Why Clinical Knowledge Governance?

- Instead of defining clinical concepts again and again, do it right once.

Without:
Impossible to exchange and then use information in a semantically safe way – no matter how well done anything (e.g. DSS) that works with the information is.

Comprehensive
High quality
Formal
Intuitive
International
Clinical Knowledge Governance

**Input**
- Initial clinical models
- Proposals
- Reviews/Feedback
- Change Requests
- Accompanying documentation

**Output**
- Published Clinical Models
  (Archetypes, Templates, Termsets)
- Release Sets
- Accompanying documentation
- Review summaries etc. for accountability & transparency

**Clinical Models**
- (Archetypes, Templates, Termsets)
- Release Sets
- Accompanying documentation
- Review summaries etc. for accountability & transparency
Clinical Knowledge Manager

- A web application for involving clinicians in defining clinical content based on archetypes, templates, and termsets.
CKM Approach

- Web 2.0 approach
  - Easier to engage clinicians: Can now use 5 mins or 1 hour of an expensive specialised clinician's time; before, they lost hours on physical meetings!

- Implementation is growing as we learn
  - Can respond quickly to changing needs, evolving methodology

- More than a tool
  - Engage and manage the community
CKM Design Overview

- **Asset Management System**
- **Core Asset Services**
- **XML Database**
- **File Stores**

CKM plugins

**Middle Tier**
- Apache Tomcat
- Google Web Toolkit
- Java Servlets and Webservices

**GWT RPC**

**Webservices**
CKM Core Principles

„Right“ separation of technical and clinical aspects to

- Involve clinicians in
  - Informal Discussions
  - Formal Reviews (content, terminology binding, translations)
  - Sharing

- Enable
  - Formal expression of content
  - Publishing
  - Revision/Version Management
  - Release and Dependency Management
Standardising Archetypes

- Empowerment of Domain Experts
- Increase Benefit
  - Record once, use multiple times
  - Aggregation of Data (Reports)
  - (Semantic) Querying
  - Semantic Interoperability
  - Basis for lifelong EHRs
  - Basis for (usable) Decision Support (which depends on having the relevant data accessible and queryable in the first place!)
Demo
Issues related to severity

I have mind mapped the concept of severity. It is quite complex and in clinical practice we use the term rather loosely. See the link to the mind map to see where I ended up:

Find map

Comments from Archetype Editorial Group - early 2008

• Comment 30 Jan 2008
  Is Symptom AT meant to be filled according to the doctor’s evaluation or according to the patient’s problem definition?
  Are we heading to a ‘single symptom’ definition? any symptom? or are/should we head to ‘symptoms’? It wouldn’t be rare if the patient would express a bunch of symptoms at a time, should we then use a bunch of Symptom ATs to express them?
  Considering a patient defining only higher stomach problem along with the words of ‘pain’, ‘cramp’, ‘burning’, ‘heaviness’, etc...
  At first look, I need to understand the difference by/‘severity’ and ‘degree’ from the perspective of the patient. If we’d ask patient both “severity” and “degree” of his/her symptom, would the patient be able to differentiate these. I ended up checking these words from Merriam-Webster since it is very difficult to express these separately in Turkish. To me, “degree” is what patient would express, “severity” is how doctor evaluates:
  Should we need “frequency of occurrences” along with “number of occurrences”? or “duration of the symptom when it’s on” along with “duration”?
  If “pain” would be taken as a symptom, then we may need an AT to describe the pain itself, the ‘type’ of pain would be an issue...

• Response 30 Jan 2008
  The Symptom cluster was designed to be a generic catch all - the basis for recording as much common material as possible about all symptoms - but then specialize by adding elements for specific symptoms where needed. So in fact, we also have a specialization for pain, which I have also attached. It also has slots to include other clusters to include more details as necessary on associated symptoms.
  See below for comments mine. Let’s keep the dialogue going.
  Is Symptom AT meant to be filled according to the doctor’s evaluation or according to the patient’s problem definition?
  From my point of view it should be usable in both an EHR and a patient’s PHR - a symptom is a symptom, and there will be potential need to share between these systems. Are we heading to a ‘single symptom’ definition? 
  Any symptom? 
  Yes, but... This is the generic/fill in archetype which may be applicable for a lot of symptoms, but will need to be specialized in the background for a more specific context or situation...
### Review of Archetype: Medication description (Summary view of 3 reviews)

