Developing Electronic Clinical Quality Measures (eCQMs) for use in CMS Programs

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What is an eCQM?

- Electronic clinical quality measures (eCQMs) are standardized performance measures derived solely for use in electronic health records (EHRs). Current CMS policy classifies eCQMs into the CMS Quality Strategy domains:

  - Clinical Processes / Effectiveness
  - Care Coordination
  - Patient and Family Engagement
  - Population and Public Health
  - Patient Safety
  - Efficient Use of Healthcare Resources

- The CMS quality programs provide financial incentives for Eligible Professional (EPs), Eligible Clinicians, Eligible Hospitals (EHs), and Critical Access Hospitals (CAHs) to report eCQMs.

  Note: eCQMs are not the only requirement to receive a financial incentive.

Key Stakeholders

- Developing an electronic measure requires the involvement of many stakeholders and use of many measure development tools and resources*
  - Healthcare Providers
  - Centers for Medicare & Medicaid Services (CMS)
  - eCQM Governance Group
  - Federal Regulators
  - HL7
  - Measure Applications Partnership (MAP)

Key Stakeholders, cont'd

- Measure Developers
- National Quality Forum (NQF)
- National Library of Medicine (NLM)
- Office of the National Coordinator for Health Information Technology (ONC)
- Patients and the general public

*Definitions of these stakeholders are provided in the Appendix

Key eCQM Tools and Resources*

- Cypress Certification Tool
- eCQI Resource Center
- CMS Measures Inventory
- CMS Measures Management System (MMS) Blueprint
- Health Quality Measure Format (HQMF) Standard
- Measure Authoring Tool (MAT)

*Definitions of these tools and resources are provided in the Appendix

Key eCQM Tools and Resources, cont'd*

- NQF Quality Positioning System
- Quality Data Model (QDM)
- Quality Reporting Document Architecture (QRDA) Standard
- Value Set Authority Center (VSAC)
- Bonnie for test driven development

eCQM Measure Development

- Develop measure narrative, numerator/ denominator, workflow, and logic, in line with existing CMS guidance
- Create value sets, collaborating with the **Value Set Authority Center,** and clinical terminology (e.g., SNOMED CT, LOINC) stakeholders
- **Use the Measure Authoring Tool (MAT) to express measures using the industry standards: Health Quality Measure Format (HQMF) and Quality Data Model (QDM)**
- Conduct complete feasibility, reliability, and validity testing **which can include working with EHR vendors to understand data element availability and implementation in the field**
- **Test, Test, Test -**
  - **Using Bonnie tool – logic testing**
  - **New standards – updates to HQMF and QDM**
- Solicit public comment on the measure **and value sets using JIRA**

Output of the MAT

- In order to report eCQMs, electronic specifications must be developed in the Measure Authoring Tool (MAT). Each component of the MAT output helps to accurately capture and calculate eCQMs:

HQMF XML

Description: A CQM written in Health Quality Measure Format (HQMF) syntax. HQMF is the industry (HL7) standard for representing a CQM as an electronic document.

