Reusable Knowledge for Best Clinical Practices:
Why We Have Difficulty Sharing – And What We Can Do about It

Panel Presenters:

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Alan Rector, MD, PhD  Jerome A. Osheroff, MD
Univ of Manchester, UK  TMIT Consulting & Univ. of Penn, USA
Organization of the Panel

• Short presentations by each of us (50-55 min)
  – To lay out key issues
  – To describe a particular position or perspective

• Audience participation (35-40 min)
  – Questions to individual presenters
  – Responses to provocative position statements by presenters
  – Open discussion
The Problem of CDS Knowledge Sharing

An Approach and a Proposal

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The current state

• Rationale and need for sharing CDS best practices growing
  – Knowledge growth, time pressures, patient demand, quality measurement & reporting, value tied to reimbursement,
  – ...

• Yet 4 main obstacles
  – No agreed format
  – Limited content
  – Lack of an “implementation science”
  – Limited tools
Status of sharing efforts

- **Collections**
  - Cochrane, EPC Centers, guidelines.gov, NICE
  - Not computable

- **Standards**
  - Arden Syntax, GELLO, Infobuttons, VMR, DSS service model
  - Limited convergence

- **Commercial offerings**
  - Order sets, drug interaction tables, infobuttons
  - Limited rules sharing

- **Multi-stakeholder collaborations**
  - CDS Consortium, Morningside Initiative/SHARPc Project 2B, HL7 CDS Working Group, Structured Care Recommednations, ONC Health eDecisions Initiative
  - Beginning to lead to models but no true content sharing
  - No sustainability so far
Primary Gaps

• Limited availability of rules knowledge
  – Usually just within vendor/user group
  – Or only at the generic level
  – Not very sharable at implementation level
    • Proprietary or incompatible KRs and data models
    • Workflow adaptations limit reusability
  – Knowledge management and update difficult
  – Particular difficulty in smaller practices and hospitals without IT staff
Example of difficulty in sharing

• 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
    • e.g., Mayo Clinic has some 10-15 variations of these rules!
Setting-specific factors (SSFs)

- Triggering/identification modes
  - On chart open, on lab test result, on provider login, ...
  - Registry, periodic panel search, patient list for day, ...
- Inclusions, exclusions
- 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, ...
Workflow adaptation – the missing link

• Estimated that adaptation can take 50-90% of effort
• Adapted artifacts not very sharable
• But principles of how done (SSF types) might be more so
  – e.g., how a screening reminder is triggered, who sees patient first, who should be recipient, how timing done
  – Can create KR with meta-tags for domain, type of rule, SSF selections
  – Can model a new rule on a paradigm (set of choices) similar to one that was successful (sort of QBE)

• Hypothesis: repositories are more sharable/reusable at this abstracted level of workflow adaptation
  – More transparent to SMEs, users
  – Could lead to development of an experience base and implementation science
“Implementation science”

- Workflow adaptation support
- KM support
  - Versioning, update, lifecycle of refinements and adaptations
- Interoperability of data and information models
- Integration into EHR environments
  - Service model
  - Incorporation directly into internal knowledge repositories
Life Cycle of Rule 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
   - Ontology of SSFs
   - Selected SSFs for particular sites
   - Authoring to support incremental adaptation

4. Convert to target representation, platform, for particular implementation
   - Host language (Drools, Java, Arden Syntax, …)
   - Host architecture: rules engine, SOA, other
   - Ready for execution
The Health eDecisions (HeD) Initiative

• Part of the US ONC’s Standards and Interoperability Framework
  – http://wiki.siframework.org/Health+eDecisions+Homepage

• Two main use cases:
  1. CDS Artifact Sharing
     • Computable representations for rules, order sets, and documentation templates
  2. CDS Guidance Service
     • Service model for delivery of CDS
Health eDecisions Homepage

Announcements

- We just finished our HeD Pilots Virtual OPEN HOUSE....A SHOWCASE FOR USE CASE 1 PILOTS!! Take a look at what we have done....

  ![open house final v2.pptx](open house final v2.pptx)

  - View a recording: [https://vimeo.com/70201880](https://vimeo.com/70201880)

- On June 6 we presented at an AMIA webinar. This presentation included an introduction to the S&I framework as well as a description of our methodology. We also presented a brief history of HeD as well as the work we have done and are continuing to do with Use Case 1, Use Case 2, and our pilots. Thank you to all who contributed! The presentation material can be seen [here](https://vimeo.com/70201880).

