**openEHR Archetypes & Templates 101**

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**Shared EHR**

ISO/TR 20514 “Electronic Health Records – Definition, scope and context” defines the shareable EHR as:

“…a repository of information regarding the health status of a subject of care, in computer processable form and based on a commonly agreed logical information model”

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**Types of interoperability**

- **Level 1:** Non-electronic data
  
  Examples include paper, mail, and phone call.

- **Level 2:** Machine transportable data
  
  Examples include fax, email, and unindexed documents.

- **Level 3:** Machine organisable data
  
  Examples include indexed (labeled) documents, images, and objects.

- **Level 4:** Machine interpretable data
  
  Examples include the automated transfer from an external lab of coded results into a provider’s EHR. Data can be transmitted (or accessed without transmission) by HIT systems without need for further semantic interpretation or translation.

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**Complexity of Health Knowledge**

Both the total number of concepts and the rate of change is high

- SNOMED medical termset codes some 350,000 atomic concepts and over 1 million relationships

Not only is health care big, it is open-ended:

- **In breadth**, because new information is always being discovered or becoming relevant
- **In depth**, because finer-grained detail is always being discovered or becoming relevant
- **In complexity**, because new relationships are always being discovered or becoming relevant
**Information complexity: timing**

<table>
<thead>
<tr>
<th>Dose frequency</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every time period</td>
<td>...every 4 hours</td>
</tr>
<tr>
<td>n times per time period</td>
<td>...three times per day</td>
</tr>
<tr>
<td>n per time period</td>
<td>...2 per day</td>
</tr>
<tr>
<td>Every time period range</td>
<td>...every 4-6 hours,</td>
</tr>
<tr>
<td>Maximum interval</td>
<td>...not less than every 8 hours</td>
</tr>
<tr>
<td>Maximum per time period</td>
<td>...to a maximum of 4 times per day</td>
</tr>
</tbody>
</table>

**Time specific**

<table>
<thead>
<tr>
<th>Time specific</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning and/or lunch and/or evening</td>
<td>...take after breakfast and lunch</td>
</tr>
<tr>
<td>Specific times of day</td>
<td>06:00, 12:00, 20:00</td>
</tr>
</tbody>
</table>

**Dose duration**

<table>
<thead>
<tr>
<th>Dose duration</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period</td>
<td>...via a syringe driver over 4 hours</td>
</tr>
</tbody>
</table>

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**Event related**

<table>
<thead>
<tr>
<th>Event related</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>After/Before event</td>
<td>...after meals</td>
</tr>
<tr>
<td>n time period before/after event</td>
<td>...before lying down</td>
</tr>
<tr>
<td>Duration n time period before/after event</td>
<td>...after each loose stool</td>
</tr>
<tr>
<td>...after each nappy change</td>
<td></td>
</tr>
</tbody>
</table>

**Treatment duration**

<table>
<thead>
<tr>
<th>Treatment duration</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date/time to date/time</td>
<td>1-7 January 2005</td>
</tr>
<tr>
<td>Now and then repeat after n time period/s</td>
<td>...stat, repeat in 14 days</td>
</tr>
<tr>
<td>n time period/s</td>
<td>...for 5 days</td>
</tr>
<tr>
<td>n doses</td>
<td>...Take every 2 hours for 5 doses</td>
</tr>
</tbody>
</table>

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**Triggers/Outcomes**

<table>
<thead>
<tr>
<th>Triggers/Outcomes</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>If condition is true</td>
<td>...if pulse is greater than 80</td>
</tr>
<tr>
<td>...until bleeding stops</td>
<td></td>
</tr>
<tr>
<td>Start event</td>
<td>...Start 3 days before travel</td>
</tr>
<tr>
<td>Finish event</td>
<td>...Apply daily until day 21 of menstrual cycle</td>
</tr>
</tbody>
</table>

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**NEW: 2 level modelling**

- **Clinical Knowledge**
  - Easier and cheaper to build and maintain
  - Contains only generic knowledge and business rules

- **Reference Model**
  - Much smaller and simpler

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The openEHR Reference Model

Reference Model
Provides generic structure that expresses all fixed attributes for a Health Record to operate:
- Clinical statements
- Observations
- Assessments
- Planning, Intervention, Management
- Structuring
- Lists
- Time Series
- Table
- Data types
- Quantity – ISO units
- Date/Time
- Yes/No
- Text/coded text

No need to record common and constant data like author, date etc

» CONCENTRATE ON THE HEALTH INFORMATION SPACE

Archetypes put the clinician in the driver’s seat!

