openEHR: towards a coherent connected ecosystem

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- Health informatician
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  - INTEROpen (UK)
- Commercial
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FACULTY OF CLINICAL INFORMATICS

freshEHR Clinical Informatics

A little history ...

openEHR

A YEAR IN GENERAL PRACTICE COMPUTING

Dr Ian T McNicoll MBChB,MRCGP

Fellow in Computing Experience

August 1985 - August 1986

Chief Scientist Office

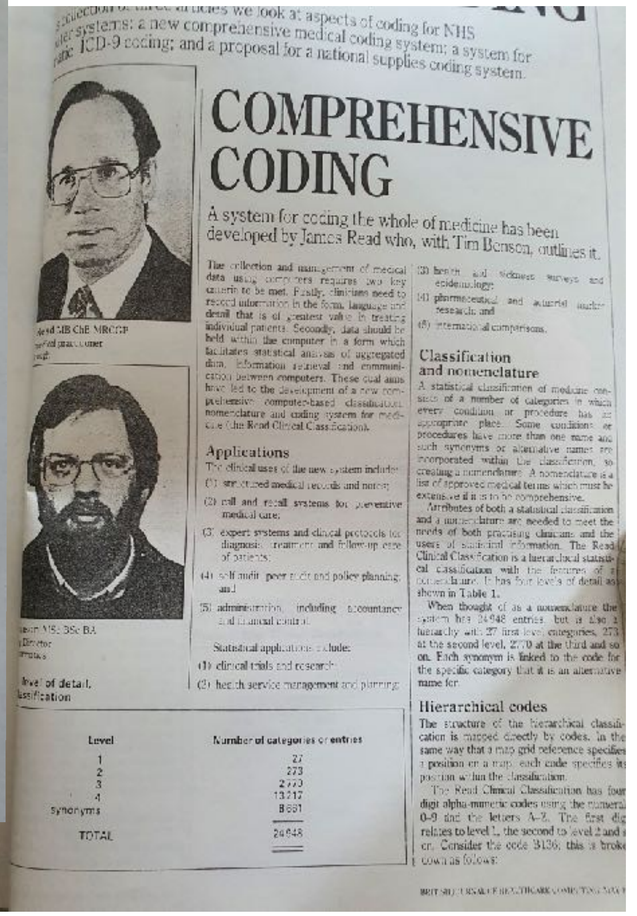
Scottish Home and Health Department

Whilst this comment is most applicable to a fully computerised GP record system it has considerable importance if GPs are to make proper and confident use of the patient problem summaries produced by GPASS.

The coding requirements of the GPASS system are currently under major review and one of the most promising options is the READ CODE. This has been developed with microcomputers in mind and has the advantage of being highly structured and hierarchical, allowing data storage and retrieval to take place at different levels of detail according to requirements. It also employs a great number of synonyms, simplifying data entry for both GP and staff and includes a codes for occupations and practical procedures.

A description of the Read Code is reproduced in the Appendix.

The principal concern, therefore, should be that GPASS provides a morbidity coding system which meets the GP's requirements, thereby encouraging morbidity recording. The epidemiolgist's needs are less exacting and are catered for by all of the codes under consideration for future use by GPASS.



systems: a new comprehensive medical coding system; a system for ICD-9 coding; and a proposal for a national supplies coding system.

COMPREHENSIVE CODING

A system for coding the whole of medicine has been developed by James Read who, with Tim Benson, outlines it.

The collection and management of medical data using computers requires two key criteria to be met. Firstly, clinicians need to record information in the form, language and detail that is of greatest value in treating individual patients. Secondly, data should be held within the computer in a form which facilitates statistical analysis of aggregated data, information retrieval and communication between computers. These dual aims have led to the development of a new comprehensive computer-based classification, nomenclature and coding system for medicine (the Read Clinical Classification).

Applications

The clinical uses of the new system include:

(1) structured medical records and notes;

(2) call and recall systems for preventive medical care;

(3) expert systems and clinical protocols for diagnosis, treatment and follow-up care of patients;

(4) self audit, peer audit and policy planning; and

(5) administration, including accountancy and financial control.

Statistical applications include:

(1) clinical trials and research;

(2) health service management and planning;

(3) health and sickness surveys and epidemiology;

(4) pharmaceutical and industrial market research; and

(5) international comparisons.

Classification and nomenclature

A statistical classification of medicine consists of a number of categories to which every condition or procedure has an appropriate place. Some conditions or procedures have more than one name and such synonyms or alternative names are incorporated within the classification, so creating a nomenclature. A nomenclature is a list of approved medical terms which must be extensive if it is to be comprehensive.

Attributes of both a statistical classification and a nomenclature are needed to meet the needs of both practising clinicians and the users of statistical information. The Read Clinical Classification is a hierarchical statistical classification with the features of a nomenclature. It has four levels of detail as shown in Table 1.

When thought of as a nomenclature the system has 24 948 entries, but it also has a hierarchy with 27 first level categories, 273 at the second level, 2770 at the third and so on. Each synonym is linked to the code for the specific category that it is an alternative name for.

Hierarchical codes

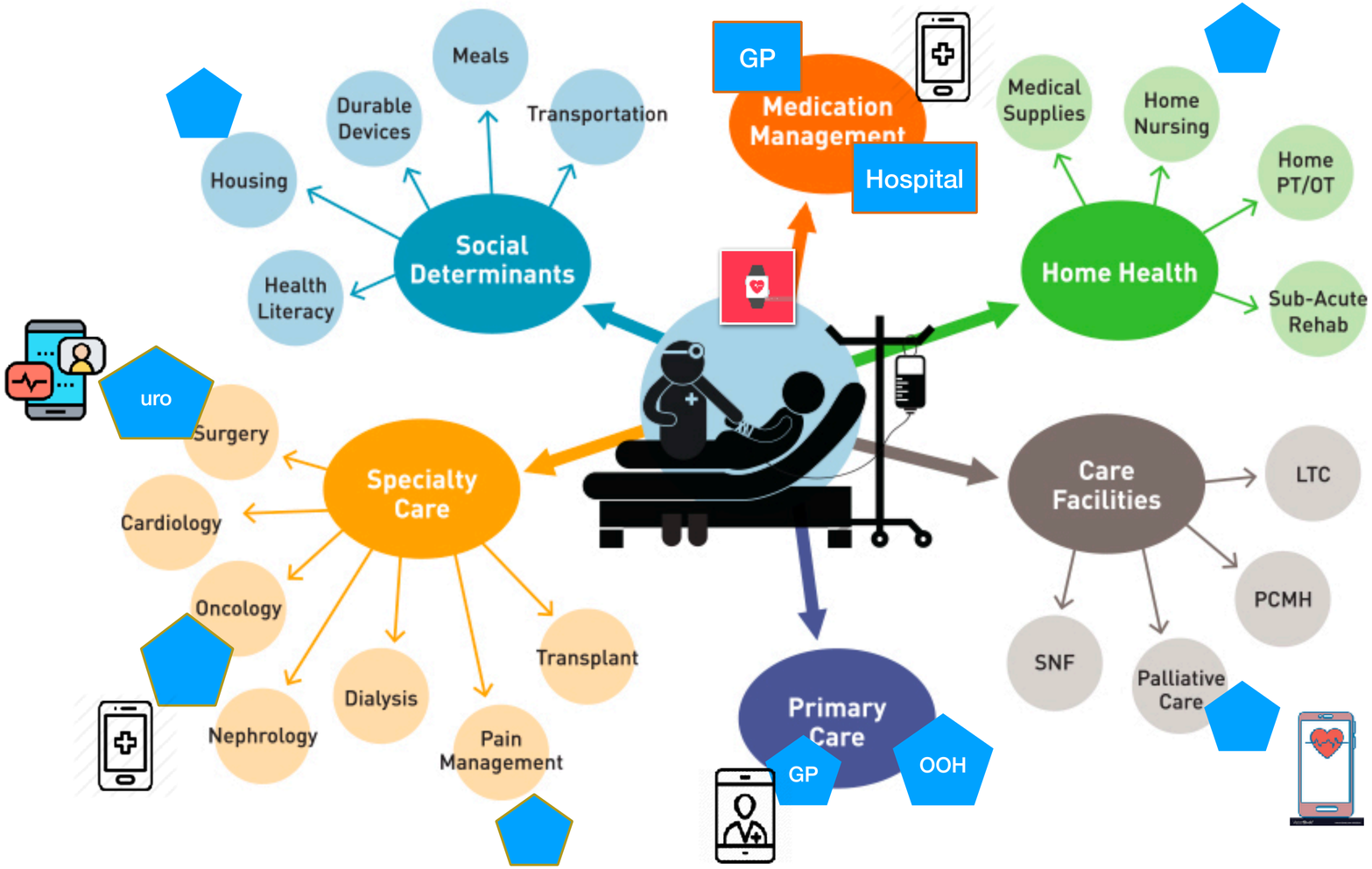
The structure of the hierarchical classification is mapped directly by codes. In the same way that a map grid reference specifies a position on a map, each code specifies its position within the classification.

The Read Clinical Classification has four digit alpha-numeric codes using the numerals 0-9 and the letters A-Z. The first digit relates to level 1, the second to level 2 and so on. Consider the code B136; this is broken down as follows:

Level	Number of categories or entries
1	27
2	273
3	2770
4	13212
Synonyms	8661
TOTAL	24948

A patient-centered coherent system?

openEHR



What is a ‘system’?

