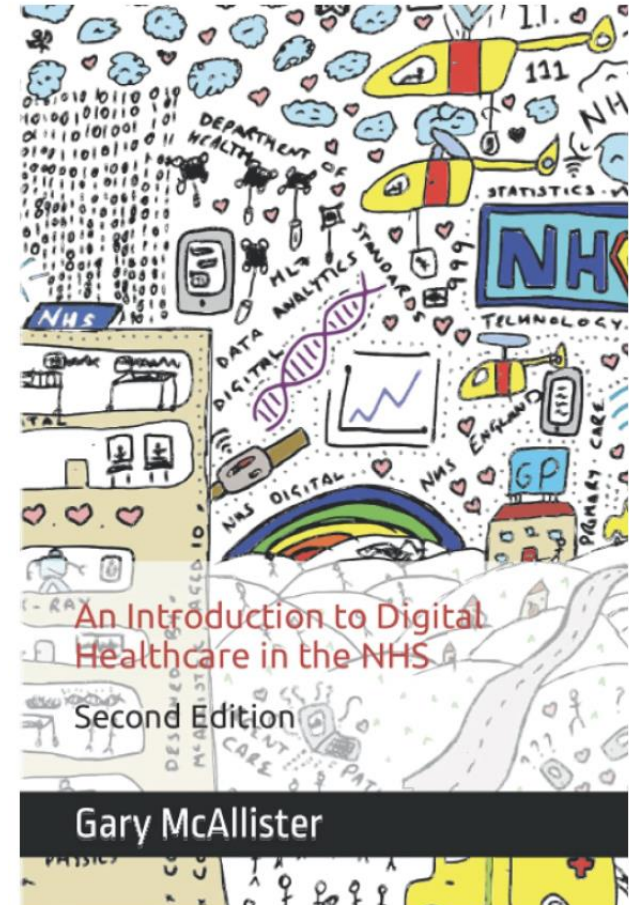


# Interoperability in the wild

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<https://amzn.to/35SptY5>



Firstly



**It's a jungle out there!**





## Secondly .... Standards (adoption)



# What standards are we talking about?



- FHIR – Fast Healthcare Interoperability Resources – the new one!
- HL7v2 – Health Level 7 – the old one!
- OpenEHR – Framework for EHR development / ‘open’ data standards (the platform)
- IHE – Standards body for creating interoperability profiles

And these rely on other standards.

- HTTP(S) – (Secure) Hypertext Transfer Protocol
- TCP – Transport Communication Protocol
- SOAP – Simple Object Access Protocol
- Etc. etc.

# Standards within standards within standards



- ICD10 – International Classification of Diseases
- SNOMED-CT – Systemized Nomenclature of Medicine
  - UTL – Unified Test List
- OPCS – Office of Population Censuses and Surveys

NHS Specific uses;

- CDS – Commissioning Data Set
- ECDS – Emergency Care Data Set
- The list goes on.....



So.. What is out there in the wild?



- There might be tears ....

# Its not all rainbows and unicorns (RIO)



Address Details	Assessment Details	Care Package	Current Communication Needs	Contact Details	Demographics And Relationships	Social Care Forms	Safeguarding Details	Service User Details	Social Worker Details		
Demographics And Relationships											
Title	First Names	Last Name	Date of Birth	Gender	Ethnicity	First Language	Fluency in English	Religion	NHS Number	NHS Number Status	Marital Status
	Duncan	Kereva	28/02/1979	Male	White				9660979622	N	
Relationships											