Archetypes
- Dictionary definition - a model or prototype
- openEHR archetypes are models of clinical or other domain-specific concepts
- They define the business rules (constraints) for valid values of each data element
- Model a range of concepts:
  - Simple and straightforward concepts such as 'blood pressure' or 'address', or
  - Complex compound concepts such as 'medication order' or 'family history'

Archetypes can be:
- Shared
- Re-used
- Specialised – for specific purposes
- Revised – as knowledge changes
- Versioned

...WITHOUT CHANGING THE REFERENCE MODEL

Types of Archetypes
- Compositions
- Sections
- Entries
- Observations
- Goals
- Instructions
- Workflow
Archetype Attributes

- Constrain data entry to improving data quality
- Include the maximum and minimum value that could possibly be sensible
- Determine the allowed units, with associated numeric ranges which are unit dependent
- Incorporate the set of terms from a terminology that could be used to populate a data point
- Define an internal value set that is allowed permitted in the archetype
- Establish whether a data point is mandatory or optional
- Quantify the number of times a data point or data set might be repeated

LEGO® design analogy

RM components = individual LEGO bricks
Archetypes = instructions for creation of meaningful structures

Designing an archetype

Clinician involvement required → Maximum Data Set

Medication Order Archetype: Data

Medication Order : Pathways
**Benefits of archetypes**

- Ensures knowledge-level interoperability
- Archetypes developed directly by clinicians, independent of “techies”
- Ensures data validation via archetype constraints for data entry
- Enables efficient querying on large amounts of EHR data
- Are integral to implementation of guidelines, workflow etc
- Enables intelligent decision support
- Incorporates versioning - currency and conflict/Audit trail
- Ensures future-proof EHRs (information is like LEGO blocks)
- Enables future-proof EHR systems (software is a “LEGO-model builder”)
Rule of Thumb #1

- Clinical application
- FLEXIBLE TEMPLE
- STABLE
- FIXED
- Reference Model

Rule of Thumb #2
1. Reference Model rules!!
2. Archetypes can’t override the RM
3. Templates can’t override the Archetypes

The openEHR Foundation
- www.openEHR.org
- a non-profit organisation (charity) registered in the United Kingdom
- founded by Ocean Informatics & University College London
- Mission - to improve clinical health care via:
  - Interoperable life-long health records, proven in practice
  - Open source specifications, software and knowledge management resources
- Jurisdiction: None
  - aims to be appropriate for all types of health care, all localities, all languages
Impact of openEHR

openEHR online Community
  - 648 members in 63 countries (Jan 2006)

Standards:
  - CEN standard for Electronic Healthcare Record Communication - EN13606-part 2 (archetype model)
  - Archetype Definition Language under consideration by ISO

Commercial activities in:
  - Australia
  - USA
  - Netherlands
  - Belgium
  - Sweden

Research Activities in:
  - UK
  - University College London
  - University of Manchester
  - Spain
  - University of Seville
  - Sri Lanka
  - University of Moratuwa
  - Australia
  - University of SA
  - University of Central Qld.
  - US
  - Mayo Clinic

The Art of Archetyping

A collaborative process...

1. Brainstorm
2. Organise
3. Mapping to existing archetypes
   - Re-use existing archetypes
   - Specialise existing archetypes
   - Create new archetypes

Brainstorm

Consider the clinical concept from all angles:
  - Who?
  - Max/Min?
  - What?
  - Normal/Abnormal?
  - Where?
  - Simple/Complex?
  - When?
  - Complications?
  - How?
  - Be inclusive/expansive

Blood Pressure Brainstorm

Source all possible content, including:
  - Minimum Data Sets
  - National/State/Local
  - Specialised
  - Reporting/Clinical
  - Internet
  - Local/International
  - Similar Projects
  - Written
  - Textbooks/publications

... & input from a broad range of clinicians
Organise
- Which Entry class?
- Focus on identifying:
  - Data elements
  - Protocol
  - State – context for interpretation
  - Allowable Events
  - Pathway steps
  - Concepts needing coding/terminology
- Re-use existing archetypes wherever possible
  ...rather than new or specialised

Organise Blood Pressure

Then...WHAT HAVE WE MISSED?

Blood Pressure #2
...additional input from other clinicians

Blood Pressure #3
...and researchers
Design of archetypes

- Wholeness
  - The information in each archetype should be able to be interpreted in isolation
    - MAXIMAL data set
  - Each archetype should be as complete as possible
    - Multiple sectors
    - Multiple purposes
    - Multiple priorities

- Discrete
  - Try to represent a single concept within a single archetype
  - Don’t try to model the too much at once
    - Small is good → multiple archetypes can be combined within larger composite archetypes
  - Overlapping concepts, where possible, should be resolved into a set of archetypes which do not overlap

- Specialisation
  - Used to resolve overlapping concepts with different information requirements
  - Allows:
    - new data points to be added
    - further constraint on existing data points
    - optional data points to be dropped