- **Consensus was achieved on the HeD CDS Guidance Service Use Case (Use Case 2) on April 4, 2013!**
  Congratulations and thank you to everyone who participated in the Use Case development process. To review the Implementation Guide and Consensus Statement votes, see the [HeD Consensus Page](https://vimeo.com/70201880).

- Use Case 1 Pilots has started!!! To participate as a pilot for Use Case 1 please complete the Pilots Survey. If you are interested in partnering with another organization be sure to complete the entire survey including the “Areas of Potential Partnership” question.

- We submitted our HL7 Ballot. To see what was submitted see the HL7 Ballot Section of the Reference wiki: [HL7 Ballot](https://vimeo.com/70201880).

- The Health eDecisions Schema can be seen [HERE](https://vimeo.com/70201880) in our HeD Google Code Repository.

Weekly Meetings

<table>
<thead>
<tr>
<th>Mondays</th>
<th>Tuesdays</th>
<th>Wednesdays</th>
<th>Thursdays</th>
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<tbody>
<tr>
<td>HeD UC 1 Pilots meetings are now held weekly</td>
<td>HL7 CDS/HeD Joint Meeting Tuesday, July 30, 2013</td>
<td>HeD Use Case 2 Standards SubWG Meeting</td>
<td>All Hands Community Meeting Monday, August 5</td>
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</table>
Our goals for HeD use case 1

- Create (with working group) a model-driven CDS authoring tool
  - Based on the HeD standard
  - Having a unified model supporting different views
  - Supporting different levels of abstraction/granularity
    - Views for SME vs. KE
  - Adopted as HL7 standard

- Provide compatibility with existing standards
  - Reference state-of-the-art data models and terminology systems
  - Convertible to existing CDS languages and data models

- Provide open-source authoring/editing tool
  - Aimed at stage 2 artifact interchange
HeD Semantic Model

• Companion to the HeD schema
  – Abstracts the content delivered by the syntax
  – HeD schema available at https://code.google.com/p/health-e-decisions/

• Defined using a modular OWL ontology for events, conditions, actions, data elements
  – Standards-based
  – Set in the context of well-known upper ontologies
  – Mirrors the HeD schema modules
Goals – Beyond HeD

• Explore use for enterprise KM
  – Built on Morningside Initiative and SHARPe 2b work on SSFs
  – To provide palettes of SSFs & primitive clause types
    • to facilitate event selection, logic customization, and action specification for rules
  – To provide meta-level tagging
    • to enable artifacts to be linked to knowledge sources, versions, and adaptation types
  – To support authoring and editing by SMEs
  – To provide (semi-) automated translation into host executable form
  – To facilitate construction of other artifacts such as order sets and documentation templates

• To provide support for smaller practices and hospitals
  – Feasible if community including vendors support the above
A proposed approach

1. Community endorse a comprehensive model-based framework
2. National and specialty organizations agree to require distribution in this format
   – e.g., proposed US Meaningful Use Stage 3 to require import of knowledge in HeD format
3. Increased focus on implementation enablers
   – This area has been neglected
   – Need to make a science out of it
4. Form open collaborative project for tools development
   – Knowledge authoring/editing
   – Knowledge management
   – Workflow adaptation
   – Better support of SME
   – Tying KR to evaluation & tracking metrics
   – …
Challenge statements

• Subject matter experts must engage more directly in knowledge authoring and adaptation
• New approaches needed to knowledge modeling
  – Top-down comprehensive development does not work - alternatives required
  – Representation must be factored
  – No fixed terminology will ever fit needs of all decision support statements
• Knowledge sharing standards will not have broad impact unless:
  – they have full engagement of a critical mass of key stakeholders (e.g., implementers, EHR vendors)
  – they are driven by the realities/needs faced by those working to transform care delivery
• Sharing effective CDS strategies must accompany sharing of CDS content in order to broadly improve outcomes
  – but who and how to organize, support, and sustain?
Reusable Knowledge for Best Clinical Practices: Why We Have Difficulty Sharing And What We Can Do

Mor Peleg
University of Haifa
Medinfo, August 22, 2013
Experience from Diabetic foot GL implementation
  ◦ Local adaptation in Israel of American GL
Experience from implementing USA and European thyroid nodule guideline
Types of knowledge
A sharable representation
Does knowledge need to change when shared with an institution?