< <head> <META http-equiv="Content-Type" content="text/html; charset=UTF-8"> <style type="text/css">

```
> <head> <META http-equiv="Content-type" content="text/html; charset=UTF-8"> <style type="text/css">
{ font-size: 13px; font-family: 'Liberation Sans'; background-color: #f1f0ee; } ul#tabs {
style-type: none; margin: 20px 0 0 0; padding: 10px 0 0 0; background-color: #497BA1; height: 20px;
order-top-right-radius: 5px; border-top-right-radius: 5px; -ms-border-top-left-radius: 5px;
r-top-left-radius: 5px; } ul#tabs li { display: inline; float: left; } ul#tabs li a { color: #497BA1;
round-color: #d0e5f5; border: 1px solid #497BA1; border-bottom: none; padding: 0.7em 0.3em 0.38em 0.
text-decoration: none; font-weight: bold; -ms-border-top-right-radius: 5px; border-top-right-radius:
-ms-border-top-left-radius: 5px; border-top-left-radius: 5px; } ul#tabs li a:hover { background-color:
e5f5; color: #1d5987; } ul#tabs li a.selected { color: #e17009; background-color: #f5f8f9; font-we
padding: 0.7em 0.3em 0.38em 0.3em; } div.tabContent { border: 1px solid #a6c9e2; padding: 0.5em;
round-color: #FFFFFF; color: #000000; } div.tabContent.hide { display: none; } .hdiv { border: 1px
#a6c9e2; margin-bottom: 20; -ms-border-top-right-radius: 5px; border-top-right-radius: 5px;
order-top-left-radius: 5px; border-top-left-radius: 5px; padding-bottom: 0px } h4 { background-color:
7BA1; border: 1px solid #a6c9e2; color: #FFFFFF; padding: 6px; margin-top: 0;
order-top-right-radius: 5px; border-top-right-radius: 5px; -ms-border-top-left-radius: 5px;
r-top-left-radius: 5px; } h5 { background-color: #497BA1; border: 1px solid #a6c9e2; color: #FFFFFF
ng: 6px; margin-top: 0; -ms-border-top-right-radius: 5px; border-top-right-radius: 5px;
order-top-left-radius: 5px; border-top-left-radius: 5px; } table { width: 100%; font-size: 13px;
family: 'Liberation Sans'; padding: 0; border-spacing: 0; } table th { background-color: #d0e5f5;
: #497BA1; padding: 3px; text-align: left; font-weight: bold; border-left: 1px solid white; } tr:hove
kground-color: #fbec88; } td { border-bottom: 1px solid lightgray; padding: 2px; } </style>
e>Social Care Record</title> <script type="text/javascript"> var tabLinks = new Array(); var
ntDivs = new Array(); function init() { var tabListItems = document.getElementById('tabs').childNodes;
var i = 0; i < tabListItems.length; i++ ) { if ( tabListItems[ (local var) tabLink: any |r tabLink =
rstChildWithTagName( tabListItems[i], 'A' ); var id = getHash( tabLink.getAttribute('href') ); tabLinks
= tabLink; contentDivs[id] = document.getElementById( id ); } } var i = 0; for ( var id in tabLinks ) {
nks[id].onclick = showTab; tabLinks[id].onfocus = function() { this.blur(); } if ( i == 0 ) tabLinks[id]
sName = 'selected'; i++; } var i = 0; for ( var id in contentDivs ) { if ( i != 0 ) contentDivs[id].
Name = 'tabContent hide'; i++; } } function showTab() { var selectedId = getHash( this.getAttribute
f' ); for ( var id in contentDivs ) { if ( id == selectedId ) { tabLinks[id].className = 'selected';
ntDivs[id].className = 'tabContent'; } else { tabLinks[id].className = ''; contentDivs[id].className =
ontent hide'; } } return false; } function getFirstChildWithTagName( element, tagName ) { for ( var i =
< element.childNodes.length; i++ ) { if ( element.childNodes[i].nodeName == tagName ) return element.
Nodes[i]; } } function getHash( url ) { var hashPos = url.lastIndexOf( '#' ); return url.substring(
os + 1 ); } </script> </head> <body onload="init()"> <ul id="tabs"> <li> <a href="#Address
ls">Address Details</a> </li> <li> <a href="#Assessment Details">Assessment Details</a> </li> <li> <a
"#Care Package">Care Package</a> </li> <li> <a href="#Current Communication Needs">Current
nication Needs</a> </li> <li> <a href="#Contact Details">Contact Details</a> </li> <li> <a
"#Demographics And Relationships">Demographics And Relationships</a> </li> <li> <a href="#Social Care
```