<table>
<thead>
<tr>
<th>Data</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong></td>
<td>Name of medication</td>
<td>The name of the intervention - which may be coded</td>
<td>Text</td>
<td>1..1</td>
<td>mandatory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic name</td>
<td>The generic name of the drug which is an alternative name to the name of medication</td>
<td>Text</td>
<td>0..1</td>
<td>optional/</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dose unit</td>
<td>The dose unit that is given for this type of medication</td>
<td>Coded Text</td>
<td>1..1</td>
<td>mandatory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Form</td>
<td>The form of the medication</td>
<td>Coded Text</td>
<td>0..1</td>
<td>optional/</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dose</td>
<td>The dose to be administered at one time</td>
<td>Cluster</td>
<td>0..1</td>
<td>optional/</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quantity by volume</td>
<td>The quantity (or range) to be administered as a single dose</td>
<td>Choice</td>
<td>1..2</td>
<td>mandatory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Contact Information:

Ocean Informatics

[Website Link]
### Template Reviews

**Initiate Template review round: Demo with hide-on-form**

You can now add special questions for the individual resource elements. These questions will be displayed to the reviewer directly below the element.

#### Review Invitations: Add special review questions

<table>
<thead>
<tr>
<th>Data</th>
<th>Header</th>
<th>or health problem</th>
<th>Special Question:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom Cluster</th>
<th>Optional, repeating (0..*)</th>
<th>Special Question:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom Text</td>
<td>The symptom experienced</td>
<td>short of breath</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Special Question:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Features Cluster</th>
<th>Special Question:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Clinical description Text</th>
<th>Description of the symptom</th>
<th>Special Question:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Severity Ordinal</th>
<th>The severity of the symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>very severe [9]</td>
<td>Special Question:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current intensity degree Ordinal</th>
<th>The degree the symptom is bothering the patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>not present [0]</td>
<td>trivial [1]</td>
</tr>
<tr>
<td>very severe [9]</td>
<td>Special Question:</td>
</tr>
</tbody>
</table>

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CKM Users

- International *open*EHR CKM instance
  - > 1000 users
  - From 80 countries
  - From all Health professions and many health domains

- Also National programs with an instance of CKM
Use the Same Archetypes in Various Applications, Worldwide
Designing Archetypes Beyond Your Realm of Influence

Region of Standardisation

World

Nation

State

Health Service Provider

Field Area Sector World Scope

- openEHR foundation
- ISO
- SKL, NHS, NeHTA, AIHW, DIMDI...
- SA, DIN, ...

Local Provider C

Medical Colleges, NNO

It’s international...
...but needs to be supported by national organisations
Federation of CKM Instances

Clinical Knowledge Manager

openEHR

nehta
National E-health Transition Authority

Imported from Remote CKM
Cached in local CKM
Reference to original location and publication status
Unchangable in local CKM
Updated from remote on demand
**New Archetypes**

<table>
<thead>
<tr>
<th>Archetype</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare provider electronic communication medium</td>
<td>3</td>
</tr>
<tr>
<td>Electronic communication medium</td>
<td>3</td>
</tr>
<tr>
<td>Person identifier</td>
<td>2</td>
</tr>
<tr>
<td>Healthcare provider identifier</td>
<td>2</td>
</tr>
<tr>
<td>Healthcare organisation</td>
<td>1</td>
</tr>
<tr>
<td>Organisation name</td>
<td>2</td>
</tr>
<tr>
<td>User role</td>
<td>1</td>
</tr>
<tr>
<td>Care Plan</td>
<td>1</td>
</tr>
<tr>
<td>Counseling</td>
<td>1</td>
</tr>
</tbody>
</table>

