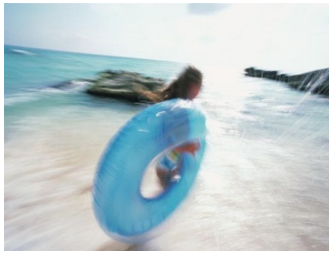
The Electronic Health Record
Why is it still so hard?



Dr Ian McNicoll
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Ocean Informatics
Editor openEHR Clinical Knowledge Manager

Cape Town MEDINFO Sept 2010

openEHR

Agenda

0900- 0945	Why is the EHR still so hard?
0945-1030	Intro to archetypes and templates
1030-1100	Coffee
1100-1230	Demo of openEHR tools
1230- 1330	Lunch
1330-1500	Practical openEHR projects
1500-1530	Afternoon break
1530-1630	Practical openEHR projects II
1630-1700	Discussion

Dr Ian McNicoll

- Scottish General Practitioner for 15 years
- Interest in health computing for 20+ years
  - Full-time health informatics consultant
  - Clinical analyst with Ocean Informatics for 4 years
  - Editor openEHR Clinical Knowledge Manager

The electronic health record

Communication

- Conversation
  - Clinician - self
  - Clinician – clinician
  - Clinician – patient
- Computation
  - Decision support
  - Process support
  - Research, audit and analysis

Searching and sharing

Searching for matching text - “Googling” - is not accurate enough

- Synonyms, mis-spelling
  - MI, heart attack, “hart attack”
- Dates, quantities, negatives
  - “I have excluded asthma in this child”
- To allow accurate searching for and sharing of clinical information we need a **common model of the structure and terms** used in clinical practice.

Clinical Information models

Computers have no innate ‘understanding’ of human language

- Clinical concepts must ultimately be described as ‘computer models’ to allow searching and computation

  - “Send a reminder to all patients with a blood pressure > 120/80 who have not been seen for 3/12
  - “Show me Mr Ian Smith’s last Cardiology clinic record”
  - “Show me an alert if I try to prescribe a drug to which the patient has an allergy”

Clinical Information models – Who needs them?

System developers

- Define local application content
- Define shared content for decision support

Standards bodies

- National, International, Professional
  - Define shared application content
  - Define clinical message content
  - Define content for secondary analysis

Is health different?

The need for a shared information model is not unique to health

- We can share other information - why not health information?
- “If the banks can do it, why can’t health?”

Is the health world different?

- Mobile population
- More providers

- More complex treatments
- Lifelong records

- Preventable harm to patients
- Increasing knowledge
- Clinical diversity

Is health information different?

- Narrative data with critical content
- Complex statements
- Variable scope of data use
- Wide variety of technologies, data and data structures
- Functional assessments involving structured approaches
- Critical information sharing often requires precise use of a shared terminology
- Analogue, time series, negation…

Volume of health knowledge

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

- SNOMED medical termset codes some 450,000 atomic concepts and over 1 million relationships

Health care is big, and 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

Capturing clinical knowledge

Formally (computably) expressed in:

- Terminology - READ, SNOMED-CT
- Medication data bases - FDBE Multilex
- Decision support – guidelines, rules
- Software "Information model" – Cerner, Lorenzo, MS HealthVault
- Messaging models – HL7 v2, HL7v3

Informally expressed in:

- Documents – professional protocols – NICE
- Data dictionaries – secondary uses

Continually evolving:

- restructured, new, deprecated

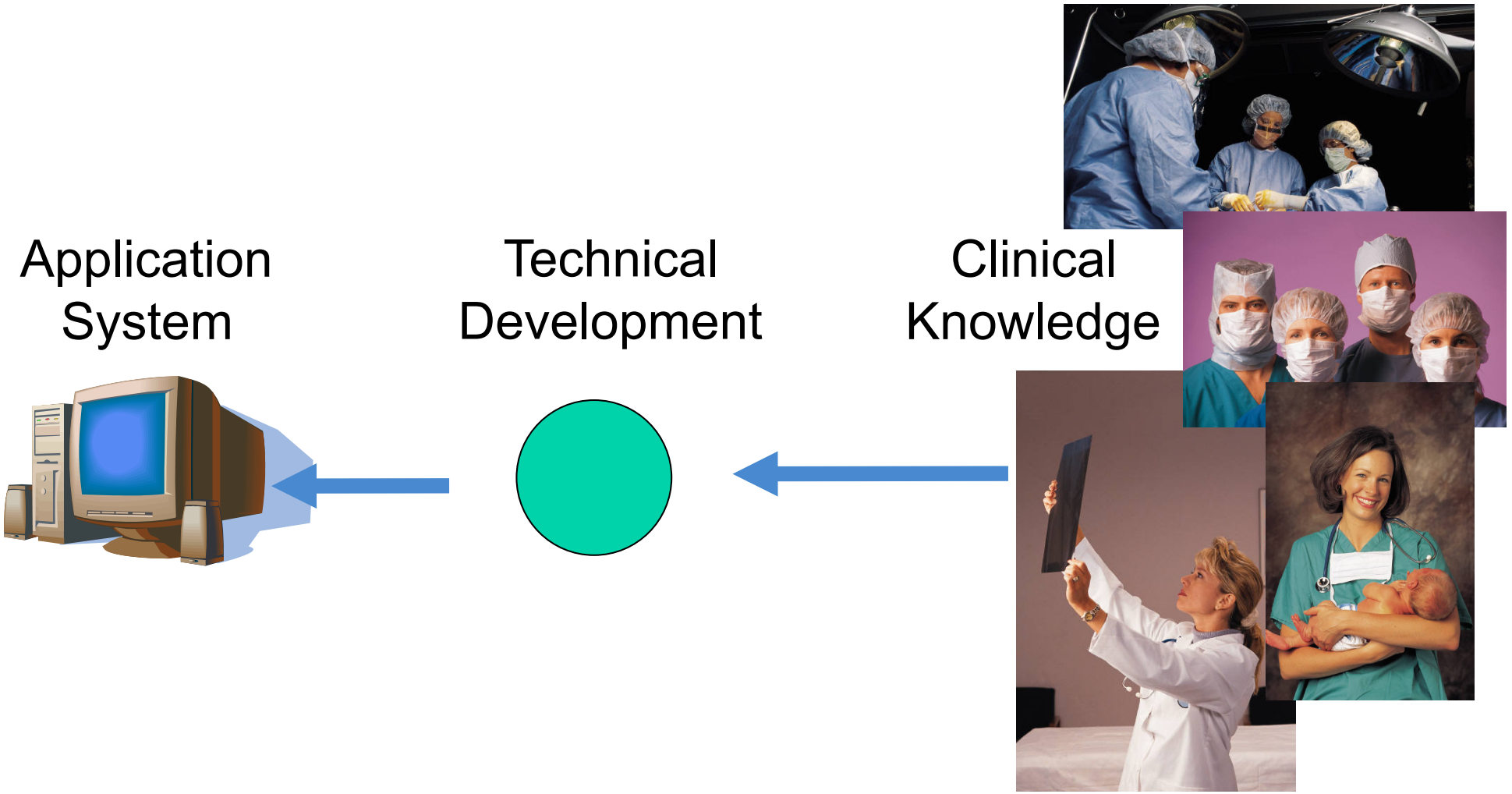
The Clinical modelling challenge

To gather and formalise clinical knowledge in a computable fashion

- to inform application design / message content
- to enable research and public health reporting
- to drive decision support and workflow

in a way that is understandable to most clinicians

Traditional approach to clinical modelling



Traditional Information model

Fields

	Name	Description
S	TypeId	Retrieves the unique identifier for the item type.

