CDISC Library: Integrating and Surfacing 360 Content

Presented by Sam Hume, DSc
VP, Data Science
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Setting the Scene

High level overview that shows our initial efforts to integrate CDISC 360 content across the project work stream to generate outputs that can be surfaced for inspection
CDISC 360 and the CDISC Library

Goals:
• Increase study implementation automation
• Reduce study implementation variability

Building Tools using the CDISC Library
Create additional concept-based metadata published via the CDISC Library to support software tools that will provide additional study implementation automation while reducing the variability across CDISC standards implementations.
Integration: Data Flow Across the Workstreams

- Uses Biomedical Concepts to generate a CRF and Define-XML
- Uses BCs and CDISC Library to create a simple study specification
- Uses automation to test the metadata content
- Shows small subset of the work done in CDISC 360 to date

Demo Constraints:
- Focused on use cases 1 & 2
- Focused on work streams 1-5
- Focused on VS domain
- Not fully end-to-end
Enhance Standards: Workstream 1

Creating Templates and Biomedical Concepts to Enhance our Standards Metadata
Enhance Standards (Workstream 1): Creating Biomedical Concepts (BCs)
Vital Signs Biomedical Concept Template

Vital Signs Measurement (C49672)
- has
  - Collection Date Time (C82515)
  - Body Position (Code C62164)
  - Procedure Location (C117525)
  - Procedure Laterality (C117526)

Vital Signs Result (c-code pending)
- may have
  - Reference Range (C71474)
  - Clinical Significance (C82582)

Reference Range Comparison (C122757)
- may be used in

Normal Range Comparison Result (C122756)
Blood Pressure Concept Map

- Blood Pressure (C0005823)
  - Laboratory Test Result (C36292)
    - Unit of Measure (C25709)
      - mmHg (C49670); cmHg (C147129)
  - Procedure Location (C117525)
    - Procedure Laterality (C117526)
      - Laterality (C99073)
        - LEFT (C25229); RIGHT (C25228)
  - Anatomical Location (C74456)
    - commonlyUsedCodes
      - ARM (C32141)
        - leg (C32974)
          - calf (C93027)
            - finger (C32608)
  - Vital Signs Test Code (C83466)
    - usesNCICodelist
  - Vital Signs Test Name (C49672)
    - usesNCICodelist
  - Vital Signs Test Code (C86741)
    - usesCodes
  - Vital Signs Test Name (C67153)
    - usesCodes

- Systolic Blood Pressure (C1306620); Diastolic Blood Pressure (C1305849)
  - SYSBP
    - (C1306620)
  - DBP
    - (C1305849)

- Planned Time Points (C2826271)
  - specify Time Points
    - Body position (C62164)
      - usesNCICodelist
    - Position (C71148)
      - defaultCode
        - SITTING (C62122)
  - Collection date/time (C82515)
    - usesCodes
    - commonlyUsedCodes
      - SITTING (C62122); SUPINE (C62167); STANDING (C62166);
        DECUBITUS (C77532); FOWLER'S (C62173);
        LATERAL DECUBITUS (C100758); LEFT LATERAL DECUBITUS (C62172);
        PRONE (C62163); REVERSE TREDELENBURG (C62169);
        RIGHT LATERAL DECUBITUS (C62171); SEMI-FOWLER'S (C62174);
        SEMI-RECUMBENT (C111310); SLING (C92604);
        TREDELENBURG (C62168); UNCONSTRAINED (C90480)
## Creating BCs in Excel

