

How to *openEHR*

A technical approach towards building
the lifelong patient-centric EHR

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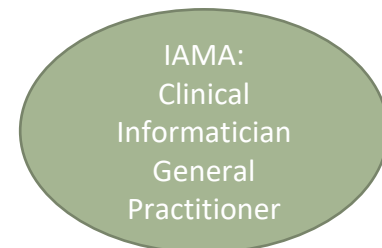
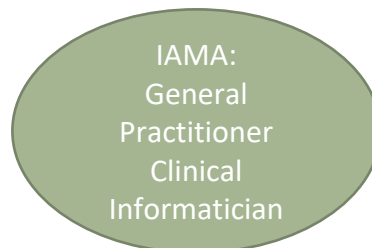
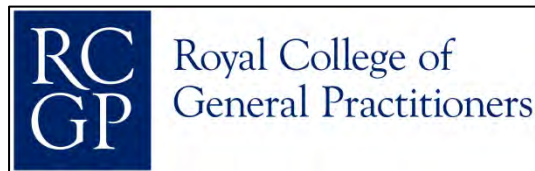
Clinical Lead, NHS Education for Scotland Technology Service

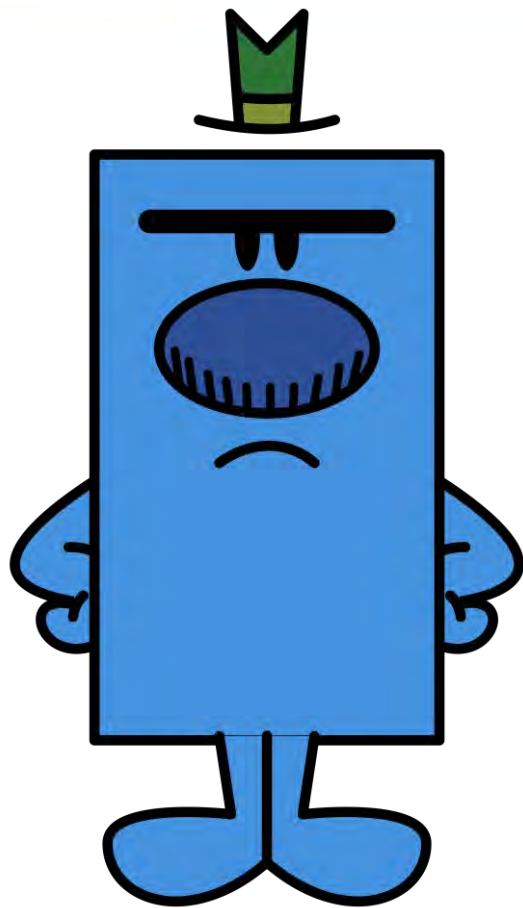
Why?

Medical records fit for the 21st
Century

Dr Paul Miller
Clinical Lead, NES Technology Service







MR. GRUÑÓN

Event	Date
MUMPS	1966
Cerner founded	1979
Epic founded	1979
Intersystems	1978
IBM PC	1981
Apple Lisa	1982
TCP/IP	1982
MS Windows	1985
WWW	1989
Linux	1992
Netscape	1994

Epic Systems Corporation



Type	Private
Industry	Information Technology Health Informatics
Founded	Madison, Wisconsin, United States (1979) ^[1]
Founder	Judith Faulkner
Headquarters	Verona, Wisconsin, United States
Key people	Judith Faulkner, Founder & CEO Carl Dvorak, President
Revenue	\$2.9 billion (2018) ^[2]
Number of employees	10,000 (2019) ^[3]
Website	epic.com

https://en.wikipedia.org/wiki/Epic_Systems

InterSystems



Type	Private
Industry	software
Founded	1978
Founder	Phillip (Terry) Ragon
Headquarters	Cambridge, Massachusetts
Key people	Phillip (Terry) Ragon, Founder and CEO
Products	InterSystems IRIS InterSystems IRIS for Health Caché Ensemble DeepSee HealthShare TrakCare GlobalsDB
Revenue	\$770 million (FY2020)
Website	www.intersystems.com

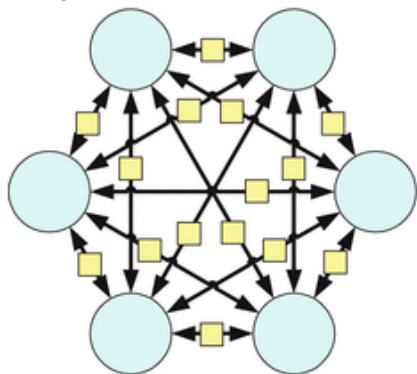
<https://en.wikipedia.org/wiki/InterSystems>

