Introducing Health Level Seven® (HL7) Fast Healthcare Interoperability Resources (FHIR®) for Electronic Clinical Quality Measure (eCQM) Reporting

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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

Introducing HL7 FHIR for eCQM Reporting
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
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

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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.


8.11.3 Resource Content

<table>
<thead>
<tr>
<th>Structure</th>
<th>UML</th>
<th>XML</th>
<th>JSON</th>
<th>Turtle</th>
<th>R3 Diff</th>
<th>All</th>
</tr>
</thead>
</table>

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

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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
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

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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>USCore Profile</th>
<th>Base Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>QICoreAdverseEvent</td>
<td>USCoreAllergyIntolerance</td>
<td>AdverseEvent</td>
</tr>
<tr>
<td>QICoreAllergyIntolerance</td>
<td>QICoreBodyStructure</td>
<td>AllergyIntolerance</td>
</tr>
<tr>
<td>QICoreBodyStructure</td>
<td>QICoreCarePlan</td>
<td>BodyStructure</td>
</tr>
<tr>
<td>QICoreCarePlan</td>
<td>QICoreCareTeam</td>
<td>CarePlan</td>
</tr>
<tr>
<td>QICoreCareTeam</td>
<td>QICoreClaim</td>
<td>CareTeam</td>
</tr>
<tr>
<td>QICoreClaim</td>
<td>QICoreCommunicationNotDone</td>
<td>Claim</td>
</tr>
<tr>
<td>QICoreCommunication</td>
<td>QICoreCommunicationRequest</td>
<td>Communication</td>
</tr>
<tr>
<td>QICoreCommunicationNotDone</td>
<td>QICoreCommunicationRequest</td>
<td>CommunicationRequest</td>
</tr>
<tr>
<td>QICoreCondition</td>
<td>USCoreCondition</td>
<td>Condition</td>
</tr>
<tr>
<td>QICoreCoverage</td>
<td>QICoreCoverage</td>
<td>Coverage</td>
</tr>
<tr>
<td>QICoreDevice</td>
<td>QICoreDeviceNotRequested</td>
<td>Device</td>
</tr>
<tr>
<td>QICoreDeviceNotRequested</td>
<td>QICoreDeviceRequest</td>
<td>DeviceRequest</td>
</tr>
<tr>
<td>QICoreDeviceRequest</td>
<td>QICoreDeviceUseStatement</td>
<td>DeviceUseStatement</td>
</tr>
<tr>
<td>QICoreDiagnosticReportLab</td>
<td>QICoreDiagnosticReportNote</td>
<td>DiagnosticReport</td>
</tr>
<tr>
<td>QICoreDiagnosticReportNote</td>
<td>QICoreEncounter</td>
<td>DiagnosticReportNote</td>
</tr>
<tr>
<td>QICoreEncounter</td>
<td>QICoreFamilyMemberHistory</td>
<td>Encounter</td>
</tr>
<tr>
<td>QICoreFamilyMemberHistory</td>
<td></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><em>QDM Attribute</em></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>qc:core-encounter-procedure</td>
<td>qc:core-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
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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

- 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?