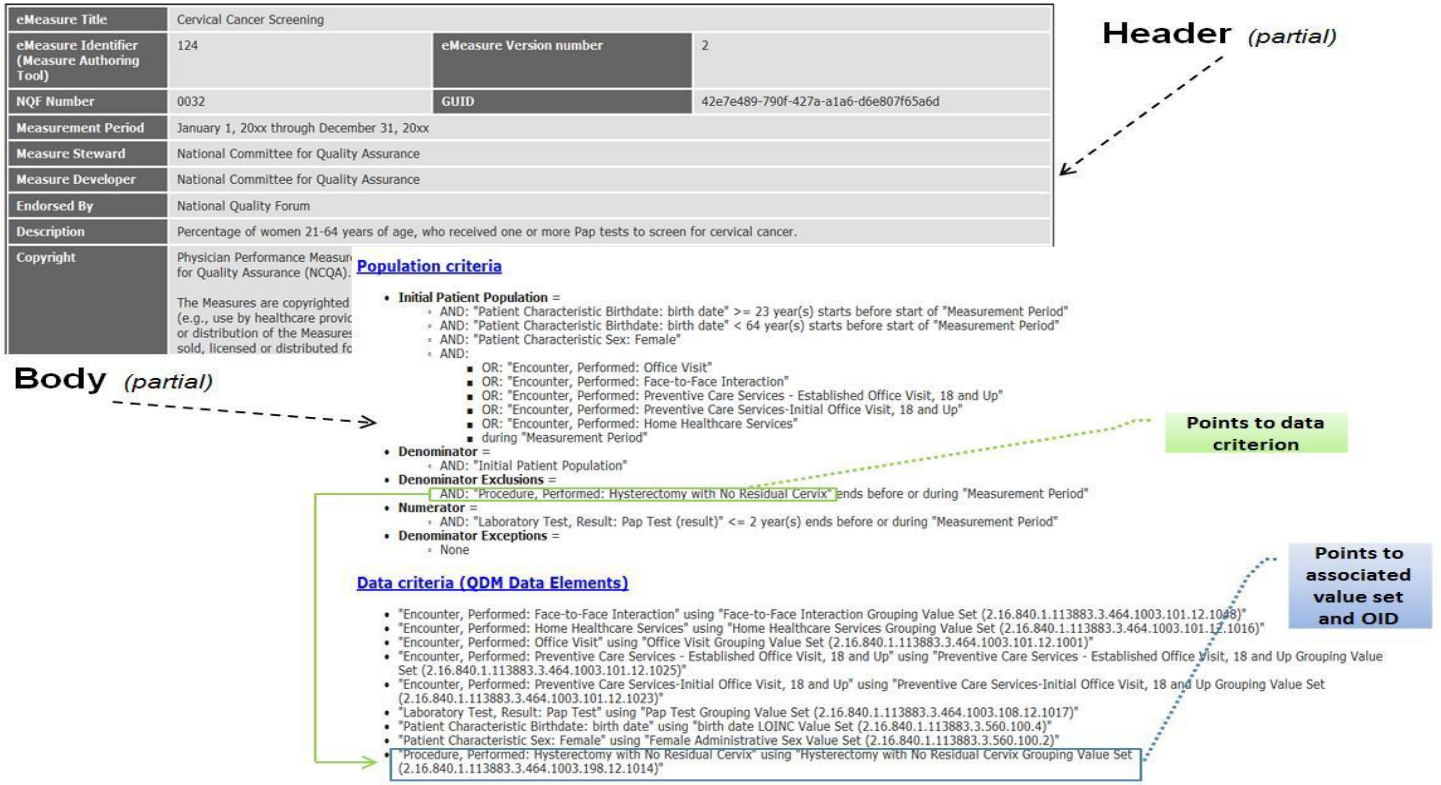
Use: To enable the automated creation of queries against an EHR or other operational data store for quality reporting.

Human-Readable

Description: The human-readable HTML equivalent of the XML file content.

Use: To identify the details of the eCQM in a human-readable format, so that the user can understand both how the elements are defined and the underlying logic of the measure calculation.

eCQM Components: Visual Basics



eMeasure Title	Cervical Cancer Screening		
eMeasure Identifier (Measure Authoring Tool)	124	eMeasure Version number	2
NQF Number	0032	GUID	42e7e489-790f-427a-a1a6-d6e807f65a6d
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 women 21-64 years of age, who received one or more Pap tests to screen for cervical cancer.		
Copyright	Physician Performance Measur for Quality Assurance (NCQA). The Measures are copyrighted (e.g., use by healthcare provic or distribution of the Measures sold, licensed or distributed fc		

Population criteria

- **Initial Patient Population** =
  - AND: "Patient Characteristic Birthdate: birth date" >= 23 year(s) starts before start of "Measurement Period"
  - AND: "Patient Characteristic Birthdate: birth date" < 64 year(s) starts before start of "Measurement Period"
  - AND: "Patient Characteristic Sex: Female"
  - AND:
    - OR: "Encounter, Performed: Office Visit"
    - OR: "Encounter, Performed: Face-to-Face Interaction"
    - OR: "Encounter, Performed: Preventive Care Services - Established Office Visit, 18 and Up"
    - OR: "Encounter, Performed: Preventive Care Services-Initial Office Visit, 18 and Up"
    - OR: "Encounter, Performed: Home Healthcare Services"
    - during "Measurement Period"
- **Denominator** =
  - AND: "Initial Patient Population"
- **Denominator Exclusions** =
  - AND: "Procedure, Performed: Hysterectomy with No Residual Cervix" ends before or during "Measurement Period"
- **Numerator** =
  - AND: "Laboratory Test, Result: Pap Test (result)" <= 2 year(s) ends before or during "Measurement Period"
- **Denominator Exceptions** =
  - None

