

U.S. Health and Human Services

Office of the National Coordinator for Health IT

Standards & Interoperability Framework

Health eDecisions Initiative

Health eDecisions Schemas (HeDS) Implementation Guide

October 2012

Revision History

|  |  |  |
| --- | --- | --- |
| Date | Document Version | Document Revision Description |
| 10/3/2012 | 0.1 - Draft | First outline of HeD Implementation Guide outline for review with workgroup |
| 10/10/2012 | 0.2 - Draft | Working Draft on Health eDecisions Schema and implementation guidance |
| 10/13/2012 | 0.3 - Draft | Working Draft – week of October 15 |

Acknowledgements

The authors of this document wish to recognize the following participants who contributed their time and expertise to the development of this guide.

* Alicia Morton
* Aziz Boxwala
* Bernadette Minton
* Bryn Rhodes
* Davide Sottara
* Rob Mcclure
* Tonya Hongsermeier
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This material includes content from the Agency for Healthcare Research and Quality (AHRQ) and its eRecs project.

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# Executive Summary

In support of the national objectives for healthcare reform, the Office of the National Coordinator for Health Information Technology (ONC) Standards and Interoperability (S&I) Framework has sponsored the development of harmonized interoperability specifications. These specifications are designed to support national health initiatives and healthcare priorities, including Meaningful Use, the Nationwide Health Information Network, and the ongoing mission to improve population health.

The nation is reaching a critical mass of Electronic Health Records (EHRs) that comply with data and vocabulary standards. Providers seeking to meaningfully use EHRs face a variety of challenging tasks. Those tasks include assessing needs, selecting and negotiating with a system vendor or reseller, implementing project management, and instituting workflow changes to improve clinical performance, control costs, and ultimately, outcomes. Additionally, many providers face the challenge of integration and interoperation with disparate systems. Many institutions use their own proprietary vocabularies and data models. Though it may offer some internal flexibility, it comes at a high, often hidden long term maintenance cost.

In support of this wide deployment of EHRs, there is an opportunity to implement a health learning system that includes clinical decision support (CDS) and provides a broad range of benefits that can contribute towards improved health of individuals and the population as a whole (refer to “Digital Infrastructure for the Learning Health System: The Foundation for Continuous Improvement in Health and Health Care: Workshop Series Summary” listed in Appendix A – Referenced Documents).

The S&I Framework Health eDecisions Initiative (HeD) is developing a foundational specification, reusing much of the work currently done in CDS standardization, to enable the structuring and encoding of CDS content for use as “knowledge artifacts”. These artifacts can be used in support of many areas of the healthcare system, including quality and utilization measures, disease outbreaks, comparative effectiveness analysis, efficacy of drug treatments and monitoring health trends. One of the key benefits of this proposed approach is the definition of a ‘lingua franca’ for the exchange of CDS knowledge and artifacts. Rather than having an unscalable network of point-to-point communication, each with its own set of transformations, different organizations will only need to transform their content in an HeD-compatible format to communicate effectively with any other point in the network of providers that comprise today’s health care system. If the models and vocabularies are rich enough in the future, some vendors may opt to use HeD as an internal specification.

This implementation guide is developed in support of the HeD Artifact Sharing Use Case and is intended to assist implementers in the development of Clinical Decision Support (CDS) Knowledge Artifacts. The approach adopted in this implementation guide is designed to be flexible and reusable, and to provide a baseline for vendors and implementers.

# Introduction

In this introductory section, the approach and purpose for the CDS Knowledge Artifact implementation guide will be outlined and discussed.

## Purpose and Approach

This implementation guide defines a specification for implementers to use when developing and integrating a Clinical Decision Support (CDS) Knowledge Artifact. The specification defined in this implementation guide is based on a harmonization of existing standards and specifications as the primary mechanism for structuring knowledge artifacts. This guide is laid out to support the following implementation objectives:

1. What are the standards upon which the Health eDecisions schema is built and how do they contribute to this new standard? Why where they chosen? How do they play together to solve this important problem and what piece of which standard is used in this guide and why? Are these supporting standards well documented and is the documentation accessible to the implementer?
2. What are the key concepts and components defined by the guide and how do they relate to one another?

The technical approach adopted is designed to provide a catalog of components to be used in generating knowledge artifacts, with a specific focus on defining the structure of the components and how they work together.

This implementation guide also focuses not only on structure but also on semantics through the use of standard terminologies, value sets and taxonomies such as SNOMED CT and that the specifications will highlight terminology bindings where defined and required.

This approach is designed to support multiple goals for implementers:

1. **Maintenance**: Any subsequent change to components used in generating knowledge artifacts will be made in a single source guide which can then be republished and made available to the clinical decision support community in developing CDS knowledge artifacts.
2. **Translation**: The implementation guide would be the natural home for transformation and mapping rules for individual CDS knowledge artifact components and the methods of transformation and specific examples to support the transforms would be built into the structure of the implementation guide. Examples of the transformations supported through this guide includes translations from the HealtheDecisions schema to the HL7 Order Sets DSTU and HL7 Arden Syntax.
3. **Modularity**: Those familiar with the CDS Knowledge Artifact Implementation Guide and its defined components would be able to mix and match specific components needed to support the development of CDS knowledge artifacts, lessening the stress and complexity faced by integrators by supporting a layer of optionality for implementation..
4. **Compatibility**: Issues of incompatibility between various knowledge artifacts can be addressed within one harmonized schema format that can structurally map to multiple CDS knowledge artifacts, so that all EHR and CDS systems operate using the same set of components, constraints, terminologies, and value sets.
5. **Ease of Use** – the structure of this implementation guide is designed in a way that makes implementing and integrating the CDS Knowledge Artifact use minimal implementation resources, provides enough constraint to ensure CDS Knowledge Artifacts are free of technical content errors, and ensure that the artifact blends easily into the user’s workflow

The approach taken to develop the CDS Knowledge Artifact Implementation Guide has some similarity to existing approaches that have been used to develop balloted implementation guides, such as the approach used to develop a template library within the HL7 Implementation Guide for CDA® Release 2: IHE Health Story Consolidation, DSTU Release 1.1 - .(US Realm),

The CDS Knowledge Artifact Sharing Specification is an implementation specification structured as a series of layered constraints for each of the components used in the CDS Knowledge Artifact. This implementation guide adopts specific constraints defined in each of the harmonized standards (vMR, CDSC L3, and CREF) and then adds constraints through conformance statements that further define and restrict the sequence and cardinality of components and the vocabularies for coded elements. These conformance statements are defined within the implementation guide at a high level to support initial piloting and adoption of the knowledge artifact.