Properties

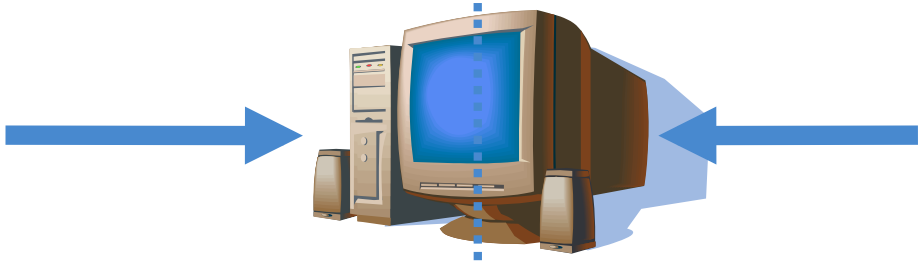
Name	Description
AllergenCode	Gets or sets the code for the allergen that causes an allergic reaction.
AllergenType	Gets or sets the type of allergen that causes an allergic reaction.
CommonData	Gets the common data for the HealthRecordItem. (Inherited from HealthRecordItem.)
Created	Gets the audit information associated with the creation of this health record item. (Inherited from HealthRecordItem.)
EffectiveDate	Gets the date and time that the health record item data was taken. (Inherited from HealthRecordItem.)
EffectivePermissions	Gets the effective permissions on the item granted to the person retrieving the HealthRecordItem. (Inherited from HealthRecordItem.)
FirstObserved	Gets or sets the approximate date of the first occurrence of the allergy.
Flags	Gets the HealthRecordItem flags. (Inherited from HealthRecordItem.)
HealthRecordItemSignatures	Gets the signatures for the HealthRecordItem. (Inherited from HealthRecordItem.)
IsDownVersioned	Gets the value indicating if the HealthRecordItem is down-versioned. (Inherited from HealthRecordItem.)
IsImmutable	Gets a value indicating whether the HealthRecordItem is immutable. (Inherited from HealthRecordItem.)
IsNegated	Gets or sets a value indicating whether the allergic reaction is negated with treatment.
IsPersonal	Gets or sets the value indicating if the HealthRecordItem is private. (Inherited from HealthRecordItem.)

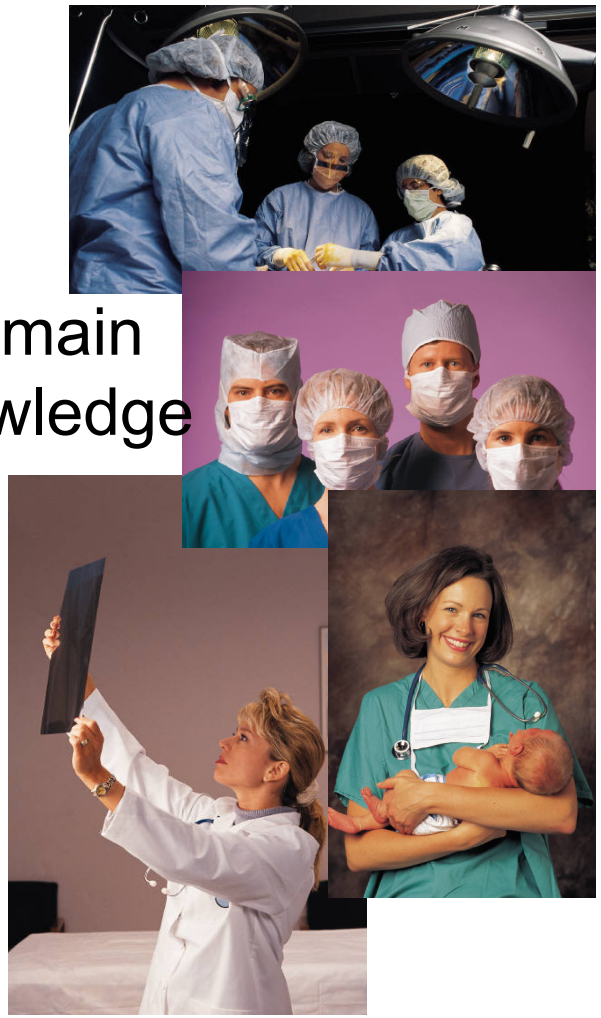
Two Level *open*EHR-Approach

Technical Development

Application System

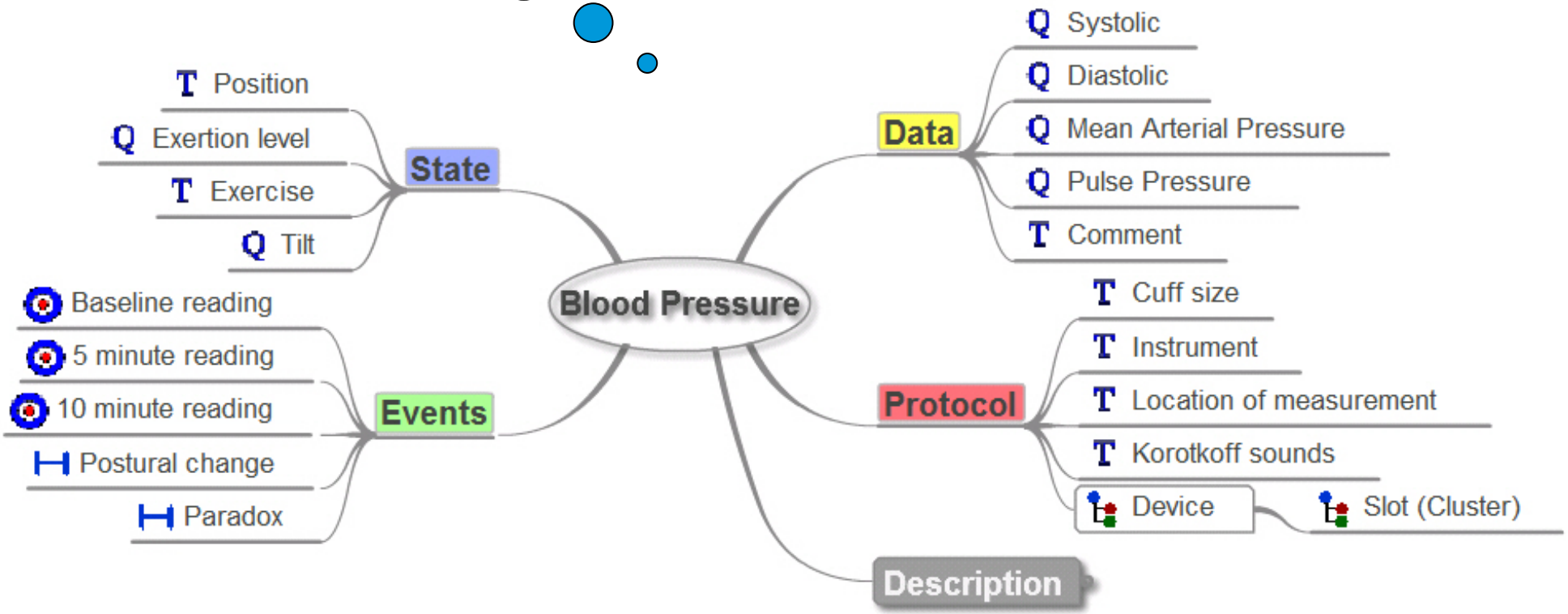
Domain Knowledge





*open*EHR Archetype

Intuitive **Model of a clinical concept**



What is *open*EHR?

Open, freely available specification of an information model for an EHR

- NOT an application
- Not primarily a software project
  - but open-source software is available
- Platform independent
  - Currently JAVA ,.NET and Ruby implementations
- License allows open or commercial use
- www.openehr.org

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The *open*EHR Foundation

- **Non-profit organisation** based at UCL
  - Established by UCL and Ocean Informatics in 2000 to own the intellectual property
  - 1000+ Members from 71 countries
  - All specifications & schemas publicly available
  - Software open source (GPL, LGPL, MPL)
  - Grew out of academic EHR projects e.g. GEHR
- Aim is to define an open specification for building an electronic health record.

