Fuel Your Digital Health Innovation with HL7 FHIR

HLTH 2024

2024 10 23

HL7 International

Daniel J. Vreeman, PT, DPT, MS, FACMI, FIAHSI, FHL7
Chief Standards Development Officer
HL7 International

Hi, I'm dan@hl7.org

Physiotherapist, biomedical informatician, interoperability aficionado

`Unusual, I know.`

Chief Standards Development Officer at HL7 International

President, Board of Directors at HL7 FHIR Foundation

At RTI International, I led interoperability projects

For 13+ years I led development of LOINC and other interoperability projects at the Regenstrief Institute

Conversation starter: *Style with a story*

THE POCKET SQUARE PROJECT

danielvreeman.com/about

Game plan for today

1. Lessons learned the hard way with health data
2. Why open standards are essential
3. FHIR basics: what innovators need to know
4. The extended FHIR family
5. Resources and tools for using FHIR
6. Discussion

Lessons learned the hard way with health data

HL7 International

Lesson 1:

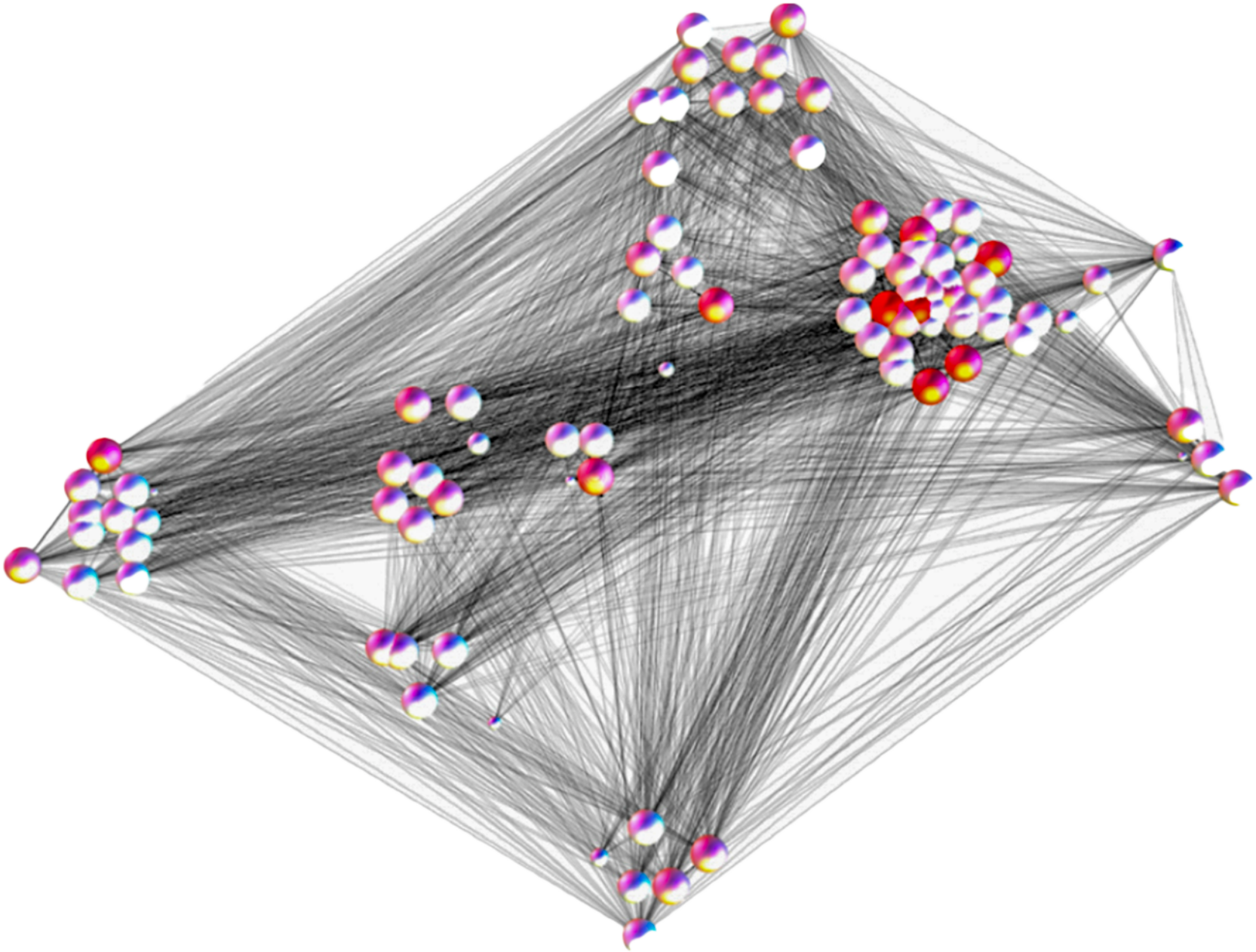
You're almost certainly ***not seeing the full picture.***

41%

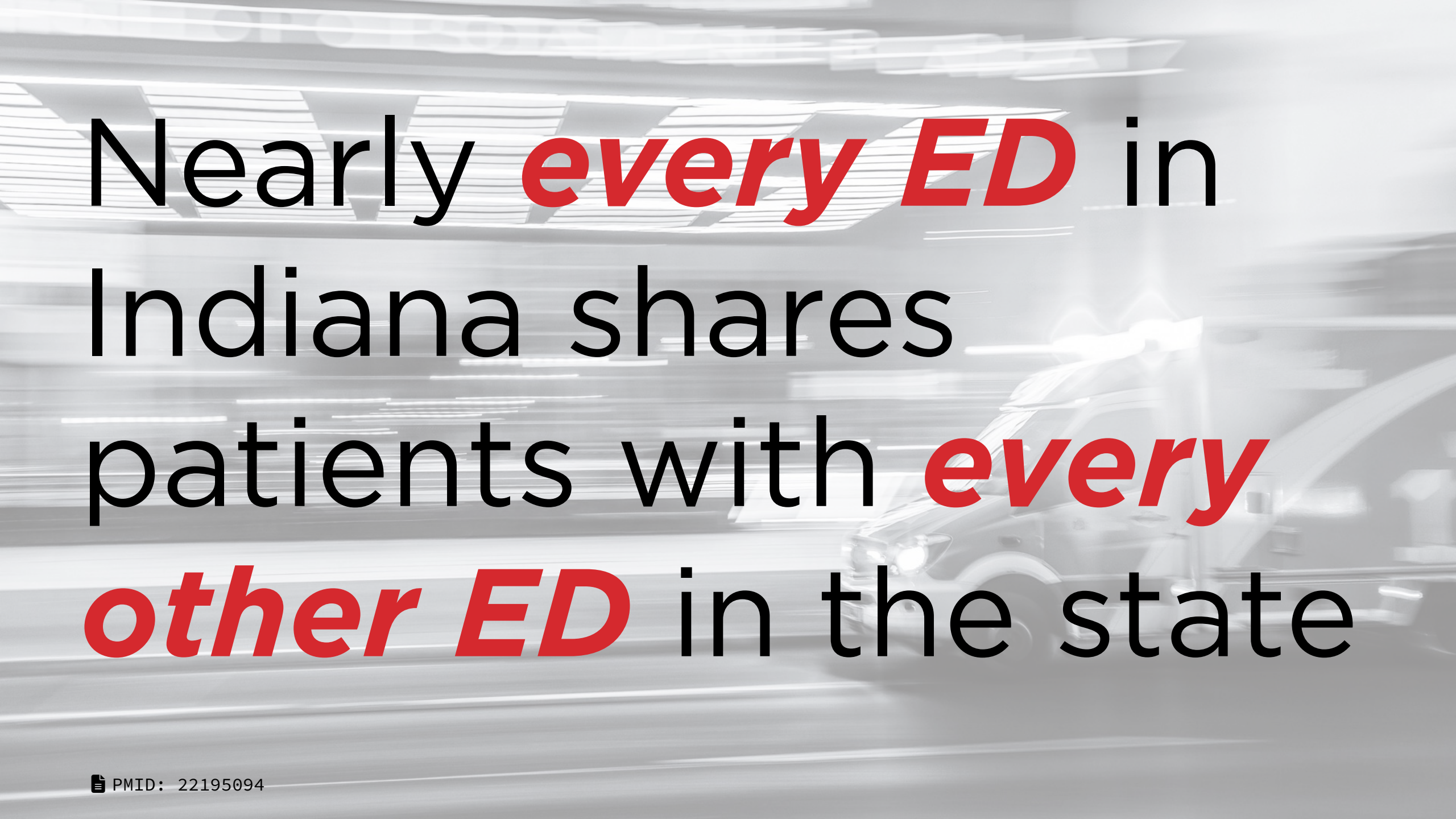
of ED visits are for patients ***with data at another institution***

PMID: 22195094

Health care is an ***intricately woven network***



PMID: 22195094



PMID: 22195094


Fixed with FHIR

Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing (HTI-1) Final Rule

ONC's HTI-1 final rule implements provisions of the 21st Century Cures Act and makes updates to the ONC Health IT Certification Program (Certification Program) with new and updated standards, implementation specifications, and certification criteria. Provisions in the HTI-1 final rule advance interoperability, improve transparency, and support the access, exchange, and use of electronic health information.

Current Endpoint Metrics

ENDPOINTS LAST QUERIED:
2024-10-07 14:07:27

TOTAL ENDPOINTS
34700

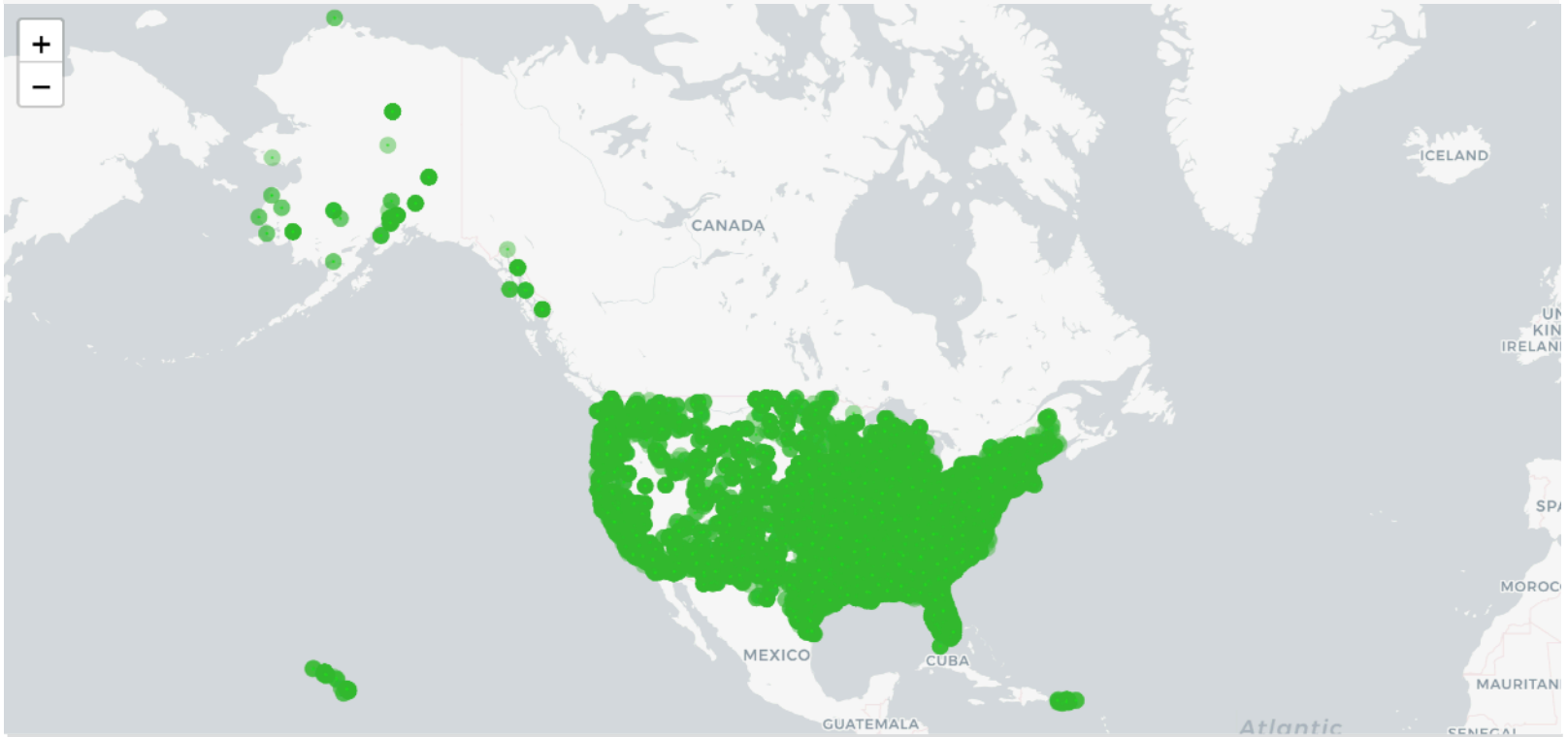
INDEXED ENDPOINTS*
34700

Current endpoint responses:

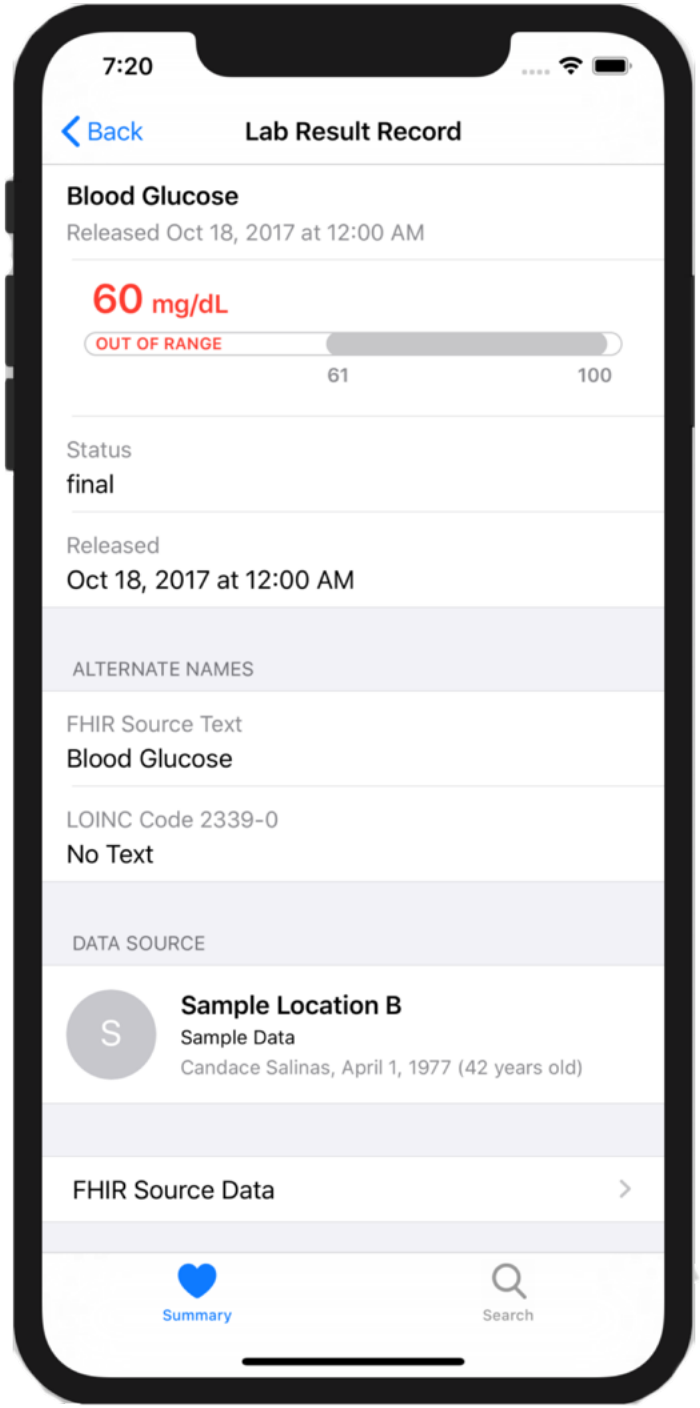
30743
200 (Success)

353
404 (Not found)

168
503 (Unavailable)