**Not importable or updatable Archetypes**

<table>
<thead>
<tr>
<th>Archetype</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare provider postal address</td>
<td>The resource exists in the local OMM as a local resource already. Cannot import a resource with the same identifier from remote.</td>
</tr>
<tr>
<td>Address</td>
<td>The resource exists in the local OMM as a local resource already. Cannot import a resource with the same identifier from remote.</td>
</tr>
<tr>
<td>Biometric identifier</td>
<td>The resource exists in the local OMM as a local resource already. Cannot import a resource with the same identifier from remote.</td>
</tr>
<tr>
<td>Other high level address components</td>
<td>The resource exists in the local OMM as a local resource already. Cannot import a resource with the same identifier from remote.</td>
</tr>
<tr>
<td>Additional identifier data</td>
<td>The resource exists in the local OMM as a local resource already. Cannot import a resource with the same identifier from remote.</td>
</tr>
</tbody>
</table>

... (Updatable Archetypes)
Challenges & Next Steps

- Federation of CKM instances
- GDL support (guidelines)

- Reference Model Independence
- Flexible Reference Model View, not constrained items only
  - E.g. ACTION.time: Point in time at which this action completed.

Long way down a very long road
Key Messages

- Knowledge Governance is crucial
  - High-quality archetypes with high-quality clinical content
  - Semantically interchangeable between clinical systems; also the basis for decision support
  - Key to success: how to engage with clinicians and capture their knowledge

- CKM is the tool for it
  - Regionally, nationally & internationally
  - Register at http://www.openehr.org/ckm
Designing Archetypes: Region and Scope

Region of Standardisation

- **World**
  - A world-wide standardised Archetype for more than one sector, e.g., a demographics Archetype

- **Nation**
  - E.g., an Australia-wide standardised Archetype for nursing

- **State**
  - Ad hoc defined Archetype, relevant to a sub-field only

- **Health Service Provider**

Scope

- **Field**
- **Area**
- **Sector**
- **World**

**Health**

- **Sectors**
  - Medicine
  - Nursing
  - Administration
  - ... (indicating other sectors)

- **Areas**
  - Medical Colleges
  - National Nursing Organisations

**Fields**

- Medical
- Nursing
- Administration
- ... (indicating other fields)
Why Clinical Knowledge Governance?

“Large e-health programs are often severely hampered by ill-defined user requirements, low levels of stakeholder engagement, slow solution adoption rates among providers, and an unwillingness to invest the often large amounts of capital required.“

...comprises all tasks related to establishing or influencing formal and informal organizational mechanisms and structures in order to systematically influence the building, dissemination, and maintaining of knowledge within and between domains.*

* Garde S, Heard S, Hovenga E. Archetypes in Electronic Health Records: Making the case and showing the path for domain knowledge governance. HIC 2005
Post-coordination

• Not all clinical relevant expressions exists in SNOMED CT as pre-coordinated concepts
• The concept Pain has 787 pre-coordinated descendents
• There are approximately $4.9 \times 10^{24}$ kind-of sensible possible descendents
  - Finding site, 26 000
  - Causative agent, 78 000
  - Severity, 7
  - ...
• Addition of post-coordinated expressions requires a versioning mechanism
Post-coordination: Pain after operation on neck

SNOMED CT Concept
  Clinical finding
    Procedure
      Neurological finding
        Procedure by method
          Sensory nervous system finding
            Pain / sensation finding
              Operation on neck
                Pain
                  Pain after operation on neck
                    Postoperative pain
                      Posttreatment pain
                        Operation on neck
                          Surgical procedure
                            Procedure by method
                              Pain
                                Postoperative pain
                                  Pain / sensation finding
                                    Operation on neck
                                      Surgical procedure
                                        Procedure
                                          Procedure by method
                                            Clinical finding
                                              Neurological finding
                                                Sensory nervous system finding
                                                  Procedure
                                                    Pain / sensation finding
                                                      Operation on neck
                                                        Posttreatment pain
                                                          Postoperative pain
                                                            Pain
                                                              Posttreatment pain
                                                                Operation on neck
                                                                  Surgical procedure
                                                                    Procedure by method
                                                                      Clinical finding
Expression repository architecture

- EHR prototype EEE
- XML DB
- Expression repository
- Data store
- OWL Classifier
Final words