## So.. What does this mean??



- Interoperability is a continually evolving feast.
- Even when suppliers implement the 'standards' they are not always supplied consistently.
- There is limited adoption and even nationally we are in a period of flux:
  - National Record Locator has implemented FHIR but is only a write-based service – does not support reading from other HIEs – has unclear SLAs etc. Not necessarily a standards issue but does demonstrate that architectural management is critical.
  - GPCConnect – has been slow to materialise because the standards needed ratification and priorities are not always on interoperability on the supply side. The progress and adoption has been very slow but beginning to materialise.
- ***There is limited evidence of end to end interoperability workflows with data-exchanging bi-directionally to support seamless information flows. This is the holy grail – reducing transcription etc...***



So lets look at some more examples.



## More examples (from London HIE).



GraphNet = SOAP

```
HTTP/1.1 200 OK
Cache-Control: private
Content-Type: text/xml; charset=utf-8
Server: Microsoft-IIS/8.5
Set-Cookie: ASP.NET_SessionId=550cmej1ack0yijt2h3sppk0; path=/; secure;
HttpOnly; SameSite=Lax
X-AspNet-Version: 4.0.30319
X-Powered-By: ASP.NET
Date: Tue, 08 Mar 2022 14:09:08 GMT
Connection: close
Content-Length: 887

<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:u="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-
utility-1.0.xsd"><s:Header><ActivityId CorrelationId="84863875-
aaf7-4a92-8f20-67fc0238539d" xmlns="http://schemas.microsoft.com/2004/09/
ServiceModel/Diagnostics">00000000-0000-0000-0000-000000000000</
ActivityId><o:Security s:mustUnderstand="1" xmlns:o="http://docs.oasis-
open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd"><u:Timestamp
u:Id="_0"><u:Created>2022-03-08T14:09:08.960Z</
u:Created><u:Expires>2022-03-08T14:14:08.960Z</u:Expires></u:Timestamp></
o:Security></s:Header><s:Body><GetPatientNumberFromNhsNumberResponse
xmlns="http://www.graphnethealth.com/gateway/framework/
2010/11"><GetPatientNumberFromNhsNumberResult>11368972</
GetPatientNumberFromNhsNumberResult></GetPatientNumberFromNhsNumberResponse></
s:Body></s:Envelope>
```

