GUIDE FOR READING ELECTRONIC CLINICAL QUALITY MEASURES (eCQMs)

VERSION 5

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Acknowledgments

This document was originally developed by the National Quality Forum (NQF, www.qualityforum.org) under contract with the U.S. Department of Health and Human Services to promote the effective use of Electronic Health Record (EHR) systems and released in October, 2010. It was subsequently updated by Health Services Advisory Group (HSAG), Lantana Consulting Group, and NQF under contract with the Centers for Medicare and Medicaid Services (CMS). The structural/format changes to the eCQMs which are seen by the end user that have occurred since the October, 2010 document are included in the Summary of Changes section.

Table of Contents

List of Figures

List of Tables

Introduction

Collecting and reporting accurate, comparable healthcare performance data has historically been a complex and time consuming manual process. Performance measures most frequently address data that is routinely available. Claims data, laboratory results and pharmaceutical usage data have traditionally been the source of information for these measures despite the fact that much of the information required for performance measurement is available in electronic health records (EHRs). Performance data from EHRs has not been routinely available for export and use to compute measures. The Medicare and Medicaid EHR Incentive Program (Meaningful Use, Stage 2) is working to reduce the burden of collecting and reporting healthcare performance data by utilizing the capabilities of EHRs.

This document provides guidance for understanding and using the electronically specified eligible professional and eligible hospital clinical quality measures ("eCQMs", also referred to as an "eMeasure") published in 2012, and updated annually, by the Centers for Medicare and Medicaid Services (CMS) for Meaningful Use, Stage 2. These measures are also referred to as the "2014 Clinical Quality Measures".

Using this Guide

This guide should assist providers, chief medical information officers (CMIOs), and quality analysts in interpreting and understanding eCQMs. This applies to electronically respecified paper-based measures and de novo eCQMs. Readers who wish to gain a greater understanding on how to develop and document an eCQM should also reference the eMeasure Specifications chapter of the *Blueprint for the CMS Measures Management System ("Blueprint")*.[1] Those wishing to implement the 2014 CQMs should reference the *Clinical Quality eMeasure Logic and Implementation Guidance* ("Implementation Guide") document published with the measure specifications.[2]

Quality Data Model (QDM)

Truly accessing the rich clinical data residing in EHRs requires that measures are specified to account for the way data are expressed in EHRs. The National Quality Forum (NQF) convened a committee of health IT industry experts, the Health Information Technology Expert Panel (HITEP), to create the Quality Data Model (QDM)—formerly referred to as the Quality Data Set (QDS)—to enable such expression of data requirements in the context of EHR use.[3] The QDM is now maintained by the Centers for Medicare and Medicaid Services (CMS).

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[1] *CMS Measures Management System Blueprint ("Blueprint")*. Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/MeasuresManagementSystemBlueprint.html.

[2] *Clinical Quality eMeasure Logic and Implementation Guidance* document. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/eCQM_Library.html

[3] *Quality Data Model (QDM), December 2013*. Available at: http://www.healthit.gov/quality-data-model

The QDM is an information model that defines concepts recurring across quality measures and clinical care and is intended to enable automation of EHR use. The process of creating an eCQM involves mapping measure data elements to corresponding QDM components to assemble the data criteria into population criteria within an eCQM. This process and the specialized measure development terminology are defined in the eMeasure Specifications chapter of the *Blueprint for CMS Measures Management System*.

Health Quality Measure Format (HQMF)

To further enable electronic measurement of EHR data, the NQF, under contract with the U.S. Department of Health and Human Services (HHS), supported the development of a Health Level Seven (HL7) standard known as the Health Quality Measures Format (HQMF) for representing a health quality measure as an electronic Extensible Markup Language (XML) document.[4] A health quality measure encoded in HQMF is referred to as an "eMeasure" or "eCQM" (electronic clinical quality measure). Through standardization of a measure's structure, metadata, definitions, and logic, the HQMF provides for quality measure consistency and unambiguous interpretation. HQMF is a component of a larger quality end-to-end framework in which providers will ideally be able to push a button and import these eCQMs into their EHRs. The eCQMs can be turned into queries that automatically retrieve the necessary information from the EHR's data repositories and generate quality data reports. From there, individual and/or aggregate patient quality data can be transmitted to the appropriate agency using Quality Reporting Document Architecture (QRDA) Category I (individual patient level) or Category III (aggregate patient data) reports.

This guide is focused on assisting readers to understand and interpret an eCQM through dissecting its human-readable rendition format; those who wish to gain a greater understanding of the HQMF syntax should reference the latest HQMF Release.

Measure Authoring Tool (MAT)

Under contract with HHS, NQF developed a web-based Measure Authoring Tool (MAT), a software application authoring tool that measure developers use to create eCQMs. The MAT allows measure developers to create their eCQMs in a highly structured format using the QDM and healthcare industry standard vocabularies. All Meaningful Use Stage 2 eCQMs are authored in and exported from the MAT. The MAT, originally made publically available through NQF in September 2011, was transitioned to HHS in late fall 2012 to manage day-to-day operations. Readers who wish to learn how to use the MAT to author eCQMs should reference the Measure Authoring Tool User Guide.[5]

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[4] *HL7 Version 3 Standard: Representation of the Health Quality Measures Format (eMeasure), Release 2* – December 2013 published. http://www.hl7.org/implement/standards/product_brief.cfm?product_id=97

[5] *Measure Authoring Tool User Guide* can be accessed via the "Helpful Links" in the footer of the landing page by clicking the "User Guide" link. https://www.emeasuretool.cms.gov/.

eCQM Components

An eCQM created in the MAT is exported as a package. Each eCQM package consist of a Zip file that contains two files and an XML Stylesheet Language for Transformations (xslt) subfolder. Each of these components helps to view and understand the eCQM:

- **eCQM XML file**: An XML document (.xml) based on the HQMF. Its major components include a Header and a Body. The Header identifies and classifies the document and provides important metadata about the measure. The HQMF Body contains eCQM sections, e.g., data criteria, population criteria, and supplemental data elements.
- **eCQM human-readable rendition**: A HyperText Markup Language file (.html) that displays the eCQM content in a human-readable format directly in a web browser. This file does not include the underlying HQMF syntax.
- **eCQM style sheet:** An XML Style Sheet file (.xsl), contained in the 'xslt' subfolder, allows the eCQM XML file to open directly in a web browser. When opened this way, the eCQM XML file displays in the same human-readable format as the eCQM human-readable HTML file.

