**ONC – Sharable CDS Project**

**CDS Sharing Structure - Description Form and Example**

**March 30, 2012**

Please take as much space as you need for your responses for the description form.

Don’t forget to provide the CDS examples listed at the end of this document, below the structure-description table.

Please return by EOB Tuesday 4/3/2012.

***Clarifying note:*** We have replaced the term “clinical decision support rule” used in the 2011 Edition EHR certification criteria and the HITSC recommended criterion with the term “clinical decision support intervention” to better align with, and clearly allow for, the variety of decision support mechanisms available that help improve clinical performance and outcomes. A CDS intervention is not simply an alert, notification, or explicit care suggestion. Rather, it should be more broadly interpreted as the user-facing representation of evidence-based clinical guidance. Our goal in clarifying the nomenclature is to focus more on the representation of the guidance (the CDS intervention) that the EHR technology should offer to the user rather than prescribe the form of either the logical representation of the clinical guidance or how the intervention interacts with the user.

1. **CDS Structure Description**

|  |  |  |
| --- | --- | --- |
|  | Example | Your responses |
| **Your name** |  | Bob Greenes, Peter Haug, Samson Tu, Mary Goldstein, Jerry Osheroff |
| **Name of your model or project** |  | Setting-Specific Factor (SSF)-Based Rule Modules |
| **Major function or purpose** | To improve readability and precision of guidelines; to provide downloadable or copyable interventions; to provide a remote CDS service | * To enable providers/care sites to easily select factors that will enable them to adapt generic rules to their workflow, usage patterns, and settings. * To provide these rules (both the generic and the localized versions) in a form that supports *readability* for clinical experts. * To simplify the implementation of tools that support modification of part or all of a decision support rule. * To provide these capabilities in a way that embraces standards. * To simplify the conversion from a readable/maintainable format to a locally implementable artifact. |
| **Primary conventions, toolkits, rules engines, data standards** | DROOLS, Arden, GEM | Builds on eRecs, Arden Syntax, ArdenML, VMR.  Built to take advantage of HL7 standards and readily available tooling for XML-based documents. The system builds on ArdenML (XML version of Arden Syntax as intermediate form for rules), the VMR data model, and evolving taxonomy of SSFs. SSFs are partially based on NQF taxonomy of trigger and realization options for CDS. The non-localized XML version of the rule, which we refer to as a Level-2 rule, is based on work by the AHRQ-funded eRecommendations (eRec) project. While not in ArdenML format currently, the rules produced can be converted to ArdenML. |
| **Active use by (vendors, agencies)** | Allscripts SCM; American College of Cardiology; NQF | Arden Syntax is used by some vendors. We are proposing ArdenML as an interlingua, because it can be converted by XSL style sheets to Drools, Java, or other host forms, and to human-readable form. |
| **Number of interventions/rules built** |  | Many Arden Rules exist. Our project starts with the rules from the eRecs project in XML form – i.e., generic logic, then enables customization. Various vendors (Eclipsys, the Regenstrief Institute, Siemens, McKesson, etc.) have proprietary rule sets. Exchange of these medical logic modules (MLMs) is hindered by the lack of a common data model. Although the curly braces provides a way around this problem in practice implementation can prove difficult,  An Austrian group, Medexter Healthcare has been building interesting, ICU-oriented systems in Europe. They have their own implementation of an Arden inferencing system with some interesting features.[[1]](#footnote-1) The eRecs project produced XML versions of 45US Preventive Services Task Force A and B preventive care recommendations and 12 Meaningful Use clinical performance measures, which are in the public domain (provided to AHRQ). |
| **How is it expressed?** |  |  |
| * XML version available? |  | ArdenML is an XML representation of the Arden syntax. eRec rules are available in XML, but need to be harmonized with ArdenML and the VMR data model, if that is decided on. |
| * Pseudo-code? |  | Arden Syntax |
| * Other coded format |  | Research has resulted in prototype translators to Java and to forms that can run within the Drools environment. One goal behind providing an XML representation is to simplify translation to other languages. |
| * Human-readable format |  | Is generated by an XSL style sheet. |
| * Other (describe) |  |  |
| **CDS Process Steps that are expressed in your model** | *(Only fill in information for the steps that your model directly supports)* |  |
| - Triggering | Event, data filing, absolute time, relative time since event, manual, other. State which of these are supported and describe | Arden syntax can respond to events, data storage, and various expressions of time.[[2]](#footnote-2) In the SSF project, each of these can have SSF template. Not all are complete. |
| - Logic | Calculations necessary to guide whether, and how, information is to be presented or filed or actions taken. Describe method | Arden syntax has more than 140 operators. They include temporal comparison functions and a variety of list management operations. Typical mathematical operations are provided. |
| - Access to Input Data | How input data is accepted, whether generic or installation-specific | Arden syntax deals with data through the "data slot" and the curly braces. In our SSF implementation, input data are not directly entered into the logic module. The elements needed are defined in the data section, and referenced in terms of the VMR model. An execution engine running the logic would be responsible for actually obtaining the data.  In principle, the execution engine can be programmed so that (1) the data section of the MLM specifies the necessary data elements, and the module invoking the MLM supplies that data. In HL7 CDS services, the data are passed in by the invoking module. |
| * Classes of data supported | Lab tests, physical findings, diagnoses, procedures, text, orders, etc. (which standards)? | Arden supports any data defined in the data slot. All of these data types can be provided via VMR model. |
| - Use of Value sets | How these are defined, used | Our model uses (1) any value sets as specified in the VMR model , (2) and as specified in the SSF ontology. Value sets can be managed entirely in the data slot and referenced there by the logic. |
| - Notification and acknowledgement, if any | Is notification supported (e.g., sending messages, email, status display) | Arden syntax is designed to support notification through services provided by the EHR. In the SSF project, we intend to support a taxonomy of actions, with templates for each type. Not all are complete. |
| * Intervention | Intervention types directly supported (i.e., you specify the core elements – for an alert, this might be an informational message, presentation of some data, and offered actions). Specify which types. See below for list. | Syntax is available in Arden to support a variety of interventions as provided through services in the EHR. Current intervention types includes: textual messages, and choice of Acknowledge, Document, Educate, Order, Prescribe, and Refer |
| * + (Describe one type) | Describe core elements in one supported intervention type and how they are represented | Generally, a combination of defined destinations (e-mail, alert queue, EHR-Datastore, pager, etc.) can be referenced by defining destinations in the data slot and messaging to those destinations in the action slot. |
| * + (Describe one type) |  | Prescribe template:  PrescribeType e.g., Display Form  Form e.g., Prescription Form  Prescription: e.g., start metformin po  Method: e.g., Send to pharmacy  RequireCompletion: Boolean |
| * + (Describe one type) |  | Refer:  ReferType: e.g., PrintReferalForm  ReferTo: e.g., Nutritionist |
|  |  |  |
| - Offered user actions | Actions the user can take are directly supported, such as documentation, adding/deleting an order, posting acknowledgement, documenting exceptions. Specify which kinds | We provide templates for user actions, but actual implementation will depend on the host system execution engine.  Arden syntax provides an inferencing environment. It expects services in the EHR to provide the interactions with the users. Syntax is provided to invoke a variety of different services. As standard services become available in EHRs, we should be able to configure Arden to use these without significant change. |

