

# openEHR reflections on the 'Blue Line'

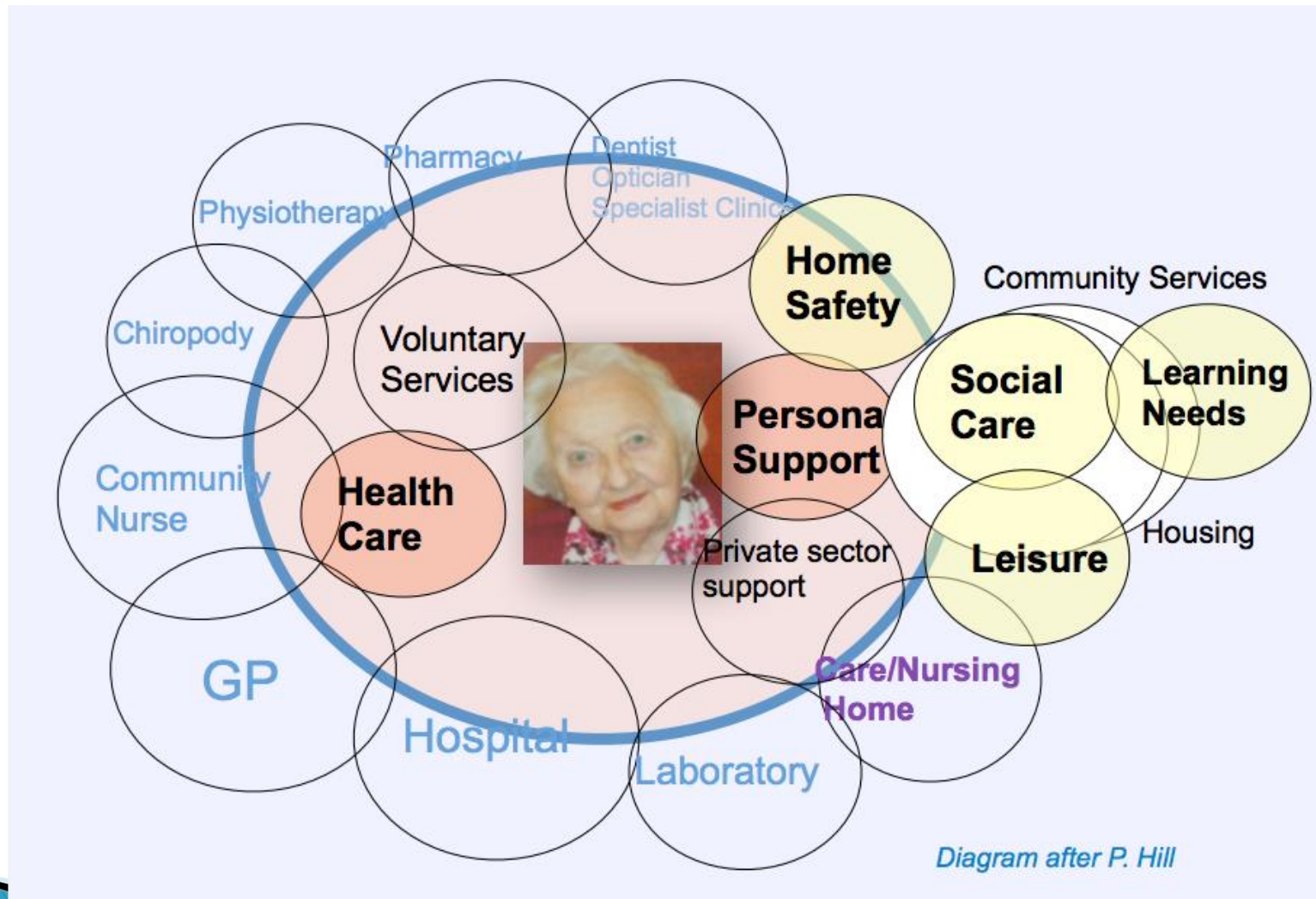
Ian McNicoll

*open*EHR

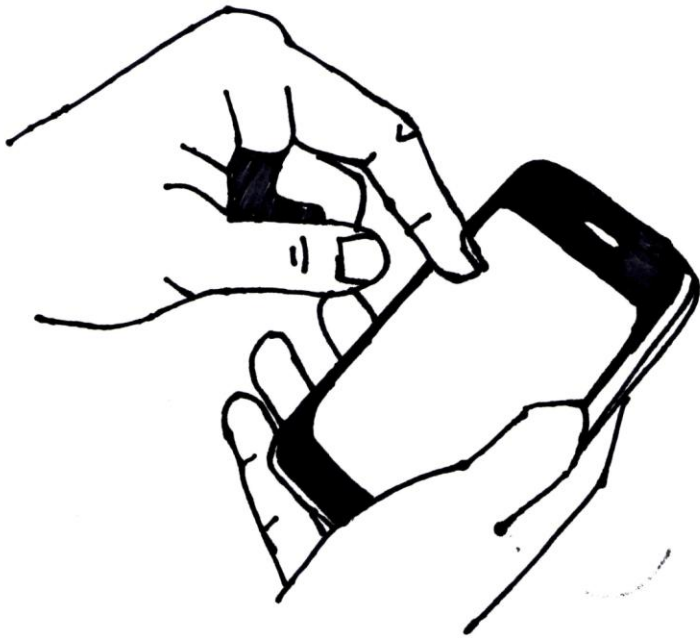


openEHR Foundation  