eCQM value sets are an important piece of an eCQM. An eCQM value sets spreadsheet is no longer provided as part of an eCQM package. Value set information is available from the online Value Set Authority Center (VSAC) established by the National Library of Medicine (NLM).[6] Credentials from the Unified Medical Language System (UMLS)[7] are required in order to access the VSAC data while in the MAT. The VSAC provides downloadable access to all official versions of vocabulary value sets contained in the 2014 Clinical Quality Measures.

eCQM File Naming Conventions

The eCQM naming conventions are described below in the order they are viewed when accessing the eCQMs related to Meaningful Use, Stage 2 ("2014 eCQMs").

Measure Packaging by Setting

There are two "All measures Zip files" available for download on the CMS web site. Each Zip file contains all of the respective eCQMs grouped by setting—29 eligible hospital and 64 eligible professional. The file names combine attributes that identify the:

1. CMS Rule year with which the eCQMs are associated (example: 2014).
2. files included—"eCQM" for eligible professional, "eCQM_Spec_for" for eligible hospital.
3. setting for which the measure applies—"EH" and "EP".

[6] Value Set Authority Center, National Library of Medicine. https://vsac.nlm.nih.gov
[7] Unified Medical Language System License. https://uts.nlm.nih.gov/license.html

4. publication date—format: MonthYYYY for eligible professional, Release _MonthYYYY for eligible hospital.

The following provides examples of Zip file names using the convention for measure packaging by setting:

Examples	*File Name*
Eligible Hospital Zip file	2014_eCQM_Spec_for_EH_Release_April2013.zip
Eligible Professional Zip file	2014_eCQM_EP_June2013.zip

CMS eMeasure Identifier

CMS created a unique "CMS eMeasure Identifier" to clearly and consistently identify eCQM files. It combines the eMeasure identifier assigned to the eCQM in the MAT with the "eMeasure Version Number", which is prepended by "CMS". Based on this universal naming convention, eligible professional measure (NQF0056-Diabetes: Foot Exam) would display the following for the first version of the measure: **CMS123v1**.

eMeasure Information	***Value***
eMeasures Identifier (MAT)	123
eMeasure Version Number	1
CMS eMeasure ID	**CMS123v1**

Measure Zip File and Folder

The naming conventions for the individual eCQM packages (Zip files and measure folder) that contain the eCQM XML file, and human-readable rendition are described below in the order in which they appear.

1. Setting for which the measure applies—"EP" or "EH" measures
2. CMS eMeasure ID (as described above)
3. NQF identifier—if not endorsed by NQF, the file will contain "NQFXXXX"
4. Abbreviated name for the clinical quality measure (example: "Diab_Foot")

Using the eligible professional measure example from above for NQF0056, the Zip file and corresponding folder would appear as follows:

Type of Artifact	***File Name***
Measure Zip file	EP_CMS123v1_NQF0056_Diab_Foot.zip
Measure folder	EP_CMS123v1_NQF0056_Diab_Foot

Individual eCQM File Components

The file type (.xml or .html) is added to the CMS eMeasure ID to complete the naming convention for the components of the eCQM package. Examples below:

Type of Artifact	***File Name***

HQMF (XML file)	**CMS123v1.xml**
HQMF (HTML file)	**CMS123v1.html**
HQMF (XSL file)	**eMeasure.xsl**

Opening eCQM Documents

Download, extract, and access eCQM documents

To view an individual eCQM, the specification package (example: EP_CMS123v1_NQF0056_Diab_Foot.zip) must be saved and extracted to your computer.

1. Download and save the zip file to your hard drive.
2. Right click on the zip file and select "extract all."
3. Identify the destination where the extract files should be saved and select "extract."
4. Navigate to the new folder containing the extracted files.

To view the XML coding directly, open the document with any text reader such as Word, Wordpad, or Notepad or any third party XML reading software.

It is important that the folder structure not be altered after the files are extracted. Due to the eMeasure style sheet that is contained in the XSLT folder, opening the eMeasure XML file in a web browser will display it in the same human-readable format as the eCQM human-readable HTML file. To open in a text editor or an XML editor, right click on the file and select "Open with," then select the text editor or XML editor of your choice.

Meaningful Use Portal

eCQMs and their value sets may also be downloaded, extracted, and accessed in the US Health Information Knowledgebase (USHIK) Meaningful Use portal.[8] In this portal, these files may be downloaded in various formats: XML, Adobe (PDF), and comma separated value (CSV), including a single Excel (XLS) file that contains all the meaningful use quality measures and their value sets.

[8] US Health Information Knowledgebase (USHIK), Agency for Healthcare Research and Quality. http://ushik.ahrq.gov/

Understanding an eCQM Human-Readable Rendition

The eCQM human-readable rendition contains a **header** and further measure detail divided into four sections: **population criteria, data criteria, reporting stratification,** and **supplemental data elements.** Continuous variable measures will also contain a **measure observations** section.

Header

The header of an eCQM identifies and classifies the document and provides important metadata about the measure. The eCQM header precedes the measure details. It includes the following components (listed in the order that they are displayed in Figure 1) as defined in Table 1 below:

Table 1: eCQM Metadata

Header Data Elements	Definition
eMeasure Title	The title of the quality eCQM.
eMeasure Identifier (Measure Authoring Tool)	A unique eCQM identifier that is automatically generated by the MAT.
eMeasure Version Number	A positive integer value used to indicate the version of the eCQM.
NQF Number	Specifies the NQF number if one has been assigned. An NQF number is only included if an eCQM is endorsed. The assigned NQF number can be cross-referenced with NQF's Quality Positioning System (QPS) to verify measure endorsement status.
GUID	Represents the globally unique measure identifier for a particular quality eCQM. This field is automatically generated by the MAT.
Measurement Period	The time period for which the eCQM applies.
Measure Steward	The organization responsible for the continued maintenance of the eCQM. The measure steward can be the same as the measure developer.
Measure Contractor	The organization that developed the eCQM.
Endorsed By	The organization that has endorsed the eCQM through a consensus-based process. All endorsing organizations are to be included.
Description	A general description of the eCQM intent.
Copyright	Identifies the organization(s) who own the intellectual property represented by the eCQM.
Disclaimer	Disclaimer information for the eCQM.
Measure Scoring	Indicates how the calculation is performed for the eCQM (e.g., proportion, continuous variable, or ratio).

