EHR Archetypes in practice: getting feedback from clinicians and the role of EuroRec

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Good clinical care needs the combination of health records and medical knowledge.

These areas need to be represented consistently to deliver meaningful and safe interoperability.
The semantically interoperable EHR

Clinical trials, functional genomics, public health databases

Clinical devices, instruments

EHR repositories

Decision support, knowledge management and analysis components

Personnel registers, security services

Mobile devices

Clinical applications

Shared logical EHR
Shared domain knowledge
What is an *openEHR/13606 Archetype*?

- A formal *sharable* model of a clinical domain concept
  - e.g. “blood pressure”, “discharge summary”, “fundoscopy”
- Can be published and shared within a clinical community, or globally
- May incorporate rules that reflect steps within a care pathway
- May be mapped to the specific information in each clinical (EHR) system
- Defines a systematic EHR target for decision support queries
**openEHR/13606 Archetypes**

**Define**

- How to record and share data relating to a health phenomenon or health care event in a consistent and complete way
- How to structure the information, and any required or fixed context
  - hierarchical clinical data structure
  - how many times something may or must be recorded
  - what values are allowed at particular nodes, to support data quality
  - how to represent the data values in different terminologies

This is “EHR domain knowledge”
### Adverse reaction (web browser view: Ocean Informatics)

#### Data: TREE

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Agent</td>
<td>The agent or substance of an adverse reaction</td>
</tr>
<tr>
<td>T Agent category</td>
<td>The category of the agent</td>
</tr>
</tbody>
</table>

#### Exposure and reaction detail

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Specific substance</td>
<td>The specific substance (different from the agent of a class)</td>
</tr>
<tr>
<td>T Reaction category</td>
<td>The type of reaction experienced by the patient</td>
</tr>
<tr>
<td>T Probability of causation</td>
<td>Degree of certainty that the reaction was due to the exposure</td>
</tr>
</tbody>
</table>

#### Dates

<table>
<thead>
<tr>
<th>Date of exposure</th>
<th>The date (+/- time) when the patient was exposed to the agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of the exposure</td>
<td>The duration of the exposure</td>
</tr>
</tbody>
</table>

#### Reaction severity

<table>
<thead>
<tr>
<th>Reaction severity</th>
<th>The category of the reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction description</td>
<td>A description of the reaction experienced by the patient</td>
</tr>
</tbody>
</table>

#### Date of onset of reaction

<table>
<thead>
<tr>
<th>Date of onset of reaction</th>
<th>The date the reaction began</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of the reaction</td>
<td>The duration of the reaction</td>
</tr>
</tbody>
</table>

#### Values

<table>
<thead>
<tr>
<th>Probability of causation</th>
<th>Free or coded text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of exposure</td>
<td>Intolerance, Sensitivity, Allergy, No reaction</td>
</tr>
<tr>
<td>Duration of the exposure</td>
<td>Certain, Highly likely, Probable, Possible</td>
</tr>
<tr>
<td>Reaction severity</td>
<td>Mild, Disabling, Life threatening</td>
</tr>
<tr>
<td>Reaction description</td>
<td>Free or coded text</td>
</tr>
</tbody>
</table>

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*UCL*
Problems with this EHR domain knowledge, today

- Embodied in guidelines, existing EHR systems, message definitions, paper documents etc.
- Not sharable between formats and systems
  - multiple overlapping definitions with no ability to cross-reference those that exist
  - good domain modelling practice cannot be shared
- Few of these formats cater for knowledge evolution
- Authorship is driven by \textit{ad hoc} teams
  - diverse approaches taken by different clinical communities
  - modelling expertise dominates over domain expertise
Clinical challenges for adopting archetypes

- Grow communities to author, review and adopt archetypes for different domains
- Enrich the tooling to support clinicians using archetypes
- Improve the binding between archetypes and coordinated terminologies e.g. SNOMED-CT
- Define good practice for archetype authorship
- Establish quality, governance and certification processes for archetypes and repositories
Clinical challenges for adopting archetypes

