ISO EN 13606 Electronic Health Communication (EHRCOM): The contribution of archetypes towards eHealth semantic interoperability

Norwegian seminar on Archetypes and Architecture
Oslo, 26th November 2009

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European health systems: priorities and challenges

- Growing expectations for equity of access, quality and efficiency, patient empowerment and engagement
- Rising incidence of chronic diseases and increased complexity of their treatment
  - age related: dementia, cancer
  - lifestyle related: diabetes, asthma, obesity, ischaemic heart disease
- Growing expectations and concerns about patient safety
- Need for better integration across wellness, health care, public health, occupational health and social care
- Demographic change
  - ageing population is driving up demand for health services
  - adverse health worker to patient ratio
- Societal pressure for demonstrable protection of privacy
Implications and opportunities for the Electronic Health Record

- Manage increasingly complex clinical care
- Connect multiple locations of care delivery
- Support team-based care
- Deliver evidence-based health care
- Improve safety
  - reduce errors and inequalities
  - reduce duplication and delay
- Improve cost effectiveness of health services
- Enrich population health management and prevention
- Empower and involve citizens
- Protect patient privacy
- Better inform and exploit bio-science research
What is an Electronic Health Record?

“A repository of information regarding the health status of a subject of care in computer processable form, stored and transmitted securely, and accessible by multiple authorised users.

It has a standardised or commonly agreed logical information model which is independent of EHR systems.

Its primary purpose is the support of continuing, efficient and quality integrated health care and it contains information which is retrospective, concurrent, and prospective.”

Goals for EHR semantic interoperability

- To support patient safety, quality of care, chronic disease management, extended home-care, patient empowerment
  - enable the safe, meaningful sharing and combining of health record data between heterogeneous systems and actors / care providers
  - enable the integration and safe use of computerised protocols, alerts and care pathways by EHR systems
  - link EHR data to explanatory and educational materials to support patient and family engagement and professional development
  - ensure the necessary data quality and consistency to enable meaningful and reliable use of longitudinal and heterogeneous data for public health, research, health service management

Clinical meaning (data, information, knowledge) must be capable of being represented consistently
In a generated medical summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Type</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>Procedure</td>
<td>Appendicectomy</td>
</tr>
<tr>
<td>1996</td>
<td>Diagnosis</td>
<td>Meningococcal meningitis</td>
</tr>
<tr>
<td>1997</td>
<td>Procedure</td>
<td>Termination of pregnancy</td>
</tr>
<tr>
<td>2003</td>
<td>Diagnosis</td>
<td>Acute psychosis</td>
</tr>
<tr>
<td>2006</td>
<td>Diagnosis</td>
<td>Schizophrenia</td>
</tr>
</tbody>
</table>

Can we safely interpret a diagnosis without its context?
Clinical interpretation context

<table>
<thead>
<tr>
<th>Emergency Department</th>
<th>Seen by junior doctor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for encounter</td>
<td>Brought to ED by family</td>
</tr>
<tr>
<td>Symptoms</td>
<td>“They are trying to kill me”</td>
</tr>
<tr>
<td>Mental state exam</td>
<td>Hallucinations, Delusions, Disordered thoughts</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>Certainty</td>
<td>Working hypothesis</td>
</tr>
<tr>
<td>Management plan</td>
<td>Admission etc.....</td>
</tr>
</tbody>
</table>

Junior doctor; emergency situation; a working hypothesis; so schizophrenia is not a reliable diagnosis.
Requirements the EHR must meet: ISO 18308

4 EHR ARCHITECTURAL REQUIREMENTS

4.1 BUSINESS REQUIREMENTS

4.1.1 Health system requirements

4.1.2 Clinical practice requirements

4.1.3 Citizen inclusion requirements

4.2 REQUIREMENTS FOR THE REPRESENTATION OF CLINICAL INFORMATION

4.2.1 Kinds of health record entries

4.2.2 Structure of health record entries

4.2.3 The representation of context within health record entries

4.2.4 Intra-record links

4.2.5 The representation of data values within health record entries

4.2.6 EHR data retrieval and views

4.2.7 Representation and support of clinical process and workflow

4.3 COMMUNICATION AND INTEROPERABILITY REQUIREMENTS

4.4 ETHICAL AND LEGAL REQUIREMENTS

4.4.1 Support for legal requirements

4.4.2 Subject of care

4.4.3 Identification and authentication

4.4.4 Health care locations

4.4.5 Dates and times

4.4.6 Version management

4.5 CONFIDENTIALITY REQUIREMENTS

3.40.1 Subject access

3.40.2 Access policies

3.40.3 Policy over-ride

3.40.4 Audit trails

3.40.5 Consents

The EHR shall preserve any explicitly defined relationships between different parts of the record, such as links between treatments and subsequent complications and outcomes.

The EHR shall preserve the original data values within an EHR entry including code systems and measurement units used at the time the data were originally committed to an EHR system.

The EHR shall be able to include the values of reference ranges used to interpret particular data values.