Ocean Informatics

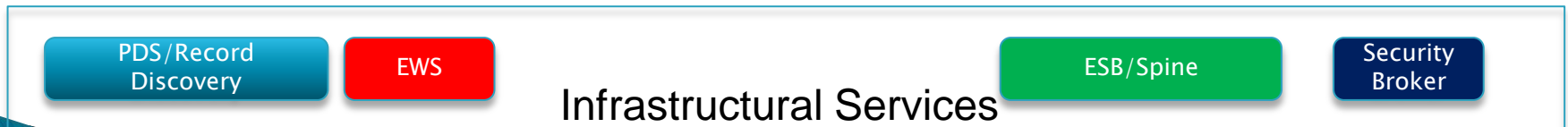
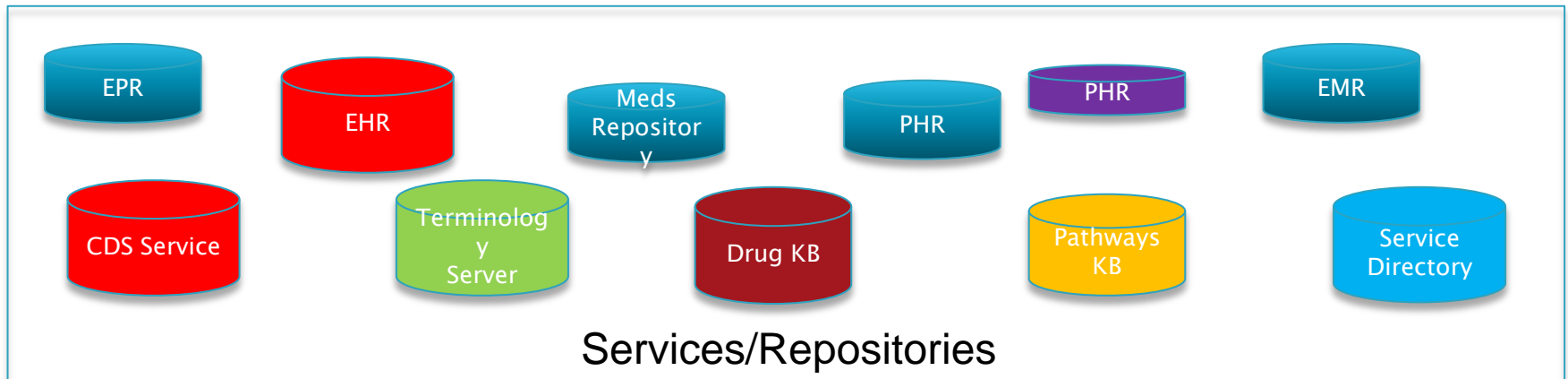
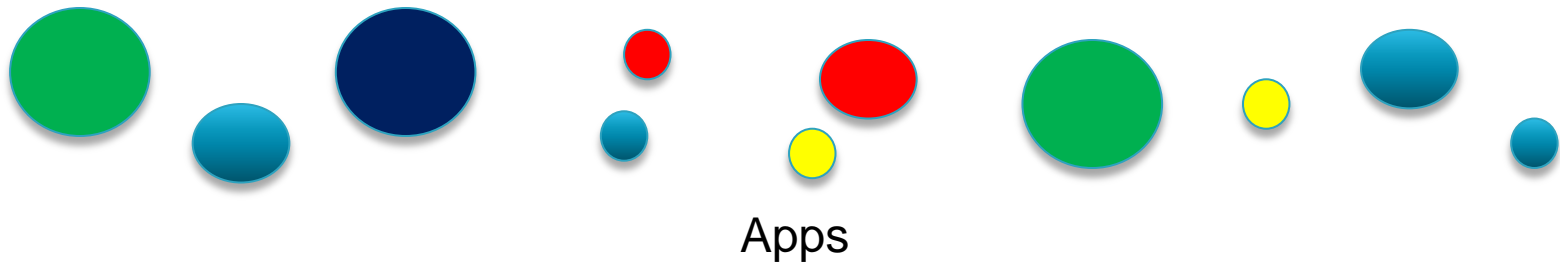
# Mary's story ...