Data criteria (QDM Data Elements)

- "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)"
- "Laboratory Test, Result: Pap Test" using "Pap Test Grouping Value Set (2.16.840.1.113883.3.464.1003.108.12.1017)"
- "Patient Characteristic Birthdate: birth date" using "birth date LOINC Value Set (2.16.840.1.113883.3.560.100.4)"
- "Patient Characteristic Sex: Female" using "Female Administrative Sex Value Set (2.16.840.1.113883.3.560.100.2)"
- "Procedure, Performed: Hysterectomy with No Residual Cervix" using "Hysterectomy with No Residual Cervix Grouping Value Set (2.16.840.1.113883.3.464.1003.198.12.1014)"

Quality Data Model (QDM)

Quality Data Model Category	Quality Data Model Data type	Quality Data Model Attribute
Condition/ Diagnosis/ Problem	Diagnosis, active	N/A
Encounter (any provider interaction)	Encounter, performed	N/A
Laboratory test	Laboratory Test, order	N/A
Laboratory test	Laboratory Test, performed	Result
Diagnostic study test	Diagnostic Study, order	N/A
Diagnostic study test	Diagnostic Study, performed	Result
Procedure	Procedure, performed	N/A

Value Sets: Using the VSAC

- The Value Set Authority Center (VSAC) houses all measure value sets
- Value sets can be newly-created or reused from those existing within the

Screenshot of a value set within the VSAC

Values included in the value set (codes, descriptors, code system, version of the code system and code system unique identifier)

Unique identifier for the value set

Vocabularies Used in Building Value Sets

- There are specific vocabularies or terminologies that are used to identify clinical concepts identified by the data elements within an eCQM. These vocabulary requirements are based on the ONC Health Information Technology Standards Committee (HITSC) recommendations for standard and transition vocabularies.
- eCQMs include both standard and transition vocabularies to convey the intended clinical intent:
  - Standard- are primarily clinical vocabularies (as opposed to billing) and can serve more needs and for a longer period of time; however are not widely used.
  - Transition- allow for immediate use and least burdensome for eCQM reporting purposes while standard vocabulary use is not yet widespread.