U.S. Office of National Coordinator for Health IT FHIR endpoint tracking



Current Endpoint Metrics

ENDPOINTS LAST QUERIED:
2024-10-07 14:07:27

TOTAL ENDPOINTS
34700

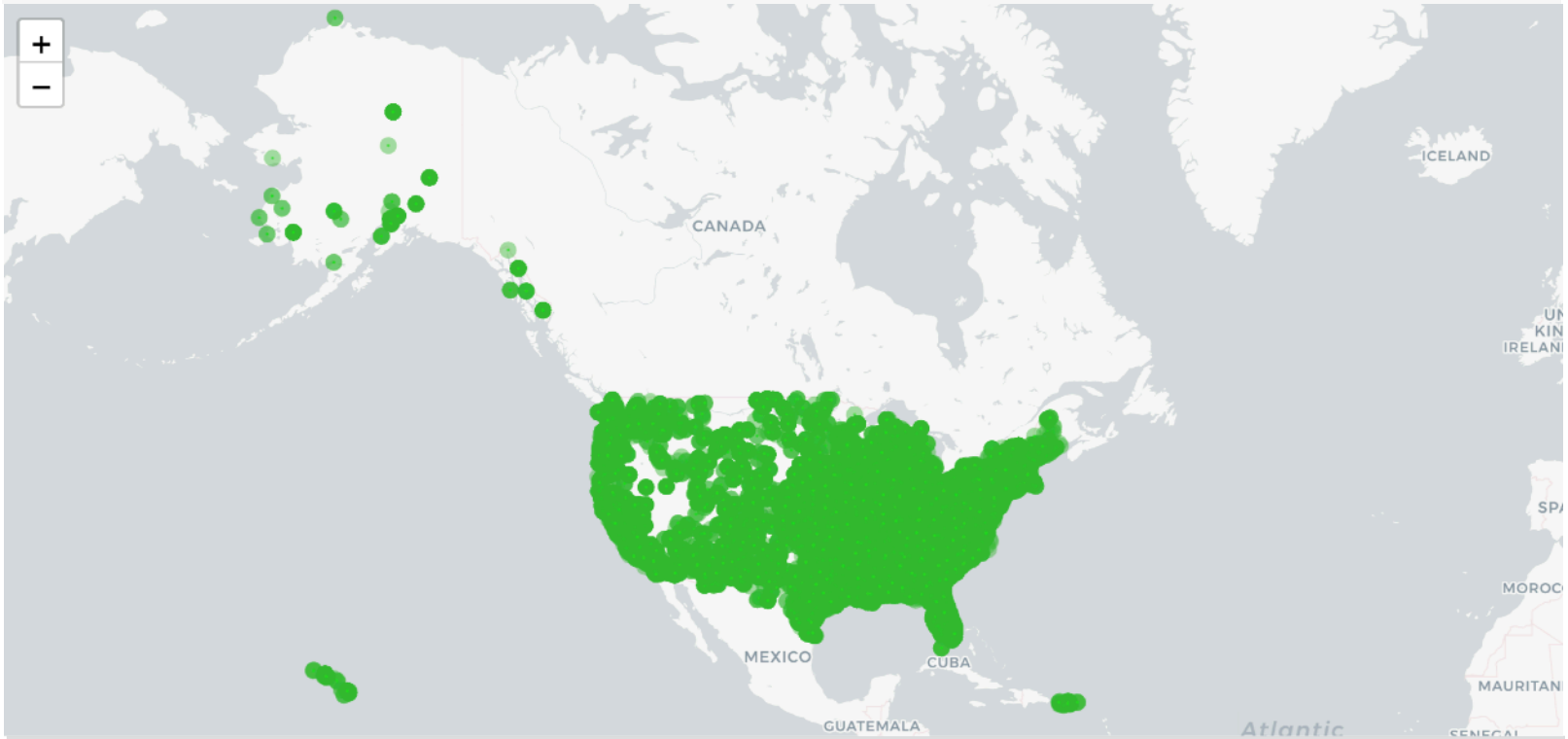
INDEXED ENDPOINTS*
34700

Current endpoint responses:

30743
200 (Success)

353
404 (Not found)

168
503 (Unavailable)

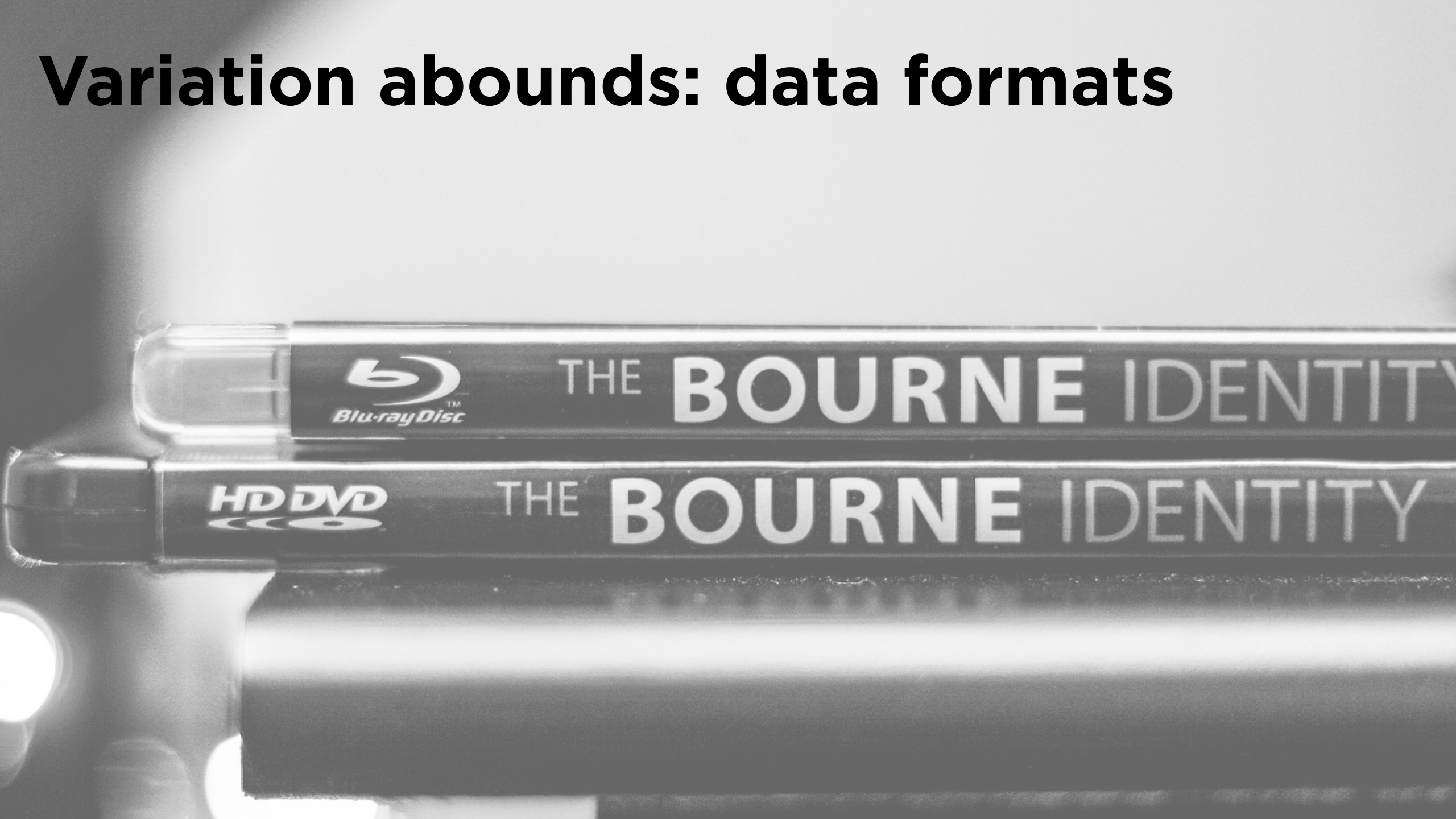


U.S. Office of National Coordinator for Health IT FHIR endpoint tracking

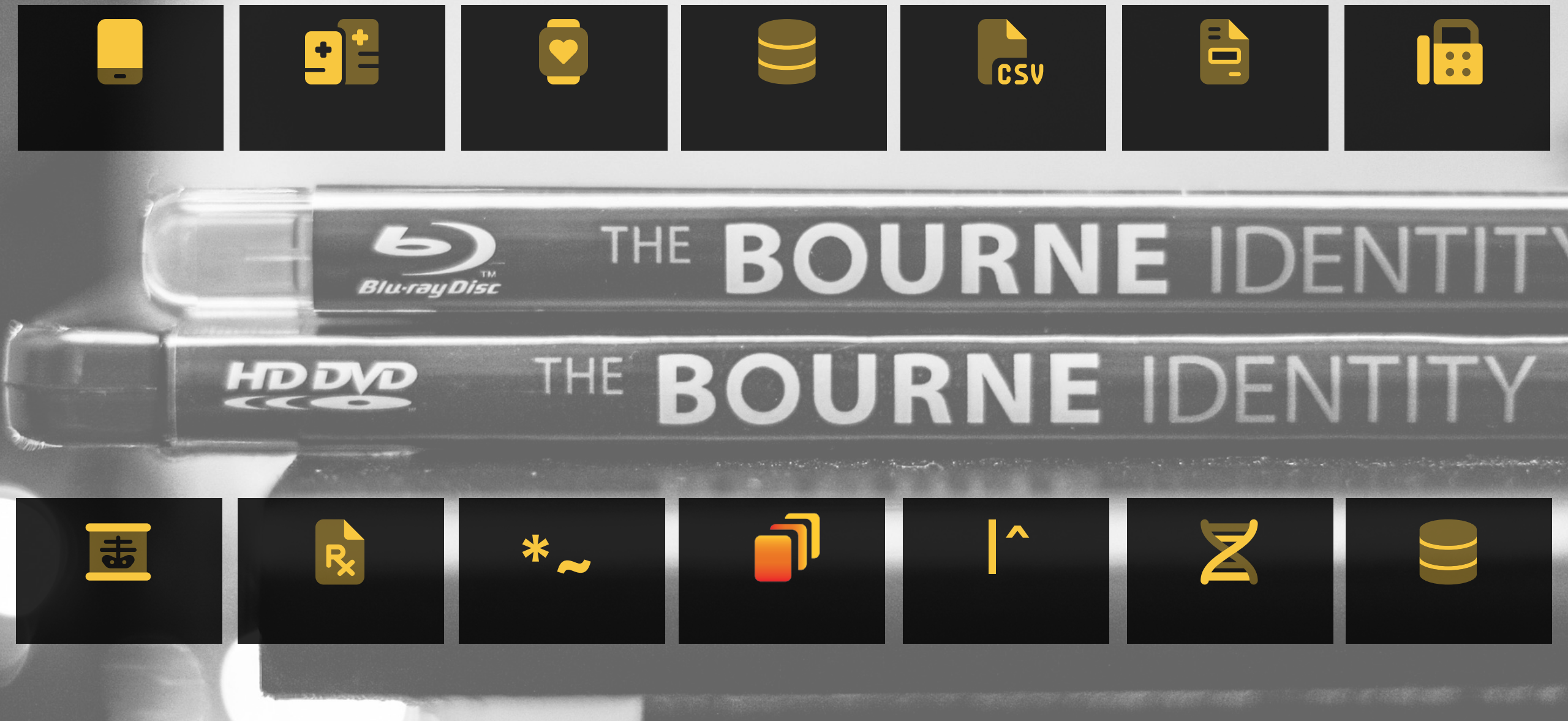
Lesson 2:

If you work with health data, ***life will be messy.***

Variation abounds: data formats



Variation abounds: data formats



Variation abounds: data formats

Variation abounds: clinical measures

CODE	NAME
34626D	Arterial BP Diastolic
39312D	ABP Diastolic
ARTDIASBP	Arterial Diastolic BP
nvArtBPS	Arterial Blood Pressure Diastolic
DBP	DBP
25284D	BP (NIBP)
2737317	Diastolic Blood Pressure #1
6881D	BP Diastolic
3800DBP	BP
77934D	BP Manual Diastolic
919109	Diastolic Blood Pressure
DiastBP	DiastolicBP
PBPD	PRE BLOOD PRESSURE DIASTOLIC
POBPD	POST BLOOD PRESSURE DIASTOLIC