Standard list of intervention types, for reference:

1. -Immediate critiques and warnings (e.g., in response to an order – “immediate alerts”)
2. -Event-driven or time-driven alerts and reminders (not in response to an order)
3. -Relevant data summary displays for a patient’s conditions/events
4. -Orders/order sets/care plans
5. -Parameter guidance (usually within ordering)
6. -Smart documentation templates
7. -Filtered reference information and knowledge resources (including infobuttons)
8. -Diagnostic advice or expert workup guidance
9. -Analytic calculations

1. **CDS Structure Examples:**

Show how your method / structure / format is used to its fullest to handle the following two CDS situations, based on Stage 1 Meaningful Use quality measures. Describe how you fulfill the elements above, e.g., triggering, access to data, logic, intervention, offered actions.

1. Ambulatory chronic care: **Hemoglobin A1c in diabetes**– done in timely fashion, recognize/deal with high values

User has choice to specify how it is to be triggered: batch search of registry or patient list, open chart, etc.

Data elements include definition of diabetes, last HbA1c result existence, date, and value.

Core primitives available to customize logic – e.g., to check existence, to compare a date range, to compare to a threshold value

Logic can be visualized graphically, as succinct human-readable text, as Arden Syntax, or in full Arden ML XML expansion.

Actions can be selected from list of available actions, and template filled in, e.g., message content, method of communicating, delay before escalating, whether acknowledgment is required.

