**Agenda**

- Components of an electronic clinical quality measure (eCQM)
- Fast Healthcare Interoperability Resources (FHIR) specification introduction and walkthrough
- Use of profiles and implementation guides (IGs)
- Quality Improvement (QI)-Core and mappings from Quality Data Model (QDM)
- Quality Measure (QM) IG
- Data Exchange for Quality Measures (DEQM)
- Introduction to FHIR operations
- Current activities update
Components of an eCQM

**Data Model:** What data to look for in the patient’s medical record

**Expression Logic:** How to calculate the result, evaluate the “right” care was provided

**Structure:** Metadata, numerator, denominator, exclusions, and exceptions
Goal is to align quality measurement standards for eCQM development and reporting using FHIR

- QI-Core replaces QDM for clinical data elements representation
- FHIR Measure replaces HQMF for eCQM structure
- FHIR Measure Report Individual and Summary replaces QRDA I and III

CQL – Clinical Quality Language | HQMF - Health Quality Measure Format | QRDA - Quality Reporting Document Architecture
What is FHIR?

• FHIR – **Fast Healthcare Interoperability Resources**

• FHIR is a next-generation standards framework created by HL7

• Provides an interoperable platform for healthcare
  • Defines a common way to structure health data known as ‘Resources’
  • Enables automated data exchange through application programming interfaces (APIs)

• FHIR uses latest technologies to be developer friendly
**FHIR Versions**

**FHIR STU 3**
- Released in 2017
- First version to contain ‘Clinical Reasoning’ module
- Basis for initial eCQM conversion and DEQM and QM IGs

**FHIR R4**
- Released 12/2018
- First version to contain ‘Normative’ resources
- Current version used for converting test eCQMs

**FHIR R4B and R5**
- R4B is a potential interim release currently in planning-critical changes only
- R5 is the next major release potentially for ballot in 2021- includes enhancements and new profiles
How is FHIR Used?

• FHIR is organized into 5 levels for easy navigation
• Levels I and II give implementers a basis for exchanging data
• Levels III and IV are used to represent data in eCQMs
• Level V provides structure for eCQMs and reporting

Introducing HL7 FHIR for eCQM Reporting
Why use FHIR for Quality Measurement?

- Align with other clinical data sharing efforts by supporting a broad range of use cases
- Standardize approaches and specifications to promote sharing between systems and applications.
- Improve flexibility and extensibility to meet multiple uses without compromising base specification
Walkthrough of FHIR

• Provide a basic navigation of the specification - http://hl7.org/fhir

• Show build vs production sites and FHIR versions
  • http://build.fhir.org - Latest build version which changes often
  • http://hl7.org/fhir - Latest published version
  • Implementation guides also have build and production sites

• Review a basic Resource ‘Encounter’
FHIR Versions

- Ribbon included at top for ‘directory of published versions’
- Version History page shows previous version sequences
- Options for download and helpful links
- (Current): Link to the ‘build’ site which is unpublished draft, changes often

http://hl7.org/fhir/directory.html
Navigating Resources

- Multiple views of resources are available
  - Categorized
  - Alphabetical
  - By Maturity
  - Security Category, etc.

http://hl7.org/fhir/resourcelist.html
Resource Structure

This extension should be used to reference an encounter where there is no property that already defines this association on the resource.

This resource is referenced by AdverseEvent, AllergyIntolerance, CarePlan, CareTeam, Chargeitem, Claim, ClinicalImpression, Communication, CommunicationRequest, Composition, Condition, Contract, DeviceRequest, DiagnosticReport, DocumentReference, itself, ExplanationOfBenefit, Flag, GuidanceResponse, ImagingStudy, Immunization, List, Media, MedicationAdministration, MedicationDispense, MedicationRequest, MedicationStatement, NutritionOrder, Observation, Procedure, QuestionnaireResponse, RequestGroup, RiskAssessment, ServiceRequest, Task and VisionPrescription

8.11.3 Resource Content

- Selecting a resource brings up its content
- Provides detail around structure for use
- Hyperlinks to descriptions, types, value sets, etc.
Resources vs Profiles

- **Resources** are the basic building block of the FHIR Specification
  - Defines how data are to be structured and exchanged
  - Intended to be generic to fit a wide range of use cases
- **Profiles** are Resources that have been modified to meet the needs of a specific use case
  - Restrict or extend APIs, Resources, Terminology
  - Indicate required elements (cardinality) and ‘Must Support’
  - Specify a value set
  - Publish- Profiles are typically published in an IG
Introducing HL7 FHIR for eCQM Reporting

HL7 FHIR Standards for Quality

- FHIR
- US Core
- QI-Core
- Content

- Universally applicable resources and guidance
- US Realm specific profiles
- Quality Improvement focused
- Use case focused

Consensus-based Promotion

Constraint-based Definition
FHIR Clinical Reasoning Module

• FHIR Measure Resource
  • Defines eCQM metadata and structure
  • Further defined in Quality Measure Implementation Guide
• FHIR MeasureReport Resource
  • Supports Individual, Subject List, Summary, and Data Collection report types
  • Further defined by Data Exchange for Quality Measure Implementation Guide
Implementation Guides for Quality Measurement