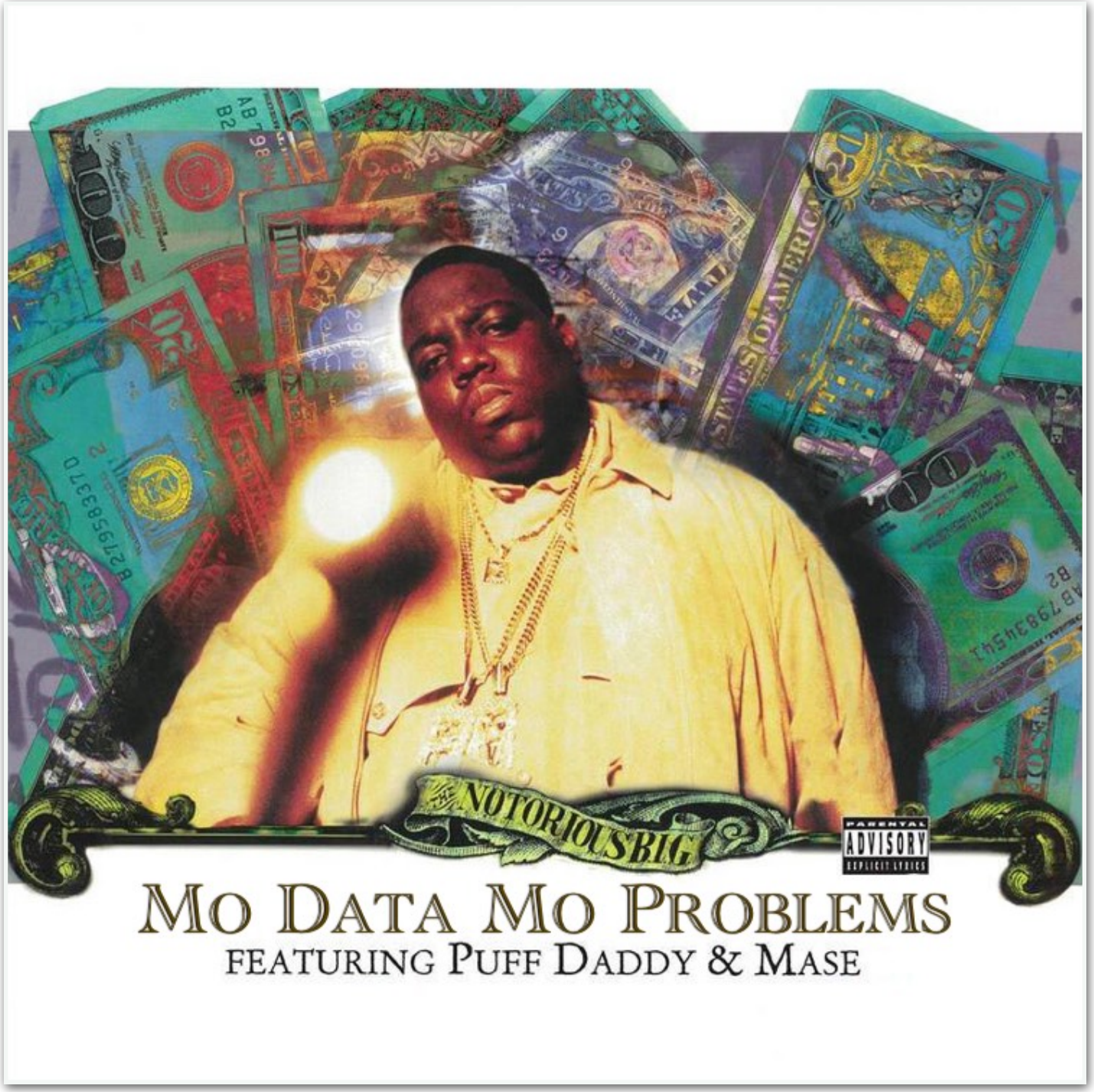
Variation abounds: lab tests

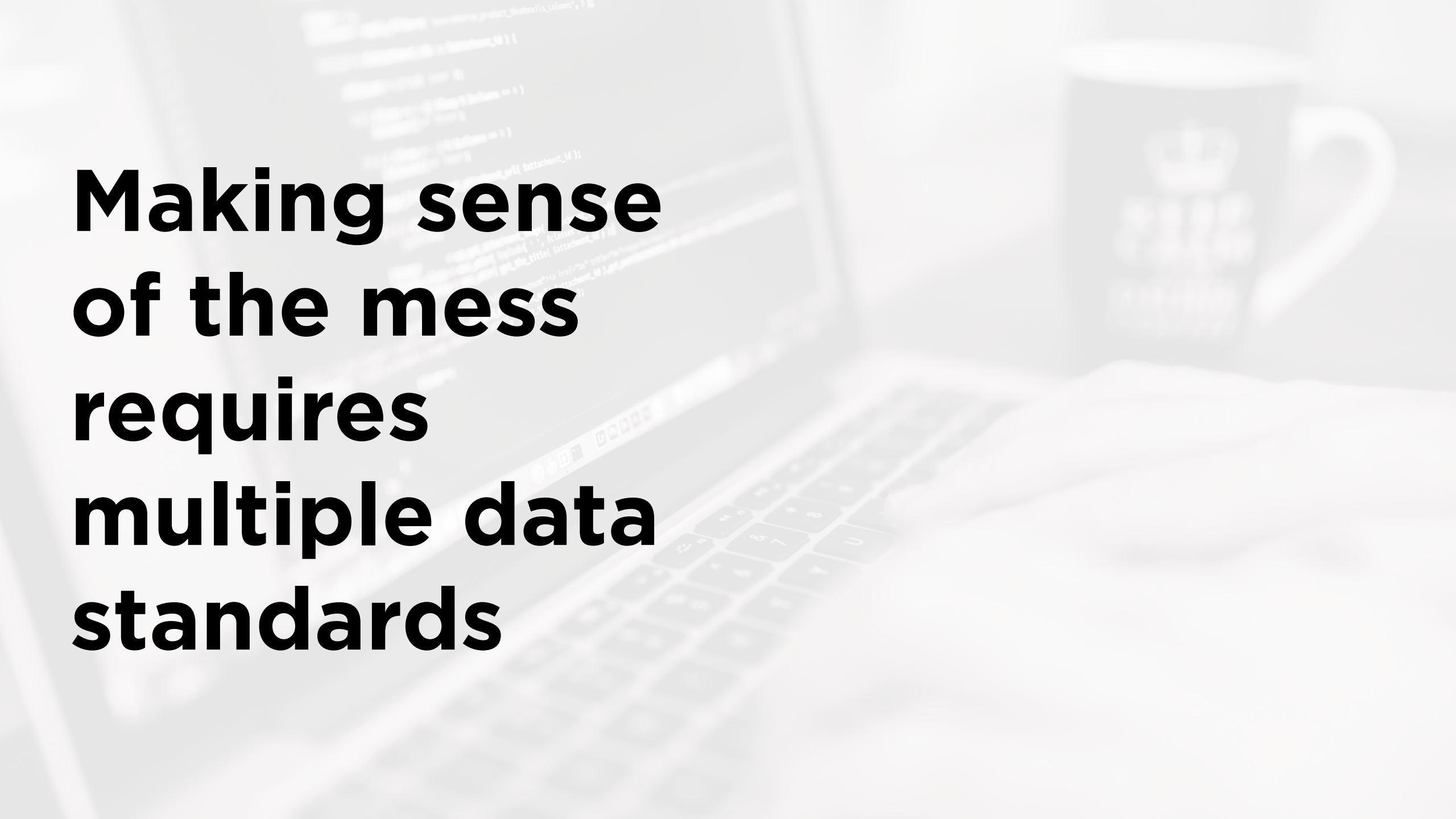
CODE	NAME
AGTCE	Angiotensin Converting Enzyme
5523	ACE SerPl Qn
ACE	ACE
22441	AngioTens Conv Enz
99234	ACE (angiotensin)
25284D	Angiotensin-1-Converting Enzyme
2737317	ACE (serum)
6881A	Angiotensin Converting Enzyme, Ser
3800ACE	ANGIOTENSIN CONVERTING ENZYME, S
77934A	Angio Convt Enzym
919109	ACE, SERUM
34ACE	Angiotensin Con. Enz
ANGCE	Angiotensin CE
6621456	Angio. Conv. Enzyme

Variation abounds: units of measure

Blank	FL	TH/UL	X10(3)
%	K/CMM	THOU/CMM	1000/UL
/100 W	k/cmm	thou/cmm	X10(3)/MCL
/CMM	K/CU MM	thou/mm3	X10(3)/UL
CMM	K/CUMM	THOU/UL	X10(6)/MCL
10 3 L	K/MCL	THOUS/CU.MM	X10*9/L
10X3UL	K/mcL	THOUS/MCL	X10E3/UL
10^3/UL	K/UL	THOU/mcL	X1000
10*3/uL	k/uL	THOUS/UL	X10X3
10?3/uL	KU/L	Thou/uL	X10^3/UL
10E3/uL	K/MM3	THOUSA	x10
10e3/uL	K/mm3	THOUSAND	X10?3/ul
10e9/L	LB	THOUSAND/UL	X10E3/UL
E9/L	PLATELET CO	U	X10E3
BIL/L	T/CMM	X 10-3/UL	K/A?L
bil/L	TH/MM3	X 10(3)/UL	K/B5L
CU MM	th/mm3	X10 3	

PMID: 24677577


THE NOTORIOUS B.I.G.
PARENTAL ADVISORY
EXPLICIT LYRICS
MO DATA MO PROBLEMS
FEATURING PUFF DADDY & MASE

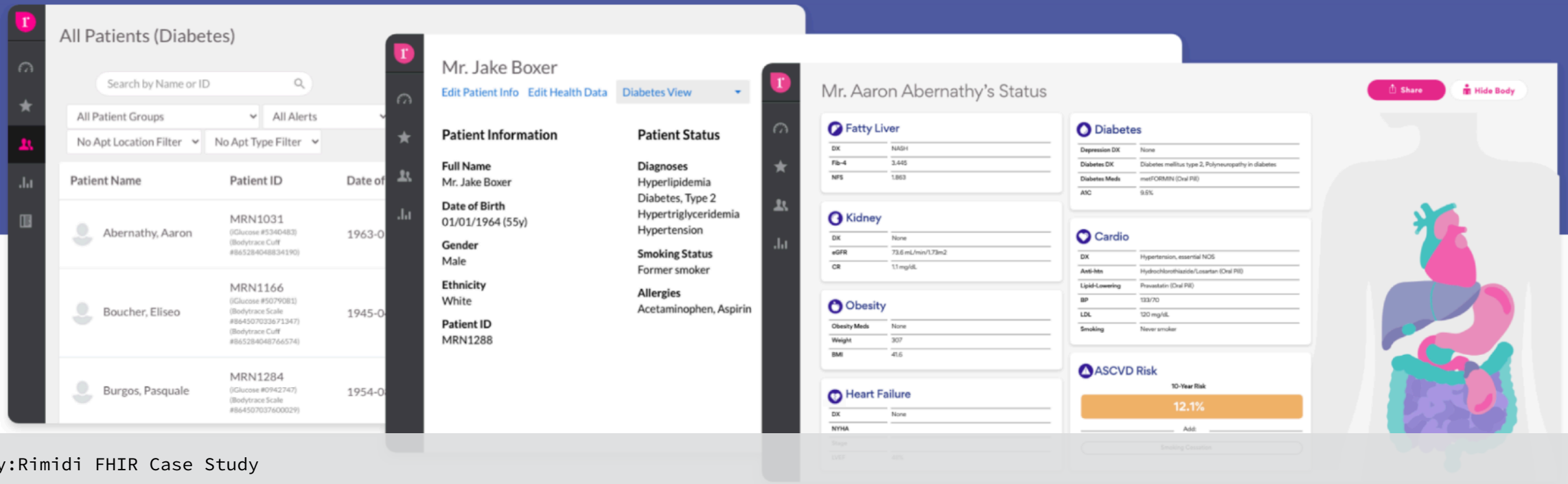


Making sense of the mess requires multiple data standards


Fixed with FHIR

A Holistic & Innovative Approach

As early pioneers of SMART on FHIR, Rimidi's clinical management platform works directly within your EHR - no separate sign in, no workflow disruption, better clinical efficiency. Rimidi combines patient-generated health data from connected devices or patient reported outcomes measures with clinical data to drive patient-specific clinical insights and actions through embedded clinical decision support cards. Current clinical use-cases of the Rimidi platform include chronic, cardiometabolic conditions, epidemic management, and perioperative care.



Emory:Rimidi FHIR Case Study

Lesson 3:

AI's magic can sparkle, but insiders know it's ***data work that powers the glow.***

"*Everyone wants to do the model work, not the data work*": Data Cascades in High-Stakes AI

Nithya Sambasivan, Shivani Kapania, Hannah Highfill, Diana Akrong, Praveen Paritosh, Lora Aroyo
[nithyasamba,kapania,hhighfill,dakrong,pkp,loraa]@google.com
Google Research
Mountain View, CA

ABSTRACT

AI models are increasingly applied in high-stakes domains like health and conservation. Data quality carries an elevated significance in high-stakes AI due to its heightened downstream impact, impacting predictions like cancer detection, wildlife poaching, and loan allocations. Paradoxically, data is the most under-valued and de-glamorised aspect of AI. In this paper, we report on data practices in high-stakes AI, from interviews with 53 AI practitioners in India, East and West African countries, and USA. We define, identify, and present empirical evidence on *Data Cascades*—compounding events causing negative, downstream effects from data issues—triggered by conventional AI/ML practices that undervalue data quality. Data cascades are pervasive (92% prevalence), invisible, delayed, but often avoidable. We discuss HCI opportunities in designing and incentivizing data excellence as a first-class citizen of AI, resulting in safer and more robust systems for all.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in HCI.**

lionized work of building novel models and algorithms [46, 125]. Intuitively, AI developers understand that data quality matters, often spending inordinate amounts of time on data tasks [60]. In practice, most organisations fail to create or meet any data quality standards [87], from under-valuing data work vis-a-vis model development.

Under-valuing of data work is common to all of AI development [125][1]. We pay particular attention to undervaluing of data in *high-stakes domains*[2] that have safety impacts on living beings, due to a few reasons. One, developers are increasingly deploying AI models in complex, humanitarian domains, *e.g.,* in maternal health, road safety, and climate change. Two, poor data quality in high-stakes domains can have outsized effects on vulnerable communities and contexts. As Hiatt *et al.* argue, high-stakes efforts are distinct from serving customers; these projects work with and for populations at risk of a litany of horrors [47]. As an example, poor data practices reduced accuracy in IBM's cancer treatment AI [115] and led to Google Flu Trends missing the flu peak by 140% [63, 73]). Three, high-stakes AI systems are typically deployed in low-resource contexts with a pronounced lack of readily available, high-quality datasets. Applications span into communities that

DOI: 10.1145/3411764.3445518

"Everyone wants to do the model work, not the data work": Data Cascades in High-Stakes AI

Paradoxically, data is the most under-valued and de-glamorised aspect of AI…

An overall lack of recognition for the invisible, arduous, and taken-for-granted data work in AI led to poor data practices, resulting in the data cascades (compounding events causing negative, downstream effects).

CCS CONCEPTS

• Human-centered computing → Empirical studies in HCI.

low-resource contexts with a pronounced lack of readily available, high-quality datasets. Applications span into communities that

DOI: 10.1145/3411764.3445518

JAMIA Open, 2(1), 2019, 197–204
doi: 10.1093/jamiaopen/ooy063
Advance Access Publication Date: 4 February 2019
Research and Applications

Research and Applications

An argument for reporting data standardization procedures in multi-site predictive modeling: case study on the impact of LOINC standardization on model performance

Amie J. Barda,[1,2] Victor M. Ruiz,[1,2] Tony Gigliotti[3] and Fuchiang (Rich) Tsui[1,2,4,5,6,7,8,*]

[1]Tsui Laboratory, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [2]Department of Biomedical Informatics, School of Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, USA, [3]Information Services Division, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA, [4]Department of Anesthesiology and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [5]Department of Biomedical and Health Informatics, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [6]Institute for Biomedical Informatics, University of Pennsylvania, Philadelphia, Pennsylvania, USA, [7]School of Computing Information, University of Pittsburgh, Pittsburgh, Pennsylvania, USA and [8]Department of Bioengineering, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

*Corresponding author: Fuchiang (Rich) Tsui, Ph.D., Tsui Laboratory, Children's Hospital of Philadelphia, 2716 South Street, Philadelphia, PA 19146, USA (tsuif@email.chop.edu)

Received 8 September 2018; Revised 22 November 2018; Editorial Decision 10 December 2018; Accepted 20 December 2018

ABSTRACT

Objectives: We aimed to gain a better understanding of how standardization of laboratory data can impact predictive model performance in multi-site datasets. We hypothesized that standardizing local laboratory codes to logical observation identifiers names and codes (LOINC) would produce predictive models that significantly outperform those learned utilizing local laboratory codes.

Materials and Methods: We predicted 30-day hospital readmission for a set of heart failure-specific visits to 13 hospitals from 2008 to 2012. Laboratory test results were extracted and then manually cleaned and mapped to LOINC. We extracted features to summarize laboratory data for each patient and used a training dataset (2008–2011) to learn models using a variety of feature selection techniques and classifiers. We evaluated our hypothesis by comparing model performance on an independent test dataset (2012).

Results: Models that utilized LOINC performed significantly better than models that utilized local laboratory test codes, regardless of the feature selection technique and classifier approach used.

Discussion and Conclusion: We quantitatively demonstrated the positive impact of standardizing multi-site laboratory data to LOINC prior to use in predictive models. We used our findings to argue for the need for detailed reporting of data standardization procedures in predictive modeling, especially in studies leveraging multi-site datasets extracted from electronic health records.

Key words: hospital readmission, heart failure, logical observation identifiers names and codes, predictive modeling, medical informatics/standards

INTRODUCTION

The growing repository of available healthcare data has motivated the healthcare community to improve medical decision-making by integrating knowledge learned from data-driven analyses.[1,2] Often, these analyses are geared toward enhancing clinical decision support (CDS) systems with models that predict events of clinical relevance, such as disease risk or progression.[2] Laboratory data are particularly valuable information in predictive modeling as they can provide in-

PMID: 30944914

JAMIA Open, 2(1), 2019, 197–204
doi: 10.1093/jamiaopen/ooy063
Advance Access Publication Date: 4 February 2019
Research and Applications

Research and Applications

An argument for reporting data standardization procedures in multi-site predictive modeling: case study on the impact of LOINC standardization on model performance

Amie J. Barda,[1,2] Victor M. Ruiz,[1,2] Tony Gigliotti[3] and Fuchiang (Rich) Tsui[1,2,4,5,6,7,8,*]

[1]Tsui Laboratory, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [2]Department of Biomedical Informatics, School of Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, USA, [3]Information Services Division, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA, [4]Department of Anesthesiology and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [5]Department of Biomedical and Health Informatics, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA, [6]Institute for Biomedical Informatics, University of Pennsylvania, Philadelphia, Pennsylvania, USA, [7]School of Computing Information, University of Pittsburgh, Pittsburgh, Pennsylvania, USA and [8]Department of Bioengineering, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

*Corresponding author: Fuchiang (Rich) Tsui, Ph.D., Tsui Laboratory, Children's Hospital of Philadelphia, 2716 South Street, Philadelphia, PA 19146, USA (tsuif@email.chop.edu)

Received 8 September 2018; Revised 22 November 2018; Editorial Decision 10 December 2018; Accepted 20 December 2018

ABSTRACT

Objectives: We aimed to gain a better understanding of how standardization of laboratory data can impact predictive model performance in multi-site datasets. We hypothesized that standardizing local laboratory codes to logical observation identifiers names and codes (LOINC) would produce predictive models that significantly outperform those learned utilizing local laboratory codes.

Materials and Methods: We predicted 30-day hospital readmission for a set of heart failure-specific visits to 13 hospitals from 2008 to 2012. Laboratory test results were extracted and then manually cleaned and mapped to LOINC. We extracted features to summarize laboratory data for each patient and used a training dataset (2008–2011) to learn models using a variety of feature selection techniques and classifiers. We evaluated our hypothesis by comparing model performance on an independent test dataset (2012).

Results: Models that utilized LOINC performed significantly better than models that utilized local laboratory test codes, regardless of the feature selection technique and classifier approach used.

Discussion and Conclusion: We quantitatively demonstrated the positive impact of standardizing multi-site laboratory data to LOINC prior to use in predictive models. We used our findings to argue for the need for detailed reporting of data standardization procedures in predictive modeling, especially in studies leveraging multi-site datasets extracted from electronic health records.