The EHR shall be able to represent or reference the calculations, and/or formulae by which data have been derived.

The EHR architecture shall enable the retrieval of part or all of the information in the EHR that was present at any particular historic date and time.

The EHR shall enable the maintenance of an audit trail of the creation of, amendment of, and access to health record entries.
The role of EHR interoperability standards

ISO/EN 13606
openEHR.org
EHR archetypes

Clinical trials, functional genomics, public health databases

EHR repositories

Decision support, knowledge management and analysis components

Personnel registers, security services

Clinical devices, instruments

Mobile devices

Clinical applications
Logical EHR architectural components

- Persistence services
- Access control and privilege management services
- Audit services
- Standards conformant interfaces (esp. ISO/EN 13606)
- Logical EHR model
  - Archetype and terminology services
  - Query and retrieval
  - Data entry and validation
Links with other components: HISA EN12967

- Learning resources
- Workflow, guidelines
- Comms & security
- Persons, resources
- Online knowledge
- Finance, billing
- Terminology
- Clinical applications
- Standard Interfaces
  - virtual EHR
- Interfaces
The openEHR Foundation

- An international not-for-profit foundation
- Uniting an international community working towards the realisation of electronic health records which are:
  - clinically comprehensive and ethico-legally sound
  - interoperable and standards-based
  - implemented as open-source components
  - supporting seamless and high quality patient care
- Governance through an Executive, and Architecture and Clinical Review Boards

- www.openehr.org
ISO/TR 20514: “...Logical information model independent of EHR systems...”

- ISO/EN 13606
  - The simplest possible EHR reference model that still meets all of the requirements
  - It is ideally suited for interoperability between heterogeneous and legacy systems
  - It is the world-wide EHR communications standard

- openEHR
  - The richest available EHR architecture, and is ideally suited for building a comprehensive EHR system
  - It is an open specification, technically validated
  - It conform to ISO/EN 13606 and extends it for maximum completeness

- Both are based on the use of archetypes
- Both are now being implemented and used across the world
CEN/ISO 13606
EHR Communications Standard

- A means to exchange part or all of a patients EHR
  - between heterogeneous systems
  - within a federation of distributed EHR systems

- Meets published EHR requirements
  - 15 years of R&D and 2 past CEN EHR standards
Parts of ISO/EN 13606

- **Part 1: Reference Model**
  - comprehensive, generic model for communicating part or all of an EHR

- **Part 2: Archetype Specification**
  - constraint-based approach for defining clinical “business objects” that are built from the Reference Model - adopted from openEHR

- **Part 3: Reference Archetypes and Term Lists**
  - initial set of archetypes mapping to other relevant standards
  - vocabularies for the Part 1 model

- **Part 4: Security**
  - measures to support access control, consent and auditability of EHR communications

- **Part 5: Interface specification**
  - message and service interfaces to enable EHR and archetype communication
EN 13606-1 Reference Model
EN 13606-1 Reference Model
Compositions
Set of entries comprising a clinical care session or document e.g. test result, letter

EHR Extract
Part or all of the electronic health record for one person, being communicated

Folders
High-level organisation of the EHR e.g. per episode, per clinical speciality

Compositions
Set of entries comprising a clinical care session or document e.g. test result, letter

Sections
Headings reflecting the flow of information gathering, or organising data for readability

Entries
Clinical “statements” about Observations, Evaluations, and Instructions

Clusters
Multipart entries, tables, time series, e.g. test batteries, blood pressure, blood count

Elements
Element entries: leaf nodes with values e.g. reason for encounter, body weight

Data values
Date types for instance values e.g. coded terms, measurements with units
Core properties of the EHR Reference Model

- the compositional record hierarchy e.g. the document level, folders and the structure of finer grained entries
- the representation of persons, such as the record subject, authorship, signatures and the information provider
- the definition of dates and times, both real world times when events occurred and the time-stamping of when details were recorded
- instance identifiers and version management properties
- data types to represent coded terms, quantities, dates and times, images etc. consistently
- a role based access control approach, with options for jurisdictional profiles of these

but, deliberately, no clinical domain knowledge
Harmonisation with HL7 and IHE

Harmonisation with HL7

- Meets the Infrastructure requirements of the EHR Functional Model
- An 13606-1 conformant R-MIM has been designed
- Detailed cross-mapping to Clinical Document Architecture
- Collaboration on archetype and template specifications
- Contributed to the Clinical Statement model design
- An HL7 13606 Implementation Guide is being developed

Harmonisation with IHE XDS

- contributed to architecture and metadata
- mapping to registry metadata
- So XDS can store and share 13606 EHR Extract data
Comparing 13606 with CDA

- CDA is a individual-document exchange message
  - fine for narratives with a few codes, or a fixed structure like CCD
  - advantage includes consistency with rest of HL7 v3
  - some technical artefacts are ready (XML schemata)
  - (although real interoperability yet to be demonstrated)