NOT FHIR



## More examples (from London HIE).



Rio = HTML

```
<?xml version="1.0" encoding="UTF-8"?>
<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/">
  <s:Body>
    <PatientSummaryViewGetResponse xmlns="http://cse-healthcare.com/API/1.0">
      <PatientSummaryViewGetResult xmlns:i="http://www.w3.org/2001/XMLSchema-instance">
        <AuthenticationToken>92453c0b-9372-455d-9d0d-43ef1f381955</AuthenticationToken>
        <Response xmlns:a="http://schemas.microsoft.com/2003/10/Serialization/Arrays">
          <a:KeyValueOfstringstring>
            <a:Key>PatientSummaryReport</a:Key>
            <a:Value><html>&#13;
&lt;head&gt;&#13;
  &lt;META http-equiv="Content-Type" content="text/html; charset=utf-8"&gt;&#13;
  &lt;meta charset="utf-8"&gt;&#13;
  &lt;style type="text/css"&gt;
    @media screen {
      DIV#report {
        overflow: auto;
        height: 100%;
      }
      button {width: 80px;}
    }

    tfoot { display: table-footer-group; }

    .ReportTitle {font-family: 'Trebuchet MS'; font-weight: bolder; font-size: 16px; color: #165B80; text-align: center;}

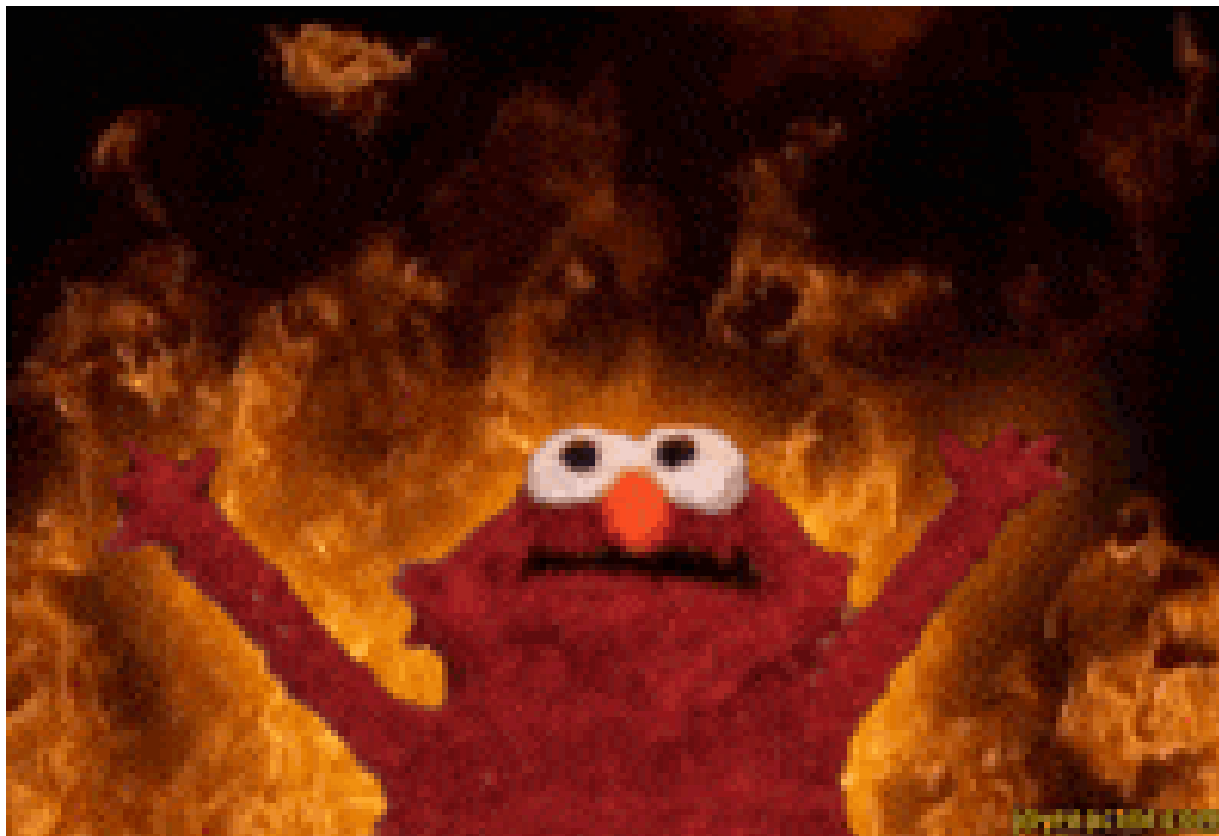
    div.textFrame {
      background-color: WhiteSmoke;
      border: 1px solid #cccccc;
      margin-top: 2px;
    }

    thead {display: table-header-group; }
    td.VerticalDivider {border-top: solid black 1px; border-left: none; border-right: none; border-bottom: none; padding: 0px}
    tr.NoData {color: Red; font-family: 'Trebuchet MS'; font-weight: bolder; font-size: 12px; border: solid #165B80 1px; text-align: center;}

    table.ReportTable {border-collapse: collapse;}
    table.ReportTable td {border: none;}
    tr.ReportTable.DataOdd {background-color: #f2f2f2;}
```



