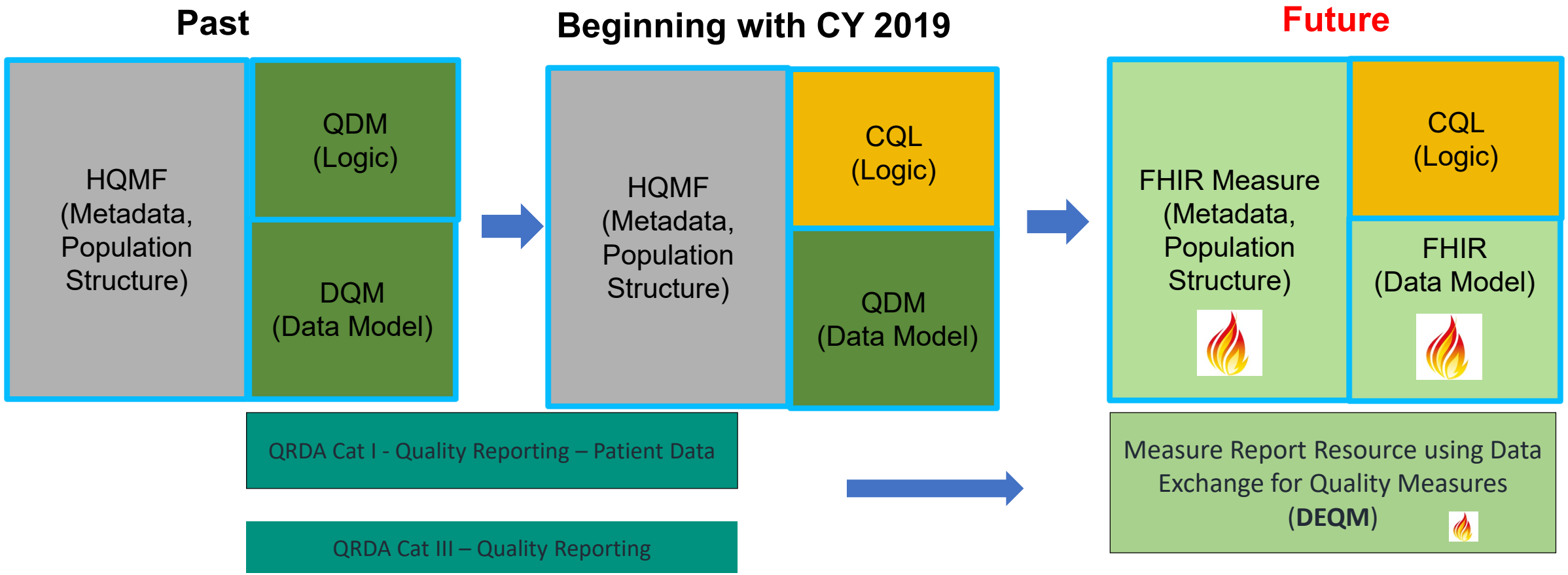
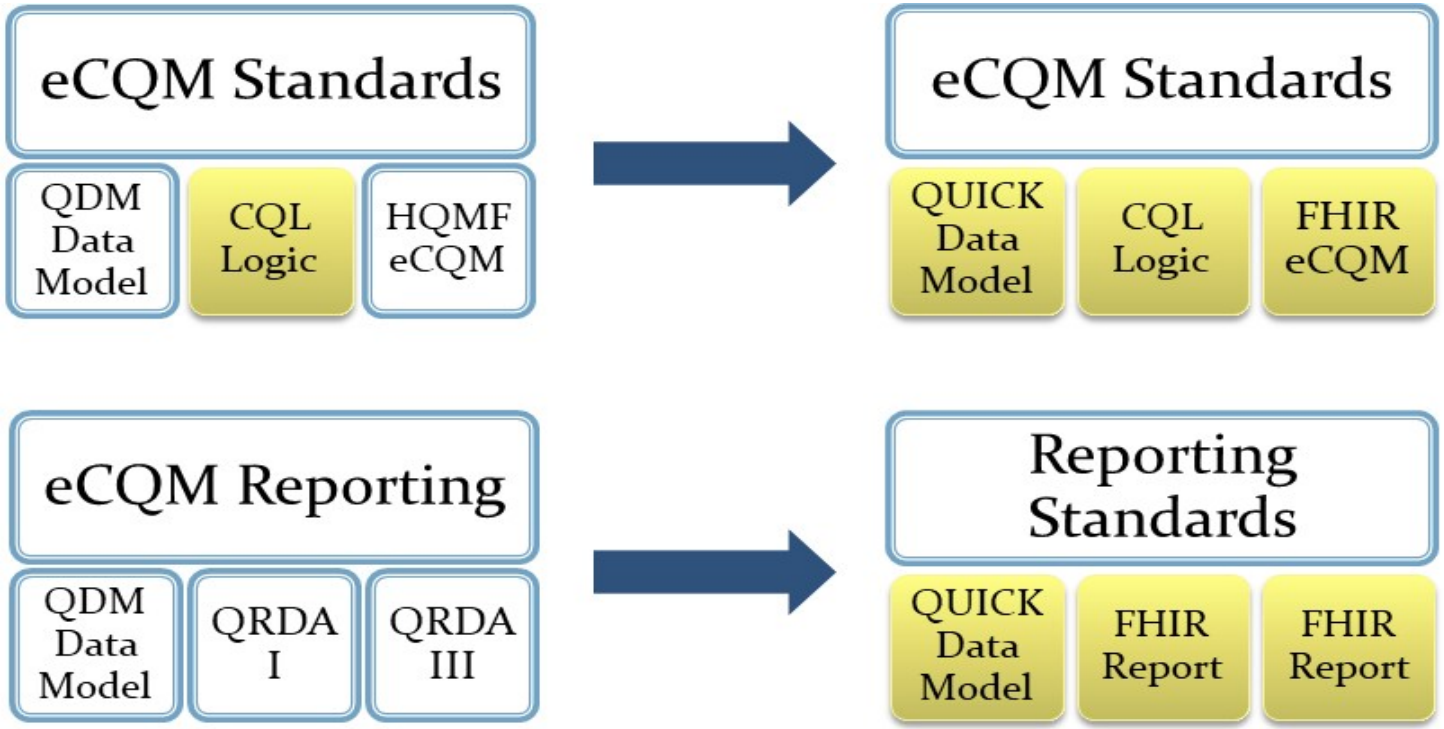
Evolving electronic Clinical Quality Measure (eCQM) Standards