- **QI-Core**
  - QI-Core is a model IG using profiles based on US Core and base FHIR resources
  - Used for eCQMs, Quality Reporting, and clinical decision support (CDS)

- **FHIR Quality Measure**
  - Specification IG detailing how eCQMs are structured
  - Based on FHIR Measure Resource

- **DEQM**
  - How quality data is to be exchanged
  - Based on FHIR Measure Report Resource
Using QI-Core

- September 2019 Ballot updated QI-Core to FHIR R4
- Includes mapping of QDM to QI-Core
- QI-Core enables a simplified view that may be used by authors to write expressions
  - Detailed overview and examples will be included in future training sessions
## Using QI-Core

### 2 QI-Core Profiles

The following table lists the QI-Core profiles that are part of the IG, which USCore profile they are derived from, if any, and the underlying FHIR resources:

<table>
<thead>
<tr>
<th>QI-Core Profile</th>
<th>US Core Profile</th>
<th>Base Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>QICoreAdverseEvent</td>
<td>USCoreAdverseEvent</td>
<td>AdverseEvent</td>
</tr>
<tr>
<td>QICoreAllergyIntolerance</td>
<td>USCoreAllergyIntolerance</td>
<td>AllergyIntolerance</td>
</tr>
<tr>
<td>QICoreBodyStructure</td>
<td>USCoreBodyStructure</td>
<td>BodyStructure</td>
</tr>
<tr>
<td>QICoreCarePlan</td>
<td>USCoreCarePlan</td>
<td>CarePlan</td>
</tr>
<tr>
<td>QICoreCareTeam</td>
<td>USCoreCareTeam</td>
<td>CareTeam</td>
</tr>
<tr>
<td>QICoreClaim</td>
<td>USCoreClaim</td>
<td>Claim</td>
</tr>
<tr>
<td>QICoreCommunication</td>
<td>USCoreCommunication</td>
<td>Communication</td>
</tr>
<tr>
<td>QICoreCommunicationNotDone</td>
<td>USCoreCommunicationNotDone</td>
<td>CommunicationNotDone</td>
</tr>
<tr>
<td>QICoreCommunicationRequest</td>
<td>USCoreCommunicationRequest</td>
<td>CommunicationRequest</td>
</tr>
<tr>
<td>QICoreCondition</td>
<td>USCoreCondition</td>
<td>Condition</td>
</tr>
<tr>
<td>QICoreCoverage</td>
<td>USCoreCoverage</td>
<td>Coverage</td>
</tr>
<tr>
<td>QICoreDevice</td>
<td>USCoreDevice</td>
<td>Device</td>
</tr>
<tr>
<td>QICoreDeviceNotRequested</td>
<td>USCoreDeviceNotRequested</td>
<td>DeviceNotRequested</td>
</tr>
<tr>
<td>QICoreDeviceRequest</td>
<td>USCoreDeviceRequest</td>
<td>DeviceRequest</td>
</tr>
<tr>
<td>QICoreDeviceUseStatement</td>
<td>USCoreDeviceUseStatement</td>
<td>DeviceUseStatement</td>
</tr>
<tr>
<td>QICoreDiagnosticReportLab</td>
<td>USCoreDiagnosticReportLab</td>
<td>DiagnosticReport</td>
</tr>
<tr>
<td>QICoreDiagnosticReportNote</td>
<td>USCoreDiagnosticReportNote</td>
<td>DiagnosticReport</td>
</tr>
<tr>
<td>QICoreEncounter</td>
<td>USCoreEncounter</td>
<td>Encounter</td>
</tr>
<tr>
<td>QICoreFamilyMemberHistory</td>
<td>USCoreFamilyMemberHistory</td>
<td>FamilyMemberHistory</td>
</tr>
</tbody>
</table>

Contents show profile, US Core Profile, and Base FHIR Resource
QI-Core Profile Example

Differential view based on US Core Encounter. Adds ‘Must Support’ and binds to terminology.
QDM to QI-Core Mapping Example

<table>
<thead>
<tr>
<th>QDM Context</th>
<th>QI-Core R4</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encounter, Performed</td>
<td>Encounter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encounter:status</td>
<td>consider constraint to - arrived, triaged, in-progress, on-leave, finished</td>
</tr>
<tr>
<td></td>
<td>Encounter:type</td>
<td>type of service by CPT</td>
</tr>
<tr>
<td>QDM Attribute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Encounter:class</td>
<td>ambulatory, ED, Inpatient, etc.</td>
</tr>
<tr>
<td>Id</td>
<td>Encounter:id</td>
<td></td>
</tr>
<tr>
<td>Relevant Period</td>
<td>Encounter:period</td>
<td>start and end time of encounter</td>
</tr>
<tr>
<td>Diagnoses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis (code)</td>
<td>Encounter:diagnosis.condition</td>
<td>can be used for coded diagnoses</td>
</tr>
<tr>
<td>PresentOnAdmissionIndicator (code)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rank (Integer)</td>
<td>Encounter:diagnosis.rank</td>
<td>for each diagnosis role</td>
</tr>
<tr>
<td>Procedures</td>
<td>qIcore-encounter-procedure</td>
<td>qIcore-encounter-procedure</td>
</tr>
<tr>
<td></td>
<td>Encounter:extension.procedure.value(x)</td>
<td>References the procedure code</td>
</tr>
<tr>
<td></td>
<td>Encounter:extension.rank.value(x).valuePositiveInt</td>
<td>References the rank; for principal procedure, the rank = 1</td>
</tr>
<tr>
<td></td>
<td>Encounter:procedure.procedure</td>
<td>A reference to the procedure that was performed</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>Encounter:length</td>
<td></td>
</tr>
<tr>
<td>Negation Rationale</td>
<td>Not Addressed</td>
<td>There is no current use case for an eCQM to request a reason for failure to perform an encounter.</td>
</tr>
<tr>
<td>Author dateTime</td>
<td>Not Addressed</td>
<td></td>
</tr>
</tbody>
</table>