• grow communities to author, review and adopt archetypes for different domains
• enrich the tooling to support clinicians using archetypes
• improve the binding between archetypes and co-ordinated terminologies e.g. SNOMED-CT
• define good practice for archetype authorship
• establish quality, governance and certification processes for archetypes and repositories
NHS investigations of archetypes

• To evaluate openEHR / EN 13606 archetypes and templates in depth and at scale
  • to produce detailed NHS data specifications for a multi-regional application design
  • to be used in the North, West, East and Midlands of England

• To develop a hierarchy of archetypes in accident and emergency and maternity care
  • identifying some points of good practice in archetype design
  • identifying additional tooling requirements

• Main activities
  • Content model requirements and scope
  • Clinical engagement on models design
  • Technical expert engagement on models design
  • Collation of other existing NHS requirements specifications for clinical data
NHS Archetype wiki: http://www.ehr.chime.ucl.ac.uk/display/nhsmodels/Home

NHS Clinical Models Home

This is the home page for the NHS Clinical Models space. We need your assistance to describe and capture clinical activity and data recording and/or to validate the data/information that is required to develop an Archetyped clinical data solution that will be fit for purpose.

Getting Involved...

- Anyone is free to add comments without the need for registering/login.
- Before you begin you may wish to look at the NHS "change challenge" presentation.
- For general introductory information about 'archetypes' and 'templates' click here.
- If you would like to contribute and edit pages you will need to register - please contact Tony Shannon or Laura Sato for a login.
- Use the user manual to guide you through the process of authoring or editing the archetypes on this wiki.

What area interests you?

- Clinical Content
- Information Modelling
- Project Information

Clinical Content

It is critical for the development and design of good and useful clinical Archetypes that clinicians from a broad range of disciplines have active input and/or review in each of the following 3 development phases:

1. Enhance the content in clinical record examples in the Clinical 'Sandpit' - CLINICAL FEEDBACK REQUIRED ASAP TO INFORM NEXT STEPS

<table>
<thead>
<tr>
<th>Clinical Domain</th>
<th>Status</th>
<th>Input Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td>Open</td>
<td>Models under review</td>
</tr>
<tr>
<td>Maternity</td>
<td>Open</td>
<td>Models under review</td>
</tr>
<tr>
<td>Perioperative</td>
<td>Open</td>
<td>Need to define scope</td>
</tr>
<tr>
<td>Mental Health</td>
<td>Open</td>
<td>Requirements being defined</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Open</td>
<td>Model under review</td>
</tr>
<tr>
<td>Vaccinations &amp; Immunisations</td>
<td>Open</td>
<td>Requirements being defined</td>
</tr>
</tbody>
</table>

2. Give feedback on the resulting organised Clinical Care Concepts

3. Review the Clinical Information Structures directly informing Archetype design - coming soon

Information Modelling

1. Contribute to the developing NHS CFH approach to content model specification.

2. Review the draft Archetypes wiki pages (SVN repository: index page, mind map, direct access)
Clinical, academic, vendor, technical, NHS engagement

- Royal College of Midwives
- Royal College of Physicians
- Royal College of Nurses
- Royal College of GPs
- International Organization for Terminology in Anaesthesia

- CHIME, UCL
- University of Manchester

- Suppliers
  - CSC Alliance (iSoft)
  - BT (Cerner)
- Vendors
  - INPS
  - EMIS
  - HL7 UK

- NHS CFH technical groups
  - Data Standards & Products
  - Information Standards Board
  - NHS Data Dictionary
  - SNOMED in Structured e-Records
  - e-Care Pathways
  - Decision Support
  - Common User Interface
  - Message Development

- NHS Scotland

*slide courtesy of Heather Leslie*
Clinical areas covered

- **Maternity**
  - Pre-conception Care Assessment
  - Confirmation of Pregnancy
  - Booking assessment
  - Antenatal Visit
  - Risk assessment
  - Birth Plan
  - Diabetic assessment in Pregnancy
  - Record Ultrasound assessment details
  - Antenatal Handheld record
  - First stage labour assessment
  - Labour interventions
  - Partogram
  - Caesarean Section
  - Second stage labour assessment
  - Third stage labour assessment
  - Newborn assessment
  - Postnatal assessment Mother