• Please reuse by forking and/or downloading
• Read the paper
• Share and tell

https://github.com/LiU-IMT/EEE
Overview Introduction of Guideline Definition Language (GDL)

Rong Chen\textsuperscript{a,b}
Nadim Anani\textsuperscript{b}
Iago Corbal\textsuperscript{a}

\textsuperscript{a}Cambio Healthcare System
\textsuperscript{b}Karolinska Institute

MedInfo 2013
Copenhagen, 2013-08-19
EHR

Clinical Decision Support

Order sets

Knowledge Management

Alerts

Information

Research

Clinical Practice

Care

Guidelines

Trials

Evidence

Knowledge

Continuous Education

Quality Registries

Clinical Trials

Compliance Checking

Computerized Guidelines
Scope & Aims

- A formal language to express CDS rules
- Natural language independent
  - Easy to add translations
- Terminology independent
  - Easy to add term bindings
- EHR model independent
  - Reuse of common EHR models both for input and output
- Rules for single decision making
  - Process handling not in scope
- Coherent and reusable
  - Encapsulated and possible to chain the rules
- Technical platform independent
Guide Definition Language (GDL) Design

A minimum rule language to glue together archetypes, terminologies and logic

Three Pillars

• Bindings between archetype elements and variables in the rules

• Rule expressions easily converted to industry rule engine languages

• Bindings between local concepts used in the rules and concepts from reference terminologies
1st Pillar: Bindings between archetype elements and rule variables

Each rule variable is unique identified by a gt code and mapped to a Archetype ID and a path to access an element

The same gt code is used to represent the variable in all rules in the same guide

Then the gt code is translated into terms in different natural languages (English, Swedish..)
2nd Pillar: Rule expressions easily converted to industry rule engine languages

```
["gt0012"] = (RULE) <
  when = <"$gt0002>=20.0 yr", "$gt0003==local::at0005|Male|">
  then = <"$gt0011.magnitude=((1.23*(140-$gt0002.magnitude))*$gt0005.magnitude)"
  priority = <2>
>
```

- **when** & **then** statements are commonly supported by rule languages

- **Expressions** used in these statements are based on common design (similar to assertions in openEHR Archetype Definition Language)
3rd Pillar: Bindings between local term used in the rules and concepts from reference terminologies

```xml
["gt0017"] = (RULE) <
    when = '"$gt0003|diagnosis| is a local::gt0100|Heart failure|"', ...>
    then = '"$gt0012=1|local::at0028|Present|"', ...
    priority = <10>
> term_bindings = <
    ["SNOMEDCT"] = (TERM_BINDING) <
        bindings = <
            ["gt0100"] = (BINDING) <
                codes = "<SNOMEDCT::84114007>, ...>
            >
        >
    >
    ["ICD10"] = (TERM_BINDING) <
        bindings = <
            ["gt0100"] = (BINDING) <
                codes = "<ICD10::I50>, ...>
            >
        >
    >
    ["ICD9"] = (TERM_BINDING) <
        bindings = <
            ["ICD9"] = (BINDING) <
                codes = "<ICD9::428.0>, ...>
            >
        >
    >
> a local term is used as a proxy to externally defined concepts in reference terminologies
a local term can be bound to list of concepts or a refset in different target reference terminologies
Guide Definition Language (GDL) Design Cont.

• A formal language based on openEHR d-ADL
  – Machine-readable format

• The main object model consists of
  – Header: Id, concept, language, description, translation
  – Archetype binding
  – Guide definition, pre-condition and list of rules
  – Each rule has when and then expressions
  – Term_definitions for language-dependent labels
  – Term_bindings for terminology bindings

• Expressions model

_Extensive reuse of existing openEHR specifications_
GDL Model
Blue: openEHR
Yellow: new
GDL - expressions
GDL Specifications

http://openehr.org/downloads/ds_and_guidelines
GDL Tools project

- OpenEHR Reference Model Implementation (ref_impl_java)
- OpenEHR Utils
- CDS (core)
- CDS Applications

https://github.com/openEHR/java-libs
https://github.com/openEHR/gdl-tools
Clinical content

- Archetypes
- Templates
- Terminology
- Ontology
GDL Editor

http://sourceforge.net/projects/gdl-editor/
GDL Editor
GDL Editor

[Image of GDL Editor interface showing instantiation of EHR archetypes for Body Mass Index calculation]
GDL Editor

![GDL Editor](image)
GDL Editor

Preconditions

- Element EHR Height/Length exists
- Element EHR Weight exists

Preconditions

- Compare (DataValue)
- Compare (NullValue)
- Compare (Element)
- Compare (Attribute)
- Element exists
- OR operator
# GDL Editor

The GDL Editor is a tool used for creating and managing clinical decision rules. In this image, we see a screenshot of the editor with a table listing various codes and their associated descriptions:

<table>
<thead>
<tr>
<th>Code</th>
<th>Text</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gi0000</td>
<td>Body Mass Index calculation</td>
<td></td>
</tr>
<tr>
<td>gi0001</td>
<td>Calculate body mass index</td>
<td></td>
</tr>
<tr>
<td>gi0002</td>
<td>Weight</td>
<td>The weight of the individual.</td>
</tr>
<tr>
<td>gi0003</td>
<td>HeightLength</td>
<td>The length of the body from crown of head to sole of foot.1</td>
</tr>
<tr>
<td>gi0004</td>
<td>Body Mass Index</td>
<td>Index describing ratio of weight to height.</td>
</tr>
</tbody>
</table>

This tool is used in the healthcare industry to automate decision-making processes based on clinical guidelines.
## GDL Editor

![GDL Editor Image]

**Local Terms** | **Terminology codes** | **URI**
--- | --- | ---
GT0100 - Congestive heart failure | I50 |  
GT0101 - Hypertension | I12, I13, I10, I11, I15 |  
GT0102 - Diabetes | E11, E10, E13, E12, E14 |  
GT0103 - Previous stroke or TIA | G459, I63, I693 |  
GT0105 - Atrial fibrillation | I48 |  

---
GDL Editor