### How the CDS Knowledge Artifact Works

The CDS Knowledge Artifact is the structureded and encoded format that this implementation guide supports. To help in understanding what the format of the artifact looks like, it is important to understand the actions and states that the knowledge artifact may go through in its lifecycle.

The processes in red show the different actions that a CDS Knowledge Artifact goes through – creation of the artifact(**Created**), publication of the artifact by a CDS Content Supplier (**Published**), review of the CDS Knowledge Artifact (**Reviewed**) and retirement of the artifact from use (**Retired**)

The processes in green show the different states that a CDS Knowledge Artifact goes through – creating prior to publication (**Draft**), active once published (**Active**), and retired (**Inactive**).

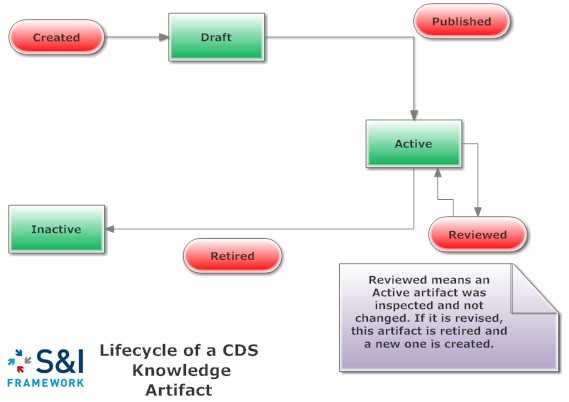


Figure - CDS Knowledge Artifact Lifecycle

### Extensibility of Knowledge Artifacts

The CDS Knowledge Artifact types and components are designed to support extensibility by implementers, which allows for vendors to employ flexibility when assembling the artifacts. The proposed new Health eDecisions schema incorporates a base level of conformance, using conformance language as structured using guidance in Section 2.5.3.4, and then allows for flexibility by implementers in determining the additional attributes and values that may be applied to artifact components.

## Audience

The audience of this implementation guide includes, but is not limited to, software developers, vendors, policy makers, and other HIT implementer parties that are interested in developing and consuming CDS knowledge artifacts. This implementation guide also specific covers consumers and integrators of the CDS Knowledge Artifact.

### Requisite Knowledge of Audience

This section includes pre-requisites for implementers and other users of the CDS Knowledge Artifact Sharing Specification. Specific prerequisites for CDS implementations using the CDS Knowledge Artifact Sharing Specification include the following:

* Implementers should have a strong knowledge of the S&I Framework HeD Artifact Sharing Use Case and an understanding of Section 11 (Dataset Requirements)
* Implementers must have a strong understanding in the use of XML, specifically XML Schema.
* Implementers should have a strong knowledge of the standards underlying this implementation guide, including:
  + The HL7 Virtual Medical Record (vMR) standard
  + The HL7 Arden Syntax standard
* Implementers should reference existing documentation and schemas on the CDSC L3 schema (as noted in Appendix A – References)
* Implementers should reference existing documentation from the Agency for Healthcare Research and Quality (AHRQ) and their eRecs project.
* Implementers should reference existing documentation and schemas on the Allscripts CREF schema (as noted in Appendix A – References)
* Implementers should reference existing documentation and schemas on the Guidelines Element Model (GEM)

For those implementers without requisite knowledge in these areas, it is HIGHLY RECOMMENDED to read each of the documents defined in Appendix A – Referenced Documents.

## Scope of the Guide

As defined in HeD Use Case 1, the scope of this implementation guide is limited to the CDS Knowledge Artifact and the different components that will be included in the knowledge artifact. This includes how to structure and encode the data elements for each of these components, and the structuring of the data elements into different knowledge artifact types. The three artifact types that are in scope are:

* Event Condition Action (ECA) Rules
* Order Sets
* Documentation Templates

Specifically out of scope is the usage of the knowledge artifact with defined system behaviors, such as how to generate the artifact, how to export and import it, or how to populate a knowledge artifact using data from an existing system, such as an Electronic Health Record (EHR). Each of these system behaviors is specifically excluded from this implementation guide.

As part of the scope, validation of the knowledge artifact is included within scope, for high level conformance with the Health eDecisions Schema, which is the XML schema based off of the harmonized standards and specifications identified by HeD to satisfy Use Case 1 requirements. Conformance requirements are currently defined at a high level and are limited to the structure and encoding of the knowledge artifact. Additionally, schematron rules will be defined to express conformance constraints.

## Alignment to HeD Artifact Sharing Use Case

The specific requirements implemented within this guide are focused on the structure, format, and encoding of a CDS knowledge artifact. These requirements are directly tied to the HeD Artifact Sharing Use Case and as noted in Section 2.2.1 of this guide, a thorough understanding of the use case is expected for implementation.

Full material on the HeD Artifact Sharing Use Case can be found here:

<http://sibrowser.siframework.org/siclient/view?type=artifact&id=b3f1c2b0-626e-4c28-91fb-5c79e9d461bc&name=SIFramework_HeD_UC1_CDSArtifactSharing_v1.0.docx>

**Prior to full release of the implementation guide, a full summary of the HeD Artifact Sharing Use Case will be included here.**

### Use Case Assumptions and Conditions

It is important for implementers to clearly understand the underlying CDS environmental assumptions defined in Section 5 of the HeD Artifact Sharing Use Case, to ensure that these assumptions align to the implementation environment in which CDS content will be exchanged using a knowledge artifact. Failure to meet any of these assumptions could impact implementation of the knowledge artifact.

#### System Requirements

This implementation guide is not focused on specific EHR and CDS system behaviors that may apply to the CDS Knowledge Artifact, such as the interaction between specific actors within the Use Case who may wish to search or import a CDS knowledge artifact.