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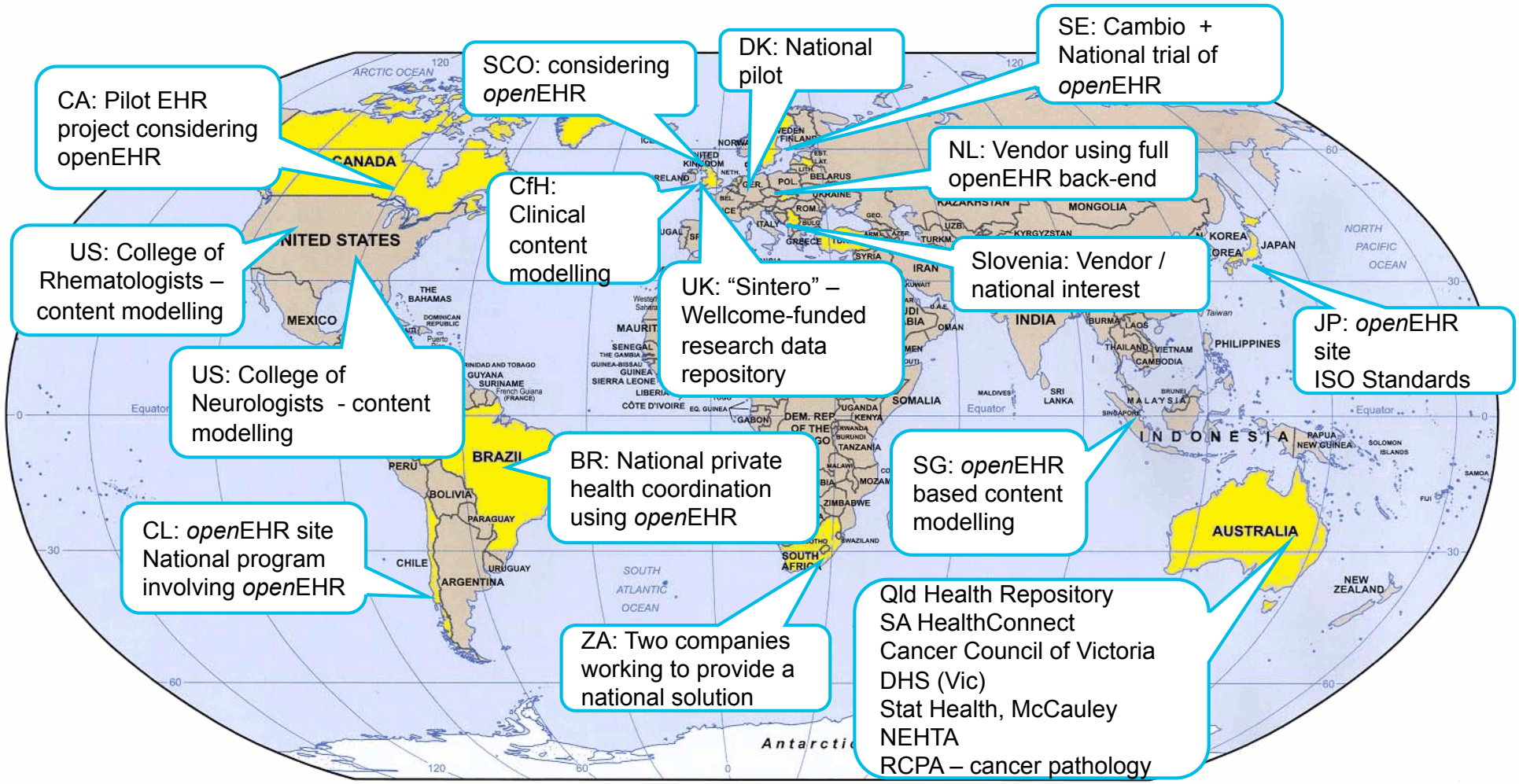
A growing clinical community of interest around the world



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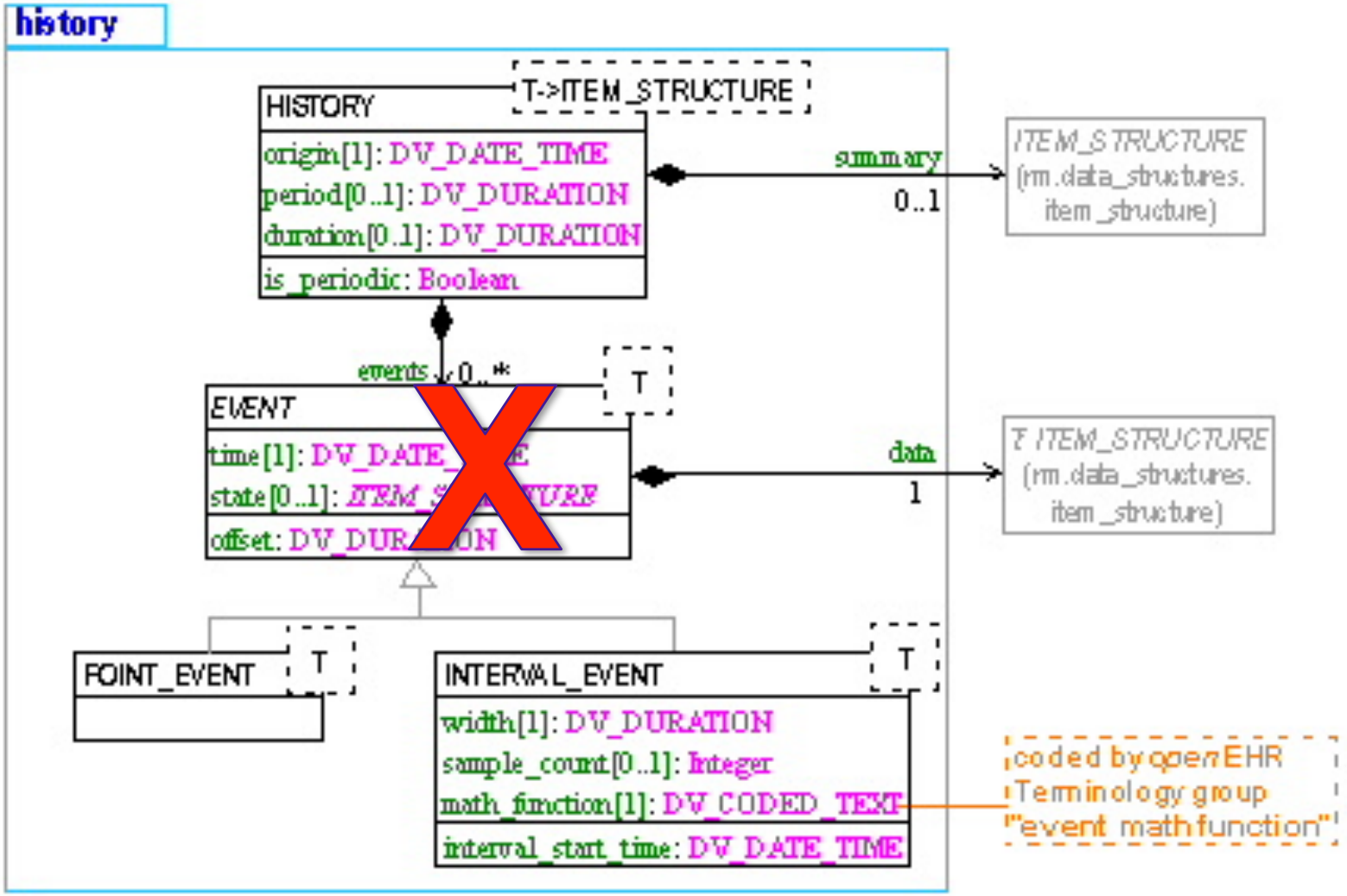
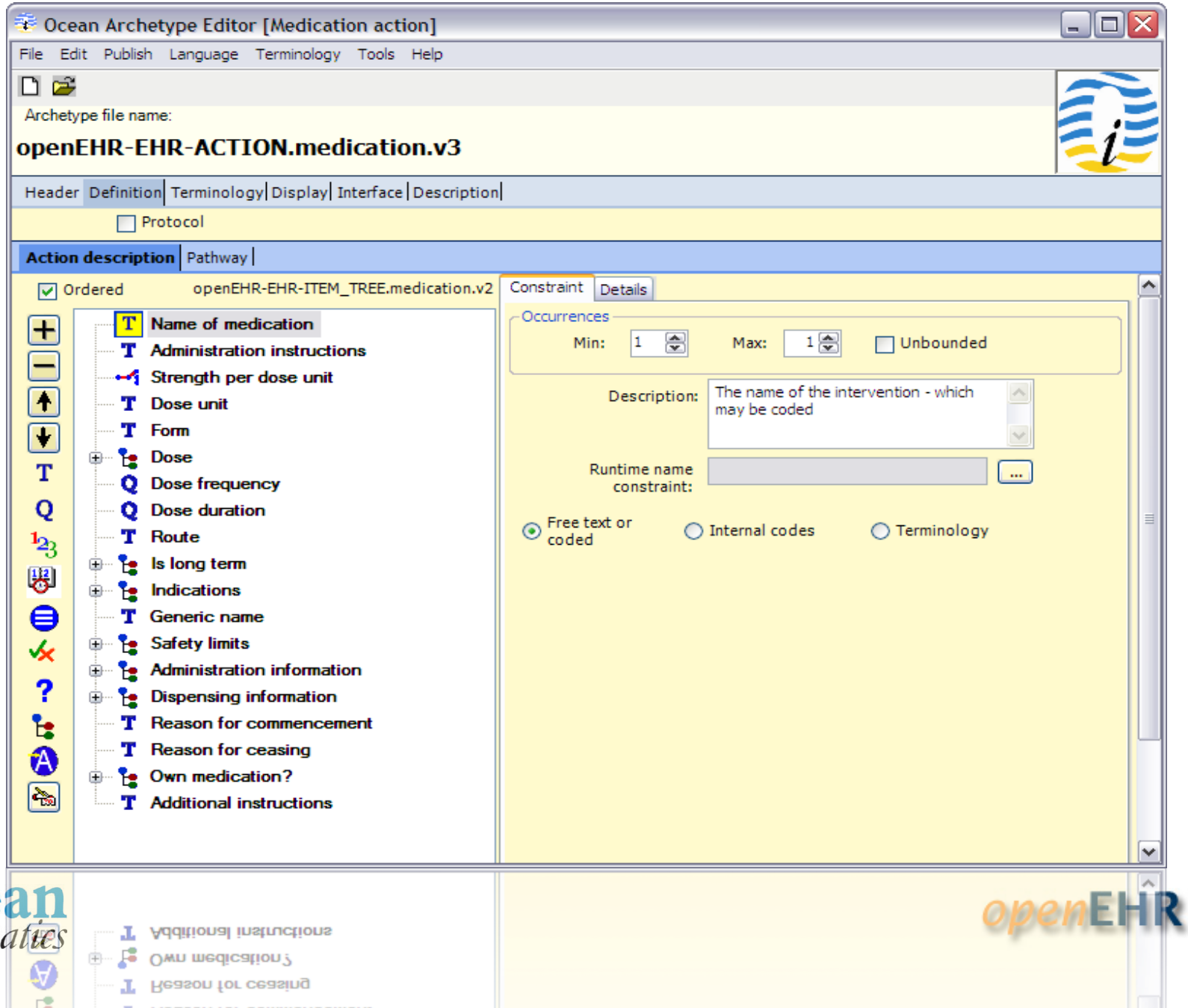
*open*EHR Reference Model



