



**“Does the technology
live up to the hype?”**

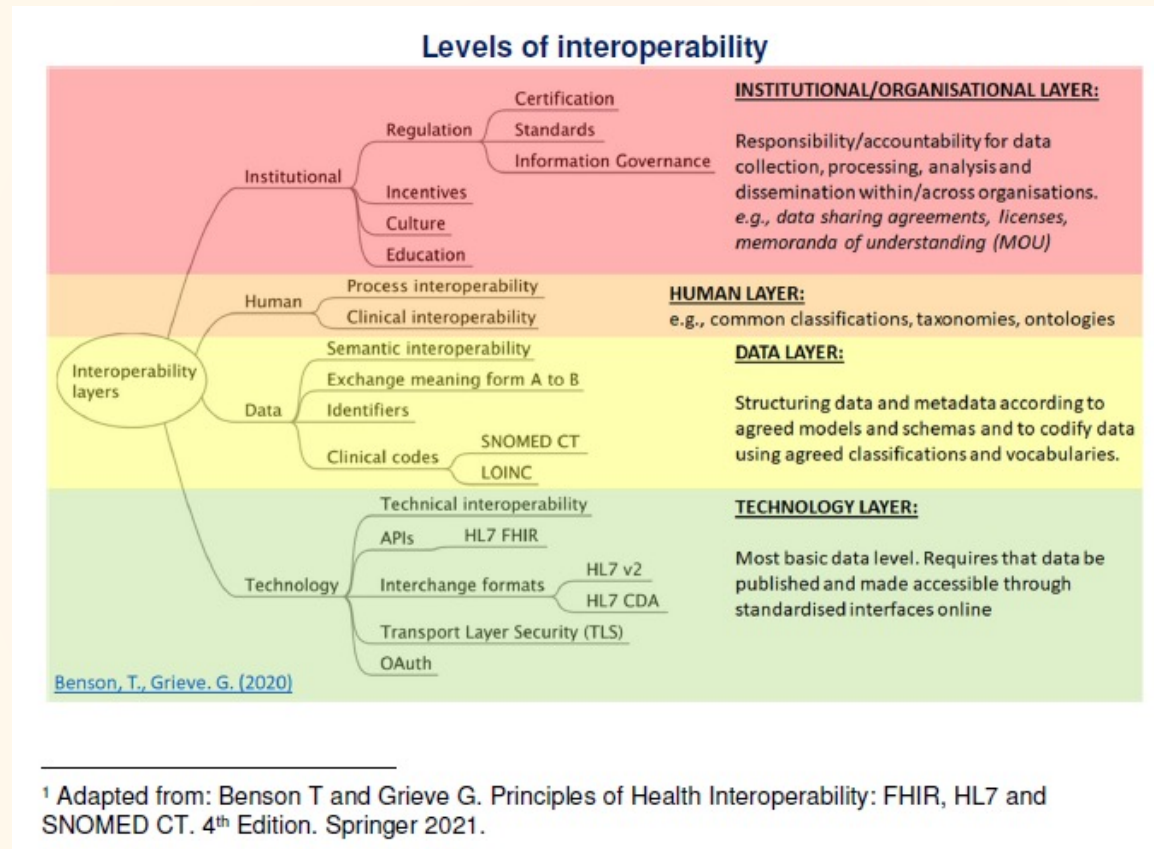




“Usable, useful and used...”



Interoperability



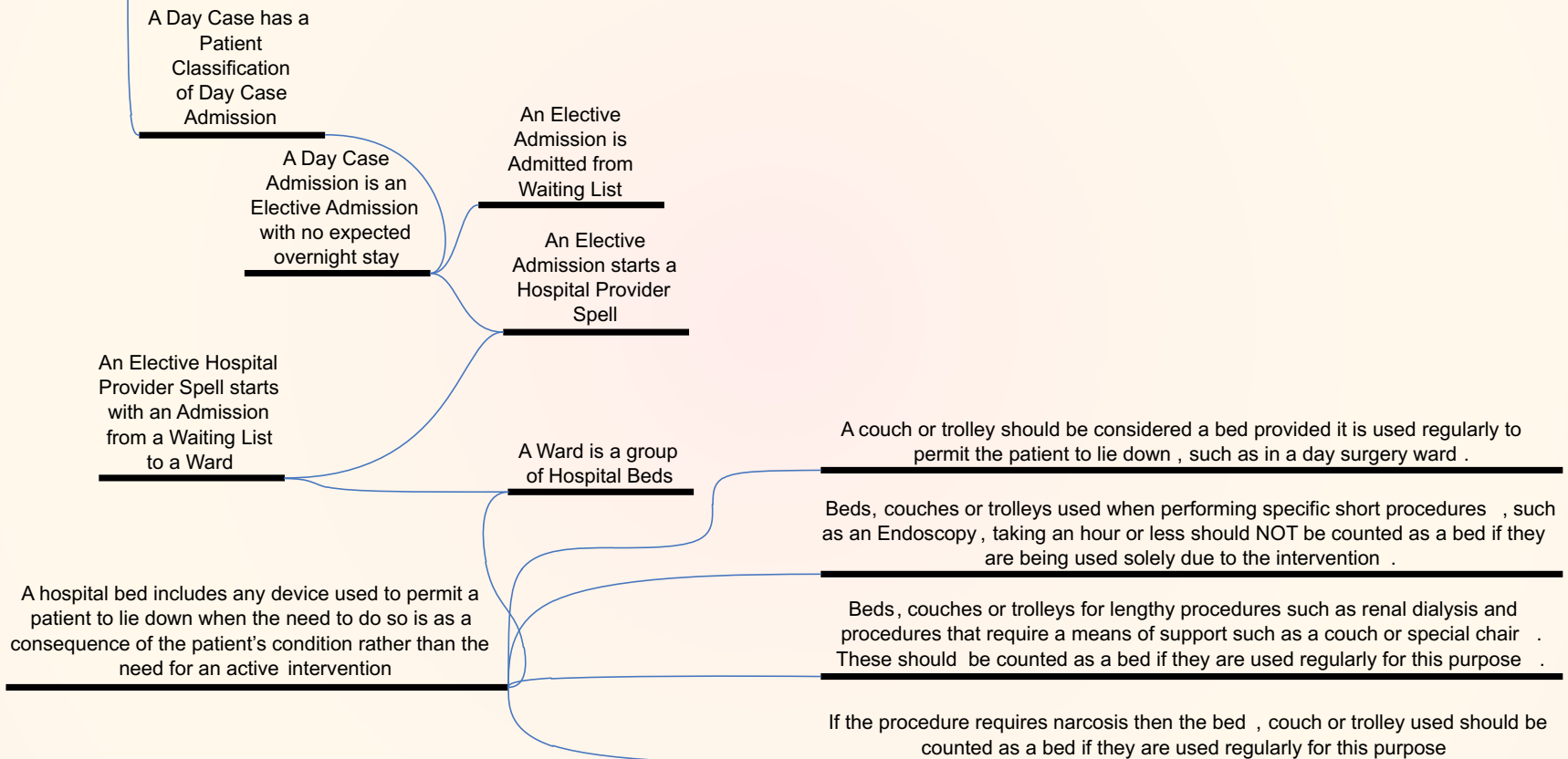
NHS Data Dictionary

- **Data model and dictionary demonstrations**
 - Components
 - Attributes
 - Classes
 - Data Elements
 - Data Sets

<https://www.datadictionary.nhs.uk/help/demonstrations.html>



What is a Day Case?