# The apps and 'hacks' revolution



# The API revolution



After E. Davis HANDI

# Experience of interoperability

## Semantic Health SiOp report 2009

“... SiOp implementation ... depends on social, cultural and human factors within each organisation, region and country, each system and each time period.

... realising full SiOp is not necessarily a consensual goal in every place at any fixed time.”

# Opportunities

- ▶ However, demand for interoperability continually emerges
  - in all sectors
  - at all levels of organisation
- ▶ In UK primary-care sector interoperability is now a key business challenge to meet multiple 'standards' demanded by different customers
- ▶ Systems and processes to meet that demand are deficient

# Interoperability is not a technical problem

- ▶ **It is a clinical problem, which reflects**
  - Diverse clinical recording practice
  - Diverse recording requirements
    - GP vs. specialist perspective
  - Lack of clinical involvement in standards development
    - Too technical?
    - Too time-consuming
    - Clinical informatics is hard



# openEHR Foundation

- ▶ Not-for-profit Foundation based at UCL CHIME
  - [www.openehr.org](http://www.openehr.org)
- ▶ develops **open specifications** for a clinical information model allowing commercial and open source use
  - as the basis for application development
  - As the basis for standardised, shared clinical content
- ▶ develops publishes crowd-sourced, open-source clinical content specifications
  - **Archetypes, Templates, Termsets**
  - openEHR Clinical Knowledge Manager (CKM)
    - [www.openehr.org/knowledge](http://www.openehr.org/knowledge)



# Archetypes

- ▶ **Computable models of discrete clinical concepts**
  - “Maximal data set”, Universal use case
  - Include bindings to terminology
- ▶ **Familiar components of a health record**
  - Blood pressure, Medication order, Family history
  - Prostate cancer histopathology result
- ▶ **Models of components of ‘clinical practice’**
  - Designed for use **within systems** not just between systems

# Archetypes: Apps for data

- ▶ Manageable clinical content components
  - Clinically and collaboratively authored
    - Using open-source development paradigm
    - Democratised clinical content development
    - Open CC-BY-SA licence allowing both commercial and open-source use.
- ▶ Agility to respond to continually changing clinical demand