*open*EHR Archetype



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Archetype modelling paradigm

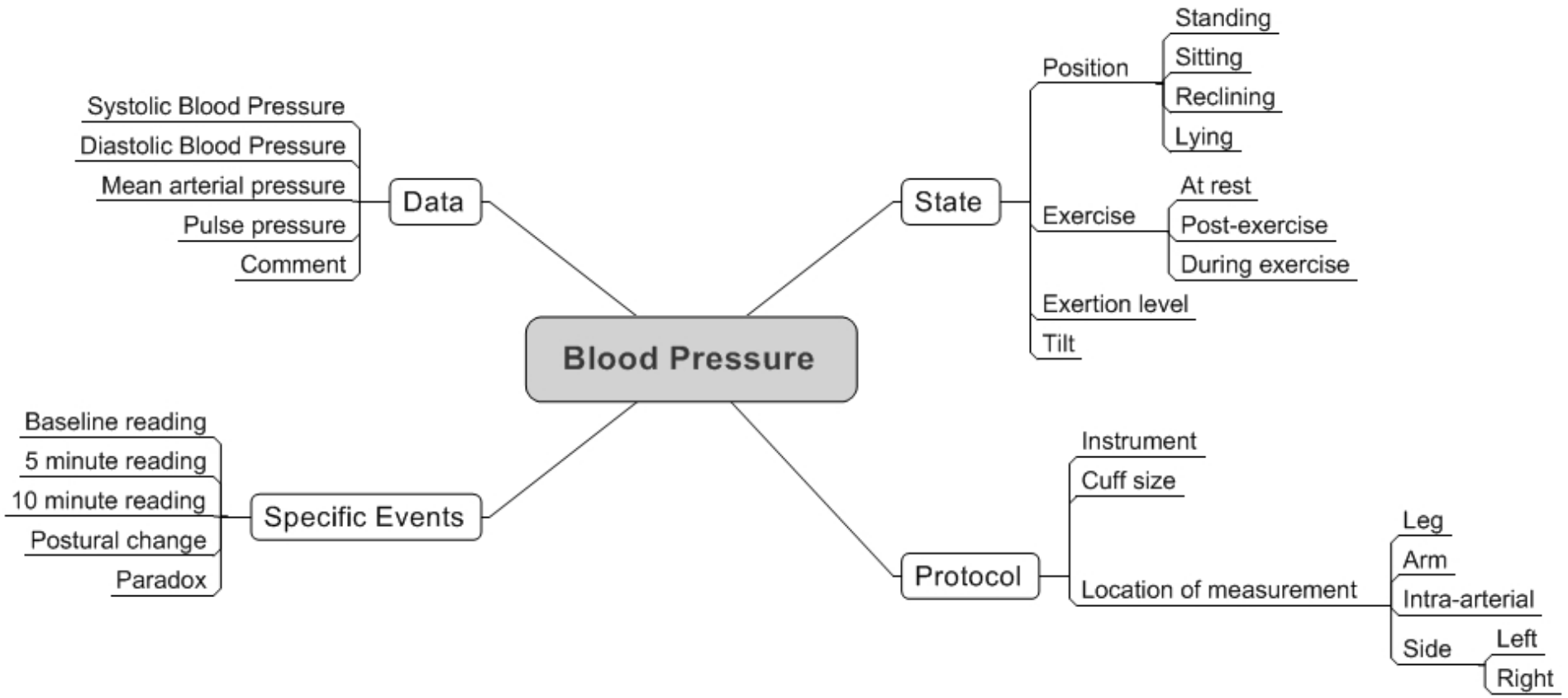
Requires:

- ~~Minimum Dataset?~~
- Maximum Dataset

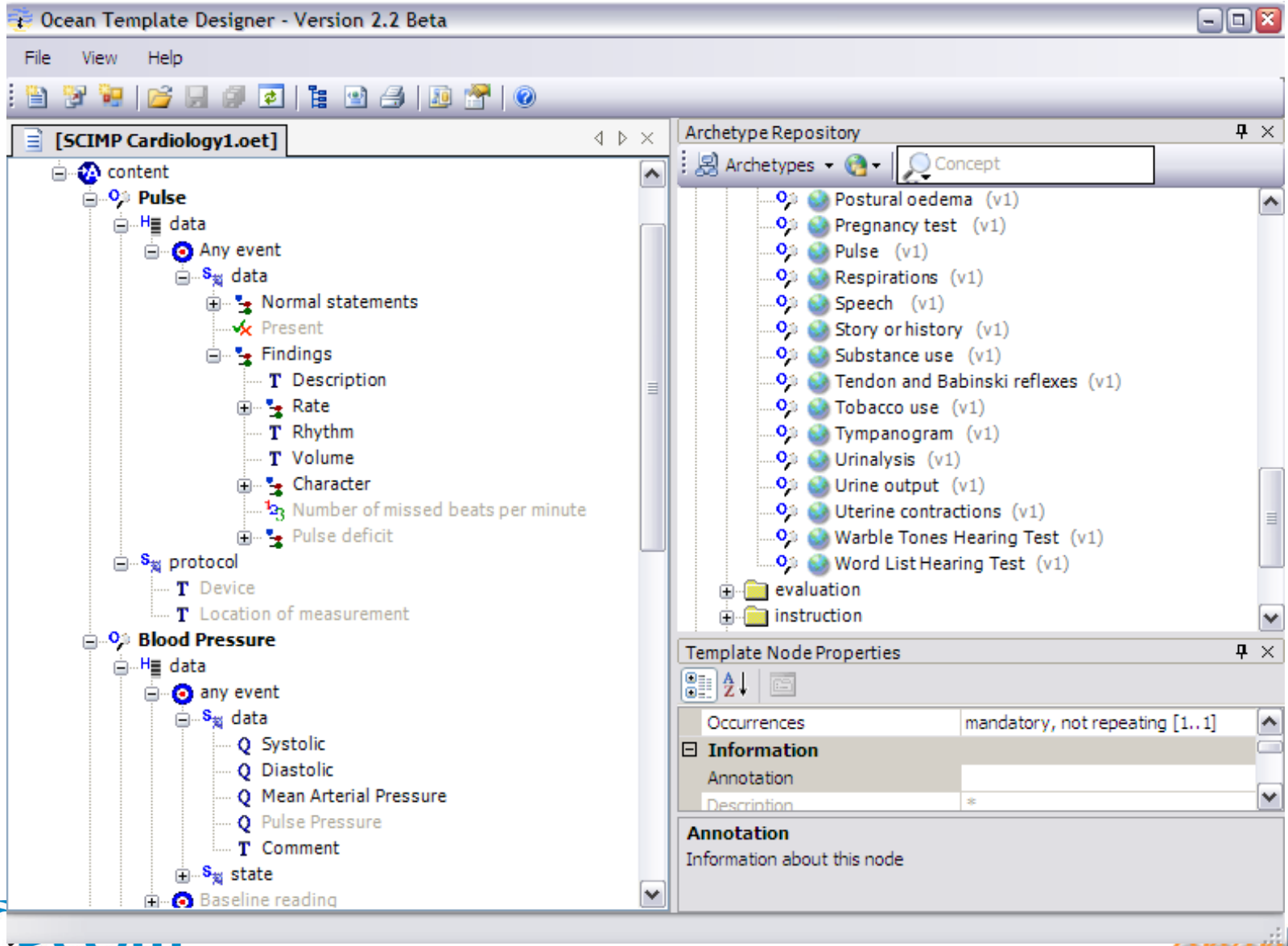
Each archetype is inclusive of

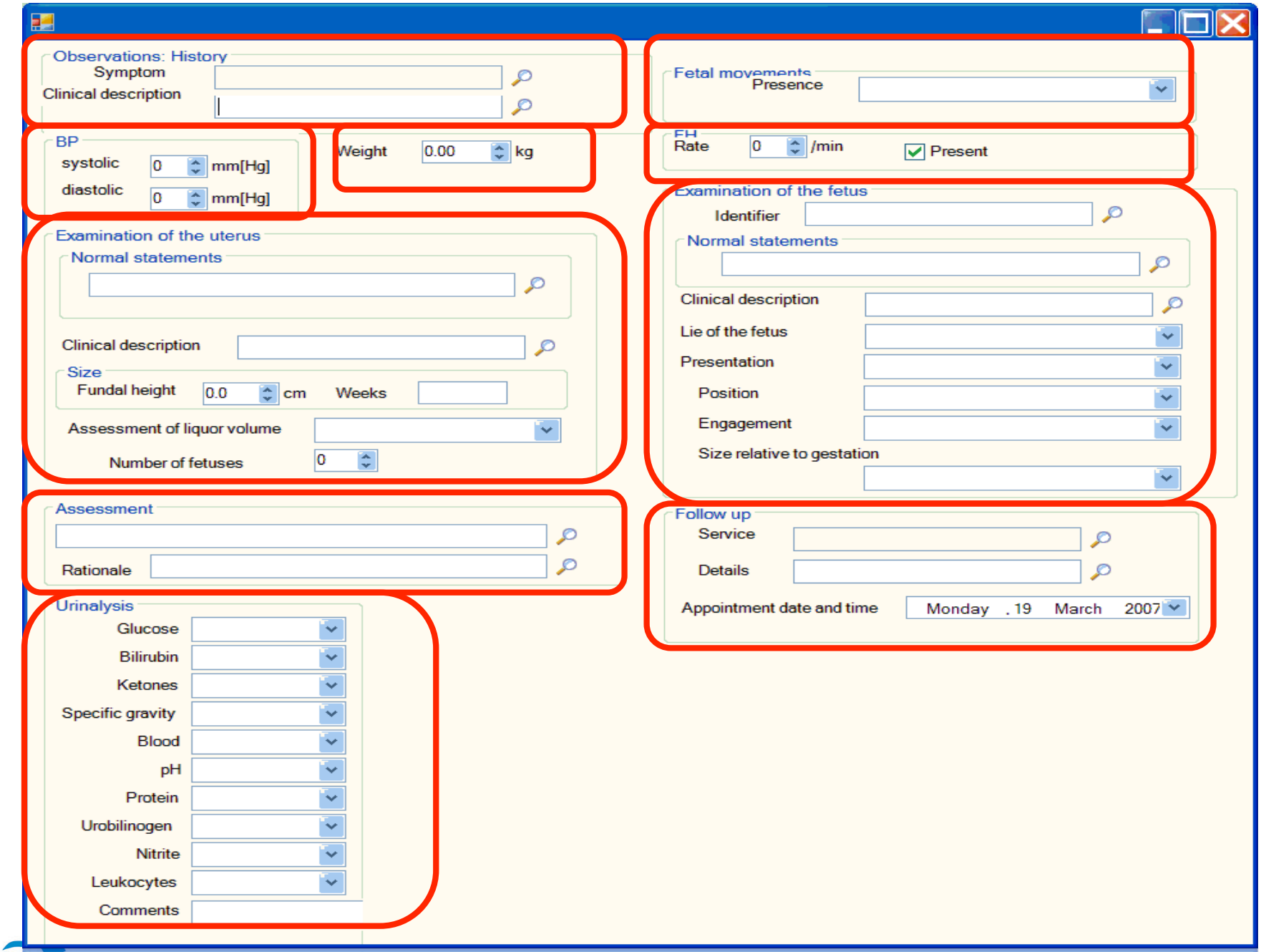
ALL attributes clinicians might want to capture about a discrete concept