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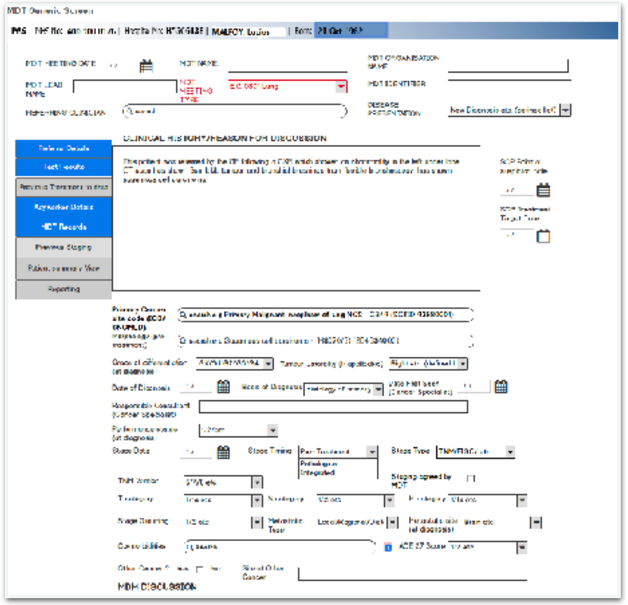
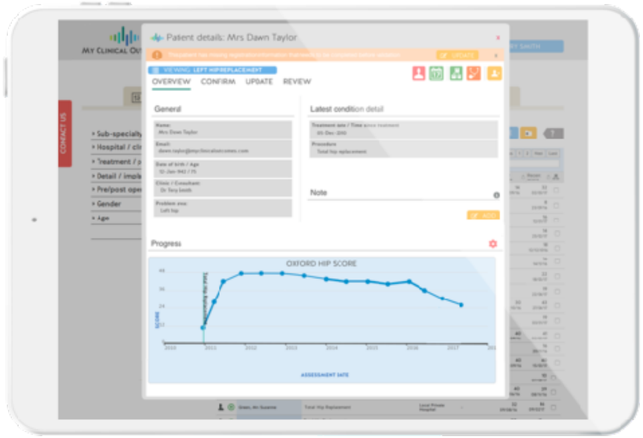
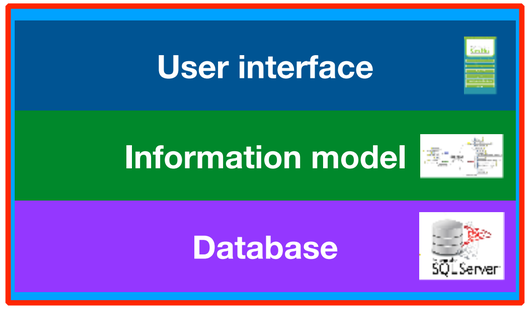
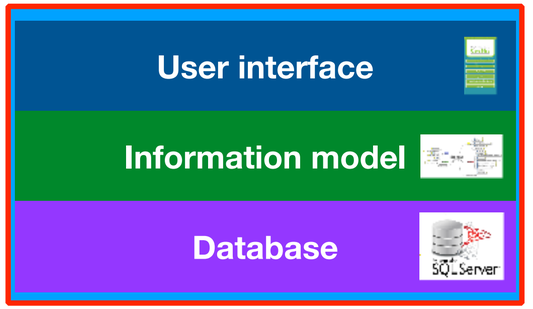


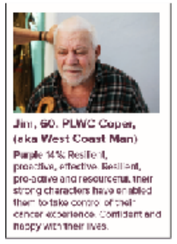


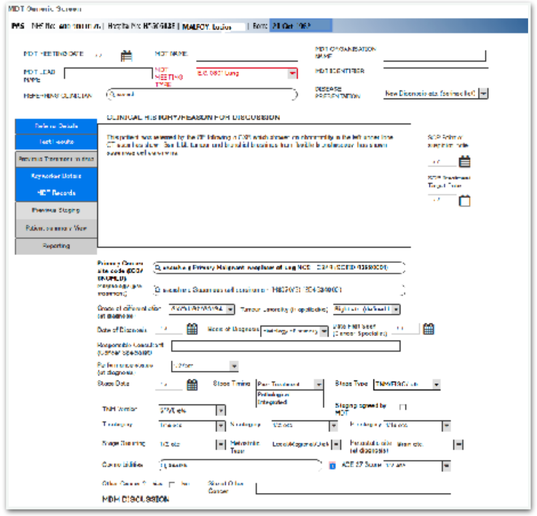


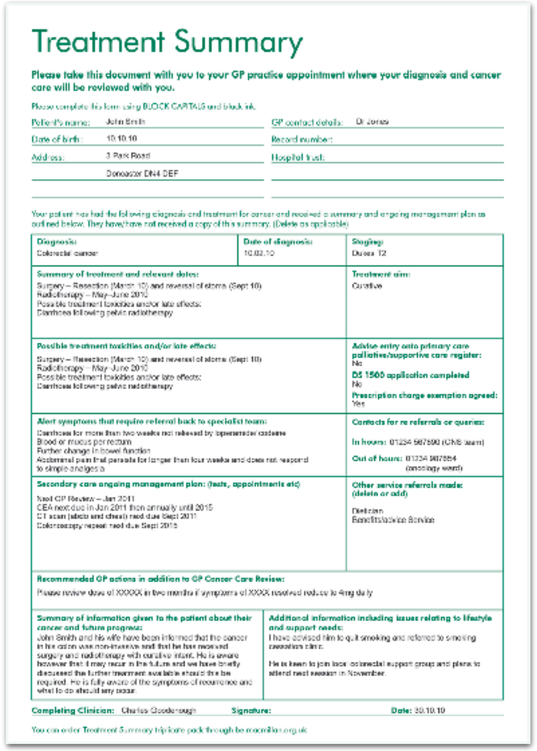


Cancer journey

openEHR







Treatment Summary

Please take this document with you to your GP practice appointment where your diagnosis and cancer care will be reviewed with you.

Please complete this form using BLOCK CAPITALS and black ink.

Patient's name:	John Smith	GP contact details:	Dr Jones
Date of birth:	10.10.10	Record number:	
Address:	3 Park Road Doncaster DN4 0EF	Hospital Trust:	

Your patient has had the following diagnosis and treatment for cancer and received a summary and ongoing management plan as outlined below. They have/have not received a copy of this summary. (Delete as applicable)

Diagnosis:	Date of diagnosis:	Staging:
Colorectal cancer	10.02.10	Dukes T2

Summary of treatment and relevant dates:
Surgery – Resection (March 10) and reversal of stoma (Sept 10)
Radiotherapy – May-June 2010
Possible treatment toxicities and/or late effects:
Diarrhoea following pelvic radiotherapy

Treatment aim:
Curative

Possible treatment toxicities and/or late effects:
Surgery – Resection (March 10) and reversal of stoma (Sept 10)
Radiotherapy – May-June 2010
Possible treatment toxicities and/or late effects:
Diarrhoea following pelvic radiotherapy

Advise entry onto primary care palliative/supportive care register:
No
DS 1500 application completed
No
Prescription charge exemption agreed:
Yes

Alert symptoms that require referral back to specialist team:
Diarrhoea for more than two weeks not relieved by loperamide/codeine
Blood or mucus per rectum
Further change in bowel function
Abdominal pain that persists for longer than four weeks and does not respond to simple analgesia

Contacts for re referrals or queries:
In hours: 01234 567890 (CNS team)
Out of hours: 01234 987654 (oncology ward)

Secondary care ongoing management plan: (tests, appointments etc)
Next GP Review – Jan 2011
CEA next due in Jan 2011 then annually until 2015
CT scan (abdo and chest) next due Sept 2011
Colonoscopy repeat next due Sept 2015

Other service referrals made: (delete or add)
Dietician
Benefits/advice Service

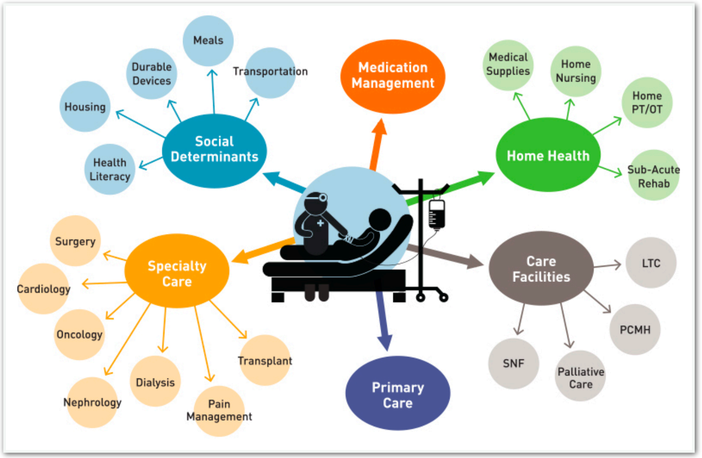
Recommended GP actions in addition to GP Cancer Care Review:
Please review dose of XXXXX in two months if symptoms of XXXX resolved reduce to 4mg daily

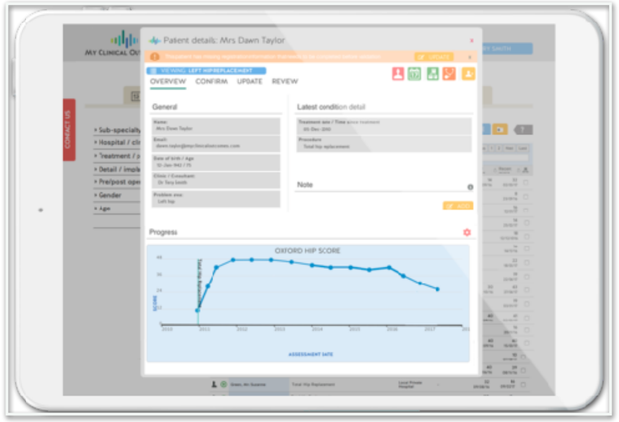
Summary of information given to the patient about their cancer and future progress:
John Smith and his wife have been informed that the cancer in the colon was non-invasive and that he has received surgery and radiotherapy with curative intent. He is aware however that it may recur in the future and we have briefly discussed the further treatment would be if this is the case. He is fully aware of the symptoms of recurrence and what to do should any occur.

Additional information including issues relating to lifestyle and support needs:
I have advised him to quit smoking and referred to smoking cessation clinic.
He is keen to join local colorectal support group and plans to attend next session in November.

Completing Clinician: Charles Goodenough **Signature:** **Date:** 20.10.10

You can order Treatment Summary triplicate pads through be macmillan.org.uk





RESPECT Recommended Summary Plan for Emergency Care and Treatment

1. This plan belongs to:

Preferred name

Date completed

One system to rule them all?

