Wide Adoption of CDS – Largely a Usability Issue

SHARPC Project 2B: Facilitation of CDS Adoption through Modeling of Setting-Specific Factors

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A focus on rule-based knowledge: shown to be effective – *yet not widely used*

- One barrier: lack of shared repositories of reliable knowledge in form of CDS rules – available rules are:
  - Either too generic – not ready for implementation
  - Or too specific – form implemented in one place not able to be used readily in another

Knowledge sources

- Too generic
  - Many guidelines but no uniform agreed upon repository of “ready-to-execute” CDS
  - USPS Task Force, professional societies, disease societies – not in executable form
    - e.g.,

“strongly recommend screening men aged 35 and older for lipid disorders”

- Too specific

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- One barrier: lack of shared repositories of reliable knowledge in form of CDS rules – available rules are:
  - Either too generic – not ready for implementation
  - Or too specific – form implemented in one place not able to be used readily in another
- Another barrier: lack of tools for readily adapting CDS to setting to make it usable

CDS can be annoying

- Those constant pop-ups / alert fatigue!
- Telling you what you already know
- Taking extra time
- Asking for data you don’t have

- Consequences
  - Turn off CDS altogether
  - Water down the recommendations so they don’t fire so often
  - Use but remain a continued source of frustration

Many ways to deliver CDS ... but issues

- Bad use of CDS backfires
- Success is highly dependent on matching to setting and workflow
- Systems and platforms are incompatible
- Experience and successful know-how not readily portable

Example of difficulty in sharing

- Subtitle: "Why is something so simple so hard to do?"
- Simple medical rules, e.g.,
  - If Diabetic, then check HbA1c every 6 months
  - If HbA1c > 6.5% then Notify
- Multiple translations
  - Based on how triggered, how/when interact, what thresholds set, how notify
  - Actual form incorporates site-specific thresholds, modes of interaction, and workflow

HGBA1c_ASSESSMENT		PHS				IH				VA		KP
		Over due	Expiring	High 1	High 2	15	16	17	18			
Conditions	Most recent HgbA1c < (or <=) 9 months old											N
	Most recent HgbA1c < (or <=) 11 months old									N	N	
	Most recent HgbA1c < (or <=) 6 months old	N	Y				N					
	Most recent HgbA1c < (or <=) 5 months old		N	Y		N						
	Most recent HgbA1c < (or <=) 3 months old			N	Y			N	N			
	Most recent HgbA1c (in the last year) > 7%			Y	Y		N	Y				
	Most recent HgbA1c (in the last year) > 8%							N	Y			
	HgbA1c documented elsewhere									N		
	HgbA1c ordered within last 7 days											N
	Patient refused HgbA1c testing within last 6 mo									N	Y	
Messages	Patient is overdue for HbA1c (rec: q 6 months)	Y										
	Missing HgbA1c data (should be done on all Patients with Diabetes)					Y						
	All Patients with Diabetes should have a HgbA1c at least every 6 months						Y					
	Diabetics need at least annual Hemoglobin A1C testing.											Y
	Hemoglobin A1C required annually for all diabetic patients. Patients with levels >7.0 should be considered for more frequent testing.									Y		
	Patient is almost due for HbA1c (rec: q 6 months)		Y									
	All Patients with Diabetes and HgbA1c between 7 and 8 should have a HgbA1c every 3 months							Y				
	All Patients with Diabetes and HgbA1c > 8 should have a HgbA1c every 3 months until under 8.0								Y			
	Last HbA1c is high, and patient is overdue for HbA1c (rec: q 3 months)			Y								
	Last HbA1c is done within 3 months, but high				Y							
	Patient refused Hemoglobin A1C testing. Ask again in 6 months.										Y	
LAB	Order A1C test today	Y	Y	Y								
	Order A1C test in 3 months			Y	Y							