Header Data Elements	Definition
Measure Type	Indicates whether the eMeasure is used to examine a process or an outcome over time (e.g., structural, process, or outcome measure).
Stratification	Describes the strata for which the measure is to be evaluated. There are three examples of reasons for stratification based on existing work. These include: (1) evaluate the measure based on different age groupings within the population described in the measure; (2) evaluate the eCQM based on either a specific condition, a specific discharge location, or both; (3) evaluate the eCQM based on different locations within a facility.
Risk Adjustment	The method of adjusting for clinical severity and conditions present at the start of care that can influence patient outcomes for making valid comparisons of outcome measures across providers. Risk adjustment indicates whether an eCQM is subject to the statistical process for reducing, removing, or clarifying the influences of confounding factors to allow more useful comparisons.
Rate Aggregation	Describes how to combine information calculated based on logic in each of several populations into one summarized result. It can also be used to describe how to risk adjust the data based on supplemental data elements described in the eCQM.
Rationale	Succinct statement of the need for the measure. Usually includes statements pertaining to importance criterion: impact, gap in care, and/or evidence.
Clinical Recommendation Statement	Summary of relevant clinical guidelines or other clinical recommendations supporting the eCQM.
Improvement Notation	Information on whether an increase or decrease in score is the preferred result (e.g., a higher score indicates better quality OR a lower score indicates better quality OR quality is within a range).
Reference(s)	Identifies bibliographic citations or references to clinical practice guidelines, sources of evidence, or other relevant materials supporting the intent and rationale of the eCQM.
Definition	Description of individual terms, provided as needed.
Guidance	Used to allow measure developers to provide additional guidance for implementers to understand greater specificity than could be provided in the logic for data criteria.
Transmission Format	Can be a URL or hyperlinks that link to the transmission formats that are specified for a particular reporting program.
Initial Population	Refers to all events (e.g., patients, episodes) to be evaluated by a specific performance eCQM who share a common set of specified characteristics within a specific measurement set to which a given measure belongs. Details often include information based upon specific age groups, diagnoses, diagnostic and procedure codes, and enrollment periods.
Denominator	The Denominator can be the same as the Initial Population or a subset of the Initial Population to further constrain the population

Header Data Elements	Definition
	for the purpose of the eCQM. Different measures within an eCQM set may have different Denominators. Continuous variable eCQMs do not have a Denominator, but instead define a Measure Population.
Denominator Exclusions	Events (e.g., patients, episodes) that should be removed from the eCQM Initial Population and Denominator before determining if Numerator criteria are met. Denominator Exclusions are used in proportion and ratio measures to help narrow the denominator.
Numerator	Numerators are used in *proportion and ratio eCQMs*. In proportion measures the numerator criteria are the processes or outcomes expected for each patient, procedure, or other unit of measurement defined in the Denominator. In ratio measures the Numerator is related to, but not directly derived from the Denominator. For example: Numerator listing the number of central line blood stream infections and a Denominator indicating the days per thousand of central line usage in a specific time period.
Numerator Exclusions	Numerator Exclusions are used only in *ratio and proportion eCQMs* to define instances that should not be included in the numerator data. (e.g., if the number of central line blood stream infections per 1000 catheter days were to exclude infections with a specific bacterium, that bacterium would be listed as a Numerator Exclusion).
Denominator Exceptions	Denominator Exceptions are those conditions that should remove a patient, procedure or unit of measurement from the denominator only if the numerator criteria are not met. Denominator Exceptions allow for adjustment of the calculated score for those providers with higher risk populations. Denominator Exceptions are *used only in proportion eCQMs*. They are not appropriate for ratio or continuous variable eCQMs. Denominator Exceptions allow for the exercise of clinical judgment and should be specifically defined where capturing the information in a structured manner fits the clinical workflow. Generic denominator exception reasons used in proportion eCQMs fall into three general categories: • Medical reasons • Patient reasons • System reasons
Measure Population	Measure population is used *only in continuous variable eCQMs*. It is a narrative description of the eCQM population (e.g., all patients seen in the Emergency Department during the measurement period).
Measure Population Exclusions	Measure Population Exclusions are used *only in continuous variable eCQMs*. Cases in the Measure Population Exclusions population are

Header Data Elements	Definition
	those that meet the Measure Population criteria and meet the Measure Population Exclusions criteria.
Measure Observations	Measure observations are used *only in ratio and continuous variable eCQMs*. They provide the description of how to evaluate performance (e.g., the mean time across all Emergency Department visits during the measurement period from arrival to departure). Measure observations are generally described using a statistical methodology such as count, median, mean, etc.
Supplemental Data Elements	CMS defines four required Supplemental Data Elements (payer, ethnicity, race, and sex), which are variables used to aggregate data into various subgroups. Comparison of results across strata can be used to show where disparities exist or where there is a need to expose differences in results. Additional Supplemental Data Elements required for risk adjustment or other purposes of data aggregation can be included in the Supplemental Data Element section. Note: HQMF R2 will permit the inclusion of Supplemental Data Elements. Upon publication of HQMF R2, the MAT will be updated.

