



The Office of the National Coordinator for
Health Information Technology

The Health eDecisions Initiative

Enhancing Clinical Decision Support



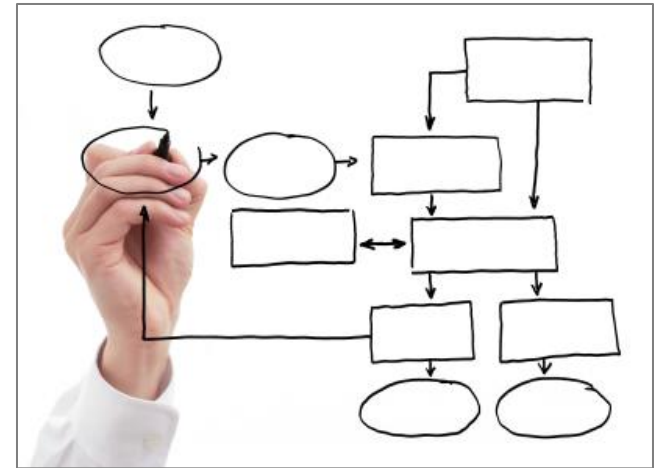
Agenda

Agenda	Presenter
Introduction	Jacob Reider, M.D. Chief Medical Officer, ONC
Methodology: Using the Standards and Interoperability Framework	Jamie Parker Associate Director, Health IT – ESAC
Use Case 1: Shareable Clinical Decision Support Knowledge	Bryn Rhodes, Software Architect – Veracity Solutions
Use Case 2	Kensaku Kawamoto, M.D., Ph.D. Initiative Coordinator, Health eDecisions Director, Knowledge Management & Mobilization Assistant Professor, Dept. of Biomedical Informatics University of Utah
Pilots	Jamie Parker
Questions	
Wrap- Up	Jacob, Bryn, Ken and Jamie

S&I Framework Overview

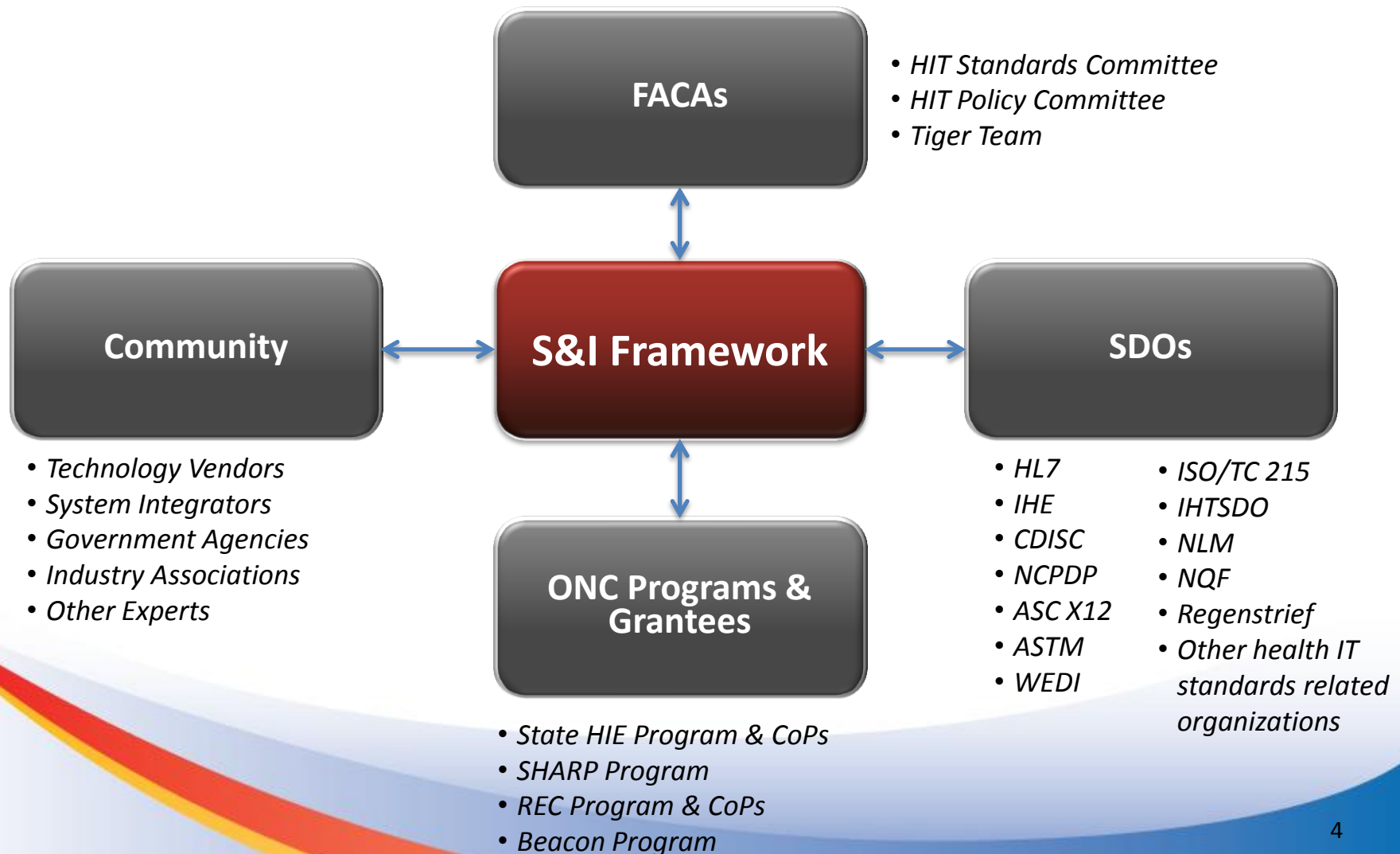
Specific health interoperability initiatives guide the design and development of a fully integrated and connected health information system.