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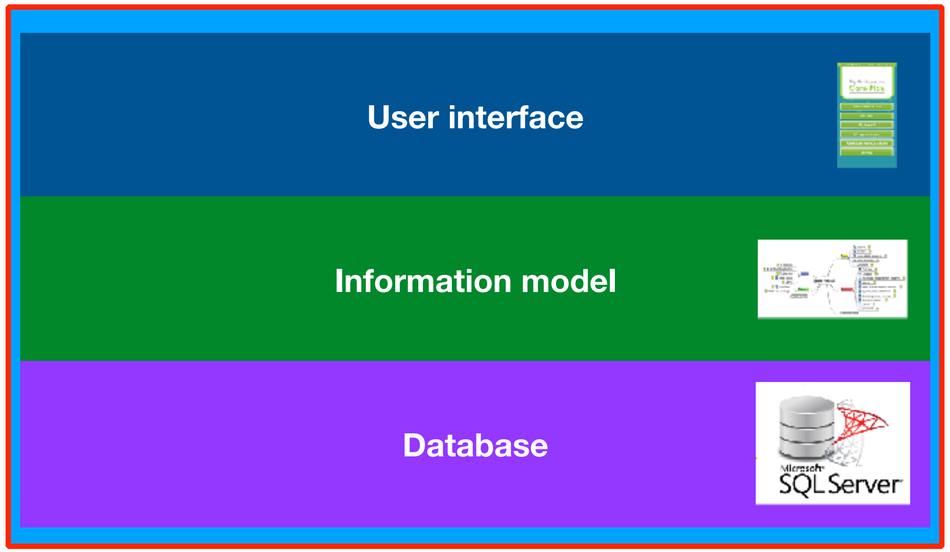
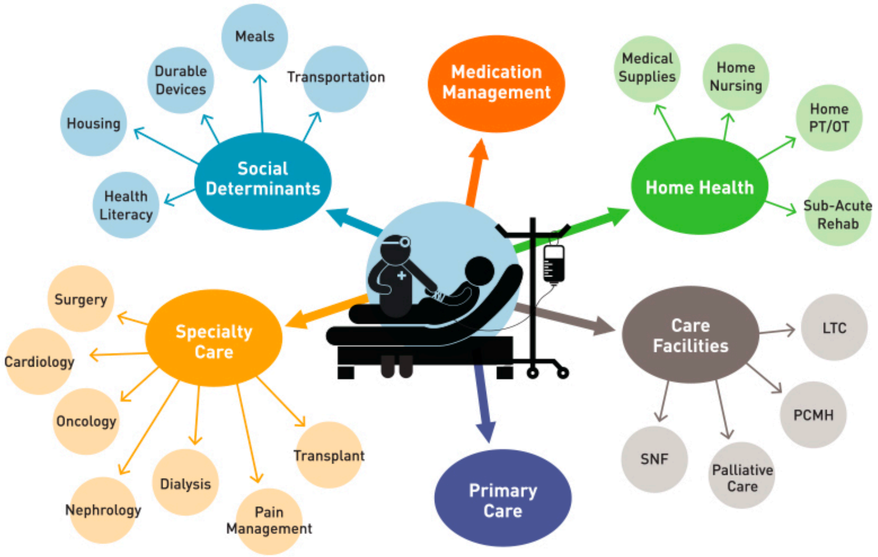
NHS Connecting for Health

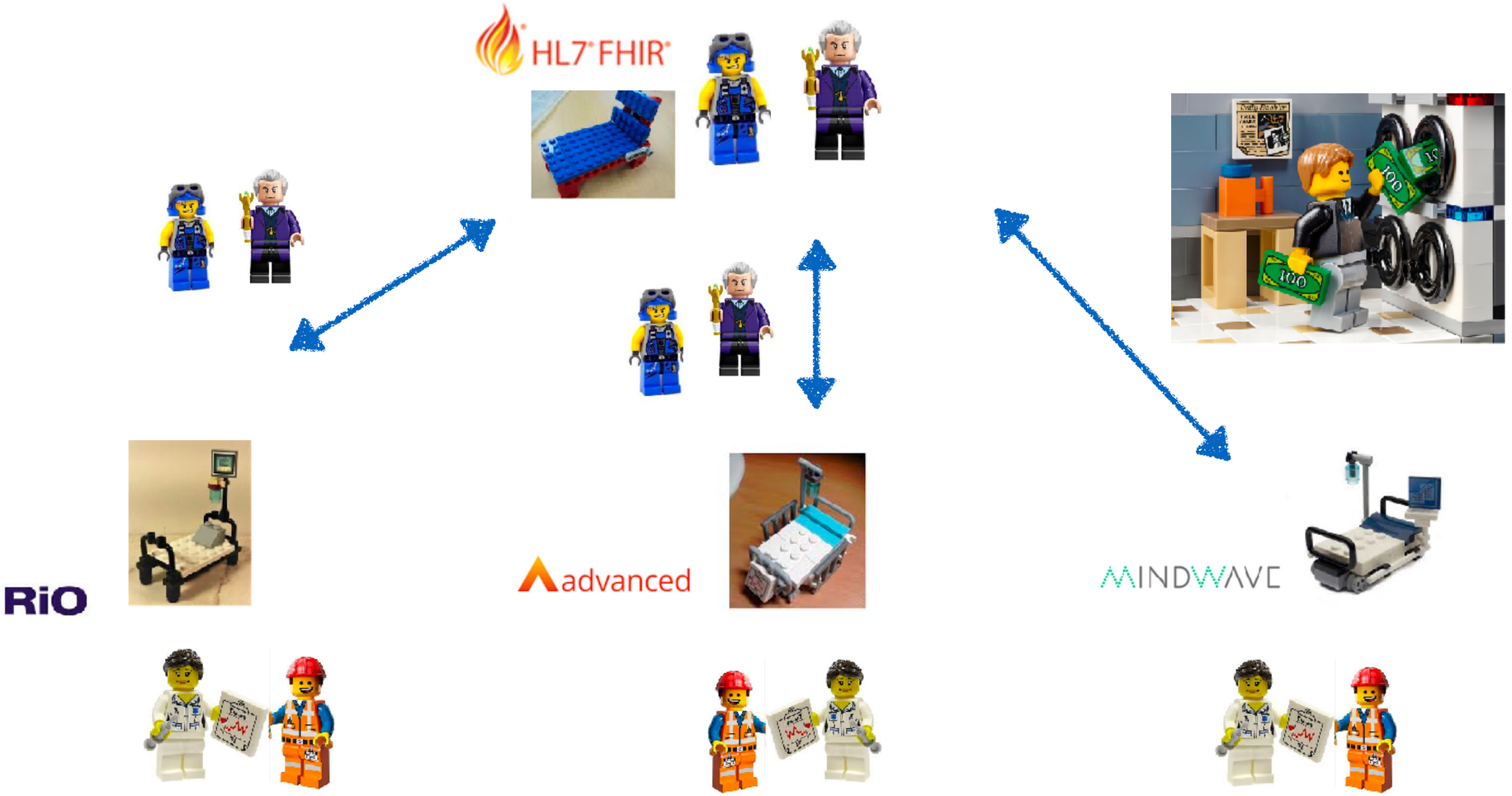
tpp





Is ‘interoperability’ what we want?

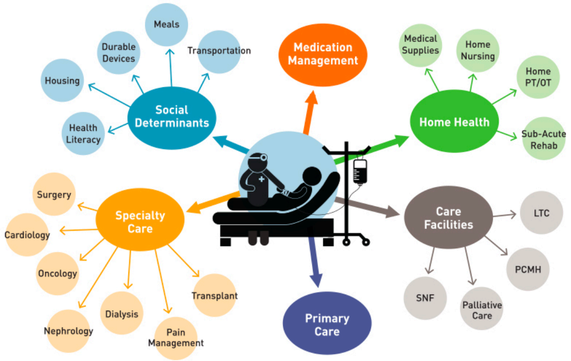
openEHR



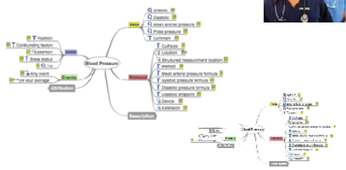
open Platform - vendor-neutral

openEHR

Apps



Vendor-neutral Information model



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Technology-neutral datastore (CDR)

EtherCIS

DIPS

code 24 .NL

better BY MARAND

CaboLabs

EHRbase

Ocean HEALTH SYSTEMS

CDR - Clinical data repository

openEHR

- Smart datastore which natively stores, retrieves, queries openEHR data via a standard API

Ocean HEALTH SYSTEMS
Smart Data. Smart Care.

DIPS

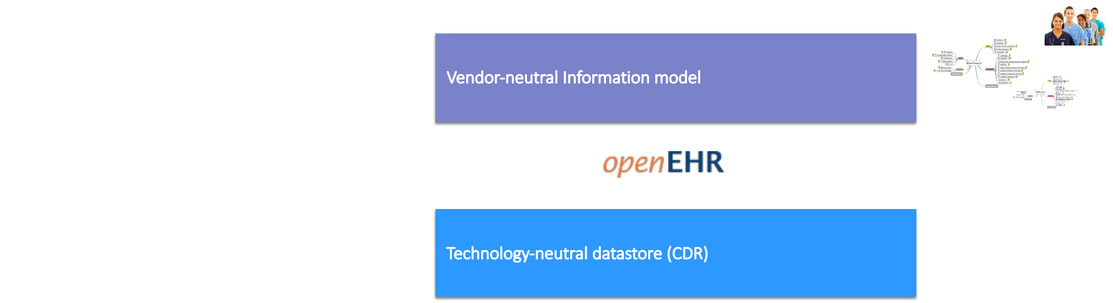
better

code 24 .NL

CaboLabs

EHRbase

  - All data completely available
  - Vendor-neutral querying
  - No engineering deployment