FHIR® Standards for eCQMs



Goal is to align quality measurement standards for eCQM development and reporting using FHIR®

- QUICK replaces QDM
- FHIR® Measure replaces HQMF
- FHIR® Measure Report Replaces QRDA

FHIR® eCQMs and Reporting

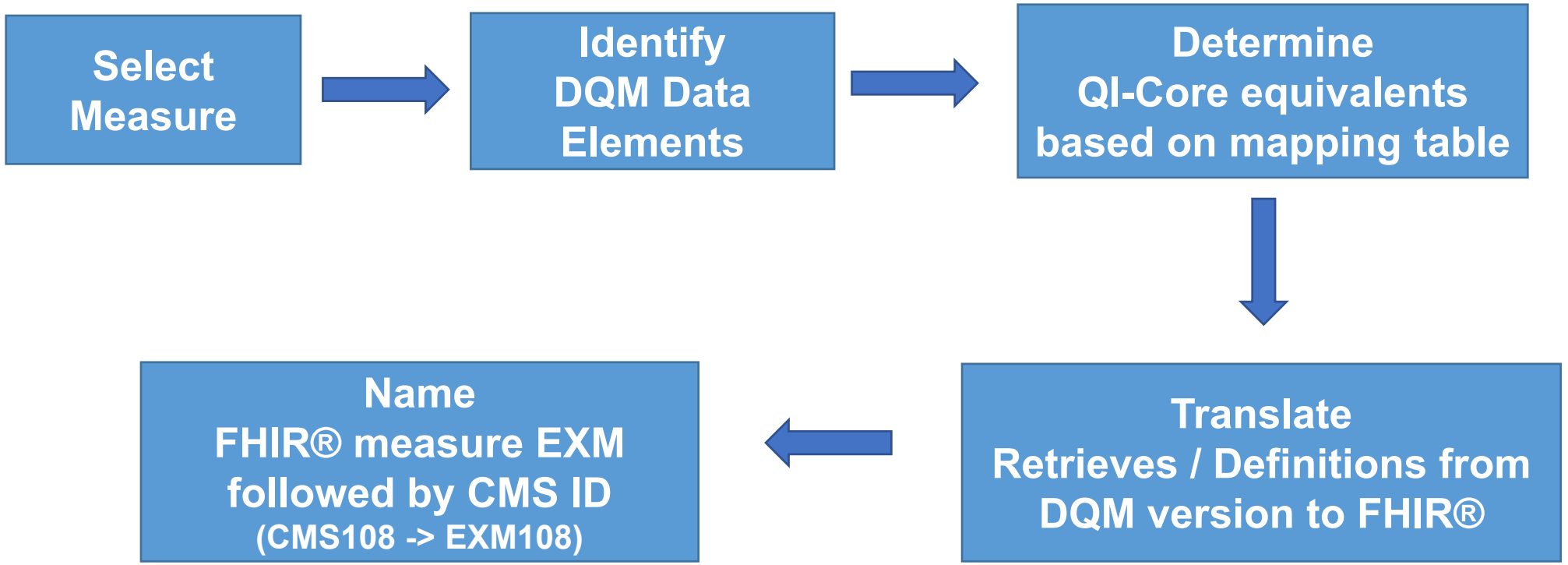
- FHIR® Measure Resource- eCQM metadata and structure
  - Tooling will support structure
  - FHIR Measure Implementation Guide
- FHIR® Measure Report
  - Supports Individual, List, and Summary
  - DEQM Implementation Guide
- Implementation Guides for Quality Measurement

  QI-Core/QUICK - Data Model for eCQMs

  FHIR® Quality Measure - Structure of an eCQM

  Data Exchange for Quality Measures (DEQM)- How quality data is to be exchanged

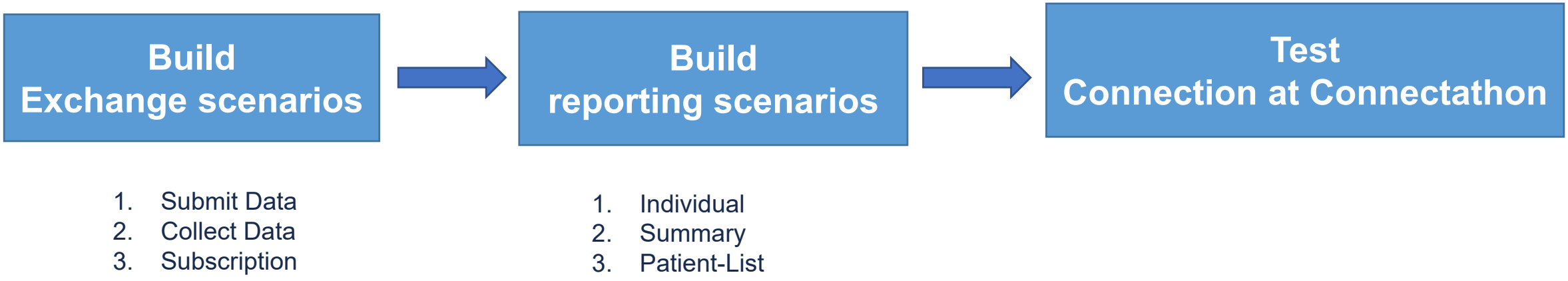
Converting eCQMs to FHIR® Measures



Post Conversion to FHIR®

Post Conversion:

- Create Test Data and share final measure example with DEQM Implementation Guide developers to build reporting requirements and exchange scenarios
- Perform connection testing at Connectathon

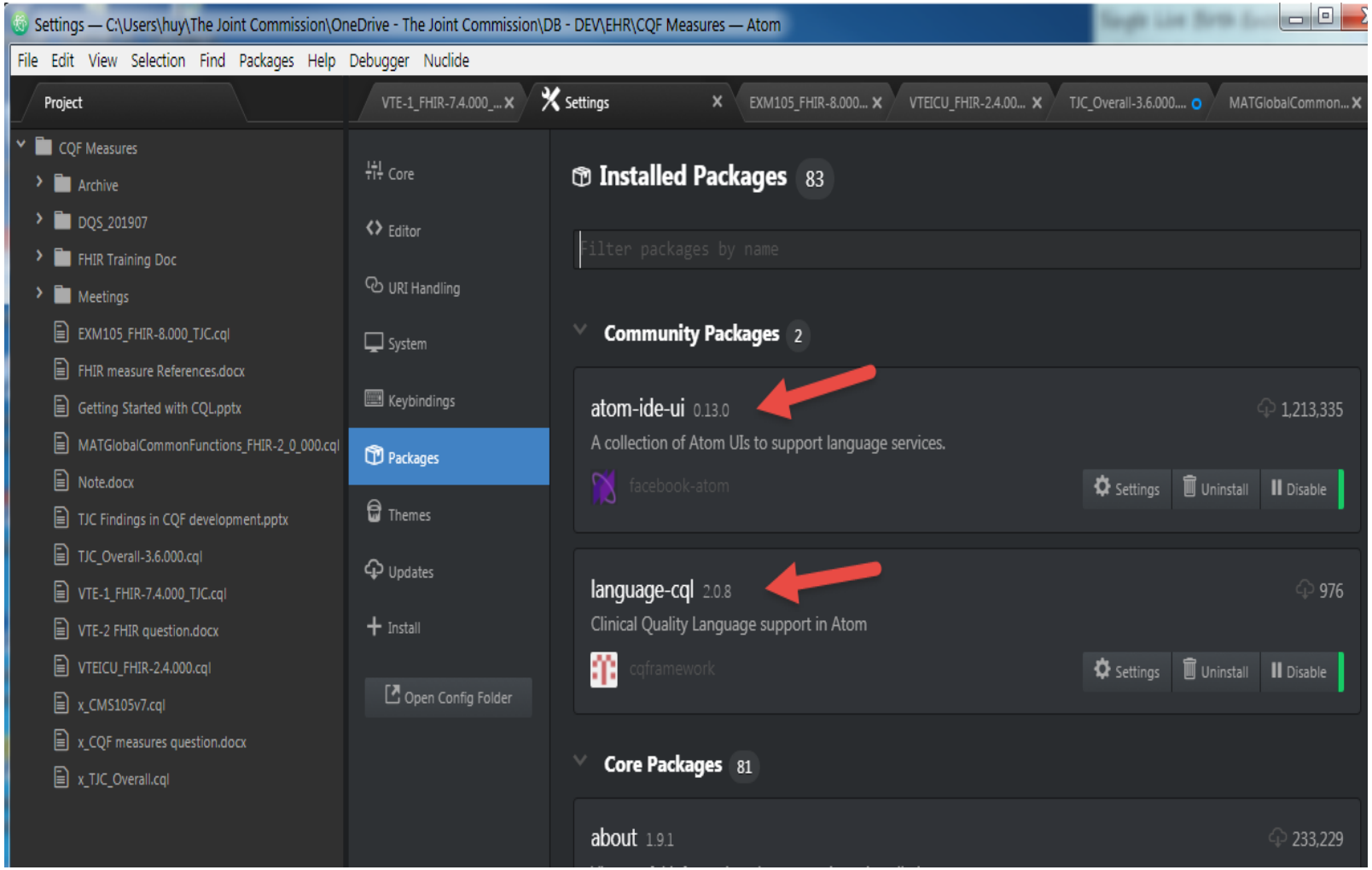


Tool to support eCQM Conversion

- Atom Text Editor
  - https://atom.io/
  - Additional Packages need to install
    - Language-cql
    - atom-ide-ui