- CDA documents can be fully represented in 13606
- Parts of 13606 Composition can be mapped to CDA
- The scope of 13606 is broader than CDA
  - 13606 is more appropriate to support a regional or national healthcare network: an EHR federation or data warehouse
- 13606 is archetype-ready
- 13606 is pre-aligned with HISA and CONTsys
- 13606 includes access control & is PMAC-ready
The advantages of systematically structured records

- Can help optimise the use of guidelines and care pathways
- Enables precise mapping to terminology for relevant values
- Can support speedy data entry if tailored to clinical workflows
- Can enable consistent data capture, promote completeness, allow error checking, and so lead to better data quality
- Easier to apply workflow logic, decision support and alerts
- Easier to generate reports and audits

But, for this, we need to adopt consistent clinical data structures within the EHR
Towards consistency of meaning

The EHR Reference Model
- standardises the way of representing and sharing the clinical and medico-legal contexts
- helps to ensure that EHR data can be interpreted longitudinally and internationally

BUT...
- ...Part 1 cannot on its own ensure the consistency or completeness of the clinical content, or define how terminology is used
- Part 2 standardises Archetypes for this purpose
What is a clinical archetype?

- a clinical archetype is an agreed, formal and interoperable specification for representing a given clinical entity such as a clinical observation, a finding, a plan or a treatment within an electronic health record

- invented and maintained by openEHR
- ratified by CEN: EN 13606 Part 2
- ratified by ISO: ISO 13606 Part 2
- to be quality labelled and licensed by EuroRec
Archetypes are knowledge-related data structures that strongly support semantic interoperability of EHRs. They help to ensure:

- reliable and easy sharing of meaningful sets of data between different health care providers
- while allowing the re-use of their 'atomic' data components separately or within other archetypes
What value do archetypes add?

- A user friendly means to capture and collate professional consensus on how clinical data should be represented
- A formal model of clinical domain concepts
  - e.g. “blood pressure”, “discharge summary”, “fundoscopy”
- Can provide a focussed context for selection of relevant terms
- Can be published and shared within a clinical community, or globally
- Can be imported by vendors into EHR system data dictionaries
- Defines a systematic EHR target for queries and for decision support
openEHR / 13606 Archetypes:  
a shared library of clinical data structures
openEHR / 13606 Archetypes: a shared library of clinical data structures
Clinical challenges for adopting archetypes

- Grow communities to author, review and adopt archetypes for different domains
- Define good practice for archetype authorship
- Enrich the tooling to support clinicians using archetypes
- Improve the binding between archetypes and co-ordinated terminologies e.g. SNOMED-CT
- Establish quality, governance and certification processes for archetypes and repositories
Four case study approaches to defining archetypes

- *open*EHR Clinical Knowledge Manager
- Royal College of Physicians
- NHS Logical Record Architecture
- UCL chronic disease management
Four case study approaches to defining archetypes

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openEHR Clinical Knowledge Manager
http://www.openehr.org/knowledge/
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# openEHR Clinical Knowledge Manager

http://www.openehr.org/knowledge/

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## Blood Pressure (v1)

- **Label:** PUBLISHED, LATEST
- **Modified:** 23-Aug-2009 06:33
- **Log message:**
  - Modification to description of Intra-arterial method
  - Update Contributors
  - Remove grammatical error in Use
  - Updated some classifications Ready for publication

## Trunk (Rev. 16)

- **Modified:** 30-Jul-2009 15:50
- **Log message:** Remove reference to Postural Change in Use

## Trunk (Rev. 15)

- **Modified:** 30-Jul-2009 15:46
- **Log message:**
  - Modified descriptions, Use, Purpose, References
  - Removed Postural Change event
  - Reordered cuff sizes
  - Updated Contributors

## Trunk (Rev. 14)

- **Modified:** 01-Jul-2009 16:08
- **Log message:**
  - Paradox event removed
  - Trendelenburg (as position) removed
  - Left Lateral (as position) modified to Lateral tilt
  - Refined Location cluster
  - Removed Incidental stressor slot and replaced with Confounding Factors element
  - Added Locations - Toe
  - Intraarterial
  - Standardised format of References;
  - Added Reference
  - Added new reviewers
openEHR Clinical Knowledge Manager
http://www.openehr.org/knowledge/

Cumulative New Users per Month

Users per Profession (Multiple choice)

<table>
<thead>
<tr>
<th>Name</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>21</td>
</tr>
<tr>
<td>Allied Health Professional</td>
<td>29</td>
</tr>
<tr>
<td>Allied Health Professional Audiologist</td>
<td>8</td>
</tr>
<tr>
<td>Consumer</td>
<td>22</td>
</tr>
<tr>
<td>Health Informatics/Health IT</td>
<td>162</td>
</tr>
<tr>
<td>Laboratory Scientist</td>
<td>37</td>
</tr>
<tr>
<td>Medical Practitioner</td>
<td>125</td>
</tr>
<tr>
<td>Midwife</td>
<td>33</td>
</tr>
<tr>
<td>Nurse</td>
<td>78</td>
</tr>
<tr>
<td>Other</td>
<td>27</td>
</tr>
<tr>
<td>Paramedical Professional</td>
<td>18</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>27</td>
</tr>
</tbody>
</table>
openEHR clinical community: Top 10 priority archetypes

