

## CIMI and SOLOR

**Content Binding** 

Keith Campbell, MD, PhD and Susan Matney, RN, PhD

#### **Motivations**

- FHIR profiles from CIMI detailed clinical models
- Profiles need to consistently bind to
  - SNOMED
  - LOINC
  - RxNorm
- Don't reinvent the wheel
- Collaborate where possible

### Objectives of the Meeting

Understand the CIMI SOLOR approach

Present the CIMI SOLOR Vital Signs work

Identify areas of collaboration

## CIMI/SOLOR Background

#### Why SOLOR?

- For interoperability we need
  - SNOMED CT
  - LOINC
  - RxNorm



#### The overlaps

**SNOMED CT** 

**LOINC:** Gentamicin is a component of laboratory tests

**SNOMED:** Gentamicin is a component of laboratory tests

LOINC: Gentamicin is a component
SNOMED: Gentamicin is a substance

**R**xNorm

**RxNorm: Gentamicin is an ingredient** 

**SNOMED**: Gentamicin is a PRODUCT

**SNOMED:** Gentamicin 0.3% preservative-free eye drops

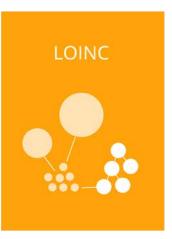
**RxNorm**: Gentamicin sulfate 0.3% Ophthalmic Solution

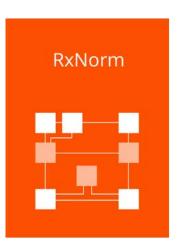
**RxNorm**: Gentamicin is a PRODUCT

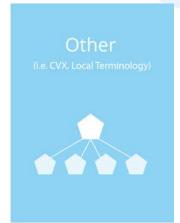


#### **SOLOR Construction**











# Clinical Information Modeling Initiative (CIMI)

- CIMI is an HL7 Work Group producing detailed clinical information models to enable interoperability of health care information systems
- CIMI conceived during a "Fresh Look" session at an HL7 meeting in 2011
- CIMI models are free for use for all purposes
- See <a href="http://www.hl7.org/Special/Committees/cimi/index.cfm">http://www.hl7.org/Special/Committees/cimi/index.cfm</a> for more details

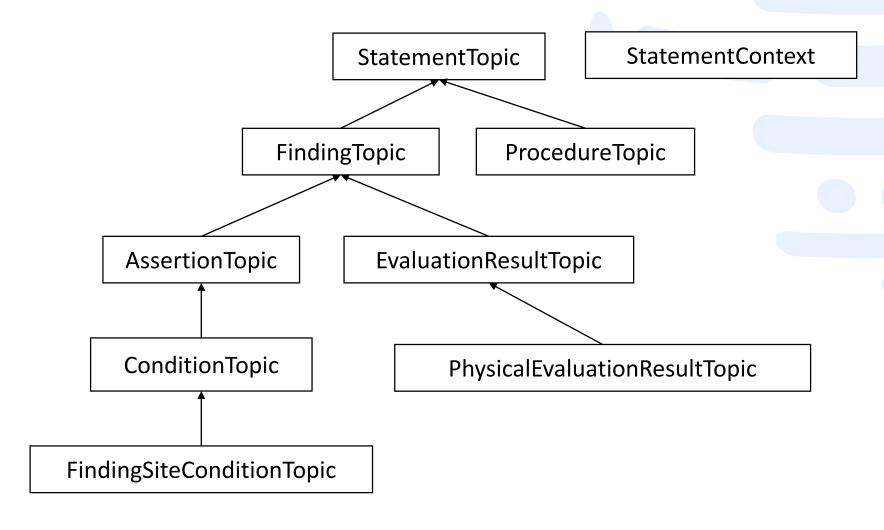
### End goal: Executable knowledge sharing

- Overcome the "curly braces problem"
- Ability to share decreases cost of implementation and deployment
- Ability to share executable knowledge reduces risk of translation/mapping/reimplementation errors

Real enablement of patient safety at scale is when we can share executable knowledge...



### **CIMI** Hierarchy



# CIMI Terminology Binding Requirements

#### CIMI Terminology Binding Requirements

- All finalized CIMI Models shall have:
  - Semantic concept binding for each data element in the model
  - A value binding for each node of type CODED\_Text
- Reference Terminologies (SNOMED, LOINC, RxNorm)