Key words: hospital readmission, heart failure, logical observation identifiers names and codes, predictive modeling, medical informatics/standards

INTRODUCTION

The growing repository of available healthcare data has motivated the healthcare community to improve medical decision-making by integrating knowledge learned from data-driven analyses.[1,2] Often, these analyses are geared toward enhancing clinical decision support (CDS) systems with models that predict events of clinical relevance, such as disease risk or progression.[2] Laboratory data are particularly valuable information in predictive modeling as they can provide in-

PMID: 30944914


Fixed with FHIR

Microsoft, Amazon, other tech giants forge ahead on healthcare data sharing pledge

by James Thorne on • July 30, 2019 at 10:00 am

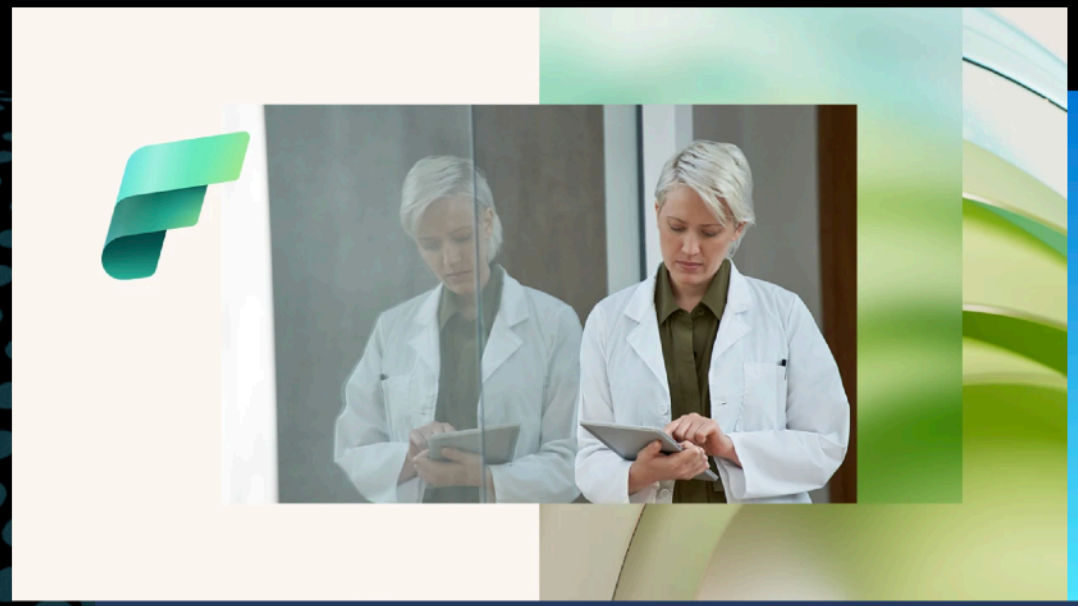
Executives from Amazon, Google, Microsoft and IBM on stage at the CMS Blue Button 2.0 Developer Conference in August 2018. From left: Dean Garfield, Alec Chalmers, Mark Dudman, Peter Lee and Greg Moore. (Microsoft Photo)

This past August, executives from Microsoft, Amazon, Google, IBM, Oracle, and Salesforce banded together to promote data sharing in healthcare. Nearly a year later, the world's largest tech companies aren't showing any signs of slowing.

Cloud providers ❤ FHIR

Big tech vendors were early voluntary adopters and now all have FHIR in their health data solutions

Geekwire coverage of White House Pledge



Healthcare News and announcements · 7 min read

Power healthcare AI with unified and protected multi-modal healthcare data

By Umesh Rustogi, General Manager, Microsoft Health and Life Sciences Data Platform

October 10, 2024

Announcing general availability of healthcare data solutions in Microsoft Fabric and public preview of healthcare application templates in Microsoft Purview.

Tags

Microsoft Fabric ❤ FHIR

Here are some of the capabilities being released in preview:

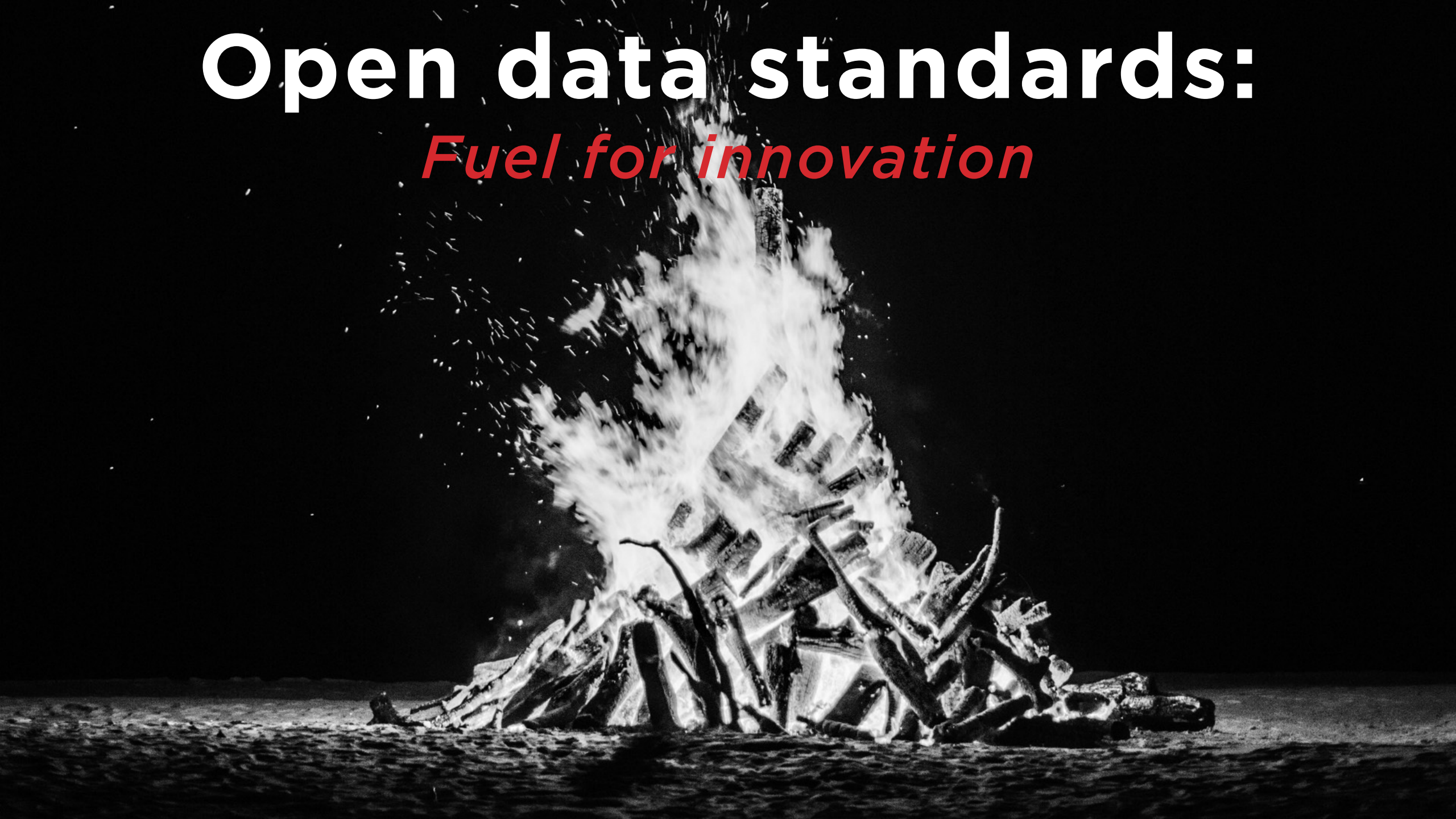
Fast Healthcare Interoperability Resources (FHIR) data ingestion. Enables easy ingestion of FHIR data from Azure Health Data Services in Microsoft Fabric Onelake environment and stores it in the bronze lakehouse as raw newline-delimited JavaScript object notation (NDJSON) files.

Relational FHIR data foundation enables the transformation of FHIR data in bronze to relational FHIR and tabular structure in open data format (delta-parquet) in Silver Lakehouse using highly scalable purpose-built pipelines. This creates a standard-based unified healthcare data model in Silver Data Lake. With support for all FHIR R4 resources, this now enables multiple downstream analytics support for scenarios leveraging the rich clinical, financial (claims and explanation of benefits), and administration data. Healthcare companies and partners can now build analytical scenarios such as quality reporting, population health management, clinical research studies, and operational reporting. It also allows a traditional SQL engine to run on top of the data for a data analyst to conduct ad-hoc exploratory analysis of the healthcare data.

Microsoft Fabric ❤ FHIR

Open data standards:

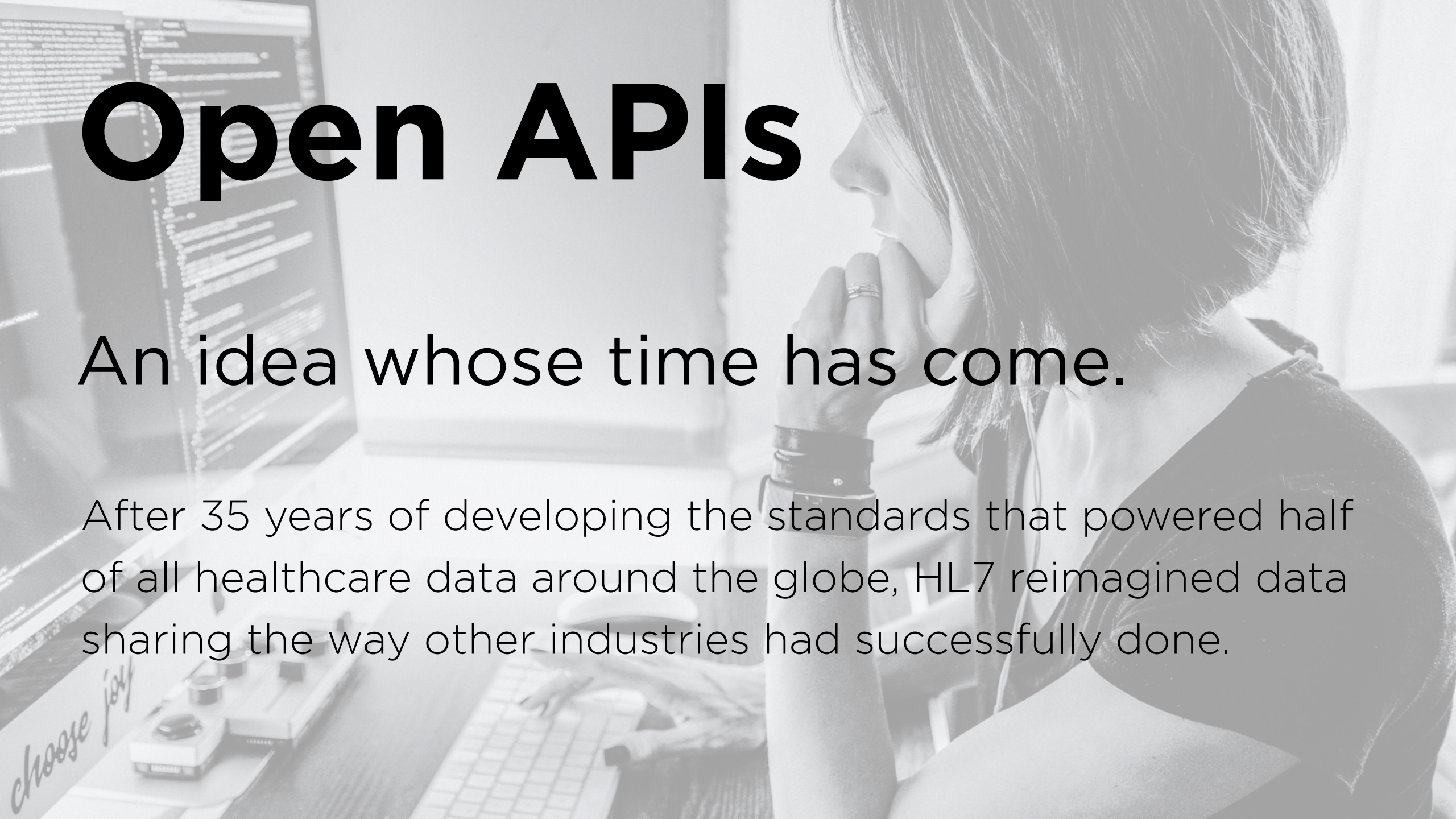
Fuel for innovation



Open APIs

An idea whose time has come.

After 35 years of developing the standards that powered half of all healthcare data around the globe, HL7 reimagined data sharing the way other industries had successfully done.



HL7® International

Organizational Profile

Not-for-profit (501c6)

Standards Development Organization

Founded in 1987

ANSI-accredited

Globally trusted

Product Families

Fast **H**ealthcare **I**nteroperability **R**esources (**FHIR**)

A transformative ***open API specification*** and ***data model*** for health information.

Now a decade+ old and a global phenomenon and public good

FHIR: the Web for health data

Why FHIR is special

Implementation focus

Foundation in modern web standards and API exchange

Open license - literally, public domain

Innovations in consensus-building and standards development

But, the biggest reason is that FHIR is also...

Why FHIR is special

Implementation focus

Foundation in modern web standards and API exchange

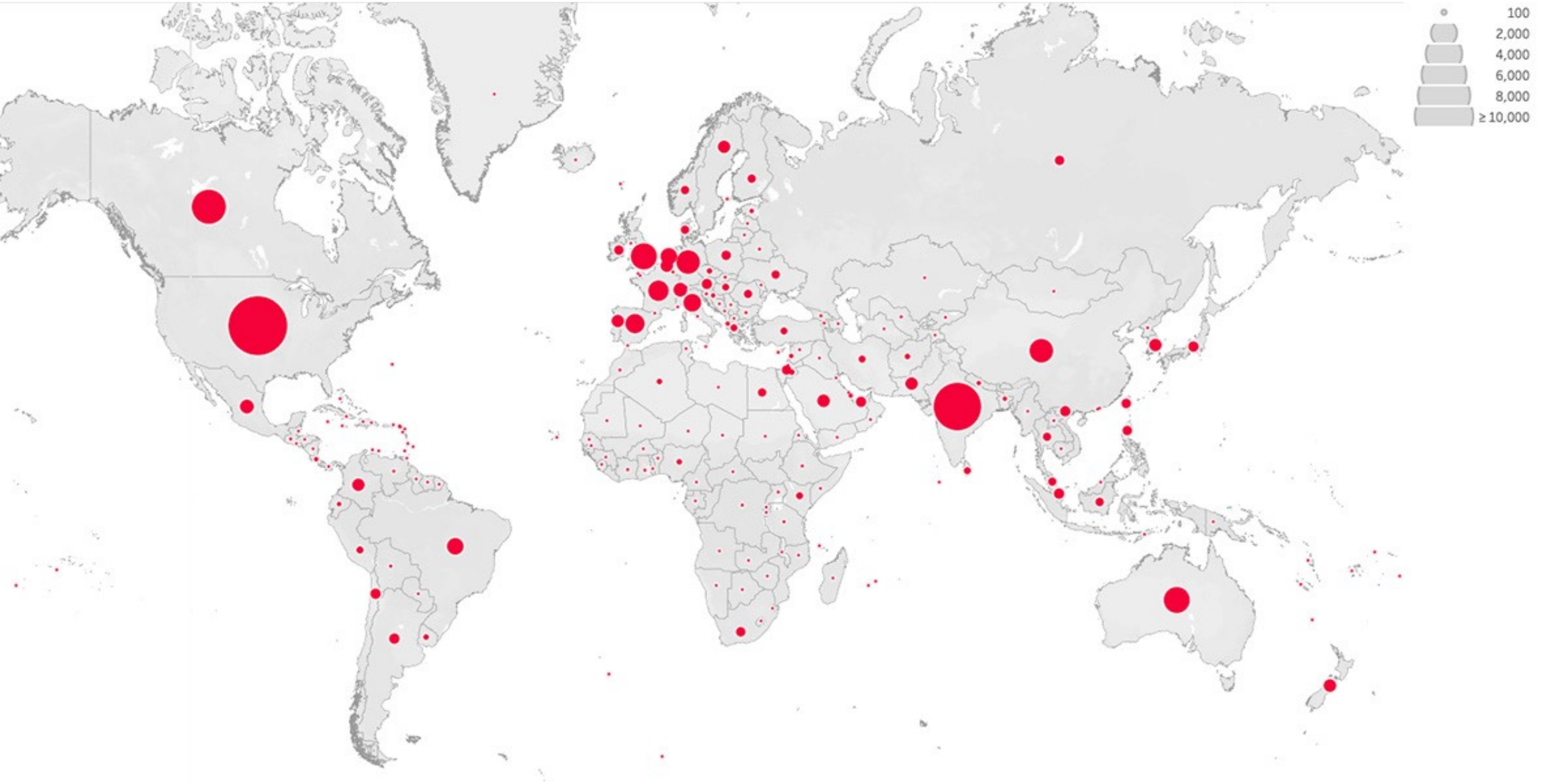
Open license - literally, public domain

Innovations in consensus-building and standards development

But, the biggest reason is that FHIR is also...

