



Clinical Decision Support

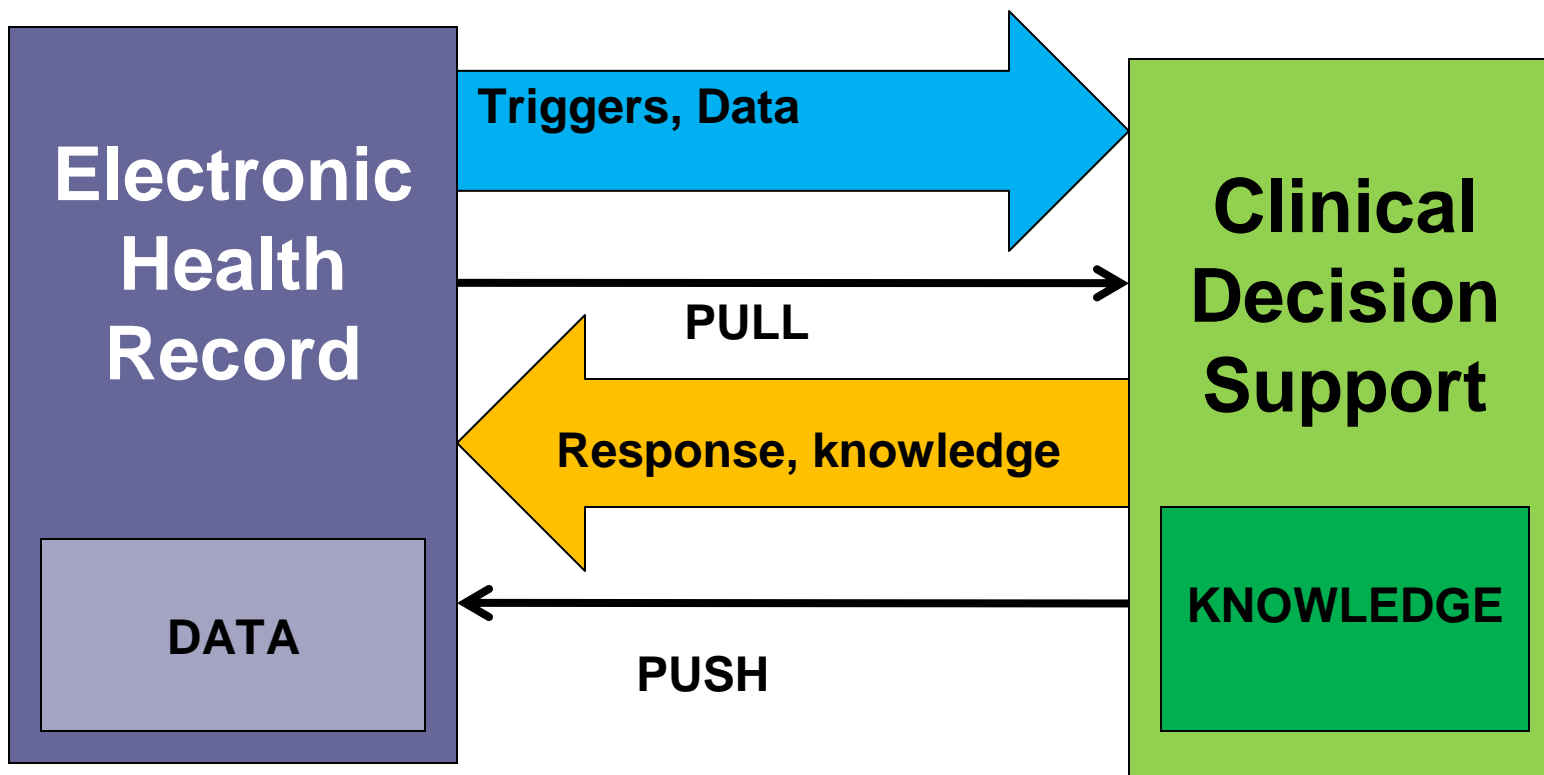
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Clinical Decision Support

- Clinical decision support (CDS) systems **apply information technology to address, in a systematic manner, questions** (and other information needs) that arise during patient care and clinical research.
- Developers and users of CDS systems seek to **improve clinical and public health outcomes.** CDS can inform and alter healthcare decisions, and standardize decisions and procedures for clinical research.