Let's use the timing of repeat HgbA1Cs as an example. In figure 1 we have an example where a trigger is specified (Registration\_Event) but where no routing of the message is provided. We would assume a default management of this message from the system. However, as an alternative we might add the statement:

LET Single\_User\_Email BE DESTINATION {email: [user@cuasdf.bitnet](mailto:user@cuasdf.bitnet)};

To the data slot and rewrite the action slot as:

action:

WRITE "Patient”||patID|| “ is a diabetic with no HgbA1c in last 6 months. Please order one." AT Single\_User\_Email;

This also requires that patID be defined in the data slot, but it gives an idea of how one might extend the behaviors available from the action slot. In fact, one can use it for messaging, for data storage, for returning results to another MLM, and to invoke additional logic with various time delays as needed. Additional flexibility (and complexity) can be added by creating a variable or object in the data slot that is defined as a message:

message\_obj := OBJECT [subject, text];

high\_PTT\_msg := MESSAGE AS message\_obj {Elevated PTT}

The result is a flexible environment for constructing notification models designed to communicate with users, with databases, or with other systems.

**maintenance**:

title: Rule 1-HgbA1c Timing;;

mlmname: HgbA1c\_Timing;;

arden: Version 2.7;;

version: 1.00;;

institution: Intermountain Healthcare;;

author: Peter Haug (Peter.Haug@imail.org);;

specialist: Peter Haug (Peter.Haug@imail.org);;

date: 2011-02-14;;

validation: testing;;

**library**:

purpose: Alert for HgbA1c if greater than 6 months. ;;

explanation: This MLM will send an alert if the patient is a diabetic (diabetes and problem list or discharge diagnoses) and

no HgbA1c is recorded within the last 6 months.;;

keywords: diabetes; HgbA1c;;

citations: to be added.;;

links: to be added;;

**knowledge**:

type: data\_driven;;

data:

LET Problem\_List\_Problem BE OBJECT [Problem, Recorder];

LET Problem\_List BE READ AS Problem\_List\_Problem {select problem, recorded\_by from Problem\_List\_Table};

LET Patient\_Dx\_Object BE OBJECT [Dx];

LET Discharge\_Dx BE READ AS Patient\_Dx\_Object {ICD\_discharge\_Diagnoses};

LET Chem\_Lab\_Object BE OBJECT [Measurement\_Name, LOINC\_Code, Measurement\_Units, Value];

LET Last\_HgA1c BE READ AS Chem\_Lab\_Object LATEST {select measurement, LOINC, units, value from Laboratory\_Table where measurement='HgbA1c'};

Let Registration\_Event BE Event {registration of patient};

;;

evoke: Registration\_Event;;

logic:

if Discharge\_Dx.Dx IS IN (250, 250.0, 250.1, 250.2, 250.3, 250.4, 250.5, 250.6 250.7, 250.8, 250.9)

or exist(Problem\_List) and "Diabetes" IS IN Problem\_List.Problem

then Diabetes\_Present := True;

endif;

if Diabetes\_Present and exist Last\_HgA1c and Last\_HgA1c Occurred not within past 6 months

then conclude true;

endif;

conclude false; ;;

action:

WRITE "Patient is a diabetic with no HgbA1c in last 6 months. Please order one.";

end:

Figure 1: Simple HgbA1C example.

1. Inpatient care: VTE prophylaxis for appropriate patients after admission

User has choice to specify how it is to be triggered: in this case, on admission

Data elements include definition of appropriate patient categories, whether VTE prophylaxis already ordered, date of admission

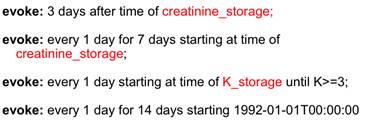
Core primitives available to customize logic – e.g., to check existence, to compare a date range

Logic can be visualized graphically, as succinct human-readable text, as Arden Syntax, or in full Arden ML XML expansion.

Actions can be selected from list of available actions, and template filled in, e.g., message content, method of communicating, delay before escalating, whether acknowledgment is required

The approach is similar. We have not had time to develop this one, but one of the eRec Level 2 XML rules addresses this.

1. They have piloted an implementation of fuzzy logic in Arden and are proposing it as an extension to the standard. [↑](#footnote-ref-1)
2. Example of some available triggering constructs for Arden Syntax.

    [↑](#footnote-ref-2)