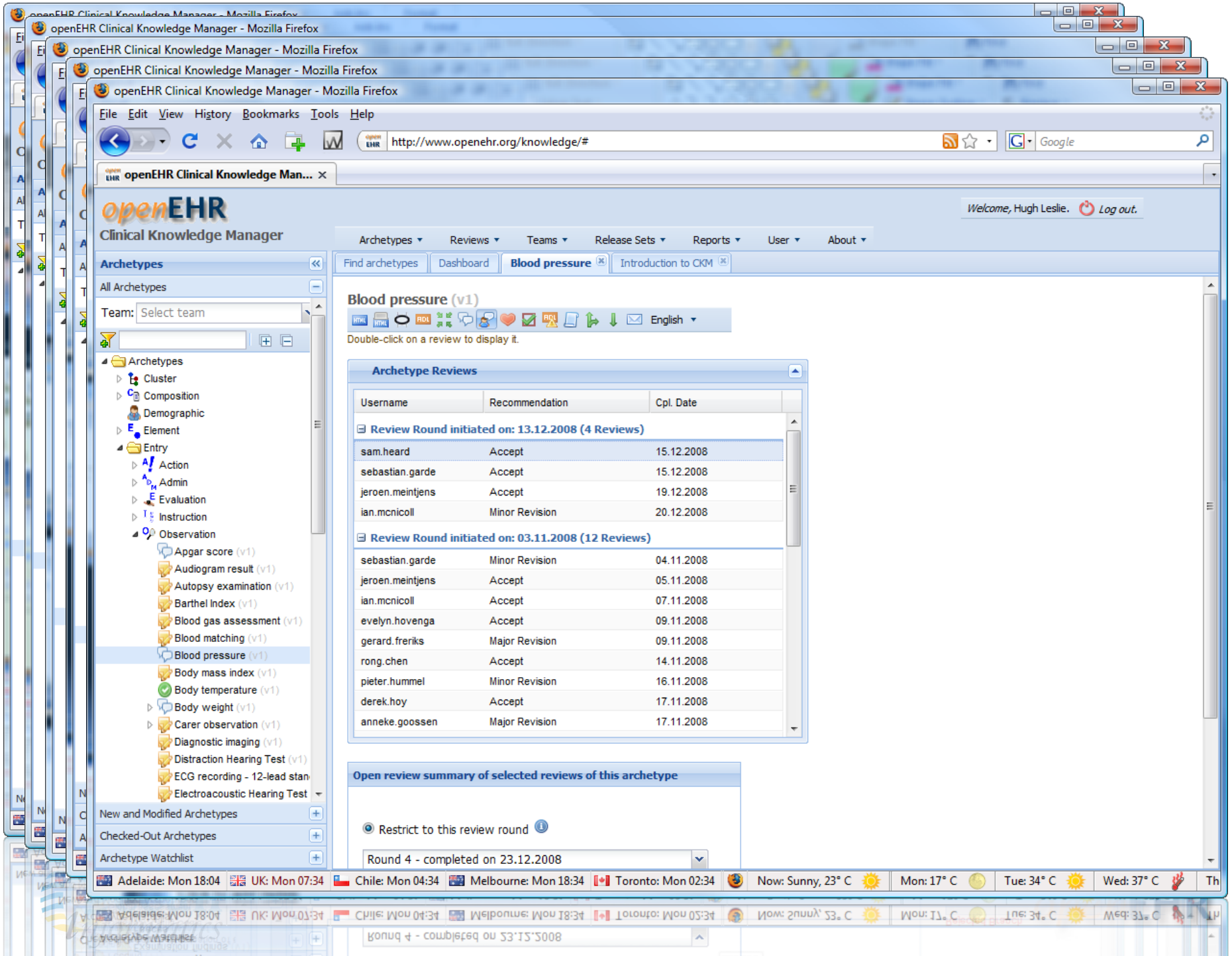
Blood Pressure archetype



*open*EHR Template



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File Edit View History Bookmarks Tools Help
http://www.openehr.org/knowledge/#
openEHR Clinical Knowledge Man...
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Clinical Knowledge Manager
Welcome, Hugh Leslie. Log out.
Archetypes Reviews Teams Release Sets Reports User About
Find archetypes Dashboard Blood pressure Introduction to CKM
Archetypes
All Archetypes
Team: Select team
Archetypes
Cluster
Composition
Demographic
Element
Entry
Action
Admin
Evaluation
Instruction
Observation
Apgar score (v1)
Audiogram result (v1)
Autopsy examination (v1)
Barthel Index (v1)
Blood gas assessment (v1)
Blood matching (v1)
Blood pressure (v1)
Body mass index (v1)
Body temperature (v1)
Body weight (v1)
Carer observation (v1)
Diagnostic imaging (v1)
Distraction Hearing Test (v1)
ECG recording - 12-lead stan
Electroacoustic Hearing Test
New and Modified Archetypes
Checked-Out Archetypes
Archetype Watchlist
Blood pressure (v1)
English
Double-click on a review to display it.
Archetype Reviews
Username Recommendation Cpl. Date
Review Round initiated on: 13.12.2008 (4 Reviews)
sam.heard Accept 15.12.2008
sebastian.garde Accept 15.12.2008
jeroen.meintjens Accept 19.12.2008
ian.mcnicoll Minor Revision 20.12.2008
Review Round initiated on: 03.11.2008 (12 Reviews)
sebastian.garde Minor Revision 04.11.2008
jeroen.meintjens Accept 05.11.2008
ian.mcnicoll Accept 07.11.2008
evelyn.hovenga Accept 09.11.2008
gerard.freriks Major Revision 09.11.2008
rong.chen Accept 14.11.2008
pieter.hummel Minor Revision 16.11.2008
derek.hoy Accept 17.11.2008
anneke.goossen Major Revision 17.11.2008
Open review summary of selected reviews of this archetype
Restrict to this review round
Round 4 - completed on 23.12.2008
Adelaide: Mon 18:04 UK: Mon 07:34 Chile: Mon 04:34 Melbourne: Mon 18:34 Toronto: Mon 02:34 Now: Sunny, 23° C Mon: 17° C Tue: 34° C Wed: 37° C

What problems does openEHR solve ?

- A full specification for an electronic health record
  - Rich robust and rigid technical specification
  - Clinical information content is defined and controlled independently by clinicians
    - A small number of ‘expert clinicians’ to design archetypes and to engage with the international work
    - A larger number of ‘interested clinicians’ to check that templates accurately reflect their local information requirements
  - Integration with external terminologies
    - SNOMED-CT, ICDx, LOINC
    - Drug references, Local terminologies

Why are standards still difficult?

Diversity of clinical practice and clinical recording standards cannot be resolved with a technical solution