NOT FHIR



## More examples (from London HIE).



Epic = IHE XCA – Cross Community Access (SOAP)

```
<?xml version="1.0" encoding="UTF-8"?>
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope" xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">urn:ihe:iti:2007:CrossGatewayQueryResponse</a:Action>
    <a:RelatesTo>a13a73c6-f595-441c-adb0-4e45b3b9698a</a:RelatesTo>
  </s:Header>
  <s:Body xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <AdhocQueryResponse xmlns="urn:oasis:names:tc:ebxml-regrep:xsd:query:3.0" status="urn:oasis:names:tc:ebxml-regrep:ResponseStatusType:Success">
      <RegistryObjectList xmlns="urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0">
        <ExtrinsicObject home="urn:oid:1.2.840.114350.1.13.525.3.7.3.688884.100" id="urn:uuid:9c105138-985d-11eb-980f-000c29cbaf7b" isOpaque="false">
          <Slot name="creationTime">
            <ValueList>
              <Value>20210408112859</Value>
            </ValueList>
          </Slot>
          <Slot name="hash">
            <ValueList>
              <Value>-1</Value>
            </ValueList>
          </Slot>
          <Slot name="languageCode">
            <ValueList>
              <Value>en-US</Value>
            </ValueList>
          </Slot>
          <Slot name="repositoryUniqueId">
            <ValueList>
              <Value>1.2.840.114350.1.13.525.3.7.3.688884.100</Value>
            </ValueList>
          </Slot>
          <Slot name="size">
            <ValueList>
              <Value>-1</Value>
            </ValueList>
          </Slot>
        </ExtrinsicObject>
      </RegistryObjectList>
    </AdhocQueryResponse>
  </s:Body>
</s:Envelope>
```

NOT FHIR



But is very useful anyhow...



KEREVA, Duncan  
NHS No 966 097 9622 Source MRNs (23) Gender M Died 24/11/2020 (41y) Born 28/02/1979

This patient is deceased

GP Records (12) Details

Report Name	Date Completed	Status	Source
Examinations	09/03/2022	ES	
EMIS Community View	09/03/2022	ES	
Events	09/03/2022	ES	
Medications	09/03/2022	ES	
EMIS Sol Care Plan	09/03/2022	ES	
Patient Details	09/03/2022	ES	
Risks/Warnings	09/03/2022	ES	
Procedures	09/03/2022	ES	
Summary	09/03/2022	ES	
Diagnosis	09/03/2022	ES	

Community and Mental Health (1) Referrals (2)

Summary

Report Name	Date Completed	Status	Source
Referral	09/03/2022	ES	BEH

Problems (43) Visit Diagnoses (61)

Details

Problem	Date	Status	Classification	Source
Abdomen and pelvis(Confirmed)		Active	No flag	ICHT, CHELWEST
Abdominal pain		Active	No flag	STGH
Abscess		Active	No flag	LST
Acne vulgaris(Confirmed)		Active	No flag	STGH
Acute kidney failure stage 3		Active	No flag	STGH
Asthma		Active	No flag	STGH
Asthma(Confirmed)		Active	No flag	RFL
Asthma(Confirmed)		Active	No flag	KNFT
Asthma(Confirmed)		Active	No flag	KNFT
BEP - Benign enlargement of prostate(Confirmed)		Active	No flag	RFL

Vital Signs (193) All Results (193)

Value

Vital Signs	15/12/2021	21/04/2021	21/04/2021	21/04/2021	15/11/2020	13/11/2020
TEMPERATURE (Cel)						
TEMPERATURE (degrees Celsius)	36.9					
BODY TEMPERATURE (Cel)						
Blood pressure (mmHg)	110/88	120/90	110/80			
Blood pressure (mmHg)	90 - 140	90 - 140	90 - 140			
HEART RATE (/min)						
HEART RATE (bpm)	80.0					
RESPIRATORY						

Alerts (0)

Summary

Alert	Onset	Source System	Received On
Allergies (34)			
Acetaminophen			
Adhesive			
Albumin			
Alcohol			
Almodan			
Almonds			
Amoxicillin			
Animal hair			
Aspirin			
Celery			

Clinical Correspondence (86) Miscellaneous Reports (9)

Details

Report Name	Date Completed	Status	Source
IP Discharge Summary (Clinical)	30/05/2019	Completed	CHST
Discharge Letter - GP	03/06/2019	Completed	KNFT
ED Discharge Summary	03/06/2019	Modified	KNFT
Discharge Summary	03/06/2019	Completed	KNFT
QIP Clinic GP Letter	04/07/2019	Completed	HOMR
Discharge Summary	04/07/2019	Completed	HOMR
Emergency Medicine Discharge Summary	04/07/2019	Completed	HOMR
CDU RMA	09/07/2019	Completed	STGH
Discharge Summary	09/07/2019	Completed	STGH
GP Discharge Letter	09/07/2019	Completed	STGH