Standard
•SNOMED CT
•LOINC
•RxNorm
•CVX
•PHIN/VADS

Transition
•ICD-9-CM
•ICD-10-CM
•ICD-10-PCS
•CPT
•HCPCS

Refer to appendices for details on each code system

Vocabularies in Relation to Data Elements

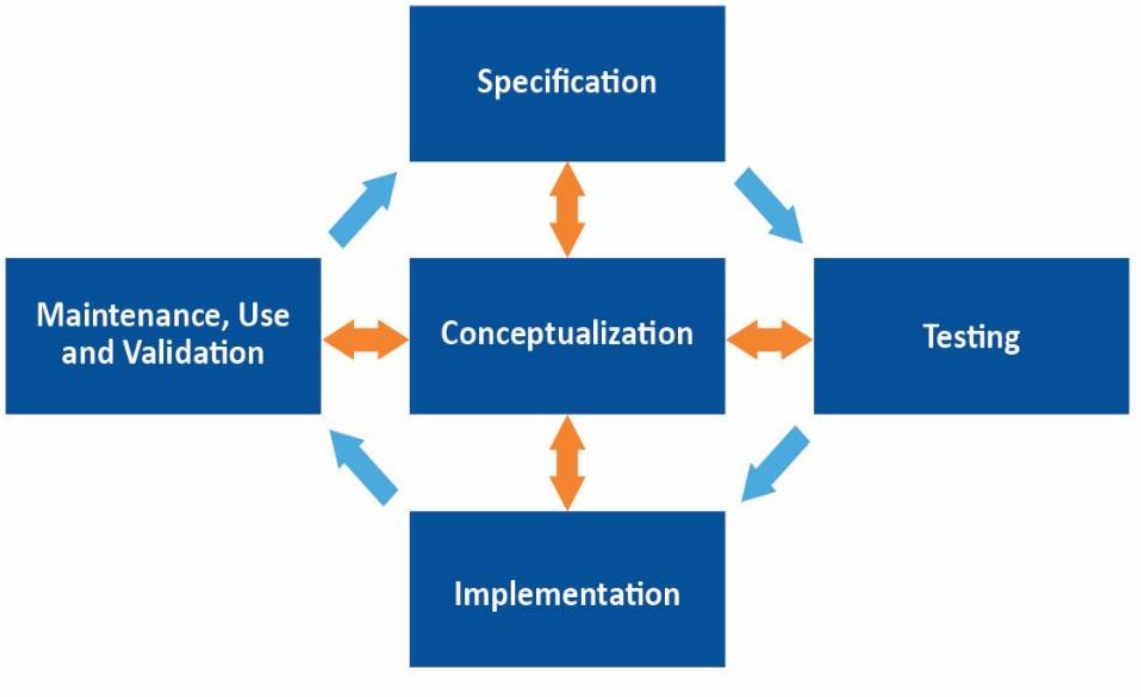
Quality Data Model Category	Quality Data Model Data type	Quality Data Model Attribute	Clinical Vocabulary Standards	Transition Vocabulary
Condition/ Diagnosis/ Problem	Diagnosis, active	N/A	SNOMED CT	ICD-9-CM, ICD-10-CM
Encounter	Encounter, performed	N/A	SNOMED CT	CPT, HCPCS, ICD-9-CM Procedures, ICD-10-PCS
Laboratory test	Laboratory Test, order	N/A	LOINC	N/A
Laboratory test	Laboratory Test, performed	Result	SNOMED CT	N/A