CIMI supports isosemantic models



#### **Condition Pattern**

ConditionTopic	Attribute	Range
topicCode : Concept [11]	246090004   Associated finding (attribute)	<< 404684003   Clinical finding (finding)
description: PlainText [01]	New	None
multimedia : Multimedia [0*]	New	Under development
interpretation : Concept [0*]	363713009   Has interpretation (attribute)	
severity: Concept [01]	246112005  Severity (attribute)	<< 272141005   Severities (qualifier value)
clinicalCourse : Concept [01]	263502005   Clinical course (attribute)	<< 288524001   Courses (qualifier value)
occurrence : Concept [01]	272120004  Occurrences (qualifier value)	<<272120004  Occurrences (qualifier value)
diseasePhase : Concept [01]	278174000   Disease phase (attribute)	
associatedSignAndSymptom: Concept [0*]	New	Under development
alleviatingFactor : Concept [0*]	New	
exacerbatingFactor : Concept [0*]	New	
clinicalStatus : Concept [01]	263493007   Clinical status (attribute)	
associatedEntity: EntityAssociationNOS [01]	47429007   Associated with (attribute)	Under development
dueTo : DueTo [0*]	42752001   Due to (attribute)	
<b>before</b> : TemporallyBefore [0*]	288556008  Before (attribute)	
after : TemporallyAfter [0*]	255234002   After (attribute)	

#### Constraining CIMI Model Patterns

 Based on one or more predefined reference model patterns and top level archetypes

 Value set HAS to be constrained from top level data element range

- Subtype
  - Attribute binding can stay at the higher level attribute –or–
  - Attribute can be further refined as a specialization

## SOLOR Content

#### Vital Sign Refsets

RefSet Name	Version	Date	Purpose
Blood Pressure Device Cuff Size Refset	v .1	TBD	This reference set contains concepts used to result the size of a blood pressure cuff used during a blood pressure measurement, referencing the SNOMED Code 722471002 "Size of blood pressure cuff (observable entity)" and the LOINC term "Blood pressure device Cuff size" 8358-4.
Blood Pressure Device Type Refset	v .1	TBD	This reference set contains concepts used to result the size of a blood pressure cuff used during a blood pressure measurement, referencing the SNOMED Code 722471002 "Size of blood pressure cuff (observable entity)" and the LOINC term "Blood pressure device Cuff size" 8358-4.
Blood Pressure Measurement Site Refset	v .1	TBD	This reference set contains values used to result the body location where a blood pressure was measured, referencing the LOINC term "Blood pressure measurement site", 41904-4.
Blood Pressure Method Refset	v .1	TBD	This reference set contains concepts used to result the method used for a blood pressure measurement, referencing the SNOMED Code 2291000205103 "Blood pressure method (observable entity)" and the LOINC term "Blood pressure method" 8357-6.
Body Position Refset	v .1	TBD	This reference set contains concepts used to result the patient's body position, referencing the SNOMED Code 397155001 Body position (observable entity) and the LOINC term "Body position with respect to gravity" 8326-1.
Body Temperature Device Type Refset	v .1	TBD	This reference set contains concepts used to result the type of device used to measure a body temperature, referencing the LOINC term "Type of Body temperature device" 8326-1.
Clothing Worn During Measure Refset	v .1	TBD	This reference set contains concepts used to result the amount of clothing worn during the measure, referencing the SNOMED Code 248159006 "State of dress (observable entity)" and the LOINC term "Clothing worn during measure" 8352-7.
Heart Rate Device Type Refset	v .1	TBD	This reference set contains concepts used to result the type of device used to measure a heart rate, referencing the SNOMED Code 1511000205100  Heart rate device type (observable entity) and the LOINC term "Type of Heart rate device" 8887-2.

Blood pressure device cuff size reference set (foundation metadata concept)

SCTID: 1481000205107, Primitive, Active, Published

Term	Acceptability (US)	Published
F ☆ Blood pressure device cuff size reference set (foundation metadata concept) ♣	Preferred	Published 3
S ★ Blood pressure device cuff size reference set □	Preferred	Published
D ★ This reference set contains concepts used to result the size of a blood pressure cuff used during a blood pressure measurement, referencing the SNOMED Code 722471002 "Size of blood pressure cuff (observable entity)" and the LOINC term "Blood pressure device Cuff size" 8358-4.	Preferred	Published ®

Туре	Destination	Group	CharType	Published
Is a (attribute)	Simple type reference set (foundation metadata concept)	0	Stated	Published
				17

#### Blood Pressure device cuff size reference set

Term	Concept ID
Blood pressure cuff, adult size (physical object)	720737000
Blood pressure cuff, adult size large (physical object)	720738005
Blood pressure cuff, adult size small (physical object)	720739002
Blood pressure cuff, adult thigh type (physical object)	720740000
Blood pressure cuff, ankle type (physical object)	8741000205104
Blood pressure cuff, extra large adult thigh cuff (physical object)	8731000205109
Blood pressure cuff, infant size (physical object)	8861000205108
Blood pressure cuff, neonatal size 1 (physical object)	8841000205107
Blood pressure cuff, neonatal size 2 (physical object)	8851000205105
Blood pressure cuff, neonatal size 3 (physical object)	8821000205104
Blood pressure cuff, neonatal size 4 (physical object)	8811000205106
Blood pressure cuff, neonatal size 5 (physical object)	8801000205109
Blood pressure cuff, pediatric size (physical object)	720736009