- **Emergency**
  - Triage overview
  - Generic acute presentation
  - Generic recording requirements for interventions & procedures
  - Discharge
  - Chest Pain
  - Shortness of Breath
  - Abdominal Pain
  - Back Pain
  - Headache
  - Overdose
  - Head Injury
  - Joint Injury
  - Long Bone Injury
  - Collapse of unknown cause

*slide courtesy of Heather Leslie*
Over 400 NHS Archetypes: emergency care, maternity, and the beginnings of mental health

<table>
<thead>
<tr>
<th>Short concept label</th>
<th>Version</th>
<th>Date</th>
<th>ADL</th>
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<tr>
<td>Auscultation of the chest</td>
<td>vl</td>
<td>11/05/2007</td>
<td>openEHR-EHR-CLUSTER.auscultation-chest.v1.adl</td>
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<td>openEHR-EHR-CLUSTER.delivery_of_infant.v1.draft.adl</td>
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<td>openEHR-EHR-CLUSTER.dimensions.v1.adl</td>
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<td>vl</td>
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<td>openEHR-EHR-CLUSTER.exam-abdomen.v2.draft.adl</td>
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<tr>
<td>Examination of skull</td>
<td>vl</td>
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<td>Examination of bone</td>
<td>vl</td>
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<tr>
<td>Examination of the chest</td>
<td>vl</td>
<td>22/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-chest.v1.adl</td>
</tr>
<tr>
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<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-eyes-newborn.v1.adl</td>
</tr>
<tr>
<td>Examination of the eyes</td>
<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-eyes.v1.adl</td>
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<tr>
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<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-face.v1.adl</td>
</tr>
<tr>
<td>Examination of the fetus</td>
<td>vl</td>
<td>17/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-fetus.v1.adl</td>
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<tr>
<td>Examination of the fetus - v2</td>
<td>vl.draft</td>
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<td>11/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-lymphnode.v1.adl</td>
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<tr>
<td>Examination of a mass</td>
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<td>11/05/2007</td>
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</tr>
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<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn-abdomen.v1.adl</td>
</tr>
<tr>
<td>Examination of the chest of a newborn</td>
<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn-chest.v1.adl</td>
</tr>
<tr>
<td>Examination of spine, hips, genitalia and anus</td>
<td>vl</td>
<td>29/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn-lower_body.v1.adl</td>
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<tr>
<td>Examination of mouth and throat of newborn</td>
<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn-mouth_and_throat.v1.adl</td>
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<tr>
<td>Examination of palate and lips of a newborn</td>
<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn-palate_and_lips.v1.adl</td>
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<tr>
<td>Examination of a named body part for a newborn exam</td>
<td>vl</td>
<td>23/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic-newborn.v1.adl</td>
</tr>
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<td>Examination of a named body part</td>
<td>vl</td>
<td>11/05/2007</td>
<td>openEHR-EHR-CLUSTER.exam-generic.v1.adl</td>
</tr>
</tbody>
</table>
Some of the NHS findings

• *open*EHR / EN 13606 archetypes provide a useful formalism for reconciling and re-using detailed clinical data specifications across different use cases

• They are generally suitable for human review and for use in software development
  • easier for humans than reviewing equivalent semantics within an HL7 V3 messaging model

• Archetypes can provide a useful mechanism for establishing and expressing national guidance for the use of SNOMED CT

• The NHS should use archetypes for user interface, messaging and dictionary content requirements
  • and to define national approaches to SNOMED CT use within clinical record statements
Clinical challenges for adopting archetypes

• grow communities to author, review and adopt archetypes for different domains
• enrich the tooling to support clinicians using archetypes
• improve the binding between archetypes and co-ordinated terminologies e.g. SNOMED-CT
• define good practice for archetype authorship
• establish quality, governance and certification processes for archetypes and repositories
Semantic Mining research on archetypes

