CINTESIS
CENTRO DE INVESTIGAÇÃO EM TECNOLOGIAS E SISTEMAS DE INFORMAÇÃO EM SAÚDE

U. FMUP

OpenEHR and Breast Cancer

Breast Cancer Workshop @ Porto

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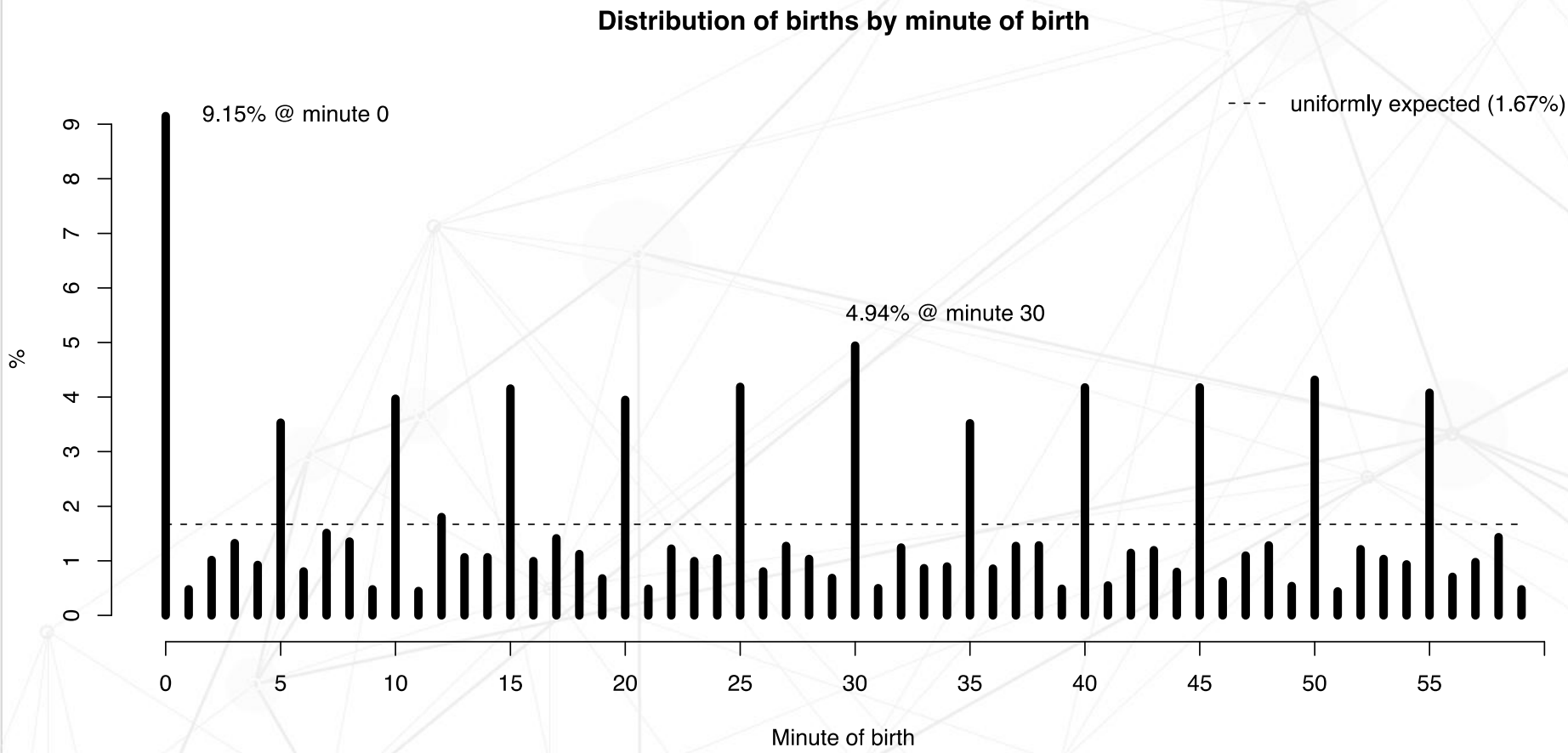
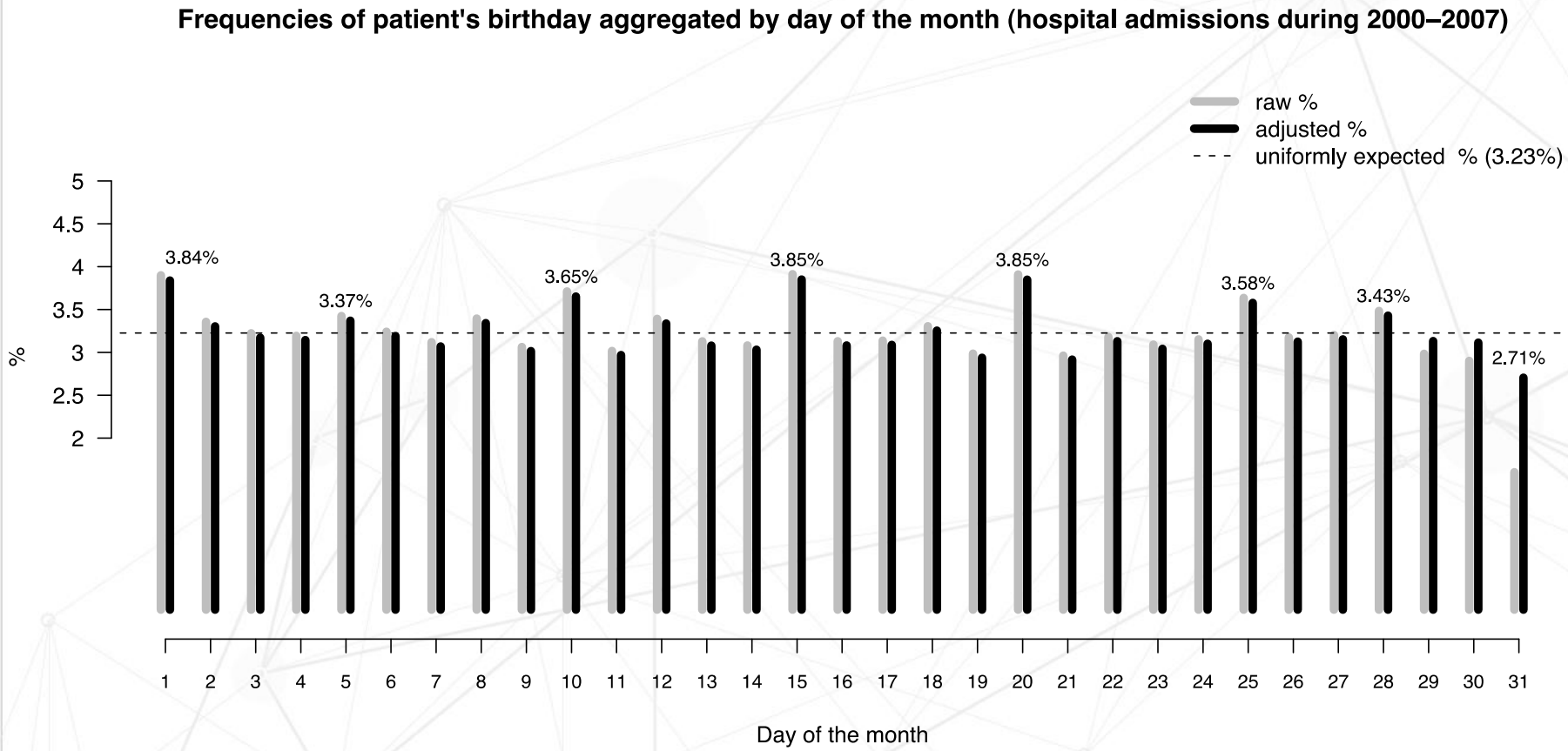
Data analysis

