child value sets is provided in Figure 3. Each value set is defined by a *taxonomy* that is based on established standards for clinical system use and interoperability. The middle section of the diagram shows the application of a *state* to the defined instance of a concept. States may be actions (*states of action*) or indicate the existence of a specific concept instance (*states of being*). The concept-state pair comprises the QDM element, which can be further described using the elements on the right of the diagram—the *attributes*. Attributes include four basic categories: *timing, actor, data flow, and concept-specific.* Greater detail is provided in Figures 4, 5, 6, and 7.

Enhancements are incorporated into the QDM to enable expanding concepts of measurement. This helps to ensure the QDM covers data required to evaluate care coordination across venues of care, patient, and family engagement in care and longitudinal outcomes. These QDM elements are used in different contexts, depending on the measure (see Figure 2, below). For example, one measure may assess if a lab test was ordered, while another may assess if it was performed, and a third may compare the actual lab result to a guideline threshold or the amount of change in the result over time.

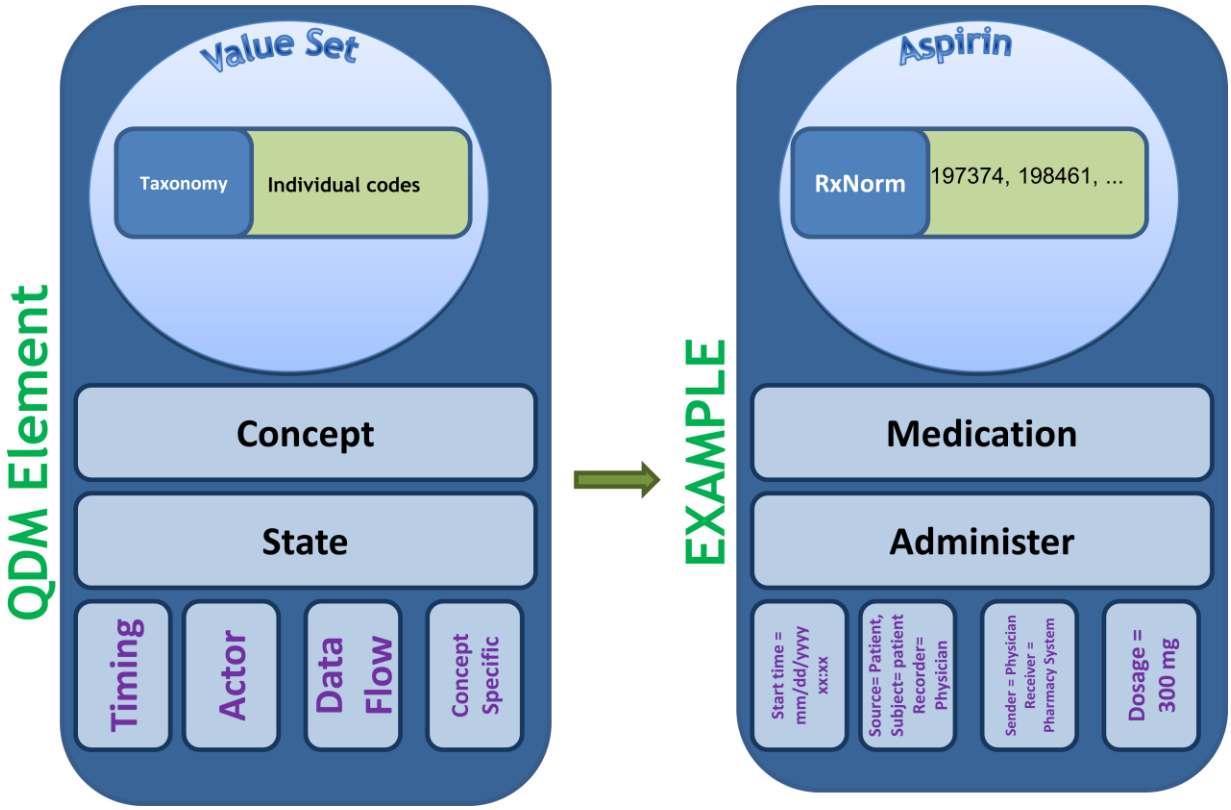