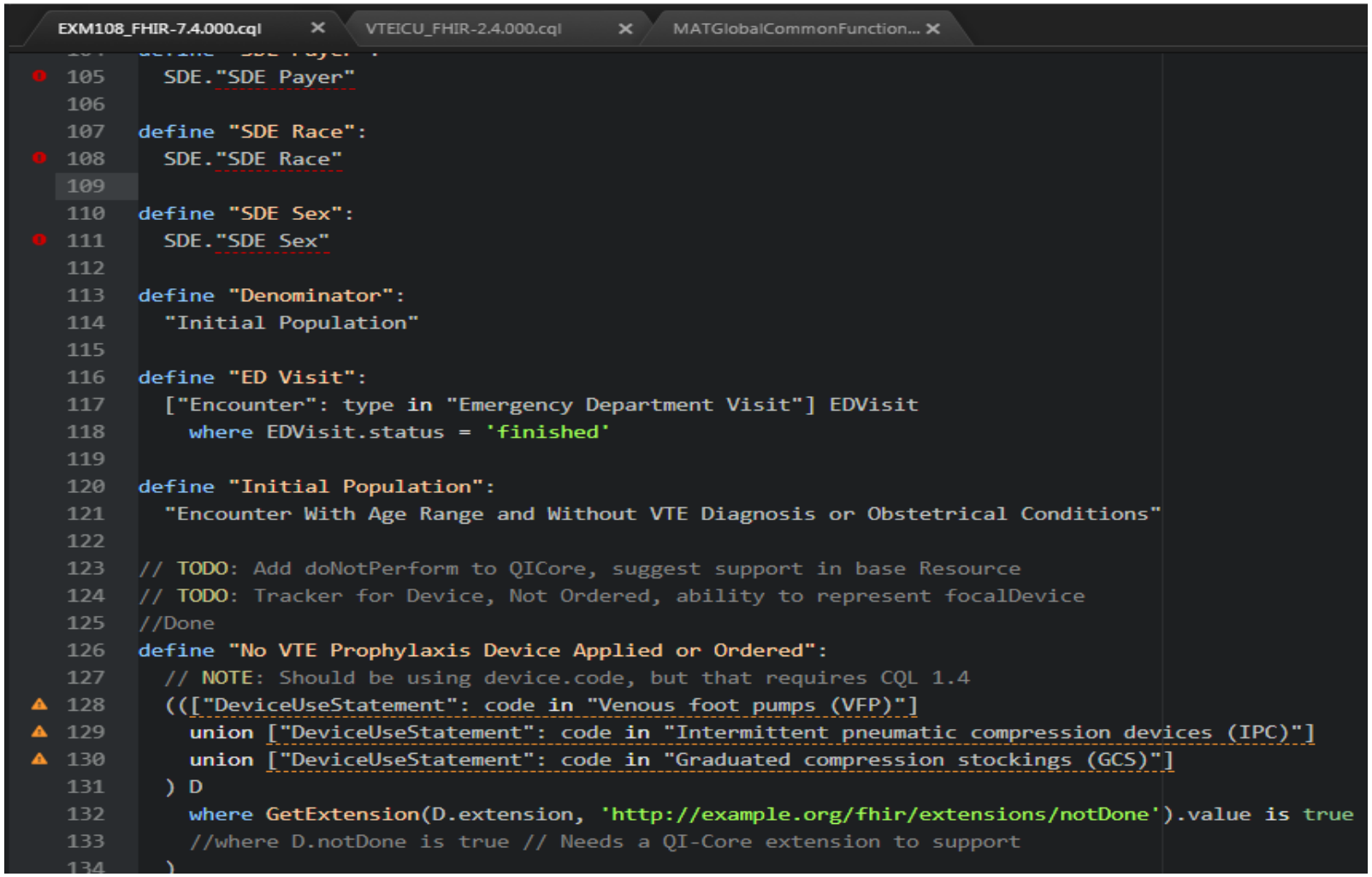
**Before install Atom, please make sure the latest Java version is installed or updated to -

https://www.java.com/en/



Tool to support eCQM Conversion

- Atom Text Editor
  - https://atom.io/
  - Provides a basic editor for authoring measures
  - CQL Highlighter to show correct expressions



Example of eCQM Conversion – VTE-1 (CMS108v7) Narratives

eCQM Title	**Venous Thromboembolism Prophylaxis**		
eCQM Identifier (Measure Authoring Tool)	108	**eCQM Version number**	7.4.000
NQF Number	0371	**GUID**	38b0b5ec-0f63-466f-8fe3-2cd20ddd1622
Description	This measure assesses the number of patients who received VTE prophylaxis or have documentation why no VTE prophylaxis was given the day of or the day after hospital admission or surgery end date for surgeries that start the day of or the day after hospital admission		
Initial Population	Patients age 18 and older discharged from hospital inpatient acute care without a diagnosis of venous thromboembolism (VTE) or obstetrics with a length of stay less than or equal to 120 days that ends during the measurement period		
Denominator	All patients in the initial population		
Denominator Exclusions	* Patients who have a length of stay less than 2 days * Patients with comfort measures documented anytime between arrival and the day after hospital admission * Patients with comfort measures documented by the day after surgery end date for surgeries that start the day of or the day after hospital admission * Patients who are direct admits to intensive care unit (ICU), or transferred to ICU the day of or the day after hospital admission with ICU length of stay greater than or equal to one day * Patients with a principal diagnosis of mental disorders or stroke * Patients with a principal procedure of Surgical Care Improvement Project (SCIP) VTE selected surgeries		
Numerator	Patients who received VTE prophylaxis: - the day of or the day after hospital admission - the day of or the day after surgery end date for surgeries that end the day of or the day after hospital admission Patients who have documentation of a reason why no VTE prophylaxis was given: - between arrival and hospital admission - the day of or the day after hospital admission - the day of or the day after surgery end date (for surgeries that end the day of or the day after hospital admission)		

Example of eCQM Conversion – VTE-1 (EXM108v7) - Populations

In QDM-CQL measure

Initial Population

"Encounter With Age Range and Without VTE Diagnosis or Obstetrical Conditions"

Denominator

"Initial Population"

Denominator Exclusions

```
"Encounter Less Than 2 Days"
    union "Encounter With ICU Location Stay 1 Day or More"
    union "Encounter With Principal Diagnosis of Mental Disorder or Stroke"
    union "Encounter With Principal Procedure of SCIP VTE Selected Surgery"
    union "Intervention Comfort Measures on Day of or Day After Start of Hospitalization"
    union "Intervention Comfort Measures on Day of or Day After Procedure"
```