- voted by the openEHR clinical community (July 2009)

1. Medication
2. Problem/Diagnosis
3. Adverse Reaction
4. Vital Signs group
5. Laboratory report
6. Alert
7. Blood Group
8. Procedure
9. Admission/Episode
openEHR CKM archetypes

- Gold standard (best practice) definitions
- Leveraging the available published evidence
- Referring to as many guidelines as can be found
- Inclusive of as many variants on the requirements as possible
  - “maximal”
- Openly developed in a social community environment
- Wide, international multi-stakeholder contributions
- Dependent upon level of interest, and on high quality inputs
  - like Wikipedia
- Final decisions based on consensus
Four case study approaches to defining archetypes

- *open*EHR Clinical Knowledge Manager
- Royal College of Physicians
- NHS Logical Record Architecture
- UCL chronic disease management
Royal College of Physicians: Clinical headings

- A standard and defined set of headings for
  - acute medical admission
  - hospital handover
  - discharge summary

- Method:
  - literature reviews
  - evaluating proformas used by different NHS Trusts
  - discussions with the care record service of Connecting for Health
  - clinician workshops
  - a questionnaire based on the headings and definitions
    - > 3000 people responded and 80% agreed on 30 of the 36 suggested headings

- Feedback and subsequent endorsement from several other Royal Colleges
Section two
Hospital admission record: headings and definitions

The headings presented here are ‘anchor’ points for the clinical information in the admission record. The detail and specialty specific requirements under each heading will be refined in work to follow. Not all headings are relevant in paper records nor on all occasions. In the electronic environment some of the headings will be automatically completed.

An example of a recommended paper proforma can be found in the Royal College of Physicians templates online at http://www.rcplondon.ac.uk/hiu

<table>
<thead>
<tr>
<th>Headings/sub-headings</th>
<th>Definition/illustrative description of the type of clinical information to be recorded under each heading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible consultant</td>
<td>The name of the consultant physician who will be responsible for the patient’s inpatient care.</td>
</tr>
<tr>
<td>Clerking doctor</td>
<td>The full name, grade and contact details of the doctor recording the clinical information contained in the admission clerking. GMC Number (unique identifier). Identify chaperone eg offered, present or not, name etc.</td>
</tr>
<tr>
<td>Source of referral</td>
<td>A record of the healthcare setting from which the patient was referred for hospital admission, e.g. GP, accident and emergency etc.</td>
</tr>
<tr>
<td>Time and date patient seen</td>
<td>The time and date the patient was assessed by the clerking doctor.</td>
</tr>
<tr>
<td>Time and date of clerking</td>
<td>The time and date the clerking doctor writes the record of the admission clerking.</td>
</tr>
<tr>
<td>Patient’s location</td>
<td>The physical location where the patient was assessed, specifying bay and bed when possible.</td>
</tr>
<tr>
<td>Reason for admission and Presenting complaints</td>
<td>The health problems and issues experienced by the patient resulting in their referral by a healthcare professional for hospital admission, e.g. chest pain, blackout, fall, a specific procedure, investigation or treatment.</td>
</tr>
<tr>
<td>Headings/sub-headings</td>
<td>Definition/illustrative description of the type of clinical information to be recorded under each heading</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>History of each presenting complaint</td>
<td>The record of clinical information directly related to the development and characteristics of each presenting complaint.</td>
</tr>
<tr>
<td>Past medical, surgical and mental health history</td>
<td>The record of the patient’s previous diagnoses, problems and issues, procedures, investigations, adverse anaesthetic events etc.</td>
</tr>
<tr>
<td>Medication record</td>
<td></td>
</tr>
<tr>
<td>- Current medications</td>
<td>The record of medications, dietary supplements, dressings and equipment that the patient is currently taking or using, eg prescribed medications, over-the-counter preparations, medications obtained from other sources etc.</td>
</tr>
<tr>
<td>- Relevant previous medications</td>
<td>The record of medications, dietary supplements, dressings and equipment that the patient has taken or has used, relevant to their presentation, e.g. prescribed medications, over-the-counter preparations, medications obtained from other sources etc.</td>
</tr>
<tr>
<td>Relevant legal information</td>
<td></td>
</tr>
<tr>
<td>- Mental capacity</td>
<td>The mental capacity of the patient to make decisions about treatment etc.  Example, where an Independent Mental Capacity Advocate (IMCA) is required for decisions relating to discharge destination, medical treatment, ability to consent etc. Who is the patient’s advocate?</td>
</tr>
<tr>
<td>- Advance decisions to refuse treatment</td>
<td>Written documents, completed and signed when a person is legally competent, that explain a person’s medical wishes in advance, allowing someone else to make treatment decisions on his or her behalf later in the disease process.</td>
</tr>
<tr>
<td>- Lasting power of attorney or deputy</td>
<td>If there is a lasting power of attorney, who is this person or their deputy.</td>
</tr>
<tr>
<td>- Organ donation</td>
<td>Has the person given consent for organ donation.</td>
</tr>
<tr>
<td><strong>Allergies and Adverse reactions</strong></td>
<td>Allergies, drug allergies and adverse reactions.</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td><strong>Risks and warnings</strong></td>
<td>Significant risk of an unfavourable event occurring, patient is Hepatitis C +ve, MRSA +ve, HIV +ve etc. Any clinical alerts, risk of self neglect/aggression/exploitation by others.</td>
</tr>
</tbody>
</table>