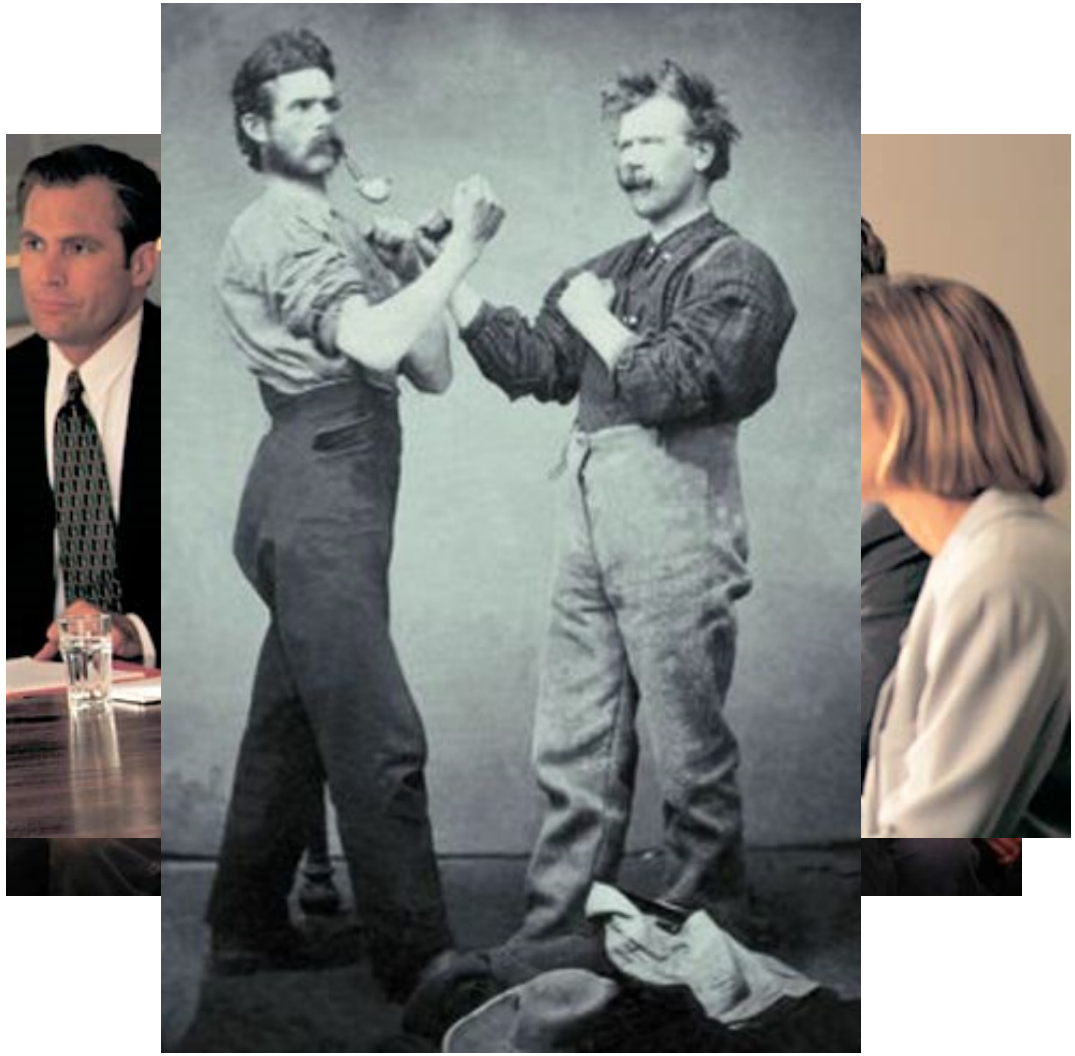
- But technology can help facilitate the conversations necessary to resolve these issues

We must put clinicians in the driving seat and equally make them responsible for clinical standards development

dys- **interoperability**

- The “usual suspects”
  - Clinical ego, technophobia, vendor lock-in
- Innovation, research
  - The little MS-Access database or Excel spreadsheet
- Information granularity
  - “Family History of breast cancer”
    - Specialist Breast Cancer unit
    - Research Breast Cancer Genetics Unit
- Organisational, operational constraints
  - Legacy systems
    - The better the system, the bigger the problem
  - National / regional / local policies and guidelines

Developing clinical standards



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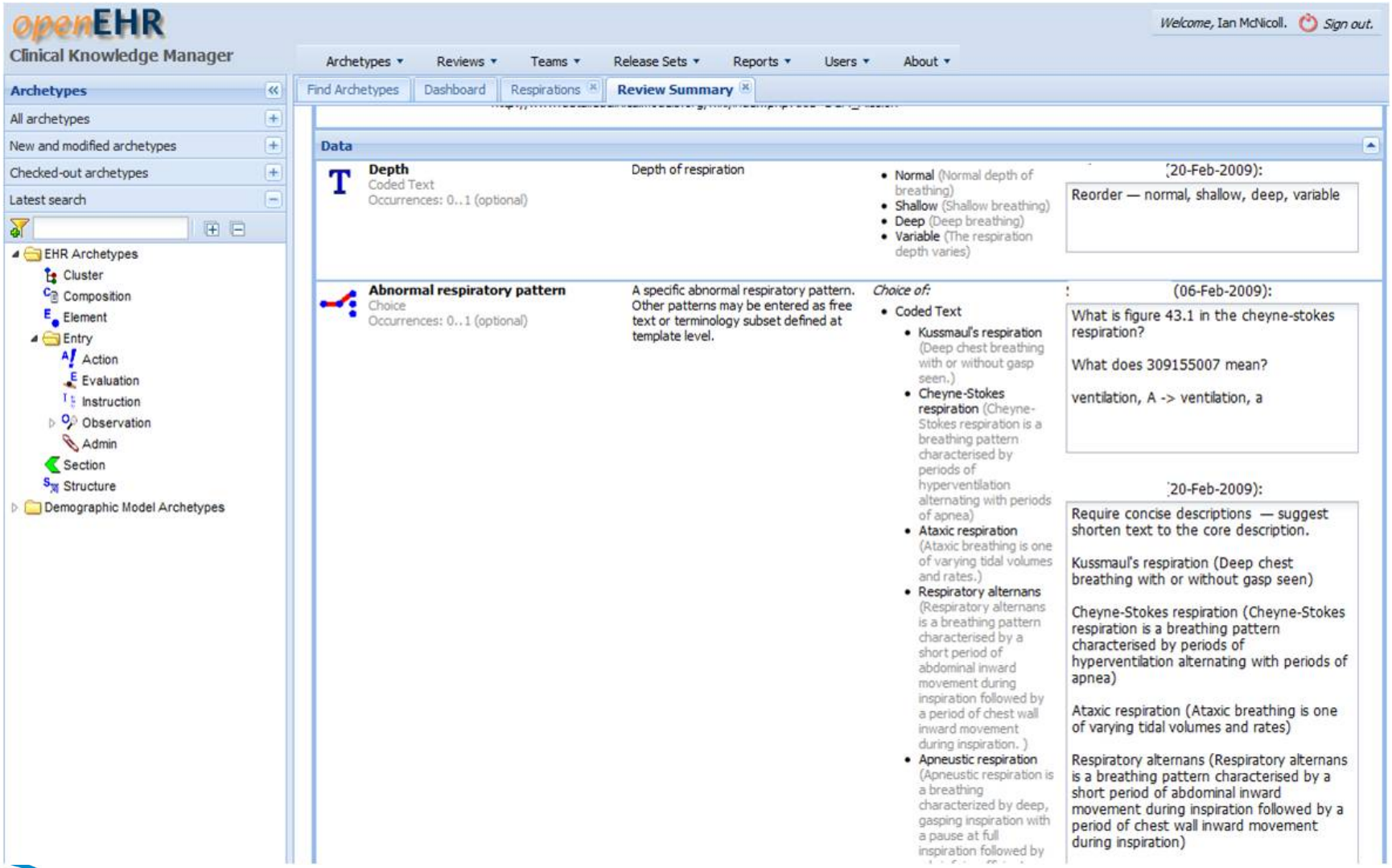