An **S&I Initiative** focuses on a single challenge with a set of value-creating goals and outcomes, and the development of content, technical specifications and reusable tools and services.



Call for Participation: The overall success of the S&I Framework is dependent upon volunteer experts from the healthcare industry and we welcome any interested party to get involved in S&I Framework Initiatives, participate in discussions and provide comments and feedback by joining the Wiki: <http://wiki.siframework.org>

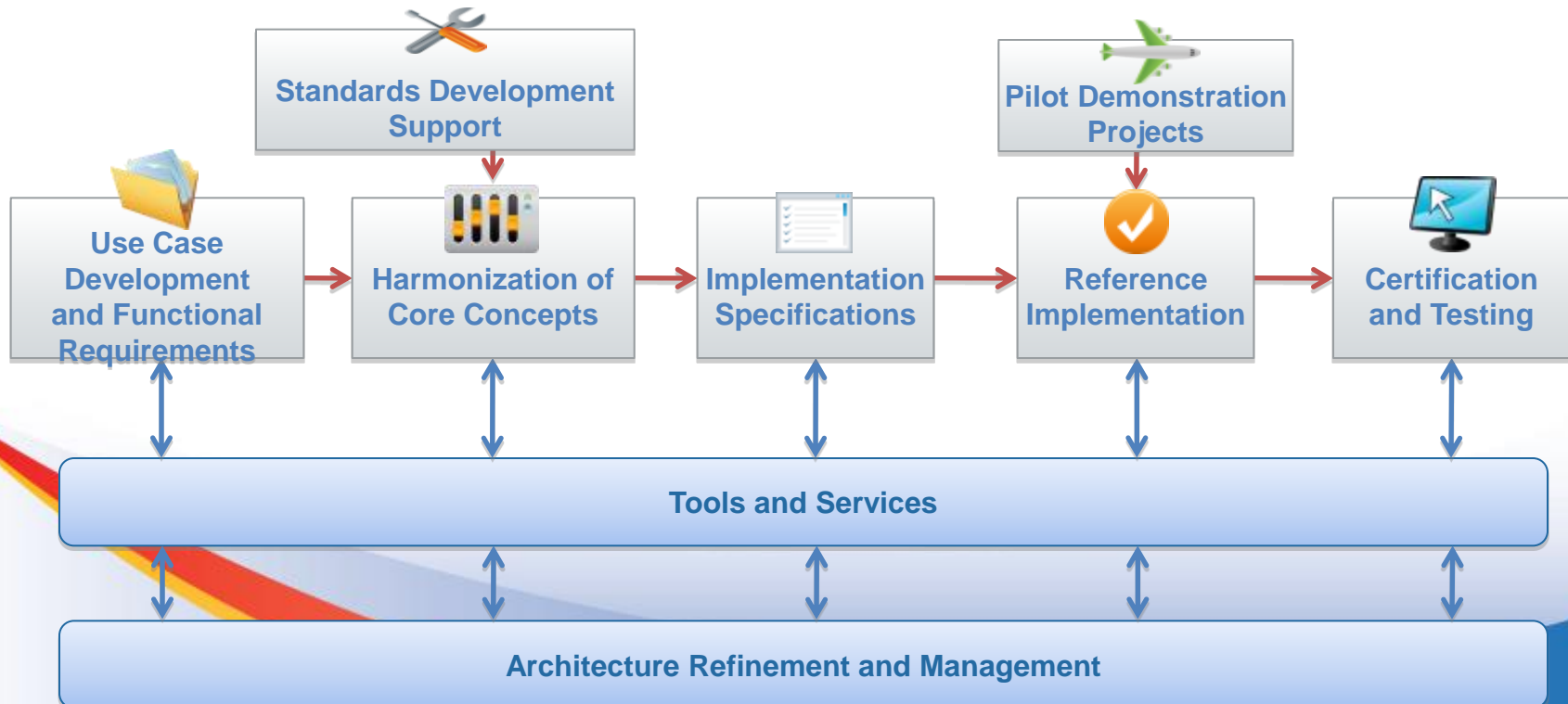
S&I Framework Coordination



ONC Standards and Interoperability (S&I) Framework Lifecycle

Our Missions

- » Promote a sustainable ecosystem that drives increasing interoperability and standards adoption
- » Create a collaborative, coordinated, incremental standards process that is led by the industry in solving real world problems
- » Leverage “government as a platform” – provide tools, coordination, and harmonization that will support interested parties as they develop solutions to interoperability and standards adoption.



Clinical Decision Support to Health eDecisions - a brief history...