Standardisation & Clinical Coding

- **Standardisation**

- clinical workflows / orders / structured data entry tools
- UK PRSB documentation - <https://theprsb.org/standards/>

- **Coding**

- | | |
|-----------------------------------|-----------|
| • diagnoses / symptoms / problems | SNOMED CT |
| • drugs | dm+d |
| • operations / procedures | OPCS 4.10 |



Classification vs Terminology (I)

- **Classification**
 - System of arranging terms of a particular type into logical groups of 'like' entities
 - Structural framework for statistical information
 - Good for audit, business planning, epidemiology
- **ICD-10** International Classification of Disease
10th edition, overseen by WHO



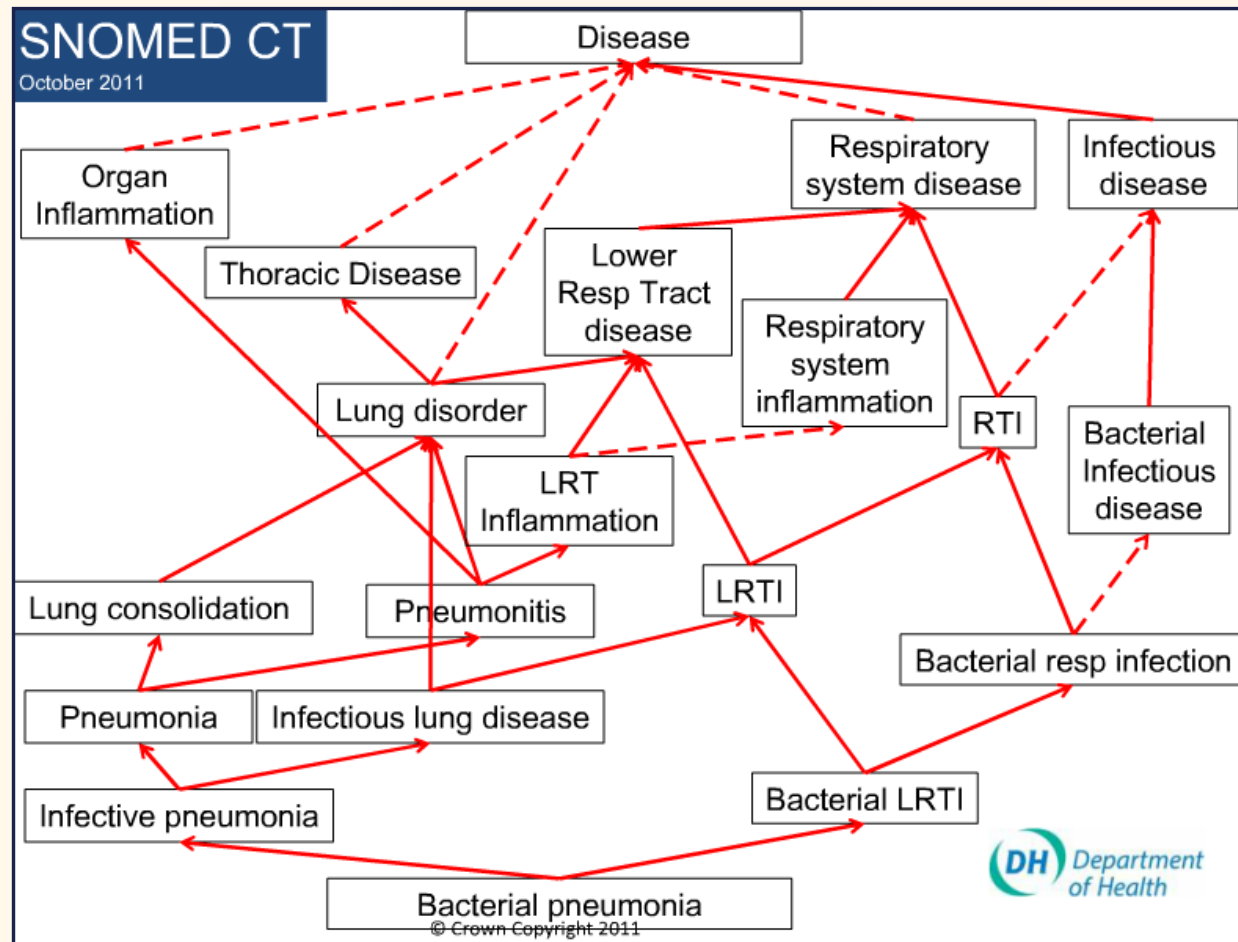
Classification vs Terminology (II)

- **Terminology**
 - Phrases used by an expert to record information
 - Organised as collections
 - Captures relationships and linkages between concepts
- **SNOMED-CT** Systematised Nomenclature of Medicine
Clinical Terms
arose from NHS & College of American
Pathologists
overseen by SNOMED International (IHTSDO)



SNOMED CT

October 2011



Classification: ICD-10

- “Struck by a turtle”
- Chapter XX
- V00-Y99 External causes of morbidity
- W50-W64 Exposure to animate mechanical forces
- W59 Contact with other non-venomous reptiles
- W59.2 Contact with turtles
- **W59.22 Struck by turtle**
 - W59.22XA initial encounter
 - W59.22XD subsequent encounter
 - W59.22XS sequela



Terminology: SNOMED CT

- “Bruised nose from a collision with an Asiatic box turtle”