- Multiple rules have similar intent
- Differences relate to how triggered, how delivered, thresholds, process/workflow integration, etc.
- Challenge is to identify core medical knowledge and to develop a process to capture differences in settings so that the knowledge can be adapted to them

Analysis by Saverio Maviglia, Morningside Initiative, 2008

Special problems where needed most

- Chronic disease such as diabetes is ~80% of national health cost
- Much of the management (and potential control of resource use and cost) is in primary care
- Yet EHR systems for office practice are still relatively less sophisticated than for hospitals
- Many practices are not part of enterprise systems

- These practices don't have the time, expertise, and resources to customize and adapt
  - More dependent on vendors
  - Under more time pressures
  - More likely to turn off or reject poorly adapted CDS

SHARP 2B is focused on overcoming both barriers

1. **Creation of sharable repositories** of best-practice rules knowledge
   - with formal specification to facilitate implementation
2. **Development of tools** for practitioners/domain experts **to customize** CDS
   - to adapt rules to their settings

Thus 2 usability issues

1. Usability of CDS
2. Usability of tools to make CDS usable

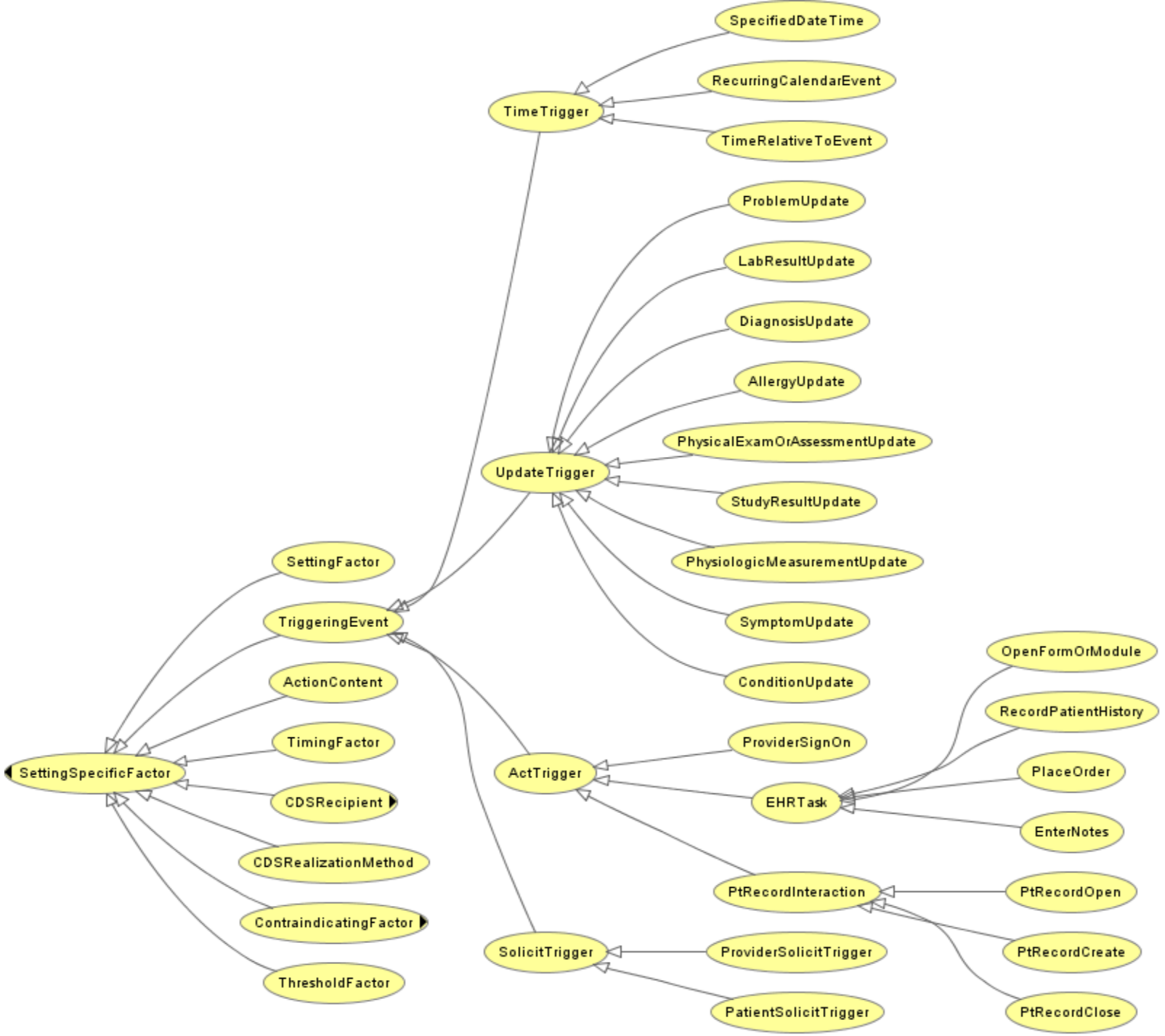
Overall goal: facilitate refinement and wide sharing of best practice knowledge by:

- Agreeing on the knowledge to be deployed
- Structuring it to make it unambiguous
- Adapting it – to make it useful and usable
  - to setting-specific factors
    - patient, site, user, workflow, vendor platform and app suite
- Learning and refining from experience
  - Working with stakeholders to refine and improve the approach
  - Creating a “learning community” around deployment and effective use

Setting-specific factors:

How, When, Who, Where ... and Refinement of the What

- Triggering/identification modes
  - On chart open, on lab test result , on provider login, …
  - Registry, periodic panel search, patient list for day, …
- Inclusions, exclusions
  - To be more patient-specific
- Interaction modes, users, settings
- Timing considerations
  - Advance, late, due now, …
- Data availability/ sources/ entry requirements
- Thresholds, constraints
- Actions/notifications
  - Message, pop-up, to do list, order, schedule, notation in chart, requirement for acknowledgment, escalation, alternate. …
- Exceptions
  - Refusal, lost to follow up, …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DiagnosisUpdate
AllergyUpdate
PhysicalExamOrAssessmentUpdate
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PhysiologicMeasurementUpdate
SettingFactor
TriggeringEvent
SymptomUpdate
ConditionUpdate
OpenFormOrModule
RecordPatientHistory
ActionContent
ProviderSignOn
TimingFactor
PlaceOrder
ActTrigger
SettingSpecificFactor
EHRTask
CDSRecipient
EnterNotes
CDSRealizationMethod
PtRecordInteraction
PtRecordOpen
ContraindicatingFactor
PtRecordCreate
SolicitTrigger
ProviderSolicitTrigger
ThresholdFactor
PatientSolicitTrigger
PtRecordClose

4-Stage Model of Knowledge Refinement

Start with EBM statement

Stage

1. **Identify key elements and logic – who, when, what to be done**
   - Structured headers, unstructured content
   - Medically specific
2. **Formalize definitions and logic conditions**
   - Structured headers, structured content (terms, code sets, etc.)
   - Medically specific
3. **Specify adaptations for execution**
   - Taxonomy of possible workflow scenarios and operational considerations: setting-specific factors ("SSFs")
   - Implementer selects appropriate SSFs for a particular use
   - Output in a l*ingua franca* - as extension of Arden ML
4. **Convert to target representation, platform, for particular implementation**
   - Host language (Drools, Java, Arden Syntax, …)
   - Host architecture: rules engine, SOA, other
   - Applications / functions in which to integrate CDS
   - Ready for execution