```gdl
1 (GUIDE) <
2   gdl_version = "0.1"
3   id = "BMI.Calculation.v.1"
4   concept = "gt0000"
5   language = (LANGUAGE) <
6     original_language = "ISO_639-1:en"
7 >
8   description = (RESOURCE_DESCRIPTION) <
9     details = <
10       ["en"] = (RESOURCE_DESCRIPTION_ITEM) <
11 >
12
13   lifecycle_state = "Author draft"
14 >
15   definition = (GUIDE_DEFINITION) <
16     archetype_bindings = <
17       [1] = (ARCHETYPE_BINDING) <
18         archetype_id = "openEHR-EHR-OBSERVATION.body_weight.v1"
19         domain = "EHR"
20         elements = <
21           ["gt0002"] = (ELEMENT_BINDING) <
22             path = "/data[at0002]/events[at0003]/data[at0001]/items[at0004]"
23 >
24
25         function = "LAST"
26 >
27
28       [2] = (ARCHETYPE_BINDING) <
29         archetype_id = "openEHR-EHR-OBSERVATION.height.v1"
30         domain = "EHR"
31         elements = <
32           ["gt0003"] = (ELEMENT_BINDING) <
33             path = "/data[at0003]/events[at0004]/data[at0001]/items[at0004]"
34 >
35 >
36 >
```
GDL Editor

Organisation:
Date:
Authorship lifecycle: Author draft
Copyright:

PRECONDITIONS
Element Height/Length exists
Element Weight exists

RULE LIST
Rule Calculate body mass index
When
Element "Weight_units" equals to 'kg'
Element "Height/Length_units" equals to 'cm'
Then
Set element "Body Mass Index_units" to 2
Set element "Body Mass Index" to 'kg/m2'
Set element "Body Mass Index magnitude" to \( \text{Weight} / ((\text{Height}/\text{Length} / 100)^2) \)
GDL Editor