Vendor-neutral information model for persistence

openEHR

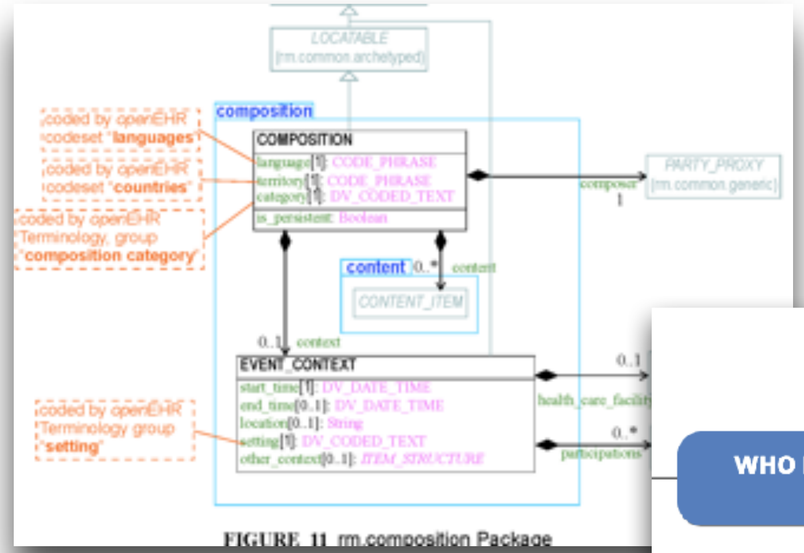
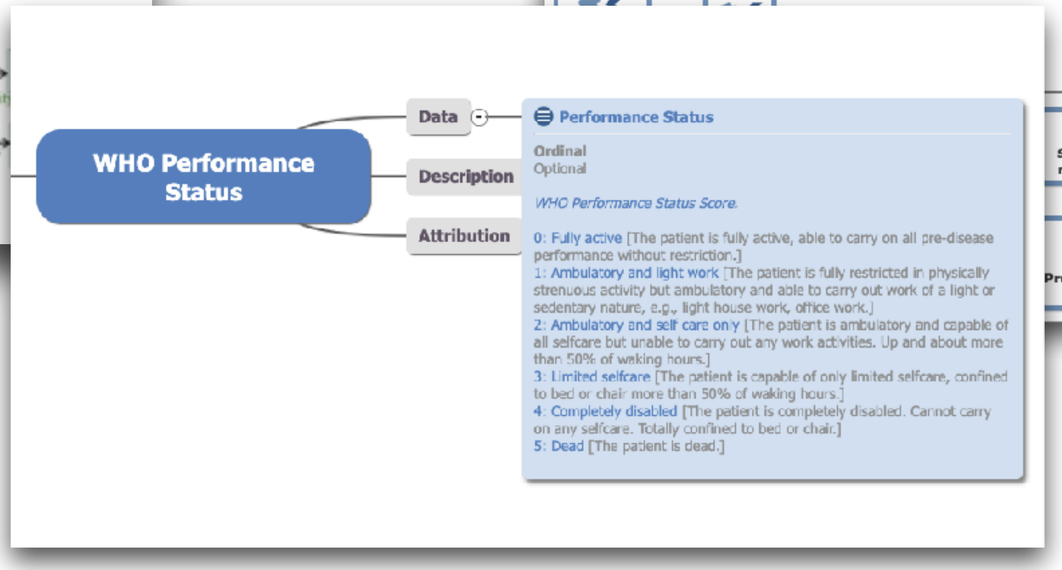
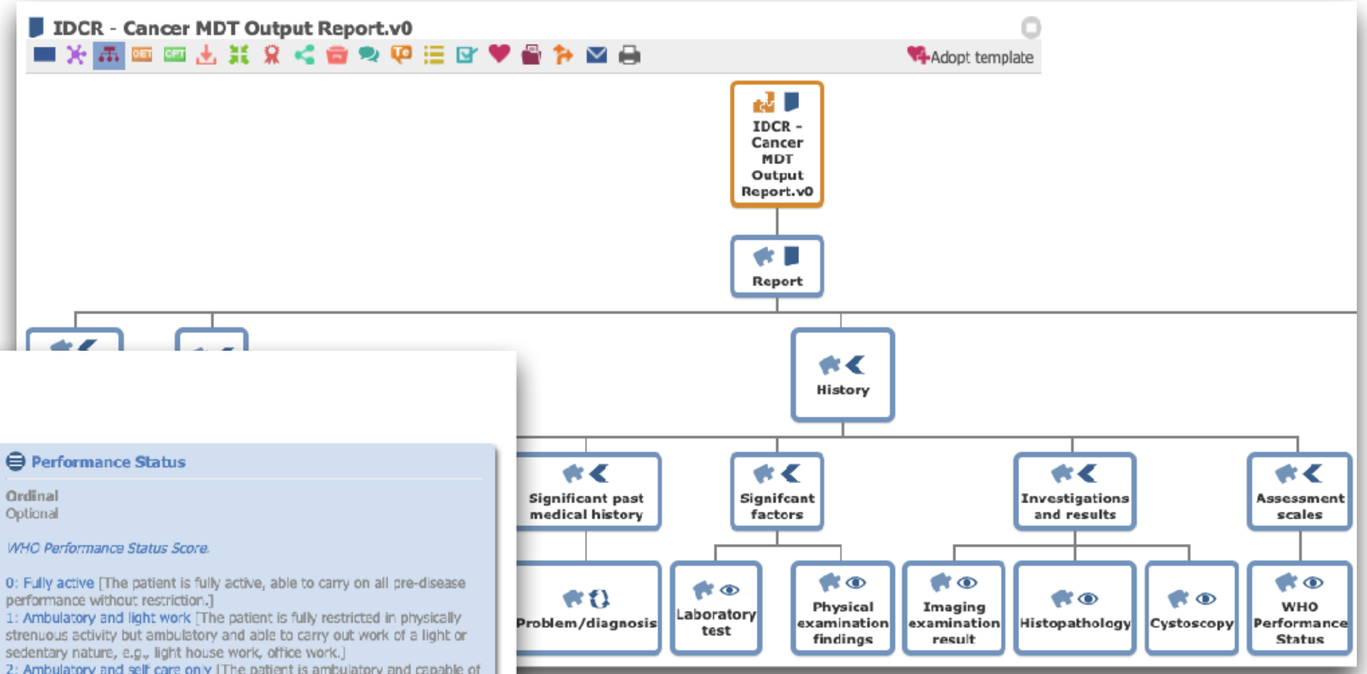