Specific system requirements targeted in this implementation guide include the following:

|  |  |
| --- | --- |
| Provides CDS Knowledge Artifact in Structured Format | The implementation guide defines how the knowledge artifact should be structured, NOT how the system actually generates the structure. |
| Provide metadata about CDS artifact in a standardized structured format | The implementation guide defines how the knowledge artifact metadata is applied to the different knowledge artifact types, and DOES NOT specify how systems should parse and interpret this metadata. |

Table - CDS System Requirements Covered in this Guide

## Organization of this Guide

### Definitions of Terms

Several terms are used throughout this document and a level of detailed technical understanding of healthcare standards is expected. It is extremely critical for the reader to review Appendix C - Definitions, to understand the specific acronyms and terms that are used in this implementation guide. In addition, the reader should be familiar with the terms defined in Appendix A of the HeD Artifact Sharing Use Case – wherever possible, this implementation guide reuses existing terms from that document and seeks to minimize the introduction of any new terms.

|  |  |
| --- | --- |
| CDS Knowledge Artifact | The CDS Knowledge Artifact (as defined in the HeD Artifact Sharing Use Case) is medical knowledge represented in a structured and encoded form to enable computer-based clinical decision support.  This implementation guide specifically is focused on the structure and encoding necessary to make the knowledge artifact available as CDS content. |
| CDS Knowledge Artifact Type | The CDS Knowledge Artifact Type represents the different types of CDS content that may constitute a CDS Knowledge Artifact. As defined in the HeD Artifact Sharing Use Case, the artifact type may consist of artifact specific data, metadata, and the components specific to that type of artifact.  This implementation guide specifically supports three initial knowledge artifact types:   * Event Condition Action (ECA) Rules * Order Sets * Documentation Templates |
| Component | A component is a grouping of data elements within the CDS Knowledge Artifact. The structure of this implementation guide supports the use of a library of reusable components when developing a knowledge artifact. |
| Health eDecisions Schema | The Health eDecisions Schema is the formal XML schema of the harmonization of multiple CDS standards and specifications adopted as the starting point for the CDS Knowledge Artifact structure, such as   * HL7 vMR * CDSC L3 * Allscripts CREF * Arden Syntax * Yale GEM * AHRQ eRecs |
| vMR (Virtual Medical Record) | A Virtual Medical Record (vMR) for Clinical Decision Support (CDS) is a data model for representing clinical data relevant to CDS. The vMR encompasses data about a patient's demographics and clinical history, as well as CDS inferences about the patient (e.g. recommended clinical interventions). |
| AHRQ eRecs |  |
| Arden Syntax |  |
| CDSC L3 |  |
| Allscripts CREF |  |

Table - Key Terms in this Guide

### Definitions of Actors

This implementation guide is specifically targeted to meeting the requirements of the following roles and actors:

|  |  |
| --- | --- |
| CDS Knowledge Artifact Supplier (including vendors and CDS content suppliers) | Provide the structure and encoding format needed to generate CDS content that conforms to the Health eDecisions Schema.  NOTE: This implementation guide DOES NOT specify HOW the content supplier actually generates the CDS knowledge artifact, only the desired structure and encoding of that artifact. |
| CDS Artifact Integration (including vendors and healthcare delivery systems that implement CDS systems) | Provides a standardized format for vendors and implementers of EHR and CDS systems to adopt when creating and/or consuming CDS Content.  NOTE: Vendors (as with all HeD Artifact Sharing actors) are given considerable flexibility when implementing the CDS Knowledge Artifact |

Table – Roles and Actors Supported in this Guide

### Conventions Used

The conventions defined in this document are specifically drawn from other implementation guides and include common conventions adopted by HL7, IHE, ASTM, and ISO.

**Question for Workgroup:**

**In terms of guide format, are there any specific conventions that are considered critical to the CDS vendor community?**

#### Use of Cardinality

The specific conventions for cardinality in this implementation guide are as follows:

|  |  |
| --- | --- |
| **Cardinality** | **Explanation of Cardinality** |
| 0..0 | The element is never present |
| 0..1 | The element MAY be omitted and has at most one occurrence |
| 1..1 | The element is present once and only once |
| 0..n | The element MAY be omitted or may |
| 1..n | The element MUST appear at least once, and MAY repeat up to n times |
| 0..\* | The element MAY be omitted, or it MAY repeat an unlimited number of times |
| 1..\* | The element MUST appear at least once, and MAY repeat an unlimited number of times |
| m..n | The element MUST appear at least *m* times, and at most, *n* times |
|  |  |

Table - Summary of Cardinality

Cardinality applies specifically to metadata and the data elements associated with the CDS Knowledge Artifact.

#### Use of Versioning

Version control for this implementation guide and the associated schema files will be enforced using the Google Code Repository that will host the Health eDecisions project. Each of the components that are developed in the associated Health eDecisions XML schema files will be versioned in this repository.

Versioning is of critical importance for this implementation guide due to the large number of XML schemas that are harmonized in this implementation guide, and wherever necessary, the specific version of the XML schema being referenced in this implementation guide will be noted.

#### Use of References

Documentation and terms that appear throughout this document in bold/italic text indicate a specific reference. Documents are referenced to indicate that implementers should refer to that documentation for final conformance language and other levels of guidance. An example is shown below:

***For conformance language, please refer to the NwHIN Authorization Framework Specification for further details***

Working code examples are also provided in this implementation guide to assist in understanding the Health eDecisions Schema. Because this guide is non-normative, examples are provided for human readability and may not be complete or fully accurate. The formal specification referred to by the example takes precedence.

#### Use of Conformance Language

Conformance language is defined within this implementation guide at a high level, to ensure alignment to the multiple standards/specifications which have been harmonized. The use of conformance language within this document is limited to further constraints or relaxation of constraint on existing standards/specifications. New conformance language that specifically deviates from the underlying standard/profile is avoided wherever possible. Also, in those instances where new metadata is being specified, specific constraints are offered. Implementers should refer to the Health eDecisions schema for the source for all conformance statements and rules.