Numerator

```
"VTE Prophylaxis Received on Day of or Day After Admission or Procedure"
    union ( "Medication Oral Factor Xa Inhibitor Administered on Day of or Day After Admission or Procedure"
            intersect ( "Encounter With Prior or Present Diagnosis of Atrial Fibrillation or VTE"
                    union "Encounter With Prior or Present Procedure of Hip or Knee Replacement Surgery"
            )
    )
    union "Low Risk for VTE or Anticoagulant Administered"
    union "No VTE Prophylaxis Due to Medical Reason"
    union "No VTE Prophylaxis Due to Patient Refusal"
```

In FHIR® Measure

```
define "Initial Population":
    "Encounter With Age Range and Without VTE Diagnosis or Obstetrical Conditions"

define "Denominator":
  "Initial Population"

define "Denominator Exclusions":
    "Encounter Less Than 2 Days"
      union "Encounter With ICU Location Stay 1 Day or More"
      union "Encounter With Principal Diagnosis of Mental Disorder or Stroke"
      union "Encounter With Principal Procedure of SCIP VTE Selected Surgery"
      union "Intervention Comfort Measures on Day of or Day After Start of Hospitalization"
      union "Intervention Comfort Measures on Day of or Day After Procedure"

define "Numerator":
      "VTE Prophylaxis Received on Day of or Day After Admission or Procedure"
        union ( "Medication Oral Factor Xa Inhibitor Administered on Day of or Day After Admission or Procedure"
            intersect ( "Encounter With Prior or Present Diagnosis of Atrial Fibrillation or VTE"
                union "Encounter With Prior or Present Procedure of Hip or Knee Replacement Surgery"
            )
        )
        union "Low Risk for VTE or Anticoagulant Administered"
        union "No VTE Prophylaxis Due to Medical Reason"
        union "No VTE Prophylaxis Due to Patient Refusal"
```

Example of eCQM Conversion – VTE-1 (EXM108v7) Header Info

In QDM-CQL measure

library VenousThromboembolismProphylaxis version '7.4.000'

using QDM version '5.3'

include MATGlobalCommonFunctions version '2.0.000' called Global

include VTEICU version '2.4.000' called VTEICU

In FHIR® Measure

```
1  library VenousThromboembolismProphylaxis version '7.4.000'
2
3  using FHIR version '3.0.0'
4
5  include FHIRHelpers version '3.0.0' called FHIRHelpers
6  include MATGlobalCommonFunctions_FHIR version '2.0.000' called Global
7  include VTEICU_FHIR version '2.4.000' called VTEICU
8  include SupplementalDataElements_FHIR version '1.0.0' called SDE
9
10 /*
```

Example of eCQM Conversion – VTE-1 (EXM108v7) Data Elements

In QDM-CQL measure

define "Inpatient Encounter":

["Encounter, Performed": "Encounter Inpatient"] EncounterInpatient

where "LengthInDays"(EncounterInpatient.relevantPeriod)<= 120

and EncounterInpatient.relevantPeriod ends during "Measurement Period"

define "SCIP VTE Selected Surgery":

["Procedure, Performed": "General Surgery"]

union ["Procedure, Performed": "Gynecological Surgery"]

union ["Procedure, Performed": "Hip Fracture Surgery"]

union ["Procedure, Performed": "Hip Replacement Surgery"]

union ["Procedure, Performed": "Intracranial Neurosurgery"]

union ["Procedure, Performed": "Knee Replacement Surgery"]

union ["Procedure, Performed": "Urological Surgery"]

In FHIR® Measure

```
define "Inpatient Encounter":
  ["Encounter": "Encounter Inpatient"] EncounterInpatient
    where EncounterInpatient.status = 'finished'
      and "LengthInDays"(EncounterInpatient.period) <= 120
    and EncounterInpatient.period ends during "Measurement Period"


define "SCIP VTE Selected Surgery":
  ["Procedure": "General Surgery"]
    union ["Procedure": "Gynecological Surgery"]
    union ["Procedure": "Hip Fracture Surgery"]
    union ["Procedure": "Hip Replacement Surgery"]
    union ["Procedure": "Intracranial Neurosurgery"]
    union ["Procedure": "Knee Replacement Surgery"]
    union ["Procedure": "Urological Surgery"] ) P
    where P.status = 'completed'
```

Example of eCQM Conversion – VTE-1 (EXM108v7) Terminology

In QDM-CQL measure

```
codesystem "LOINC:2.63": 'urn:oid:2.16.840.1.113883.6.1' version 'urn:hl7:version:2.63'

valueset "ONC Administrative Sex": 'urn:oid:2.16.840.1.113762.1.4.1'
valueset "Race": 'urn:oid:2.16.840.1.114222.4.11.836'
valueset "Ethnicity": 'urn:oid:2.16.840.1.114222.4.11.837'
valueset "Payer": 'urn:oid:2.16.840.1.114222.4.11.3591'
valueset "Atrial Fibrillation/Flutter": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.202'
valueset "Comfort Measures": 'urn:oid:1.3.6.1.4.1.33895.1.3.0.45'
valueset "Direct Thrombin Inhibitor": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.205'
valueset "Emergency Department Visit": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.292'
valueset "General or Neuraxial Anesthesia": 'urn:oid:2.16.840.1.113883.3.666.5.1743'
valueset "General Surgery": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.255'
valueset "Glycoprotein IIb/IIIa Inhibitors": 'urn:oid:2.16.840.1.113762.1.4.1045.41'
valueset "Graduated compression stockings (GCS)": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.256'
valueset "Gynecological Surgery": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.257'
valueset "Hemorrhagic Stroke": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.212'
valueset "Hip Fracture Surgery": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.258'
valueset "Hip Replacement Surgery": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.259'
valueset "Injectable Factor Xa Inhibitor for VTE Prophylaxis": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.211'
valueset "INR": 'urn:oid:2.16.840.1.113883.3.117.1.7.1.213'
```