Implementing American Diabetic Foot GL in Israel

- Defining concepts
  - 2 of 10 concepts not defined in original GL
  - 6 definitions restated according to available data

- Adjusting to local setting
  - GPs don’t give parenteral antibiotics (4 changes)

- Defining workflow
  - Two courses of antibiotics may be given (4)

- Matching with local practice
  - e.g. EMG should be ordered (4)

Can we share an entire guideline?

Peleg et al., *Intl J Med Inform* 2009 78(7):482-493
Peleg et al., *Studies in Health Technology and Informatics* 2008 139:243-52

Work with Karniely
RAMBAM Medical Center
EMR schema & data availability affect decision criteria

- Multiple guideline concepts mapped to 1 EMR data item (e.g., abscess & fluctuance)
- A single guideline concept mapped to multiple EMR data (e.g., “ulcer present”)
- Guideline concepts were not always available in the EMR schema (restate decision criteria)
- Unavailable data (e.g., “ulcer present”)
- Mismatches in data types and normal ranges (e.g., a>3 vs. “a_gt_3.4”)

Once you agree on the clinical knowledge, sharing decision rules is just a technical problem.
Experience from Diabetic foot GL implementation

Experience from implementing USA and European thyroid nodule guideline
  ◦ Work with Jeff Garber and Jason Gaglia from Harvard
  ◦ John Fox, Ioannis Chronakis, Vivek Patkar and Deontics Ltd. team
  ◦ 6 GL authors from Europe and USA

Types of knowledge

A sharable representation
### USA & European thyroid guideline: are the differences large?

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>USA</th>
<th>Europe</th>
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<tbody>
<tr>
<td></td>
<td>Iodine sufficient area</td>
<td>Iodine insufficient</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Algorithm recommendation</th>
<th>USA</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TSH indicated</td>
<td>Calcitonin measured by default</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Calcitonin not measured (unless family history of MEN2 or MTC)</th>
<th>Calcitonin measured by default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound not indicated for low TSH if all nodules hot</td>
<td>Ultrasound indicated</td>
<td>Scintigraphy is indicated for low TSH OR In iodine insufficient areas and multi nodule goiter</td>
</tr>
<tr>
<td>Scintigraphy is indicated only for low TSH</td>
<td>Scintigraphy is indicated for low TSH OR In iodine insufficient areas and multi nodule goiter</td>
<td></td>
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</tbody>
</table>

<table>
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<tr>
<th>FNA biopsy</th>
<th>USA</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>No surgery (just follow-up) if FNA is benign</td>
<td>Although FNA was benign surgery is indicated (high calciton</td>
<td></td>
</tr>
</tbody>
</table>
Workflows are different

European algorithm

USA algorithm
Deontics approach of flexible Wf

Identifying all GL recommendations and preparing KB of:

- **Clinical data** needed to choose alternatives
- **Decision options**: TSH, Calcitonin
- **Algorithm**: History prior to Calcitonin and TSH
Deontics approach of flexible Wf cont.

- User can enter any data which could be used by the GL, at any order
- Based on available data, actions recommended
- User can choose non-indicated actions and still get decision support
Agenda

- Experience from Diabetic foot GL implementation
- Experience from implementing USA and European thyroid nodule guideline
- Types of knowledge – what K can be shared?
- A sharable representation
Types of knowledge (1)