### Social history

- **Lifestyle**
  The record of lifestyle choices made by the patient which are pertinent to his or her health or social care. Example the record of the patient's current and previous use of tobacco products, alcohol, recreational drugs, pets, hobbies, sexual habits, menstrual and coital history.

- **Social and personal circumstances**
  The record of a patient's social background, network and personal circumstances, e.g. occupational history, housing and religious, ethnic and spiritual needs.

- **Services and carers**
  The description of services and carers provided for the patient to support their health and social wellbeing.

### Family history

The record of relevant illness in family relations deemed to be significant to the care or health of the patient, including mental illness and suicide.

### Systems enquiry

The record of clinical information gathered in response to questions to the patient about general symptoms from various physiological systems, including food intake (increasing/decreasing), weight change, swallowing difficulties. Mood/anxiety etc.

### Patient’s concerns, expectations and wishes

The record of the patient's comments related to their perceptions of their symptoms, their wishes and goals related to their health and their perceptions of their anticipated treatment (which may influence treatment). This could be the carer giving information if the patient is not competent. Also the extent to which the patient wants clinical information to be shared with relatives and others.

### Observations and findings

Any clinical observation or finding made by the clerking doctor, with or without specific clinical examination.
<table>
<thead>
<tr>
<th>Headings/sub-headings</th>
<th>Definition/illustrative description of the type of clinical information to be recorded under each heading</th>
</tr>
</thead>
<tbody>
<tr>
<td>- General appearance</td>
<td>The record of a doctor’s ‘end of the bed’ assessment including general clinical examination findings, eg clubbing, anaemia, jaundice, obese/malnourished/cachectic, height, weight etc.</td>
</tr>
<tr>
<td>- Structured scales</td>
<td>e.g. Glasgow Coma Scale, ADL scales such as Barthel, nutrition screening scale etc.</td>
</tr>
<tr>
<td>- Vital signs</td>
<td>The record of essential physiological measurements, eg respiration rate, O2 saturation, heart rate, blood pressure, temperature and weight, Early Warning Score (EWS), including the time and date they were obtained.</td>
</tr>
<tr>
<td>- Mental state</td>
<td>e.g. Depression, anxiety, confusion, delirium.</td>
</tr>
<tr>
<td>- Cardiovascular system</td>
<td>The record of findings from the cardiovascular system examination.</td>
</tr>
<tr>
<td>- Respiratory system</td>
<td>The record of findings from the respiratory system examination.</td>
</tr>
<tr>
<td>- Abdomen</td>
<td>The record of findings from the abdominal examination.</td>
</tr>
<tr>
<td>- Genito-urinary</td>
<td>The record of findings from the genito-urinary examination.</td>
</tr>
<tr>
<td>- Nervous system</td>
<td>The record of findings from the nervous system examination.</td>
</tr>
<tr>
<td>- Musculoskeletal system</td>
<td>The record of findings from the musculoskeletal system examination.</td>
</tr>
<tr>
<td>- Skin</td>
<td>The record of findings from examination of the skin.</td>
</tr>
<tr>
<td>Problem list and/or</td>
<td>Summary of problems that require investigation or treatment.</td>
</tr>
<tr>
<td>Differential diagnosis</td>
<td></td>
</tr>
<tr>
<td>Relevant risk factors</td>
<td>Factors that have been shown to be associated with the development of a medical condition being considered as a diagnosis/differential diagnosis. Thrombo-prophylaxis.</td>
</tr>
<tr>
<td>Section two</td>
<td>Hospital admission record: headings and definitions</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td><strong>Discharge planning</strong></td>
<td>Information in relation to discharge planning should be entered here, starting at the time of admission.</td>
</tr>
<tr>
<td><strong>Management plan</strong></td>
<td>Overall assessment and actions.</td>
</tr>
<tr>
<td>- Summary and interpretation of findings</td>
<td>Summary and interpretation of findings.</td>
</tr>
<tr>
<td>- Next steps</td>
<td>Next steps.</td>
</tr>
<tr>
<td>- Special monitoring required</td>
<td>e.g. neuro-obs, O2 saturation etc.</td>
</tr>
<tr>
<td>- Resuscitation status</td>
<td>Resuscitation status.</td>
</tr>
</tbody>
</table>
| - Information given to the patient and/or authorised representative | This can include:  
  - relatives and carers  
  - specific verbal advice and details of any discussions  
  - written information including leaflets, letters and any other documentation.  
  Differentiation required between information given to patients, carers and any other authorised representatives. |
| **Investigations and initial procedures** | The results and/or interpretation of results of investigations and procedures. Planned procedures. |
| **Person completing clerking** |  |
| - Doctor's name |  |
| - Grade |  |
| - Doctor's signature |  |
| **Specialist registrar/senior review** | Where an admission clerking is reviewed by a specialist registrar or other senior doctor. |
| **Post take ward round** | Where a history and initial results are reviewed, clinical decisions are made, a management plan is formulated, and further investigations planned. |
# Observations and Findings – Respiratory System