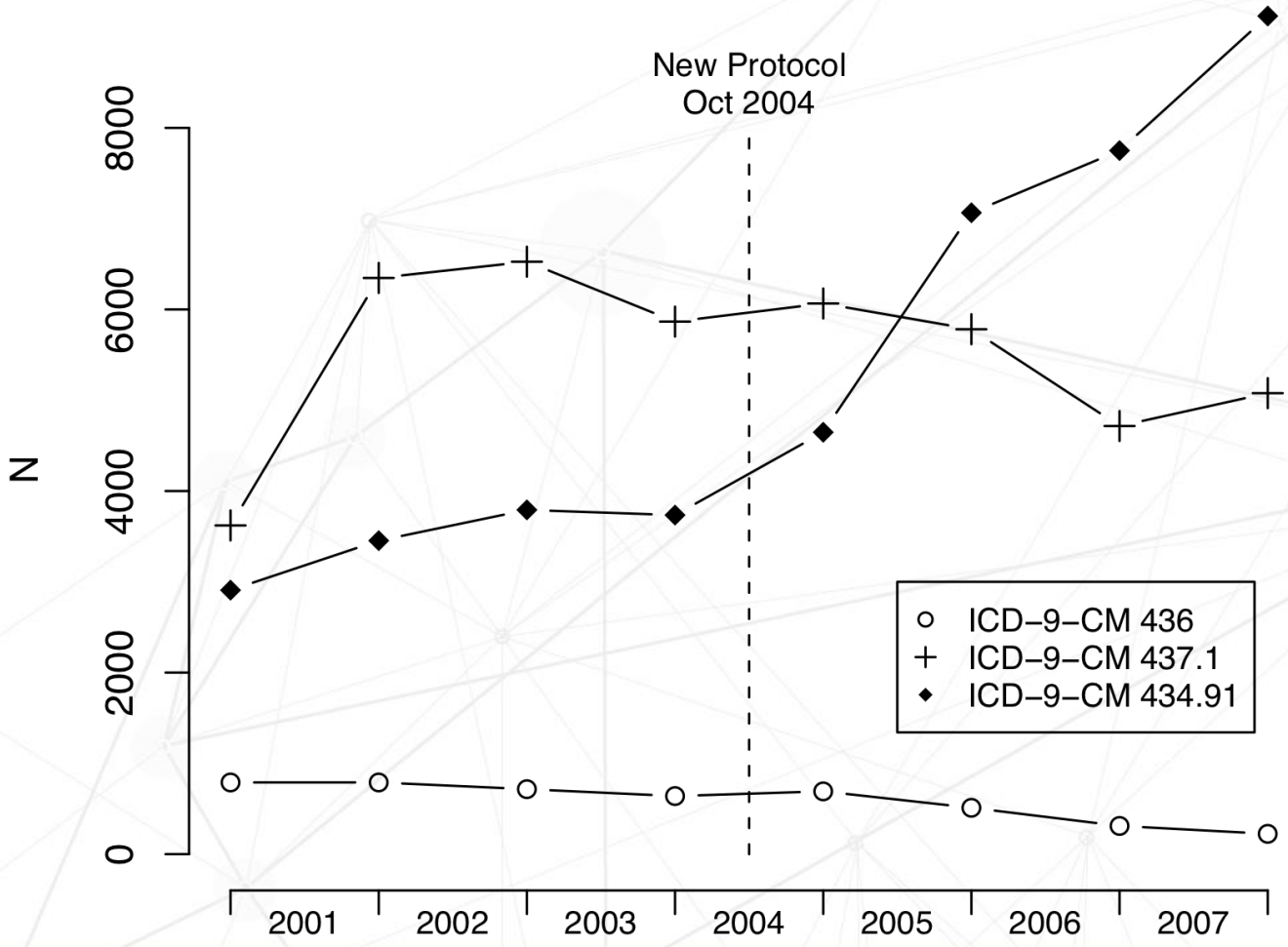


Data analysis



Health data comprehension

Evolution of ischemic cerebral-vascular disease coding



Background

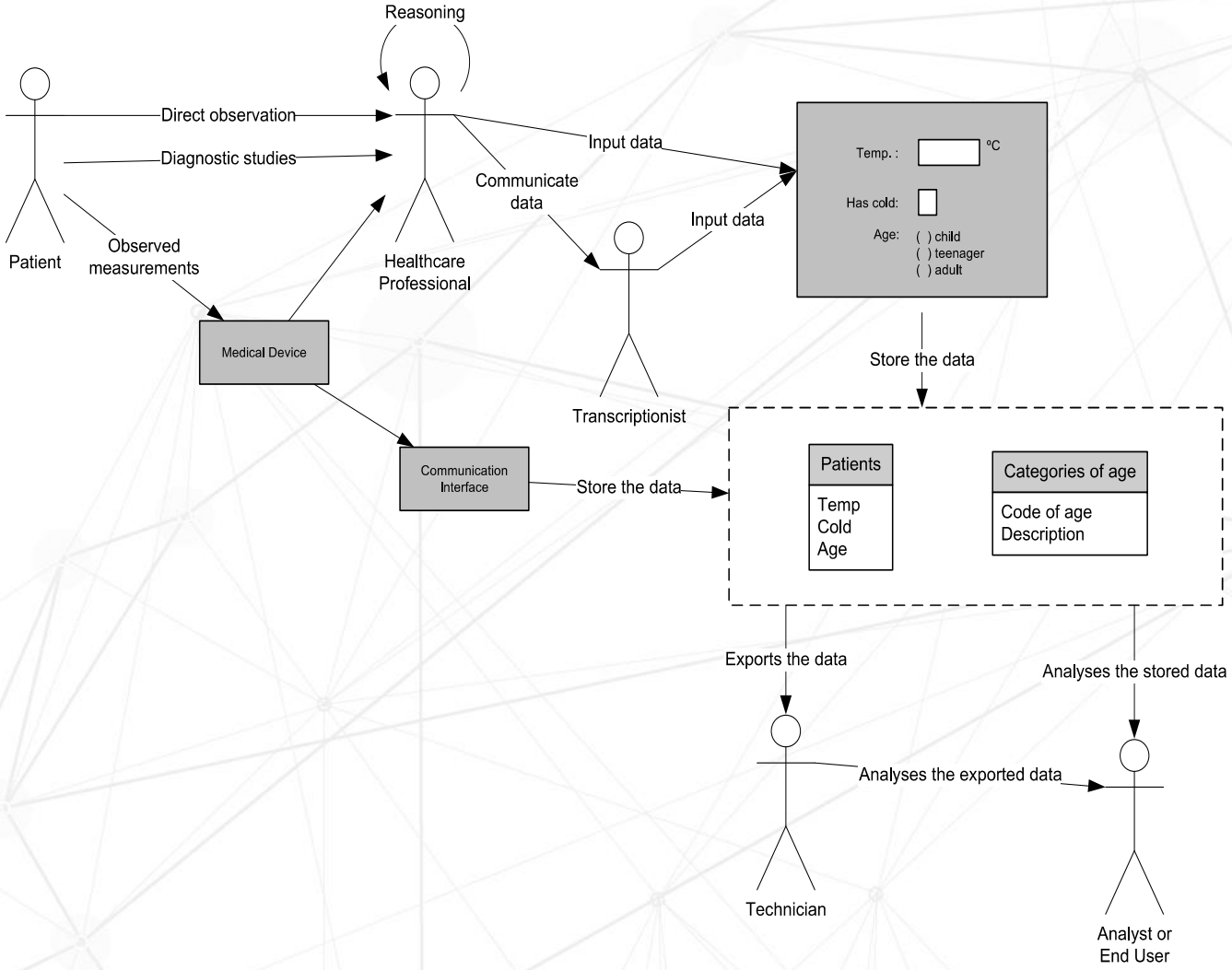
- The complexity of clinical data is driven by the highly detailed and different data needs of diverse care environments: inpatient, outpatient, specialist, intensive care, surgery, etc.
- With all the different activities in different areas, the modern hospital is in some ways more like a **city** than a **corporation**

Background

- Health data and healthcare business model is very complex

- The heart of a modern information environment is the set of **databases** where data are stored and where **data relationships** are established

Information flow



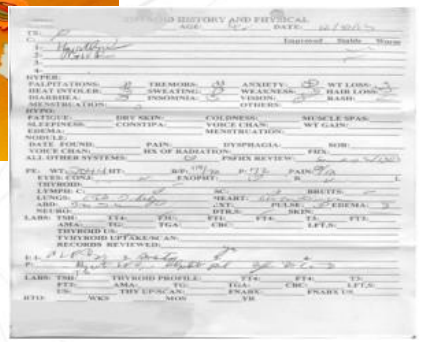
Tension btw Consolidation and Independence of Databases - Silos

- Classically, heathcare data is in silos by function
  - E.g. Laboratory, pharmacy, radiology, billing, ADT
  - Each database need to handle complex data, but most of the complexity is only relevant to system operators, not their customers (e.g. Reagents of lab)
  - A small subset of data is sufficient to link the functional silo with the rest of the organization (e.g. Patient id)
- Data held within the databases of a healthcare setting is both **vast** and constantly **expanding**

Relational Databases – Limitations

- Increasing Complexity of Data Models
  - Data modeling in two dimensions (**tables and relationships**)
  - Real world domains require many tables and relationships, it becomes very difficult in domains with
    - Intrinsic hierarchy
    - Unlimited nesting
- Need to **manage complex objects** as Units
  - E.g Clinical Report => Many tables
  - RD have no notion of documents – collection of rows from many tables that form a complex object
    - These documents can be edited by various staff members, but signed by a clinician . They can be amended however with special permission including visual highlights to emphasize its changed state. They need versions.