Figure 1: eCQM Header for Diabetes: Foot Exam (NQF 0056)

eMeasure Title	Diabetes: Foot Exam		
eMeasure Identifier (Measure Authoring Tool)	123	**eMeasure Version Number**	1
NQF Number	0056	**GUID**	c0d72444-7c26-4863-9b51-8080f8928a85
Measurement Period	January 1, 20xx through December 31, 20xx		
Measure Steward	National Committee for Quality Assurance		
Measure Developer	National Committee for Quality Assurance		
Endorsed By	National Quality Forum		
Description	Percentage of patients 18-75 years of age with diabetes who had a foot exam during the measurement period		
Copyright	Physician Performance Measure (Measures) and related data specifications were developed by the National Committee for Quality Assurance (NCQA). The Measures are copyrighted but can be reproduced and distributed, without modification, for noncommercial purposes (e.g., use by healthcare providers in connection with their practices). Commercial use is defined as the sale, licensing, or distribution of the Measures for commercial gain, or incorporation of the Measures into a product or service that is sold, licensed or distributed for commercial gain. Commercial use of the Measures requires a license agreement between the user and NCQA. NCQA is not responsible for any use of the Measures.		

	Copyright 2012 National Committee for Quality Assurance. All Rights Reserved. Limited proprietary coding is contained in the Measure specifications for user convenience. Users of proprietary code sets should obtain all necessary licenses from the owners of the code sets. NCQA disclaims all liability for use or accuracy of any CPT or other codes contained in the specifications. CPT(R) contained in the Measure specifications is copyright 2004-2011 American Medical Association. LOINC(R) copyright 2004-2011 Regenstrief Institute, Inc. This material contains SNOMED Clinical Terms (R) (SNOMED CT[R]) copyright 2004-2011 International Health Terminology Standards Development Organization. ICD-10 copyright 2011 World Health Organization. All Rights Reserved. Due to technical limitations, registered trademarks are indicated by (R) or [R] and unregistered trademarks are indicated by (TM) or [TM].
Disclaimer	These performance Measures are not clinical guidelines and do not establish a standard of medical care, and have not been tested for all potential applications. THE MEASURES AND SPECIFICATIONS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND.
Measure Scoring	Proportion
Measure Type	Process
Stratification	None
Risk Adjustment	None
Rate Aggregation	None
Rationale	Diabetes mellitus (diabetes) is a group of diseases characterized by high blood glucose levels caused by the body's inability to correctly produce or utilize the hormone insulin. It is recognized as a leading cause of death and disability in the U.S. and is highly underreported as a cause of death. Diabetes of either type may cause life-threatening, life-ending or life-altering complications, including poor circulation, nerve damage or neuropathy in the feet and eventual amputation. Nearly 60%-70% of diabetics suffer from mild or severe nervous system damage. The consensus among established clinical guidelines is that patients with both types of diabetes should have a foot exam soon after diagnosis and annually thereafter. Comprehensive foot care programs can lower amputation rates by 45%-85% (American Diabetes Association, 2009).
Clinical Recommendation Statement	American Diabetes Association (ADA, 2009) Guidelines/ Recommendations: Perform annual comprehensive foot examination to identify risk factors predictive of ulcers and amputations. The foot examination should include inspection, assessment of foot pulses, and testing for loss of protective sensation (10-g monofilament plus testing any one of: vibration using 128-Hz tuning fork, pinprick sensation, ankle reflexes, or vibration perception threshold).
Improvement Notation	Higher score indicates better quality
Reference	American Diabetes Association. Executive Summary: Standards of Medical Care in Diabetes-2009. Diabetes Care January 2009 32:S6-S12; doi:10.2337/dc09-S006
Definition	Foot exam: visual inspection with either a sensory exam or a pulse exam
Guidance	Only patients with a diagnosis of Type 1 or Type 2 diabetes should be included in the denominator of this measure; patients with a diagnosis of secondary diabetes due to another condition should not be included.
Transmission Format	None
Initial Patient Population	Patients 18-75 years of age with diabetes and a visit during the measurement period
Denominator	Equals Initial Patient Population

Denominator Exclusions	Patients with a diagnosis of gestational diabetes during the measurement period
Numerator	Patients who received a foot exam (visual inspection with either a sensory exam or pulse exam) during the measurement period
Numerator Exclusions	Not Applicable
Denominator Exceptions	None
Measure Population	Not Applicable
Measure Observations	Not Applicable
Supplemental Data Elements	For every patient evaluated by this measure also identify payer, race, ethnicity and sex.

Data Criteria (QDM Data Elements)

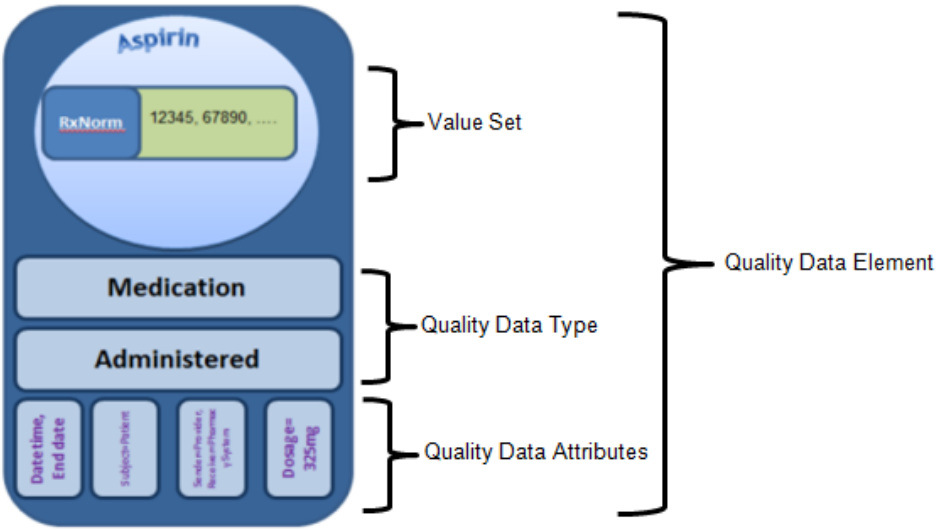
Data criteria are used as building blocks to assemble population criteria; hence, it is important to first understand how to interpret a data criterion. The Data Criteria section of the eCQM human-readable rendition lists all unique QDM elements used by a measure in alphabetical order.

QDM Element

A QDM element is an atomic unit of information corresponding to a data criterion in an eCQM. If quality data attributes are used to further specify a QDM element, then these attributes are also displayed in the Data Criteria section following all the QDM elements.