Cerner Corporation

Cerner World Headquarters in North Kansas

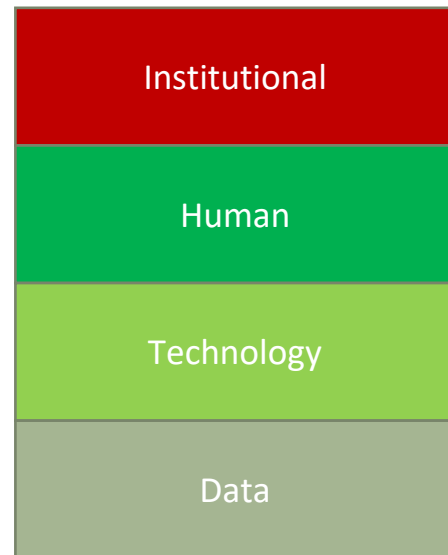
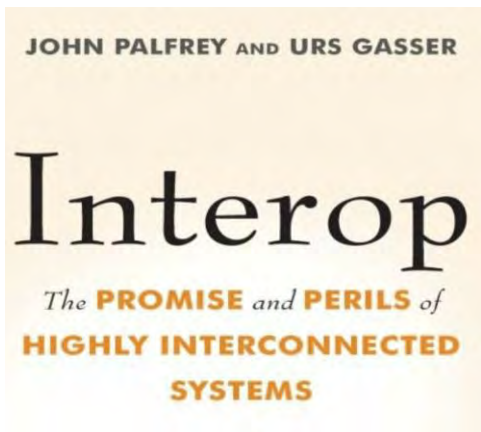
Type	City, Missouri
Traded as	Subsidiary
Industry	Nasdaq: CERN
Founded	Health Care
Founders	Information Technology
Headquarters	1979, 44 years ago
Key people	Neal Patterson
Products	Paul Globe
Revenue	Clif Ilig
	Kansas City, Missouri, U.S.
	David Feinberg (President and CEO) ^[1]
	Health informatics software
	▼ US\$5.505 billion (2020)

<https://en.wikipedia.org/wiki/Cerner>



$$(n(n-1)/2)$$

Principles of Health Interoperability, Tim Benson & Grahame Grieve, 3rd Ed.



Interoperability.

Typically, people associate this term with API's or ETL's that move data between systems to support the needs of one or more applications. However, healthcare organisations have been wrestling with this idea of

interoperability for years, which is understandable — stitching together an entire healthcare system in this way with 100's of applications is highly complex and challenging.

<https://medium.com/@alastairallen/why-openehr-is-eating-healthcare-e28bd792c50c>

Interoperability

*a fabled Nirvana in which today's sewers of **recalcitrant proprietary data** are magically **transformed into a sea of pure Evian™** whose meaningful molecules will be 'understood' by drooling **next generation apps** that will instantly discover what is wrong with each of us, and **tell us how to fix it.***

*This Nirvana will **never be reached by the current methods.***

<https://wolandscat.net/2018/07/21/why-the-platform-will-replace-todays-interoperability-standards-in-healthcare/>

The Emperor's New Clothes

🌐 45 languages ▾

Article [Talk](#)

Read [Edit](#) [View history](#) [Tools](#) ▾

From Wikipedia, the free encyclopedia

This article is about the story by Hans Christian Andersen. For other uses, see [The Emperor's New Clothes \(disambiguation\)](#).

Not to be confused with [The Emperor Wears No Clothes](#).

"The Emperor's New Clothes" (Danish: *Kejserens nye klæder* [ˈkʰɑjsəns ˈnyʔə ˈkʰlɛːɐ̯]) is a literary [folktale](#) written by Danish author [Hans Christian Andersen](#), about a vain [emperor](#) who gets exposed before his subjects. The tale has been translated into over 100 languages.^[1]

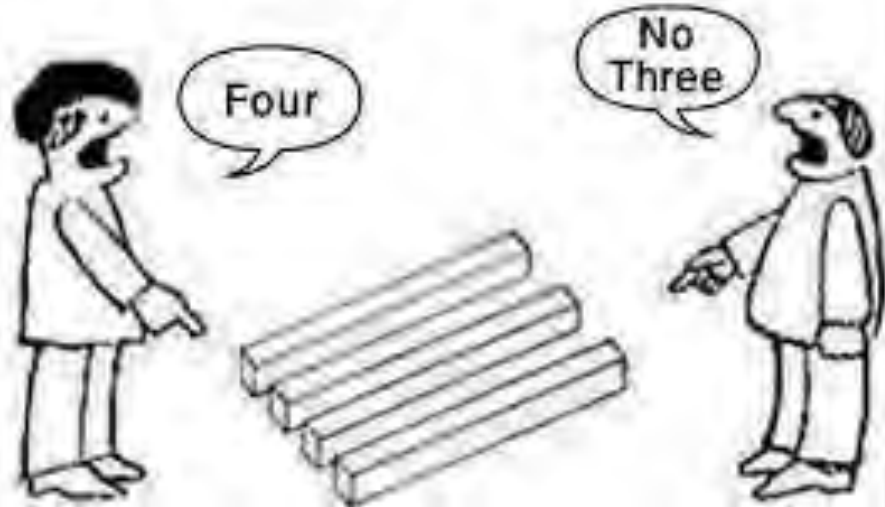
"The Emperor's New Clothes" was first published with "[The Little Mermaid](#)" in [Copenhagen](#), Denmark, by C. A. Reitzel, on 7 April 1837, as the third and final installment of Andersen's *[Fairy Tales Told for Children](#)*. The tale has been adapted to various media, and the story's title, the phrase "the Emperor has no clothes", and variations thereof have been adopted for use in numerous [other works](#) and as [idioms](#).