<table>
<thead>
<tr>
<th>#</th>
<th>C-code</th>
<th>Biomedical Concept</th>
<th>Definition</th>
<th>Test Code</th>
<th>Test Name</th>
<th>Unit</th>
<th>Unit Type</th>
<th>Anatomic Location</th>
<th>Position</th>
<th>Result Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pending</td>
<td>Diastolic Blood Pressure</td>
<td>The blood pressure after the contraction of the heart while the chambers of the heart refill with blood. (NCI)</td>
<td>DIABP (C25299)</td>
<td>Diastolic Blood Pressure (C25299)</td>
<td>mmHg (C49670)</td>
<td>TBD</td>
<td>N/A</td>
<td>DECUBITUS (C77532); FOWLERS (C62173); LATERAL DECUBITUS (C100758); LEFT LATERAL DECUBITUS (C62172); PRONE (C62165); REVERSE TRENDELENBURG (C62169); RIGHT LATERAL DECUBITUS (C62171); SEMI-FOWLERS (C62174); SEMI-RECUMBENT (C111310); SITTING (C62122); SLING (C92604); STANDING (C62165); SUPINE (C62167); TRENDELENBURG (C62168); UNCONSTRAINED (C90480)</td>
<td>Numeric</td>
</tr>
<tr>
<td>2</td>
<td>Pending</td>
<td>Systolic Blood Pressure</td>
<td>The blood pressure during the contraction of the left ventricle of the heart. (NCI)</td>
<td>SYSBP (C25298)</td>
<td>Systolic Blood Pressure (C25298)</td>
<td>mmHg (C49670)</td>
<td>TBD</td>
<td>N/A</td>
<td>DECUBITUS (C77532); FOWLERS (C62173); LATERAL DECUBITUS (C100758); LEFT LATERAL DECUBITUS (C62172); PRONE (C62165); REVERSE TRENDELENBURG (C62169); RIGHT LATERAL DECUBITUS</td>
<td>Numeric</td>
</tr>
</tbody>
</table>
What do Biomedical Concepts Do?

• A biomedical concept is a unit of knowledge created by a unique combination of characteristics (ISO 11179)
  • Independent of a standards implementation

• Include an identifier, name, label, and definition

• Specify valid units

• Specify the needed qualifiers

• Specify valid controlled terminology subsets
Publish Standards: Workstream 2
Transforming Biomedical Concepts into Machine-readable Metadata and Publishing them via the CDISC Library
Publish Standards (Workstream 2): Transforming BCs into Machine-readable Metadata

Generating the CRF and Define-XML are for testing purposes
What does the CDISC Library Do?

- Provides access to CDISC standards metadata
- Machine-readable metadata as linked data
- Provides access to the CDISC controlled terminology
- Ultimately will provide access to the foundational standards as well as the CDISC 360 content via the API
Generating the Vitals Signs CRF: What’s Missing?

- What vital signs tests are included
- What units apply per tests
- What qualifiers are required for a specific test
- Valid controlled terminology subsets
- Common vs repeating content
- Specific (ODM) datatypes
- Length and SignificantDigits
Question: Where is the Height Variable?

- Height is a VS TEST, but not a variable
- You might think of Height as a virtual variable
- It needs to be defined as a Data Element for use as a field in CDASH, or a variable in SDTM
- Biomedical Concepts help us to create a Height data element
Transforming Biomedical Concepts into JSON

"designation": "Height",
"conceptId": "X25347",
"label": "Height Biomedical Concept",
"definition": "The vertical measurement or distance from the base…",
"testCode": "HEIGHT",
"testConceptId": "C25347",
"testName": "Height",
"loincCode": "8302-2",
"resultType": "Numeric",
"unitList": ["cm (C49668)", "in (C48500)", "mm (C28251)"],
"standardUnit": "cm (C49668)"
Standards and Biomedical Concepts Work Together

VS Domain from CDISC Library

Height BC from CDISC 360
Applying Biomedical Concepts

- CDISC Library
  - Controlled Terminology
  - Template Definition
- Biomedical Concept Definitions
- Standards Bindings
  - CDASHIG 2.0 Bindings
  - SDTMIG 3.2 Bindings
- Operational Outputs
  - CRF
  - Define-XML
Applying Biomedical Concepts: Binding to Standards

CDISC 360
VS Biomedical Concepts
- Height
- Weight
- Heart Rate
- Diastolic BP
- Systolic BP
- ...

IG/TAUG
Bindings
- testName
- unitList
- bodyPosition
- dataType
- length
- significantDigits
- identifierRole

CDISC Library
CDASHIG 2.0
VS Fields
- VSTEST
- VSORRES
- VSORRESU
- VSPOS
- STUDYID
- ...

VSORRESU
We want to select a set of vital signs concepts
ODM CRF Generated using BCs, Bindings, & Standards

ODM-based VS CRF

Stylesheet rendering of ODM VS CRF
Generating a Vital Signs Define-XML: What’s Missing?