## Model Examples

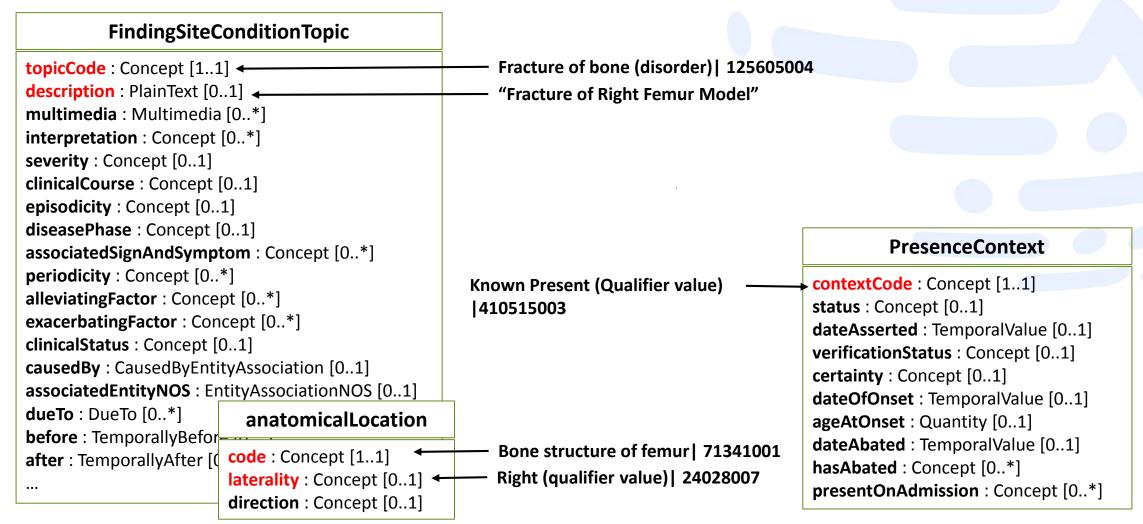
### Systolic Blood Pressure

**DCM Name**: SystolicBloodPressure **Underlying Pattern**: PhysicalEvaluationResult From LOINC Topic Code: Systolic blood pressure (8480-6) Core part of And/or SNOMED CT Systolic arterial pressure (72313002 model – Q/A Consists of a logical model result integer pattern that imparts the Quantity with units: mm Hg model's structure and a set of constraints that **Blood Pressure Body Location** bodyLocation gives meaning to the Subset of concepts from body structure pattern (blue in diagram). Qualifying core 901000205107 |Blood pressure measurement site reference set part of model From SNOMED CT **Patient Position** Device Subset of concepts from Physical objects 1471000205105 |Blood pressure device type reference set

# Condition "Chronic Hypertension"

#### ConditionTopic Hypertensive disorder, systemic arterial (disorder) | 38341003 topicCode : Concept [1..1] **description**: PlainText [0..1] "Chronic Hypertension Model" multimedia: Multimedia [0..\*] interpretation: Concept [0..\*] severity: Concept [0..1] Chronic (qualifier value) | 90734009 clinicalCourse : Concept [0..1] ← episodicity : Concept [0..1] diseasePhase: Concept [0..1] **PresenceContext** associatedSignAndSymptom: Concept [0..\*] **periodicity**: Concept [0..\*] contextCode : Concept [1..1] **Known Present (Qualifier value)** alleviatingFactor: Concept [0..\*] status: Concept [0..1] 410515003 exacerbatingFactor: Concept [0..\*] dateAsserted: TemporalValue [0..1] clinicalStatus : Concept [0..1] verificationStatus: Concept [0..1] causedBy: CausedByEntityAssociation [0..1] certainty : Concept [0..1] associatedEntityNOS: EntityAssociationNOS [0..1] dateOfOnset: TemporalValue [0..1] dueTo: DueTo [0..\*] ageAtOnset: Quantity [0..1] **before**: TemporallyBefore [0..\*] dateAbated: TemporalValue [0..1] after: TemporallyAfter [0..\*] hasAbated : Concept [0..\*] presentOnAdmission : Concept [0..\*]