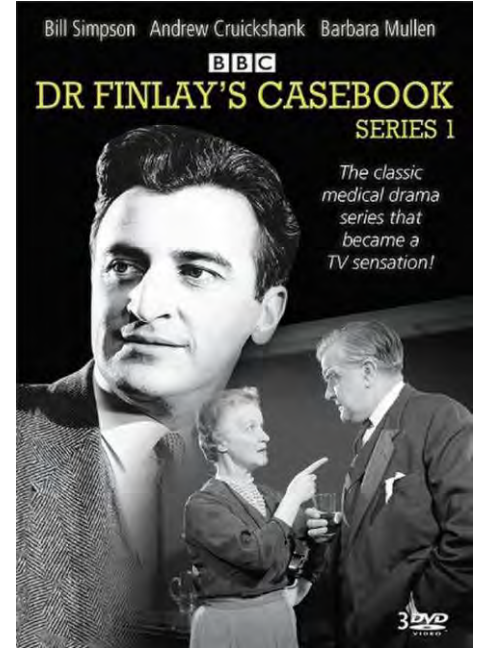
Plot [\[edit\]](#)

Two swindlers arrive at the capital city of an emperor who spends lavishly on clothing at the



It is really confusing!!!



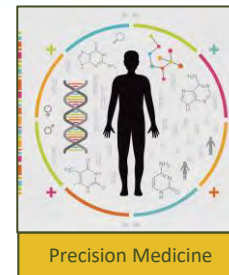


Public service productivity, healthcare, England: financial year ending 2020

- In the financial year ending 2020 (FYE 2020) **public service** **healthcare productivity decreased by 1.9%** following a negative growth of 0.4% in FYE 2019.

Moreover, technology has not made health care less expensive; indeed, the evidence suggests otherwise, unlike virtually all other industries, technology has made health care more labour intensive and more expensive.

Wachter, R. M. & Howell, M. D. (2018). Resolving the Productivity Paradox of Health Information Technology. *JAMA*, 320 (1), 25-26. doi: 10.1001/jama.2018.5605.



Precision Medicine



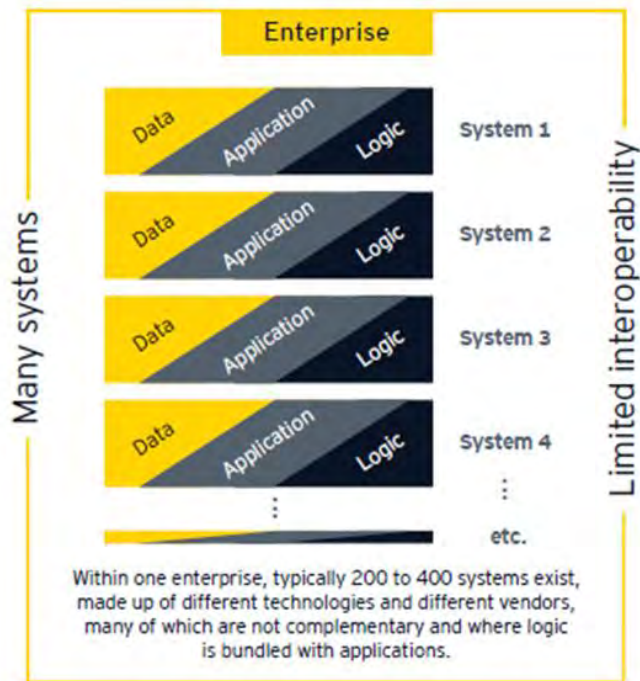
Dynamic Decision Support



Artificial Intelligence



Now



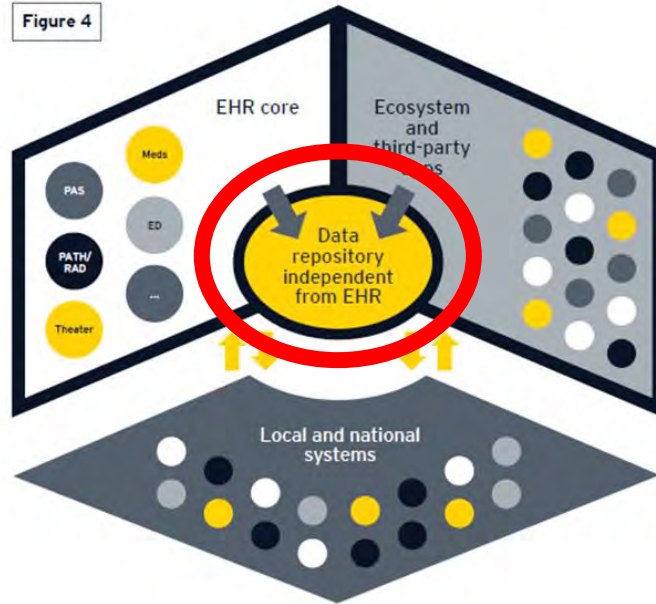
Present: Many systems all with intimately bound data logic and applications

Ernst & Young

“How will you design information architecture to unlock the power of data?”

https://www.ey.com/en_gl/health/how-will-you-design-information-architecture-to-unlock-the-power

Figure 4



https://www.ey.com/en_gl/health/how-will-you-design-information-architecture-to-unlock-the-power

Gartner

Market Guide for Digital Health Platforms

The DHP Reference Architecture

New Digital Experiences
(Composed Application)