Figure 2. QDM Element Structure—The components of a QDM element are shown in the figure. The figure on the left identifies the terms used for each component of the QDM element. The figure on the right uses each of these components to describe a QDM element indicating "Medication, *administer* aspirin." Each QDM element is composed of a *concept*, the *state* in which that concept is expected to be used and a *value set* of codes in a defined *taxonomy* to specify which instance of the concept is expected. The boxes in the lower section of the QDM element specify individual *attributes*, or additional data to

describe the QDM element. Attributes include: *timing*, *actor*, *data flow*, and *concept-specific*. More detail about each of these QDM components is provided in the text.

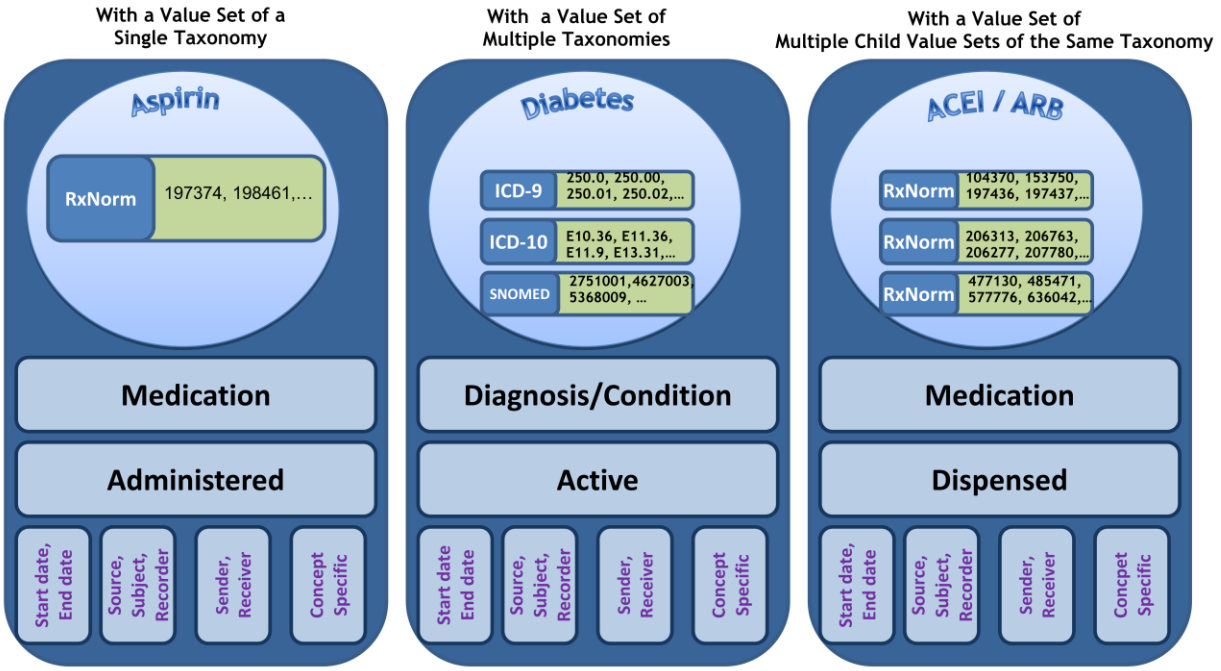

Figure 3. QDM Use of Value Sets—This figure shows three QDM elements, each of which uses value sets. The figure on the left shows a value set for medication (aspirin) that includes a single set of codes using a single taxonomy. The middle figure shows the instance *diabetes* of the concept diagnosis. In the middle figure the value set provided is a *parent* value set composed of three *child* value sets, one each using the *taxonomies* SNOMED-CT, ICD-9-CM, and ICD-10-CM, respectively. In this case the parent value set indicates the same concept instance but expressed in different taxonomies. The figure on the right provides a *parent* value set titled ACEI/ARB* comprised of two child value sets, each in the same taxonomy (RxNorm). This example uses a parent value set for convenience, expressing a combination of two different concept instances (both ACEI and ARB medications). *ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker.