- Knowledge can be procedural or declarative
- Declarative definitions of terms

```plaintext
positive_culture = "Yes" or positive_culture_from_bone = "Yes" or gangrene = "Yes" or ulcer_margins_infected = "Yes" or ulcer_margins_necrotic = "Yes" or ulcer_margins_clean = "No" or ulcer_grade = "st3" or ulcer_grade = "st4" or ulcer_grade = "st5" or lymphangitis = "Yes" and lymphadenopathy = "Yes" or lymphangitis = "Yes" and redness = "Yes" or lymphangitis = "Yes" and swelling = "Yes" or lymphangitis = "Yes" and odor_from_wound = "Yes" or lymphadenopathy = "Yes" and redness = "Yes" or lymphadenopathy = "Yes" and swelling = "Yes" or lymphadenopathy = "Yes" and odor_from_wound = "Yes" or redness = "Yes" and swelling = "Yes" or redness = "Yes" and odor_from_wound = "Yes"
```
Following Newell: knowledge enables an agent to choose actions in order to attain goals
- e.g., to attain normal BP, 11 drug groups are possible
- ACEI is indicated for hypertension patients who also have diabetes but is contra-indicated during pregnancy
- This knowledge can be represented:
  - Rules for, against, confirming, excluding
  - Concept relationships: contra-indications, good drug partners,
  - Action tuples – more sharable
## Action tuples: declarative representation of actions and goals

<table>
<thead>
<tr>
<th>#</th>
<th>precondition</th>
<th>Action</th>
<th>Phase</th>
<th>BodySys</th>
<th>Outcome</th>
<th>Desir</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>history-of_ulcer=T or ulcer=T</td>
<td>schedule_followup (1-3 M)</td>
<td></td>
<td></td>
<td>followup_scheduled=T</td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>history_ulcer = unknown</td>
<td>Ask_ulcer_history</td>
<td>History</td>
<td></td>
<td>history_ulcer≠unknown</td>
<td></td>
</tr>
<tr>
<td>E9</td>
<td>ulcer = unknown</td>
<td>Examine_ulcer</td>
<td>Phys.</td>
<td>Derm</td>
<td>ulcer ≠ unknown</td>
<td></td>
</tr>
<tr>
<td>E5</td>
<td>feelingTouch=unknown</td>
<td>Semmes</td>
<td>Phys.</td>
<td>Neur.</td>
<td>feelingTouch≠unknown</td>
<td>1.0</td>
</tr>
<tr>
<td>E6</td>
<td>feelingTouch=unknown</td>
<td>Biothesiometer</td>
<td>Phys.</td>
<td>Neur.</td>
<td>feelingTouch≠unknown</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Initial state: diabetes =True and followup_scheduled = False
Goal state: diabetes =True and followup_scheduled = True

Planning can construct procedure from action tuple base.
Benefits of Action tuples

- Reuse and combination of clinical knowledge
- Easier guideline maintenance
  - Knowledge not locked into a workflow
- Specialization (Local adaptation) of knowledge
  - Local preconditions
- Exceptions can be handled by exploring other options leading to goal
Conclusion

- Local adaptation of Diabetic Foot GL forced changes to declarative & procedural Knowledge
  - Harder to share algorithms than rules
- USA and European versions of Thyroid GL have data and decision options in common but do not share data flow; single KB offers flexibility
- Action tuples are easy to maintain & share; procedural Wf could be planned from them
  - More work needed on desirability of actions
Thank you!

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http://www.mobiguide-project.eu/
Provocative Statements

- There is no way to separate out clinical knowledge from best-practice knowledge
- Sharing procedural knowledge is not very useful
- Pieces of executable knowledge could be shared and assembled together into a Workflow
Decision Support, Terminologies & EHRs
Living with the Limits of the possible

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http://www.cs.man.ac.uk/~rector
Lessons from our Collective Experience

► Comprehensive, interoperable decision support is a hard problem.
  ► We have been working on it for a long time
    • Medical knowledge representation has been an issue for ≥ 35 years!!

► Terminology is a big part of that problem
  ► The “Curly Bracket Problem” has been with us for ≥ 30 years!!

► Comprehensive top-down development is a failed fantasy
  ► Our successful standards are limited
    • e.g. HL7 v2, LOINC, DICOM, (jpg, xml, …)
      ‣ or grown organically – HTML
  ► Abandon the waterfall model

Pauker, Gorry, Kassirer & Schwarz
Toward the Simulation of Clinical Cognition: Taking a Present Illness by Computer
Am J Med 1976

McDonald CJ. Protocol-based computer reminders, the quality of care and the non-perfectability of man. NEJM. 1976

Pryor TA, Gardner RM, Clayton PD

Abandon hope all ye who enter here.

Looks beautiful...