Conformance language is defined throughout this implementation guide using **BOLD** **CAPS** to denote the conformance criteria to be applied. The conformance language that is used in this implementation guide is drawn from RFC 2219, and the conformance matrix offered for use in this implementation guide is drawn from the HL7 Implementation Guide for CDA® Release 2: IHE Health Story Consolidation, Release 1:

* **SHALL/MUST**: an absolute requirement for all implementations of the Knowledge Artifact
* **SHALL NOT**: an absolute prohibition against inclusion for all implementations of the Knowledge Artifact
* **SHOULD/SHOULD NOT**: A best practice or recommendation to be considered by implementers within the context of their requirements to implement the Knowledge Artifact; there may be valid reasons to ignore an item, but the full implications must be understood and carefully weighed before choosing a different course
* **MAY**: This is truly optional language for an implementation; can be included or omitted as the implementer decides with no implications

The Consolidated Conformance Verb Matrix included as part of the HL7 Implementation Guide for CDA® Release 2: IHE Health Story Consolidation, Release 1 (shown below) summarizes how the different standards/profiles are used within the implementation guide, and also lists specific recommendations used in this implementation guide:

| **RFC 2119** | **HL7** | **IHE** | **HITSP** |
| --- | --- | --- | --- |
| SHALL  Absolute requirement of the specification | SHALL  Required/Mandatory | R (Required)  Element must be present but can be NULL. | R (Required)  Data elements must always be sent. A NULL can be sent. |
| SHALL NOT  Absolute prohibition of the specification | SHALL NOT  Not Required/Mandatory | - | - |
| SHOULD  Recommended  There may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course. | SHOULD  Best Practice or Recommendation | R2 (Required if known)  The sending application must be able to demonstrate that it can send all required if known elements, unless it does not in fact gather that data. If the information cannot be transmitted, the data element contains a value indicating the reason for omission of the data. | R2 (Required if known)  If the sending application has data for the data element, it is REQUIRED to populate the data element. If the value is not known, the data element need not be sent. |
| SHOULD NOT  Not Recommended | SHOULD NOT  Not Recommended | - | - |
| MAY  Optional | MAY  Accepted/Permitted | O (Optional) | O (Optional) |
| - | - | C (Conditional)  A conditional data element is one that is required, required if known or optional depending upon other conditions. | C (Conditional)  Required to be sent when the conditions specified in the HITSP additional specifications column are true. |

Table - Implementation Guide- Conformance Verb Matrix

The use of the word “recommendation” is also used throughout this implementation guide, especially in light of the initial level of development being done on the harmonization of CDS standards into an Health eDecisions Schema. A recommendation is used to offer implementers flexibility in their CDS environments, by recommending an approach to be followed while not constraining in any way the use of alternative options. Recommendations are primarily used in those areas where the S&I Framework requests further implementation feedback from implementers and pilot sites prior to defining conforming criteria.

Optionality is further defined for implementers for each of the metadata elements that were outlined within the HeD Artifact Sharing Use Case in Section 11, using IHE guidelines:

|  |  |
| --- | --- |
| Required | Element must be present and CANNOT BE NULL (no NULL flavors allowed). |
| Required if Known | The sending system must be able to demonstrate that it can send all required elements within the CDS knowledge artifact, unless it does not gather that specific element or does not plan to include it. If the information cannot be transmitted in the CDS knowledge artifact, the data element contains a value indicating the reason for omission of the data from the knowledge artifact. |
| Optional | There is no need to include this element unless the implementer so desires. |
| Conditional | A conditional data element is one that is required, required if known or optional depending upon other conditions that may be present in the CDS environment.  Implementers have some latitude to apply conditions to specific metadata or other data elements within the knowledge artifact that do not apply to their environment. |

Table - Data Element - Optionality Levels

# Implementation Approach

As noted in Section 2, the approach used for implementation of CDS knowledge artifacts is to document implementation of the CDS Knowledge Artifact using a modular organization, and basing implementation on usage of these components.

The foundation of each component is the Health eDecisions Schema, which represents each CDS Knowledge Artifact component in a standardized format for generation and consumption of CDS content. The schema is a harmonized representation of multiple existing CDS standards and specifications.

## Overview of Modular Schema Approach

The modular approach is based on the concept of defining specific constraints for each of the components defined within the CDS Knowledge Artifact, to allow for implementation of components in a flexible and environmental-independent manner. The components are defined in detail in Section 5 of this guide.

This approach is based on several key technical decisions already made in the Health eDecisions workgroup, including the use of a harmonized schema that seeks to define a new standardized format for a CDS Knowledge Artifact.

The schemas harmonized include:

* HL7 Virtual Medical Record (vMR)
* CDSC L3
* Allscripts CREF
* Guidelines Element Model (GEM)

Each of the components defined in this schema would represent an individual building block that can be used to assemble a CDS Knowledge Artifact.

## Schema Roadmap

The approach used to document the Health eDecisions Schema will be very similar to the approach used in the development of the HL7 Version 3 Domain Analysis Model: Virtual Medical Record for Clinical Decision Support (vMR-CDS), Release 1. The schema will be developed as a set of XSD files that will then be documented within this implementation guide, together with the adopted datatypes for each of the schema elements.

For the code and supporting documentation used in developing the Health eDecisions Schema, a Google Code Repository has been made available to support the hosting of needed code and material surrounding implementation. The location of this repository is at:

<http://code.google.com/p/health-e-decisions/>

Section 4 of the guide covers the different knowledge artifact types supported by the Health eDecisions schema. Section 5 of the guide details the different components that can go into an artifact type, and Section 6 covers types defined in the Health eDecisions schema.

For knowledge artifact types, a more relaxed level of constraint is applied (many of the components within knowledge types will have more optionality.) For components, a more strict level of constraint is applied (specific constraints and rules apply to elements and attributes to ensure that components within artifacts are well understood and can interoperate.)

# CDS Knowledge Artifact Types

This implementation guide is designed to support each of the three CDS Knowledge Artifact Types defined in the HeD Artifact Sharing Use Case. In this section, specific guidance on implementing each of these artifact types will be defined, with specific emphasis on:

* What is required and what is optional for each knowledge artifact type
* Conformance statements for each knowledge artifact type

Each of the knowledge artifact types will be structured as a profile to allow for flexibility in implementation by CDS vendors.