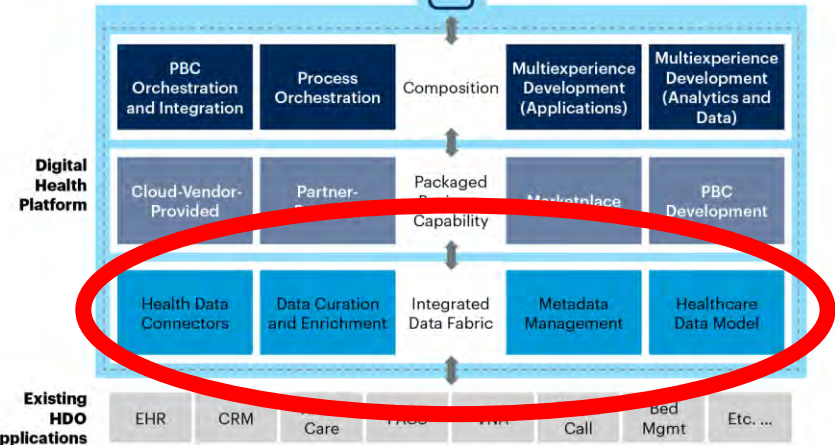
Care Team Collaboration

Patient Relationship Management

Enterprise Imaging

Digital Front Door

Population Health Management



Source: Gartner
PBC = packaged business capability
752852_C

Gartner

<https://www.better.care/market-guide-for-digital-health-platforms/>

- Technically it is a **platform approach**, rather than a 'set of standards' or monolithic specification or product;
- It offers the most **comprehensive semantic framework** available in e-health, combining formal clinical modelling, terminology, and a services infrastructure;
- It deals directly with the very difficult challenges of e-health, including **semantic scalability** - handling complex and constantly changing information and clinical workflows, forever;
- It supports the establishment of a **platform-based economic ecosystem**, in which the customer retains control of purchasing at a component level, using platform specifications (information models, APIs, clinical models etc) as conformance points for procurement;
- This in turn **prevents lock-in** on the basis of data format, or any other technical element;
- It also **ensures that the customer retains control and ownership of the data**, ensuring it does not incur unexpected costs in the future for its long term use.
- It provides a direct **way for clinical experts to be involved** in the specification and steady state development of the system into the future.

- **Platform approach**
- **Comprehensive semantic framework**
- **Semantic scalability**
- **Platform-based economic ecosystem**
- **Prevents lock-in**
- **Customer retains control & ownership of the data**
- **Way for clinical experts to be involved**

SCOTLAND'S DIGITAL HEALTH & CARE STRATEGY

ENABLING, CONNECTING & EMPOWERING

We will begin work now to deliver a Scottish health and care 'national digital platform' through which relevant real-time data and information from health and care records, and the tools and services they use, is available to those who need it, when they need it, wherever they are, in a secure and safe way.

<https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2018/04/scotlands-digital-health-care-strategy-enabling-connecting-empowering/documents/00534657-pdf/00534657-pdf/govscot%3Adocument/00534657.pdf>



National Digital Platform

Technology for health and social care

[Home](#) [About](#) [Service catalogue](#) [Assurance](#) [Blog](#) [Data](#)

The open technology platform for Scotland

National Digital Platform (NDP) will make it simpler to deliver technology that improves the care and wellbeing of people in Scotland.

[More about NDP](#) →

[Home](#) / [Service catalogue](#)

Service catalogue

Details of the technology services that are available on the National Digital Platform (NDP).

[Application development framework](#) →

A collection of components that enable the quick development of NDP solutions.

[Identity and access management \(IAM\)](#) →

How we provide safe and secure access to services and data on the NDP.

[API catalogue](#) →

APIs that can be made available and the subsequent data that can be accessed.

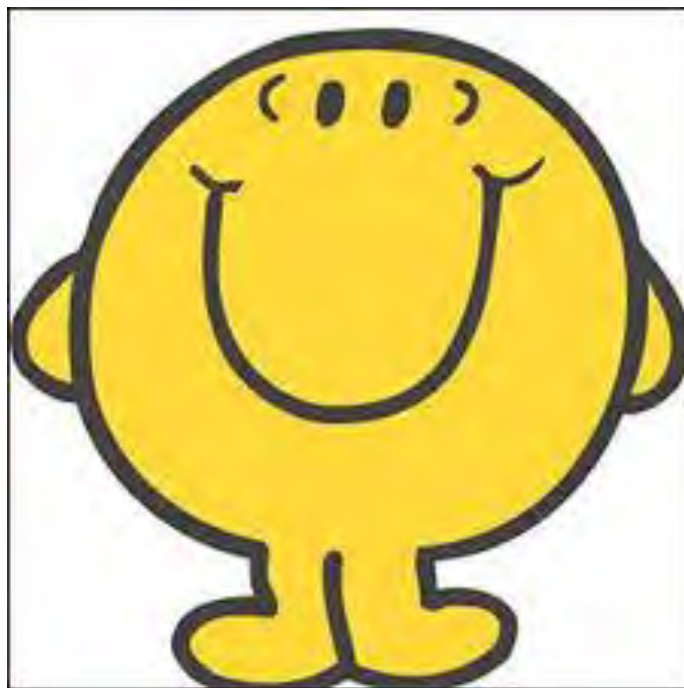
[Integration Service](#) →

Standards-based data integration capability.

[NDP Launchpad](#) →

Launch NDP-enabled applications in patient context.

<https://www.nationaldigitalplatform.scot/>



What?

What is *openEHR*?

Cancer journey



NET General - Screen
PMS NHS No: 420308275 | NHSUK No: 92566818 | MALCOLM LOCKIE | Birth: 31-04-1962

CLINICAL HISTORY/REASON FOR DISCUSSION
This patient was referred to the GP Surgery as GP advised on observance in the left lower lobe CT scan to meet local GPs, national and local guidelines from biopsy information. See letter, questionnaire and a website.

Primary Care
Surgery - Resilient (Mar 10) and review of same (Sep 10)
Surgery - Resilient (Mar 10) and review of same (Sep 10)
Surgery - Resilient (Mar 10) and review of same (Sep 10)

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 BOOK CARES and take with you.