Link between data and knowledge



Decision Support Service (DSS)

- Business Purpose

- To facilitate implementation and maintenance of CDS applications

- Functionality

- Evaluates patient data using knowledge modules and returns machine-interpretable conclusions

- Based on CDS Web service developed at Duke by Dr. Ken Kawamoto

- CD WG and SOA WG supporters



Virtual Medical Record (vMR)

- Data Model and implementation guide
- Based on HL7 RIM
- Represents clinical data inputs and outputs to/from clinical decision support services
- Local EHR, in absence of semantic interoperability, are mapped into vMR to engage with CDSS. Results are then either displayed or mapped back into local EHR.



Order Sets

- **An order set is a functional grouping of orders in support of a protocol that is derived from evidence based best practice guidelines.**
 - **Order sets have a specific purpose.**
 - **Order sets may contain conditional logic.**
 - **Some items in an order set may be fully specified, others may have more optionality.**
 - **Order sets may be part of a larger care plan.**



Arden Syntax

- Arden Syntax is an HL7/ANSI Standard; current version 2.7
- Arden Syntax arose from the need to make medical knowledge available for decision making at the point-of-care
- Make the knowledge and logic explicit
- Allow sharing within and between institutions
- Standardize the way medical knowledge is integrated into health information systems



Library Slots - Example

library:

purpose: To alert the health care provider of new or worsening serum creatinine level.;;

explanation: If the creatinine is at or above a threshold (1.35 mg/dl), then an alert... ;;

keywords: renal insufficiency; renal failure ;;

citations: Proceedings of the Fifteenth Annual Symposium on Computer Applications in Medical Care; 1991 Nov 17-20; Washington, D.C. New York: IEEE Computer Society Press, 1991.

links: URL "NLM Web Page",
<http://www.nlm.nih.gov/> ;;



Logic Slot - Example

logic:

if last_creat is not present then

 alert_text := "No recent creatinine available. Consider
 ordering creatinine before giving IV contrast.";

 conclude true;

elseif last_creat > 1.5 then

 alert_text := "This patient has an elevated creatinine.
 Giving IV contrast may worsen renal function." ;

 conclude true;

else conclude false;

endif;



Arden Syntax v2.8 (coming)

- Introduces “fuzzy logic” (moderately severe, possibly associated)
- XML: Arden Markup Language
- Support Complex Clinical Guidelines
- Enhanced structured outputs
- Address uncertainty
- More ...



GuideLine Interchange Format (GLIF)

- A format for sharing clinical guidelines independent of platforms and systems
- Based on a object-oriented logical model of concepts
- Has an XML-based syntax
- GLIF is evolving as an open standard



GLIF Model

- Flowchart representation of a temporal sequence of clinical steps
- Guideline has title and author
- Guideline Step
 - Action step
 - Decision step
 - Branch step
 - Synchronization step
 - Patient sleep step



Abstract Machine representation

- Unambiguous syntax for logical expressions based on Arden Syntax
- All logical expressions & actions refer to defined concepts (medical ontology)
- Allowed values, ranges, and time constraints
- Can be interpreted and analyzed for correctness
 - Syntax, type, and range checking



GELLO: Common Expression Language

- Executable language for expressing logical rules and queries in CDSS
- Object-oriented; based on OCL
- Used to
 - Build up queries to extract and manipulated data from EHRs
 - Construct decision criteria by building up expressions to reason about particular data features/values such as guidelines
 - Create expressions, formulae, and queries for applications within other HL7 standards



Expression Language

- Used for specifying decision criteria and deriving summary values
- Provides basic built-in data types, assuming an underlying data model virtual medical record (vMR) that is a refinement of the HL7 RIM
- Major problem to sharing clinical knowledge is lack of common format for data encoding and manipulation



Infobutton Manager

- Software that supports implementation of Infobuttons in an application independent manner.
- The application passes parameters to the Infobutton Manager which generates an HTML document with a set of natural language questions that are hyperlinks to clinical information resources.



Quality Indicators

- **IF** a vulnerable elder has had a myocardial infarction, **THEN** he/she should be offered a beta blocker unless there is a contraindication.
- **IF** an ambulatory vulnerable elder has an osteoporotic fracture diagnosed, **THEN** physical therapy or an exercise program should be offered within 3 months.
- **IF** a vulnerable elder is taking warfarin for atrial fibrillation, **THEN** an INR should be checked at least every 6 weeks.



Healthcare Quality Measure Format

- For clinical performance measures
- Used by CMS for incentive payments
- Algorithm in computable form
- Need to collect digital data in structured format
- Working with AMA Collaborative