In FHIR® Measure

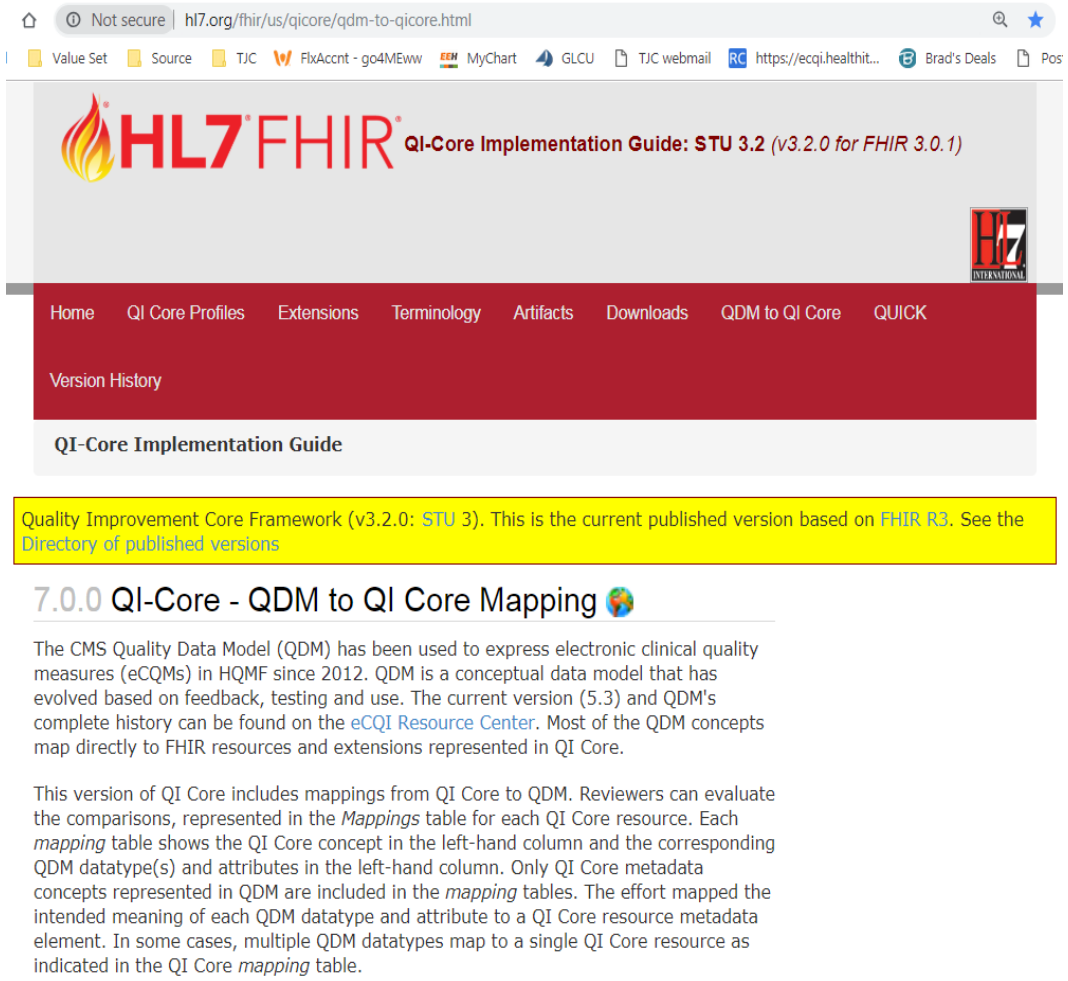
```
22  codesystem "SNOMEDCT": 'http://snomed.info/sct/731000124108'
23  codesystem "LOINC": 'http://loinc.org'
24
25  valueset "ONC Administrative Sex": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1'
26  valueset "Race": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.114222.4.11.836'
27  valueset "Ethnicity": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.114222.4.11.837'
28  valueset "Payer": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.114222.4.11.3591'
29  valueset "Atrial Fibrillation/Flutter": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.20
30  valueset "Comfort Measures": 'https://cts.nlm.nih.gov/fhir/ValueSet/1.3.6.1.4.1.33895.1.3.0.45'
31  valueset "Direct Thrombin Inhibitor": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.205'
32  valueset "Emergency Department Visit": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.292
33  valueset "General or Neuraxial Anesthesia": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.666.5.17
34  valueset "General Surgery": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.255'
35  valueset "Glycoprotein IIb/IIIa Inhibitors": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1045.
36  valueset "Graduated compression stockings (GCS)": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.11
37  valueset "Gynecological Surgery": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.257'
38  valueset "Hemorrhagic Stroke": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.212'
39  valueset "Hip Fracture Surgery": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.258'
40  valueset "Hip Replacement Surgery": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.259'
41  valueset "Injectable Factor Xa Inhibitor for VTE Prophylaxis": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.
42  valueset "INR": 'https://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113883.3.117.1.7.1.213'
```

Mapping QDM to QI-Core

- QDM to QI-Core Mapping
  * QDM v5.3 to QI-Core v3.2 for VTE-1 CQF (EXM108 v7.4)

  http://hl7.org/fhir/us/qicore/qdm-to-qicore.html

- Review mapping table



FHIR Resources supported for VTE-1 (EXM108v7)