Diagnostic study test	Diagnostic Study, order	N/A	LOINC	HCPCS
Diagnostic study test	Diagnostic Study, performed	Result	SNOMED CT	N/A
Procedure	Procedure, performed	N/A	SNOMED CT	CPT, HCPCS, ICD-9-CM Procedures, ICD-10-PCS

Updates to Vocabularies and Standards

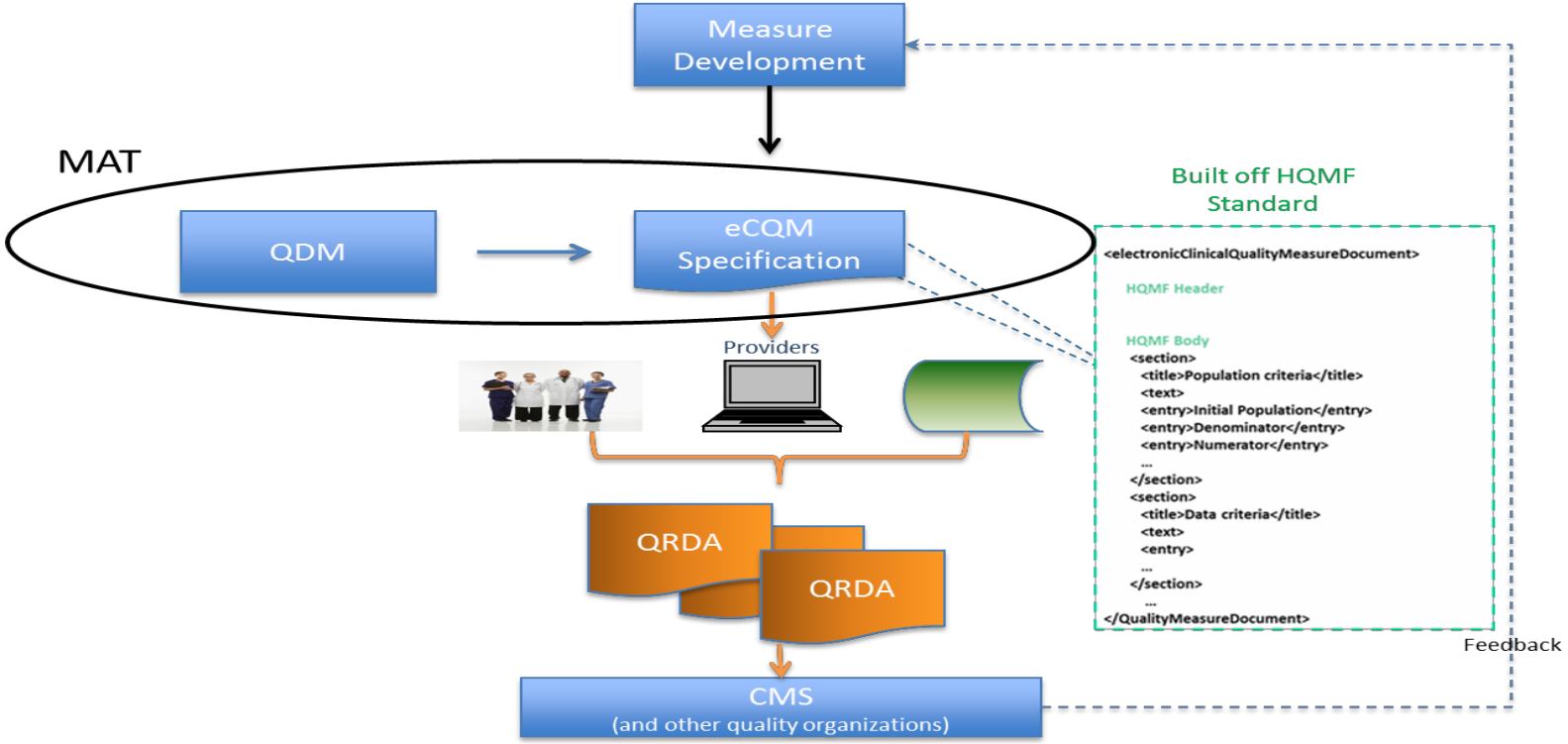
- Vocabularies and standards are updated by their respective owners.
- CMS uses vocabularies and standards for eCQMs in their quality reporting programs.
- Vocabularies are updated:
  - Annually - ICD and CPT
  - Bi-annually – SNOMED CT, LOINC
  - Monthly – RxNorm
- HQMF standard – International standard for authoring quality measures (maintained by HL7)