Patient's name: Jim Lockie GP contact details: Dr Jones
Date of birth: 30/04/62 Second referral:
Address: 3 Park Road Hospital trust
Diagnosis: D14.0 DEF

Your patient has had the following diagnosis and treatment for cancer and associated primary and ongoing management plans as indicated below. This document has been created as part of the summary. Check or update as applicable.

Diagnosis	Date of diagnosis (DD/MM/YY)	Treatment	Staging
Colorectal cancer	10/02/10	Curettage	Stage 10

Summary of treatment and relevant dates:
Surgery - Resilient (Mar 10) and review of same (Sep 10)
Surgery - Resilient (Mar 10) and review of same (Sep 10)
Possible treatment location and/or side effects:
Chemotherapy following colorectal cancer

Possible treatment medicines and/or late effects:
Surgery - Resilient (Mar 10) and review of same (Sep 10)
Radiotherapy - Mar-June 2010 and review of same (Sep 10)
Chemotherapy following colorectal cancer

Advise entry into primary care, palliative/supportive care register, or 1000 application completed. Prescription change exemption agreed. Yes.

Most symptoms that require referral back to specialist team:
Continued for more than two weeks not relieved by appropriate course.
Further change in bowel function.
Additional pain that persists for longer than two weeks and does not respond to simple analgesia.

Checklist for the referral on system:
In house: 01234 56789 (G26 form)
Out of house: 01234 56789 (consultancy needs)

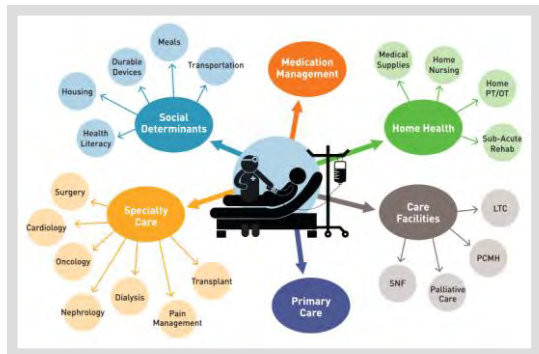
Other service referrals made:
(date or date)
Diagnosis:
Specialist Service

Recommended GP actions in addition to GP Cancer Care Review:
Repeat review date of XXXXX at two weeks if symptoms of XXXX resolved reduce to long only

Summary of information given to the patient about their cancer and future prognosis:
Jim's health care team has been informed that the cancer in the left lower lobe may be early stage and that he has received surgery and chemotherapy. He is being reviewed for 6 months in the future and we have invited Jim to join our national support group and plans to attend next session in November.
He is to be aware of the symptoms of recurrence and what to do should they occur.

Additional information including issues relating to Myer's interest and future prognosis:
I have advised him to quit smoking and return to smoking immediately.
He is keen to join our national support group and plans to attend next session in November.

Completing Clinician: Charles Cunningham | Signature: | Date: 30/10/10
You can order Treatment Summary template packs through the recordlink.org.uk