» Resources Used:

Resource Type	Profile Name	Link to STU3 Profile
Condition	QI Core Condition Profile	QI Core Condition (STU3)
Coverage	QI Core Coverage Profile	QI Core Coverage (STU3)
DeviceRequest	DEQM DeviceRequest Profile	DEQM DeviceRequest (STU3)
DeviceUseStatement	DEQM DeviceUseStatement Profile	DEQM DeviceUseStatement (STU3)
Encounter	QI Core Encounter Profile	QI Core Encounter (STU3)
Library	CQFM Library Profile	CQFM Library (STU3)
Location	QI Core Location Profile	QI Core Location (STU3)
Measure	CQFM Measure Profile	CQFM Measure (STU3)
MeasureReport	DEQM Individual MeasureReport Profile	DEQM Individual MeasureReport Profile (STU3)
MedicationAdministration	DEQM MedicationAdministration Profile	DEQM MedicationAdministration (STU3)
MedicationRequest	DEQM MedicationRequest Profile	DEQM MedicationRequest (STU3)
Observation	QI Core Observation Profile	QI Core Observation (STU3)
Organization	DEQM Organization Profile	DEQM Organization (STU3)
Patient	QI Core Patient Profile	QI Core Patient (STU3)
Practitioner	DEQM Practitioner Profile	DEQM Practitioner (STU3)
Procedure	QI Core Procedure Profile	QI Core Procedure (STU3)
ProcedureRequest	QI Core ProcedureRequest Profile	[QI Core ProcedureRequest (STU3)]

FHIR Resources supported for VTE-1 (EXM108v7) - Encounter

In QDM-CQL measure

define "Inpatient Encounter":

["Encounter, Performed": "Encounter Inpatient"] EncounterInpatient

where "LengthInDays"(EncounterInpatient.relevantPeriod) <= 120

and EncounterInpatient.relevantPeriod ends during "Measurement Period"

In FHIR® Measure

```
define "Inpatient Encounter":
  ["Encounter": "Encounter Inpatient"] EncounterInpatient
    where EncounterInpatient.status = 'finished'
      and "LengthInDays"(EncounterInpatient.period) <= 120
    and EncounterInpatient.period ends during "Measurement Period"
```

FHIR Resources supported for VTE-1 (EXM108v7) - Condition

In QDM-CQL measure

```
Define
( Global."Inpatient Encounter" InpatientEncounter
        where not ( exists ( InpatientEncounter.diagnoses EncounterDiagnoses
                where ( EncounterDiagnoses in "Obstetrics"
                        or EncounterDiagnoses in "Venous Thromboembolism"
                        or EncounterDiagnoses in "Obstetrics VTE"
                ))) )
    intersect ( Global."Inpatient Encounter" InpatientEncounter
        without ( ["Diagnosis": "Obstetrics"]
            union ["Diagnosis": "Venous Thromboembolism"]
            union ["Diagnosis": "Obstetrics VTE"] ) Diagnosis
        such that Diagnosis.prevalencePeriod starts during Global."Hospitalization"(InpatientEncounter)  )
```

In FHIR® Measure

```
define "Admission Without VTE or Obstetrical Conditions":
    (Global."Inpatient Encounter" InpatientEncounter
    where not (Global.EncounterDiagnosis(InpatientEncounter).code in "Obstetrics"
                or Global.EncounterDiagnosis(InpatientEncounter).code in "Venous Thromboembolism"
                or Global.EncounterDiagnosis(InpatientEncounter).code in "Obstetrics VTE"
            )
    )
    intersect (Global."Inpatient Encounter" InpatientEncounter
        without ( ["Condition": code in "Obstetrics"]
                union ["Condition": code in "Venous Thromboembolism"]
                union ["Condition": code in "Obstetrics VTE"])  Diagnosis
        such that Diagnosis.clinicalStatus = 'active'
            and Diagnosis.verificationStatus = 'confirmed'
            and Global."Normalize Onset"(Diagnosis.onset) during Global."Hospitalization"(InpatientEncounter)
            )
```

FHIR Resources supported for VTE-1 (EXM108v7) – DeviceUseStatement

In QDM-CQL measure

define “No VTE Prophylaxis Device Applied”:
["Device, Not Applied": "Intermittent pneumatic compression devices (IPC)"]
union ["Device, Not Applied”: "Venous foot pumps (VFP)"]
union ["Device, Not Applied": "Graduated compression stockings (GCS)"]

In FHIR® Measure

```
define "No VTE Prophylaxis Device Applied":
  // NOTE: Should be using device.code, but that requires CQL 1.4
  (["DeviceUseStatement": code in "Venous foot pumps (VFP)"]
    union ["DeviceUseStatement": code in "Intermittent pneumatic compression devices (IPC)"]
    union ["DeviceUseStatement": code in "Graduated compression stockings (GCS)"]
  ) D
    where GetExtension(D.extension, 'http://example.org/fhir/extensions/notDone').value is true
    //where D.notDone is true // Needs a QI-Core extension to support
  )
```

FHIR Resources supported for VTE-1 (EXM108v7) – DeviceRequest

In QDM-CQL measure

define “No VTE Prophylaxis Device Ordered”:
["Device, Not Ordered": "Intermittent pneumatic compression devices (IPC)"]
union ["Device, Not Ordered": "Venous foot pumps (VFP)"]
union ["Device, Not Ordered": "Graduated compression stockings (GCS)"]