Working with RD



Medical Data Typing

- Databases and programming languages strengths are often described with their data types
  - Strong data typing avoids many problems
  - Programs do not need to protect themselves against unexpected data types
- Unfortunately, **the real world is more complex**
- A lab. instrument may have a lower detection limit of 10
  - When a specimen is below 10, the value is neither 10 or any specific value under 10, but “below 10”
  - One possibility (with problems) is to store one integer value and one text value

Documents (XML) for storage

- XML has been given as the answer to most questions about the future of information processing, but it actually depends on the XML-based languages to solve the problems
  - MathML (Mathmatical Markup Language)
  - CDA (HL7 Clinical Document Architecture)
  - MAGE-ML (MicroArray and Gene Expression Markup Language)
- XML is a **tag-based**, **hierarchical** way of writing documents that are both machine and human readable
- XML's basic unit of organization is a document. XML solves 2 big problems of SQL:
  - Hierarchy
  - Complex collections

OPENEHR

Knowledge complexity

- The number of clinical concepts is large
  - SNOMED terms are more than 450.000 and more than 1 million relations
    - Ex: "Injury to the optic nerve” "is a" (kind of) "Injury to the visual pathway”

- These numbers are gowing
  - In “width”, as new information is being discovered
  - In “depth”, new detail are becoming relevant
  - In “complexity”, as new relations are discovered

Diversity in health data

- Large diversity in statements
  - Heart rate
  - Microbiology results
  - Psychiatric evaluation
- Diversity in structure
- Different contexts change meaning
- [Un]Certainty
- Text vs Structured data

Traditional development of SW

Clinical knowledge

Data model

What is OpenEHR

- A specification for lifelong records
  - Mainly clinical
  - International
    - Multi-language
  - Able to use different terminologies
  - Comunity based
- Technical: aims to create **specification** and open-source **software** that allows sharing complex concepts
- Clinical: aims to create reusable **content** and **process** models of high quality (**archetypes**) with formal interfaces to terminology

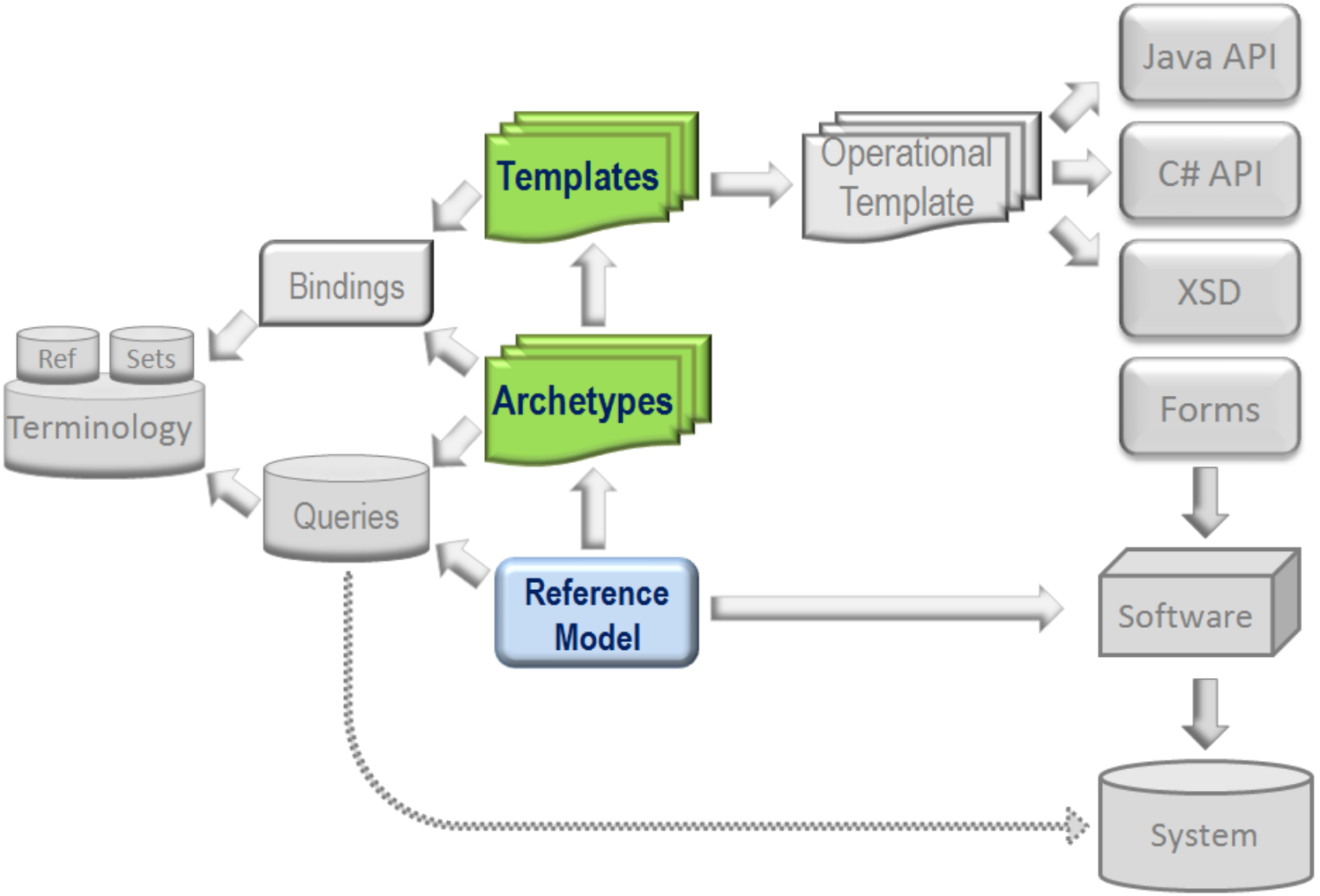
What OpenEHR is not

- It is not a database
- It is not a system to generate forms
- It is not a patient record