As shown in Figure 2, a QDM element is specified by selecting (1) a QDM category, (2) the QDM data type, the context in which the category is expected to be found with respect to electronic clinical data, (3) a value set from an appropriate taxonomy or vocabulary, and (4) all required attributes. A QDM category is a particular group of information that can be addressed in a quality measure (e.g., condition, medication, procedure, etc.). The combination of category and data type makes up a QDM element. For Meaningful Use Stage 2 measures, readers should reference the December 2013 published QDM specification for complete technical details of the QDM, such as definitions for all its quality data types and attributes.

Figure 2: Prototypic Quality Data Element



All QDM elements in an eCQM human-readable conform to the following naming convention: *"QDM _data_type*: *measure_data_element_name"*. For example, to create the QDM element "Diagnosis, Active: Diabetes" as shown in Figure 3, a measure developer needs to first map the measure data element *Diabetes* to the correct QDM category, which is *Diagnosis*, then apply the correct state, *Active*, based on the measure. The next step is to specify a *Diabetes* value set and associate it to the "Diagnosis, Active" QDM data type.

Figure 3: eCQM Data Criteria - Diabetes: Foot Exam (NQF 0056)

Data criteria (QDM Data Elements)

- "Diagnosis, Active: Diabetes" using "Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1001)"
- "Diagnosis, Active: Gestational Diabetes" using "Gestational Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1010)"
- "Encounter, Performed: Annual Wellness Visit" using "Annual Wellness Visit Grouping Value Set (2.16.840.1.113883.3.526.3.1240)"
- "Encounter, Performed: Face-to-Face Interaction" using "Face-to-Face Interaction Grouping Value Set (2.16.840.1.113883.3.464.1003.101.12.1048)"
- "Encounter, Performed: Home Healthcare Services" using "Home Healthcare Services Grouping Value Set (2.16.840.1.113883.3.464.1003.101.12.1016)"
- "Encounter, Performed: Office Visit" using "Office Visit Grouping Value Set (2.16.840.1.113883.3.464.1003.101.12.1001)"
- "Encounter, Performed: Preventive Care Services - Established Office Visit, 18 and Up" using "Preventive Care Services - Established Office Visit, 18 and Up Grouping Value Set (2.16.840.1.113883.3.464.1003.101.12.1025)"
- "Encounter, Performed: Preventive Care Services-Initial Office Visit, 18 and Up" using "Preventive Care Services-Initial Office Visit, 18 and Up Grouping Value Set (2.16.840.1.113883.3.464.1003.101.12.1023)"
- "Patient Characteristic Birthdate: birth date" using "birth date LOINC Value Set (2.16.840.1.113883.3.560.100.4)"
- "Physical Exam, Performed: Pulse Exam of Foot" using "Pulse Exam of Foot Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1015)"
- "Physical Exam, Performed: Sensory Exam of Foot" using "Sensory Exam of Foot Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1014)"
- "Physical Exam, Performed: Visual Exam of Foot" using "Visual Exam of Foot Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1013)"

Value Set

A value set is a set of concept representations drawn from a single or multiple code systems. Each value set can be uniquely identified by the Object Identifier (OID) that is assigned. In the eCQM human-readable rendition, value sets are referred to by both a name (*value_set_name*) *and identifier* (*value_set_OID*). The use of a given value set in an eCQM is indicated by "**using** *'value_set_name* (*value_set_OID*)'". For example, "'Diabetes, Active: Diabetes' using 'Diabetes Grouping Value Set (2.16.840.1.113883.3.464.3.3.2.1)'", where 2.16.840.1.113883.3.464.3.3.2.1 is the OID for the value set that is named "Diabetes".

There are two types of value sets: regular value sets and grouping value sets. eCQMs created in the MAT list the value sets using the following convention:

1. "*value_set_name code_system_name* **Value Set**" (e.g., Adolescent Depression Screening SNOMED). This indicates the value set contains a single code or an enumerated list of codes from a single code system. Details of the value set can be found in the VSAC from NLM.

2. "*value_set_name* **Grouping Value Set**" (e.g., Diabetes Grouping Value Set). The word "Grouping" indicates the value set contains a collection of individual value sets representing the same measure data element in different code systems. For example, the Diabetes Grouping value set includes two value sets, one with codes for diabetes from SNOMED CT and another with ICD-10-CM diabetes codes. The constituent individual value sets are also identified by their OIDs; but they are not specifically listed in the Data Criteria section. Only the OID of the grouping value set is included in the Data Criteria. Details for grouping value sets and their constituent individual value sets can also be found in the VSAC.

To improve value set authorship, curation, and delivery, for Meaningful Use Stage 2, NLM performed quality assurance checks to assess the validity of value set codes, terms and associated vocabularies. NLM supports ongoing maintenance of controlled value sets through a publicly available authoritative repository, the VSAC. The VSAC provides downloadable access to all official versions of vocabulary value sets contained in the 2014 Clinical Quality Measures. The value sets in the VSAC describe the specific populations included and excluded in order to properly calculate each 2014 CQM.

Versioning Value Sets

The VSAC is updated on a regular basis as the quality measures are updated. All value sets contained in the VSAC are versioned with a publication date stamp (format: YYYYMMDD).
Examples:

- 20121025
- 20121221
- 20130401

This version identifier is viewable whether reviewing the value set directly on the VSAC website[9] or on the exported Excel spreadsheet, and is titled "definition" or "definition version", respectively. When value sets are modified (i.e., removal/addition/code changes), yet the purpose and intent remain the same, the value set version/publication date stamp will change within the VSAC. When value sets are modified, and the purpose and intent of the value set are also changed, a new OID will be assigned to the value set.

Note: Only versions of the value sets that are valid for submission to CMS are those with publication dates that match the measure releases. The default view in the VSAC is the most recent version of the value set and ***not*** the most recent approved version.

QDM Attribute

Figure 4 shows an example of an attribute in the Data Criteria section. Only coded attributes that are bound to a value set are listed in the Data Criteria section. The naming convention for listing an attribute is '**Attribute:** "*QDM_attribute*: *value_set_name*"'. The label "Attribute" indicates this is an attribute to a QDM element, but the association between the attribute and the QDM element is shown in the Population Criteria section. In this example, the attribute *Ordinality* is bound to the "Principal SNOMED-CT Value Set" that is identified by the OID "2.16.840.1.113883.3.117.1.7.1.14".