## Event Condition Action (ECA) Rules

An Event Condition Action (ECA) Rule is constructed using the following components:

|  |  |  |
| --- | --- | --- |
| **Component Name** | **Component** | **OID** |
| Knowledge Artifact Metadata |  |  |
| Event |  |  |
| Action |  |  |
|  |  |  |
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## Order Sets

An Order Set is constructed using the following components:

|  |  |  |
| --- | --- | --- |
| **Component Name** | **Component** | **OID** |
| Knowledge Artifact Metadata |  |  |
| Supporting Evidence |  |  |
| Supporting Reference |  |  |
| Clinical Data Mapping |  |  |
| Expression |  |  |
| Attribute-Value List |  |  |
| Order Set Reference |  |  |
|  |  |  |
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## Documentation Templates

A Documentation Template is constructed using the following components:

|  |  |  |
| --- | --- | --- |
| **Component Name** | **Component** | **OID** |
| Knowledge Artifact Metadata |  |  |
| Expression |  |  |
| Attribute-Value List |  |  |
|  |  |  |
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# CDS Knowledge Artifact Components

The approach is to structure each of the components in a way that will show reusable implementation, and then to provide working XML examples for each within this implementation guide and through references to the Google Code Repository.

For each component, further detail on implementation, constraint, and cardinality will be defined, specific to the Health eDecisions Schema. The components are not tied to a specific artifact type in this section, but examples may be included showing how the components work in each artifact type.

## Knowledge Artifact Metadata

The current metadata model is intended to represent key knowledge artifact data independent of the containing components. The Knowledge Artifact metadata in this model describes the contents of the CDS Knowledge Artifact without specifically constraining this content.

To support the use of knowledge artifact metadata, the Harmonized HeD Schema supports a complex type called **<Metadata>** which defines all the attributes for the knowledge artifact metadata, as shown in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **HeD Data Element** | **XPath** | **Optionality** | **Cardinality** | **Datatype** |
| Artifact Title | title | Required | 1..\* |  |
| Artifact Description | description | Optional | 0..1 |  |
| Artifact Identifier | identifier | Required | 1..\* | II |
| Artifact Contributor | contributor | Optional | 0..\* | Contribution |
| Related Resource (e.g. eMeasure reference, clinical quality measure reference, dependent artifacts, other versions) | KnowledgeResource |  |  |  |
| Source of Artifact |  |  |  |  |
| Supporting Evidence | supportingEvidence | Optional | 0..\* | Evidence |
| Artifact Documentation | documentation | Optional | 0..1 | ED |
| Publisher Name | publisher | Optional | 0..\* | Organization |
| Publisher Contact Information | publisher | Optional | 0..\* | Organization |
| Licensing , Usage, Restriction | usageTerms | Optional | 0..\* |  |
| Schema Version | schemaVersion | Required | 1 | INT |
| Schema Identifier | schemaIdentifier | Required | 1 | INT |
| Artifact Status | status |  |  | ArtifactStatusType |
| Artifact History | eventHistory |  |  | ArtifactEvent |
| Category | category | Optional | 0..\* | CD |
| Key Terms | keyTerms | Optional | 0..\* | CD |

Table - HeD Knowledge Artifact Metadata - Overview

### General Conformance Requirements – Metadata

For each CDS Knowledge Artifact, a general set of constraints, through the Knowledge Artifact metadata, will apply.

* A CDS Knowledge Artifact **SHALL** contain a single (1) title element
* A CDS Knowledge Artifact **SHALL** contain a single (1) description element
* A CDS Knowledge Artifact **SHALL** contain one or more (1..\*) identifier elements

**NOTE – Workgroup will need to define potentially multiple here, as that is not common cardinality clause.**

* A CDS Knowledge Artifact **SHALL** contain a single (1) documentation element
* A CDS Knowledge Artifact **SHALL** contain a single (1) schema version element
* A CDS Knowledge Artifact **SHALL** contain a single (1) schema identifier element
* A CDS Knowledge Artifact **SHALL** contain one or more (1..\*) publishers, which MAY be represented by a person or organization
* A CDS Knowledge Artifact **SHALL** contain a single (1) status code.
* A CDS Knowledge Artifact **SHOULD** use the HeDArtifactStatus value set
* A CDS Knowledge Artifact **MAY** stipulate the use of MESH for specifying key terms to enable the search of knowledge artifacts.

## Actions

The Actions element will be documented here

## Supporting Evidence

The Supporting Evidence element uses the Evidence complex type to express specific values associated with the evidence included

* The supportingEvidence element **MUST** be the only element to use the Evidence complex type in a CDS Knowledge Artifact.

## Supporting Reference

The Supporting Reference element

## Clinical Mapping Data

## Expression

The Expression Language element defines a base expression language for use with the CDS Knowledge Artifact. The language defined in the Harmonized HeD schema is closely aligned to the HL7 Adren Syntax and seeks to leverage many of its best practices

An expression within a CDS Knowledge Artifact is modeled to allow for customization using specific operators to compute logic that may be embedded in the artifact

# Health eDecisions Schema

The Health eDecisions schema represents a data model that contains all the components necessary to develop a CDS Knowledge Artifact. The files included for the Health eDecisions schema are listed below and can be found in the Health eDecisions Google Code Repository:

|  |  |
| --- | --- |
| Action.xsd | Contains the clinical actions that can be implemented by users of the Health eDecisions schema. This schema file includes the base.xsd and datatypes.xsd files and is modeled on the HL7 Arden Syntax. |
| Base.xsd | Contains the base types used in the Health eDecisions schema, and includes the datatypes.xsd file, which extends the base ISO 21090 datatypes |
| Datatypes.xsd | This file adds data types that are not included in the datatypes-iso21090.xsd or are restrictions or extensions of types defined in that file. |
| Expression.xsd | Contains the expression types used to define the logic used for computation within a CDS Knowledge Artifact. This schema imports the vMR datatypes schema (org.opencds.vmr.v1\_0.schema.datatypes) |
| Metadata.xsd | Contains the types used to express CDS knowledge artifact metadata, and includes the datatypes.xsd |

Table - Health eDecisions Schema Files - Summary

This section of the implementation guide includes the following sections which document the important parts of the schema:

* Simple datatypes are drawn from the ISO 21090 schema and are simplified and constrained to support the requirements of the Health eDecisions Schema. The source of reference
* Complex datatypes are designed to support the use of specific attributes with elements. Complex types are further categorized by the specific components they may support.

## Simple Datatypes

Data types are further defined in this implementation guide for data types defined in the ISO 21090 have a usage of R, RE, C(a/b). In all case, implementers are encouraged to refer to the base standard as authoratiative documentation for all simple data types.

Depending on the components used within a CDS Knowledge Artifact, the usage of simple data types may vary.

### AD (Address)

The Address simple data type is used to define address information within a CDS Knowledge Artifact. As per the documentation of ISO 21090, the AD datatype represents an assembly of address parts.