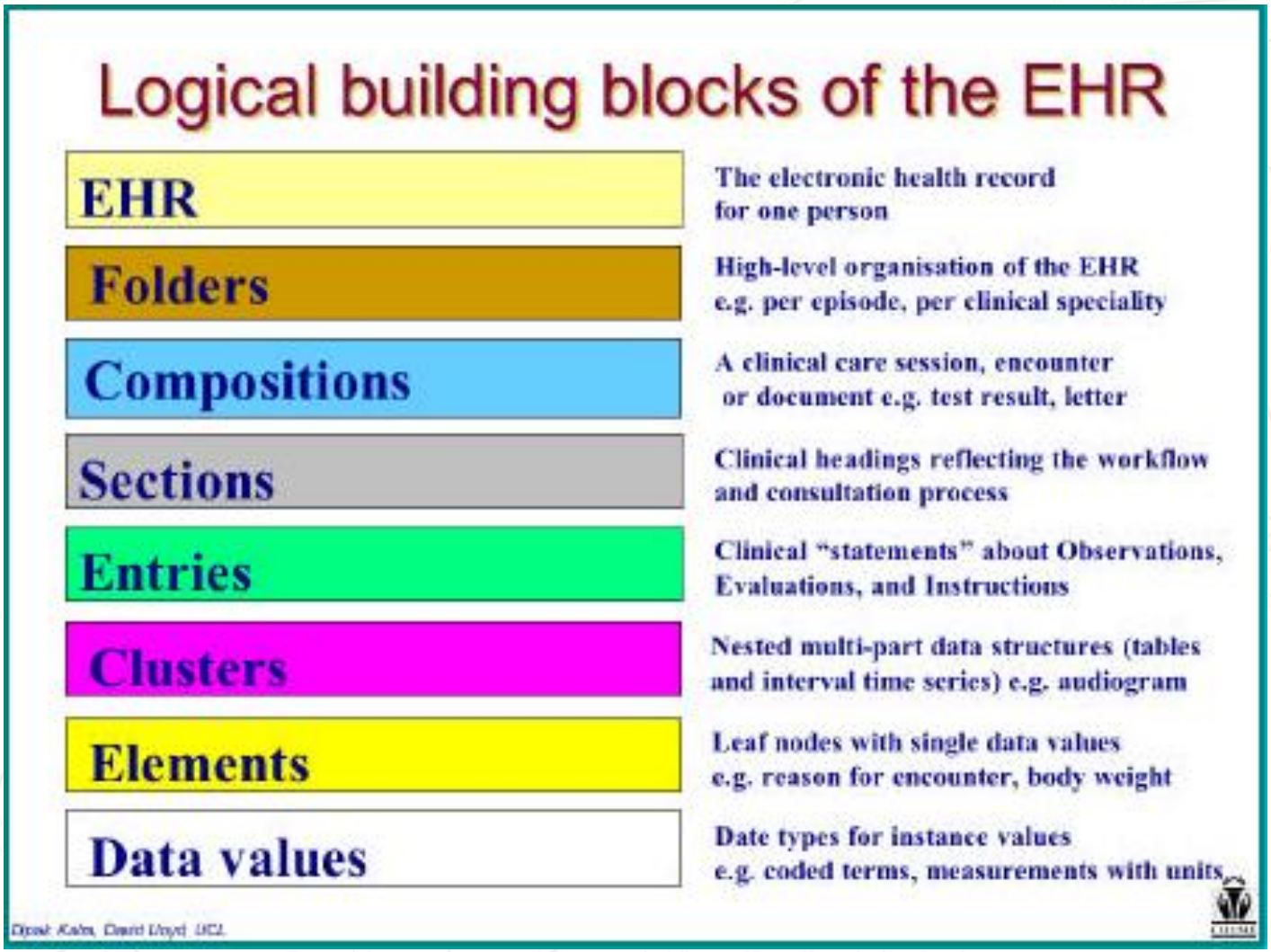
Main openEHR outcome

- The essential outcome is systems and tools for computing with health information at a **semantic level**, thus enabling true analytic functions like **decision support**, and **research querying**