60897004 | contusion of nose |

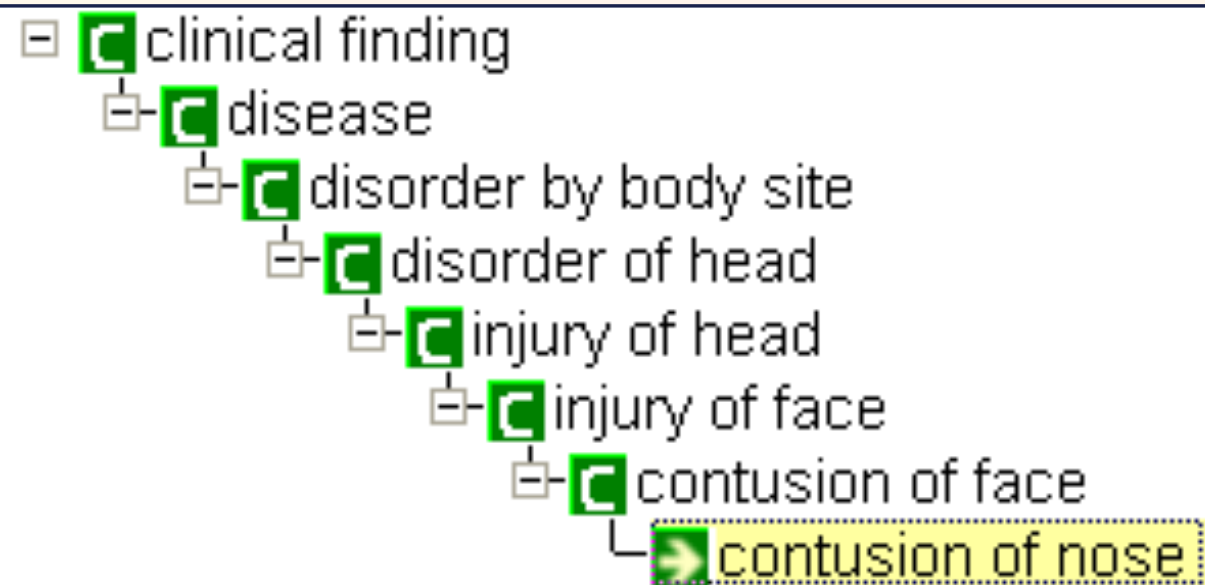
42752001 | due to |

217883006 | accidental collision with moving object |

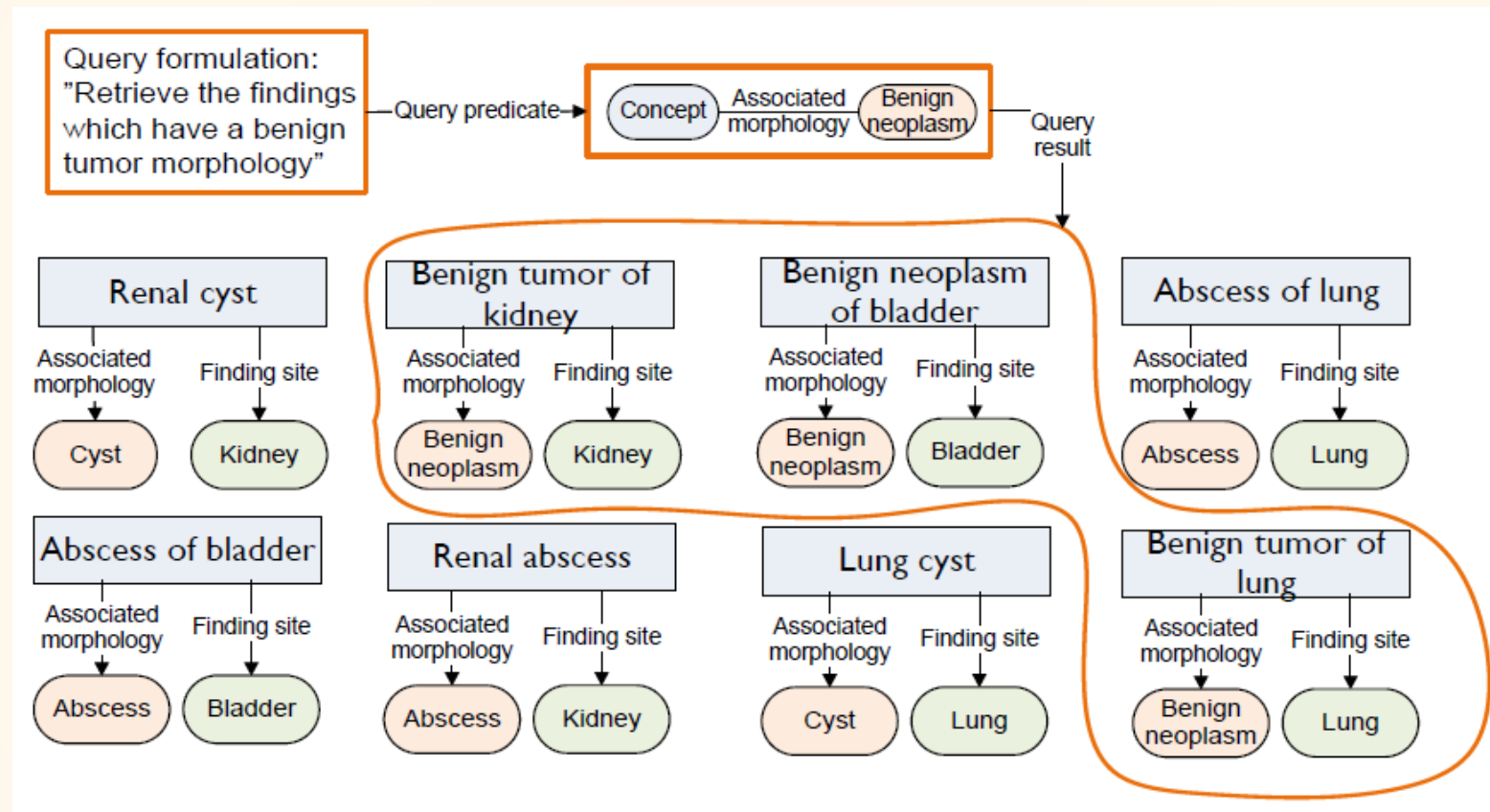
246075003 | causative agent |

31067007 | Asiatic box turtle |

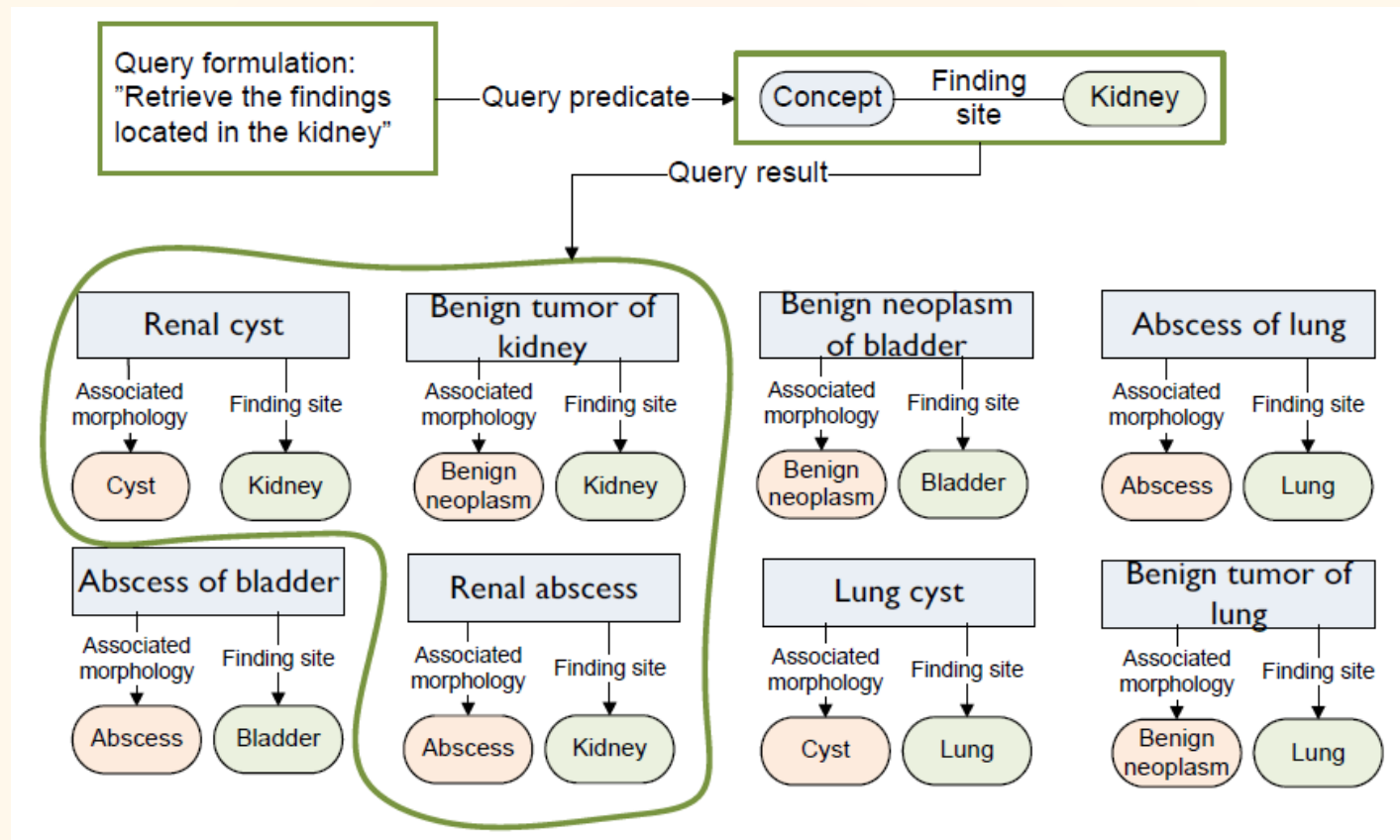




Records-based analysis (I)



Records-based analysis (II)





Professional
Record
Standards
Body

Better records
for better care

HOME [STANDARDS](#) ▾ [PROJECTS](#) ▾ [USING OUR STANDARDS](#) ▾ [NEWS](#) ▾ [ABOUT US](#) ▾

STANDARDS

CRISIS CARE SUMMARY
DIGITAL CARE AND SUPPORT PLAN
E-DISCHARGE SUMMARY
EMERGENCY CARE DISCHARGE