1. *QDM Concepts and States Table:* The following table lists all the QDM concepts and states. More details on the possibilities of each concept and state and the relationships among all concepts and all states are included in the companion document, *QDM Technical Specifications.* The QDM element (concept, state, value set, and attributes) comprise the atomic data expression that is used to specify data criteria required for the quality measure.

Table 1. QDM Concepts

QDM Concepts
1. Allergy
2. Characteristics
3. Communication
4. Condition/Diagnosis/Problem
5. Device
6. Diagnostic Study
7. Encounter
8. Experience
9. Family History
10. Functional Status
11. Health Record Component
12. Intervention
13. Intolerance
14. Laboratory Test
15. Medication
16. Physical Exam
17. Preference
18. Procedure
19. Risk Evaluation
20. Substance
21. Symptom
22. System Resources
23. Transfer

Table 2. QDM States

QDM States	
QDM State of Action	QDM State of Being
1. Access	1. Active
2. Acknowledge	2. Inactive
3. Administer	3. Resolved
4. Alert	
5. Apply	
6. Assess	
7. Calculate	
8. Create	
9. Decline	
10. Discontinue	
11. Dispense	
12. Document	
13. Implement	
14. Notify	
15. Order	
16. Perform	
17. Plan	
18. Receive	
19. Recommend	
20. Reconcile	
21. Record	
22. Remind	
23. Report	
24. Request	
25. Review	
26. Stratify	
27. Transmit	
28. Update	

Attributes

QDM Element attributes include four basic categories: *timing, actor, data flow, and concept-specific*. Greater detail is provided in Figures 4, 5, 6, and 7.

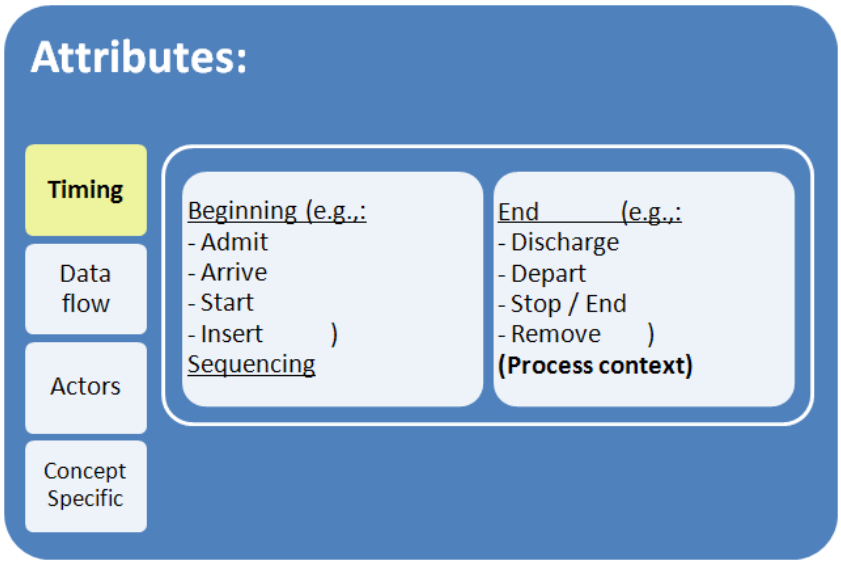

Figure 4. Timing Attribute: The timing attribute indicates the time of occurrence, including whether the beginning or end of a process is the time of interest. Timing provides the process context for the QDM element.