R-SPECT Recommended Summary Plan for Emergency Care and Treatment

1. This plan belongs to:

Preferred name

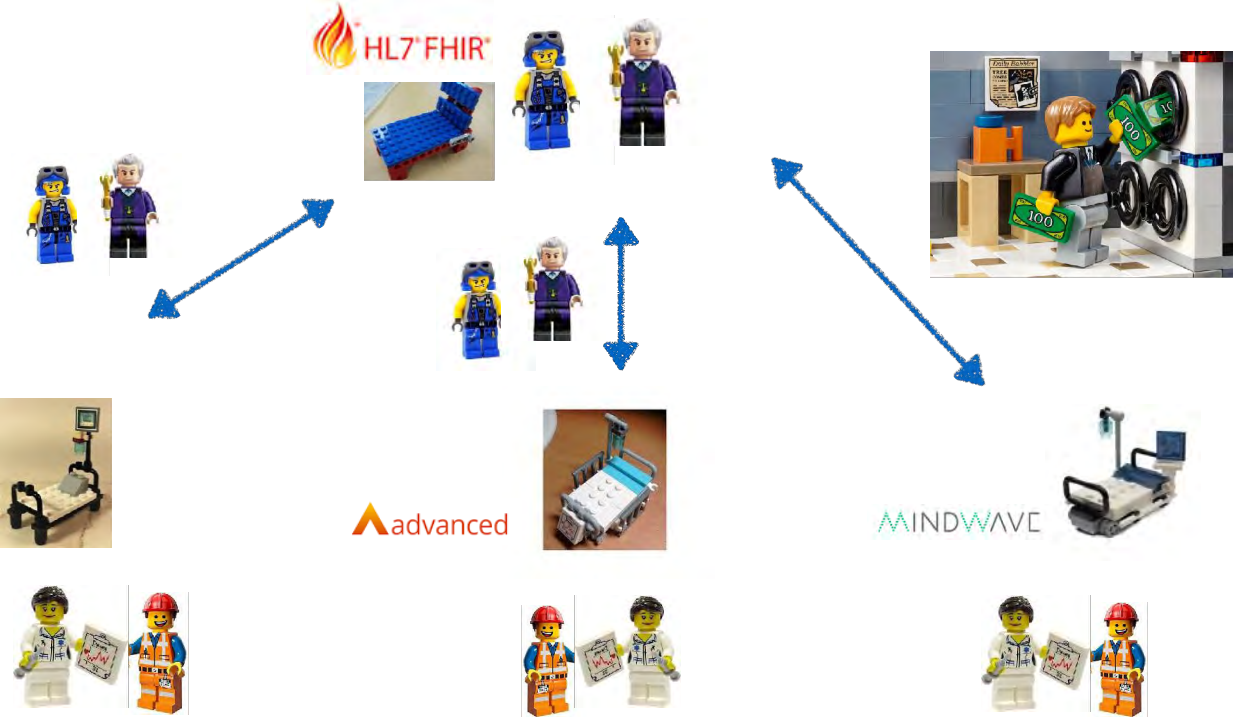
Date completed

Overview: COMBINE OFFICE REVIEW

Details:
Labels: COMBINE OFFICE REVIEW

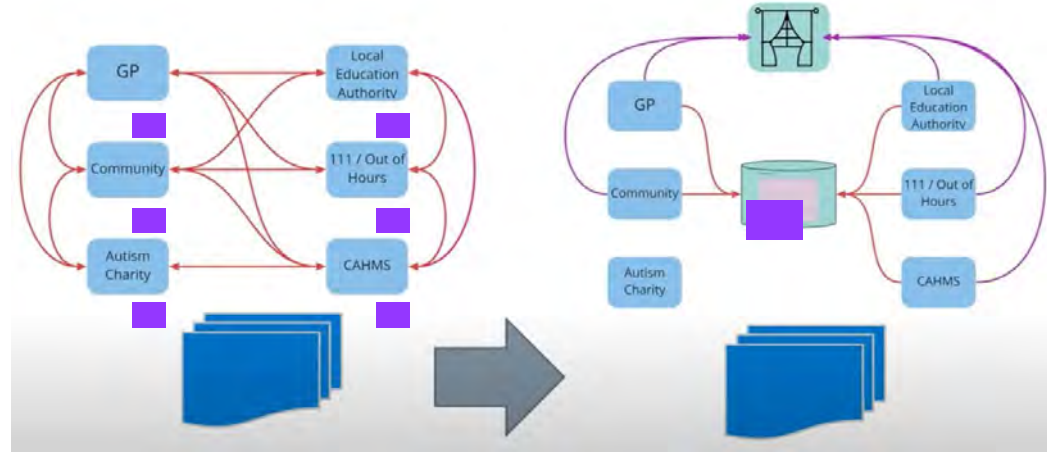
Progress:
COPING THE SCORE

Exchange and synchronisation



open Data Platform architecture

- Separate apps from data and organising **primary** patient information into federated vendor-neutral datastores



- Apperta Defining an Open Platform
- NHS-E Solid PODS
- EY open Platform paper
- WHO Digital Health Platform paper

<https://www.youtube.com/watch?v=kXEIgpYA9sM>



https://apperta.org/assets/Apperta_Defining_an_Open_Platform.pdf



https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/health/ey-global-health-tech.pdf



<https://apps.who.int/iris/bitstream/handle/10665/337449/9789240013728-eng.pdf>

'open Platform' architecture

Apps

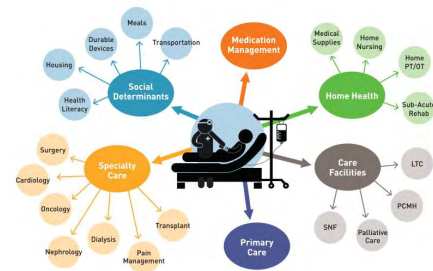


Vendor-neutral Information model



*open*EHR

Technology-neutral datastore (CDR)



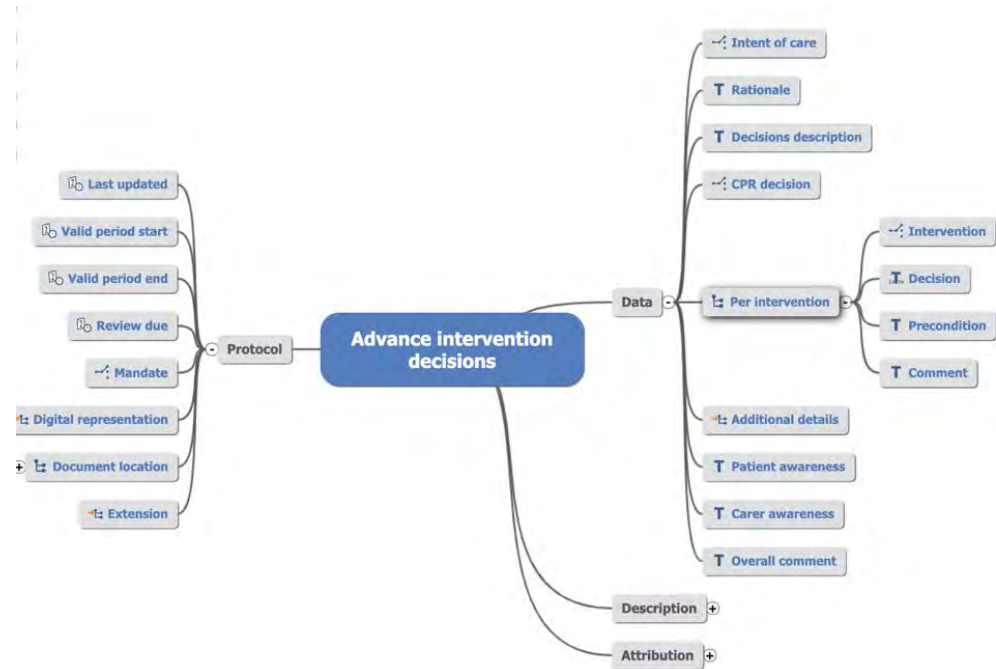
openEHR CDR - Clinical data repository

- Smart datastore which natively stores, retrieves, queries openEHR data via a standard API
- 'No-code' deployment of new clinical content definitions
- All data completely available and queryable
- AQL - Vendor-neutral querying
- No control from the CDR vendor



openEHR Archetypes : Concrete clinical record components

- An open-source library of shared clinical content components
- Developed/ managed by clinical informaticians
- Capable of supporting any health or care record
- openEHR is trying to (slowly!) 'boil the ocean' of concrete clinical record component definitions
- not just the 80:20 of commonly exchanged data (FHIR)