A vibrant, open, collaborative, respectful, and well-orchestrated ***community***

Propelled by an Active Community Worldwide



HL7 International Liaisons to (45) other organizations

- Alliance of Community Health Plans *(J Skapik)*
- America's Health Insurance Plans *(L James)*
- American College of Physicians *(C Jaffe)*
- American Dental Association *(R Fiehn)*
- American Health Information Management Association *(V Nguyen)*
- American Hospital Association *(open)*
- American Medical Association *(C Jaffe)*
- American Medical Informatics Association *(C Jaffe)*
- American Society for Testing Materials *(open)*
- Council for Affordable Quality Healthcare *(V Nguyen)*
- CEN/TC 251 *(E Hammond)*
- Civitas Networks for Health *(C Jaffe)*
- Clinical Data Interchange Standards Consortium *(open)*
- Coalition for Health AI *(C Jaffe)*
- College of Health Information Management Executives *(C Jaffe)*
- Designated Standards Maintenance Committee *(A Goss)*
- Digital Imaging and Communication In Medicine *(B Bialecki)*
- GS1 *(N Piper)*
- Global Consortium for eHealth Interoperability *(D Vreeman)*
- Healthcare Information and Management Systems Society *(V Nguyen)*
- IEEE *(E Hammond)*
- Integrating the Healthcare Enterprise International, Inc *(D Vreeman)*
- Interamerican Development Bank *(D Kaminker)*
- International Conference on Harmonisation *(open)*
- International Medical Informatics Association *(E Hammond)*
- International Organization for Standardization *(multiple)*
- Joint Initiative Council *(D Vreeman)*
- National Council for Prescription Drug Programs *(F McKinney)*
- Object Management Group *(K. Rubin)*
- Observational Health Data Sciences and Informatics *(E Hammond)*
- Open Concept Lab, LLC *(D Vreeman)*
- OpenMRS, Inc. *(D Vreeman)*
- Pharmaceutical Users Software Exchange *(P Guerra)*
- Regenstrief Institute, Inc. *(D Vreeman)*
- The Sequoia Project *(A Truscott)*
- SHIELD *(J Skapik)*
- SNOMED International *(A Truscott)*
- TransCelerate BioPharma, Inc *(C Jaffe)*
- UDAP.org *(D Pyke)*
- U.S. Department of Veterans Affairs *(K Rubin)*
- U.S. Food and Drug Administration *(C Jaffe)*
- U.S. Office of the National Coordinator for Health IT *(C Jaffe, D Vreeman)*
- Web3D Consortium *(E Hammond)*
- Workgroup for Electronic Data Interchange *(C Jaffe)*
- World Health Organization *(D Vreeman)*
- X12 *(J Keegan)*

A Software “Bill of Rights”

Freedom to:

1. Run the program, for any purpose
2. Study how the program works, and change it so it does your computing as you wish
3. Redistribute copies
4. Distribute copies of your modified versions, giving the community opportunity to benefit from your changes

- The Four Freedoms
- What is Free Software?

This notion of free is **not about price**.

It is about the freedom to ***create***.


HL7® FHIR®
Freedom to
Harness global interoperability wisdom
Implement, inspect, and improve the specification
Redistribute refinements, helping others

Let’s dive a little deeper

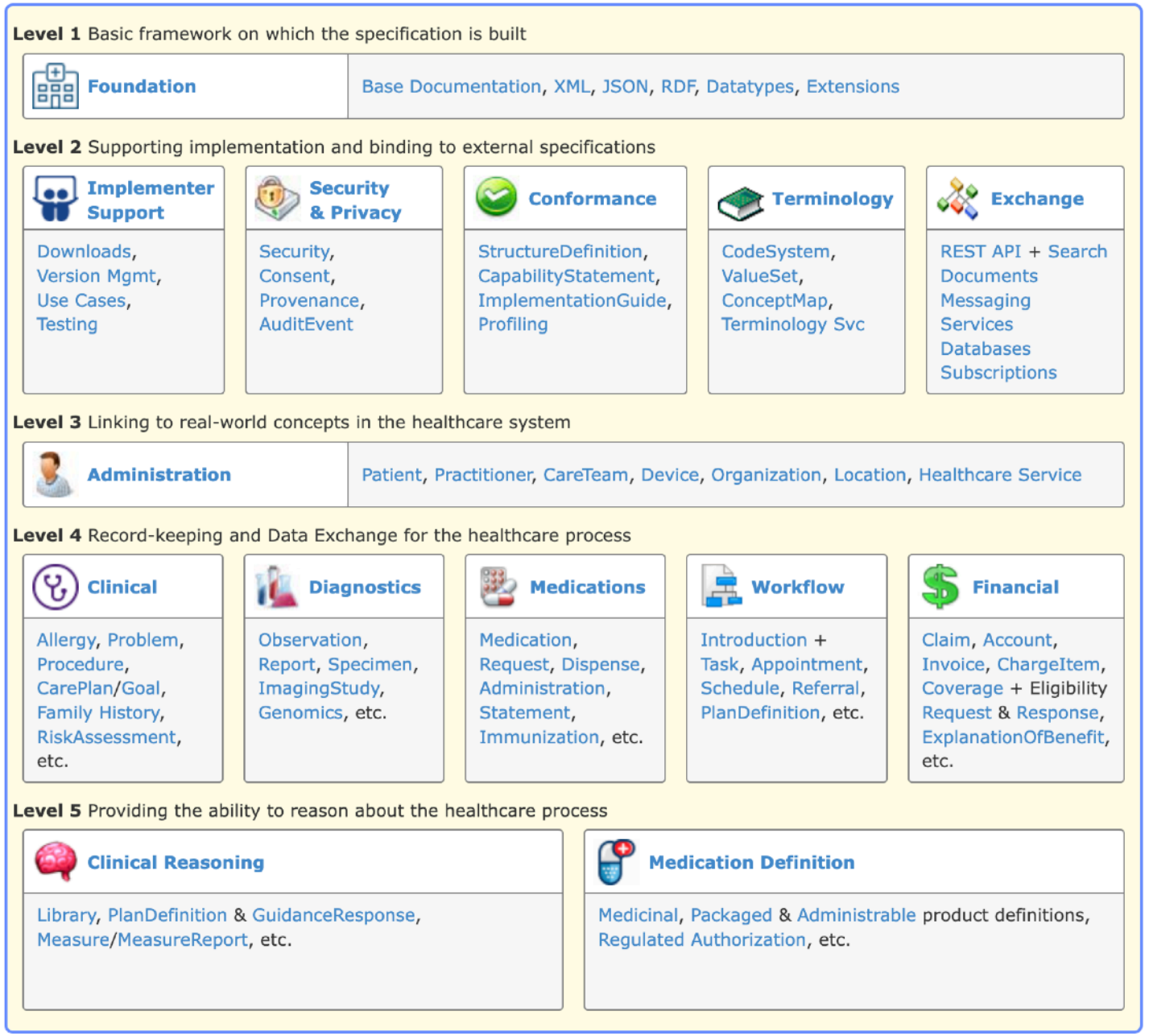
HL7 International

The FHIR spec contains 157 modular data models called **Resources**.

Each defines exchangeable content.

As a base platform standard, FHIR supports many use cases.

Implementer focus:
Will 80% of systems implement this element?



Meet Esperanza Córdova

Ms. Córdova is not feeling well
(fever, body aches, congestion, coughing).

Ugh.

So, she arranges a visit with her primary care provider (Alleen Anderson, MD).

Patient

Individual receiving health services

Name	Flags	Card.	Type	Description & Constraints
Patient	N		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	An identifier for this patient
active	?! Σ	0..1	boolean	Whether this patient's record is in active use
name	Σ	0..*	HumanName	A name associated with the patient
telecom	Σ	0..*	ContactPoint	A contact detail for the individual
gender	Σ	0..1	code	male | female | other | unknown Binding: AdministrativeGender (Required)
birthDate	Σ	0..1	date	The date of birth for the individual
deceased[x]	?! Σ	0..1		Indicates if the individual is deceased or not
deceasedBoolean			boolean	
deceasedDateTime			dateTime	
address	Σ	0..*	Address	An address for the individual
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient Binding: Marital Status Codes (Extensible)
multipleBirth[x]		0..1		Whether patient is part of a multiple birth
multipleBirthBoolean			boolean	
multipleBirthInteger			integer	
photo		0..*	Attachment	Image of the patient
contact	C	0..*	BackboneElement	A contact party (e.g. guardian, partner, friend) for the patient *+ Rule: SHALL at least contain a contact's details or a reference to an organization*
relationship		0..*	CodeableConcept	The kind of relationship Binding: Patient Contact Relationship (Extensible)
name	C	0..1	HumanName	A name associated with the contact person
telecom	C	0..*	ContactPoint	A contact detail for the person
address	C	0..1	Address	Address for the contact person

Patient

Individual receiving health services

Name	Flags	Card.	Type	Description & Constraints
Patient	N		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	An identifier for this patient
active	?! Σ	0..1	boolean	Whether this patient's record is in active use
name	Σ	0..*	HumanName	A name associated with the patient
telecom	Σ	0..*	ContactPoint	A contact detail for the individual
gender	Σ	0..1	code	male | female | other | unknown Binding: AdministrativeGender (Required)
birthDate	Σ	0..1	date	The date of birth for the individual
deceased[x]	?! Σ	0..1		Indicates if the individual is deceased or not
deceasedBoolean			boolean	
deceasedDateTime			dateTime	
address	Σ	0..*	Address	An address for the individual
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient Binding: Marital Status Codes (Extensible)
multipleBirth[x]		0..1		Whether patient is part of a multiple birth
multipleBirthBoolean			boolean	
multipleBirthInteger			integer	
photo		0..*	Attachment	Image of the patient
contact	C	0..*	BackboneElement	A contact party (e.g. guardian, partner, friend) for the patient *+ Rule: SHALL at least contain a contact's details or a reference to an organization*
relationship		0..*	CodeableConcept	The kind of relationship Binding: Patient Contact Relationship (Extensible)
name	C	0..1	HumanName	A name associated with the contact person
telecom	C	0..*	ContactPoint	A contact detail for the person
address	C	0..1	Address	Address for the contact person

Patient

Ms. Esperanza Córdova is a **married female** who prefers to communicate in **Spanish**


```
{
    "resourceType": "Patient",
    "id": "62928",
    "identifier": [ …
    ],
    "name": [
        {
            "use": "official",
            "family": "Córdova800",
            "given": [
                "Esperanza675"
            ],
            "prefix": [
                "Ms."
            ]
        }
    ],
    "telecom": [ …
    ],
    "gender": "female",
    "birthDate": "1972-05-28",
    "address": [ …
    ],
    "maritalStatus": {
        "coding": [
            {
                "system": "http://terminology.hl7.org/CodeSystem/v3-MaritalStatus",
                "code": "M",
                "display": "Married"
            }
        ],
        "text": "Married"
    },
    "communication": [
        {
            "language": {
                "coding": [
                    {
                        "system": "urn:ietf:bcp:47",
                        "code": "es",
                        "display": "Spanish"
                    }
                ],
                "text": "Spanish"
            },
            "preferred": true
        }
```

Patient

Ms. Esperanza Córdova is a **married female** who prefers to communicate in **Spanish**


```
{
    "resourceType": "Patient",
    "id": "62928",
    "identifier": [ …
    ],
    "name": [
        {
            "use": "official",
            "family": "Córdova800",
            "given": [
                "Esperanza675"
            ],
            "prefix": [
                "Ms."
            ]
        }
    ],
    "telecom": [ …
    ],
    "gender": "female",
    "birthDate": "1972-05-28",
    "address": [ …
    ],
    "maritalStatus": {
        "coding": [
            {
                "system": "http://terminology.hl7.org/CodeSystem/v3-MaritalStatus",
                "code": "M",
                "display": "Married"
            }
        ],
        "text": "Married"
    },
    "communication": [
        {
            "language": {
                "coding": [
                    {
                        "system": "urn:ietf:bcp:47",
                        "code": "es",
                        "display": "Spanish"
                    }
                ],
                "text": "Spanish"
            },
            "preferred": true
        }
```

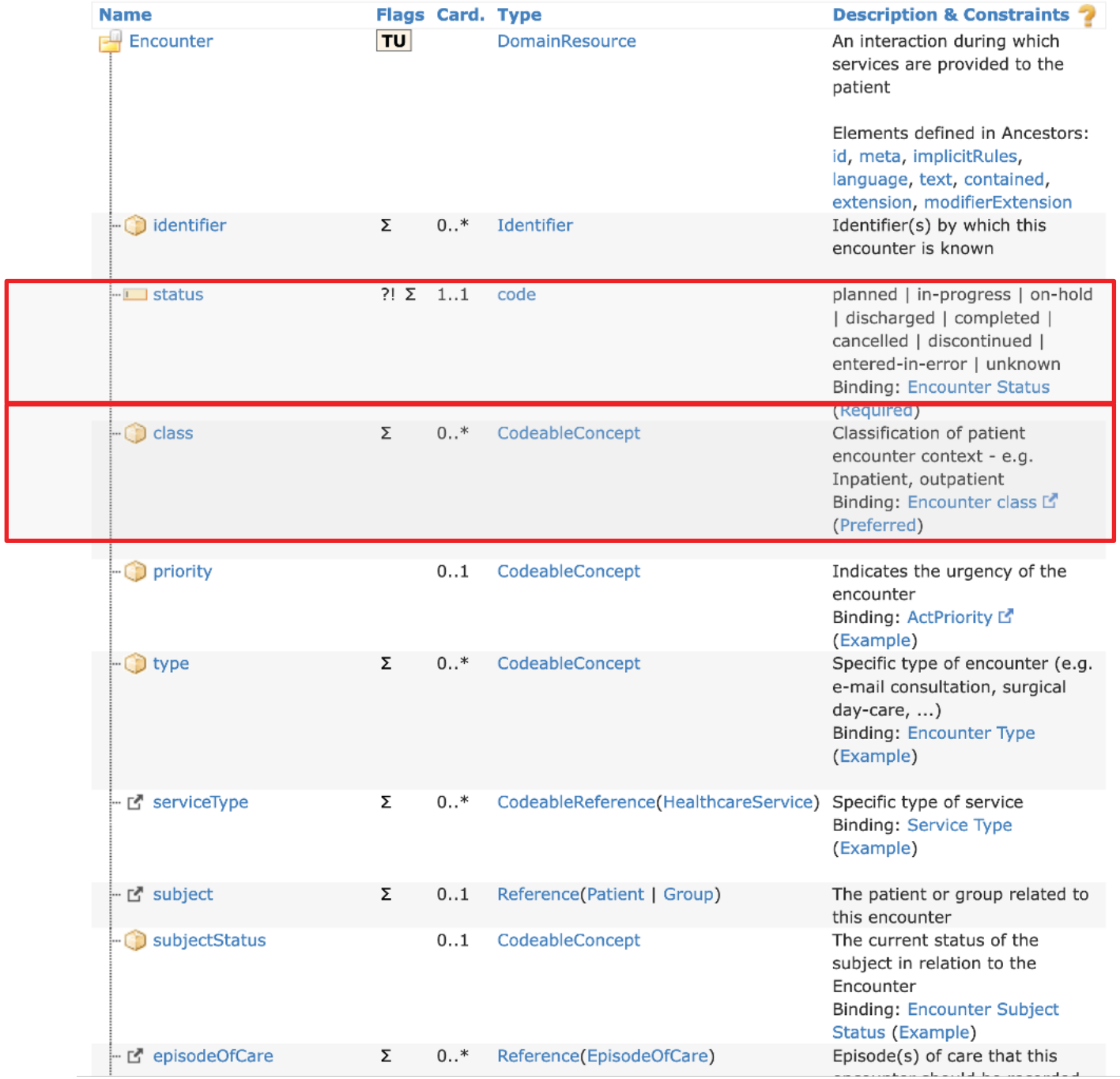
Encounter

An interaction during which services are provided for a patient

Name	Flags	Card.	Type	Description & Constraints
Encounter	TU		DomainResource	An interaction during which services are provided to the patient Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	Identifier(s) by which this encounter is known
status	?! Σ	1..1	code	planned | in-progress | on-hold | discharged | completed | cancelled | discontinued | entered-in-error | unknown Binding: Encounter Status (Required)
class	Σ	0..*	CodeableConcept	Classification of patient encounter context - e.g. Inpatient, outpatient Binding: Encounter class (Preferred)
priority		0..1	CodeableConcept	Indicates the urgency of the encounter Binding: ActPriority (Example)
type	Σ	0..*	CodeableConcept	Specific type of encounter (e.g. e-mail consultation, surgical day-care, ...) Binding: Encounter Type (Example)
serviceType	Σ	0..*	CodeableReference(HealthcareService)	Specific type of service Binding: Service Type (Example)
subject	Σ	0..1	Reference(Patient | Group)	The patient or group related to this encounter
subjectStatus		0..1	CodeableConcept	The current status of the subject in relation to the Encounter Binding: Encounter Subject Status (Example)
episodeOfCare	Σ	0..*	Reference(EpisodeOfCare)	Episode(s) of care that this

Encounter

An interaction during which services are provided for a patient



Name	Flags	Card.	Type	Description & Constraints
Encounter	TU		DomainResource	An interaction during which services are provided to the patient Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	Identifier(s) by which this encounter is known
status	?! Σ	1..1	code	planned | in-progress | on-hold | discharged | completed | cancelled | discontinued | entered-in-error | unknown Binding: Encounter Status (Required)
class	Σ	0..*	CodeableConcept	Classification of patient encounter context - e.g. Inpatient, outpatient Binding: Encounter class (Preferred)
priority		0..1	CodeableConcept	Indicates the urgency of the encounter Binding: ActPriority (Example)
type	Σ	0..*	CodeableConcept	Specific type of encounter (e.g. e-mail consultation, surgical day-care, ...) Binding: Encounter Type (Example)
serviceType	Σ	0..*	CodeableReference(HealthcareService)	Specific type of service Binding: Service Type (Example)
subject	Σ	0..1	Reference(Patient | Group)	The patient or group related to this encounter
subjectStatus		0..1	CodeableConcept	The current status of the subject in relation to the Encounter Binding: Encounter Subject Status (Example)
episodeOfCare	Σ	0..*	Reference(EpisodeOfCare)	Episode(s) of care that this