Appointments (2) Encounters (238)

Details

Appointment Date/Time	Appointment Type	Speciality	Consultant	Location	Source
16/09/2022 13:00:00	Follow Up		Varney, V	St Heller Springall Unit Ground Floor, Ferguson House, F Block, St Heller Hospital	ESTH
01/11/2022 09:00:00		Trauma and Orthopaedics	Henry, Abdonson	HDALC - Orthopaedic	NMUH

Social Care (1) Summary

Report Name	Date Completed	Status	Source
Barnet Mosaic Social Care	09/03/2022	BC	BC

Blood Sciences (845) Microbiology/Virology (39)

Details

Order Name	Results	Value	Reference Range	Date Resulted	Result Comments
FBC AND DIFFERENTIAL	Platelet count	333	150 - 450	26/01/2022	
FBC AND DIFFERENTIAL	Myelocytes	0.0%	0 - 0.01	26/01/2022	
FBC AND DIFFERENTIAL	Metamyelocytes	0.0%	0 - 0.01	26/01/2022	
FBC AND DIFFERENTIAL	RDW	12.0 %	11.5 - 15.0	26/01/2022	
FBC AND DIFFERENTIAL	White cell count	9.00	3.0 - 10.0	26/01/2022	
FBC AND DIFFERENTIAL	Blasts	0.0%	0 - 0.01	26/01/2022	
FBC AND DIFFERENTIAL	Monocytes	0.0%	0.2 - 1.0	26/01/2022	
FBC AND DIFFERENTIAL	Eosinophils	0.0%	0.0 - 0.4	26/01/2022	
FBC AND DIFFERENTIAL	Basophils	0.0%	0.0 - 0.1	26/01/2022	
FBC AND DIFFERENTIAL	Neutrophils	70.0%	2.0 - 7.5	26/01/2022	

Histopathology (19) Radiology (92)

Summary

Report Name	Date Completed	Source
HISTOLOGY	21/04/2021	KNFT
Orthology Process	10/03/2021	Kings
Histology Process	10/03/2021	Kings
Orthology Process	19/02/2021	Kings
Histology Process	19/02/2021	Kings
Orthology Process	18/02/2021	Kings
Histology Process	15/02/2021	Kings
Orthology Process	15/02/2021	Kings
Histology Process	03/11/2020	ICHT
Histo WOLP	03/11/2020	ICHT

Procedures (50) Summary

Name	Date	Source
Bladder outlet operations		STGH
Combined operations on primary long saphenous vein		KNFT
Ear care assessment		STGH
Nephrectomy		STGH
X-ray		Royal London
DIAGNOSTIC FIBEROPTIC ENDOSCOPIC EXAMINATION OF LOWER (DIAG FIBROSCOPIC EXAM LOW RESP TRACT LAVAGE LESION LOW RESP)	05/10/2021	NMUH
LATERALITY OF OPERATION (RIGHT SIDED OPERATION)	05/10/2021	NMUH
OTHER OPERATIONS ON LUNG (NEEDLE BIOPSY OF LESION OF LUNG)	05/10/2021	NMUH
OTHER RESPIRATORY TRACT (BRONCHUS)	05/10/2021	NMUH
Ear care assessment	16/11/2020	ICHT, CHELWEST