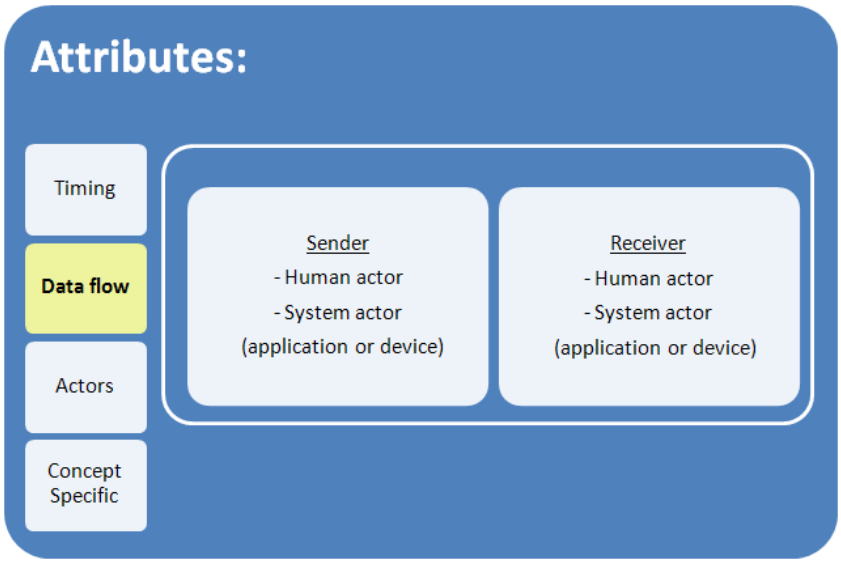

Figure 5. Data Flow Attribute: The data flow attribute allows specification of a specific sender or receiver of a transaction, enabling expression of criteria that a specific health care component is shared by a clinician (sender) with a patient (receiver).

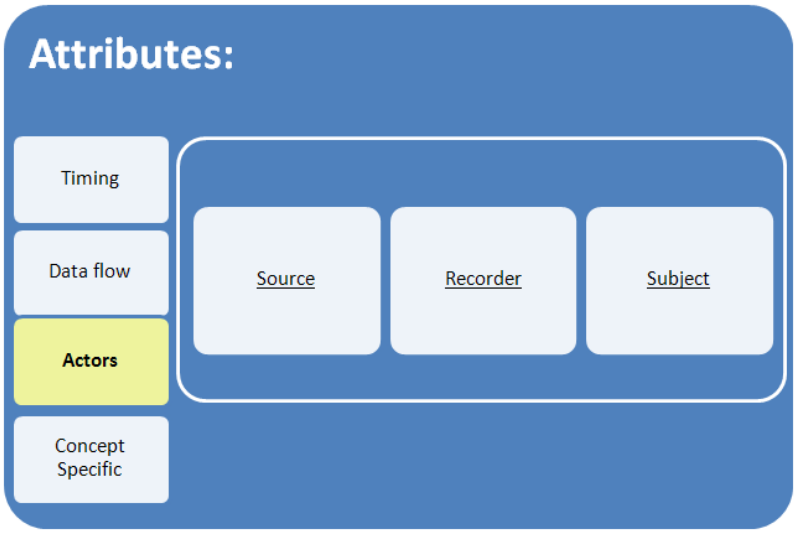

Figure 6. Actor Attribute: The actor attribute allows the measure developer to define the expected source, recorder, and subject for each QDM element; thus, it is possible to specify data only derived and recorded by devices, patients, or clinicians.