- Content suppliers and EHR/PHR vendors all have proprietary formats and methods for exchanging, implementing, life-cycle managing, and executing CDS interventions
- Each content supplier-EHR/PHR vendor integration for CDS exchange is unique
- No widely accepted/adopted standards for exchange or services insertion
- Even within a vendor, clients cannot always exchange content with each other
- Healthcare systems with successful implementation of CDS are unable to share their proven interventions with others in an importable format, even if they wished to

Clinical Decision Support to Health eDecisions - a brief history continued

- Barriers exist to the adoption and implementation of CDS despite research demonstrating effectiveness in improving quality and safety
- Lack of widely accepted, implementable standards for importing and/or sharing proven CDS interventions (reminders, order sets, documentation templates)
- ONC and AHRQ have invested in multiple research projects such as GLIDES, CDSC, ACDS and eRecs to advance CDS implementation, sharing and adoption
- In April 2012, ONC and AHRQ at the April 2012 F2F stakeholders gathered from across the vendor, academic, and healthcare communities to discuss how to advance the shareability of CDS interventions and build on the research and existing standards to date from this came the Health eDecisions Initiative



S&I Framework Phases & Health eDecisions Activities

Phase	Planned Activities
Pre-Discovery	<ul style="list-style-type: none"> • Development of Initiative Synopsis • Development of Initiative Charter • Definition of Goals & Initiative Outcomes 
Discovery	<ul style="list-style-type: none"> • Creation/Validation of Use Cases, User Stories & Functional Requirements • Identification of interoperability gaps, barriers, obstacles and costs • Review of Vocabulary 
Implementation	<ul style="list-style-type: none"> • Creation of aligned specification • Documentation of relevant specifications and reference implementations such as guides, design documents, etc. • Validation of Vocabulary • Development of testing tools and reference implementation tools 
Pilot	<ul style="list-style-type: none"> • Validation of aligned specifications, testing tools, and reference implementation tools • Revision of documentation and tools
Evaluation	<ul style="list-style-type: none"> • Measurement of initiative success against goals and outcomes • Identification of best practices and lessons learned from pilots for wider scale deployment • Identification of hard and soft policy tools that could be considered for wider scale deployments

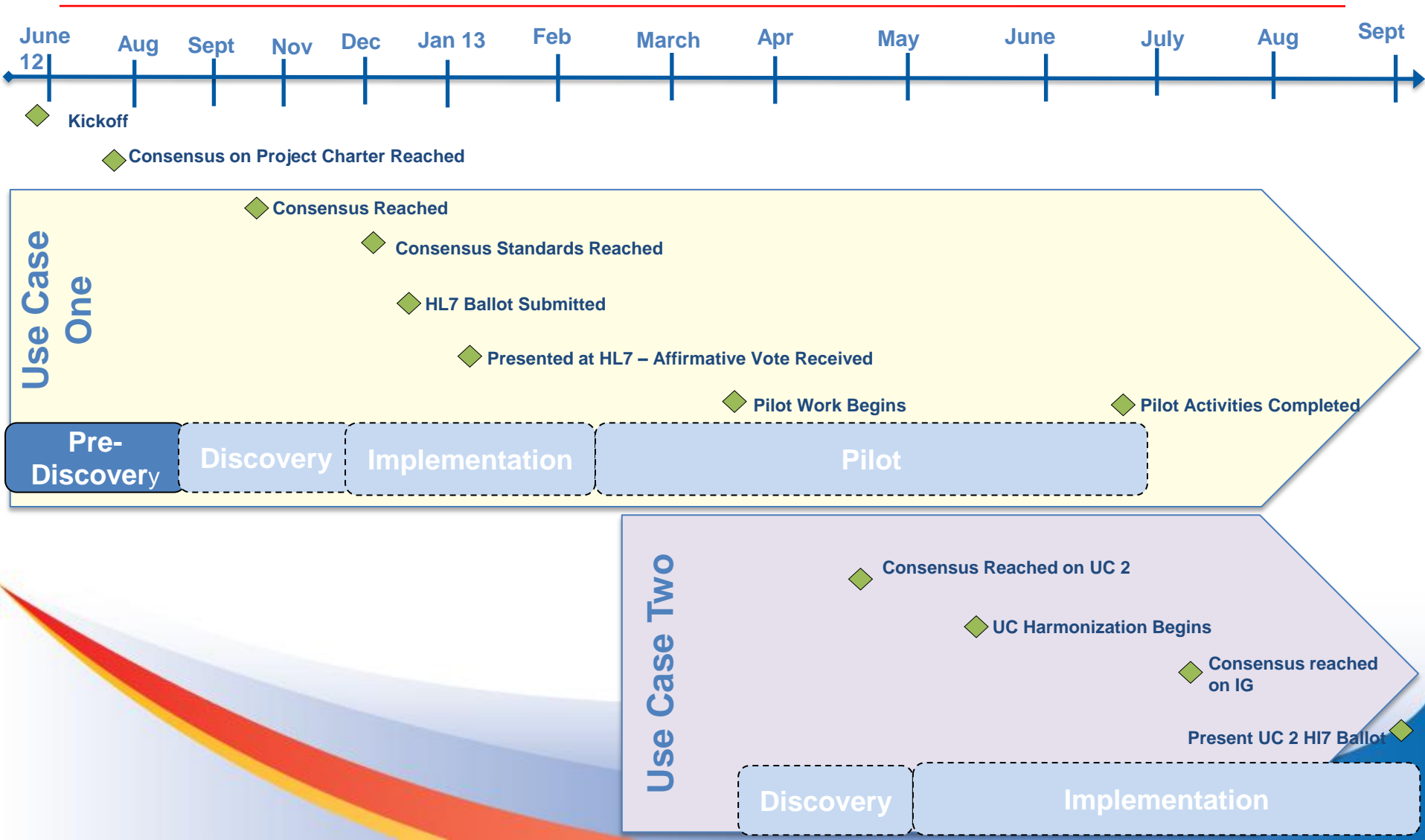
Health eDecisions Project Charter and Scope