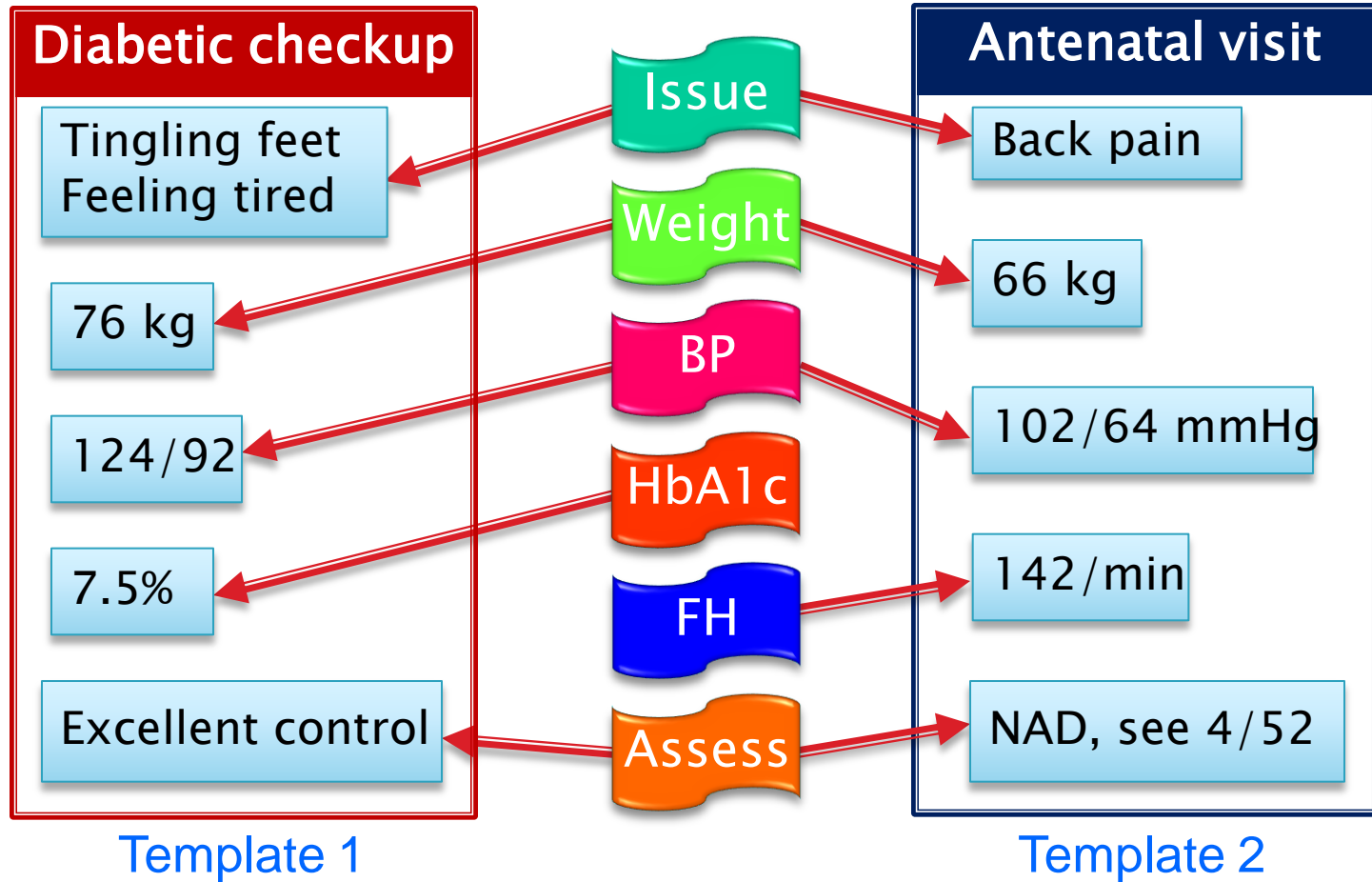
# Models of clinical practice



# Templates

- ▶ Formally define a specific aggregation of archetypes
  - For a particular clinical setting or use-case.
  - Constrain the component archetypes to make the maximal dataset 'fit for purpose'
  