## Content

Normal on examination: □ Yes □ No □ Not Examined

Respiratory Rate: breaths per min (2 digit number)

Peak flow: litres per min (3 digit number)

Historical best peak flow: litres per min (3 digit number)

Usual/normal peak flow: litres per min (3 digit number)

## Oximetry

Oxygen support: Please select

Oxygen saturation: 0%

Inspired oxygen (FiO2): 0%

Inspired oxygen: 0% min

Site of measurement: Please select

Breathing description: Please select

Rhythm: Please select

Character: Please select

Signs of increased effort: Please select

Chest Wall: Please select (free text field)

Chest expansion: Please select

Chest expansion - symmetry: Please select

Trachea position: Please select

Percussion: Please select Please select Please select Please select

Auscultation: Please select (free text field)

Description/comment (e.g. Vocal fremitus, subcutaneous emphysema): (free text field)

Enter further information, annotating the enclosed image required
RCP Archetype approach

- Selection of a focussed domain
- Single profession, for now
- Start top down, with clinical headings
- Define content per heading
- Involve clinicians and other stakeholders through workshops
- Get them to propose content
- Focus on what every good doctor should record
- Not necessarily maximal
- Consider most items to be optional
- Use a paper record template to provide a visual cue to the content being proposed
Four case study approaches to defining archetypes

- openEHR Clinical Knowledge Manager
- Royal College of Physicians
- NHS Logical Record Architecture
- UCL chronic disease management
Coded Clinical Finding

- Severity
  - Occurrence
  - Onset
  - Course
  - Episodicity
  - Finding site
    - Site
    - Laterality
  - Associated morphology
  - Finding method
  - Disorder details
    - Causative agent
    - Pathological process

Occurrences
Min: 0
Max: 1
Unbounded

Description: the direct causative agent of a disease

Runtime name constraint:

Constraint: SCT Severity

Description
The LRA base elements

- Element
  - Observation
    - Property
    - Finding
  - Activity
    - Investigation
    - Substance Activity
    - General Activity
  - Relationship
NHS LRA approach

- Deliver semantic representation within the EHR through SNOMED CT
- Utilise pre- and post-coordination to meet the needs of clinical expressivity
- Utilise the ISO/EN 13606 Reference Model for its structural and medico-legal properties, but adopt only a basic Entry hierarchy as the container for SNOMED CT term expressions
- Define a small number of archetypes to reflect the set of SNOMED contexts
- Work to develop terminology based constraints as the way to ensure semantic consistency and interoperability
Four case study approaches to defining archetypes

- openEHR Clinical Knowledge Manager
- Royal College of Physicians
- NHS Logical Record Architecture
- UCL chronic disease management
Anticoagulation planning

- Indication for anticoagulation - *mandatory, ordinal, 15 specified conditions*
- Other indication - *optional, free text*
- Anticoagulant drug name - *mandatory, ordinal, 3 specified drugs*
- Target INR - *mandatory, quantity, range 0-5*
- Target INR range
  - Upper - *mandatory, quantity*
  - Lower - *mandatory, quantity*
- Intended end date - *optional, calendar date*  
  __________ one must
- If life-long treatment intended - *optional, Boolean*  
  __________ be provided
- Actual end date - *optional, calendar date*
- Precautions to be taken - *optional, free text*
Anticoagulation