MENTAL HEALTH INPATIENT DISCHARGE
OUTPATIENT LETTERS
HEALTHY CHILD RECORD

PRSB STANDARDS

STRUCTURE AND CONTENT OF PATIENT RECORDS
STRUCTURE AND CONTENT OF AMBULANCE RECORDS

The PRSB develops national standards for the structure and content of health and social care records. These cover, for example, hospital referral letters, handover communications, discharge summaries, and inpatient and outpatient letters.

Our care record standards are widely accepted and endorsed across the UK.

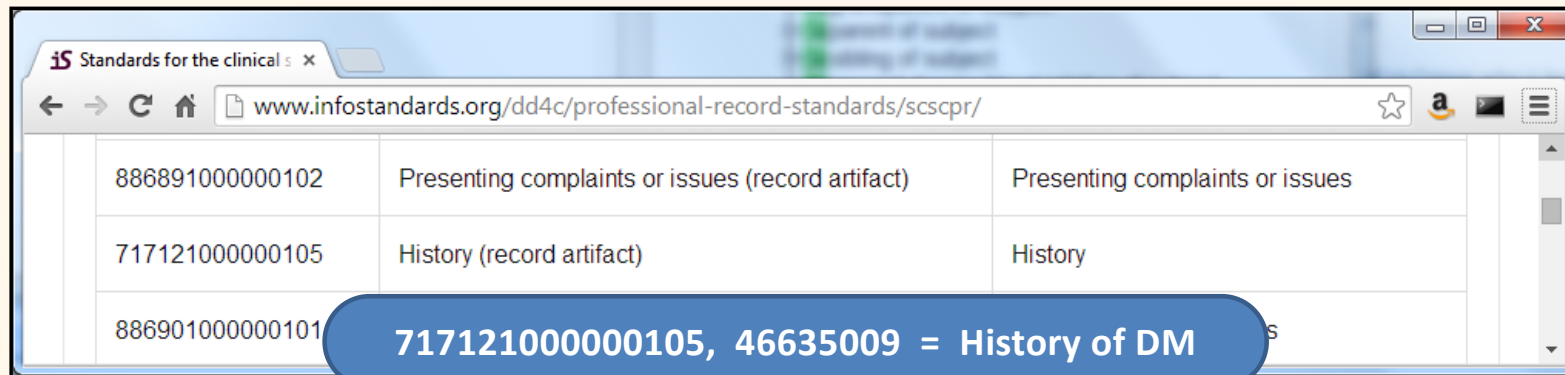


PRSB STANDARDS



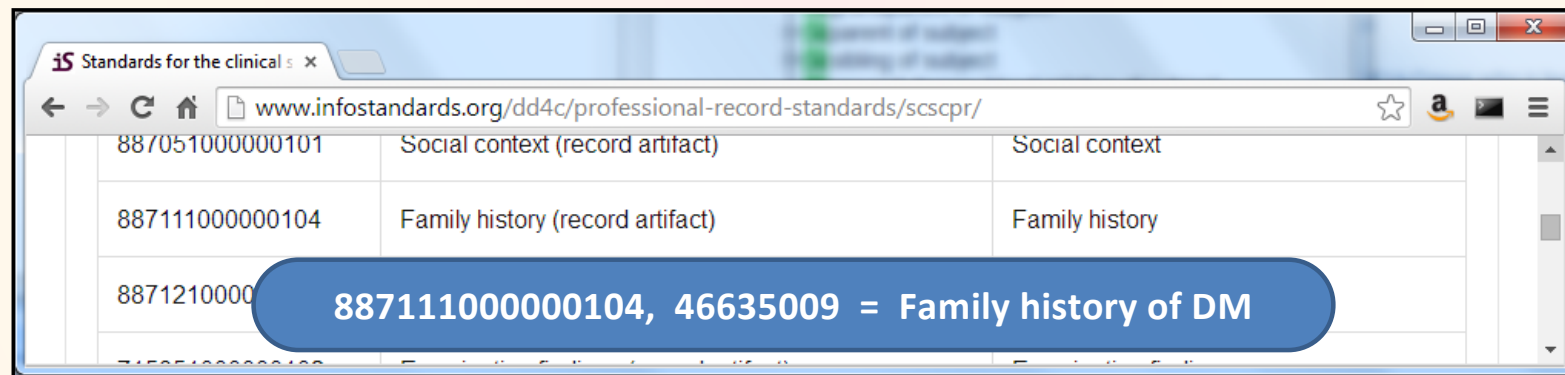
- [Digital care and support plan](#)
- [Healthy child record](#)