- ▶ Create 'minimum datasets' to underpin ...
  - Data entry screens ,messages
  - Clinical standards
  - "Model-driven development"

# Archetype re-use in Templates



- [-] Pulse
  - [H] data ▲ Hidden
  - [+] Any event ▲ Hidden
    - [S] data ▲ Hidden
      - ✓ Pulse present
      - Q Heart rate ▲ NAME (from 'Rate')
      - T Rate description
      - M Missed beats per minute
      - T Strength ▲ NAME (from 'Volume') VALUE (values cl
      - Character
      - T Regularity ▲ NAME (from 'Rhythm pattern') VALUE
      - [-] Pulse deficit
      - T Comment
    - [+] state ▲ Hidden
    - [+] protocol ▲ Hidden
  - [-] Blood pressure
    - [H] data ▲ Hidden
      - [+] any event ▲ Hidden
        - [S] data ▲ Hidden
          - Q Systolic
          - Q Diastolic
          - Q Mean Arterial Pressure
          - Q Pulse Pressure
          - T Comment
        - state ▲ Hidden

Archetypes ▼

- [-] observation
  - Waist, abdominal and hip circumference
  - Anthropometry (v1)
  - Apgar score (v1)
  - Apnoea (v1)
  - Assessment of symptoms of high or low blo
  - Audiogram result (v1)
  - Autopsy examination (v1)
  - Barthel Index (v1)
  - Basic Living Assessment (BLA) (v1)
  - Blood matching (v1)
  - Blood Pressure (v1)
  - Blood pressure (v1)
  - Blood pressure (Training sample) (v1)

ID	e0cfb6d7-3d36-4bfd-b7d8-cl
Name	ISPEK - ZN - Vital signs Dialog
Purpose	
Template Use	

**Name**  
The name of this template.

Ocean Template Designer - 2.6 (sl-SI) BLAŽUN, ANAMARIJA  
BIS 912448 — STAROST 4L 10M ♀

File View Tools Help

[ISPEK - ZN - Vi... Encounter.oet]

**Template Properties**

- Vital functions ▲ NAME (from 'Encounter')
- context
  - other\_context
    - Context detail
      - Podrobnosti
  - content
    - Vital signs
      - items
        - Telesna temperatura
        - Srčni utrip
          - data
            - \*Any event(en)
              - data
                - Heart rate
                - Strength
                - Regularity
              - state
                - Napor
            - protocol
              - Naprava
          - Krvni tlak
            - data
              - \*any event(en)
                - data
                  - Sistolični
                  - Diastolični
                  - Srednji arterijski tlak
                  - Pulzni tlak
                - state

|                   |
|-------------------|
| Temperatura       |
| Pulz in tlak      |
| Koža              |
| Teža in višina    |
| Dolžinske meritve |
| Lega              |
| Aktivnost         |
| Urin in blato     |

Utrip

Obseg  Razsežen/Poln  Enakomeren  
 Ozek/Majhen  Ne enakomeren

Krvni tlak - Sist / Diast   mm[Hg]

Srednja vrednost  mm[Hg]

Srednja vrednost 33,37 mm[Hg] 45,10 mm[Hg]

\*Method(en)  \*Non-invasive(en)  \*Invasive(en)

\*Non-invasive locations(en)

ID

Velikost manšete

**Frankovič, Anamarija**  
 BIS 987654321 — STAROST 8L 5M Ž — SPR 23.02.2001 — OPER 5D  
 NAROČIL Elke Šulman 12.10.2010  
 OPOMBA Preveriti udobnost ležišča

|                     |
|---------------------|
| Teža in višina      |
| Temperatura         |
| <b>Pulz in tlak</b> |
| Koža                |
| Urin in blato       |
| Lega                |
| Aktivnost           |
| O intervenciji      |