- Planning
- Monitoring

- Present health situation
- Treatment controller
- Current INR
- Decision support recommended warfarin dose
  - If recommended dose accepted
- Actual warfarin dosage
- Decision support recommended monitoring interval
  - If recommended interval accepted
- Actual appointment date
- Clinic name
- Advice given
- Medical comments
package uk.co.chimeventures.record.clinical.cardiovascular.anticoagulant;
import uk.co.chimeventures.archetypes.annotations.*;
import java.sql.Timestamp;
import java.util.HashSet;
import java.util.Set;
import javax.persistence.ManyToOne;
import javax.persistence.ManyToMany;
import javax.persistence.FetchType;
import javax.persistence.JoinColumn;
import javax.persistence.JoinTable;
import javax.persistence.Entity;
import javax.persistence.Transient;
@Version(1)
@ArchetypeName("Anticoagulation Indication")
@Entity
@DateOfIncorporation(1163421429000L)
@LibraryName("uk.co.chimeventures.record.clinical.cardiovascular.anticoagulant")
@PublicationStatus(PublicationStatusType.PRIVATE)
@ArchetypeIdentifier("AnticoagulationIndication")
@DateLastVerified(1163421429000L)
public class AnticoagulationIndication extends uk.co.chimeventures.record.Element implements uk.co.chimeventures.record.Ordinal {
    public AnticoagulationIndication() {
        super();
    }
    public AnticoagulationIndication(java.lang.String recordComponentIdentifier) {
        this();
        super.setRecordComponentIdentifier(recordComponentIdentifier);
    }
    public AnticoagulationIndication(java.lang.String recordComponentIdentifier, java.lang.String recordComponentName) {
        this(recordComponentIdentifier);
        super.setRecordComponentName(recordComponentName);
    }
    public AnticoagulationIndication(java.lang.String recordComponentIdentifier, java.lang.String recordComponentName, uk.co.chimeventures.record.ItemCategory itemCategory) {
        this(recordComponentIdentifier, recordComponentName);
        super.setItemCategory(itemCategory);
    }
    public AnticoagulationIndication(java.lang.String recordComponentIdentifier, java.lang.String recordComponentName, uk.co.chimeventures.record.ItemCategory itemCategory, java.lang.String value) {
        this(recordComponentIdentifier, recordComponentName, itemCategory);
        super.setOrdinalValue(value);
    }
    @Transient
    public java.lang.String getAnticoagulationIndication() {
        return super.getOrdinalValue();
    }
    public void setAnticoagulationIndication(java.lang.String value) {
        super.setOrdinalValue(value);
    }
}
Anticoagulation Plan

Fields marked * are mandatory

Anticoagulant Drug Name: * WARFARIN

Intended End Date: [Pick a date]

Actual End Date: [Pick a date]

Format allowed: 31-01-2000 or 31-Jan-2000

Indefinite Treatment: *

Target INR: *

Target INR Range:

Target INR Range Lower: *

Target INR Range Upper: *

To use the Decision Support System, this must be set to 2.5

Precautions:

Anticoagulation Indication: *

Anticoagulation Indication Other:

DEEP_VEN_THROMBOSIS

PULMONARY_EMBOLUS
ATRIAL_FIBRILLATION
MITRAL_VALVE_DISEASE
TRANSIENT_ISCHAEMIC_ATTACK
SYSTEMIC_EMBOLUS
RECURRENT_DEEP_VEN_THROMBOSIS
RECURRENT_PULMONARY_EMBOLUS
AROTIC_VALVE_REPLACEMENT
MITRAL_VALVE_REPLACEMENT
AROTIC_AND_MITRAL_VALVE_REPLACEMENT
MITRAL_STENOSIS
MITRAL_REGURGITATION
PROTEIN_S_DEFICIENCY
PROTEIN_C_DEFICIENCY
ANTI_THROMBIN_III_DEFICIENCY
SUBCLAVIAN_VEN_THROMBOSIS
AXILLARY_VEN_THROMBOSIS
PROPHYLAXIS
## Anticoagulation Plan

**Date committed:** 08-Jun-2007

<table>
<thead>
<tr>
<th>Anticoagulation Plan</th>
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<tbody>
<tr>
<td>Anticoagulant Drug Name:</td>
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<tr>
<td>Intended End Date:</td>
</tr>
<tr>
<td>Indefinite Treatment:</td>
</tr>
<tr>
<td>Target INR:</td>
</tr>
<tr>
<td>Target INR Range:</td>
</tr>
<tr>
<td>Target INR Range:</td>
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<tr>
<td>Anticoagulation Indication:</td>
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</table>

This Plan ends in seven days or less. You might wish to **Create a Withdrawal Letter**.
Anticoagulation Plan

Revision History:
Record shown committed on: 08-Jun-2007 12:23.
Date committed: 08-Jun-2007

<table>
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<tr>
<th>Anticoagulant Drug Name:</th>
<th>WARFARIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intended End Date:</td>
<td>03-Jun-2007</td>
</tr>
<tr>
<td>Indefinite Treatment:</td>
<td>false</td>
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<tr>
<td>Target INR:</td>
<td>2.5</td>
</tr>
<tr>
<td>Target INR Range:</td>
<td>2.2</td>
</tr>
<tr>
<td>Target INR Range:</td>
<td>2.5</td>
</tr>
<tr>
<td>Anticoagulation Indication:</td>
<td>DEEP_VEN_THROMBOSIS</td>
</tr>
</tbody>
</table>

This Plan ends in seven days or less. You might wish to Create a Withdrawal Letter.

Return to normal view
CORRECTION: No reason for revision given.
Previous by date committed:
08-Jun-2007 12:23 (Latest) >> 08-Jun-2007 12:12 >> 31-May-2007 14:01 (First)
Anticoagulant Clinician Summary report generated by HeartBeat for Tony Austin (CHIME) on Thursday, 06 November 2008. This report was based on data available to the user at that time and may not reflect the current situation.