Figure 4: eCQM Data Criteria - Attribute Example

- Attribute: "Ordinality: Principal" using "Principal SNOMED-CT Value Set (2.16.840.1.113883.3.117.1.7.1.14)"

Population Criteria

Population criteria are assembled from the underlying data criteria. The populations that are applicable for a particular measure depend on the type of measure scoring. The value of the "measure scoring" header element indicates whether an eCQM is a proportion, ratio, or continuous variable measure. Definitions for each population and measure observations are listed in the Header section of this guide.

- **Proportion measures:** Measures that define quality based on the number of cases that meet a criterion for quality (the Numerator) divided by the number of eligible cases within a given time frame (the Denominator) where the Numerator cases are a subset of the Denominator cases (e.g., percentage of eligible women with a mammogram performed in the last year).
- **Continuous variable measures:** Measures that define quality based on variables among the patients in the defined population (e.g., based on average wait time for patients seen in the emergency department and subsequently admitted to the hospital).

[9] Value Set Authority Center, National Library of Medicine. https://vsac.nlm.nih.gov

- **Ratio measures:** Measures that define quality based on the ratio of two events (e.g., number of patients with central line infection divided by number of patients in the intensive care unit).

Proportion is the most common used measure scoring type for the Meaningful Use Stage 2 measures.

Figure 5 below shows an example of population criteria which will vary based on the type of measure scoring. It contains Initial Population, Denominator, Denominator Exclusions, Numerator, and Denominator Exceptions. If the Denominator Exclusions and Denominator Exceptions are not applicable to a particular eCQM, a "None" is displayed.

Figure 5: eCQM Population Criteria

Population criteria

- **Initial Population** =
  - AND:
    - AND: "Patient Characteristic Birthdate: birth date" >= 5 year(s) starts before start of "Measurement Period"
    - AND: "Patient Characteristic Birthdate: birth date" < 40 year(s) starts before start of "Measurement Period"
  - AND: "Diagnosis Active: Asthma" starts before or during ("Encounter, Performed: Encounter Office & Outpatient Consult" during "Measurement Period")
  - AND: >= 2 count(s) of
    - AND: "Encounter, Performed: Encounter Office & Outpatient Consult" during "Measurement Period"
- **Denominator** =
  - AND: "Initial Population"
- **Denominator Exclusions** =
  - None
- **Numerator** =
  - AND:
    - OR:
    - AND: "Symptom Assessed: Asthma Daytime Symptoms Quantified"
    - AND: "Symptom Assessed: Asthma Nighttime Symptoms Quantified"
    - starts before or during ("Encounter, Performed: Encounter Office & Outpatient Consult" during "Measurement Period")
    - OR:
    - AND: "Symptom Active: Asthma Daytime Symptoms"
    - AND: "Symptom Active: Asthma Nighttime Symptoms"
    - starts before or during ("Encounter, Performed: Encounter Office & Outpatient Consult" during "Measurement Period")
    - OR: "Risk category / assessment: Asthma Symptom Assessment Tool" starts before or during ("Encounter: Encounter Office & Outpatient Consult" during "Measurement period")
- **Denominator Exceptions** =
  - None

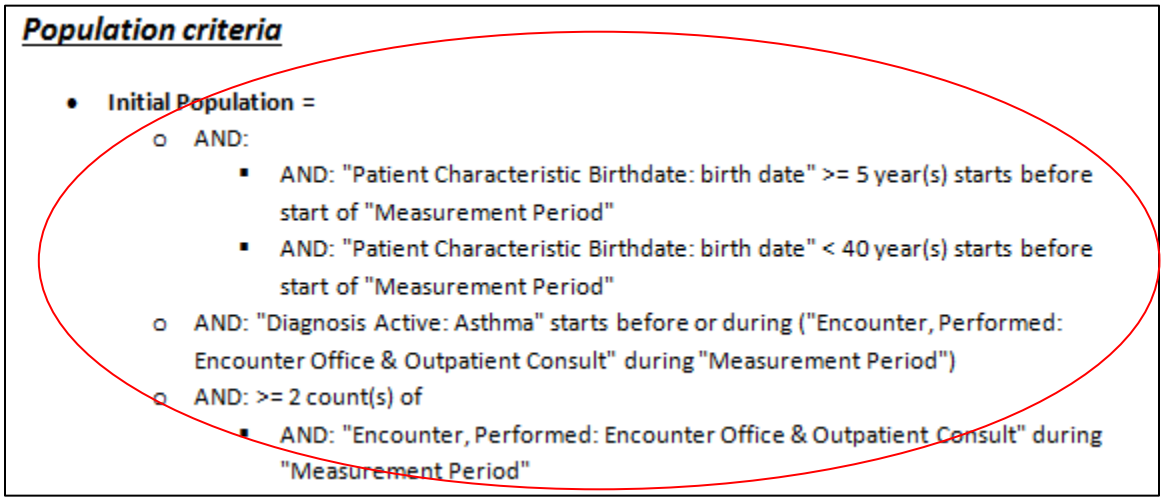
Understanding Logic Descriptions within the Population Criteria

Boolean Operators (AND and OR): ANDs and ORs are used to assemble data criteria to form population criteria. Appropriate temporal context and comparators such as "starts before or during" and relative comparators such as FIRST and LAST can also be used to form a population criterion measure phrase. The AND operator means all elements joined by the AND have to be true for consideration by the measure. The OR operator means any one element has to be true for consideration by the measure.

Figure 6 below shows an Initial Population for a sample eCQM. There are four conditions that need to be met for this patient to be included in the initial patient population.

1) The patient must have an active diagnosis of diabetes that started prior to or during the measurement period, AND 2) the patient must be greater than or equal to 5 years of age, prior to the measurement period, AND 3) the patient must be less than 40 years of age prior to the measurement period AND 4) the patient must have greater than or equal to 2 office & outpatient consult encounters during the measurement period.