- Archetype tools and repositories
- Clinical questionnaires that use archetype knowledge, and map to SNOMED
- Evaluation frameworks for archetype editors and concept dictionaries
- Binding archetypes to SNOMED-CT
- Ontologies to enhance the semantic consistency of archetypes
- Querying the EHR (for clinical care and research)
- Visualising longitudinal EHRs
University of Linköping Archetype Editor
University of Manchester MoST plugin to bind archetype nodes to SNOMED CT
Ocean Informatics Archetype Finder

Find Archetypes

Search for archetypes

Any term

Advanced Search >>

Connect search items using:
- or
- and

Search  Reset

Change Language

Supported by the General Practice Computing Group of Australia through funding from the Australian Government Department of Health and Ageing.

Developed in cooperation with Health Informatics, Central Queensland University.
University of Linköping Terminology Visualiser
Ocean Informatics Template Composer
### INSERM / HEGP Systematic Design of Patient Questionnaires

#### Paramétrage du bilan médical

<table>
<thead>
<tr>
<th>N°</th>
<th>Libellé contrat</th>
<th>Concept</th>
<th>Type</th>
<th>PG</th>
<th>O.M.</th>
<th>N.M.</th>
<th>N.V.</th>
<th>Nom</th>
<th>Déc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4101</td>
<td>CONTEXTE HOSPITALISATION</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4102</td>
<td>Moins d'hospitalisation</td>
<td>FCSE_Moins d'hospitalisation</td>
<td>Texte court</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4103</td>
<td>Antécédents et contexte clinique</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>Antécédents chirurgicaux</td>
<td>AT_NC_Antécédents chirurgicaux</td>
<td>Texte court</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>Texte court</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>FM_SDV_Facteurs de risque cardiovasculaire</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

#### Organisation de l'affichage des questions

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>OBSERVATION (ACCÉDATION)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauche</td>
<td>Droite</td>
</tr>
</tbody>
</table>

#### Synthèse et conclusion clinique

- Conclusion examen d'entrée
- Conclusion de l'examen clinique
- Synthèse et conclusion hospital (texte long)
- Synthèse et conclusion hosp (texte court)
- Traitements à la sortie (texte court)

#### Transfert

- Suivi à donner/Démarches utiles (texte court)
INSERM / HEGP mapping questions to concepts

<table>
<thead>
<tr>
<th>Questions (free wording)</th>
<th>« Question concepts » (standardized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>« Hypertension ? »</td>
<td>« Hypertension »</td>
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<tr>
<td>« Hypertensive patient ? »</td>
<td>« Hypertensive patient »</td>
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<tr>
<td>« High blood pressure ? »</td>
<td>« High blood pressure »</td>
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</tbody>
</table>

<table>
<thead>
<tr>
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</table>

response type (Text, numeric, binary, list, etc)
University of Linköping EHR Visualisation
UCL archetype-driven clinical applications and portal

Welcome to HeartBeat, Dr. Dipak Kalra. Your patient is Ahmand Khaliq (29-Jan-1933).

Users
Logout

Patients
Nota Bene
Select Patient

Administration
Accounts
Important Dates

Anticoagulant Control
Plan
Clinic Contact

Medical Summary
Service Delivery

Reports and Letters
Clinic List
Patient Summary
Clinician Summary
Clinical Governance
Withdrawal Letter

Additional Links
British Heart Foundation
Heart Health
Anticoagulation Facts

Allergies
There are no Allergies records for this patient.
Create new Allergies record

Clinical Conditions

<table>
<thead>
<tr>
<th>Date committed:</th>
<th>Name:</th>
<th>Current Problem:</th>
<th>Concerns:</th>
<th>View This Record</th>
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</thead>
<tbody>
<tr>
<td>09-May-2007</td>
<td>Asthma</td>
<td>true</td>
<td>Acute attacks, esp winter</td>
<td>View This Record</td>
</tr>
<tr>
<td>08-Jun-2007</td>
<td>Diabetes</td>
<td>true</td>
<td>Fear of needles</td>
<td>View This Record</td>
</tr>
</tbody>
</table>