• Value Level Metadata

• List of applicable tests

• Valid set of units for each test

• ODM Datatypes for Define-XML

• Length and SignificantDigit values

• Standard units

• Valid controlled terminology subsets (e.g. body position)
Define-XML Generated using BCs, Bindings, & Standards

Define-XML v2.1 VLM

```
<MetaDataVersion Description="SDTMIG BC Define-XML Example" Name="SDTM Define Example"
OID="MDV.CDISC360.DEM01">
  <def:Standards>
    <def:Standard Name="SDTMIG" OID="STD.1" Status="Final" Type="IG" Version="3.2"/>
    <def:Standard Name="CDISC/OC" OID="STD.2" PublishingSet="SDTM" Status="Final" Type="CT" Version="2019-06-29"/>
  </def:Standards>
  <def:ValueListDef OID="VL.VS.VSORES">
    <ItemRef ItemOID="IT.VS.VSORES.Temperature" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.TEMP"/>
    <ItemRef ItemOID="IT.VS.VSORES.Height" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.HEIGHT"/>
    <ItemRef ItemOID="IT.VS.VSORES.DiastolicBP" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.DIAMBP"/>
    <ItemRef ItemOID="IT.VS.VSORES.SystolicBP" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.SYSBP"/>
    <ItemRef ItemOID="IT.VS.VSORES.Weight" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.WEIGHT"/>
    <ItemRef ItemOID="IT.VS.VSORES.HeartRate" Mandatory="No"/>
    <WhereClauseRef WhereClauseOID="VC.VS.VTESTCD.HR"/>
  </def:ValueListDef>
```

Stylesheet rendering of Define-XML VS

<table>
<thead>
<tr>
<th>VS (Vital Signs)</th>
<th>[SDTMIG 3.2]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STUDY</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>DOMAIN</strong></td>
<td>Text, 2</td>
</tr>
<tr>
<td><strong>VSRECORD</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>VSRECCT</strong></td>
<td>Text, 8</td>
</tr>
<tr>
<td><strong>VSRECCT.REFDS</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>VSTEST</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>VSTEST.REFDS</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>TEST</strong></td>
<td>Text, 40</td>
</tr>
<tr>
<td><strong>TEST.REFDS</strong></td>
<td>Text, 40</td>
</tr>
</tbody>
</table>

#CDISCUS | #ClearDataClearImpact
Define: Workstream 4

Define a Standards-based Study Specification for Developing Study Specific Standards Metadata
Define (Workstream 4): Create Standard Specification
Using a Study Metadata Library to Configure the Study Specification

1. Specify Study Definition
2. Study metadata
3. Select & Configure Biomedical Concepts
4. Select & Configure Schedule of Assessment
5. List Study Metadata
6. Generate Study Specification
7. SDTM define.xml specification

UC1
- Specify Study Definition
- Study metadata
- Select & Configure Biomedical Concepts
- Select & Configure Schedule of Assessment
- List Study Metadata
- Generate Study Specification
- SDTM define.xml specification

UC1&2 shared
- CDISC Library
- Standards Work Library
- Search standard definitions
- Load standard definitions
- Study metadata
- Test data
- SDTM define.xml specification

UC2
- Select & Configure SDTM mapping
- List Study Metadata
- Generate Study Specification
- SDTM define.xml specification

Metadata Listings

Standards test data

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- SDTM define.xml specification

Metadata Listings

Standards test data
Selecting & Configure Study Specification Content

Vital Signs in the Working Library

VSORRES in the Working Library

```json
{
    "core": "HR",
    "question": "What was the result of the measurement?",
    "name": "VSORRES",
    "data_type": "Char",
    "definition": "Result of the vital signs measurement as originally received or collected."
    "label": "Vital Signs Result",
    "prompt": "Result",
    "ordinal": 16
}
```
Build: Workstream 5

Build Study Metadata Artifacts
Build (Workstream 5): Generate Study Metadata Artifacts
We want to generate a CRF from CDISC Library

Would you like to measure Blood Pressure and Heart Rate at multiple time points?