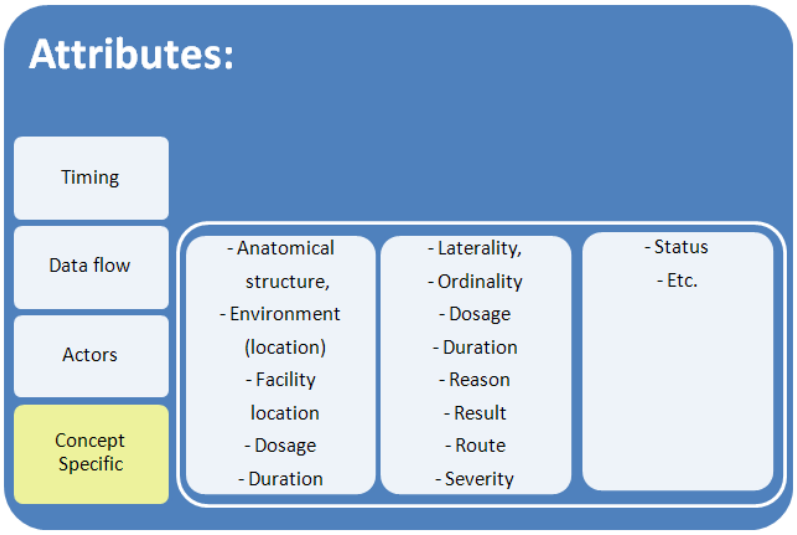

Figure 7. Concept-Specific Attribute: *Concept-specific* attributes are listed separately in Table 3 of this document.

Table 3. QDM Concepts and Specific Attributes:—This table provides detail on the specific relationships between the attributes and concepts. The individual concept-specific attributes are provided as headers for each column. The concepts define the rows. Concept-specific attributes that apply to each concept are depicted with an *x* in the applicable columns. Full descriptions of the concepts and attributes are provided in the *QDM Technical Specification* (glossary section) companion document.

Concept (From Version X.X)	Anatomical structure	Dosage	Environmental location	Facility location	Health Record Field	Laterality	Ordinality	Reason	Result	Route	Severity	Status
1. Allergy					x						x	x
2. Characteristics					x							x
3. Communication					x			x				x
4. Condition/ Diagnosis/ Problem	x				x	X	X				x	x
5. Device	x				x	X	X	x				
6. Diagnostic study	x			X	x	X		x	x			
7. Encounter			x	X	x			x				
8. Experience					x							
9. Family History					x							x
10. Functional Status	x				x	X			x			
11. Health record component	x		x	x	x	X						
12. Intervention	x		x	x	x	X	X	x	x			
13. Intolerance					x						x	x
14. Laboratory test	x		x	x	x	x		x	x			
15. Medication		x			x					x		
16. Physical Exam	x		x	x	x	x		x	x			
17. Preference					x			x				
18. Procedure	x		x	x	x	x	X	x	x			x
19. Risk evaluation	x				x	x			x			
20. Substance		x			x					x		
21. Symptom	x		x	x	x	x	X				x	x

Concept (From Version X.X)	Anatomical structure	Dosage	Environmental location	Facility location	Health Record Field	Laterality	Ordinality	Reason	Result	Route	Severity	Status
22. System resources			x	x	x			x				
23. Transfer			x	x	x			x				

The companion document, *QDM Technical Specification*, provides greater detail on the technical issues and specifications (e.g., expression language, relative timing) associated with the QDM.

This document includes the following:

QDM Glossary: Provides detailed definitions with relevant examples for all terms and components of the QDM.

QDM Relative Timings Functions and Operators: Describes the interactions of QDM components related to the: 1) relative timing, 2) operator, or 3) function. Relative timings allow a measure developer to describe timing relationships among individual QDM elements. Combining the QDM elements in this way allows the measure developer to create phrases that can add meaning to the individual elements. Operators allow measure developers to compare two or more QDM elements logically or mathematically. Functions use a QDM element as an input and return a calculation based on that input.

QDM Mapping of Concepts to States: Provides detail on the possibilities of each concept and state and describes the relationships among all concepts and all states (e.g., every state that corresponds with diagnosis).