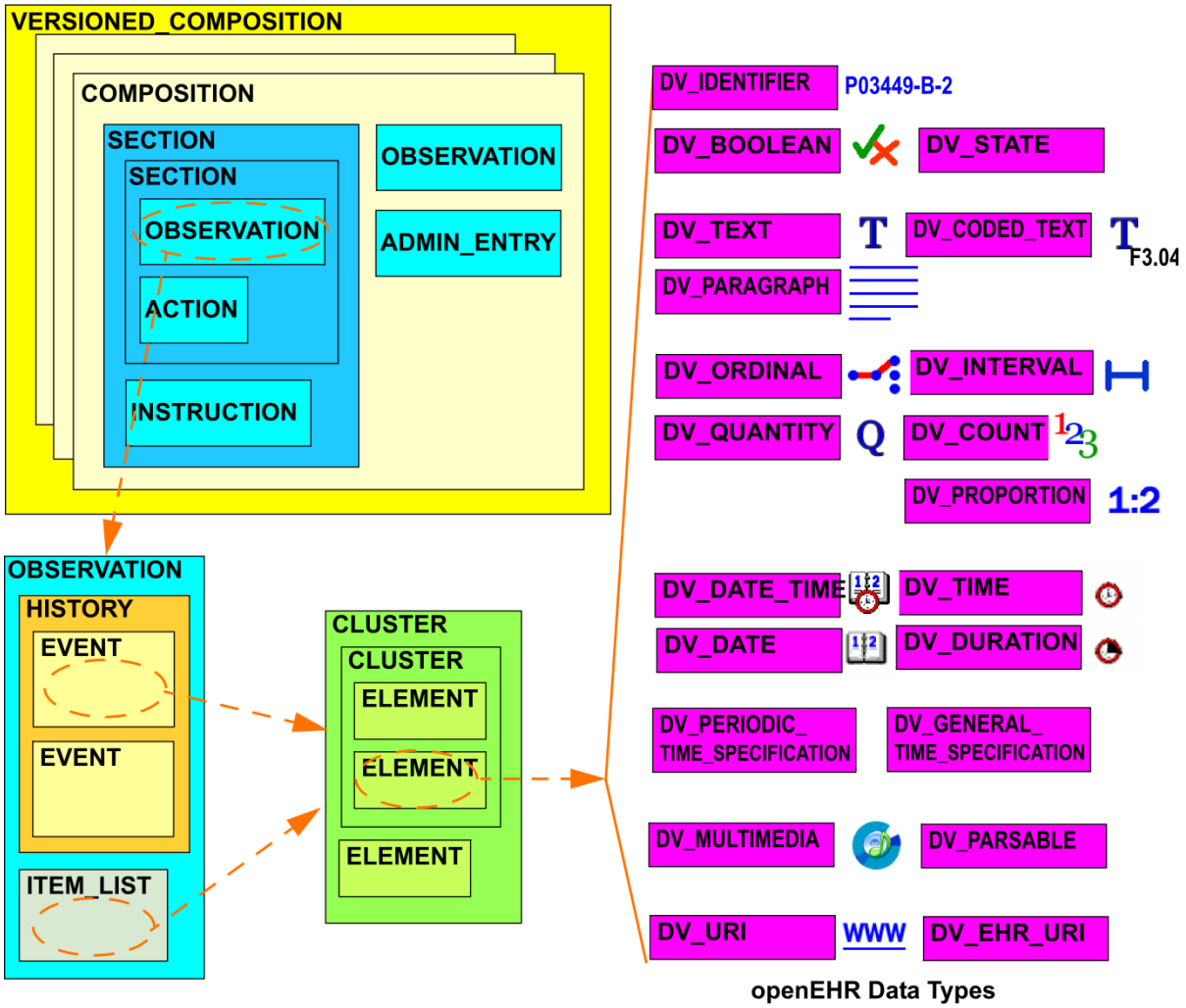
Multi-level Modelling



Types of archetypes



Relation between archetypes



openEHR Data Types

Entries

- In *open*EHR (as well as in models like CEN EN13606-1 and HL7 CDA)
  - 'Entry' type in the model corresponds to a 'clinical statement'.
  - Entries hold the 'hard data' of the EHR Composition or document.
  - Entries may contain only a single (often coded) datum, such as a diagnosis, or more usually, they contain a number of data points in a defined structure, e.g. Apgar result, Barthel index, ante-natal visit.
- In *open*EHR the Entry has been specialised into 5 types in the EHR

Types of entries

- **OBSERVATION** - for recording information from the patient's world - anything measured by a clinician, a laboratory or by them, or reported by the patient as a symptom, event or concern

- **EVALUATION** - for recording opinions and summary statements (usually clinical), such as problems, diagnoses, risk assessments, goals etc that are generally based on Observation evidence

- **INSTRUCTION** - for recording orders, prescriptions, directives and any other requested interventions

- **ACTION** - for recording actions, which may be due to Instructions, e.g. drug administrations, procedures etc.

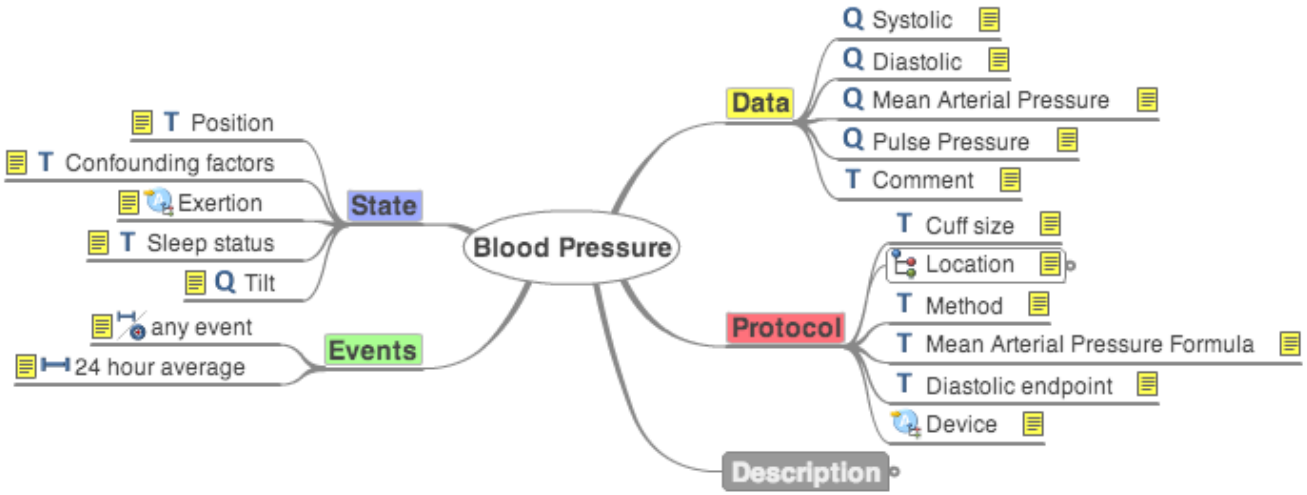
- **ADMIN_ENTRY** - for recording administrative events, e.g. admission, discharge, consent etc

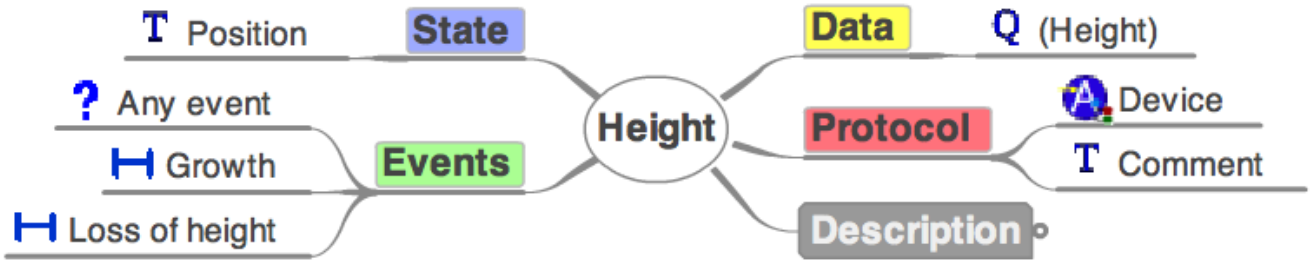
IS architecture using openEHR

- Information tools
  - Forms
- **Information models**
  - **Templates**
- **Domain models**
  - **Archetypes**
- Domain terminologies
  - SNOMED
  - ICD