Encounter

Ms. Córdova sees Dr. Anderson for an ambulatory visit about her symptoms.


```
{
    "resourceType": "Encounter",
    "id": "62988",
    "status": "finished",
    "class": {
        "system": "http://terminology.hl7.org/CodeSystem/v3-ActCode",
        "code": "AMB"
    },
    "type": [
        {
            "coding": [
                {
                    "system": "http://snomed.info/sct",
                    "code": "185345009",
                    "display": "Encounter for symptom (procedure)"
                }
            ]
        }
    ],
    "subject": {
        "reference": "Patient/62928",
        "display": "Ms. Esperanza675 Córdova800"
    },
    "participant": [
        {
            "type": [
                {
                    "coding": [
                        {
                            "system": "http://terminology.hl7.org/CodeSystem/v3-ParticipationType",
                            "code": "PPRF",
                            "display": "primary performer"
                        }
                    ],
                    "text": "primary performer"
                }
            ],
            "period": {
                "start": "2020-02-29T07:56:34-05:00",
                "end": "2020-02-29T08:57:34-05:00"
            },
            "individual": {
                "reference": "Practitioner/15116",
                "display": "Dr. Alleen813 Anderson154"
```

Encounter

Ms. Córdova sees Dr. Anderson for an ambulatory visit about her symptoms.


```
{
    "resourceType": "Encounter",
    "id": "62988",
    "status": "finished",
    "class": {
        "system": "http://terminology.hl7.org/CodeSystem/v3-ActCode",
        "code": "AMB"
    },
    "type": [
        {
            "coding": [
                {
                    "system": "http://snomed.info/sct",
                    "code": "185345009",
                    "display": "Encounter for symptom (procedure)"
                }
            ]
        }
    ],
    "subject": {
        "reference": "Patient/62928",
        "display": "Ms. Esperanza675 Córdova800"
    },
    "participant": [
        {
            "type": [
                {
                    "coding": [
                        {
                            "system": "http://terminology.hl7.org/CodeSystem/v3-ParticipationType",
                            "code": "PPRF",
                            "display": "primary performer"
                        }
                    ],
                    "text": "primary performer"
                }
            ],
            "period": {
                "start": "2020-02-29T07:56:34-05:00",
                "end": "2020-02-29T08:57:34-05:00"
            },
            "individual": {
                "reference": "Practitioner/15116",
                "display": "Dr. Alleen813 Anderson154"
```

Observation

Because of her symptoms, Ms. Córdova has a NAAT for SARS-CoV-2


```
{
    "resourceType": "Observation",
    "id": "63006",
    "status": "final",
    "category": [
        {
            "coding": [
                {
                    "system": "http://terminology.hl7.org/CodeSystem/observation-category",
                    "code": "laboratory",
                    "display": "laboratory"
                }
            ]
        }
    ],
    "code": {
        "coding": [
            {
                "system": "http://loinc.org",
                "code": "94309-2",
                "display": "SARS-CoV-2 (COVID-19) RNA [Presence] in Specimen by NAA with probe detection"
            }
        ],
        "text": "SARS-CoV-2 (COVID-19) RNA [Presence] in Specimen by NAA with probe detection"
    },
    "subject": {
        "reference": "Patient/62928"
    },
    "encounter": {
        "reference": "Encounter/62988"
    },
    "effectiveDateTime": "2020-02-29T08:57:34-05:00",
    "issued": "2020-02-29T08:57:34.125-05:00",
    "valueCodeableConcept": {
        "coding": [
            {
                "system": "http://snomed.info/sct",
                "code": "260373001",
                "display": "Detected (qualifier value)"
            }
        ],
        "text": "Detected (qualifier value)"
    }
}
```

Observation

Because of her symptoms, Ms. Córdova has a NAAT for SARS-CoV-2


```
{
    "resourceType": "Observation",
    "id": "63006",
    "status": "final",
    "category": [
        {
            "coding": [
                {
                    "system": "http://terminology.hl7.org/CodeSystem/observation-category",
                    "code": "laboratory",
                    "display": "laboratory"
                }
            ]
        }
    ],
    "code": {
        "coding": [
            {
                "system": "http://loinc.org",
                "code": "94309-2",
                "display": "SARS-CoV-2 (COVID-19) RNA [Presence] in Specimen by NAA with probe detection"
            }
        ],
        "text": "SARS-CoV-2 (COVID-19) RNA [Presence] in Specimen by NAA with probe detection"
    },
    "subject": {
        "reference": "Patient/62928"
    },
    "encounter": {
        "reference": "Encounter/62988"
    },
    "effectiveDateTime": "2020-02-29T08:57:34-05:00",
    "issued": "2020-02-29T08:57:34.125-05:00",
    "valueCodeableConcept": {
        "coding": [
            {
                "system": "http://snomed.info/sct",
                "code": "260373001",
                "display": "Detected (qualifier value)"
            }
        ],
        "text": "Detected (qualifier value)"
    }
}
```

RESTful API

Defines common interactions (read, update, search, etc) performed on a repository of typed Resources

HL7 FHIR Release 5

Exchange > **RESTful API**

This page is part of the FHIR Specification (v5.0.0: R5 - STU). This is the current published version. For a full list of available versions, see the Directory of published versions. Page versions: **R5** R4B R4 R3 R2

3.2.0 RESTful API

FHIR Infrastructure Work Group	Maturity Level: Normative	Standards Status: Normative

FHIR is described as a 'RESTful' specification based on common industry level use of the term REST. In practice, FHIR only supports Level 2 of the REST Maturity model as part of the core specification, though full Level 3 conformance is possible through the use of extensions. Because FHIR is a standard, it relies on the standardization of resource structures and interfaces. This may be considered a violation of REST principles but is key to ensuring consistent interoperability across diverse systems.

For each "resource type" the same set of interactions are defined which can be used to manage the resources in a highly granular fashion. Applications claiming conformance to this framework claim to be conformant to "RESTful FHIR" (see Conformance).

In addition to a number of General Considerations this page defines the following interactions:

Instance Level Interactions	
read	Read the current state of the resource
vread	Read the state of a specific version of the resource
update	Update an existing resource by its id (or create it if it is new)
patch	Update an existing resource by posting a set of changes to it
delete	Delete a resource
history	Retrieve the change history for a particular resource
Type Level Interactions	
create	Create a new resource with a server assigned id
search	Search the resource type based on some filter criteria
delete	Conditional Delete across a particular resource type based on some filter criteria
history	Retrieve the change history for a particular resource type
Whole System Interactions	

API Examples:

Return *SARS-CoV-2 RNA NAAT* **Observation** for my patient

```
GET {base}/Observation?patient=62928&code=94309-2
```

Return any **Patients** with a *SARS-CoV-2 RNA NAAT* **Observation**

```
GET {base}/Patient?_has:Observation:patient:code=94309-2
```

FHIR Feature: Flexibility + Adaptation

Health data is inevitably complex; the **long tail**.

As a platform standard, FHIR's solution: specific techniques for extending and constraining via **profiles**.

FHIR Feature: Flexibility + Adaptation

Health data is inevitably complex; the **long tail**.

As a platform standard, FHIR's solution: specific techniques for extending and constraining via **profiles**.

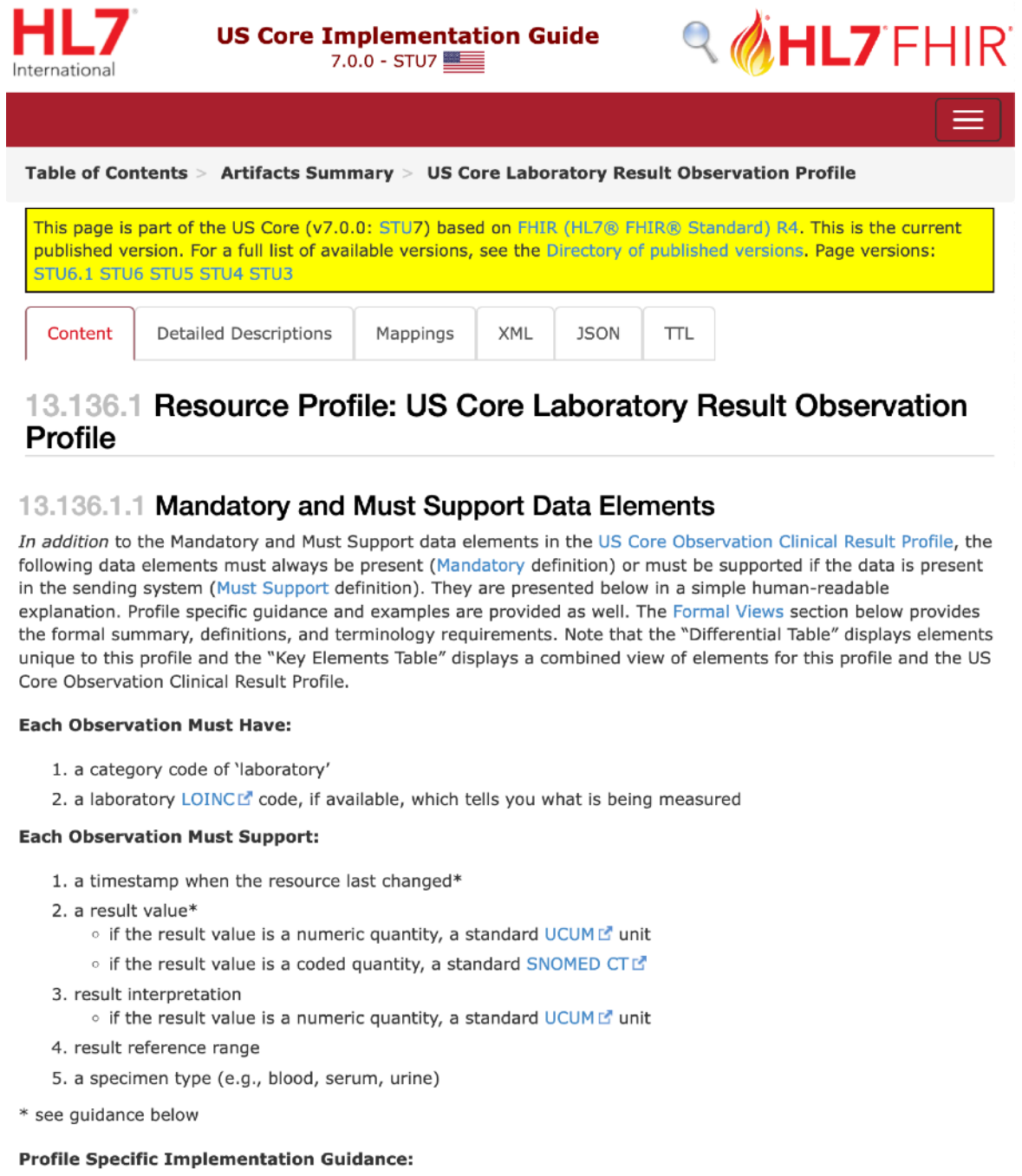
FHIR Lingo: *Implementation Guide (IG)*

A specification for how FHIR resources (and APIs) are used for a particular interoperability problem, including computable structures (called **profiles**) representing the adaptations of the base FHIR standard for that use case.

Profile

[Observation]

The FHIR specification is designed to be both **extended** and **constrained** for specific purposes



HL7 International

US Core Implementation Guide
7.0.0 - STU7

HL7 FHIR

Table of Contents > Artifacts Summary > US Core Laboratory Result Observation Profile

This page is part of the US Core (v7.0.0: STU7) based on FHIR (HL7® FHIR® Standard) R4. This is the current published version. For a full list of available versions, see the Directory of published versions. Page versions: STU6.1 STU6 STU5 STU4 STU3

Content | Detailed Descriptions | Mappings | XML | JSON | TTL

13.136.1 Resource Profile: US Core Laboratory Result Observation Profile

13.136.1.1 Mandatory and Must Support Data Elements

In addition to the Mandatory and Must Support data elements in the US Core Observation Clinical Result Profile, the following data elements must always be present (Mandatory definition) or must be supported if the data is present in the sending system (Must Support definition). They are presented below in a simple human-readable explanation. Profile specific guidance and examples are provided as well. The Formal Views section below provides the formal summary, definitions, and terminology requirements. Note that the "Differential Table" displays elements unique to this profile and the "Key Elements Table" displays a combined view of elements for this profile and the US Core Observation Clinical Result Profile.

Each Observation Must Have:

1. a category code of 'laboratory'
2. a laboratory LOINC code, if available, which tells you what is being measured

Each Observation Must Support:

1. a timestamp when the resource last changed*
2. a result value*
   - if the result value is a numeric quantity, a standard UCUM unit
   - if the result value is a coded quantity, a standard SNOMED CT
3. result interpretation
   - if the result value is a numeric quantity, a standard UCUM unit
4. result reference range
5. a specimen type (e.g., blood, serum, urine)

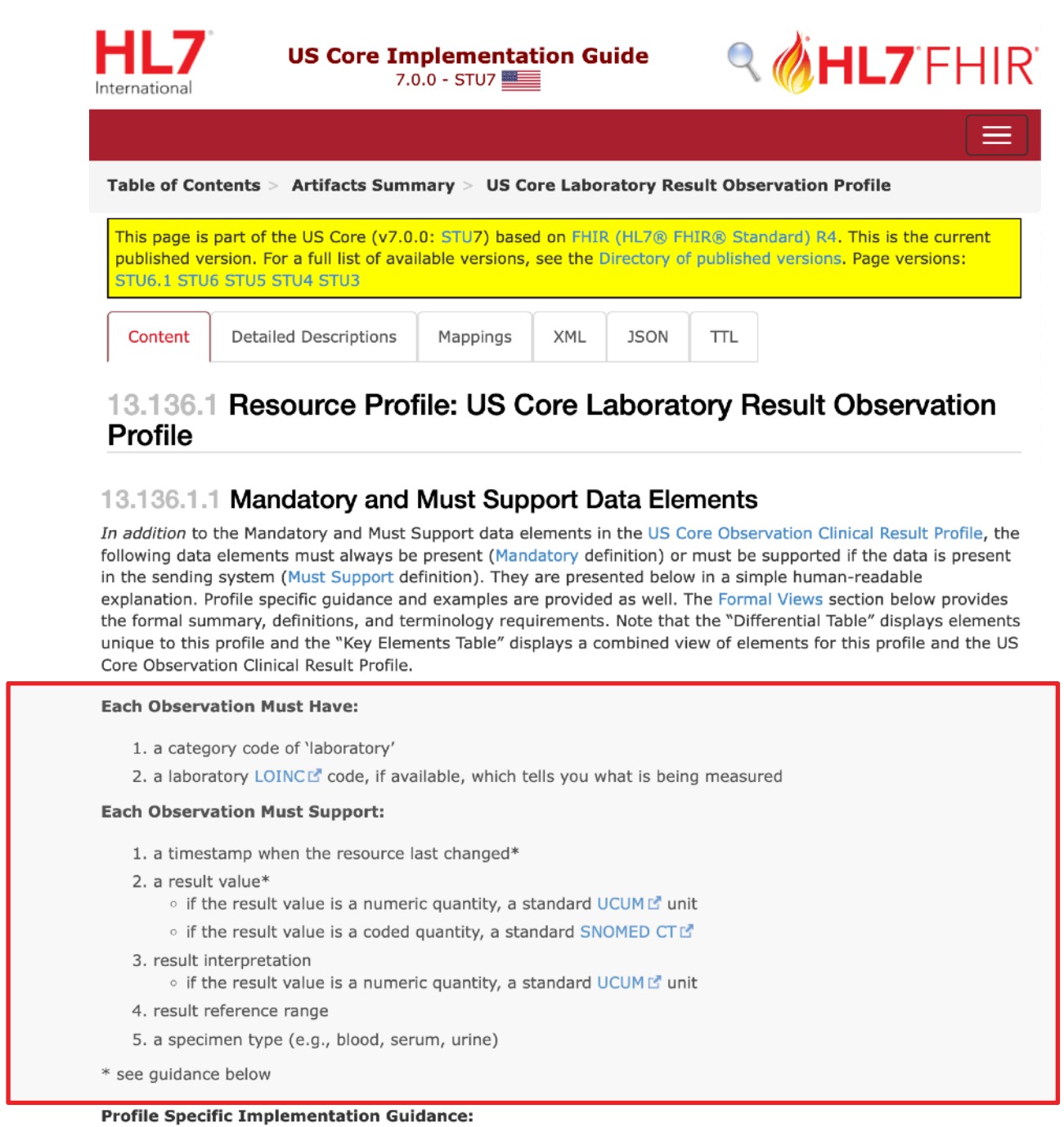
* see guidance below

Profile Specific Implementation Guidance:

Profile

[Observation]

The FHIR specification is designed to be both **extended** and **constrained** for specific purposes



HL7 International

US Core Implementation Guide
7.0.0 - STU7

HL7 FHIR

Table of Contents > Artifacts Summary > US Core Laboratory Result Observation Profile

This page is part of the US Core (v7.0.0: STU7) based on FHIR (HL7® FHIR® Standard) R4. This is the current published version. For a full list of available versions, see the Directory of published versions. Page versions: STU6.1 STU6 STU5 STU4 STU3

Content | Detailed Descriptions | Mappings | XML | JSON | TTL

13.136.1 Resource Profile: US Core Laboratory Result Observation Profile

13.136.1.1 Mandatory and Must Support Data Elements

In addition to the Mandatory and Must Support data elements in the US Core Observation Clinical Result Profile, the following data elements must always be present (Mandatory definition) or must be supported if the data is present in the sending system (Must Support definition). They are presented below in a simple human-readable explanation. Profile specific guidance and examples are provided as well. The Formal Views section below provides the formal summary, definitions, and terminology requirements. Note that the "Differential Table" displays elements unique to this profile and the "Key Elements Table" displays a combined view of elements for this profile and the US Core Observation Clinical Result Profile.