- Effective CDS requires availability of computable biomedical knowledge, person-specific data, and a reasoning or inference mechanism that combines these elements to generate and present helpful information to clinicians, patients or caregivers in the right way – and the right time.
- In order to recognize these benefits, CDS interventions must be made more easily shareable so that anyone can easily acquire and deploy CDS interventions.
- To this end, standards must be advanced to enable either the consumption of CDS via a web service or the import of CDS interventions into CDS systems
- Scope Statement:
 - To define standards that facilitate the emergence of systems and services whereby CDS interventions can be shared or accessed by any healthcare stakeholder via an importable format or via a CDS web service

Deliverables

- Two Use Cases:
 - Use Case 1: CDS Artifact Sharing (including Functional Requirements)
 - Use Case 2: CDS Guidance as a Service (including Functional Requirements)
- 2 HL7 approved implementation guides (as Draft Standards for Trial Use - DSTUs)
- Functional pilots for UC 1 (and if time and resources permits UC 2)

Health eDecisions - Timeline



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Health eDecisions Use Case 1

Shareable Clinical Decision Support
Knowledge

Goal

- CDS interventions must be made shareable and implementable so that they can be acquired and deployed by any organization.

Definitions

- **Clinical Decision Support** - Broad term describing the general process of enhancing health-related decisions and actions with pertinent, organized clinical knowledge and patient information.
- **Knowledge Artifact** - Medical knowledge represented in a structured form to enable CDS
- **Repository** - A repository where knowledge artifacts are collected for distribution.
- **Artifact Supplier** - An organization that collects and distributes artifacts

Use Case 1



**CDS Knowledge
Artifact Supplier**



CDS Artifact Integrator

Out of Scope

- Authoring, Creation and Maintenance of Clinical Decision Support Knowledge
- Search Mechanisms
- Knowledge Repository Design

Out of Scope

- Queries
- Implementation in Systems
- User Presentation
- Transport

**Computable CDS
Knowledge Artifact**

In Scope

- Format of the CDS Knowledge Artifact

Sharing CDS Knowledge

Broadly then, this use case requires:

- **Syntax** – Ability to unambiguously communicate knowledge
- **Semantics** – Utilizing a common data model
- **Terminology** – Selecting and utilizing standard concept vocabularies

HeD Schema

Format for specifying computable CDS knowledge

Harmonization of several formats and ideas

- CDSC-L3
- ArdenML
- CREF
- Other inputs (GELLO, GEM, HQMF, ...)

Components

- Metadata
- Expressions
- Actions
- Triggers

Schema Design

The HeD Schema is designed as a set of components that can be put together in different ways to support different artifact types

In Scope Artifact Types

- Event Condition Action (ECA) Rule
- Order Set
- Documentation Template

Out of Scope

- Context-Aware Data Retrieval
- Other...

Metadata

Identifiers

- Id, Title, Description, Artifact Lifecycle

Documentation

- Documentation, Related Resources

Supporting Evidence

Data Models

KeyTerms

Metadata (Example)

```
<identifiers>
  <identifier root="www.newmentor.com/cds/rule/NQF-0068" version="1.0" />
</identifiers>
<artifactType value="Rule" />
<schemaIdentifier root="urn:hl7-org:v3/hed" version="1.0" />
<dataModels>
  <modelReference>
    <description value="Virtual Medical Record model" />
    <referencedModel value="urn:hl7-org:v3/vmr"/>
  </modelReference>
</dataModels>
<title value="Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antithrombotic" />
<description value="Recommend use of antithrombotic in ischemic vascular disease" />
```

Expressions

External Data

- Specifies the data required to evaluate the artifact
- Restricted expression subset to ensure computability of data requirements

Expressions

- Reusable “chunks” of logic that can be referenced anywhere within the artifact.

Conditions

- “Root” conditions of the artifact (e.g. ApplicableScenario)

External Data Example

```
<def name="onAntiThrombotic">
  <expression xsi:type="ClinicalRequest" cardinality="Multiple"
    dataType="vmr:SubstanceAdministrationEvent" codeProperty="substanceAdministrationGeneralPurpose"
    dateProperty="administrationTimeInterval.begin" useValueSets="true">
    <description>Patient prescribed antithrombotic within the past year</description>
    <codes xsi:type="ValueSet" id="2.16.840.1.113883.3.464.1003.196.12.1211"
      authority="National Committee for Quality Assurance" />
    <dateRange xsi:type="Interval">
      <begin xsi:type="DateAdd">
        <date xsi:type="Today" />
        <granularity xsi:type="Literal" valueType="DateGranularity" value="Month" />
        <numberOfPeriods xsi:type="Literal" valueType="xsi:int" value="-12" />
      </begin>
      <end xsi:type="Today" />
    </dateRange>
  </expression>
</def>
```