CKM - Collaborative review / publication

Preferred View

All Resources

Subdomain: All subdomains

Project / Incubator: All projects

Active Under review Published

Archetypes

- Modified Braden Q scale (v0)
- Modified Mallampati classification (v0)
- Modified Rankin Scale (mRS) (v0)
- MOXFQ (v0)
- MSFC score (v1)
- MSKCC Bowel Function Instrurr
- Murray score (v0)
- National Early Warning Score (1
- National Early Warning Score 2
- Neonatal Skin Risk Assessment
- New York Heart Association fun
- NIH Stroke Scale (v0)
- Nine Hole Peg Test (v1)
- Nutrition intake (v0)
- Nutritional Risk Screening (NRS
- Oocyte and embryo assessmen
- Oucher pain scale (v0)
- Oxford Elbow Questionnaire Sc
- Oxford Hip Questionnaire Score
- Oxford Knee Questionnaire Sc
- Oxford Shoulder Instability Qu

Projects & Incubators

New and Modified Resources

Resource Watchlist

Archetypes ▾ Templates ▾ Termsets ▾ Release Sets ▾ Reviews ▾ Projects ▾ Discussion ▾ Reports ▾ Tools ▾ Help ▾

Dashboard Find Resources Clinica...PS 2.0) Nationa...(NEWS2)

National Early Warning Score 2 (NEWS2) LATEST REVISION / LATEST PUBLISHED | 16 [1.0.4] ✓

English Adopt archetype

```
graph LR; Root["National Early Warning Score 2 (NEWS2)"]; Root --- Extension; Root --- Protocol; Root --- Events; Root --- Data; Root --- Description; Data --- RespirationRate["Respiration rate"]; Data --- SpO2Scale1["SpO2 Scale 1"]; Data --- SpO2Scale2["SpO2 Scale 2"]; Data --- AirOxygen["Air or oxygen?"]; Data --- SystolicBP["Systolic blood pressure"]; Data --- Pulse; Data --- Consciousness; Data --- Temperature; Temperature --- Ordinal; Temperature --- Optional; Temperature --- Range["Range category for the body temperature measurement:"]; Range --- R1["3: <=35.0 [The body temperature is less than/equal to 35 degrees Celsius.]"]; Range --- R2["1: 35.1-36.0 [The body temperature measurement is between 35.1 and 36.0 degrees Celsius.]"]; Range --- R3["0: 36.1-38.0 [The body temperature measurement is between 36.1 and 38.0 degrees Celsius.]"]; Range --- R4["1: 38.1-39.0 [The body temperature measurement is between 38.1 and 39.0 degrees Celsius.]"]; Range --- R5["2: 39.1-40.0 [The body temperature measurement is between 39.1 and 40.0 degrees Celsius.]"];
```

Extension

Protocol

Events

Data

- Respiration rate
- SpO₂ Scale 1
- SpO₂ Scale 2
- Air or oxygen?
- Systolic blood pressure
- Pulse
- Consciousness
- Temperature
 - Ordinal
 - Optional
 - Range category for the body temperature measurement:
 - 3: ≤35.0 [The body temperature is less than/equal to 35 degrees Celsius.]
 - 1: 35.1-36.0 [The body temperature measurement is between 35.1 and 36.0 degrees Celsius.]
 - 0: 36.1-38.0 [The body temperature measurement is between 36.1 and 38.0 degrees Celsius.]
 - 1: 38.1-39.0 [The body temperature measurement is between 38.1 and 39.0 degrees Celsius.]
 - 2: 39.1-40.0 [The body temperature measurement is between 39.1 and 40.0 degrees Celsius.]

Description

What is openEHR?

- open specification for patient-centric, healthcare information
 - where data is separated from apps
 - vendor /technology/ license neutral
- openEHR International
 - Non-profit collaborative of industry / care professionals/ health organisations

- openehr.org
- ckm.openehr.org
- discourse.openehr.org

The screenshot shows the openEHR website with a navigation bar including 'About us', 'Clinicians', 'Providers', 'Research', 'Developers', and a 'Newsfeed' button. The main content area is titled 'About openEHR' and contains the following text:

openEHR is a non-profit organisation that publishes technical standards for an EHR platform along with domain-developed clinical models to define content.

The principal architectural concepts include the lifelong, patient-centric shared health record, future-proof data and clinical process support.

All openEHR IP is published under either Apache 2.0 or CC-BY licenses.

At the bottom of the page, there are three buttons: 'Organisation', 'Vision', and 'Intellectual Property'.