## This is not to say these vendors don't have FHIR



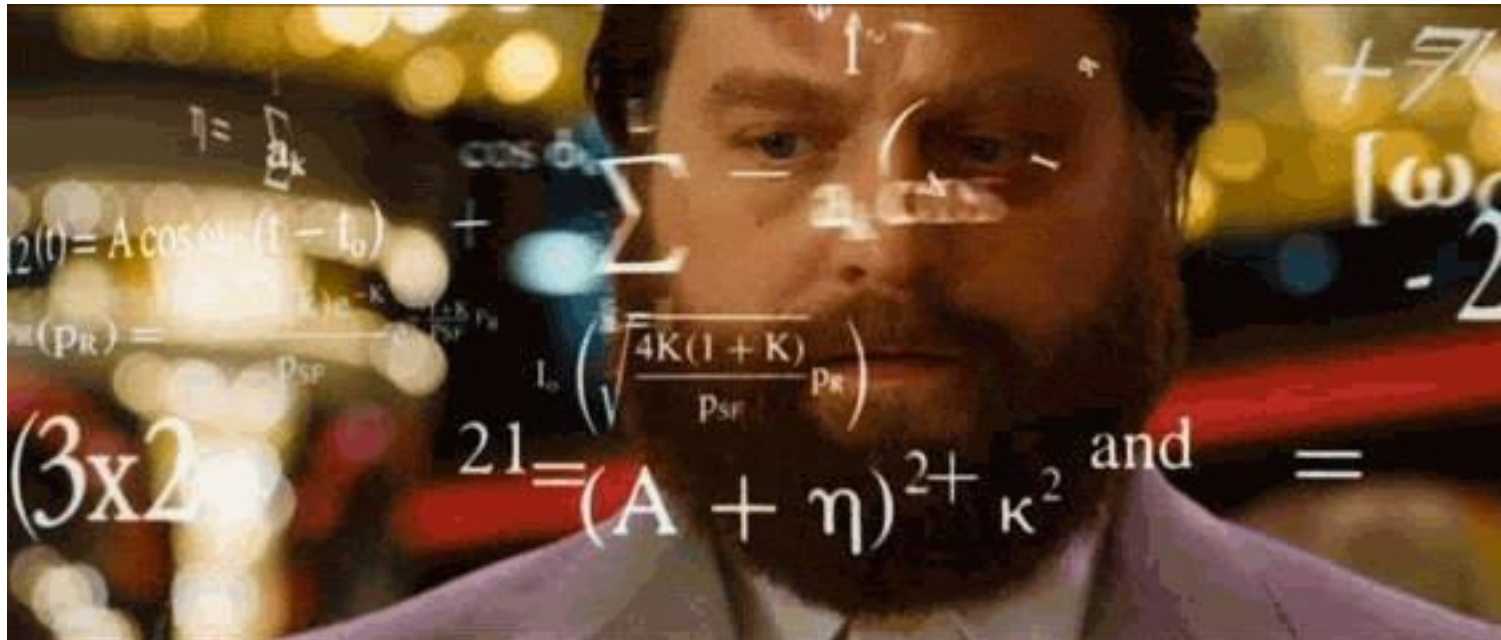
- FHIR is relatively new as we know – and will take time to embed and adopt
- The FHIR standard is still maturing / evolving so will take time to stabilise for all clinical use cases.
- Most have or are working towards FHIR adoption but progress is really slow....



## So what about this ... Open EHR thing??



- Is an ISO standard for designing, building open Electronic Health Record systems.
- Build on archetypes and an Clinical Data Repository.
- Its good, but not perfect – but does enforce interoperability as an architectural discipline.



- So what does it look like under the hood?
- There are other flavours of CDR

```
{
  "needs_and_preferences_care_information": {
    "nhs_funded_continuing_care": {
      "is_the_patient_in_receipt_of_nhs_funded_continuing_care": {
        {
          "code": "Y_CC",
          "value": "Yes-[NHS] funded",
          "terminology": "CMC-PatientReceipt"
        },
        "additional_details": "DS1500 Has been applied for",
        "ds1500_disability_living_allowance_status": {
          {
            "code": "N",
            "value": "No",
            "terminology": "CMC-DS1500"
          }
        },
        "help_and_support": {
          {
            "help_with_care": {
              {
                "social_issue_name": "Help with care",
                "does_patient_receive_any_help_with_personal_or_domestic_care": {
                  {
                    "code": "N",
                    "value": "No",
                    "terminology": "CMC-HomecareHelp"
                  }
                },
                "additional_details": "Has home help 2 days a week"
              },
              "family_support": {
                {
                  "social_issue_name": "Family support",
                  "does_patient_receive_any_support_from_family_members": [
                    {
                      "code": "N",
                      "value": "No",