Expressions Example

```
<def name="ActivePertussisProblems">
  <expression xsi:type="Filter">
    <description>Problem status is not resolved or not inactive. In other words,
    the problem is active or status is not specified</description>
    <source xsi:type="ExpressionRef" name="PertussisProblems" />
    <condition xsi:type="Not">
      <operand xsi:type="In">
        <element xsi:type="Property" path="problemStatus">
          </element>
        <collection xsi:type="List">
          <element xsi:type="CodeLiteral" codeSystem="2.16.840.1.113883.6.96"
            code="73425007" displayName="Inactive" />
          <element xsi:type="CodeLiteral" codeSystem="2.16.840.1.113883.6.96"
            code="413322009" displayName="Resolved" />
        </collection>
      </operand>
    </condition>
  </expression>
</def>
```

Conditions Example

```
<condition>
  <logic xsi:type="And">
    <description>(Patient lives in SD or Care was in SD) and
    (Diagnosed with Pertussis or Cause of Death was Pertussis)</description>
    <operand xsi:type="Or">
      <operand xsi:type="ExpressionRef" name="PatientLivesInSDCounty" />
      <operand xsi:type="ExpressionRef" name="RelatedEncounterWasInSDCounty" />
    </operand>
    <operand xsi:type="Or">
      <!-- Necessary clinical conditions -->
      <operand xsi:type="ExpressionRef" name="HasActivePertussisProblems" />
      <operand xsi:type="ExpressionRef" name="DeathWasCausedByPertussis" />
      <operand xsi:type="ExpressionRef" name="HasPertussisCultureResultsPositive" />
      <operand xsi:type="ExpressionRef" name="HasGeneralCultureResultsPositiveForPertussis" />
      <operand xsi:type="ExpressionRef" name="HasBPertussisTestResults" />
    </operand>
  </logic>
  <conditionRole value="ApplicableScenario" />
</condition>
```


Actions

Message Action

Create/Modify/Remove Action

- Indicates proposal for some action
 - e.g. create a SubstanceAdministrationProposal
 - create a CommunicationProposal

Collect Information Action

- Defines information to be collected

Action Groups

- Provide structure for actions as well as behaviors

Message Action

```
<simpleAction xsi:type="MessageAction">  
  <message xsi:type="StringLiteral"  
    value="This patient has or is suspected of having pertussis.  
    Patients diagnosed with or suspected of having pertussis must  
    be reported to County of San Diego Health and Human Services  
    Agency within one working day of identification or suspicion" />  
</simpleAction>
```

Create Action

```
<simpleAction xsi:type="CreateAction">
  <textEquivalent value="Prescribe aspirin or other antithrombotic"/>
  <actionSentence xsi:type="ObjectExpression"
    objectType="vmr:SubstanceAdministrationProposal">
    <description>Prescribe aspirin or other antithrombotic</description>
    <property name="substance.substanceCode">
      <value xsi:type="CodeLiteral"
        code="2.16.840.1.113883.3.464.1003.196.12.1211"
        codeSystem="National Committee for Quality Assurance"
        displayName="Select a medication from this value set." />
    </property>
  </actionSentence>
</simpleAction>
```

Collect Information Action

```
<simpleAction xsi:type="CollectInformationAction">
  <documentationConcept>
    <displayText value="Pain Location" />
    <itemCodes>
      <itemCode code="Location" codeSystem="EMCode" />
    </itemCodes>
    <responseDataType value="String"/>
    <responseCardinality value="Multiple"/>
    <responseRange xsi:type="ListConstraint"
      strictSelection="false">
      <constraintType value="List"/>
      <item>
        <value xsi:type="StringLiteral" value="Suprapubic Area" />
      </item>
      <item>
        <value xsi:type="StringLiteral" value="Right Flank" />
      </item>
      <item>
        <value xsi:type="StringLiteral" value="Left Flank" />
      </item>
    </responseRange>
  </documentationConcept>
</simpleAction>
```

Triggers

Data Event

- Triggers on data modification
- e.g. When a Substance Administration is added to the patient data

Periodic

- Triggers on a recurring schedule
- e.g. Every morning at 2:00AM

Data Event Trigger

```
<def name="PertussisProblems">
  <expression xsi:type="ClinicalRequest" cardinality="Multiple"
    dataType="vmr:Problem" isInitial="true" useValueSets="true"
    dateProperty="diagnosticEventTime.begin" codeProperty="problemCode"
    triggerType="DataElementAdded">
    <description>Map to pertussis problems in problem list,
    that were diagnosed today or yesterday</description>
    <codes xsi:type="ValueSet" id="2.16.840.1.114222.4.11.7005"
      version="1" />
  </expression>
</def>

<trigger>
  <eventType>DataEvent</eventType>
  <expression xsi:type="ExpressionRef" name="PertussisProblems" />
</trigger>
```