Figure 6: eCQM Initial Population Logic Description



Criteria Nesting: Population criteria can be a simple flat list of measure phrases, or a set of measure phrases that can be deeply nested. There are two types of nesting that are represented in an eCQM human-readable through using either indentation or parentheses.

Indentation: Indents are used to show items that are grouped together. Measure phrases that are on the same level of indentation should be evaluated together as a group. Where the nesting exists, the lowest level should be evaluated first, and then move to the outside next immediate upper indentation level. In Figure 6 above, the circled portion indicates that if the patient had an instance of any one of the encounter types contained in this list, then they satisfy the criterion when calculating the initial patient population. The phrase "during 'Measurement Period'" at the bottom of this indented list applies to each measure phrase in the group, which will read the same as "OR: 'Encounter, Performed: Office Visit' during 'Measurement Period'".

Parentheses: Multiple measure phrases may be joined in one logic statement by a series of relationship types (e.g., starts before the start of) and timeframes (e.g.,<=10 months). Parentheses are used to clarify which elements, time relationship, and timeframe belong to which phrase, similar to how parentheses are used in mathematical equations. As a result, at the end of one statement there may be one or more parentheses. Careful examination of the statement will reveal the nested phrases and time relationship to which the parenthesis

belongs—e.g., "'A" starts before start of ("B" during "C")' or "'A" <= 2 day(s) ends after end of ("B" during "C")'.

Logical Function - NOT: NOT is a logical function of the QDM that negates a QDM element with its associated attribute(s) or phrase. It can be used together with the Boolean operators to form an "AND NOT" or an "OR NOT". Figure 7 shows two examples of population criteria where NOT is used. To illustrate, in Example 1, instead of saying that the patient must have an active principal diagnosis of Venous Thromboembolism (VTE) during the inpatient encounter; the NOT logical function has negated the entire measure phrase to mean the patient must not have an active principal diagnosis of VTE during the inpatient encounter.

Figure 7: eCQM Population Criteria - NOT Logical Function Example

Example 1:

- AND NOT:
  - OR: "Diagnosis, Active: Obstetrics"
  - OR: "Diagnosis, Active: Venous Thromboembolism
  - OR: "Diagnosis, Active: Obstetrics VTE"

Example 2:

- OR NOT:
  - AND: "Diagnostic Study, Performed: VTE Diagnostic Test" starts before or during "Encounter, Performed: Inpatient Encounter"
  - AND: "Diagnostic Study, Result: VTE Confirmed" starts after start of "Encounter, Performed: Inpatient Encounter"

QDM Attributes: A QDM attribute is shown in a parenthesis immediately after the QDM element that it is associated with. For example, *ordinality* is an attribute to the *Diagnosis, Active* as shown in Figure 7. The *ordinality* is a coded attribute, and is bound to a value set for "Principal Diagnosis". Not all attributes are coded attributes; a measure may contain attributes such as *discharge datetime* and *length of stay* for an encounter, e.g., "Encounter, Performed: Inpatient Encounter (discharge datetime)" and "Encounter, Performed: Inpatient Encounter (length of stay <= 120 day(s))". Readers should reference the *Quality Data Model* for the complete list of attributes and their definitions, and reference the *Measure Authoring Tool User Guide*[10] to see what attributes apply to a specific QDM data type.

Measurement Period/Start Date/End Date: Measurement period, measurement start date, and measurement end date are the three QDM elements that are not listed in the Data Criteria section. They are defined in the measure header, and could be used in the population criteria.

[10] *Measure Authoring Tool User Guide* can be accessed via the "Helpful Links" in the footer of the landing page by clicking the "User Guide" link. https://www.emeasuretool.cms.gov/.

Relative Timings: Allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements. Relative timings are described in detail in the *Quality Data Model*. There are currently fourteen timing relationships that are available for use by a measure in the MAT:

1. concurrent with
2. during
3. ends after end of
4. ends after start of
5. ends before or during
6. ends before start of
7. ends concurrent with
8. ends during
9. starts after end of
10. starts after start of
11. starts before or during
12. starts before start of
13. starts concurrent with
14. starts during

Note: New timing relationships will be added to the QDM as it continues to evolve.

When a timing relationship is used to connect two QDM elements, the QDM element on the left side of the timing relationship is regarded as the source act and the QDM element on the right side is considered as the target act. A measure phrase "'A" starts before or during "B"' means the effective time of "A" starts before the start of "B" or starts during "B"'s effective time.

Clear definitions of the computation of time intervals are used for the eCQMs included in Meaningful Use, Stage 2, to allow for unambiguous interpretation. This is essential given that assessing the relative timing of events within a patient's medical record is an integral part of computing the quality measures. Reference the Blueprint[11] or Implementation Guide[12] appendices to understand the mathematical definition of the computation of time durations in conjunction with the temporal operators used in eCQMs.

Occurrence of a QDM Element: A QDM element can be referenced several times in a measure and represent one to many instances or occurrences of that element (e.g., if a measure references more than one encounter, it will distinguish between **Occurrence A of Encounter** and **Occurrence B of Encounter**). To differentiate to the reader if each instance of that element is the same as or different from a prior episode referenced elsewhere in the measure, a label of "Occurrence" can be placed before the element.

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[11] eMeasure Specifications section, CMS Measures Management System Blueprint. Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/MeasuresManagementSystemBlueprint.html.

[12] Clinical Quality eMeasure Logic and Implementation Guidance document. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/eCQM_Library.html

Other Data Relationships: A data element in a measure can be associated with other data elements to provide more clarity. These relationships include "Is Authorized By" (used to express that a patient has provided consent); "Is Derived By" (used to indicate a result that is calculated from other values); "Has Goal Of" (used to relate a Care Goal to a procedure); "Causes" (used to relate causality); and "Has Outcome Of" (used to relate an outcome to a procedure as part of a care plan).

Measure Set: Located at the very bottom of an eCQM human-readable rendition, it indicates which measure set this measure belongs to. For example, "Measure Set: Surgical Care Improvement Project (SCIP)" means this measure is part of the Surgical Care Improvement Project measure set. This designation only applies to hospital measures in the EHR Incentive Program; eligible professional measures do not use measure sets.