```
rule "BMI Calculation, v1/gt0001"
  salience 1
  no-loop true
  when
  $gt0002.ElementInstance(id="openEHR-EHR-OBSERVATION.body_weight.v1", data[at0002]events[at0003]data[at0001]files[at0004])
  $gt0003.ElementInstance(id="openEHR-EHR-OBSERVATION.height.v1", data[at0001]events[at0002]data[at0003]items[at0004])
  $gt0004.ElementInstance(id="openEHR-EHR-OBSERVATION.body_mass_index.v1", data[at0001]events[at0002]data[at0003]items[at0004])
  eval($gt0002.hasValue() & $gt0003.hasValue())
  eval($gt0002.hasValue() & (((DvQuantity)$gt0002.getDataValue()).getUnits().equals("kg")))
  eval($gt0003.hasValue() & (((DvQuantity)$gt0003.getDataValue()).getUnits().equals("cm")))
  then
  $gt0004.setDataValue(DVUtil.createDV($gt0004,"DV_QUANTITY","precision",2),$gt0004.setNullFlavour(null);ExecutionLogger.addLog(drools, $gt0004);
  $gt0004.setDataValue(DVUtil.createDV($gt0004,"DV_QUANTITY","units","kg/m2"));$gt0004.setNullFlavour(null);ExecutionLogger.addLog(drools, $gt0004);
  $gt0004.setDataValue(DVUtil.createDV($gt0004,"DV_QUANTITY","magnitude",((DvQuantity)$gt0002.getDataValue()).getMagnitude());Math.pow(((DvQuantity)$gt0003.getDataValue()), 2);ExecutionLogger.addLog(drools, $gt0004);
  end
```
GDL Editor

Calculate body mass index

Conditions
- Element "Weight_UNITS" == 'kg'
- Element "Height/Length_UNITS" == 'cm'

Actions
- Set element "Body Mass Index_PRECISION" to 2
- Set element "Body Mass Index_UNITS" to 'kg/m2'
- Set element "Body Mass Index" (Weight / ((Height/Length / 100) ^ 2))
GDL Editor

Calculate body mass index

Input
- openEHR-EHR-OBSERVATION.body_weight.v1
  - EHR Q Weight: 73 kg
- openEHR-EHR-OBSERVATION.height.v1
  - EHR Q Height/Length: 179 cm

Result
- openEHR-EHR-OBSERVATION.body_mass_index.v1
  - CDS Q Body Mass Index: 21.83 kg/m²

Execution log:
- Calculate body mass index

Conditions & Actions
- Compare (DataValue)
- Compare (NullValue)
- Compare (Element)
- Compare (Attribute)
- Element exists
- Or operator

Conditions
- Element EHR "Weight.Unit" == 'kg'
- Element EHR "Height.Unit" == 'cm'
Overview Introduction of Guideline Definition Language (GDL)

Rong Chen\textsuperscript{a,b}
Nadim Anani\textsuperscript{b}
Iago Corbal\textsuperscript{a}

\textsuperscript{a}Cambio Healthcare System
\textsuperscript{b}Karolinska Institute

MedInfo 2013
Copenhagen, 2013-08-19
Creating Electronic Health Records within 15 minutes with Ruby on Rails and ISO 13606/openEHR standardised Clinical Models

Shinji KOBAYASHI, Eizen KIMURA, Ken ISHIHARA

Ehime University

Medinfo 2013
2013/08/21
Announcement

- Keynote is in "Plenum room"
  - U.S. Navy Capt. Michael Weiner
  - Title: Efficient Care: Improving Quality Health Care in the Post Electronic Health Record World.
Agenda

- Ruby
- Ruby on Rails
- Demo: Creating EHR by rails
- The openEHR project
- Demo: Creating EHR with the openEHR archetype
Ruby

- Object Oriented Scripting Language
- Creator: Yukihiro 'Matz' Matsumoto
Ruby on Rails

- Highly productive web development framework
- Creator: David Heinemeier Hanson, born in Copenhagen!
Denmark and Japan
Requirements

- Ruby 1.9.3 or later (2.0.0 recommended)
- Rails 4.0
- Editor or IDE (as you like)
- OS: Linux, MacOS, Windows or other platform that Ruby runs.
Rails demo

- Create people list
- Create healthcare note
The openEHR project

- An open domain-driven platform to implement EHR systems
- Basis of ISO 13606
- Archetype clinical concept models
- Open source implementation
Ruby implementation of the openEHR

- Open source software (Apache 2 license)
- GitHub: https://github.com/skoba/openehr-ruby
- GitHub: https://github.com/skoba/openehr-rails
openehr-rails demo

- Install openehr-rails
- Get archetype from CKM (Clinical Knowledge Manager)
- Generate scaffold from archetype
Conclusion

- As just you have watched.
- Ruby is good!
- Rails is very good!
- Copenhagen is excellent!
Designing an Archetype Infrastructure for the Valencia Health Agency EHR Project

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HSEAVS project