Standardized Terminology – Content is King

- A successful model consists of a finely tuned **alignment** to both:
 1. Easy to identify information exchange elements
 - These describe "the kind of information needed"
 2. Widely understood concepts
 - These represent the patient-specific information
 - This *is not two things*, but one complete whole
- Development of this matched set requires an **iterative** development process
 - It's hard to do both simultaneously
 - Model often comes first – best practice to quickly build a terminologist team
 - Modeling often must actually start with what ends up as the terminology - "what information do we need to send/communicate"
 - Second part of this is to try to determine how to standardize terminology content first then move on to characterize "how to group and send it"
 - Expect changes to the model - this will happen *everywhere*
 - Shouldn't accept only "what exists now" but expect small advances
- Requires **real user data** (both e-data and paper), real practitioners, as well as modeling and terminology experts
- Build upon existing work
 - **Re-use** and re-work; Not Restart!
 - We are working towards open re-use of common value sets
 - Target truly implementable models

Tooling

Value Sets and Terminology Tooling

- Dictionary of Value Sets and Terminologies used as a basis for artifact creation

HeD Schema Framework


- Framework for Verification, Translation, and Evaluation of HeD Artifacts
- Currently supports Verification and Translation to CREF
- Designed to support translation to N formats
- Open Source, used on Pilot Projects to translate to CREF

UML Modeling Transformation Framework

- Based on OMG UML Modeling Tools
- Open Source Eclipse-based Functionality
- Used on Pilot Projects to translate to VA CPRS format

HeD Schema Status

HeD Schema for UC1 was successfully balloted as an HL7 DSTU. Changes made as a result of pilot projects will be incorporated into the HeD Schema and the Implementation Guide and re-balloted in September.



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Health eDecisions Use Case 2

Clinical Decision Support Guidance Service

Goal

- Allow any organization to easily obtain CDS guidance through a secure, standard Web service interface.

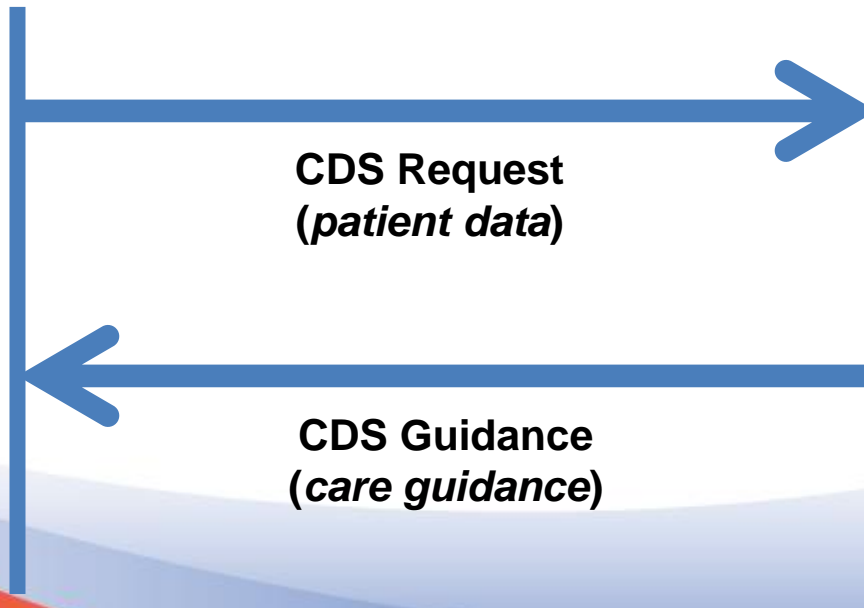
Use Case Overview



CDS Guidance Requestor



CDS Guidance Supplier



Key Standards

- HL7 Decision Support Service (DSS)
 - Defines SOAP Web service interface for CDS guidance services
 - REST Web service interface being added
- HL7 Virtual Medical Record (vMR)
 - Provides easy-to-understand data model for CDS
- HL7 Consolidated CDA (CCDA) and Quality Reporting Document Architecture (QRDA)
 - Terminology bindings and value sets largely being adopted within vMR

Report Type	Date/Time	Status	Fac
Comprehensive Clinic Note	07/06/2007 00:00	DUMI	
GLYCATED HEMOGLOBIN (HBA1C)	03/22/2007 15:01	DUMI	
CHOLESTEROL, TOTAL	03/22/2007 15:01	DUMI	
LDL-CHOLESTEROL (DIRECT)	03/22/2007 15:00	DUMI	
FAM Endocrinology Follow Up	03/22/2007 00:00	DUMI	
MICROALBUMIN/CREATININE RATIO	07/13/2006 16:54	DUMI	



Patient: [REDACTED]

GENLAB Chemistry: Final 03/22/2007 15:01 Acc# [REDACTED]

GLYCATE	<observationResult>	<problem>
LIPID PAN	<id root="670dded2-53a	<id root="d11275e7-67ae-11db-bd13-0800200c9a66"/>
OP4 (TBIL	<observationFocus code	<problemCode codeSystem="2.16.840.1.113883.6.96" code="73211009" displayName="Diabetes mellitus"/>
OP7 (CO2	<observationEventTime	<problemEffectiveTime low="1950"/>
Endocrino	<observationValue xsi:ty	<diagnosticEventTime low="20110825" high="20110825"/>
MAMMOG	</observationResult>	<problemStatus codeSystem="2.16.840.1.113883.6.96" code="55561003" displayName="Active"/>
Clinic Note		</problem>