Each Observation Must Have:

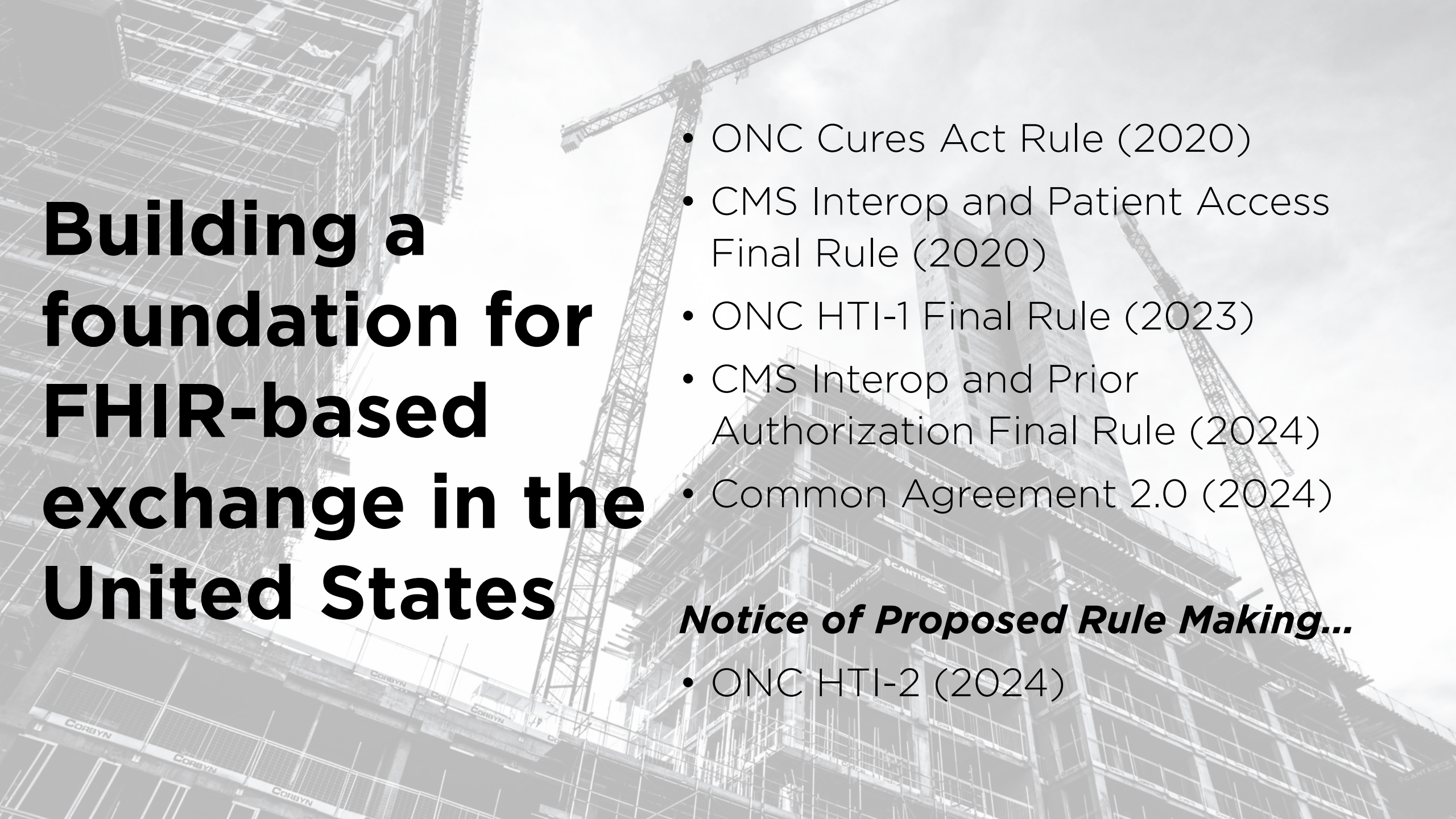
1. a category code of 'laboratory'
2. a laboratory LOINC code, if available, which tells you what is being measured

Each Observation Must Support:

1. a timestamp when the resource last changed*
2. a result value*
   - if the result value is a numeric quantity, a standard UCUM unit
   - if the result value is a coded quantity, a standard SNOMED CT
3. result interpretation
   - if the result value is a numeric quantity, a standard UCUM unit
4. result reference range
5. a specimen type (e.g., blood, serum, urine)

* see guidance below

Profile Specific Implementation Guidance:



Building a foundation for FHIR-based exchange in the United States

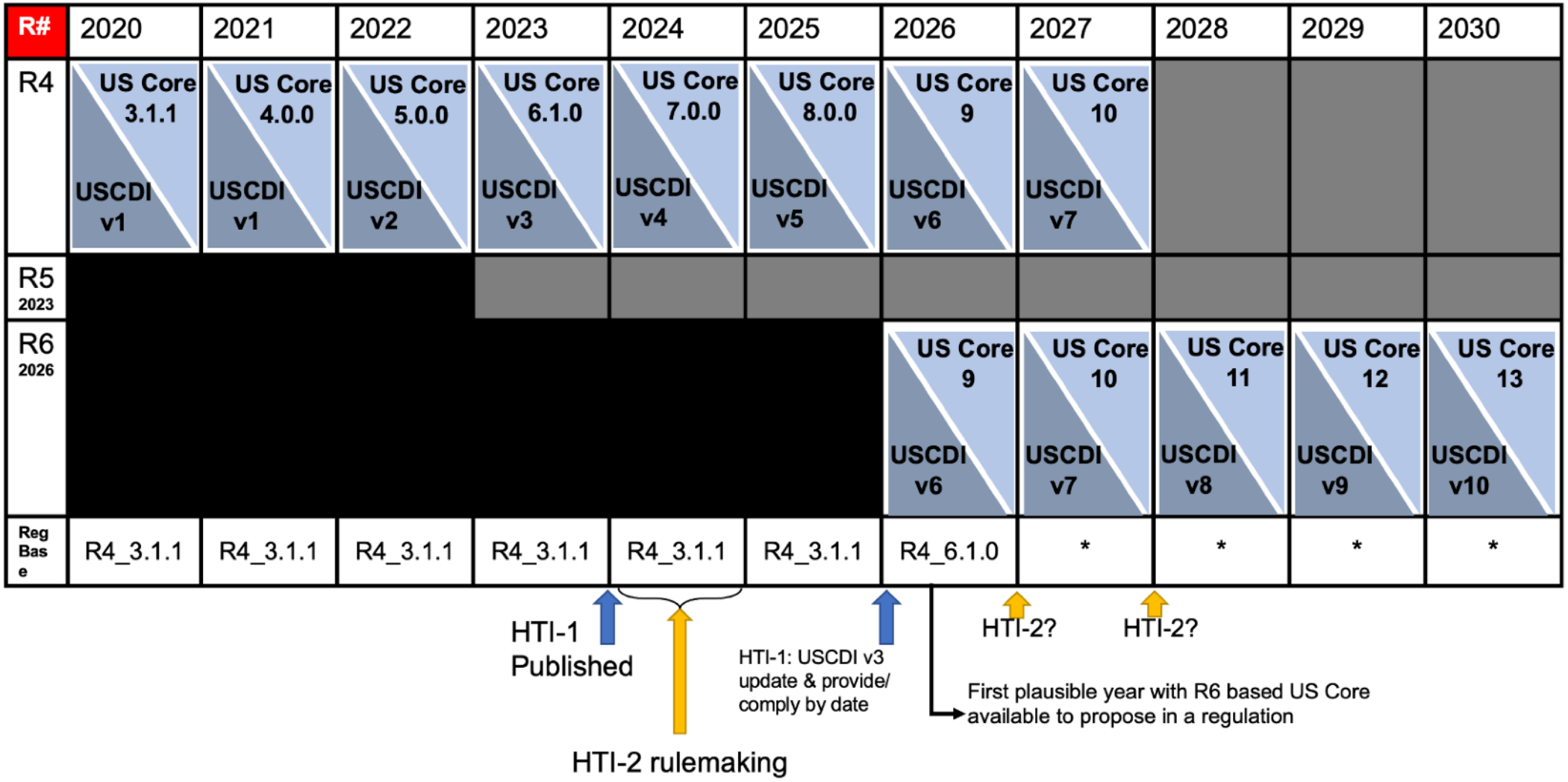
- ONC Cures Act Rule (2020)
- CMS Interop and Patient Access Final Rule (2020)
- ONC HTI-1 Final Rule (2023)
- CMS Interop and Prior Authorization Final Rule (2024)
- Common Agreement 2.0 (2024)

Notice of Proposed Rule Making…

- ONC HTI-2 (2024)

U.S. Core Data for Interoperability (V2)

Advancing FHIR U.S. Core to meet industry needs



HL7 International

US Core Implementation Guide
7.0.0 - STU7

HL7 FHIR

Home | Conformance | Guidance | FHIR Artifacts | Security | Examples | Downloads | Change Log

Table of Contents > **Home**

This page is part of the US Core (v7.0.0: STU7) based on FHIR (HL7® FHIR® Standard) R4. This is the current published version. For a full list of available versions, see the Directory of published versions. Page versions: STU6.1 STU6 STU5 STU4 STU3 STU2 STU1

1 Home

Official URL: **http://hl7.org/fhir/us/core/ImplementationGuide/hl7.fhir.us.core**		*Version*: **7.0.0**
IG Standards status: Trial-use	Maturity Level: 3	*Computable Name*: USCore
Other Identifiers: OID:2.16.840.1.113883.4.642.40.2		
Copyright/Legal: Used by permission of HL7 International, all rights reserved Creative Commons License		

STU Note
Key updates and detailed changes between this and prior versions are available on the US Core Change Log and Changes Between Versions pages.

1.1 Introduction

This guide and the US Core profiles have become the foundation for US Realm FHIR implementation guides. This annual release reflects changes to U.S. Core Data for Interoperability (USCDI) and comments and requests from the US Realm FHIR community. (The Future of US Core page outlines this approach to yearly updates.) US Core has benefitted from testing and guidance by the Argonaut Project Team. Their feedback continues to lay the groundwork for documenting the US Core Profile design, interactions, requirements, and guidelines for patient data access and ONC Certification testing. Under the guidance of HL7 and the HL7 US Realm Steering Committee, the content will expand in future versions to meet the needs specific to the US Realm.

The US Core Implementation Guide is based on FHIR Version R4. It defines the minimum constraints on the FHIR resources to create the US Core Profiles. The elements, extensions, vocabularies, and value sets that SHALL be present are identified, and how they are used is defined. It also documents the minimum FHIR RESTful interactions for each US Core Profiles to access patient data. Establishing the "floor" of standards to promote interoperability and adoption through common implementation allows for further standards development evolution for specific use cases. There are two different ways to implement US Core:

1. Profile Only Support: Systems may support *only* the US Core Profiles to represent clinical information.
2. Profile Support + Interaction Support: Systems may support *both* the US Core Profile content structure *and* the RESTful interactions defined for a resource.

For a detailed description of these different usages of US Core, see the Conformance Requirements page.

1.2 Background

The US Core requirements were initially developed, balloted, and published in FHIR DSTU2 as part of the Office of the National Coordinator for Health Information Technology (ONC) sponsored Data Access Framework (DAF) project. The Argonaut Data Query Implementation Guide superseded DAF and documented security and authorization and the querying of the 2015 Edition Common Clinical Data Set (CCDS) and static documents. US Core descended directly from the Argonaut guide to support FHIR Version STU3 and eventually FHIR R4 and The ONC U.S. Core Data for Interoperability (USCDI).

1.3 How To Read This Guide

This Guide is divided into several pages, which are listed at the top of each page in the menu bar.

Corresponds to USCDI V4

CMS Interoperability and Prior Authorization Final Rule CMS-0057-F

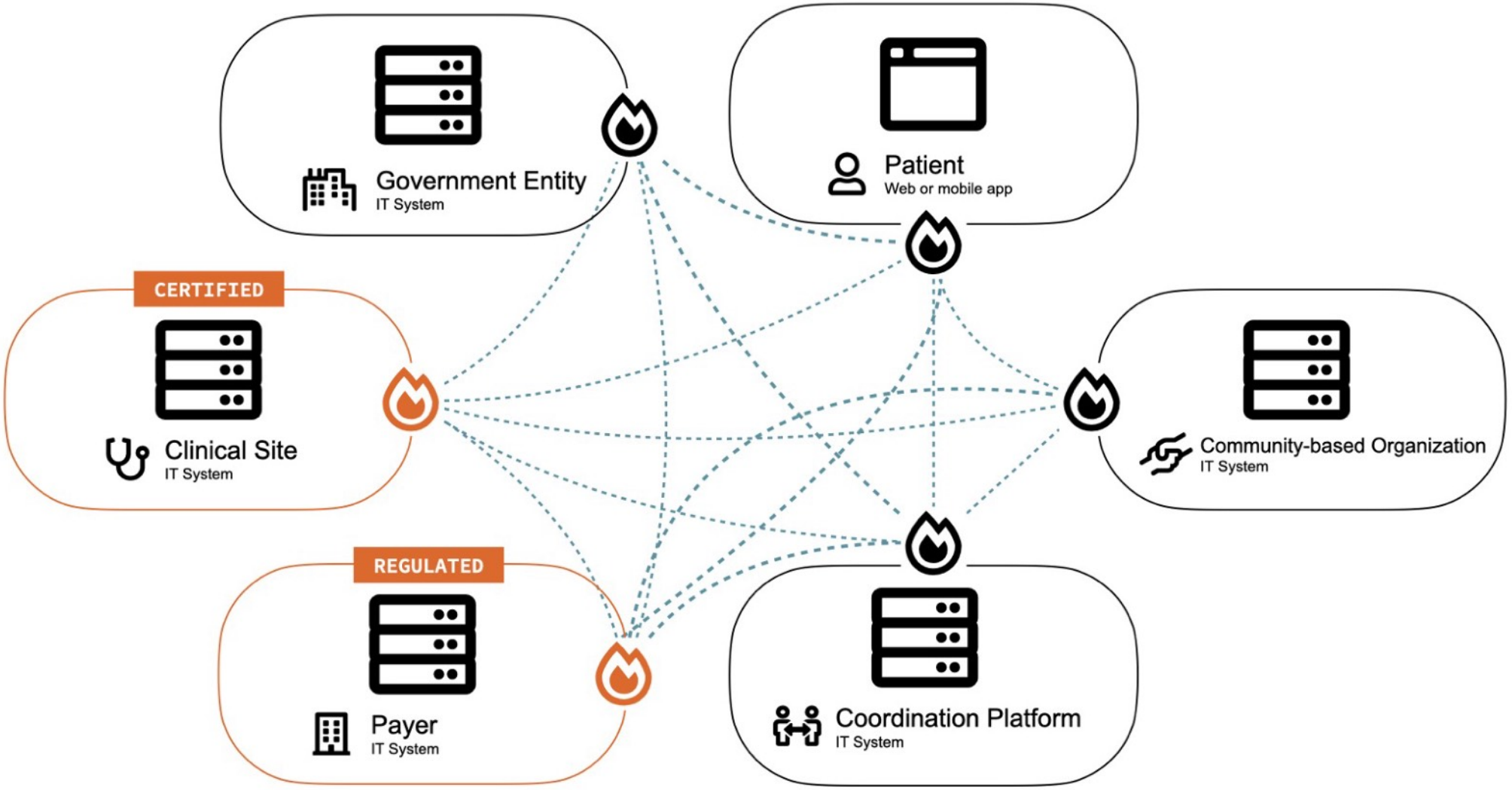
Required API Standards from HL7

	Patient Access API	Provider Access API	Provider Directory API	Payer-to-Payer APi	Prior Auth API
FHIR Release 4.0.1	✓	✓	✓	✓	✓
HL7 FHIR US Core IG STU 3.1.1	✓	✓	✓	✓	✓
HL7 SMART App Launch Framework IG 1.0.0	✓	✓	×	×	✓
HL7 FHIR Bulk Data Access IG v 1.0.0 STU 1	×	✓	×	✓	×

Recommended IGs from HL7

CARIN for Blue Button IG Version STU 2.0.0	✓	✓	×	✓	×
FHIR SMART App Launch IG Release 2.0.0	×	✓	×	✓	×
Da Vinci PDex IG Version STU 2.0.0	✓	✓	×	✓	×
Da Vinci PDex U.S. Drug Formulary IG Version STU 2.0.1	✓	×	×	×	×
Da Vinci PDex Plan Net IG Version STU 1.1.0	×	×	✓	×	×
Da Vinci Coverage Requirements Discovery (CRD) IG Version STU 2.0.1	×	×	×	×	✓
Da Vinci Documentation Templates/Rules (DTR) IG Version STU 2.0.0	×	×	×	×	✓
Da Vinci Prior Authorization Support (PAS) IG Version STU 2.0.1	×	×	×	×	✓

Growing the FHIR-enabled digital foundation




Fixed with FHIR

MCG, Regence, and MultiCare Connected Care Receive 2023 KLAS Points of Light Award

Leaders in prior auth automation recognized for their innovative work in the HL7 ® Da Vinci Project

SEATTLE, Wash., June 27, 2023 – MCG Health, part of the Hearst Health network and an industry leader in technology-enabled, evidence-based guidance, along with Regence Health Plans and MultiCare Connected Care, were recognized by KLAS with the 2023 Points of Light award. This was the first collaboration between a payer, provider, and clinical decision support vendor to produce a scalable and automated prior authorization (PA) workflow based on the HL7 Da Vinci Project's implementation guides (IGs). The three organizations were presented with the KLAS Points of Light award during the annual KLAS K2 Summit on May 10, 2023, in Salt Lake City.