• The Electronic Health Record of the Valencia Health Agency (HSEAVS) has as a main objective to guarantee the access to relevant clinical information of patients for citizens and health professionals.

• Thus, we will need to formalise clinical information and data structures.
  – We need to use standards, archetypes, clinical models or patterns, terminologies…
HSEAVS project

• Architecture

- Abucasis
- Orión
- Other systems
- HCDSNS
- epSOS
- Document repository
- Query interface
- EHR repository
- Transformation and normalisation
- HL7 CDA
- ISO 13606
- Original data
- Terminology server
- Concept repository
- Identification management
- Information reuse
- Patient summary
- Citizens portal
This module is in charge of the management of clinical models and semantic resources used by HSEAVS

- Not only archetypes!
- We define concepts, their relationships, lifecycle and their associated resources.
- It includes search and review functionalities, user control, comments…
- The ROC module is pre-deployment.
## Concept Oriented Repository (ROC)

### PARÁMETROS DE BÚSQUEDA

- **Nombre:**
- **Modelo:**
- **Contiene las palabras:**
- **Autor nombre:**
- **Primer apellido:**
- **Segundo apellido:**
- **Terminología:**
- **Estado:**

- Limitar búsqueda al resultado anterior
- Incluir contenido de documentos en la búsqueda

### DCM

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**Nombre:** Medicación

**Propósito:**
- Especifica la descripción de la medicación.

**Usar para:**
- El almacenamiento de una medicación completa de un paciente

**No usar para:**
- Almacenar la medicación en una historia clínica resumida

**Descripción:**
- Usualmente, esto será en respuesta a una orden o prescripción de medicación, pero puede ser también automedicada o proporcionada por un profesional.

**Palabras clave:**
- medicina, orden, pastilla, tomars

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- CC-BY-SA

Guarda los cambios.
Structured Clinical Information Repository (RICE)

• This module stores all relevant clinical data of patients of the Valencia Region
  – It is not a document repository
  – It is not designed to support daily health care
  – It must avoid duplicity of information but maintain original context information

• It will be populated by existing systems and documents, through an archetype-based transformation and normalisation process.
Structured Clinical Information Repository (RICE)
Structured Clinical Information Repository (RICE)

• Repository based on ISO13606 RM
  – ENTRY level repository
  – Hybrid XML/relational design, easily adaptable to model changes or other models
  – Dynamic support of new archetypes
    • Static RM indexes + Dynamic archetype based index generation
    • This functionality is constrained due to operational requirements of AVS
RICE - Design

- **ISO 13606 extract**
  - **API::storeExtract(...)**
    - **Does the archetype exist?**
      - No → **Error**
      - Yes → **Extract ENTRYS**
        - **Calculate the unicity value**
          - **Is the information already stored?**
            - No → **Store**
            - Yes → **Add new data origin reference**
• **Archetype-based query system**
  – It requires a clinical-oriented query editor
  – It requires transformation of queries to the native query language
  – It must support filtering, aggregation and basic conversion of data

• **Archetypes to be used must be previously be registered in RICE**
Current situation

• Due to changes in the Valencia Health Agency and the Secretary of Health, the project is in a redefinition phase.
  – ROC is completed and in pre-production
  – RICE and Query module specifications are finished, awaiting implementation.

• Lessons and experience learned during the definition of the project are of a great value for other developments and projects.

• …But there is hope!
THANK YOU!

ANY QUESTIONS?

"If you win, you live. If you lose, you die. If you don't fight you can't win “
Eren Jaeger