Create new Clinical Conditions record

Regular Drugs

<table>
<thead>
<tr>
<th>Date committed:</th>
<th>Name:</th>
<th>Actual Start Date:</th>
<th>Actual End Date:</th>
<th>Description:</th>
<th>Dosage:</th>
<th>View This Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-Jun-2007</td>
<td>Aspirin</td>
<td>02-Apr-2007</td>
<td></td>
<td></td>
<td>1.0</td>
<td>View This Record</td>
</tr>
<tr>
<td>13-Jun-2007</td>
<td>Ventolin</td>
<td>07-Jun-2006</td>
<td></td>
<td></td>
<td>1.0</td>
<td>View This Record</td>
</tr>
<tr>
<td>13-Jun-2007</td>
<td>Valium</td>
<td>01-Jan-2007</td>
<td>13-Jun-2007</td>
<td></td>
<td>2.0</td>
<td>View This Record</td>
</tr>
</tbody>
</table>

Create new Regular Drugs record

Lifestyle Information
There are no Lifestyle Information records for this patient.
Create new Lifestyle Information record

Services And Needs
There are no Services and Needs records for this patient.
Create new Services and Needs record
Towards EHR semantic interoperability

• Goals
  • to be able to recognise and process semantically equivalent information homogeneously, even if instances are heterogeneous
  • to minimise the diversity of ways in which equivalent expressions are represented

• Semantic Health is defining a roadmap for consistently using EHRs and archetypes alongside terminology such as SNOMED CT

• Without this, computer-based interpretation of longitudinal and national EHRs risk being unsafe
Clinical challenges for adopting archetypes

• grow communities to author, review and adopt archetypes for different domains
• enrich the tooling to support clinicians using archetypes
• improve the binding between archetypes and co-ordinated terminologies e.g. SNOMED-CT
• define good practice for archetype authorship
• establish quality, governance and certification processes for archetypes and repositories
The openEHR Clinical Review Board

• oversees the authorship, peer review and governance of archetype development
• specifies additional requirements for archetype tools and repository services
• will collate and share the experience of archetype development and use internationally, working closely with
  • NHS Connecting For Health
  • The EuroRec Institute, and its national ProRec Centres
Q-REC Inventory and Register of EHR Archetypes

- Identify high quality archetypes which will have been developed elsewhere and to make them available to a broader community
- Develop formal methods of validating the design and content of archetypes
- Develop a formal process of verification and certification for archetypes
Dimensions of quality, for archetypes

- Clinical guidance
  - patient profiles and situations for which it is suitable
  - translations of textual content
  - when this archetype and the evidence should be reviewed
- Transparency
  - clinical validation, including multi-professional inputs
  - the clinical evidence used, its currency
- Provenance
  - authorship and professional endorsement
  - currency, version management
  - jurisdictional approval and formal certification
Dimensions of quality, for archetypes

- A declared set of EHR clinical use cases
  - for which corresponding EHR entries are considered comparable
- Inclusive (superset) of the data item requirements across those use cases
- Consistent naming conventions
  - mapped to a high level concept model
- Minimal mandatory properties unless necessary across all of the use cases
  - can be constrained further via specialisation or in templates
- Maximum re-use across archetypes
  - so, the smallest granularity that is meaningful
  - term (value) lists available to multiple archetypes
- Simplest possible structure to meet these needs
Dimensions of quality, for archetype libraries

- Standardised archetype format
- Editorial approval processes
  - clinical verification
  - technical verification
- Repository technical management
- Semantic indexing, search and retrieval facilities
- Access control and licensing
- Management and distribution of updates
- Certification
Conclusions

• Clinical communities need to be fostered
  • to contribute domain expertise into the design of archetypes
  • to champion professional consensus on organising EHRs

• The NHS has started - watch this space!

• EHR Archetypes need to be quality assured
  • since they will direct the ways in which clinical data is captured, processed and communicated

• EuroRec is partnering the openEHR Foundation in developing
  • governance practices for archetype development
  • quality criteria and editorial policies by which certified libraries of EHR Archetypes can be recognised