Reporting Stratification

Measure developers may define Reporting Strata, which are variables on which the measure is designed to report inherently (e.g., report different rates by type of intensive care unit in a facility; stratify and report separately by age group [14-19, 20-25, and total 14-25]).

The Reporting Stratification section is always included in an eCQM human-readable rendition. If the eCQM does not have reporting strata defined, "None" is displayed as the default.

If the eCQM contains reporting stratification, each of the reporting strata is listed separately under its own heading, as shown in Figure 8 (example from the hospital measure NQF0143, *children's asthma care (CAC-1) relievers for inpatient asthma*). Similar rules that are described above under the *Understanding Logic Descriptions within the Population Criteria* section of this guide also apply when interpreting a reporting stratum.

Figure 8: Reporting Stratification Example

- **Reporting Stratum 1 =**
  - AND: "Patient Characteristic Birthdate: birth date" >= 2 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
  - AND: "Patient Characteristic Birthdate: birth date" <= 4 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
- **Reporting Stratum 2 =**
  - AND: "Patient Characteristic Birthdate: birth date" >= 5 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
  - AND: "Patient Characteristic Birthdate: birth date" <= 12 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
- **Reporting Stratum 3 =**
  - AND: "Patient Characteristic Birthdate: birth date" >= 13 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
  - AND: "Patient Characteristic Birthdate: birth date" < 18 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
- **Reporting Stratum 4 =**
  - AND: "Patient Characteristic Birthdate: birth date" >= 2 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"
  - AND: "Patient Characteristic Birthdate: birth date" < 18 year(s) starts before start of "Encounter, Performed: Inpatient Encounter"

Supplemental Data Elements

Supplemental Data Elements are variables used to aggregate data into various subgroups. Comparison of results across strata can be used to show where disparities exist or where there is a need to expose differences in results. CMS specifies that sex, race, ethnicity, and payer are the four supplemental data elements that must be defined in each of the Meaningful Use Stage 2 measures. Different supplemental data elements can be indicated as mandatory according to different program requirements. For example, Tax Identification Number (TIN), National Provider Identifier (NPI), CMS Certification Number (CCN), and beneficiary claim number (HIC) may be requested as supplemental data elements with additional guidance that will be provided by the program.

Measure Observations

Continuous variable measures also include a Measure Observations section. This section defines variables (e.g. time from check in to time of antibiotic administration) used to score particular aspects of performance. Measure observations are not population criteria, in that they do not determine whether or not a patient is to be counted in a measure. Rather, measure observations are data elements that are to be collected on patients meeting the population criteria within a continuous variable measure. Figure 9 shows an example for the Measure Observations section from the hospital measure NQF0495, median time from ED arrival to ED departure for admitted ED patients.

Figure 9: Measure Observations Example

Measure observations

- Time difference of:
  - AND: "Encounter, Performed: Emergency Department Visit (facility location arrival datetime)"
  - AND: "Encounter, Performed: Emergency Department Visit (facility location departure datetime)"

eCQM Value Set

Value sets are currently authored directly in the Value Set Authority Center (VSAC), and they are not part of the published eCQM. Value sets information is available from the online VSAC established by the National Library of Medicine (NLM). The NLM will support ongoing maintenance of controlled value sets through this publicly available authoritative repository. Access to the VSAC requires a free Unified Medical Language System® (UMLS) Metathesaurus License.

Summary of Changes

The changes to the eCQMs which are seen by the end user that have occurred since October, 2010 are summarized in Table 2.

Table 2: Summary of Changes to eCQMs

	October, 2010	2014 eCQMs (including 2014 Annual Updates)
eCQM Components	eCQM Specification (pdf) eCQM Code List (xls)	eCQM Specification (xml) eCQM human-readable (html) eCQM style sheet (xsl) eCQM value sets available through the Value Set Authority Center.
Software Needed to Open eCQM	Adobe Acrobat Reader; any spreadsheet reader that understands Microsoft Excel	text reader such as Word, Wordpad, or Notepad or any third party XML reading software
Naming Conventions for Files	NQF_HQMF_HumanReadable_*xxx*.pdf NQF_Retooled_Measure_*xxx*.xls	Please refer to eCQM Components section
eCQM Header Data Elements	Header elements found in MU1 measures, but not in MU2 include – set id and available date.	Header elements found in MU2 measures, but not in MU1 include – eMeasure identifier (Measure Authoring Tool), NQF number, transmission format, Initial Population, Denominator, Denominator Exclusions, Numerator, Numerator Exclusions, Denominator Exceptions, Measure Population, Measure Observations, and Supplemental Data Elements. Updated header elements definition for Initial Population, Denominator Exclusions, Numerator Exclusions and Measure Observations. Added Measure Population exclusion as a header data element

Acronyms and Abbreviations

CMIO	Chief Medical Information Officer
CMS	Centers for Medicare and Medicaid Services
CPT	Current Procedural Terminology
CQM	Clinical Quality Measure
eCQM	electronic Clinical Quality Measure
EH	Eligible Hospital
EHR	Electronic Health Record
EP	Eligible Professional
GUID	Globally Unique Identifier
HIT	Health Information Technology
HITSC	Health Information Technology Standards Committee
HL7	Health Level Seven
HTML	HyperText Markup Language
HQMF	Health Quality Measure Format
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
ICD-10-CM	International Classification of Diseases, Tenth Revision, Clinical Modification
LOINC	Logical Observation Identifiers Names and Codes
MAT	Measure Authoring Tool
NCQA	National Committee for Quality Assurance
NLM	National Library of Medicine
NQF	National Quality Forum
OID	Object Identifier
QDM	Quality Data Model (previously known as Quality Data Set)
QPS	NQF Quality Positioning System
QRDA	Quality Reporting Document Architecture
SNOMED-CT	Systematized Nomenclature of Medicine, Clinical Terms
UMLS	Unified Medical Language System
USHIK	US Health Information Knowledgebase
VSAC	Value Set Authority Center

XML	Extensible Markup Language
XSL	Extensible Stylesheet Language
XLST	Extensible Stylesheet Language Transformations