Utrip  /min

Kakovost  Močan  Reden  
 Šibek  Ne-reden

Krv tlak - Sist / Diast   mmHg

Srednja vrednost  mmHg

Srednja vrednost 33,37 kg

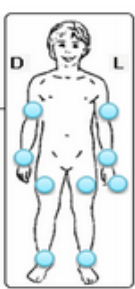
Pulzni tlak 45,10 kg

Način  Ne-invazivno  Invazivno

Lokacija merjenja --Izberi lokacijo--

Aparat --Izberi aparat--

Velikost manšete --Izberi velikosti--



**Model-driven  
GUI**







[epSOS Patient Summary.oet]

- +... < Allergies, Adverse Reactions    Δ [0..\*] to [0..1], NAME (from 'Adhoc heading')
- +... < History of past illness and disorders    Δ [0..\*] to [0..1], NAME (from 'Adhoc heading')
- +... < List of current Problems / Diagnosis    Δ [0..\*] to [0..1], NAME (from 'Adhoc heading')
- ... < Vital signs    Δ [0..\*] to [0..1], NAME (from 'Adhoc heading')
  - ... items
    - ... Blood Pressure
      - ... data
        - ... any event
          - +... data
          - ... state
            - ... T Position
            - ... T Confounding factors
            - +... Exertion
            - ... T Sleep status
            - ... Q Tilt
        - +... 24 hour average
      - ... protocol
        - ... T Cuff size
      - ... Location
        - ... T Location of measurement
        - ... T Site of measurement    Δ NAME (from 'Specific location')
        - ... T Method

# openEHR CKM: Web 2 collaboration

The screenshot shows the openEHR Clinical Knowledge Manager (CKM) interface. The top navigation bar includes 'Archetypes', 'Templates', 'Termsets', 'Release Sets', 'Reviews', 'General Discussion', 'Teams', 'Reports', 'Tools', and 'About'. The main content area displays the 'Blood Pressure' archetype, which is a 'Systolic' quantity. The definition is: 'Peak systemic arterial blood pressure over one cycle - measured in systolic or contraction phase of the heart cycle'. The units are '0.0, <1000.0 mm[Hg]' with a limit of 0 decimal places. The archetype is associated with several users and their comments: Jeroen Meintjens (05-Nov-2008) notes it is defined in the ADL at present; Anneke Goossen (17-Nov-2008) discusses a concept for average day interval systolic blood pressure; and Melvin Reynolds (17-Nov-2008) mentions non-invasive blood pressure. A left-hand sidebar shows a tree view of archetypes, with 'Blood Pressure' selected under 'Observation'.

This screenshot shows the version control and log message interface for the 'Blood Pressure' archetype. It displays two branches: 'Trunk (Rev. 23)' (Active branch) and 'Trunk (Rev. 22)' (Committed branch). The 'Trunk (Rev. 23)' details include: Current state: Published; Modified: 19-Dec-2011 05:07; Log message: 'Translated archetype from English to Spanish (Argentina). Traducción del arquetipo del Inglés al...'. The 'Trunk (Rev. 22)' details include: Modified: 14-Jul-2011 13:20; Log message: 'Translated archetype from English to Arabic (Syria). Translation outline checked with Google Translate'. A 'Compare' button is visible for both branches. Below the log messages, a list of branches shows 'thanga.cbe (Rev. 23.1)' as the active branch and 'domingo.liotta (Rev. 22.1)', 'domingo.liotta (Rev. 22.2)', and 'domingo.liotta (Rev. 22.3)' as committed branches.