FIGURE 11 rm.composition Package

Reference model



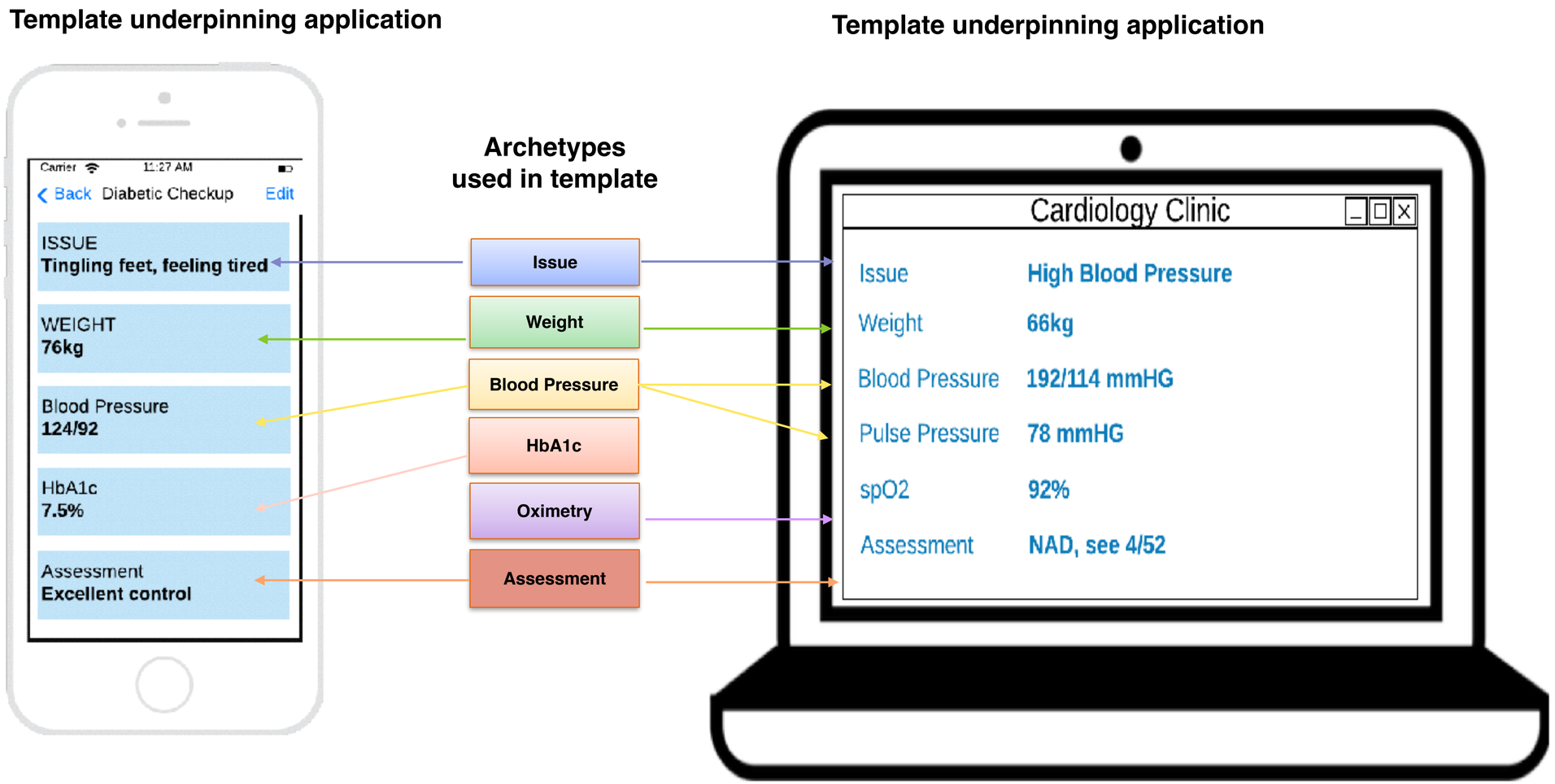
Archetypes



Templates

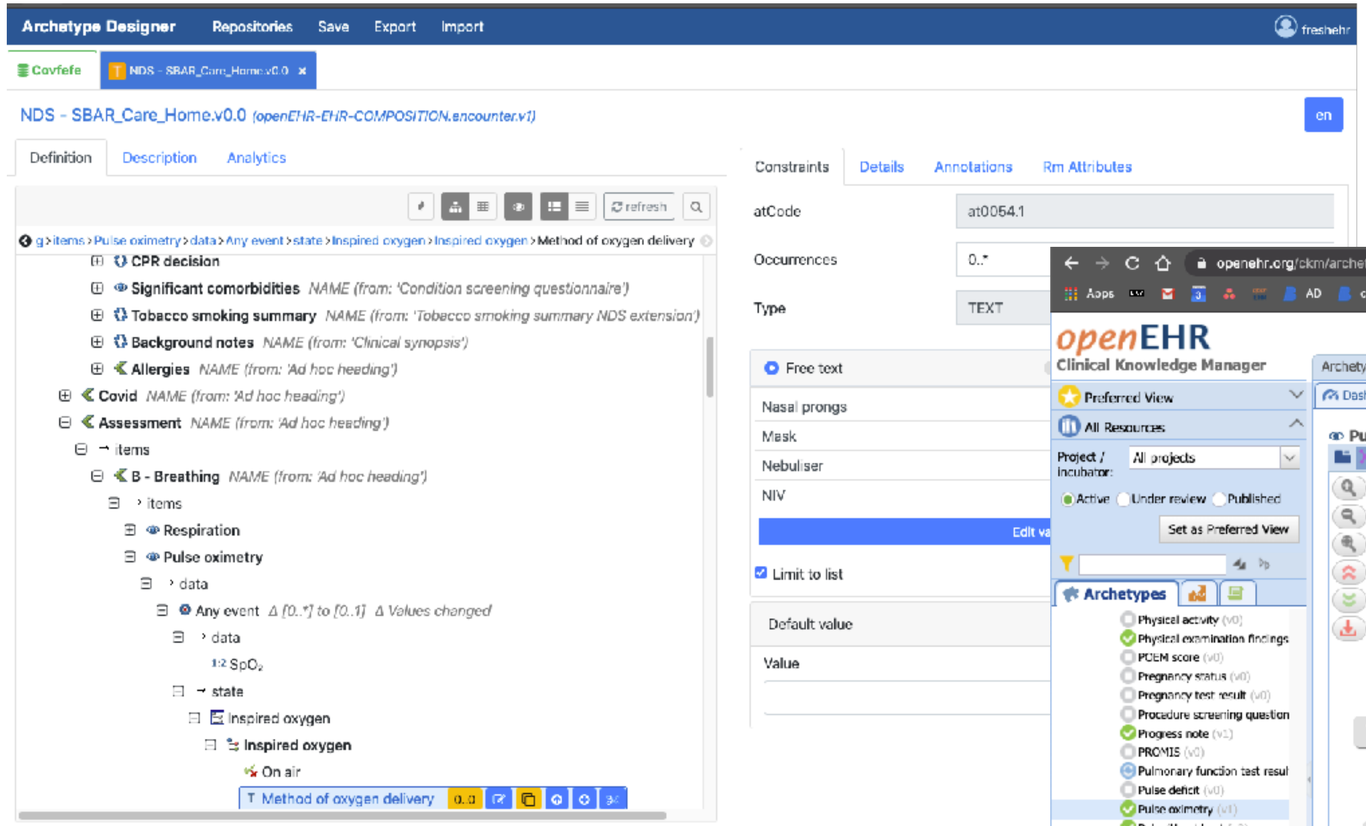
Archetypes and templates

openEHR



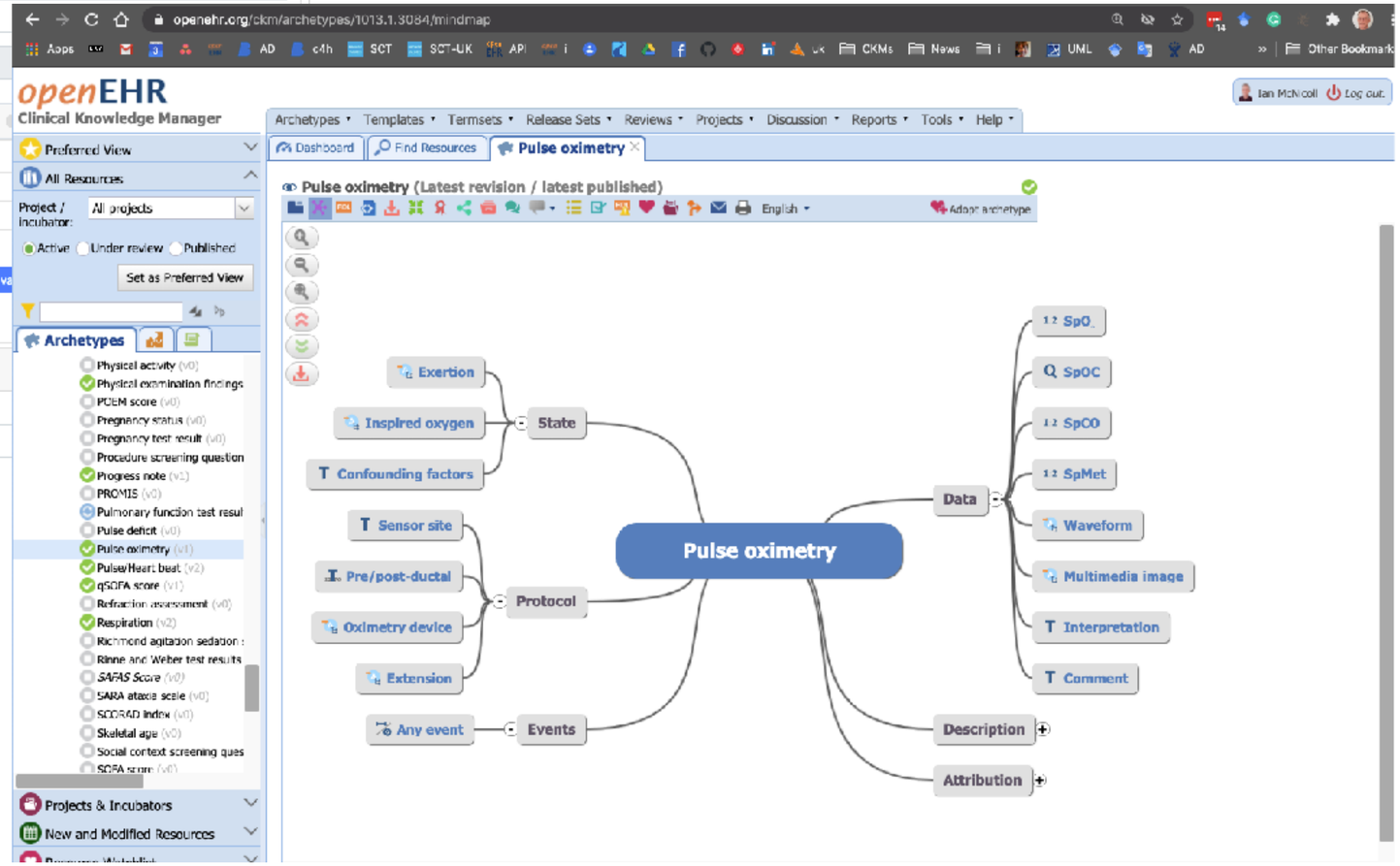
openEHR tooling

openEHR



https://openehr.org/ckm

https://tools.openehr.org/



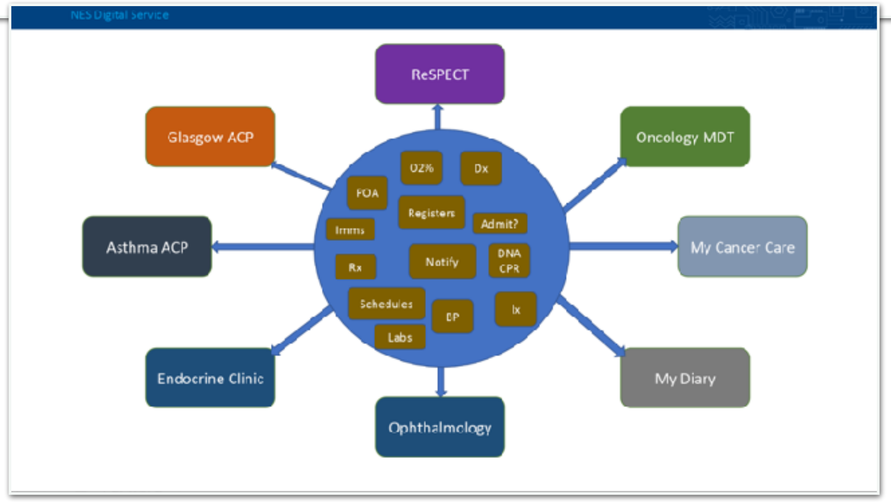
NHS Scotland: National Digital Platform

194. It is no longer acceptable in this age that our health service is still using multip incompatible systems and various platforms. In all our work we have heard

It is no longer acceptable in this age that our health service is still using multiple incompatible systems…

167. We agree the best way forward for data sharing is through a single platform, or spine, for data that other systems connect into and we note witnesses and the Scottish Government are in agreement. Can the Scottish Government advise whether it has had discussions with other countries regarding the use of a single platform?

…the best way forward for data sharing is through a single platform…



Open digital platform — 1 - 2 years

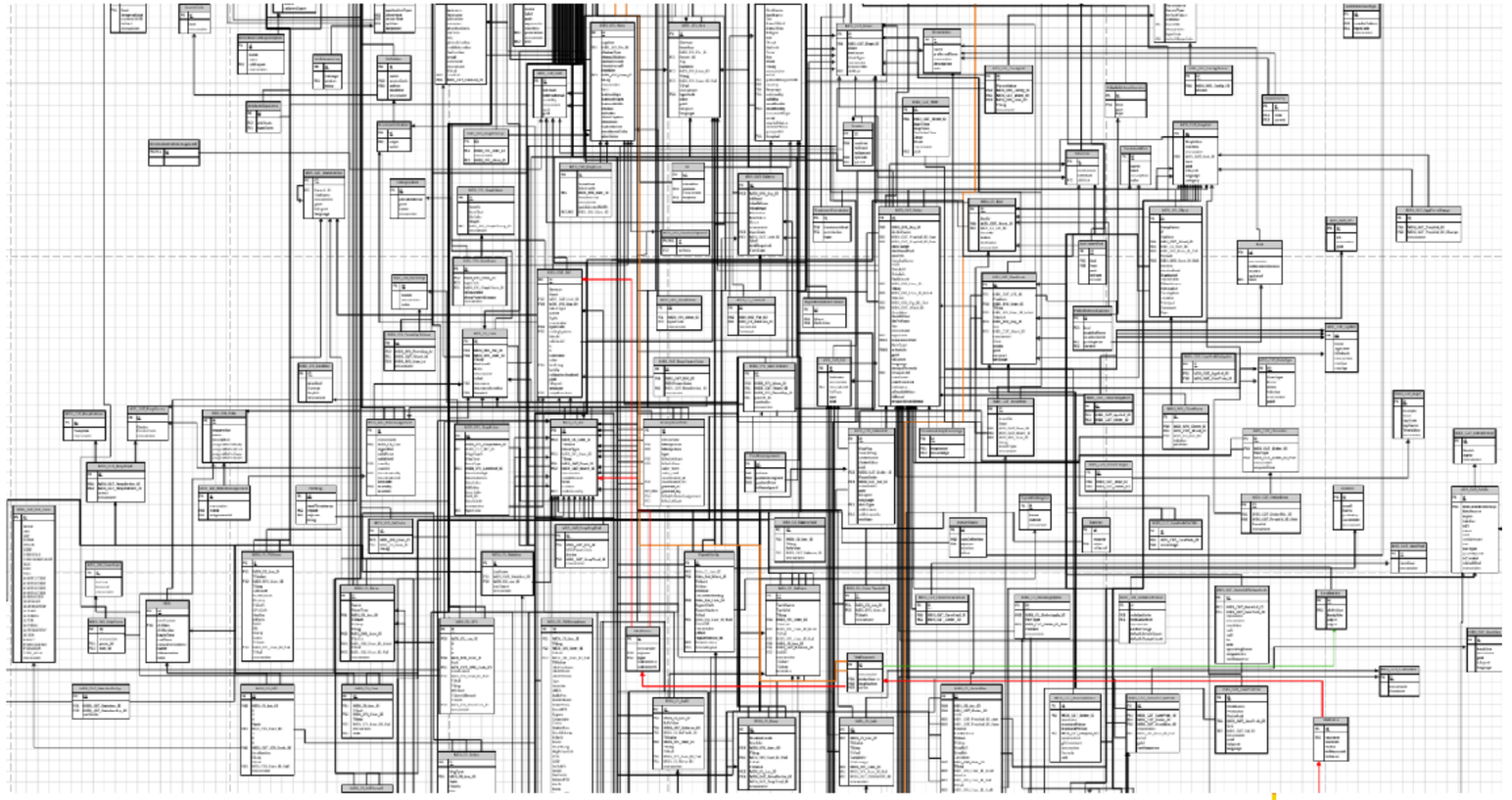
- Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification strategy.
- Enhance the NHS Wales Integration and Interaction Engine to provide a truly open platform for NHS Wales.
- Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles whilst progressing the programme as a whole.
- Make migrating the WCP to an open architecture the highest priority for the product in the next 12 months. This will need to address any impacts on the current work programme.