The eCQM Development Lifecycle

eCQM Development Lifecycle

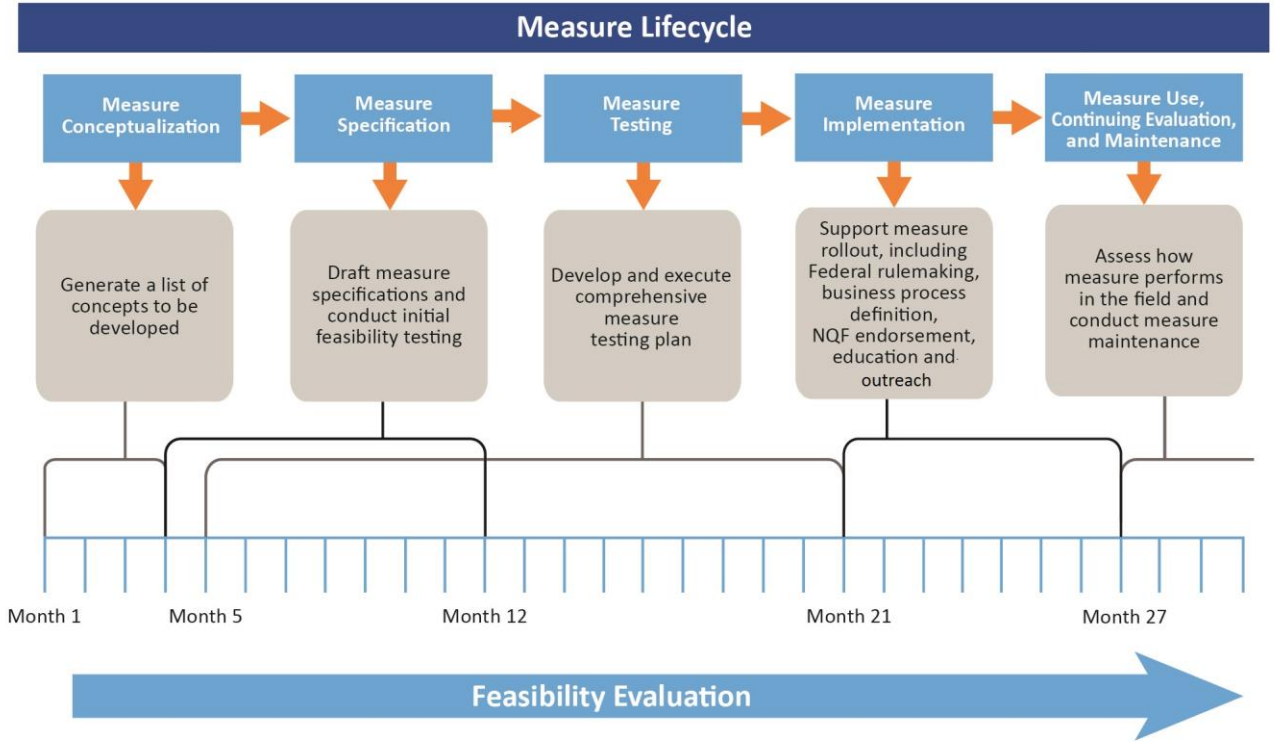


Intersection of QDM, HQMF, and QRDA



To view eCQM packages: https://ecqi.healthit.gov/

eCQM Development Lifecycle



Questions?

Links to Resources

- Measure Authoring Tool (MAT) - https://www.emeasuretool.cms.gov/web/guest/mat-Home
- Value Set Authority Center (VSAC) - https://vsac.nlm.nih.gov/
- MMS Blueprint - https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/MMS-Blueprint.html
- eCQI Resource Center - https://ecqi.healthit.gov

Appendix

- Key Stakeholders
- Key Tools and Resources
- Common Vocabularies

Key Stakeholders

Stakeholder	Role in eCQM Development Process
Centers for Medicare & Medicaid Services (CMS)	• CMS manages the programs that use eCQMs, including managing eCQM selection and development.
CMS Measures Management Contractor	• Provides technical support to measure developers in understanding the CMS MMS Blueprint processes, identifying measures for harmonization purposes, and interpreting NQF processes as they relate to measure development, endorsement, and maintenance.
eCQM Governance Group	• The eCQM Governance Group is a decision-making group that proposes, reviews, and approves decisions regarding all aspects of eCQM specification.
Federal Regulators	• Several federal offices support CMS in posting the measure for public comment and confirming the final version published in the Federal Register.
Health Caregivers	• Providers of healthcare, including doctors, nurses, and other medical professionals.
Health Level Seven International (HL7)	• HL7 is a standards development organization dedicated to providing a comprehensive framework and standards for the exchange, integration, sharing, and retrieval of electronic health information. The Quality Reporting Document Architecture (QRDA) and the Health Quality Measure Format (HQMF) are both published by HL7.
Measure Applications Partnership (MAP)	• MAP is a public-private partnership that reviews performance measures for potential use in federal public reporting and performance-based payment programs, while working to align measures being used in public- and private-sector programs.

Key Stakeholders, cont'd

Stakeholder	Role in eCQM Development Process
National Library of Medicine (NLM)	• NLM manages the Value Set Authority Center (VSAC) which publishes value sets for use in the eCQM development process.
National Quality Forum (NQF)	• The NQF is a non-profit organization that reviews, endorses, and recommends healthcare quality measures. NQF convenes the Measure Applications Partnership (MAP).
Office of the National Coordinator for Health Information Technology (ONC)	• ONC publishes regulations on EHR Standards and Certification Criteria.
Patients and the General Public	• Recipients of healthcare and those who are part of the healthcare system.
Technical Expert Panel (TEP)	• A group of experts (typically clinicians, statisticians, quality improvement, methodologists, pertinent measure developers, and patients) who provide technical input to the measure contractor on the development, selection, and maintenance of measures for which CMS contractors are responsible.

Key Tools and Resources

Tool	Use in eCQM Development Process
CMS Measures Management System (MMS) and Blueprint	• A standardized approach to the development and maintenance of the quality measures used in CMS quality initiatives and programs, the MMS provides a set of business processes and decision criteria that CMS-funded measure developers (or contractors) follow to develop, implement, and maintain quality measures. The Blueprint is the resource that documents these business processes and decision criteria. The Blueprint aligns with those cited by NQF for endorsement.
CMS Measures Inventory	• Database maintained by the CMS Measures Management contractor that contains details on the measures and measure concepts created for use in CMS programs along with statuses of the measures (e.g., archived, future, current, implemented, etc.). Developers can request input to identify measures and concepts that may require harmonization.
Cypress	• Cypress is an open source certification testing tool for evaluating the accuracy of clinical quality measure calculations in electronic health records (EHRs) systems and EHR modules. Cypress enables testing of an EHR's ability to accurately calculate eCQMs. Cypress serves as the official eCQM testing tool for the EHR Certification program by ONC.
eCQI Resource Center	• The eCQI Resource Center is the one stop shop for the most current information to support electronic clinical quality improvement. It is the source of truth for the electronic specifications for eCQMs adopted by CMS programs.