MAMMOGRAPHY-SCREEN	05/19/2004 09:00	DUMI	*****
ASA (81 mg)	known to be allergic to aspirin		40+yo: no contraindications
	in listed as prescribed		

Eval.
Result

vMR

Decision Support
Service

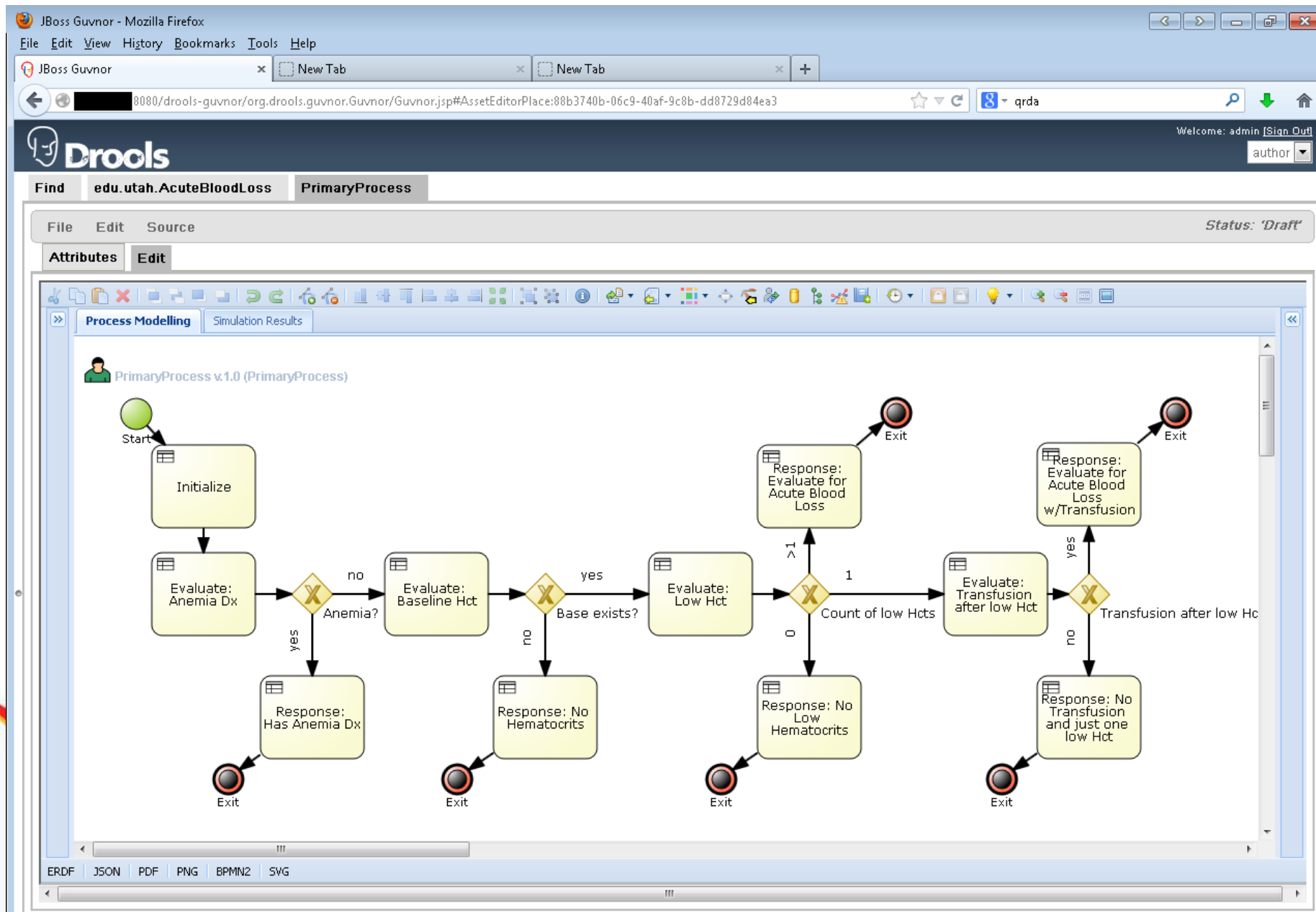
EHR System

Sample Current Implementers

- OpenCDS (www.opencds.org)
 - Multi-institutional open-source effort led by University of Utah
 - Implements HL7 DSS and vMR standards; will support HeD UC 2
 - Example implementation: Immunization Calculation Engine (ICE), led by HLN Consulting, & used by New York City, Alabama, eClinicalWorks
- Enterprise Clinical Rules Service
 - Part of CDS Consortium effort
- Epic EHR
 - Will support CDS Guidance Services in 2014 release

OpenCDS Knowl. Editor

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HeD Status – Use Case 2

- Use Case requirements consented April 2013
 - <http://wiki.siframework.org/UC+2+--+CDS+Guidance+Service>
- HL7 specifications being prepared for September 2013
 - DSS Implementation Guide
 - Updates to relevant base standards (DSS, vMR)
- Focus on defining simple, reusable vMR building blocks (e.g., vMR Problem, vMR Lab Result)
- Examples for prototypical functional areas (e.g., immunization guidance, drug-drug interaction guidance)
- Pilots in Fall 2013

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Health eDecisions Pilots

Use Case 1: Shareable Clinical
Decision Support Knowledge

HeD Pilots Goal

Goal



The goal of this initiative is to produce, consume and where feasible, execute implementable CDS interventions.