### CD (Concept Descriptor)

The CD simple data type is used to capture specific concepts or terms that are referenced within the CDS Knowledge Artifact, such as a terminology or vocabulary.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| code | ST | 0..1 | Optional |  |  |
| codeSystem | ST | 0..1 | Optional |  |  |
| codeSystemName | ST | 0..1 | Optional |  |  |
| displayName | ST | 0..1 | Optional |  |  |
| originalText | ST | 0..1 | Optional |  |  |

### CO (Coded Ordinal)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
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### ED (Encapsulated Data)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
|  |  |  |  |  |  |
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### EN (Entity)

The Entity simple data type

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
|  |  |  |  |  |  |
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### II (Instance Identifier)

An II data type is used to uniquely identify a specific resource, artifact, or object.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| root | ST | 1 | Required |  |  |
| extension | ST | 0..1 | Optional |  |  |

### IVL\_TS (Timestamp – Interval)

### ST (String)

The ST data type supports the inclusion of text information and is designed to emulate the ST datatype defined in the ISO21090 schema.

* Any data element in the CDS Knowledge Artifact that uses the ST datatype **MUST** have at least 1 character or **MUST** be null.

### TEL (Telecom)

### TS (Timestamp)

The TS data type supports the inclusion of date and time information and is designed to emulate the TS datatype defined in the ISO21090 schema.

* Any data element in the CDS Knowledge Artifact that uses the TS datatype **MUST** have a value defined using ISO 8824 (generalized time).

## Complex Types – Metadata

The complex types

### ArtifactEvent

The ArtifactEvent complex type is used to represent the specific types of events that may occur in the lifecycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| eventType | ArtifactEventType | 1..1 | Required |  |  |
| eventDateTime | TS | 1..1 | Optional |  |  |

### ArtifactLifecycleEventType

The ArtifactLifecycleEventType represents a specific type of event in the lifecycle of the CDS Knowledge Artifact at a specific point in time. It is constrained by the HeDArtifactLifecycleEventType value set to a specific set of values

### ArtifactStatusType

The ArtifactStatusType represents the status of a CDS Knowledge Artifact and is included as part of the metadata for the artifact. The list of statuses are constrained to the list of values in the HeDArtifactStatusType value set.

### ArtifactType

The ArtifactType complex type represents a specific type for a CDS Knowledge Artifact. This type is constrained by the HeDArtifactType value set to the 3 knowledge artifact types defined in the HeD Artifact Sharing Use Case.

### Metadata

Metadata is the complex data type defined in Section 5.1 for the CDS Knowledge Artifact . It supports each of the metadata elements listed in Section 5.1 and derived from the HeD Knowledge Sharing Use Case under Section 11.2. Refer to Section 5.1 for the list of attributes within this complex type.

## Complex Types – Actions

### Action

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| actionMode | ActionModeType |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

### ActionModeType

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
|  |  |  |  |  |  |

## Complex Types - Base

### BibliographicResource

The BibliographicResource complex type is used to capture the citation associated with bibliographic information that is included with a knowledge resource.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| citation | ST | 1..1 | Required |  |  |

### Contribution

The Contribution complex type is constrained to support a defined list of contributor types and the name of the specific contributor. The name of the contributor is constrained to the Party complex type, which allows for names to be defined as individuals or organizations.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Contributor | Party | 1..1 | Required |  |  |
| Type | ContributorType | 1..1 | Required |  |  |

### ContributorType

The ContributorType complex type is constrained to 3 specific values as defined in the proposed HeDContributorType value set.

### Coverage

The Coverage complex type represents the specific scope and coverage for a CDS Knowledge Artifact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| focus | CoverageType | 0..1 | Optional |  |  |
| code | CD | 0..1 | Optional |  | Recommend use of MeSH for coding |
| range | IVL\_PQ | 0 | Optional |  |  |
| description | ST | 0 | Optional |  |  |

### CoverageType

The CoverageType complex type represents

### Entity

|  |  |
| --- | --- |
| **Used By** |  |
| KnowledgeResource |  |
| Party |  |

The Entity complex data type is used to describe any entity

### Evidence

The Evidence complex data type is used to represent research upon which the CDS Knowledge Artifact is based.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| qualityOfEvidenceScheme | CD | 0..1 |  |  |  |
| qualityOfEvidenceScore | CO | 0..1 |  |  |  |
| strengthOf  RecommendationScheme | CD | 0..1 |  |  |  |
| strengthOf  RecommendationScore | CO | 0..1 |  |  |  |
| bibliographicInformation | BibliographicResource | 0..\* |  |  |  |
| synthesis | KnowledgeResource | 0..\* |  |  |  |

### IVL\_RTO

An IVL\_RTO data type is used to support data elements that need to represent a set of consecutive values of an ordered base datatype.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| ATTR\_RTO\_LOW |  |  |  |  |  |
| ATTR\_RTO\_HIGH |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

### KnowledgeEntity

### KnowledgeResource

The KnowledgeResource complex type extends an Entity complex type to represent information associated with a knowledge resource, which MAY be included in a CDS Knowledge Artifact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Title | ST | 0..1 | Optional |  |  |
| Location | TEL | 0..1 | Optional |  |  |
| Description | ST | 0..1 | Optional |  |  |

### Organization

The Organization complex type defines a specific organization and inherits from the Party complex type. The primary purpose of the Organization complex type is to allow for the constraining of a Party to a specific organizational name.

### Party

The Party complex type allows for the definition of individuals or groups inheriting from the Entity complex type. An additional element is included to support the name of the Entity.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Name | AD | 0..\* | Required |  | **MUST** support 1 and only 1 name element |
| Telephone | TEL | 0..\* | Required |  |  |

### ResourceReference

The Resource Reference complex type

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Relationship | Resource  RelationshipType | 1 | Required |  |  |
| Resource | KnowledgeResource | 1..n | Required |  |  |

### ResourceRelationshipType

The ResourceRelationshipType is a simple type that constrains the ResourceRelationship to values defined in the

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Relationship | Resource  RelationshipType | 1 | Required |  |  |
| Resource | KnowledgeResource | 1..n | Required |  |  |

### RightsDeclaration

The RightsDeclaration complex type supports the need for reporting licensing, usage and restrictions as part of a CDS Knowledge Artifact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| Rights | ST |  | Required |  |  |
| Rights Holders | Party |  | Required |  |  |
| Permissions | ST | 0..\* | Required |  |  |

## Complex Types – Expression

### Aggregate Expression

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| source | Expression | 1 | Required |  |  |
| property | ST | 0..\* | Optional |  |  |

#### All

#### Any

#### Avg

#### Count

#### Max

#### Min

#### Sum

### BinaryExpression

The BinaryExpression type defines the abstract base type for all expressions that take two arguments.