Approach

- Work with stakeholders
  - Establish a “learning community”
    - EHR vendors, US Federal Collaboratory on CDS, Beacon projects, REC MUVers, other project input, buy-in
  - KMR project & selected vendor testbed deployment
- SSF taxonomy development
  - Amalgam of NQF expert panel, Morningside/ SHARP/ Advancing-CDS workflow studies, eRec implementation considerations, etc.
- Knowledge base
  - Initially Diabetes, based on prior Morningside Initiative work
    - HbA1c, lipid, BP, feet, eyes, kidneys/, BMI, depression, vaccines
    - Drug dosing
  - Also USPS Task Force prevention and screening A&B recommendations, from AHRQ eRec project
  - Meaningful Use eMeasures converted to eRecommendations from eRec project
- Implementer’s Workbench
  - Prototyping, testing, and iterative refinement using pilot sites with vendor/implementer partners

Example: Evolving a CDS Rule Using SSFs

Description (Site-Specific Difference)	Post-Editing Expression
Initial expression:	**If Diabetes_Present and exist Last_HgA1C and Last_HgA1C Occurred after 6 months ago**

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Specify Intervention: Display message "Pt. Almost due for HgA1c"	Logic: If Diabetes_Present and exist Last_HgA1C and Last_HgA1C Occurred after 6 months ago and Last_HgA1c Occurred before 5 months ago Intervention: Order HgA1c ***and display message "Pt. Almost due for HgA1c"***

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Add Trigger: On chart open by attending physician	***Trigger: OnChartOpen (User:=AttendingPhysician)*** Logic: If Diabetes_Present and exist Last_HgA1C and Last_HgA1C Occurred after 6 months ago and Last_HgA1c Occurred before 5 months ago Intervention: Order HgA1c and display message "Pt. Almost due for HgA1c"

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Specify Setting: Inpatient Status and NOT ICU_Inpatient	Trigger: OnChartOpen (User:=AttendingPhysician) ***Setting: Pt.Status.Type = Inpatient and NOT Pt.Status.Location = ICU*** Logic: If Diabetes_Present and exist Last_HgA1C and Last_HgA1C Occurred after 6 months ago and Last_HgA1c Occurred before 5 months ago Intervention: Order HgA1c and display message "Pt. Almost due for HgA1c"

Implementer's Workbench Desired Features

- Search for and select new or existing rule for editing
- Auto-track versions and derivatives
- Ease of creating logic
  - based on primitive clauses – either matched to text or browsed for
  - logic expression graphic design tool
- Data naming based on defaults from vMR data model, hiding complexity
- SSFs guide user to specify features desired

Primitives

- Small number of rule relation-clause types
  - Used singly or in combination
  - Expressed in terms of few data classes
  - e.g., from Greenes, Sordo, et al, MEDINFO, 2004:

```
If MedOrder MedName IS MEDICATION  then ALTERNATE
RX SUGGESTION
If MedOrder MedName IS MEDICATION  then request
approval
If MedOrder MedName IS in MedList CURRENT-
MEDICATION   then display message
If MedOrder MedName IS MEDICATION and any of the
last 1 CREATININE results during the last 99 days
is > 1.5  then  suggest change dose based on
patient's renal function
If MedOrder MedName IS IN Patient Allergies then
display message
```

Modelled Primitives in 2004 Study

System			Modelled Primitives	
Name	**No. Rules**	**No. Primitives***	**No.**	**%**
Automatic Alerting	32	9	9	100
Outpatient Reminders	25	14	14	100
MGH CPOE	95	9	9	100
BWH CPOE				
Results Manager	48	9	9	100
ADE	54	10	10	100

*Out of total of 51 primitives, 41 unique primitives used

Expected results

- Shared knowledge resources in deployable form
  - Knowledge content
  - Templates
  - Taxonomies
- Refined methods/tools
  - Implementer’s workbench
  - Transformation processes
- Inputs to standards process
  - Representation
  - Data model/code sets
  - SSFs
- Sharable experience/know-how

Questions, comments?

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Views expressed are those of the authors/presenters and not necessarily those of the affiliated organizations

Acknowledgment: Funding for this work by SHARPC grant to University of Texas Houston from the Office of the National Coordinator. Contributions to this work from Morningside Initiative, eRecommendations, and KMR project participants.