The diagram on the right, titled 'Healthcare and Research Domain', illustrates the architecture. It shows 'Clinical professionals' (Hospital EHR, Regional EHR, Research Analysts) interacting with 'Domain Knowledge' and 'openEHR Vendors'. The vendors provide 'platform systems' and 'platform apps' which are supported by 'openEHR International' through 'specifications' and 'open source software'.



openEHR in the UK

- Digital Health and Care, Wales
- NHS Scotland National Digital platform
- GENOCEANIC N. Ireland Genomics platform

- Plymouth FT, Wye Valley FT
- Dartford and Gravesham FT
- South London and Maudsley mental health Trust
- Oxford Mental Health Trust, South Tees hospital FT
- Somerset FT
- Salford FT

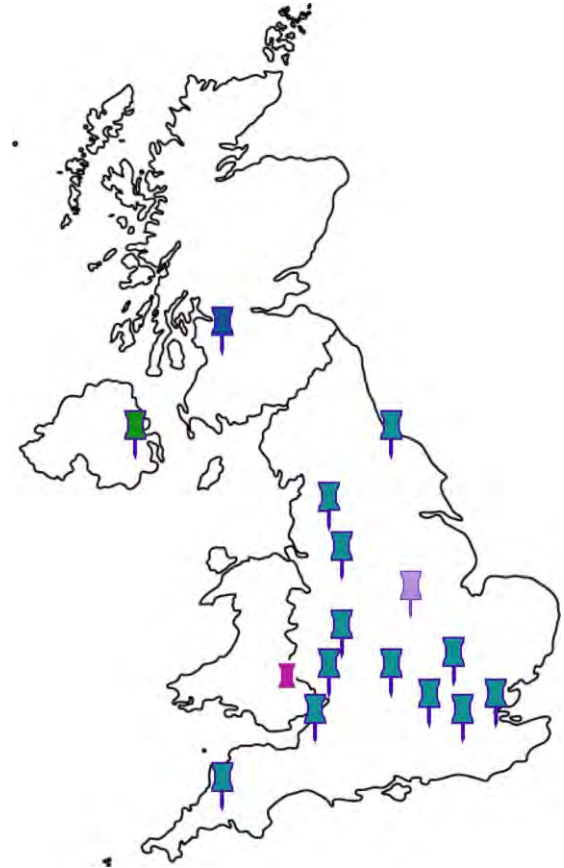
- West Midlands Cancer Alliance
- North Thames and West Midlands NHS genomics medicine
- Lancashire Shared Medication

- Christie Hospital, Manchester Cancer EPR

- OpenOutcomes PROMS
- Univ. Manchester Pharmacogenetics

- SNEE ROSI - End of life / Anticipatory care

- One London Universal Care plan



One London Universal Care plan



- Urgent Care Plan

- Multiple integrations inc. GP, Hospital, OOH
- 50,000 live records to be migrated
- Sophisticated CMC app to be replicated

- Universal care plan platform

- 'Information for life' pattern
- ? Sickle-cell disease
- ? Frailty / dementia / care homes
- ? Longitudinal paediatrics record

Free text External Coded

Query Local terms

Terminology

CMC-LevelOfTrtmt

Value set

FULLACTIVCPR Full active treatment including CPR

FULLACTIVHOSP Full active treatment including in acute hospital setting, but not CPR

OTHER Other

SYMPTRONLY Symptomatic treatment only:

Edit valueset

EMERGENCY CARE AND TREATMENT PLAN

ZUBIK, Sarah Otis Feb 2007 - 15y 3m NHS No: 288 515 7113 No known allergies

Clinical Recommendation *

Full active treatment including CPR

Full active treatment including in acute hospital setting, but not CPR

Treatment of any reversible conditions (including acute hospital setting if needed) but not for any ventilation or CPR

Treatment of any reversible conditions but only in the home/hospice setting: keep comfortable

Symptomatic treatment only: keep comfortable

Other

Further details

further details text on clinical recommendation

CPR Recommendation

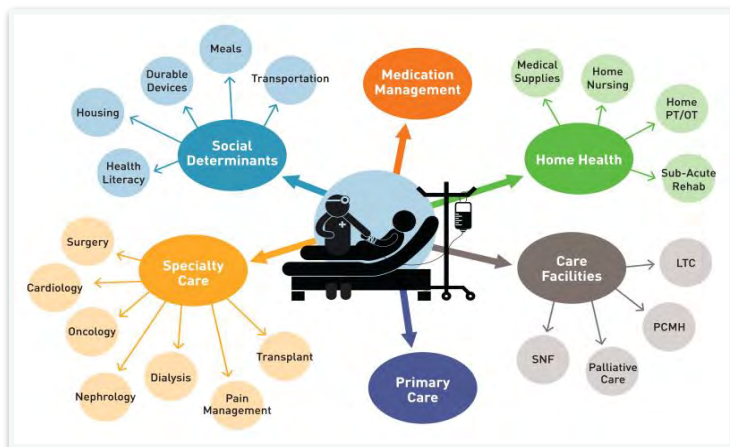
Do you recommend CPR? *

Yes No

Date of CPR recommendation *

01/02/2022 Today

The nirvana of Patient-centric Coherent Information



Treatment Summary

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

Episode Number	Start of episode	End of episode	Frequency	Location
1	2010-01-01	2010-01-01	1	Home
2	2010-01-01	2010-01-01	1	Home

Clinical History

Recommended Summary Plan for Emergency Care and Treatment



RESPECT Recommended Summary Plan for Emergency Care and Treatment

1. This plan belongs to:

Preferred name

Date completed

How?

John Meredith

Thank you