Messaging Constructs



717121000000105, 46635009 = History of DM

886891000000102	Presenting complaints or issues (record artifact)	Presenting complaints or issues
717121000000105	History (record artifact)	History
886901000000101		



887111000000104, 46635009 = Family history of DM

887051000000101	Social context (record artifact)	Social context
887111000000104	Family history (record artifact)	Family history
887121000000105		

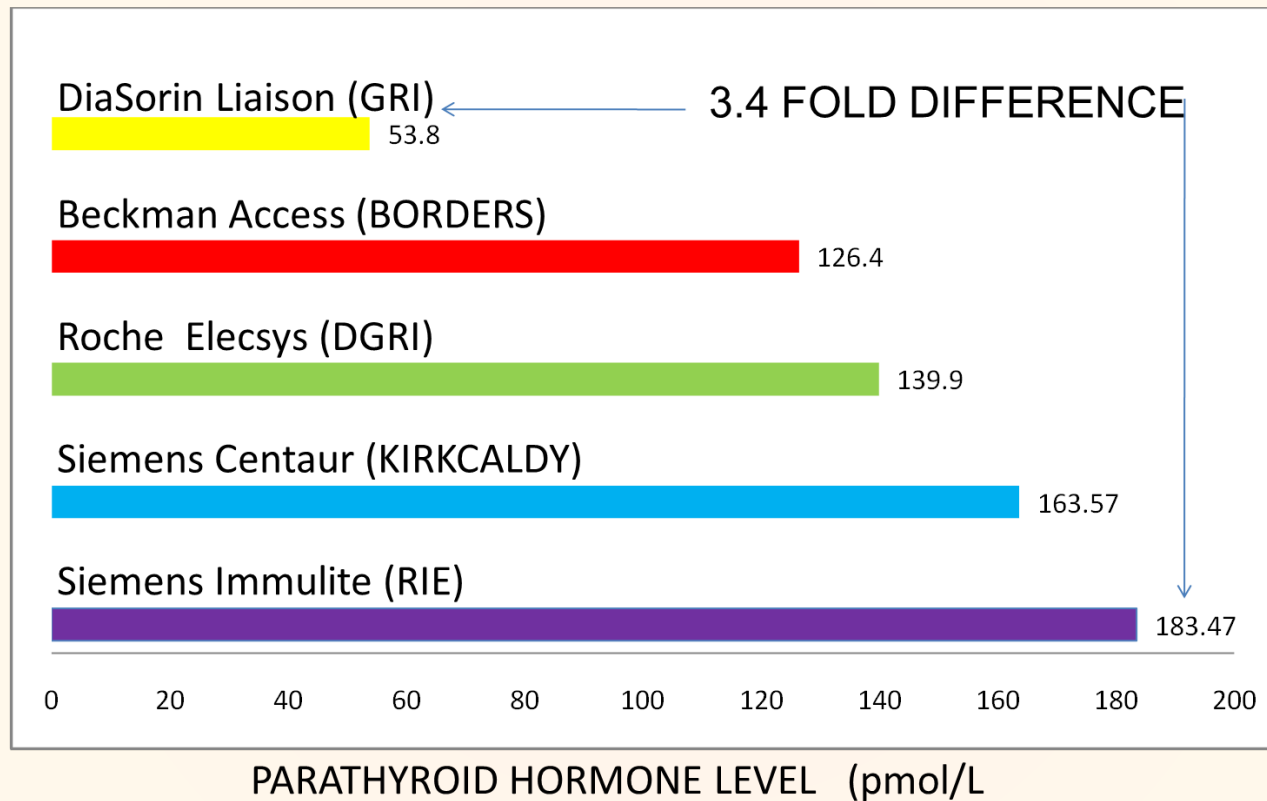


Laboratory

- **Which assay? Which units etc....?**
- **September 23, 1999**
 - Mars orbiter spacecraft was lost
 - 286-day journey
 - \$327.6 million project cost
 - Incorrect units used in the thruster calculations
 - Lockheed Martin sent data in Imperial units (pounds)
 - NASA was expecting metric units (Newtons)



ONE PATIENT – 5 LABORATORIES



DAPB4017: Pathology Test and Results Standard (RETIRED)

DAPB4101: Pathology and Laboratory Medicine Reporting Information Standard

About this information standard

This information standard comprises 3 inter-related specifications, aligned with clinical, commissioning and patient needs, to:

- help standardise information exchanged between clinical pathology laboratories and laboratory information systems
- enable the sharing of pathology results across the NHS, and across care settings and organisational boundaries.

These specifications are:

1. **Unified Test List (UTL)** - a national catalogue of pathology test requests and results, using SNOMED CT
2. **Units of Measures (UoM)** - a national set of standardised units of measure, using The Unified Code for Units of Measure (UCUM), aligned with the UTL and HL7 FHIR
3. **Message Specification** - a message specification, using Health Level 7 (HL7) Fast Healthcare Interoperability Resources (FHIR).





API platform

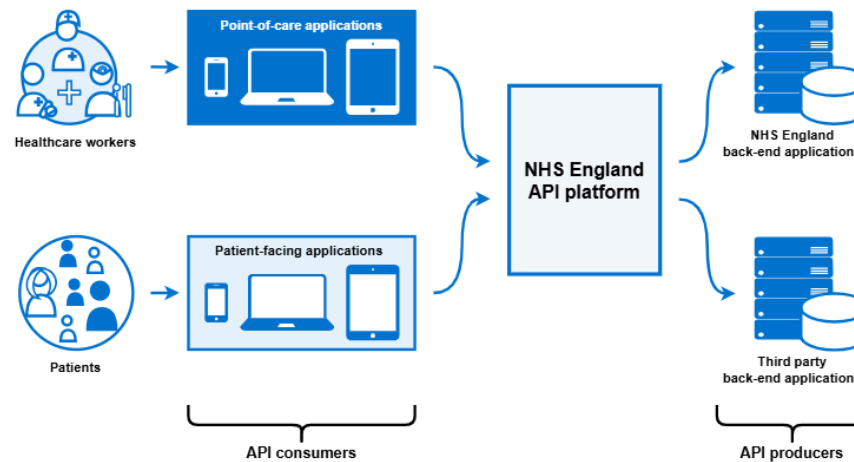
The NHS England API platform is a 'front door' for health and care APIs, primarily for the NHS in England.