Yes
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed

No
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed

Select time points
- 5 minutes pre-dose
- 30 minutes post-dose
- 1 hour post-dose
- 2 hour post-dose
- 4 hour post-dose
- 8 hour post-dose
Select the versions of the standards to use

Which CDASH version is needed?
- Option 1.1
- Option 2.0

Which Terminology version is needed?
- 2019-09-03
- 2019-06-06
- 2019-03-01
- 2018-11-20
Generate a Vital Signs CRF based on ODM

Common fields appear once

Test fields repeat
<table>
<thead>
<tr>
<th>Variable</th>
<th>Where Condition</th>
<th>Label / Description</th>
<th>Type</th>
<th>Length or Display Format</th>
<th>Controlled Terms or ISO Format</th>
<th>Origin / Source / Method / Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUDYID</td>
<td></td>
<td>Unique identifier for a study.</td>
<td>text</td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>DOMAIN</td>
<td></td>
<td>Two-character abbreviation for the domain.</td>
<td>text</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>USUBJID</td>
<td></td>
<td>Identifier used to uniquely identify a subject across all studies for all applications or submissions involving the product.</td>
<td>text</td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>VSEQ</td>
<td></td>
<td>Sequence Number given to ensure uniqueness of subject records within a domain. May be any valid number.</td>
<td>integer</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>VTESTCD</td>
<td></td>
<td>Short name of the measurement, test, or examination described in VTEST. It can be used as a column name when converting a dataset from a vertical to a horizontal format. The value in VTESTCD cannot be longer than 8 characters, nor can it start with a number (e.g., &quot;1TEST&quot;). VTESTCD cannot contain characters other than letters, numbers, or underscores. Examples: SYSBP, DIABP, BMI.</td>
<td>text</td>
<td></td>
<td>8 Vital Signs Test Code [6 Terms]</td>
<td></td>
</tr>
<tr>
<td>VTEST</td>
<td></td>
<td>Nomenclature name of the test or examination used to obtain the measurement or finding. The value in VTEST cannot be longer than 3 characters. Examples: Systolic Blood Pressure, Diastolic Blood Pressure, Body Mass Index.</td>
<td>text</td>
<td></td>
<td>40 Vital Signs Test Name [6 Terms]</td>
<td></td>
</tr>
<tr>
<td>VSORRES</td>
<td></td>
<td>Result of the vital signs measurement as originally received or collected.</td>
<td>text</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;TEMP&quot;</td>
<td></td>
<td>VSORRES for Temperature</td>
<td>float</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;HEIGHT&quot;</td>
<td></td>
<td>VSORRES for Height</td>
<td>float</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;DIABP&quot;</td>
<td></td>
<td>VSORRES for Diastolic Blood Pressure</td>
<td>integer</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;SYSBP&quot;</td>
<td></td>
<td>VSORRES for Systolic Blood Pressure</td>
<td>integer</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;WEIGHT&quot;</td>
<td></td>
<td>VSORRES for Weight</td>
<td>float</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>VTESTCD = &quot;HR&quot;</td>
<td></td>
<td>VSORRES for Heart Rate</td>
<td>integer</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>VSORRESU</td>
<td></td>
<td>Original units in which the data were collected. The unit for VSORRES. Examples: IN, LB, BEATS/MIN.</td>
<td>text</td>
<td></td>
<td>20</td>
<td>Units for Vital Signs Results Temperature</td>
</tr>
<tr>
<td>VTESTCD = &quot;TEMP&quot;</td>
<td></td>
<td>VSORRESU for Temperature</td>
<td>text</td>
<td></td>
<td></td>
<td>&quot;°C&quot;, &quot;°F&quot;</td>
</tr>
</tbody>
</table>
Conclusion

What does the demonstration tell us?
Key Points

• The new CDISC 360 metadata enables implementers to more completely generate metadata artifacts

• The metadata can be used by different technology implementations

• Future sprints will incrementally change the metadata used in the demo

• Future sprints will expand on the scope of the current demonstration

• Ultimately, the new metadata will be available in the CDISC Library
Session 3, Track B: CDISC 360 Use Cases - Industry Perspectives

• Use Case 1: DEFINE - End to Start Standards Specification

• Use Case 2: BUILD - Study Configuration & Artifact Creation

• Use Case 3: EXECUTE - Automated Data Processing

• Pacific Ballroom 14-15
  • 14:00 – 15:30
Thank You!