Introducing Health Level 7 (HL7) Fast Healthcare Interoperability Resources (FHIR®) for Implementers

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Agenda

» Components of an electronic Clinical Quality Measure (eCQM)
» FHIR Specification Introduction and Walkthrough
» Use of Profiles and Implementation Guides (IGs)
» QI-Core and mappings from Quality Data Model (QDM)
» Quality Measure IG
» Data Exchange for Quality Measures
» Introduction to FHIR Operations
» Current Activities Update
Parts 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, Exceptions
Goal is to align quality measurement standards for eCQM development and reporting using FHIR
- QI-Core replaces QDM for clinical data
- 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
  - [http://hl7.org/fhir](http://hl7.org/fhir)

» 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 APIs

» FHIR uses latest technologies to be developer friendly
FHIR - A Brief History

**FHIR DSTU 2***
- Balloted in early 2015
- Initial version of FHIR focused on core data set and exchange using APIs
- Focus of the Argonaut project and ONC Common Clinical Data Set

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

**FHIR R4**
- Published 12/2018
- First version to contain ‘Normative’ resources
- Target implementation for many EHR Vendors
- Current version used for converting test eCQMs

*Note HL7 no longer uses ‘Draft’ for naming conventions*
Introducing HL7 FHIR® for Implementers

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
Walkthrough of FHIR

- [http://hl7.org/fhir](http://hl7.org/fhir)
- Basic Navigation of the specification
- Build vs. Production sites and FHIR versions
  - build.fhir.org: Latest specification, changes often
  - fhir.hl7.org: Latest published version
    Implementation guides also have build and production sites
- Review of a basic Resource ‘Encounter’
Introducing HL7 FHIR® for Implementers

- 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

- 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 is to be structured and exchanged
  – Intended to be generic to fit a wide range of use cases

» Profiles are Resources that have been changed for a specific use case
  – Can both restrict and extend APIs, Resources, Terminology
  – Required elements (cardinality) and ‘Must Support’
  – Specify a value set
  – Profiles are typically published in an Implementation Guide
DEQM – Data Exchange for Quality Measures (HL7 Standard)
HEDIS – Healthcare Effectiveness Data and Information Set (National Committee for Quality Assurance (NCQA))
Implementation Guides for Quality Measurement

» **QI-Core**
  QI-Core is the data model built on top of FHIR Resources (US Core and base FHIR resources)
  A set of profiles for eCQMs, Quality Reporting, and CDS
  - Based on FHIR and US Core

» **FHIR Quality Measure**
  Structure of an eCQM (metadata, populations)
  - Based on FHIR Measure Resource

» **Data Exchange for Quality Measures (DEQM)**
  How quality data is to be exchanged
  - Based on FHIR Measure Report Resource
Using QI-Core

» September 2019 Ballot updates QI-Core to FHIR R4
» Includes mapping of Quality Data Model (QDM) to QI-Core
» QUICK- A conceptual view of QI-Core for authoring included in IG
Using QI-Core