...but...
Key Questions

► What has the biggest clinical payoff?
  ► Organisational change supported by IT
  ► The answer may NOT be IT
    • Checklists (Gawande), near miss monitoring, countersigning, anaesthesia hose interlocks, (intrathecal vincristine disasters), …
    • What role for IT – The “Diane Forsythe question”
      ‣ How to use it?
      ‣ How to integrate it into care?
      ‣ How to keep IT out of the way?

► What can we do without solving “The AI Problem”??
  ► The do-able ≤ the possible ≤ what’s interesting ≤ our aspirations

► How can we best use new developments?
Factoring the problem

► Clinical practice, behaviour, decisions, content
  ► What
    • Most often originates in free text
      ‣ Possibly derived from expert opinion, literature, big data, (& observation?)…
    • Initially informal (usually)

► Health Informatics Implementation (HIT)
  ► How
    • Generic mechanisms
    • Specific content – the content expressed using the mechanisms
    • Must be systematized to be executed
Factoring the Informatics

Information Model
(Patient Data Model)

Inference Model
(Guideline Model)

Concept Model
(Ontology)

Patient Specific Records

Dynamic Guideline Knowledge

Static Domain Knowledge
Factoring the HIT problem: Four levels

1. Presentation – data entry & documentation
   ► What it looks like
     • What do we want to say and read?
     • Language: How do we talk about them?

2. Data structures - schemas
   ► What & how to store and retrieve what we have said about this patient?

3. Background knowledge
   ► Static contingencies
     • Evidence, uncertainties, contingencies, procedures, heuristics, monitors, rules, decision trees, bayesian networks … … …
   ► Dynamic rules

4. Definitions & terminology – necessities
   ► Ontology: What are the medical things we know about?
Getting out from under the waterfall: Agile development for decision support

► Hypotheses:

1. Build for concrete needs that can be achieved
   • It is easier to merge limited systems that work than specialise grand unimplemented designs
     ‣ *Beware the “second system effect”* (Brookes, *The Mythical Man-month*)
       - Apple-3, HL7-v3, Clinical Terms v3, (first system usually v2)

2. …but early organisational commitment necessary
   • Build from the bottom up
   • Organise from the top down

3. Reducing the effort by 80% is a good target
   • Striving for more than 90% is counterproductive

4. Pre-coordinated terminologies will rarely fit decision support.
   • Could you practice medicine from a phrasebook?
     ‣ *So limit your investment in them but maximise collaboration*

5. Interaction of components must be managed throughout development
   • Focus on interfaces & dependencies
Terminology, Ontology, and Decision Support

► Three problems – don’t confuse them
  1. Recording the results and rationale of decision support in EHRs
  2. Extracting information for decision support from EHRs & the literature
  3. Having a terminology adequate to express the reasoning in decision support

► All standard terminologies are too big and too small
  ► Too big to use
  ► Too small for the detail needed
  ► The number of things to be said is indefinitely large & evolving
Ways forward

► Reduce the effort of linking to standard terminologies in literature and EHRs
  ► Focus on APIs and “bindings” to terminology
  ► Develop tools for agile multi-level development
  ► Use standard terms/concepts if they exist: Formalise new terminology when required
    • Keep best mappings – even if imprecise
      ‣ Some new terminology will (almost) always be needed

► Post co-ordination helps
  ► Could you practice medicine from a phrase book?
  ► … but not a panacea
    • Only deals with the “known unknowns”

► Extensibility required
  ► An organisational and social challenge
Factoring the problem another way

► Mining & machine learning vs Authoring
  ► What can be mined? learned?
    • Text, Structured knowledge bases, EHRs, Web, Big Data, Watson and its successors/competitors?
  ► When?
    • Analysis, authoring, run-time, QA, …?

► Is it time to review case-based reasoning?
  ► Can we base reasoning on similar patients?

► What about wide scale epidemiological research?
  ► What are the hazards for this patient?