```

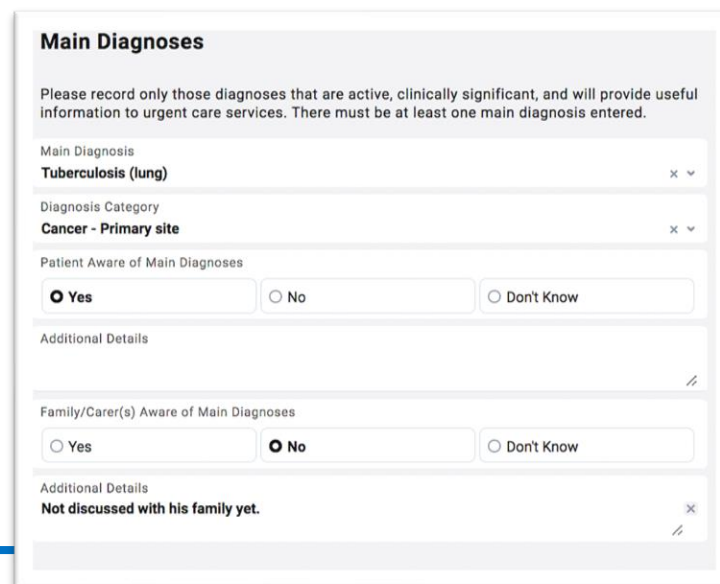
Not FHIR





- Data is well-designed and curated by clinical communities, enforcing high fidelity capture of information.
- As archetypes are built by communities there is no 'closed' solution.
- Open EHR platforms are 'interoperable by design' as they meet the OpenEHR specification which includes APIs etc.
- All specifications are open etc. etc. so limited vendor lock-in.

# BUT...



**Main Diagnoses**

Please record only those diagnoses that are active, clinically significant, and will provide useful information to urgent care services. There must be at least one main diagnosis entered.

Main Diagnosis  
**Tuberculosis (lung)** x v

Diagnosis Category  
**Cancer - Primary site** x v

Patient Aware of Main Diagnoses  
☒ Yes ☐ No ☐ Don't Know

Additional Details

Family/Carer(s) Aware of Main Diagnoses  
☐ Yes ☒ No ☐ Don't Know

Additional Details  
**Not discussed with his family yet.** x

Its not FHIR



## So in summary...



- There is no perfect answer at the moment when it comes to interoperability.
- Even the great FHIR over HTTP(S) has limitations, requiring architectural considerations for event driven workflows (FHIR-Cast).
- Be patient as things mature in the industry but we need to drive suppliers to adopt the appropriate standards.
- Everything is version controlled so can and will change over-time.
- ***Focus on the goal of the interoperability need rather than the technology because nothing is perfect atm.***
- *And just in case you wondered....*

## This is what some FHIR looks like - JSON 😊



```
{
  "resourceType": "Patient",
  "id": "example",
  "text": {
    "status": "generated",
    "div": "

\n\t\t\t\t\t|  |  |
| --- | --- |
|\n\t\t\t\t\t\t Name | Peter James \n                <b>Chalmers</b> (&quot;Jim&quot;)\n |
\n\t\t\t\t\t|\n\t\t\t\t\t\t Address | 534 Erewhon, Pleasantville, Vic, 3999 |
\n\t\t\t\t\t|\n\t\t\t\t\t\t Contacts | Home: unknown. Work: (03) 5555 6473 |
\n\t\t\t\t\t|\n\t\t\t\t\t\t Id | MRN: 12345 (Acme Healthcare) |
\n\t\t\t\t\n\t\t\t\n\t\t</div>

"
  },
  "identifier": [
    {
      "use": "usual",
      "type": {
        "coding": [
          {
            "system": "http://terminology.hl7.org/CodeSystem/v2-0203",
            "code": "MR"
          }
        ]
      },
      "system": "urn:oid:1.2.36.146.595.217.0.1",
      "value": "12345",
      "period": {
        "start": "2001-05-06"
      },
      "assigner": {
        "display": "Acme Healthcare"
      }
    }
  ],
  "name": [
    {
      "family": "Chalmers",
      "given": "Peter",
      "prefix": ""
    }
  ]
}
```



Thanks for listening.