**Stef Verlinden** (22-Jan-2009 15:28)

**Interpretation of blood pressure values**

From the recent literature it can be learned that a single 'office measurement' (even in dupli- or triplicate) doesn't have much value. In about 25% of cases the actual BP (masked hypertension). Overall in only 50% if the office measurements the actual BP is measured.

The gold standard for determining the actual BP is the 24 hours BP measurement. In that case the average from a 24 hours measurement represents the actual BP.

Second best is the home blood pressure measurement according to the ESH protocol. For seven day the BP is remaining 24 measurements represents the actual BP.

My question is where/ how do we store these average values and how can we discriminate such a calculated (and not measured) value?

My initial thought was to see those calculations as an evaluation but I know that there where some arguments (although I don't know what they are).

Cheers,

Stef

**Ian McNicoll** (08-Jan-2009 00:54)

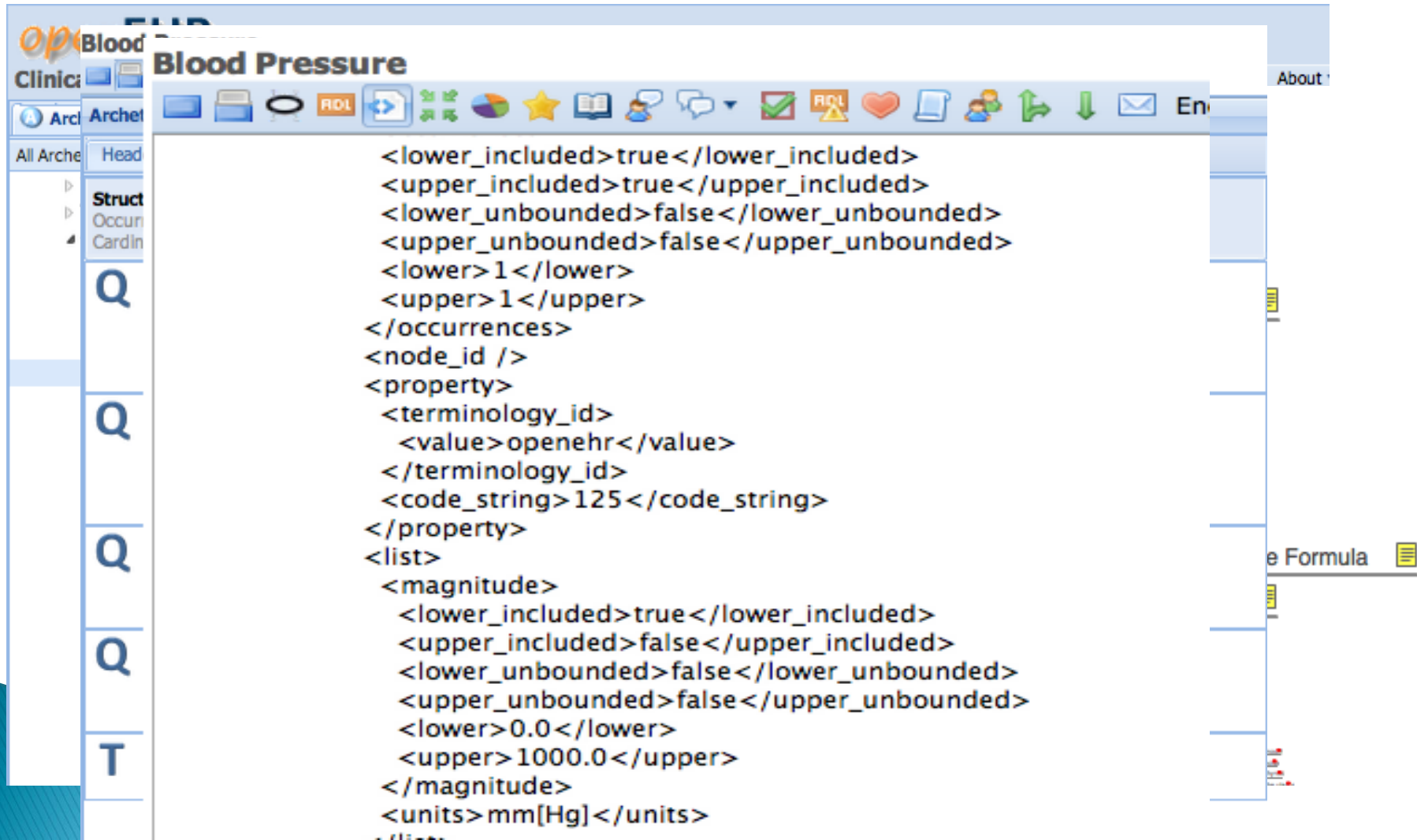
**Do we need something on anxiety level?**