RDBMS - ‘so 20th century’?

openEHR

PDMS Database

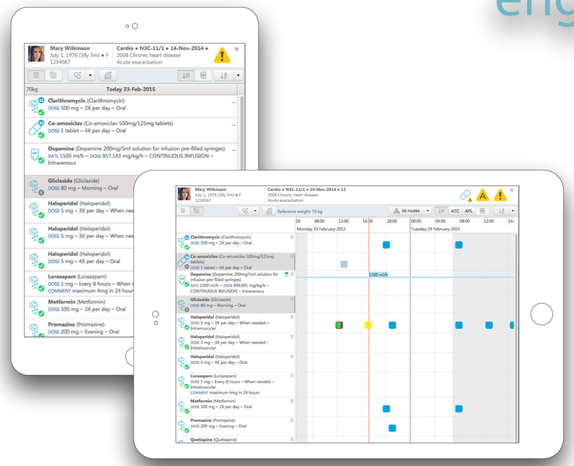
HiGHmed
Medical Informatics

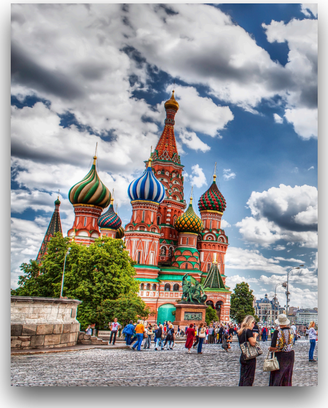


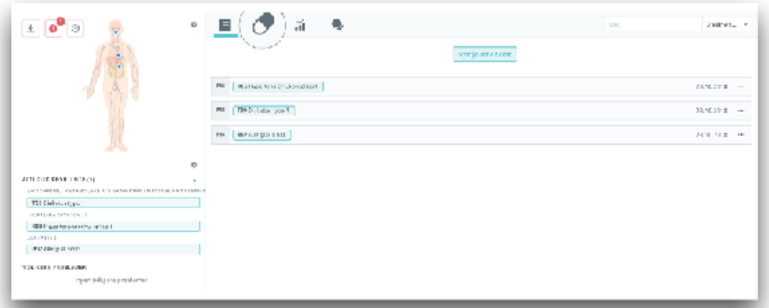
openEHR applications - at scale

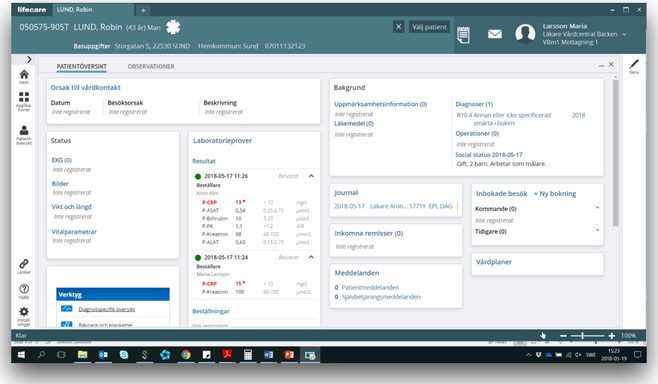
openEHR

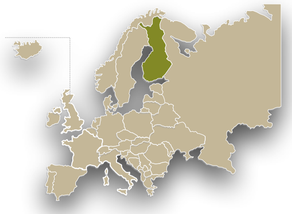
Genomics england

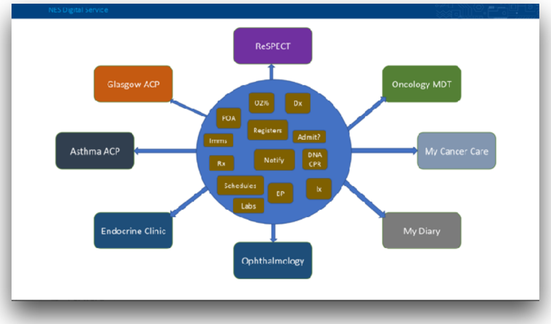












Covid-19

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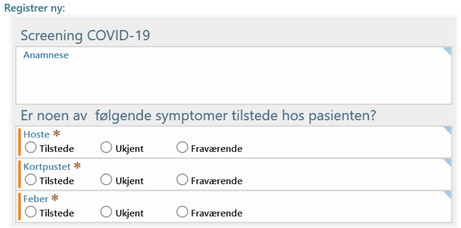