Page contents

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- [Who the service is for](#)
- [National usage policy](#)
- [How this service works for API producers](#)
- [Status, service level and current usage](#)
- [Examples of use](#)
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About this service



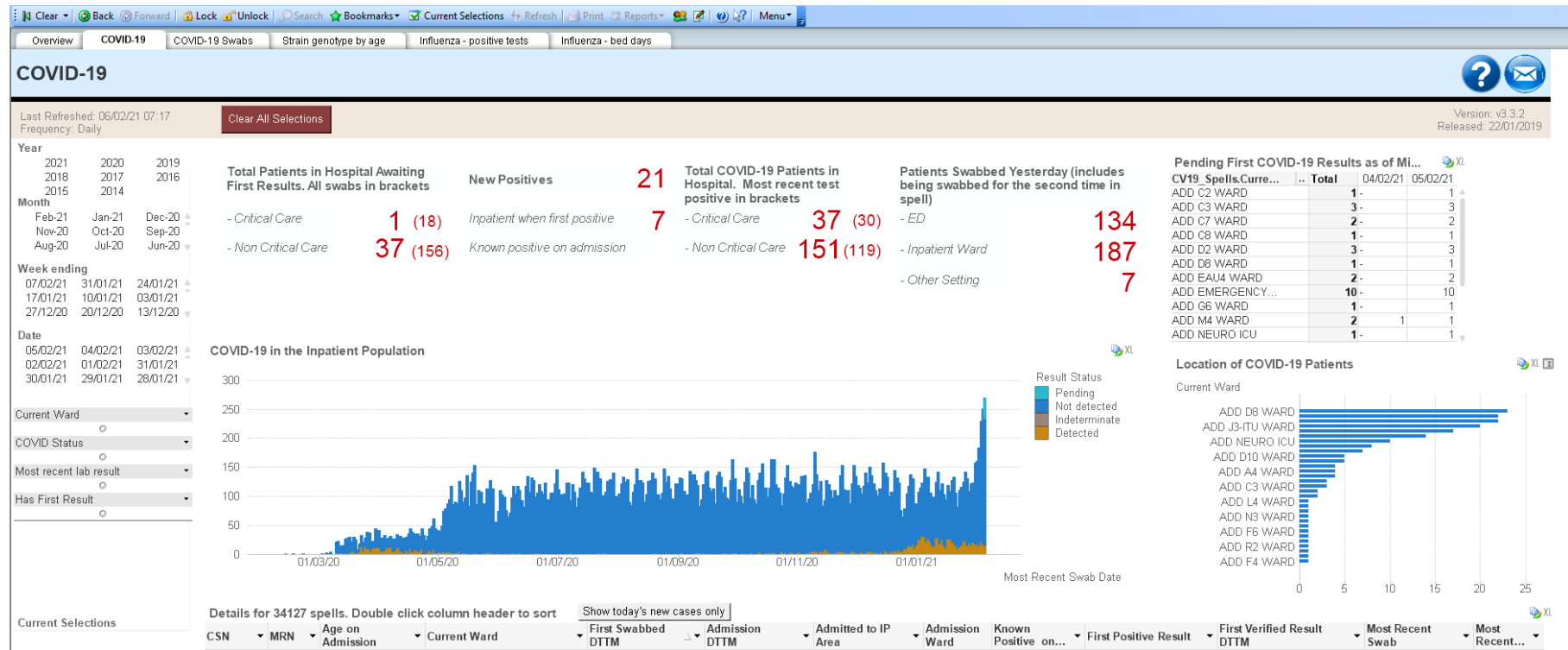
The NHS England API platform is the centralised hub for building, hosting, and securely accessing APIs to integrate with all digital services within the NHS ecosystem.



Real life...



Operational Analysis - Internal



Transforming the future...

Operational Analysis - External

Healthcare delivery, economics and global health



ORIGINAL RESEARCH

Monitoring indirect impact of COVID-19 pandemic on services for cardiovascular diseases in the UK

Simon Ball,^{1,2} Amitava Banerjee ,^{3,4,5} Colin Berry ,^{6,7} Jonathan R Boyle,^{8,9} Benjamin Bray,¹⁰ William Bradlow,¹¹ Afzal Chaudhry,¹² Rikki Crawley,¹³ John Danesh,^{8,12} Alastair Denniston,^{1,2} Florian Falter,¹⁴ Jonine D Figueroa,¹⁵ Christopher Hall,¹⁶ Harry Hemingway ,^{3,5} Emily Jefferson,^{17,18} Tom Johnson,¹⁹ Graham King,²⁰ Kuan Ken Lee ,²¹ Paul McKean,²⁰ Suzanne Mason,^{22,23} Nicholas L Mills ,^{15,18,24} Ewen Pearson,^{17,18} Munir Pirmohamed,^{22,25} Michael T C Poon ,^{15,26} Rouven Priedon,²⁷ Anoop Shah,²⁸ Reecha Sofat,^{4,29} Jonathan A C Sterne,³⁰ Fiona E Strachan,³¹ Cathie L M Sudlow,^{15,18,27} Zsolt Szarka,¹⁶ William Whiteley,³² Michael Wyatt,¹⁹ CVD-COVID-UK Consortium

Records-based Analysis (III)

Identifying undiagnosed primary immunodeficiency diseases in minority subjects by using computer sorting of diagnosis codes

Charlotte Cunningham-Rundles, MD, PhD,^a Peter Sidi, MA,^b
Lissette Estrella, RN, PNP,^a and John Doucette, PhD^c *New York, NY*