#### Add

#### Concat

#### Div

#### Divide

#### Equal

#### Greater

#### GreaterOrEqual

#### IfNull

#### Less

#### LessOrEqual

#### LN

#### Log

#### Mod

#### Multiply

#### Power

#### Subtract

### Expression

The Expression complex type defines the abstract base type for all expressions used in the HeD expression language. This complex type includes the KnowledgeEntity complex type.

#### Combine

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| listToCombine | Expression | 1..1 |  |  |  |
| separator | Expression | 0..1 |  |  |  |

#### If

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| condition |  |  |  |  |  |
| then |  |  |  |  |  |
| else |  |  |  |  |  |

<If>

<condition xsi:type="Equal">

<operand xsi:type="Property" Path="Name"/>

<operand xsi:type="Value">

<value xsi:type="xs:string" value="Test"/>

</operand>

</condition>

<then xsi:type="Value">

<value xsi:type="xs:string" value ="Name was Test"/>

</then>

<else xsi:type="Value">

<value xsi:type="xs:string" value ="Name was not Test"/>

</else>

</If>

#### Interval

The Interval selector defines an interval value. An interval must be defined on values that support comparison, as well as successor and predecessor values. The beginning and ending of the interval may each be defined as open or closed. The default is closed, indicating an inclusive interval.

An example of the use of an Interval is shown below:

<Interval>

<begin xsi:Type="Value">

<value xsi:Type="xs:Date" value="2010-10-10"/>

</begin>

<end xsi:Type="Value">

<value xsi:Type="xs:Date" value="2010-10-11"/>

</end>

</Interval>

#### Split

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| stringToSplit | Expression | 1..1 |  |  |  |
| separator | Expression | 0..1 |  |  |  |

#### Substring

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| stringToSub | Expression | 1..1 |  |  |  |
| startIndex | Expression | 1..1 |  |  |  |
| length | Expression | 0..1 |  |  |  |

#### Value

### ExpressionReference

The ExpressionReference type defines an expression that references a previously defined NamedExpression. The result of evaluating an ExpressionReference is the result of evaluating the referenced NamedExpression.

### Filter

### NamedReference

### NaryExpression

#### AND

#### Case

#### Coalesce

#### LIST

#### OR

### SortExpression

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| collection | Expression |  |  |  |  |
| orderBy | ST | Required |  |  |  |

### TernaryExpression

The TernaryExpression type defines the abstract base type for all expressions that take three arguments.

### UnaryExpression

#### Ceiling

#### Floor

#### IsNull

#### Length

#### NOT

### ValueSetExpression

The ValueSetExpression complex type is used to define a value set within an expression.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute** | **Datatype** | **Cardinality** | **Usage** | **Value Set** | **Comments for Implementation** |
| valueSetID | ST | 0..\* | Required |  |  |
| version | INT | 0..\* | Optional |  |  |

## HeD Value Sets and Vocabularies

The Harmonized HeD schema supports multiple value sets that are designed to constrain specific data elements included in the CDS Knowledge Artifact/ Several of these value sets relate to metadata that would provide specific descriptive detail on the CDS Knowledge Artifact, while other elements pertain to constraining (through enumeration) of values for a specific data element included in the knowledge artifact. The approach used for this section is as follows:

|  |  |
| --- | --- |
| Value | Specific value as defined in the value set – many of these values will not tie back to a specific terminology but our constrained to be specific to the CDS Knowledge Artifact. |
| Description | Describes the specific value being cited |
| Comment | Includes comments on implementation of this value within a CDS Knowledge Artifact |

Many of the value sets included in this section are initial proposals that are not currently maintained in any existing value set repository and are informative for the purposes of implementing the CDS Knowledge Artifact.

In addition, vocabulary recommendations are provided for specific elements within the artifact, to ensure further consistency between artifacts and to ensure close alignment to existing terminologies used in Meaningful Use Stage 1 and Stage 2 regulations.

### HeDActionModeType

This value set constrains the list of values for possible Actions that may be applied to a specific CDS Knowledge Artifact.

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| newAction |  |  |
| modifyOtherAction |  |  |
| cancelOtherAction |  |  |

### HeDArtifactLifecycleEventType

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| Created | The CDS Knowledge Artifact has been created and made available per the requirements defined in the HeD Knowledge Sharing Use Case. |  |
| Published | The CDS Knowledge Artifact has been published. |  |
| Reviewed | The CDS Knowledge Artifact has been reviewed. |  |
| Retired | The CDS Knowledge Artifact is retired and is no longer available. |  |

### HeDArtifactStatus

This value set supports the ArtifactStatus complex datatype and is constrained to use of ST (String) and 3 specific values

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| Draft | The status of the CDS Knowledge Artifact is that it is in a draft state |  |
| Active | The status of the CDS Knowledge Artifact is that it is active |  |
| Retired | The status of the CDS Knowledge Artifact is that it is |  |

### HeDArtifactType

This value set supports the definition of a type for a specific CDS Knowledge Artifact. It is constrained to 3 specific values as defined below:

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| Rule | An ECA rule has the general syntax "on event if condition is true do action” and will consist of three distinct parts:     * The event part specifies the signal that triggers the invocation of the rule * The condition part is a logical test that, if satisfied or evaluates to true, causes the action to be carried out * The action part consists of execution of operations. These actions may in turn cause further events to occur, which may in turn cause more ECA rules to fire |  |
| Order Set | A pre-defined and approved group of orders related to a particular clinical condition (e.g., hypertension treatment and monitoring) or stage of care (e.g., hospital admission to Coronary Care Unit). Often the order set consists of both diagnostic and therapeutic orders. The goals in creating order sets are to standardize care, increase compliance with best clinical practices, and facilitate the order entry process. |  |
| Documentation Template | A structured form for recording information on a patient into a set of pre-defined data slots. |  |

### HeDContributorType

This value set constrains the list of types of contributors that can be defined for a specific CDS Knowledge Artifact. There are 3 specific values defined in this value set.