Key Tools and Resources, cont'd

Tool	Use in eCQM Development Process
Health Quality Measure Format (HQMF)	• HQMF is the industry (HL7) standard for representing a CQM as an electronic document.
Measure Authoring Tool (MAT)	• The MAT is a publicly available, web-based tool for measure developers to create eCQMs.
NQF Quality Positioning System (QPS)	• An online tool that allows users to search for NQF-endorsed measures.
Quality Data Model (QDM)	• The QDM is an information model that defines relationships between patients and clinical concepts in a standardized format to enable electronic quality performance measurement. The model is the current structure for electronically representing quality measure concepts for stakeholders involved in electronic quality measurement development and reporting.
Quality Reporting Document Architecture (QRDA)	• QRDA is the standard for transmitting/reporting health care quality measurement information. QRDA Category I reports individual patient-level data, while QRDA Category III reports aggregate data from multiple patients. QRDA reports are then able to be transmitted from certified vendor systems to CMS and other quality organizations.
Value Set Authority Center (VSAC)	• The Value Set Authority Center (VSAC) is the authoritative source of value sets that support eCQMs. The VSAC provides search, retrieval, and download capabilities through a Web interface and APIs.

Common Vocabularies

Vocabulary	Standard/ Transition	Definition	Clinical Concepts
SNOMED CT	Standard	A comprehensive clinical terminology originally developed by the College of American Pathologists and is now owned, administered, and maintained by SNOMED International, a non-for-profit organization.	• Adverse effects/ allergies/intolerances • Substances • Clinical findings • Communication artifacts (e.g., med list, clinical summaries) • Test results (diagnostic & laboratory) • Procedures • Devices/equipment • Settings • Interventions
Logical Observation Identifiers Names and Codes (LOINC)	Standard	A universal code system that facilitates exchange, pooling, and processing of results.	• Assessment instruments and questions • Laboratory test and diagnostic study names • Staffing resources
RxNorm	Standard	A standardized nomenclature that provides names and identifiers for clinical drugs	• Medications administered (except vaccines) • Medication and ingredient adverse effects and intolerances

Common Vocabularies, cont'd

Vocabulary	Standard/ Transition	Definition	Clinical Concepts
CVX	Standard	Vaccine coding system which identifies the type of vaccine product used.	• Vaccinations administered
CDC-Public Health Information Network (PHIN)/Vocabulary Access and Distribution System (VADS) **"PHIN VADS"**	Standard	Vocabulary system for accessing, searching, and distributing vocabularies used in public health and clinical care practice.	• Patient characteristics such as gender, date of birth, ethnicity, race, and payer.

Common Vocabularies, cont'd

Vocabulary	Standard/ Transition	Definition	Clinical Concepts
ICD-9-CM (diagnoses) *International Classification of Diseases – 9th Revision – Clinical Modification (ICD)*	Transition	An epidemiological classification used to identify diagnoses. -Not to be used for services on or after 10/1/2015	• Condition • Diagnosis • Problem • Family history
ICD-9-CM (procedures)	Transition	An epidemiological classification used to identify procedures. -Not to be used for services on or after 10/1/2014	• Inpatient Encounter • Intervention • Procedure
ICD-10-CM *International Classification of Diseases – 10th Revision – Clinical Modification*	Transition	Diagnosis classification system developed by the Centers for Disease Control and Prevention for use in all health care settings.	• Condition • Diagnosis • Problem • Family history
ICD-10-PCS *International Classification of Diseases – 10th Revision – Procedure Coding System*	Transition	Procedure classification system developed by CMS for use only in inpatient hospital settings.	• Inpatient Encounter • Intervention • Procedure

Common Vocabularies, cont'd

Vocabulary	Standard/ Transition	Definition	Clinical Concepts
Current Procedural Terminology (CPT)	Transition	Provides a uniform language that describes medical, surgical, and diagnostic services provided by physicians.	• Encounter • Intervention • Procedure
Healthcare Common Procedure Coding System (HCPCS)	Transition	Health care procedure codes based on CPT covering specific items and services provided in the delivery of health care.	• Communication • Non-lab diagnostic study • Encounter • Intervention • Procedure