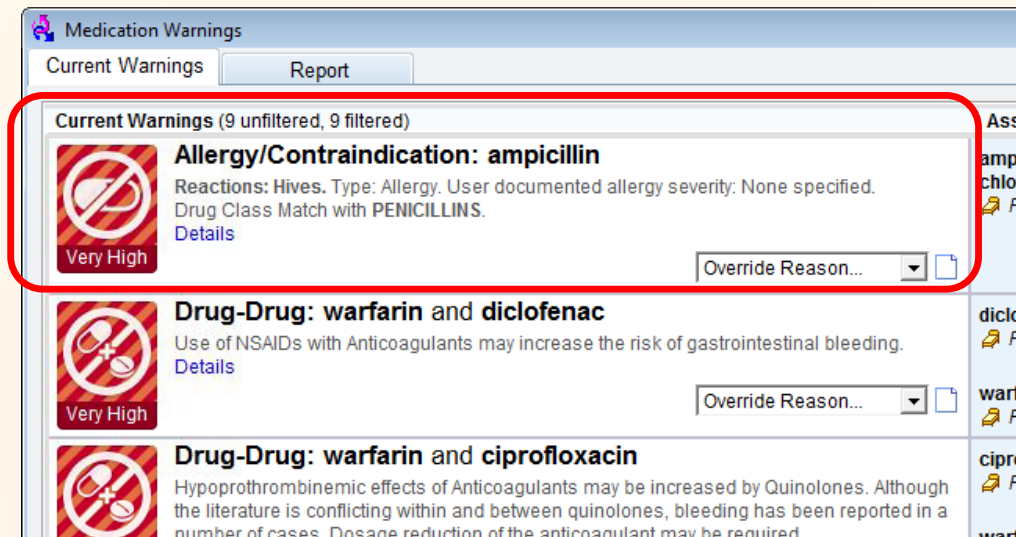
- Routine diagnoses, each attributed 1-3 points
- 6+ points = possible undiagnosed immunodeficiency

J Allerg Clin Immunol 2014

Records-based Analysis (IV)

- 40 diagnoses with SNOMED CT codes
- 2.1 million patient records scanned: 1 Jan 2015 - 31 Dec 2017
- 16,085 patients had one or more diagnoses
- 842 with a score of 6 or higher
- 92 with a score of 9 or higher

Decision Support (I)



- 16% of allergy-related alerts lead to a change in prescription
- 850+ significant adverse medication reactions prevented (at least 2,500 bed days & £1m saved per year)

(c) Epic Systems Corporation 2026

Records-based Analysis - ML (I)

Big Data Analysis of Electronic Health Records: Clinically interpretable representations of older adult inpatient trajectories using time-series numerical data and Hidden Markov Models

 Maria Herrero-Zazo,  Tomas Fitzgerald, Vince Taylor, Helen Street,  Afzal N Chaudhry,  John Bradley,
 Ewan Birney,  Victoria L Keevil

doi: <https://doi.org/10.1101/2021.06.18.21258885>

- Capability of generative models to extract biological signals from routine clinical data to represent interpretable patients' trajectories

Records-based Analysis - ML (II)

- **Hidden Markov Models**
 - unsupervised models
 - represent each day of admission as of 1 of 17 'states'
 - visual clinical interpretation showed differences between those who died and those who were discharged
 - all states had features allowing clinical interpretation and differentiation

THE UK EPIC COMMUNITY

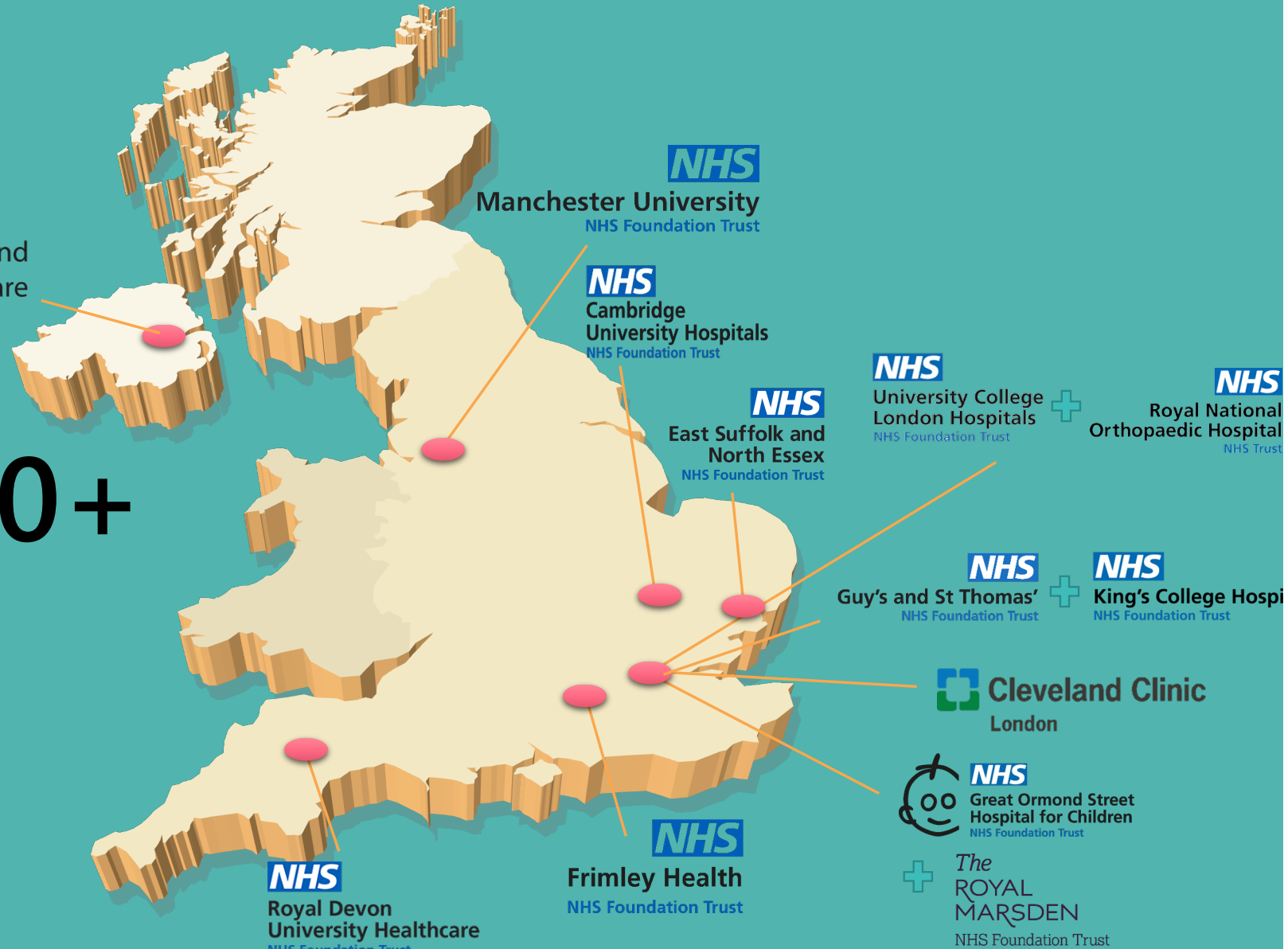


1,000,000+

patient records exchanged
monthly

60+%

of exchanges are with
other vendors





But...