1. Event Condition Action Rules (ECA Rules)
2. Order Sets
3. Documentation Templates

Pilot Scope

1. Health eDecisions will apply defined aspects of the Implementation Guide in a real-world setting.
2. Modify the Implementation Guide to ensure it is usable
3. Submission of explicit feedback to sub workgroups such as vMR and vocabulary and terminology to close gaps
4. The real-world pilots evaluate not only the technology, standards and model (VMR), but also provide a test bed to evaluate the interaction of technology, implementation support, and operational infrastructure required to meet Health eDecisions use case 1 objectives at the stakeholder or organization levels.
5. Demonstrate intent of artifact (specifically structures and semantics) are communicated either by direct execution or by translation to native format
6. Ensure Completeness and consumability of artifact

Pilot Partnerships

EHR	Pilot	Content Supplier
Design Clinicals	Order Sets – Heart Failure	Zynx
AllScripts	ECA Rules –NQMF 068 (Million Hearts)	NewMentor 
Allscripts	ECA Rule - San Diego Pertussis	CDC
VA	Documentation Template – Urinary Tract Infection	Wolters Kluwer 

NQF-0068 ECA Rule

NQF-0068 / PQRS-204 - Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antithrombotic.

Artifact was developed with NewMentor as an example artifact to be included as part of the HeD UC1 Implementation Guide

We then used the example as a vehicle for a UC1 Pilot with Allscripts to demonstrate translation

HeD to CREF Example


```
<!-- HeD -->
<def name="onAntiThrombotic">
  <expression xsi:type="ClinicalRequest" cardinality="Multiple"
    dataType="vmr:SubstanceAdministrationEvent" codeProperty="substanceAdministrationGeneralPurpose"
    dateProperty="administrationTimeInterval.begin" useValueSets="true">
    <codes xsi:type="ValueSet" id="2.16.840.1.113883.3.464.1003.196.12.1211" authority="National Committee for Quality Assurance" />
    <dateRange xsi:type="Interval">
      <begin xsi:type="DateAdd">
        <date xsi:type="Today" />
        <granularity xsi:type="Literal" valueType="DateGranularity" value="Month" />
        <numberOfPeriods xsi:type="Literal" valueType="xsi:int" value="-12" />
      </begin>
      <end xsi:type="Today" />
    </dateRange>
  </expression>
</def>

<!-- CREF Equivalent -->
<ds:NamedExpression Name="onAntiThrombotic">
  <ds:FilterExpression>
    <ds:RequestExpression Cardinality="Multiple" Type="Medication">
      <ds:ValueSetExpression ValueSetID="2.16.840.1.113883.3.464.1003.196.12.1211" />
      <ds:DateRange>
        <ds:DateAdd Granularity="Month">
          <ds:Today />
          <ds:ValueExpression Type="Int32" Value="-12" />
        </ds:DateAdd>
        <ds:Today />
      </ds:DateRange>
      <ds:RequestExpression.Codes />
    </ds:RequestExpression>
    <ds:BinaryExpression Operator="opEqual">
      <ds:PropertyExpression Path="Status" />
      <ds:ValueExpression Type="String" Value="Active" />
    </ds:BinaryExpression>
  </ds:FilterExpression>
</ds:NamedExpression>
```

UTI Documentation Template

The artifact was developed with Wolters Kluwer Health as an example documentation template in the UC1 Implementation Guide.

We then used the example as a vehicle for a UC1 Pilot with the VA to translate to their CPRS format.



UTI Documentation Template

```
<!-- HeD -->
<simpleAction xsi:type="CollectInformationAction">
  <documentationConcept>
    <displayText value="Pain Location" />
    <itemCodes>
      <itemCode code="Location" codeSystem="EMCode" />
    </itemCodes>
    <responseDataType value="String"/>
    <responseCardinality value="Multiple"/>
    <responseRange xsi:type="ListConstraint"
      strictSelection="false">
      <constraintType value="List"/>
      <item>
        <value xsi:type="StringLiteral" value="Suprapubic Area" />
      </item>
      <item>
        <value xsi:type="StringLiteral" value="Right Flank" />
      </item>
      <item>
        <value xsi:type="StringLiteral" value="Left Flank" />
      </item>
    </responseRange>
  </documentationConcept>
</simpleAction>

<!-- CPRS Equivalent -->
<p>- Pain Location : [Suprapubic Area, Right Flank, Left Flank]</p>
```


Questions

Useful Links

Wiki

- <http://wiki.siframework.org/Health+eDecisions+Homepage>

Use Case 1& 2

- <http://wiki.siframework.org/Health+eDecisions+Use+Case>
- **UC 2: Use Case 2:** <http://wiki.siframework.org/UC+2+-+CDS+Guidance+Service>

Pilots

- <http://wiki.siframework.org/Health+eDecisions+Pilots>

HL7 Ballot Submission:

- <http://wiki.siframework.org/Health+eDecisions+Reference+Materials#Ballot>

UC 1 Harmonization and IG:

- <http://wiki.siframework.org/Health+eDecisions+Harmonization+and+Standards+%28Implementation%29>

HeD Glossary

- <http://wiki.siframework.org/HeD+Glossary>

Contacts:

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