Embrace diversity

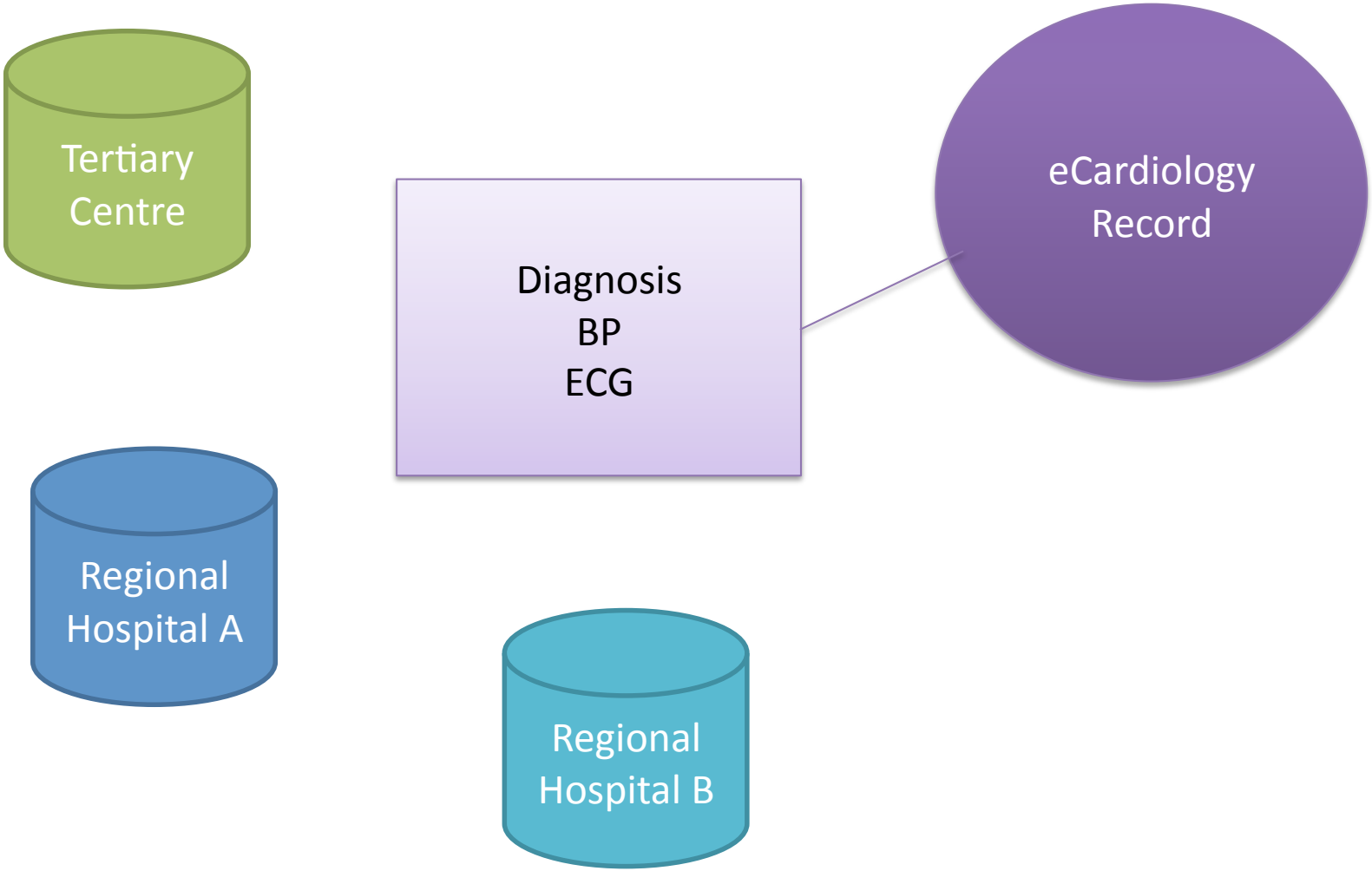
- Break the endless cycling between
  - Central ‘ruthless standardisation’

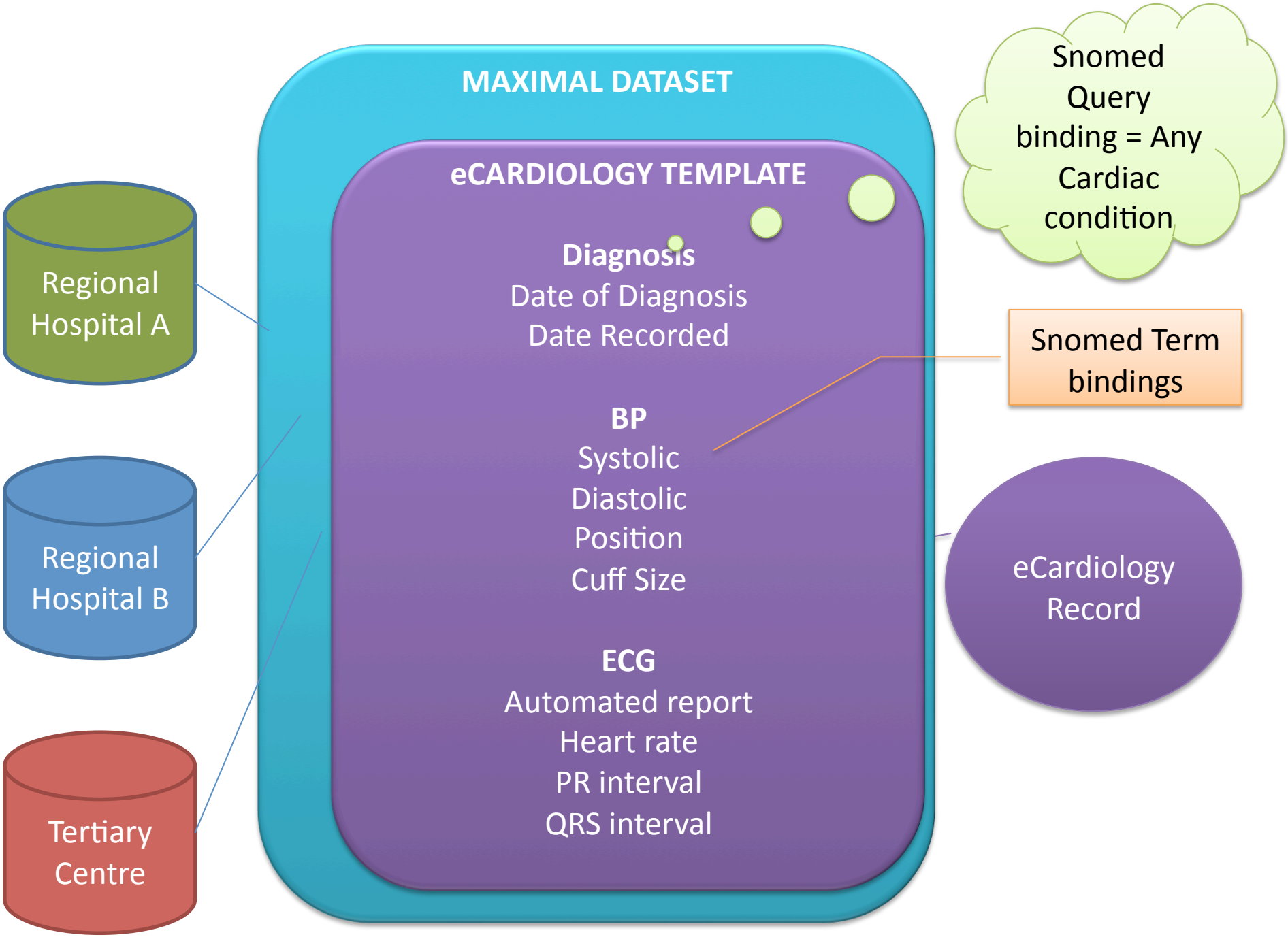
  vs.
  - Unconstrained local variation
- Develop methodologies and associated tools that embrace the need for both
- Allow standards to develop both
  - Organically
  - By diktat (where circumstances are favourable)
  - But in a controlled and cooperative environment

Positively manage diversity

- Democratise clinical content modelling
  - Non-proprietary approach, widest natural community possible
  - Modelling tools and methodologies must be
    - Clinically orientated, non-technical, minimise demands on clinical time
      - Web 2.0 “social network” applications
- Capture content at all organisational levels
  - Include diverse models
    - Today’s outlier may be tomorrow’s standard
  - Communicate who is modelling what
    - “Archetype nursery”
  - Hierarchical clinical content modelling
    - Top-down advice, bottom-up modelling (mostly)
      - “Middle-out” ? E. Coiera

Managing diversity




MAXIMAL DATASET
eCARDIOLOGY TEMPLATE
Diagnosis
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Date Recorded
BP
Systolic
Diastolic
Position
Cuff Size
ECG
Automated report
Heart rate
PR interval
QRS interval
Regional Hospital A
Regional Hospital B
Tertiary Centre
Snomed Query binding = Any Cardiac condition
Snomed Term bindings
eCardiology Record