1.8 Contents

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>QICore-AdverseEvent</td>
<td>USCore-Condition</td>
<td>Condition</td>
</tr>
<tr>
<td>QICore-AllergyIntolerance</td>
<td>USCore-AllergyIntolerance</td>
<td>AllergyIntolerance</td>
</tr>
<tr>
<td>QICore-BodyStructure</td>
<td>USCore-BodyStructure</td>
<td>BodyStructure</td>
</tr>
<tr>
<td>QICore-Claim</td>
<td>USCore-Claim</td>
<td>Claim</td>
</tr>
<tr>
<td>QICore-Communication</td>
<td>USCore-Communication</td>
<td>Communication</td>
</tr>
<tr>
<td>QICore-CommunicationRequest</td>
<td>USCore-CommunicationRequest</td>
<td>CommunicationRequest</td>
</tr>
<tr>
<td>QICore-Condition</td>
<td>USCore-Condition</td>
<td>Condition</td>
</tr>
<tr>
<td>QICore-Coverage</td>
<td>USCore-Coverage</td>
<td>Coverage</td>
</tr>
<tr>
<td>QICore-Device</td>
<td>USCore-Device</td>
<td>Device</td>
</tr>
<tr>
<td>QICore-DeviceRequest</td>
<td>USCore-Device</td>
<td>DeviceRequest</td>
</tr>
<tr>
<td>QICore-DeviceUseStatement</td>
<td>USCore-Device</td>
<td>DeviceUseStatement</td>
</tr>
<tr>
<td>QICore-DiagnosticReportLab</td>
<td>USCore-DiagnosticReportLab</td>
<td>DiagnosticReport</td>
</tr>
<tr>
<td>QICore-DiagnosticReportNote</td>
<td>USCore-DiagnosticReportNote</td>
<td>DiagnosticReport</td>
</tr>
<tr>
<td>QICore-Encounter</td>
<td>USCore-Encounter</td>
<td>Encounter</td>
</tr>
<tr>
<td>QICore-FamilyMemberHistory</td>
<td>USCore-FamilyMemberHistory</td>
<td>FamilyMemberHistory</td>
</tr>
<tr>
<td>QICore-Flag</td>
<td>USCore-Goal</td>
<td>Flag</td>
</tr>
<tr>
<td>QICore-Goal</td>
<td>USCore-Goal</td>
<td>Goal</td>
</tr>
<tr>
<td>QICore-ImagingStudy</td>
<td>USCore-ImagingStudy</td>
<td>ImagingStudy</td>
</tr>
</tbody>
</table>

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

Description of Profiles, Differentials, and Snapshots.

<table>
<thead>
<tr>
<th>Name</th>
<th>Flags</th>
<th>Card.</th>
<th>Type</th>
<th>Description &amp; Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encounter</td>
<td></td>
<td>0..*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>id</td>
<td></td>
<td>0..1</td>
<td>id</td>
<td></td>
</tr>
<tr>
<td>encounter-reasonCancelled</td>
<td></td>
<td>0..1</td>
<td>CodeableConcept</td>
<td>Explanation for cancellation</td>
</tr>
<tr>
<td>qicore-encounter-procedure</td>
<td>S</td>
<td>0..*</td>
<td>Complex</td>
<td>Encounter Procedure Extension</td>
</tr>
<tr>
<td>status</td>
<td></td>
<td>1..1</td>
<td>code</td>
<td></td>
</tr>
<tr>
<td>class</td>
<td>S</td>
<td>1..1</td>
<td>Coding</td>
<td></td>
</tr>
<tr>
<td>type</td>
<td>S</td>
<td>1..*</td>
<td>CodeableConcept</td>
<td></td>
</tr>
<tr>
<td>priority</td>
<td></td>
<td>0..1</td>
<td>CodeableConcept</td>
<td>Binding: SNOMED CT Priorities Codes (preferred)</td>
</tr>
<tr>
<td>subject</td>
<td>S</td>
<td>1..1</td>
<td>Reference(QICorePatient)</td>
<td></td>
</tr>
<tr>
<td>basedOn</td>
<td></td>
<td>0..*</td>
<td>Reference(QICoreServiceRequest)</td>
<td></td>
</tr>
</tbody>
</table>

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

## 7.10.3 Encounter, Performed

<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>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>Diagnosis</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></td>
<td>Currently referenced as Procedure.priority in QDM 5.5. Principal procedures are more appropriately managed as Encounter.procedures; Elective procedures are more appropriately managed using Encounter.priority = elective with Encounter.procedure.rank = 1.</td>
</tr>
<tr>
<td></td>
<td>Encounter.procedure.code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encounter.procedure.sequence</td>
<td>Extension for Procedure.sequence to be consistent with the FHIR Claim resource includes a Claim.procedure.sequence used to uniquely identify procedure entries. Claim.procedure.type provides a relative ranking with two example concepts - primary (the first procedure in a series to produce an overall patient outcome) and secondary (the second procedure in a series required to produce an overall patient outcome). However, type refers to procedures within a series for which one is first. Such a sequence does not assure that the first procedure is the principal procedure for an encounter.</td>
</tr>
</tbody>
</table>