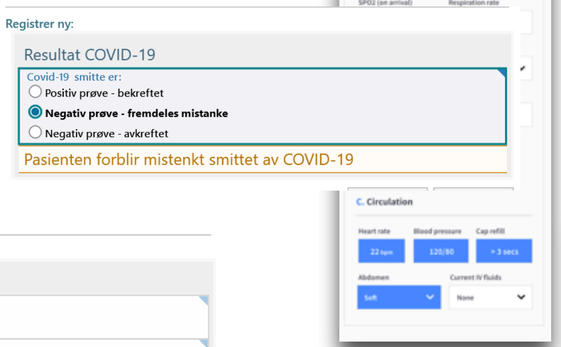

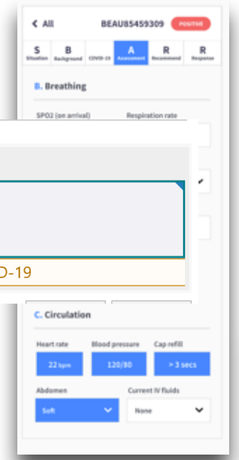

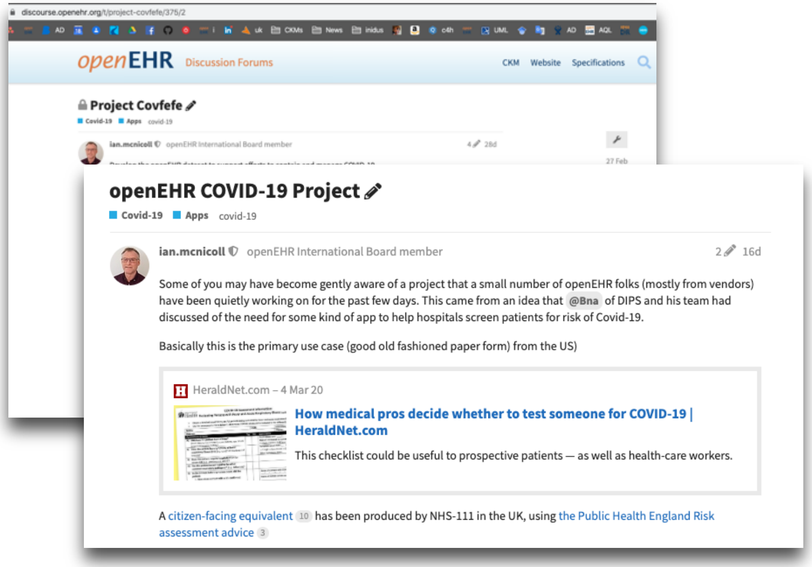

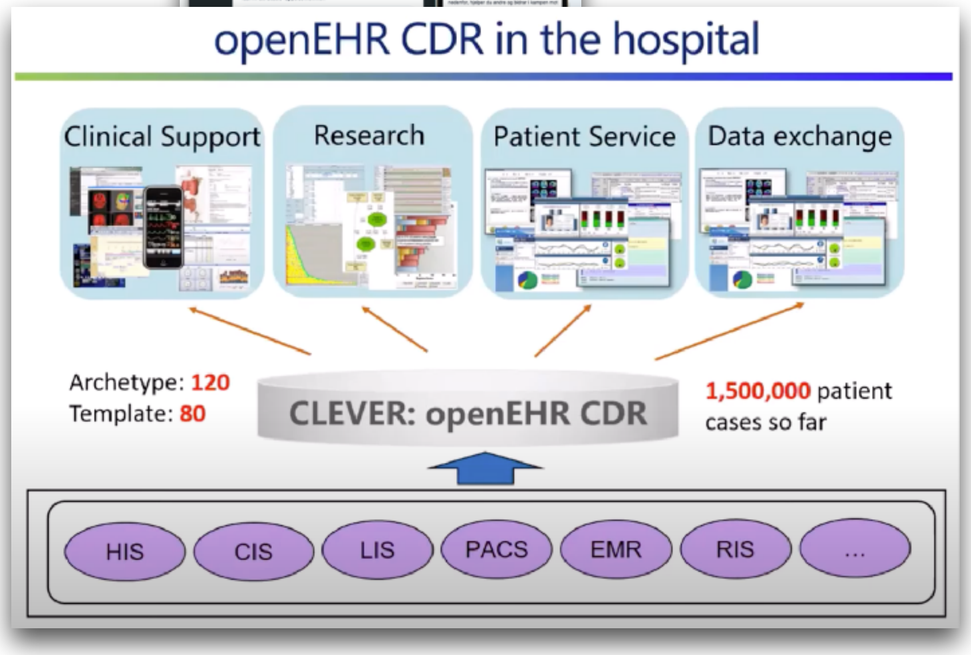

https://www.youtube.com/watch?v=oAzjHdiioDY&feature=youtu.be

EY - connected Health ecosystem

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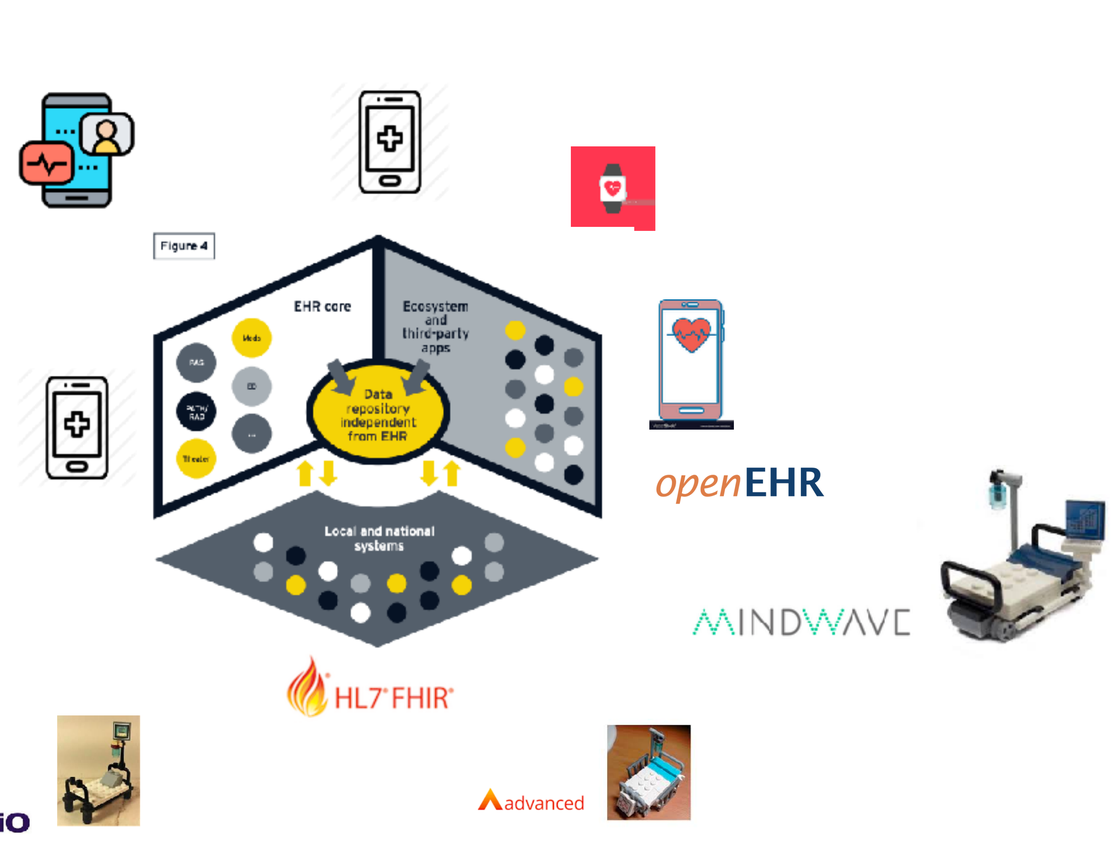

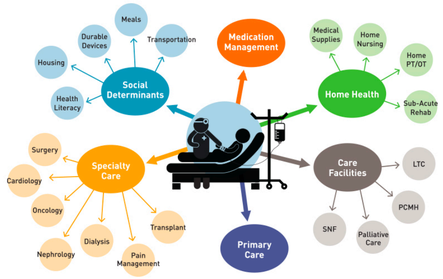

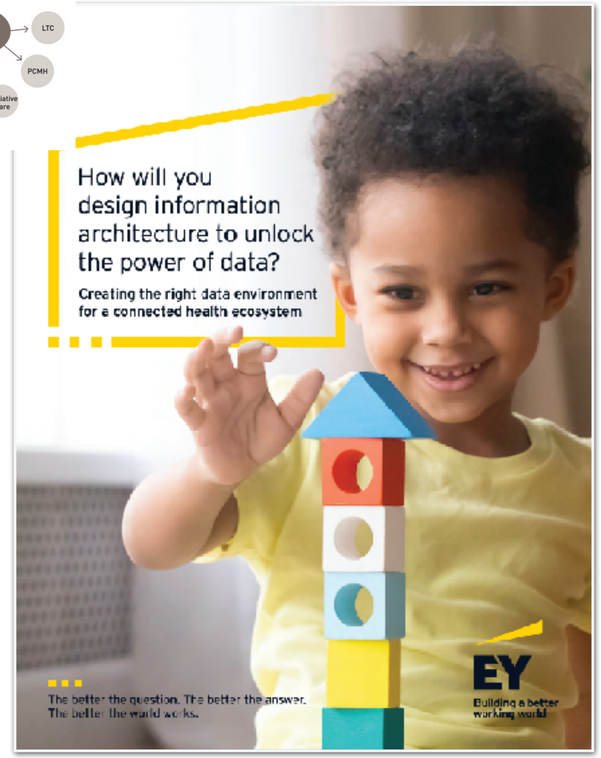

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Information models and Terminology -1

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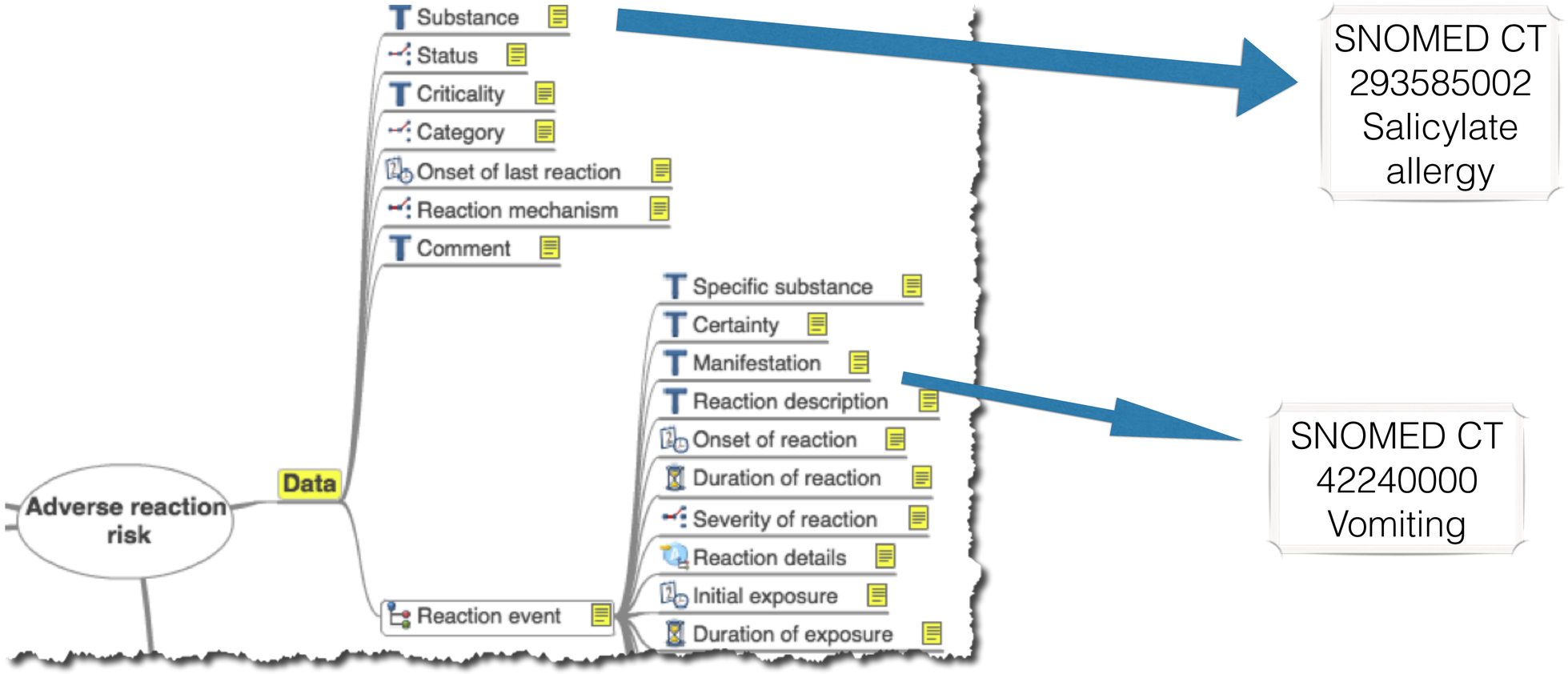

Information models and Terminology -2

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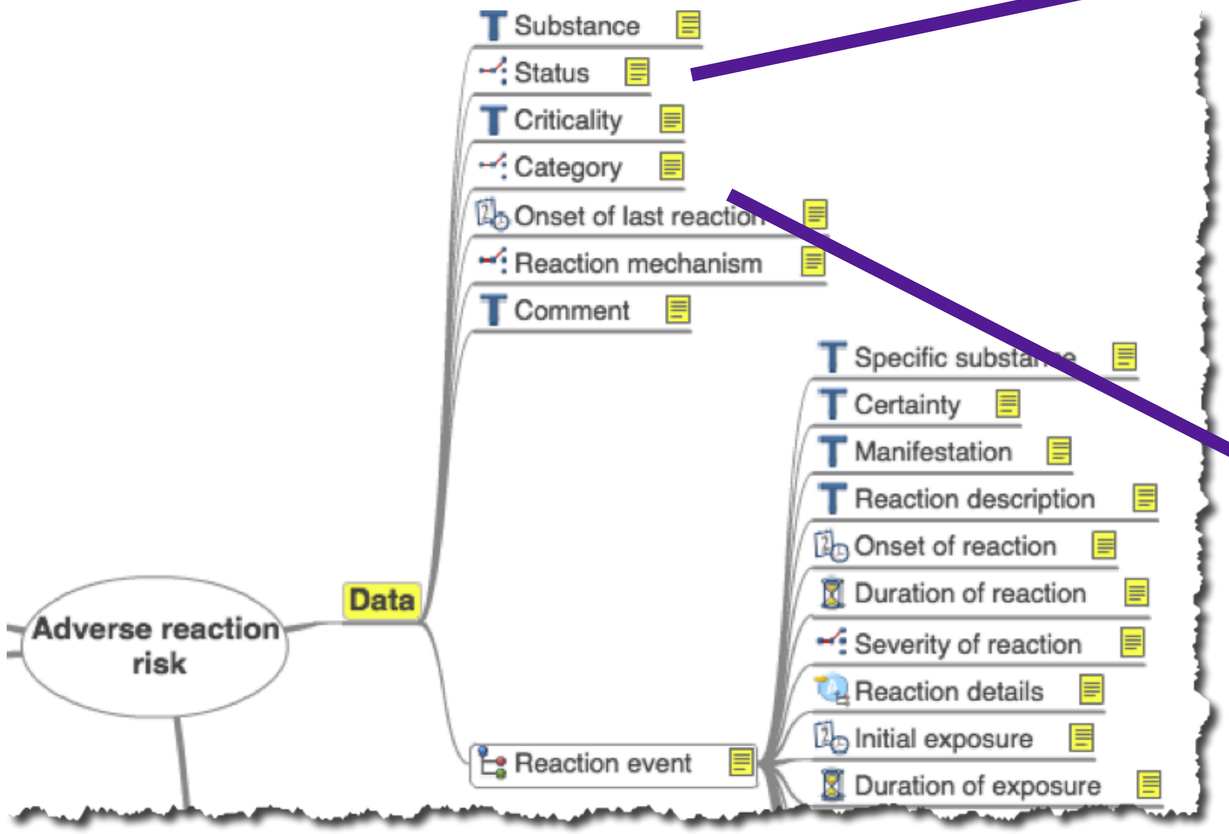


- **Suspected** [A low level of clinical certainty about the propensity of a reaction to the identified 'Substance'.]
- **Likely** [A reasonable level of certainty about the propensity for a reaction to the identified 'Substance'.]
- **Confirmed** [A high level of certainty about the propensity for a reaction to the identified 'Substance', which may include clinical evidence by testing or re-challenge.]
- **Resolved** [The previously known reaction to the identified 'Substance' has been clinically reassessed and considered no longer to be an active risk.]
- **Refuted** [The propensity for a reaction to the identified 'Substance' has been clinically reassessed or has been disproved with a high level of clinical certainty by re-exposure or deliberate challenge.]