Shows QDM datatypes, mapping to QI-Core profile, additional notes, and implementer guidance.
Quality Measure IG

- Defines a standard approach for representing eCQM content
  - Describes the required metadata
  - Provides guidance for using CQL with FHIR measures
  - Defines parameters, use of terminology, and measure population descriptions
- Profiles define requirements for various measure scoring types (continuous variable, proportion, etc.)
- Includes examples of eCQMs, libraries, and value sets
Profiles describe several measure types and structure of measure library.
DEQM IG

- Specifies a framework for exchanging quality measure data
  - Data Exchange
  - Individual Measure Report
  - Summary Measure Report
- Specifies profiles and extensions necessary for data exchange and reporting
- Defines operations for exchanging and evaluating measures
Introducing HL7 FHIR for eCQM Reporting

DEQM IG (Cont’d)
Converting eCQMs to FHIR

- CMS began converting QDM-based eCQMs to use FHIR in spring of 2019
- CMS program measures continue to be tested at HL7 Connectathons
- Measure Authoring Tool (MAT) and Bonnie have been updated with FHIR functionality
- Created a measure repository
  - For work-in-progress eCQMs and example expressions
  - https://github.com/cqframework/ecqm-content-r4
FHIR operations

• FHIR specifications describe how health data should be structured for exchange

• Operations in FHIR describe the interactions used to exchange that data

• Basic operations include CRUD (Create, Read, Update, Delete)
  • Enables storage, search, and retrieval

• Allow systems to describe general operations
  • Displays as an action preceded by a dollar sign (e.g., $evaluate-measure)
FHIR Operations (Cont’d)

• Clinical Reasoning defines $evaluate-measure
  • Allows a client system to request a particular quality measure be evaluated
  • Uses input parameters (e.g., periodStart, periodEnd, measure)
  • Output is a MeasureReport Resource

• Other operations used in Quality Reporting
  • $collect-data- a request to collect data for a measure
  • $submit-data- submission of data of interest for a measure
  • $data-requirements- returns parameters and required data for a measure
eCQM Reference Implementation

- FHIR reference implementations are used to test specifications
- Allows implementers to test systems against known results
- Provides an environment for use in Connectathons
- eCQM Reference Implementation evaluates measures and creates measure reports
CQF Ruler

- CQF Ruler is a reference implementation of the FHIR Clinical Reasoning module
  - Reference implementations are used to test an IG
  - CQF Ruler includes CQL-to-Expression Logical Model (ELM) Translation and Measure Evaluation service
  - Open source Java implementation
  - https://github.com/DBCG/cqf-ruler

- Quick Start Guide has been developed to aid set-up
  https://github.com/DBCG/connectathon/wiki/Quickstart
Tools for Implementers

• CQL-to-ELM Translator
  • https://github.com/cqframework/clinical_quality_language/blob/master/Src/java/cql-to-elm/OVERVIEW.md

• JS CQL Execution Engine
  • https://github.com/cqframework/cql-execution

• Java CQL Execution
  • https://github.com/dbcg/cql_engine
Current Activities

• eCQM conversion of 2020 CMS program measures to FHIR is ongoing using MAT on FHIR

• Planning for ballots and updates
  • DEQM was balloted September 2020, applying updates
  • QM IG May 2021 - ballot
  • QI Core based on US Core Fall 2021 - planned update

• Connectathons are held three times per year
  • CMS January 2020 (completed)
  • HL7 May Connectathon
  • HL7 September Connectathon

• See our poster at the CMS Quality Conference March 2-3, 2021
Thank You!

• Implementers can access links to IGs, training, and other resources on the Electronic Clinical Quality Improvement (eCQI) Resource Center https://ecqi.healthit.gov/fhir

• Direct comments or questions to fhir@esacinc.com
Resources

• Current FHIR Measures
  • https://github.com/cqframework/ecqm-content-r4

• FHIR R4 Standards and IGs
  • http://hl7.org/fhir/ (Current Version R4.0.1)
  • http://build.fhir.org/ (Current build- will change)
  • http://hl7.org/fhir/us/core/ (US Core R4 version)
  • DEQM (Current version published Aug 2020)
  • QM IG (Current version published Feb 2020)
Questions?