Dr Archana Tapuria  
CHIME, UCL  
Holborn Union Building, Highgate Hill  
London  
UK  
N19 5LW

Miss Matilda Bloggs

Therapy Plan Summary

<table>
<thead>
<tr>
<th>Target INR Range</th>
<th>Planned End Date</th>
<th>Reason For Anticoagulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 - 3.0</td>
<td>Lifelong Patient</td>
<td>ATRIAL_FIBRILLATION</td>
</tr>
</tbody>
</table>

Most Recent Clinic Contact Detail

<table>
<thead>
<tr>
<th>Date</th>
<th>INR Test Result</th>
<th>Next Dose</th>
<th>Next Appointment</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-Nov-2008</td>
<td>2.5</td>
<td>2.5 mg</td>
<td>06-Nov-2008 10:00 (CHIME)</td>
</tr>
</tbody>
</table>

Notes for Patient: Excellent work, keep it up!
Notes for Doctor: Patient well maintained

Recent Past Readings

<table>
<thead>
<tr>
<th>Date</th>
<th>Prescribed Dose</th>
<th>Monitoring Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-Nov-2008</td>
<td>2.5 mg</td>
<td>5 days</td>
</tr>
</tbody>
</table>

Historic INR Test Results
This report summarises the quality of anticoagulant control by site, individual, and therapeutic range, between Wednesday, 06 August 2008 and Thursday, 06 November 2008.

Service Summary

This section summarises the data for the service as a whole over the review period.

The total patients in the service who were dosed by any provider in the review period (active patients) were: 1
The total patients in the service who received a new therapy plan from any provider in the review period (new patients) were: 1
The total visits to any provider in the review period were: 2

The following charts indicate the range of absolute INR values and the diversion of measured INR from the target INR range for every recorded visit to the service.

![Absolute INR Values Chart](image1)

![Diversion of measured INR from Target INR Chart](image2)

The total visits below an absolute INR of 1.2 in the review period were: 0 out of 1 or 0.0%
The total visits above an absolute INR of 8.0 in the review period were: 0 out of 1 or 0.0%
The total visits outside 0.5 of the desired INR in the review period were: 0 out of 1 or 0.0%
The total visits outside 0.75 of the desired INR in the review period were: 0 out of 1 or 0.0%

The following charts show how the diversion of measured INR from target INR differs according to the therapeutic range employed:

![Range 2.0-3.0 Chart](image3)

Where possible, these figures will be broken down by account and individual practitioner in further sections.

Summary for account: CHIME

This section summarises the data for this account over the review period.

The total patients in the service who were dosed by this provider in the review period (active patients) were: 1
The total patients in the service who received a new therapy plan from this provider in the review period (new patients) were: 1
De facto archetype approach

- Focus on the specific support of clinical shared care
- Work with multiple professionals from the start
- Develop archetypes with a view to what is feasible to record and useful to share: sometimes reflecting common practice rather than best practice
- Archetypes need to mirror data the structures in real use: some are quite specialised, not always generic and reusable
- Build on existing paper and electronic systems if they are useful and used
- Developed with rapid reflection back via clinical application screens to provide a visual cue to the content being proposed
- Encourage practice data entry based on real patients
- Diversity still needs to exist - clinical best practice might not always be at a consensus - yet!
The EHR landscape - for archetypes
Archetypes need to be quality assured

- It is important that the design of individual archetypes is an accurate and faithful reflection of good practice for the clinical disciplines in which each of them might be used.

- Libraries of archetypes need to be mutually consistent and collectively to be complete enough to represent the needs of particular clinical domains.

- If record-sharing communities are to construct safe EHR instances in accordance with archetypes, and to trust EHR data conforming to archetypes, a formal process of verification and certification is needed for archetypes in the same way as EHR systems need to be certified.
Quality assurance of archetypes

- IHTSDO and the openEHR Foundation are launching a collaborative work program
  - to explore how best to support the use of openEHR archetypes and SNOMED CT together to support data capture, complex queries, decision support and reporting
  - The goal is the practical development of effective and sustainable clinical content for electronic health records

- The openEHR Foundation is partnering the EuroRec Institute in developing
  - good practice for archetype development
  - quality criteria and editorial policies by which certified libraries of EHR Archetypes can be recognised
  - EuroRec has published the first major analysis of archetype quality criteria and possible certification approaches
Conclusion: the 13606 EHR Communications standard

- defines a logical model for the core EHR
  - supporting interoperability between heterogeneous systems
  - providing a common view across message paradigms
- meets published EHR requirements
- draws on 15 years of significant R&D
  - including multi-national implementation experience
- draws on two generations of CEN EHR standard
- incorporates *open*EHR archetypes for sharing semantic structures
- offers a framework for sharing disclosure consent and access control information
- can be used alongside other CEN standards, in particular HISA and CONTsys