In GP patient anxiety/ agitation is a common confounding patient state for a number of observations e.g BP, Respirations, heart rate.

Should we include a cluster Slot for a CLUSTER archetype Anxiety level

CLUSTER

# openEHR CKM – archetype repository



The screenshot displays the openEHR CKM interface for editing an archetype. The main window title is "Blood Pressure". The left sidebar shows a tree view with "Struct" selected. The central area contains XML code defining the archetype's constraints and properties.

```
<lower_included>true</lower_included>
<upper_included>true</upper_included>
<lower_unbounded>false</lower_unbounded>
<upper_unbounded>false</upper_unbounded>
<lower>1</lower>
<upper>1</upper>
</occurrences>
<node_id />
<property>
  <terminology_id>
    <value>openehr</value>
  </terminology_id>
  <code_string>125</code_string>
</property>
<list>
  <magnitude>
    <lower_included>true</lower_included>
    <upper_included>false</upper_included>
    <lower_unbounded>false</lower_unbounded>
    <upper_unbounded>false</upper_unbounded>
    <lower>0.0</lower>
    <upper>1000.0</upper>
  </magnitude>
  <units>mm[Hg]</units>
</list>
```

# openEHR CKM – clinical collaboration



## Mean Arterial Pressure

Quantity

Occurrences: 0..1 (optional)

The average arterial pressure that occurs over the entire course of the heart contraction and relaxation cycle. MAP can be calculated using (2 x Systolic Blood Pressure + Diastolic Blood Pressure) divided by 3.

Property: Pressure

Units:

- 0.0..<1000.0 mm[Hg]  
Limit decimal places: 1

Eugene Iqras (19-Jan-2009)

As per Cardiovascular Physiology Concepts by Richard E. Klabunde, Mean Arterial Pressure (MAP) is determined by the cardiac output (CO), systemic vascular resistance (SVR) and central venous pressure (CVP):  $MAP = CO * SVR + CVP$ . Because CVP is usually at or near 0 mmHg, the above formula is often simplified to:  $MAP = CO * SVR$ .

In practice, MAP is determined using arterial pressure measurements. At resting heart rates, MAP can be approximated using systolic pressure (SP) and diastolic pressure (DP):

$$MAP \approx DP + 1/3 * (SP - DP)$$

or equivalently:

$$MAP \approx (2 * DP + SP) / 3$$

Also see: <http://www.mdcalc.com/map>

**Clinical Review**

Andrew James (21-Jan-2009)

There is also a commonly used "easy" formula:  $DBP + pulse\ pressure / 3$ . The "geometric MAP" may be the best measure (Chemlla et al, J Appl Physiol 99: 2278-2284, 2005 ) but this may not be widely known, and is probably not used in standard measuring devices. Suggest seek advice for one of the specialist cardiology societies

# ‘One language on the Blue Line?’

- ▶ Interoperability cannot be technically or philosophically engineered
    - It must be negotiated by stakeholders
    - Vendors must play a critical role in process
    - “Ontologies are not enough”
  - ▶ Traditional ‘standards’ development is too slow and inflexible to meet consumer needs
    - Open-source, web 2.0 collaborative methods and timescales must be adopted
- 