OpenEHR

Archetype samples



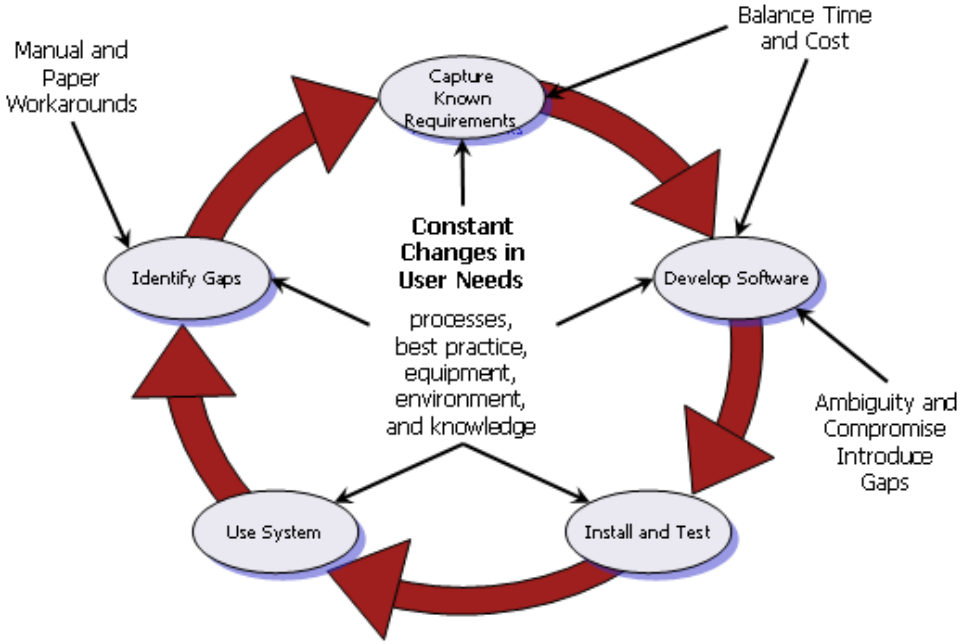


http://www.openehr.org/knowledge/

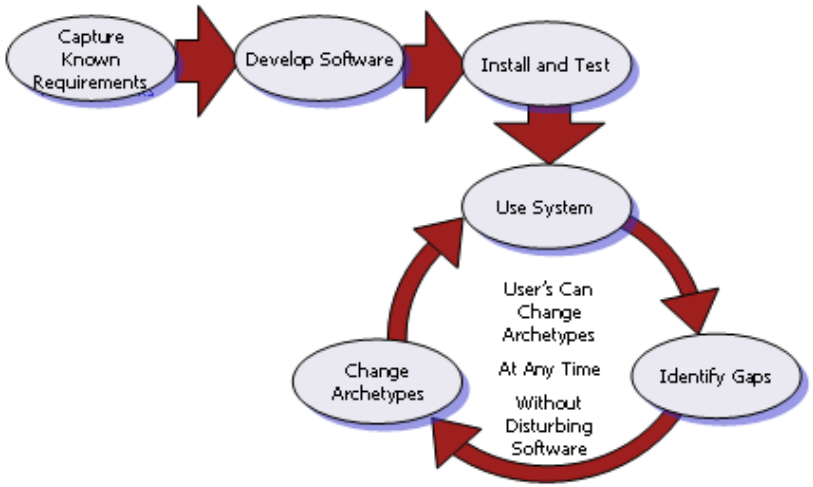
Archetype modelling

- Each archetype should include **all attributes** that health professionals may want to campture about a clinical concept