- **Immune mediated** [Immune mediated reaction, including allergic reactions and hypersensitivities.]
- **Non-immune mediated** [A non-immune mediated reaction, which can include pseudo-allergic reactions, side effects, intolerances, drug toxicities (for example, to Gentamicin).]
- **Indeterminate** [The physiological mechanism could not be determined.]

Good use-cases for a reference terminology?

Querying - AQL and terminology

openEHR

POST localhost:8080/ehrbase/rest/openehr/v1/query/aql Send

200 OK 1.4 s 892 B

JSON Auth Query Header 2 Docs

```
{
"q": "select
a_a/data[at0002]/items[at0022]/value/defining_code/code_string as admin_gender,
e/ehr_id/value as ehr_id,
a/context/start_time/value as time,
a/composer/name as author

from EHR e contains COMPOSITION a contains EVALUATION a_a[openEHR-EHR-EVALUATION.gender.v1]

WHERE a_a/data[at0002]/items[at0022]/value/defining_code/code_string
matches{TERMINOLOGY('expand', 'org.hl7.fhir.r4','url=http://terminology.hl7.org/ValueSet/v2-0001')}"
}
```

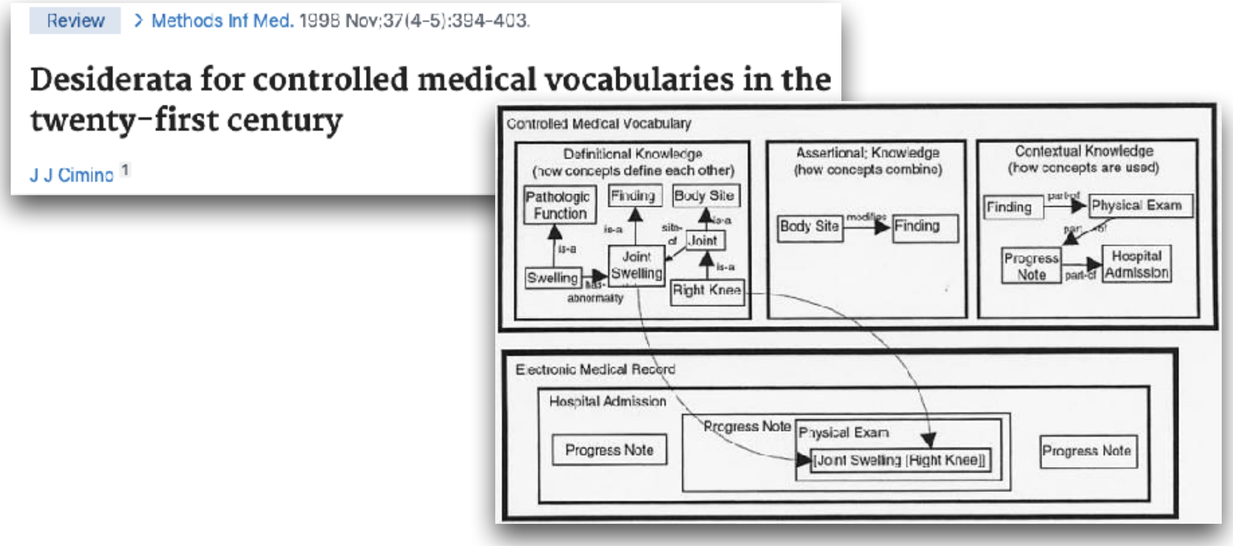
Preview Header 12 Cookie Timeline


```
{
  "q": "select  \na_a/data[at0002]/items[at0022]/value/defining_code/code_str
ehr_id,\na/context/start_time/value as time,\na/composer/name as author\n  \n
a_a[openEHR-EHR-EVALUATION.gender.v1] \n\nWHERE a_a/data[at0002]/items[at0022
\nmatches{TERMINOLOGY('expand', 'org.hl7.fhir.r4','url=http://terminology.hl7
  "columns": [
    {
      "path": "/data[at0002]/items[at0022]/value/defining_code/code_string",
      "name": "admin_gender"
    },
    {
      "path": "/ehr_id/value",
      "name": "ehr_id"
    },
    {
      "path": "/context/start_time/value",
      "name": "time"
    },
    {
      "path": "/composer/name",
      "name": "author"
    }
  ],
  "rows": [
    [
      "F",
      "3a92c98e-9e05-4d3b-a544-722ef3c84478",
      "2020-03-01T18:09:52.921+00:00",
      "Dr. Yamamoto"
    ],
    [
      "M",
      "3a92c98e-9e05-4d3b-a544-722ef3c84478",
      "2020-03-01T18:09:52.921+00:00",
      "Dr. Yamamoto"
    ]
  ]
}
```

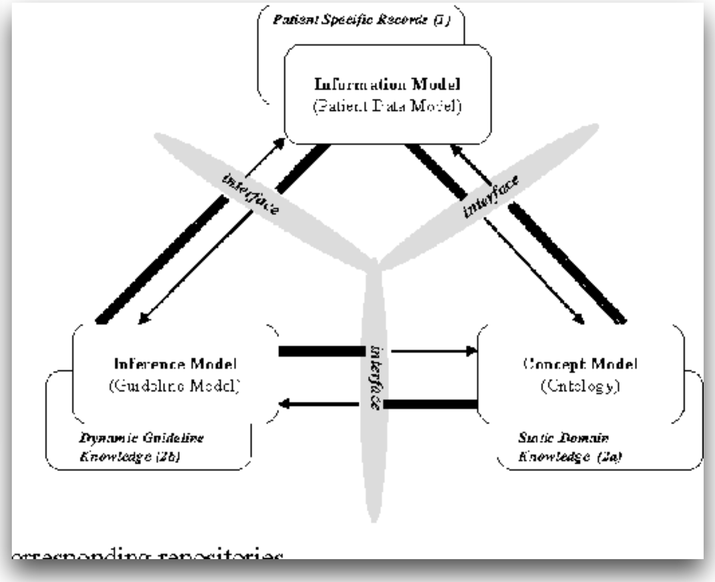

EHRbase

Why not ‘just’ terminology?

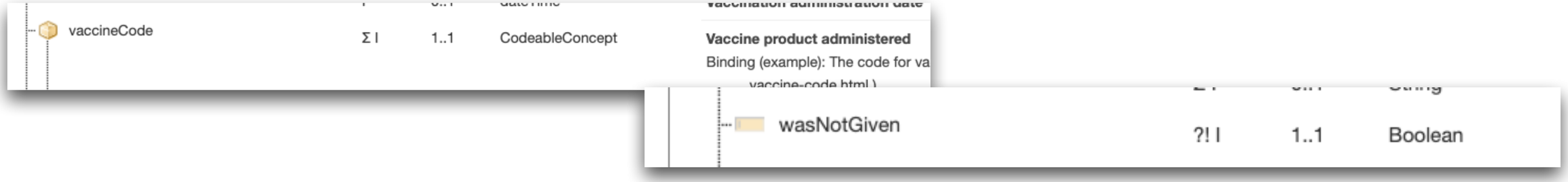
- “SNOMED CT is the lingua-franca of healthcare”
- “We need to build an ‘ontology’ of healthcare records”
- Ignores the importance (if only practically) of the information model in managing state and context.



Alan Rector :
https://slideplayer.com/slide/4781146/



Handling context / state



Carry ALL of the meaning in SNOMED CT

> Vaccination procedure = “61761000000109 | Second measles, mumps and rubella vaccination **not done** (situation) |”
> notGiven = “true”

Distribute meaning between information model and SNOMED CT

> Vaccination procedure = “170433008 | Measles mumps and rubella vaccination - second dose (procedure) |”
> notGiven = “true”
> resonNotGiven = "213257006 | Generally unwell (finding) |"

Next steps?

- SNOMED CT ‘free’ sets - more!!
  - Build on the IPS and COVID-19 free sets
  - Scales, Scores, ‘metadata’ ??
  - Lab analytes, histopathology findings ??

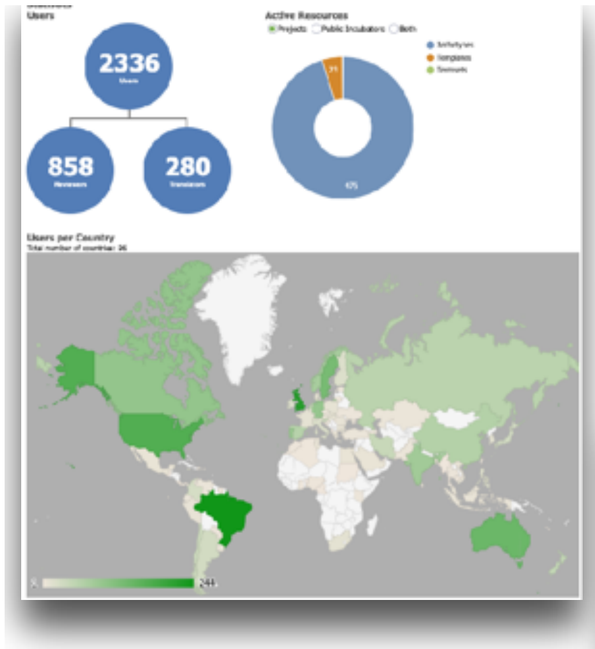
Next steps?

openEHR

- Education that terminology/ ontology cannot solve all of the issues in standardising health and care records - we need information models
- SNOMED CT+ FHIR + openEHR
- build on existing work e.g. FHIR Vital signs advice

openEHR International : openehr.org

openEHR



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