► Can we combine mining, learning, statistics & authoring?
  ► How?
  ► Could it ever be safe? Auditable? Comprehensible?
    • Is it responsible not to try?
Summary & Position statements

► Top-down comprehensive development does not work.
  ► Alternatives required
    • Bottom-up / middle-out
    • Agile development and prototyping
    • Limited scope

► Representation must be factored
  ► Ontologies, Contingent knowledge, Rules Data structures, and Presentation
    • Focus on interfaces

► No fixed terminology will ever fit needs of all decision support statements
  ► Extensibility, Post-coordination, …

► Future systems will be hybrids
  ► Can they be made comprehensible and safe?
Reusable Knowledge for Best Clinical Practices: Why We Have Difficulty Sharing And What We Can Do

Working Backward from Better Outcomes

Jerome A. Osheroff, MD, FACP, FACMI
Principal, TMIT Consulting, LLC
Adjunct Associate Professor of Medicine, University of Pennsylvania
Begin with the End in Mind

- Improve Outcomes
- Enhance Processes: Decision/Actions
- Deliver Pertinent Knowledge
CDS Definition

“A process for enhancing health-related decisions and actions with pertinent, organized clinical knowledge and patient information to improve health and healthcare delivery.” Improving Outcomes with CDS. HIMSS. 2012

- Very broad: way beyond rules/alerts
- Knowledge sharing: clinical and CDS
Framework: CDS Five Rights

To improve decisions/actions/outcomes you must provide:

- the **right information** (risks, care gaps, recommendations…)
- to the **right people** (clinicians *and* patients…)
- in the **right CDS intervention types** (next slide)
- through the **right channels** (EHR, registry, smartphones…)
- at the **right points in workflow** (decision/action …)

✔ Optimize information flow: *what, who, how, where, when*
CDS Formats: “How” Options

- Relevant data presentation
  - Patient Lists/Provider Scorecards
  - Flow sheets and Graphs
  - Dashboards
- Documentation Templates
- Order sets
- Reference information
- Alerts and reminders

Consider both clinicians AND patients as recipients ("Who")
Improving Care Delivery/Outcomes: “When” Options

• What needs to happen?
  – Decisions
  – Actions
  – Communication
  – Data gathering

• Care Flow Steps where these happen (Ambulatory):

[Diagram showing patient-specific activities during an office visit with population-oriented activities.]
Tools for CDS Five Rights

- Knowledge Publishers (‘What’, ‘How’)
  - Curate/package/distribute content
  - Optimize penetration (channels), value

- EHR vendors (‘Where’ [and ‘How’])
  - Sell systems that meet content needs
  - Role for ‘apps’, cloud?

Proprietary links => Standards (e.g., Health eDecisions)
CDS/PI Collaborative

Getting Better Faster – Together SM

- >240 participants; staff from
  - Small practices, hospitals, health system
  - Federal agencies/initiatives
  - EHR/CDS vendors
  - Societies (including AMIA)

- Collaboration on CDS strategies

- Refining/using CDS/QI Worksheet
  - Together with US Office of the National Coordinator for Health IT (Related to ‘Meaningful Use’)
Ambulatory Worksheet (Simplified)

Target
Current performance on target
# Inpatient Worksheet (Detailed)

## Care Flow Steps

<table>
<thead>
<tr>
<th>Decision Support Opportunity</th>
<th>Care Activities</th>
<th>Examples of Care Activities</th>
<th>Notes</th>
<th>Optimal State (Sample activities to optimize performance)</th>
<th>Current State (Your current CDS/GI configuration)</th>
<th>Enhanced State (Improvements you could implement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Department</td>
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<tr>
<td>Registration/Intake</td>
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<td>History/Assessment</td>
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<tr>
<td>Educational/Shared</td>
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<td>Encounters</td>
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## Optimal Care

## Potential Enhancements

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[Diagram of care flow steps and information flow with tables showing care activities, CDS & Rights, and proposed enhancements]
Worksheet Uses

- Blank version as QI/CDS worksheet
  - Document/analyze/share/improve local strategy
  - Accelerate improvement by sharing across sites
  - Support client–vendor collaborations

- Format for conveying proven approaches
  - Strategy yielding high performance in one site
  - Success strategies from literature
  - Recommendations from extensive QI experience
Summary

- **Sharing CDS Knowledge/Artifacts**
  - Crucial to accelerate quality improvement
  - Hard but may finally be yielding
  - Needs more focus on broad needs and realities

- **Sharing Implementation Strategies/Results**
  - Likewise crucial for QI
  - Interdependent complement to content sharing
  - Tools, approaches and groups gaining traction
Contact Info

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CDS/PI Collaborative