Data Structures & Definitions

Review of the Organ Donor Register

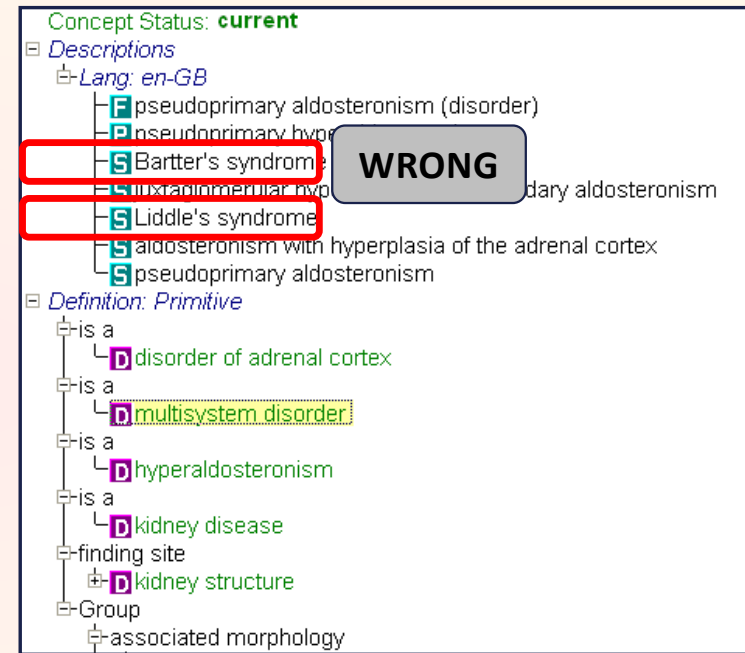
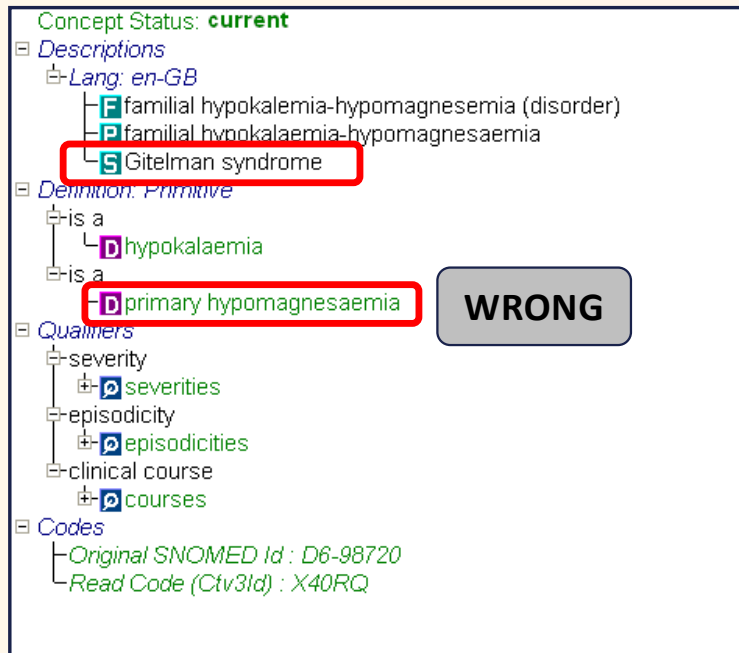
*Report to the Secretary of State for Health by
Professor Sir Gordon Duff
FRCP, FMedSci, FRSE*

Table 3. Transposition between the DVLA record and the ODR (1999)

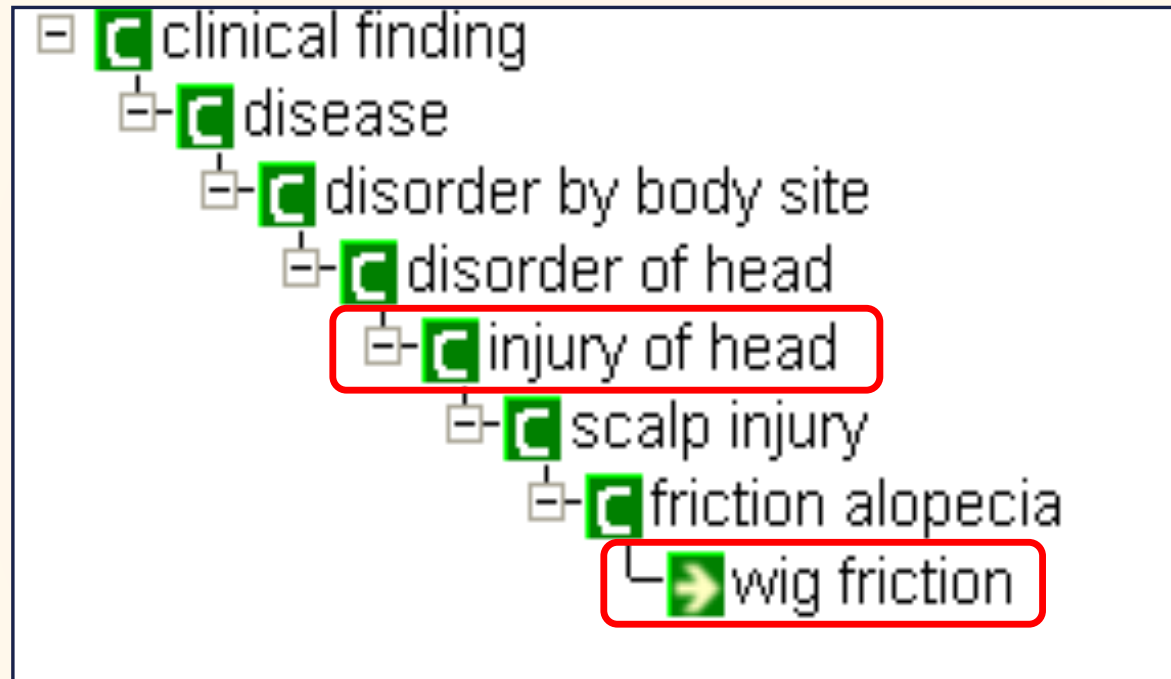
DVLA Consent to donate	Recorded on ODR
All organs	All organs
Kidney	Kidney
Cornea	Heart
Heart	Liver
Lungs	Cornea
Liver	Lungs
Pancreas	Pancreas



Quality Control



Semantic Control



Is this true? Yes & No



Challenges - Qualifiers

- **Emergency Care Dataset**
 - requirement to record a diagnosis for all attendees
 - necessary to indicate if a diagnosis is confirmed or suspected
 - relates to pathological uncertainty, not diagnostic uncertainty



Challenges - Qualifiers

- ECDS review by ISAS 2016
 - **No professionally agreed standard** for consistently recording the uncertainty of a diagnostic statement
 - **No agreed standard for ensuring technical interoperability** of SNOMED CT qualified statements
 - The **proposed solution** of adding the qualifier **did not conform** to current SNOMED CT modelling of attributes and values
 - GP systems cannot accept SNOMED CT concepts which utilise qualifiers and so **semantic interoperability cannot be supported**





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