### Condition Exercise "Fractured Right Femur"



# Condition "No Bone Fractures"

#### **FindingSiteConditionTopic** Fracture of bone (disorder) | 125605004 topicCode : Concept [1..1] **description**: PlainText [0..1] "No Fracture of Bone Model" multimedia: Multimedia [0..\*] interpretation: Concept [0..\*] severity: Concept [0..1] clinicalCourse: Concept [0..1] episodicity: Concept [0..1] diseasePhase: Concept [0..1] associatedSignAndSymptom: Concept [0..\*] **periodicity**: Concept [0..\*] Known Absent (Qualifier value) | alleviatingFactor: Concept [0..\*] 410516002 exacerbatingFactor: Concept [0..\*] clinicalStatus : Concept [0..1] causedBy: CausedByEntityAssociation [0..1] associatedEntityNOS: EntityAssociationNOS [0..1] dueTo: DueTo [0..\*] anatomicalLocation **before**: TemporallyBeforcode: Concept [1..1] **after**: TemporallyAfter [( laterality: Concept [0..1] direction: Concept [0..1]

#### **PresenceContext**

status : Concept [0..1]

**dateAsserted**: TemporalValue [0..1] **verificationStatus**: Concept [0..1]

**certainty**: Concept [0..1]

dateOfOnset: TemporalValue [0..1]

ageAtOnset : Quantity [0..1]

dateAbated: TemporalValue [0..1]

hasAbated : Concept [0..\*]

presentOnAdmission : Concept [0..\*]

# Lab Evaluation Result Exercise "Blood Hemoglobin of 6.1 g/dl is Critically Low"

\* Note this is the model for the instance above. LaboratoryTestResultTopic Hemoglobin [Mass/volume] in Blood LN 718-7 topicCode : Concept [1..1] ← **description**: PlainText [0..1] ← "Hemoglobin, Blood, Mass/Volume Model" multimedia: Multimedia [0..\*] **interpretation**: Concept [0..\*] **Critically Low (need SCT code)** method : Concept [0..\*] **device**: ClinicalDevice [0..\*] **referenceRange**: ReferenceRange [0..\*] evaluationProcedure : ProcedurePerformedStmt [0..1] **precondition**: Concept [0..\*] LaboratoryTestResultContext partOf : ProcedureStatement [0..\*] **basedOn**: ClinicalStatement [0..\*] Recorded (need new code)contextCode : Concept [1..1] **derivedFrom**: ClinicalStatement [0..\*] status : Concept [0..1] Final report (record artifact)diagnosticService : Concept [0..1] issued: Instant [0..1] **specimen**: Specimen [0..\*] comment : PlainText [0..1] poctIndicator: Concept [0..1] **observed**: Attribution [0..1] exceptionValue : Concept [0..1] **deltaFlag**: Concept [0..1] resultValue : DataType [1] Gram/deciliter (qualifier value) **specimenCollectionTime**: TemporalValue [0..1]

#### Evaluation Result Exercise "Patient's skin turgor decreased"

#### Physical Evaluation Result Topic

topicCode : Concept [1..1]

description : PlainText [0..1]

multiple dia : Multiple dia [0..\*]

multimedia: Multimedia [0..\*] interpretation: Concept [0..\*]

method : Concept [0..\*]

**device**: ClinicalDevice [0..\*]

referenceRange : ReferenceRange [0..\*]

evaluationProcedure : ProcedurePerformedStmt [0..1]

precondition : Concept [0..\*]

partOf : ProcedureStatement [0..\*]
basedOn : ClinicalStatement [0..\*]
derivedFrom : ClinicalStatement [0..\*]

diagnosticService : Concept [0..1]

poctIndicator : Concept [0..1]

...

\* Only new constraints are shown in diagrams

#### **EvaluationResultContext**

contextCode: Concept [1..1]

status : Concept [0..1]
issued : Instant [0..1]

Skin Turgor | LNC 39109-4

"Skin Turgor Model"

comment : PlainText [0..1]
observed : Attribution [0..1]
exceptionValue : Concept [0..1]

deltaFlag : Concept [0..1]
resultValue : DataType [1]

Decreased skin turgor (finding) | SCT 425244000

#### **SOLOR** Information

- SOLOR project information on HSPC Confluence
  - o <a href="https://healthservices.atlassian.net/wiki/spaces/SOLOR/overview">https://healthservices.atlassian.net/wiki/spaces/SOLOR/overview</a>
- Sources for Documentation and Tools
  - KOMET <a href="https://github.com/OSEHRA/komet">https://github.com/OSEHRA/komet</a>
  - ISAAC <a href="https://github.com/OSEHRA/ISAAC">https://github.com/OSEHRA/ISAAC</a>
- SOLOR JIRAs
  - https://healthservices.atlassian.net/projects/SOL/summary
  - https://healthservices.atlassian.net/projects/SIK/summary
- SOLOR Website
  - o <a href="http://solor.io">http://solor.io</a>
  - http://solor.io/blog/
- SOLOR Viewer App and User Guide
  - Navigate to Learn More section of <a href="http://solor.io">http://solor.io</a>