Shows Quality Data Model datatypes, mapping to QI-Core profile and additional notes and implementer guidance.
Converting eCQMs to FHIR

» CMS began converting QDM based eCQMs to use FHIR in Spring of 2019

» Intent of conversion is to
  – Identify gaps in emerging standards
  – Perform initial testing of FHIR eCQMs
  – Training for measure developers

» Measure Repository
  – For work-in-progress eCQMs and example expressions
    http://build.FHIR.org/ig/cqframework/draft-measures/examples.html
FHIR® Clinical Reasoning Module

» FHIR Measure Resource
  – Defines eCQM metadata and structure
  – FHIR Measure Implementation Guide

» FHIR MeasureReport Resource
  – Supports Individual, List, and Summary
  – DEQM Implementation Guide

Guides are currently based on FHIR STU 3
  – Updates for R4 planned for Feb 2020 ballot cycle
Quality Measure Implementation Guide

» Introductory and Overview Information required for creating eCQMs
  – Describes the meta data required
  – Guidance for using CQL with FHIR measures
  – Defines parameters, use of terminology, and measure population descriptions

» CQF Measure and other profiles define requirements for several measure types

» Includes examples of eCQMs, libraries, and value sets
Quality Measure IG (Cont’d)

Profiles describe several measure types and structure of measure library

Data Exchange for Quality Measures (DEQM)

» Specifies a framework exchanging quality measure data
  – Data Exchange
  – Individual Measure Report
  – Summary Measure Report

» Specifies profiles and extensions necessary for exchange and reporting

» Defines operations for exchange
Data Exchange for Quality Measures (DEQM)

2.1.1 General Guidance and Definitions

Contents:
- Introduction
- Preconditions and Assumptions
- DEQM MeasureReport Profiles
  - Data Exchange
  - Measure Reporting
- Other Profiles Used in the Evaluation of a Measure
- Negation Patterns for Quality Measures
- Must Support

2.1.2 Introduction

Clinical Quality Measures are a common tool used throughout healthcare to help evaluate and understand the impact and quality of the care being provided to an individual or population.

The Data Exchange for Quality Measures (DEQM) Implementation Guide defines the interactions for two arrays in the Quality Measure Ecosystem. The

https://build.fhir.org/ig/HL7/davinci-deqm/guidance.html
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

» Allows systems to describe general operations
FHIR Operations (Cont’d)

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

» Other operations used in Quality Reporting
  – $collect-data
  – $submit-data
  – $data-requirements
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
Clinical Quality Framework (CQF) Ruler

» CQF Ruler is a reference implementation of the FHIR Clinical Reasoning module
  – Includes CQL-to-ELM Translation and Measure Evaluation service
  – Open source Java implementation
  – https://github.com/DBCG/cqf-ruler

» Quick Start Guide has been developed to aid in 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

» Quality Measure and DEQM Implementation Guides R4 Ballot update

» Connectathons
  – CMS January (completed)
  – HL7 February Connectathon (Sydney)
  – HL7 May Connectathon (San Antonio)

» See us at 2020 CMS Quality Conference
Thank You!

» Implementers can use specifications and resources posted to the eCQI Resource Center: https://ecqi.healthit.gov/fhir

» Comments or questions can be directed to the eCQI Resource Center to ecqi-resource-center@hhs.gov
Resources

» More Examples: http://build.fhir.org/ig/cqframework/draft-measures/examples.html

» FHIR R4 Standards and Implementation Guides
  – http://hl7.org/fhir/ (Current Version)
  – http://build.fhir.org/ (Current build- will change)
  – http://hl7.org/fhir/us/core/ (US Core R4 version)
  – Data Exchange for Quality Measures (Feb 2020)
  – Quality Measures IG (Feb 2020)

» FHIR STU 3 Standards and Implementation Guides
QUESTIONS?