Tradicional



With OpenEHR



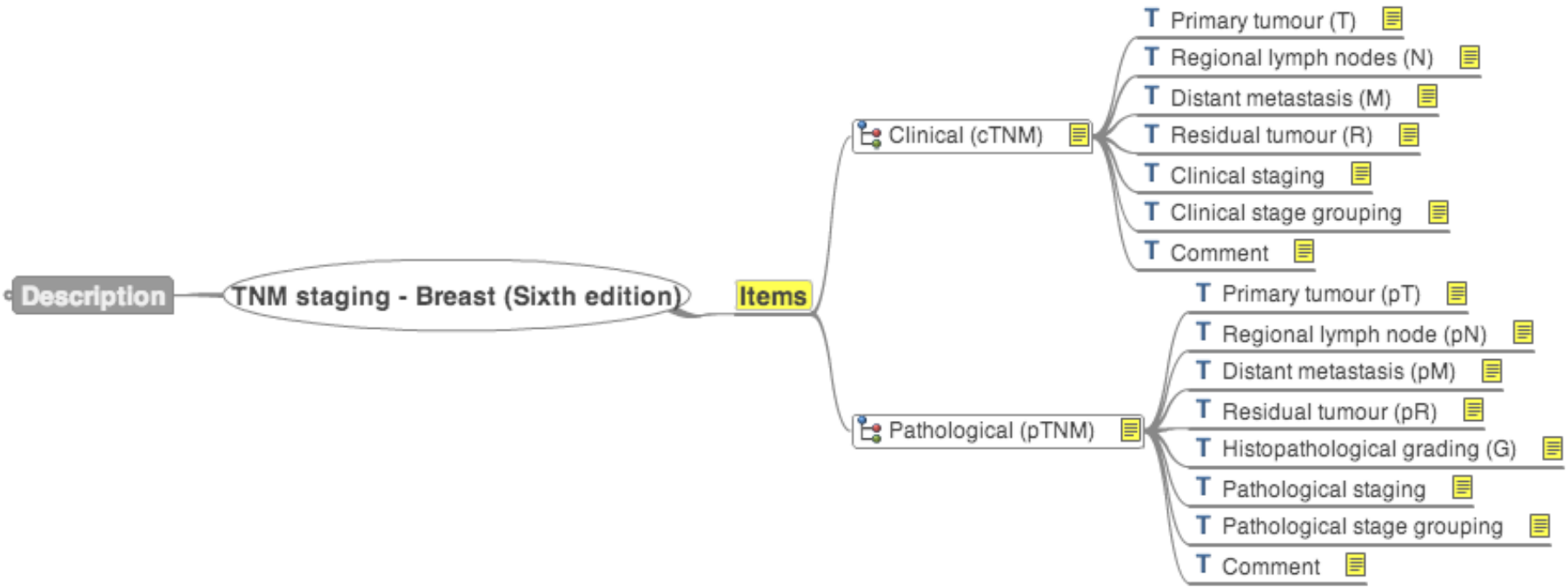
OPENEHR IN BREAST CANCER

Existing useful archetypes

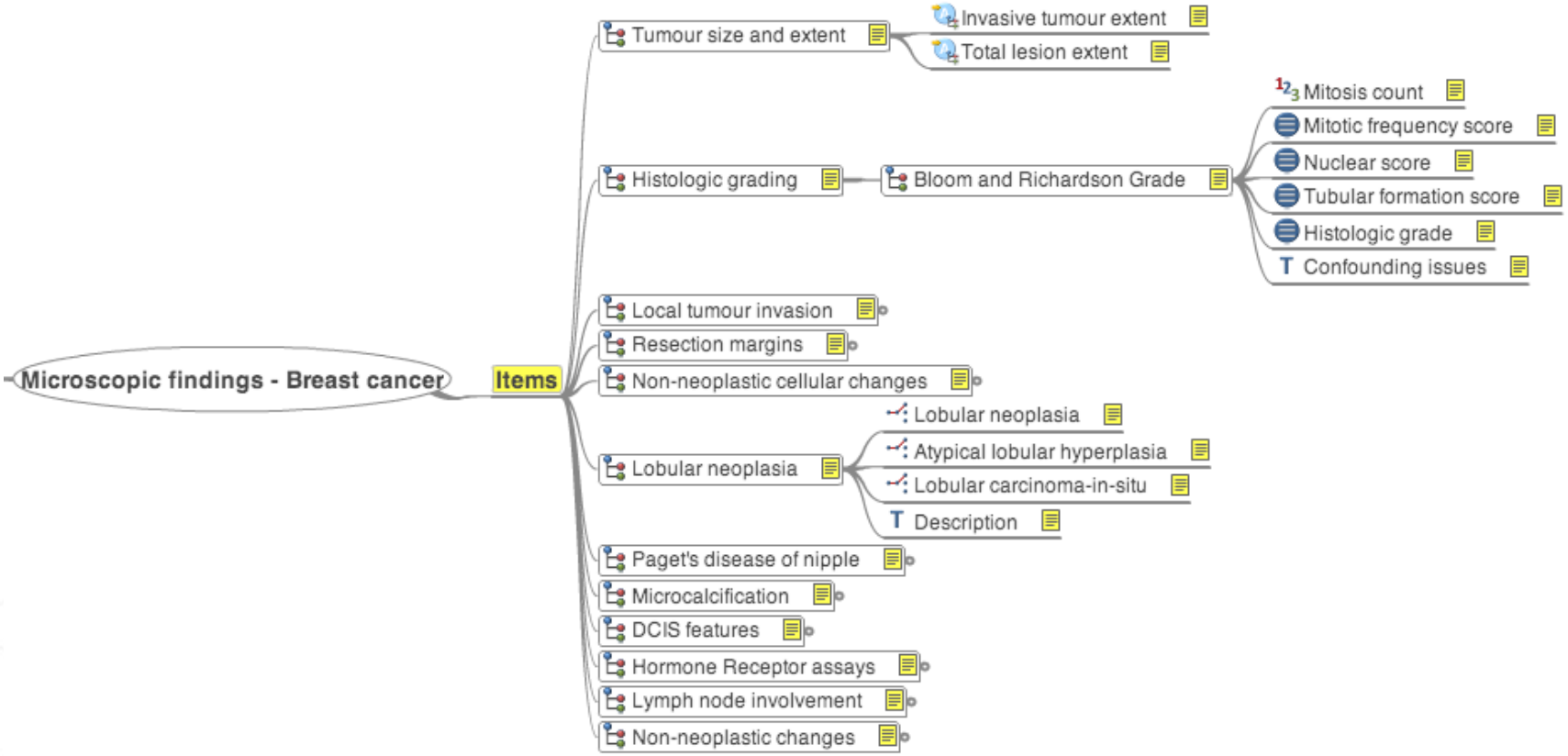
- Generic
  - http://openehr.org/ckm/
  - http://dcm.nehta.org.au/ckm/

- Microscopic findings – Breast cancer
- Microscopy breast carcinoma,

TNM staging


Description
TNM staging - Breast (Sixth edition)
Items
Clinical (cTNM)
Primary tumour (T)
Regional lymph nodes (N)
Distant metastasis (M)
Residual tumour (R)
Clinical staging
Clinical stage grouping
Comment
Pathological (pTNM)
Primary tumour (pT)
Regional lymph node (pN)
Distant metastasis (pM)
Residual tumour (pR)
Histopathological grading (G)
Pathological staging
Pathological stage grouping
Comment

Microscopic findings



Cookbook to create templates

- Find appropriate existing archetypes
- Create your own, when they do not exist
- Create a template using the archetypes
- Implement a form/web-service based on the templates

FIM