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| Author |  |  |
| Editor |  |  |
| Reviewer |  |  |

### HeDEncounter

The HeDEncounter value set further constrains the patient data type for EncounterEvent to a specific set of applicable values for a CDS Knowledge Artifact.

|  |  |
| --- | --- |
| encounterType |  |

### HeDPatientDataType

This value set constrains the list of possible patient data types for use with expressions. It draws directly from vMR data types.

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| AdverseEvent |  |  |
| AppointmentProposal |  |  |
| AppointmentRequest |  |  |
| DeniedAdverseEvent |  |  |
| DeniedProblem |  |  |
| EncounterEvent |  |  |
| Goal |  |  |
| GoalProposal |  |  |
| MissedAppointment |  |  |
| ObservationOrder |  |  |
| ObservationProposal |  |  |
| ObservationResult |  |  |
| Problem |  |  |
| ProcedureEvent |  |  |
| ProcedureOrder |  |  |
| ProcedureProposal |  |  |
| ScheduledAppointment |  |  |
| ScheduledProcedure |  |  |
| SubstanceAdministrationEvent |  |  |
| SubstanceAdministrationOrder |  |  |
| SubstanceAdministrationProposal |  |  |
| SubstanceDispensationEvent |  |  |
| SupplyEvent |  |  |
| SupplyOrder |  |  |
| SupplyProposal |  |  |
| UnconductedObservation |  |  |
| UndeliveredProcedure |  |  |
| UndeliveredSubstanceAdministration |  |  |
| UndeliveredSupply |  |  |

### HeDProblem

The HeDProblem is used to constrain

Specific data elements requiring coded elements include the following:

|  |  |
| --- | --- |
| problemCode | Support use of SNOMED-CT |
| importance |  |
| severity |  |
| problemStatus | Support initial use of |

### HeDResourceRelationshipType

This value set constrains the list of possible relationships for the types of relationships between a knowledge resource and the CDS Knowledge Artifact

|  |  |  |
| --- | --- | --- |
| **Value** | **Description** | **Comment** |
| adaptedFrom |  |  |
| associatedResource |  |  |
| dependsOn |  |  |
| derivedFrom |  |  |
| similarTo |  |  |
| versionOf |  |  |

# Appendix A – Referenced Documents

The reference documents specific to the CDS Knowledge Artifact are presented in the table below. This implementation guide is built based on the premise of reusing as much existing material as possible, and as such, the list of references is fairly extensive, and may be expanded upon as the implementation guide is developed and balloted.

|  |  |  |
| --- | --- | --- |
| **Reference Name** | **Location** | **How this reference was used in development of the CDS Knowledge Artifact Implementation Guide** |
| S&I Framework Health eDecisions - CDS Artifact Sharing Use Case | <http://wiki.siframework.org/file/view/SIFramework_HeD_UC1_CDSArtifactSharing_v1.0.docx> | The use case serves as the baseline for all functional and system requirements associated with the CDS knowledge artifact, and provides scoping for the implementation guide |
| The Arden Syntax for  Medical Logic Systems  Version 2.7 |  |  |
| HL7 Version 3 Domain Analysis Model: Virtual Medical Record for Clinical Decision Support (vMR-CDS), Release 1 |  |  |
| HL7 Version 3 Implementation Guide:  Virtual Medical Record for Clinical Decision Support(vMR-CDS) for GELLO, Release 1  Draft Standard for Trial Use |  | GELLO is included in this list of references due to the structure of the vMR/GELLO implementation guide that was balloted by HL7. The HeD initiative wishes to emulate several elements of that structure to assist implementers |
| Guidelines Element Model (GEM) |  |  |
| Digital Infrastructure for the Learning Health System: The Foundation for Continuous Improvement in Health and Health Care: Workshop Series Summary. Institute of Medicine. | This PDF is available from The National Academies Press at http://www.nap.edu/catalog.php?record\_id=12912 www,nap.edu October 2011. ISBN 978-0-309-15416-1" | Cited as reference for learning health system in Executive Summary |

Table - List of CDS References for Implementers

# Appendix B - Acronyms

|  |  |
| --- | --- |
| **Acronym** | **Definition/Description** |
| CDS | Clinical Decision Support |
| CDSC L3 | Clinical Decision Support Consortium Level 3 |
| CREF | Allscripts CREF specification |
| DAM | Domain Analysis Model |
| EHR | Electronic Health Record |
| EMR | Electronic Medical Record |
| eRecs | AHRQ Electronic Recommendations |
| GEM | Guidelines Element Model |
| HIE | Health Information Exchange |
| HIT | Health Information Technology |
| HITECH Act | Health Information Technology for Economic and Clinical Health Act – part of the American Recovery and Reinvestment Act of 2009 (ARRA), HITECH aims to accelerate the adoption of interoperable electronic health records, and other health information technology, in addition to promoting health information exchange. |
| HIPAA | Health Insurance Portability and Accountability Act |
| HeD | Health eDecisions |
| HITSP | Health Information Technology Standards Panel |
| HL7 | Health Level 7 |
| MU | Meaningful Use |
| ONC | Office of the National Coordinator for Health IT |
| S&I Framework | Standards & Interoperability Framework |
| vMR | HL7 Virtual Medical Record |
| XML | Extensible Markup Language |
| XSD | XML Schema |

Table - List of Acronyms used in this Guide

# Appendix C – Definitions

Because the CDS Knowledge Artifact introduces new concepts and terms, an additional appendix of definitions is provided to support implementer understanding of terms that may be used in various sections of this document, specifically documentation and examples in Sections 4-6.

|  |  |
| --- | --- |
| **Term** | **Definition/Description** |
|  |  |
|  |  |
|  |  |
|  |  |
| Complex Type |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| Simple Type |  |
|  |  |
|  |  |
| Value Set | A uniquely identifiable set of valid concept identifiers, where any concept identifier in a coded element can be tested to determine whether it is a member of the Value Set. |
|  |  |

# Appendix D – Conformance Statement Review

A summary of the conformance statements for the CDS Knowledge Artfiact are provided in this appendix, using a requirements traceability format to show how each of the requirements outlined in the HeD Artifact Sharing Use Case are fulfilled by this implementation guide.