In FHIR® Measure

```
define "No VTE Prophylaxis Device Ordered":
  // NOTE: Should be using device.code, but that requires CQL 1.4
 ((
    ["DeviceRequest": code in "Venous foot pumps (VFP)"]
      union ["DeviceRequest": code in "Intermittent pneumatic compression devices (IPC)"]
      union ["DeviceRequest": code in "Graduated compression stockings (GCS)"]
  ) D
    where D.intent ~ ToConcept("Order")
      and GetExtension(D.extension, 'http://example.org/fhir/extensions/doNotPerform').value is true
    //where D.doNotPerform is true // Needs a QI-Core extension to support
  )
```

FHIR Resources supported for VTE-1 (EXM108v7) – Procedure

In QDM-CQL measure

```
define “SCIP VTE Selected Surgery”:
    ["Procedure, Performed": "General Surgery"]
        union ["Procedure, Performed": "Gynecological Surgery"]
        union ["Procedure, Performed": "Hip Fracture Surgery"]
        union ["Procedure, Performed": "Hip Replacement Surgery"]
        union ["Procedure, Performed": "Intracranial Neurosurgery"]
        union ["Procedure, Performed": "Knee Replacement Surgery"]
        union ["Procedure, Performed": "Urological Surgery"]
```

In FHIR® Measure

```
define "SCIP VTE Selected Surgery":
  ( ["Procedure": "General Surgery"]
    union ["Procedure": "Gynecological Surgery"]
    union ["Procedure": "Hip Fracture Surgery"]
    union ["Procedure": "Hip Replacement Surgery"]
    union ["Procedure": "Intracranial Neurosurgery"]
    union ["Procedure": "Knee Replacement Surgery"]
    union ["Procedure": "Urological Surgery"] ) P
    where P.status = 'completed'
```

FHIR Resources supported for VTE-1 (EXM108v7) – ProcedureRequest

In QDM-CQL measure

define “Intervention Comfort Measures”:
["Intervention, Order": "Comfort Measures"]
union ["Intervention, Performed": "Comfort Measures"]

In FHIR® Measure

```
define "Intervention Comfort Measures":
  (["ProcedureRequest": "Comfort Measures"] P
    where P.intent = 'order')
    union
    (["Procedure": "Comfort Measures"] IntervetionPerformed
    where IntervetionPerformed.status = 'completed')
```

FHIR Resources supported for VTE-1 (EXM108v7) – MedicationAdministration

In QDM-CQL measure

```
define “VTE Prophylaxis by Medication Administered”:
  ( ["Medication, Administered": "Low Dose Unfractionated Heparin for VTE Prophylaxis"] VTEMedication
                  where VTEMedication.route in "Subcutaneous route"
  )
        union ["Medication, Administered": "Low Molecular Weight Heparin for VTE Prophylaxis"]
        union ["Medication, Administered": "Injectable Factor Xa Inhibitor for VTE Prophylaxis"]
        union ["Medication, Administered": "Warfarin"]
```

In FHIR® Measure

```
define "VTE Prophylaxis by Medication Administered":
  ( ["MedicationAdministration": medication in "Low Dose Unfractionated Heparin for VTE Prophylaxis"] VTEMedication
     where VTEMedication.status = 'completed'
           and VTEMedication.dosage.route in "Subcutaneous route"
  )
    union ["MedicationAdministration": medication in "Low Molecular Weight Heparin for VTE Prophylaxis"]
    union ["MedicationAdministration": medication in "Injectable Factor Xa Inhibitor for VTE Prophylaxis"]
    union ["MedicationAdministration": medication in "Warfarin"]
```

FHIR Resources supported for VTE-1 (EXM108v7) – MedicationRequest

In QDM-CQL measure

```
define “VTE Prophylaxis by Medication Ordered”:
  ["Medication, Not Ordered": "Low Dose Unfractionated Heparin for VTE Prophylaxis"]
        union ["Medication, Not Ordered": "Low Molecular Weight Heparin for VTE Prophylaxis"]
        union ["Medication, Not Ordered": "Injectable Factor Xa Inhibitor for VTE Prophylaxis"]
        union ["Medication, Not Ordered": "Warfarin"]
```

In FHIR® Measure

```
define "No VTE Prophylaxis Medication Ordered":
  ( ["MedicationRequest": medication in "Low Dose Unfractionated Heparin for VTE Prophylaxis"]
  union
  ["MedicationRequest": medication in "Low Molecular Weight Heparin for VTE Prophylaxis"]
  union
  ["MedicationRequest": medication in "Injectable Factor Xa Inhibitor for VTE Prophylaxis"]
  union
  ["MedicationRequest": medication in "Warfarin"]
  ) MedicationOrder
  where MedicationOrder.intent = 'order'
    and GetExtension(MedicationOrder.extension, 'http://example.org/fhir/extensions/doNotPerform').value is true
    //MedicationOrder.doNotPerform is true // Needs a QI-Core extension to support
```

Gaps in FHIR Measure Conversion VTE-1 (EXM108v7) by FHIR STU3

- GForge #22786/#22797: To be able to identify a Principal / Elective procedure
- GForge #20601: need support “notDone/doNotPerform” for the following FHIR resources.
  - **DeviceUseStatement**
  - **DeviceRequest**
  - **MedicationRequest**
- Consider adding “recordedOn“ to support the timings for “MedicationAdministration.notGiven” and “Procedure.notDone”.

Profile	Timing used for Done	Timing used for doNotPerform
DeviceUseStatement	whenUsed	recordedOn
DeveiceRequest	authoredOn	authoredOn
MedicationAdministration	effective	
MedicaitonRequest	authoredOn	authoredOn
Procedure	performed	
ProcedureRequest	authoredOn	authoredOn