KLAS recognized MCG, Regence, and MultiCare Connected Care for utilizing interoperability standards from the HL7 Da Vinci Project to create an end-to-end HL7 FHIR® (Fast Healthcare Interoperability Resources) workflow for prior authorizations. This technology automated the submission of prior authorization requests from the provider's electronic health record (EHR) to the payer's medical management system and was able to return an authorization determination in real-time back to the provider's EHR. MCG's rules engine was integrated into the process to ensure care

HL7 Product Portfolio

The extended FHIR family unlocks a massive world of opportunity

SMART on FHIR | Bulk FHIR | CQL | CDS Hooks

HL7 International

SMART on FHIR

Plug-and-play apps for seamless interoperability.

Highlight Reel

Dev friendly, OAuth 2.0-based

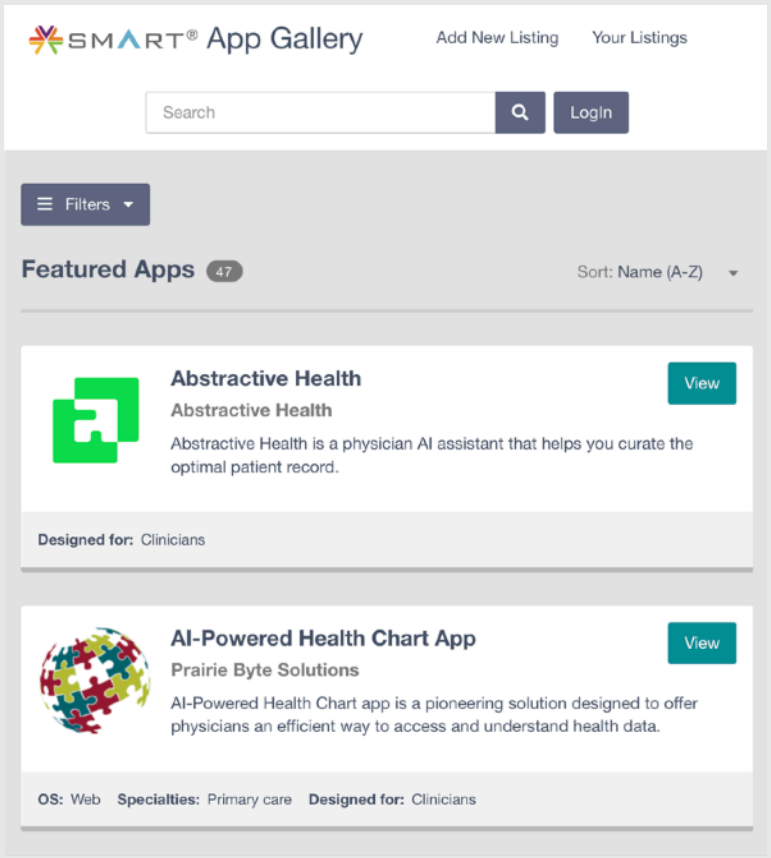
Patterns for user-facing apps and backend services

Capabilities for limiting access to certain data via *scopes*

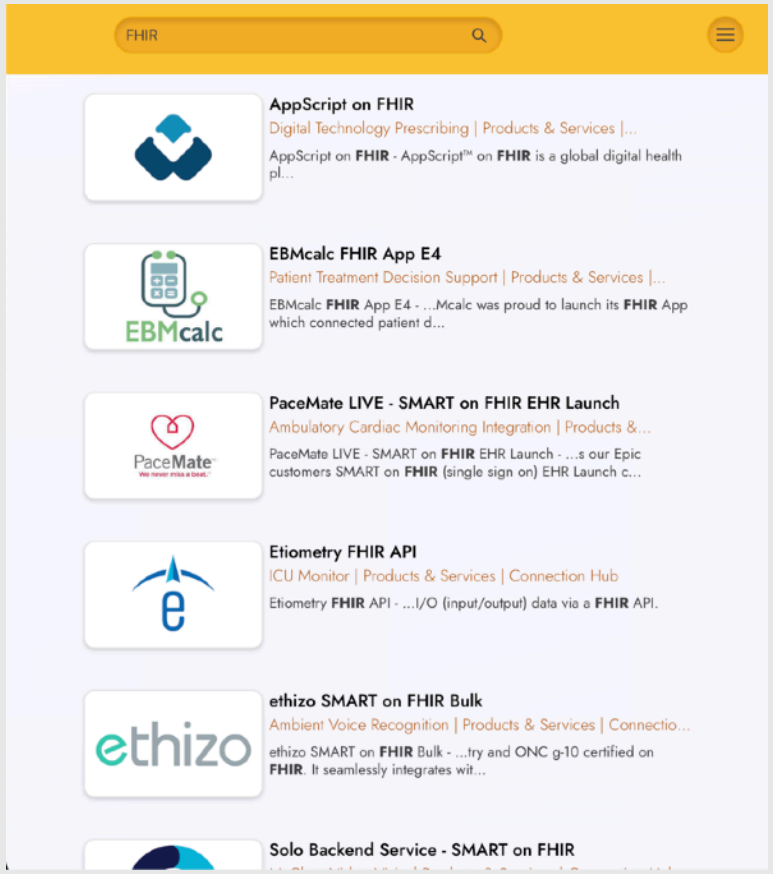
Required in certified Health IT systems by federal regulations (e.g. HTI-1)

HL7 FHIR SMART App Launch

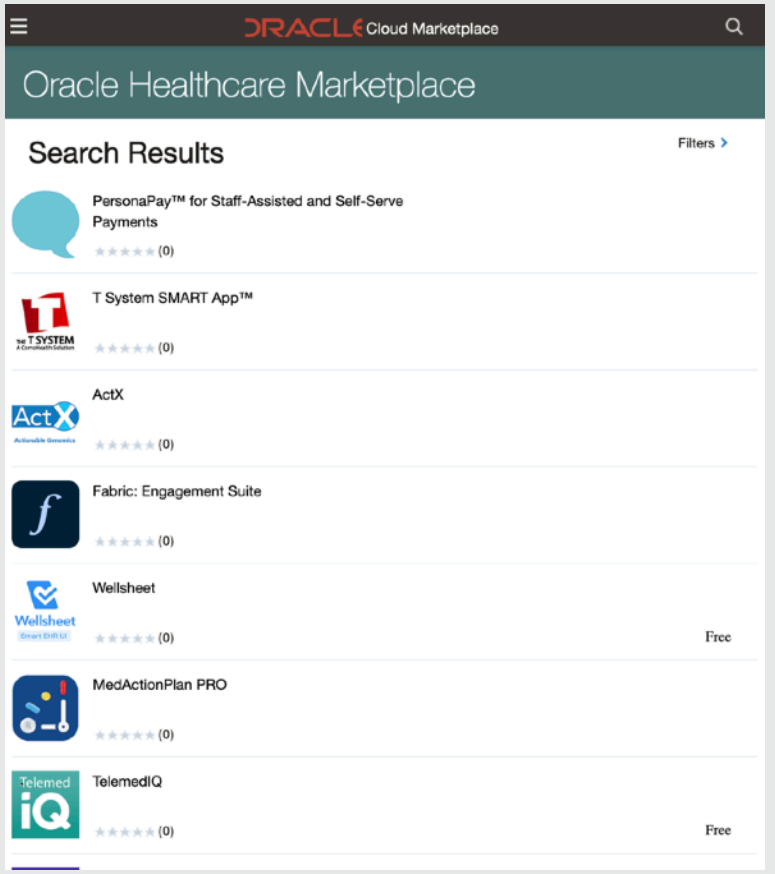
A Blooming App Ecosystem



SMART App Gallery



Epic Showroom



Oracle Healthcare Marketplace

Bulk FHIR

Efficient access to large data sets on groups of individuals

Highlight Reel

Uses FHIR asynchronous (single) request pattern

Produces FHIR in compact NDJSON

Uses system:system SMART backend services for security

Required in certified Health IT systems by federal regulations (e.g. HTI-1)

HL7 FHIR Bulk Data Access IG

HL7 International SMART

Bulk Data Access IG
2.0.0 - Standard for Trial Use

HL7 FHIR

Table of Contents > Bulk Data IG Home Page

This page is part of the FHIR Bulk Data Access (Flat FHIR) (v2.0.0: STU 2) based on FHIR R4. This is the current published version. For a full list of available versions, see the Directory of published versions

1 Bulk Data IG Home Page

- Conformance
- Use Cases
- Additional Documentation

Providers and organizations accountable for managing the health of populations often need to efficiently access large volumes of information on a group of individuals. For example, a health system may want to periodically retrieve updated clinical data from an EHR to a research database, a provider may want to send clinical data on a roster of patients to their ACO to calculate quality measures, or an EHR may want to display claims data to help close gaps in care. The data exchange often involves extracting a specific subset of fields from the source system, mapping the fields into a structured file format like CSV, and persisting the files in a server from which the requester can then download them into the target system. This multi-step process increases the cost of integration projects and can act as a counter-incentive to data liquidity.

Existing FHIR APIs work well for accessing small amounts of data, but large exports can require hundreds of thousands of requests. This implementation guide defines a standardized, FHIR based approach for exporting bulk data from a FHIR server to a pre-authorized client.

1.1 Conformance

To declare conformance with this IG, a server should include the following URL in its `CapabilityStatement.instantiates`: `http://hl7.org/fhir/uv/bulkdata/CapabilityStatement/bulk-data`

1.2 Use Cases

This implementation guide is designed to support sharing any data that can be represented in FHIR. This means that the IG should be useful for such diverse systems as:

- "Native" FHIR servers that store FHIR resources directly
- EHR systems and population health tools implementing FHIR as an interoperability layer
- Financial systems implementing FHIR as an interoperability layer

1.2.1 US Core Data for Interoperability

Applies to: EHR systems that support the US Core Data for Interoperability.

This use case exports all resources needed for the US Core Data for Interoperability, as profiled by the HL7 Argonaut FHIR Accelerator. For a full list of these resources and profiles, see http://www.hl7.org/fhir/us/core/.

CQL

Clinical quality language: standardized clinical logic for decision support and quality measures

Highlight Reel

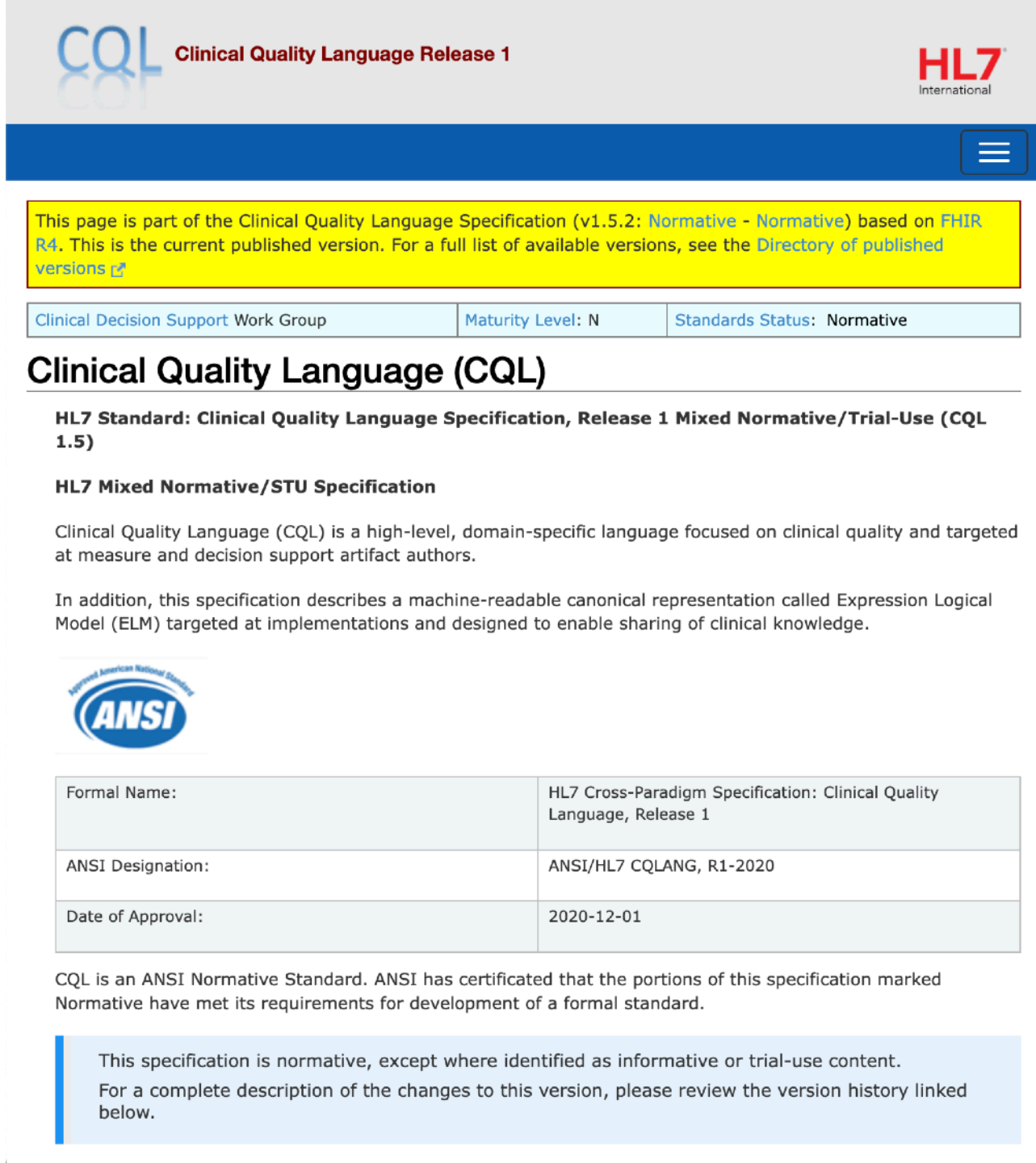
Same logic can be deployed across multiple FHIR-based systems, enhancing efficiency and consistency

Enables clinicians and developers to clearly define clinical criteria and decision logic

Works [hand-in-hand with FHIR]

The language used to evaluate eCQMs in CMS quality programs

HL7 CQL Specification



CDS Hooks

Standardized integration with remote decision support services within a clinician's workflow

Highlight Reel

Synchronous, workflow-triggered CDS calls returning information, suggestions, or App launch

Works perfect with FHIR as patient data

"Hooks" for things like "opening a patient's record", "placing an order"

Proposed in draft HTI-2 regulation

HL7 CDS Hooks specification

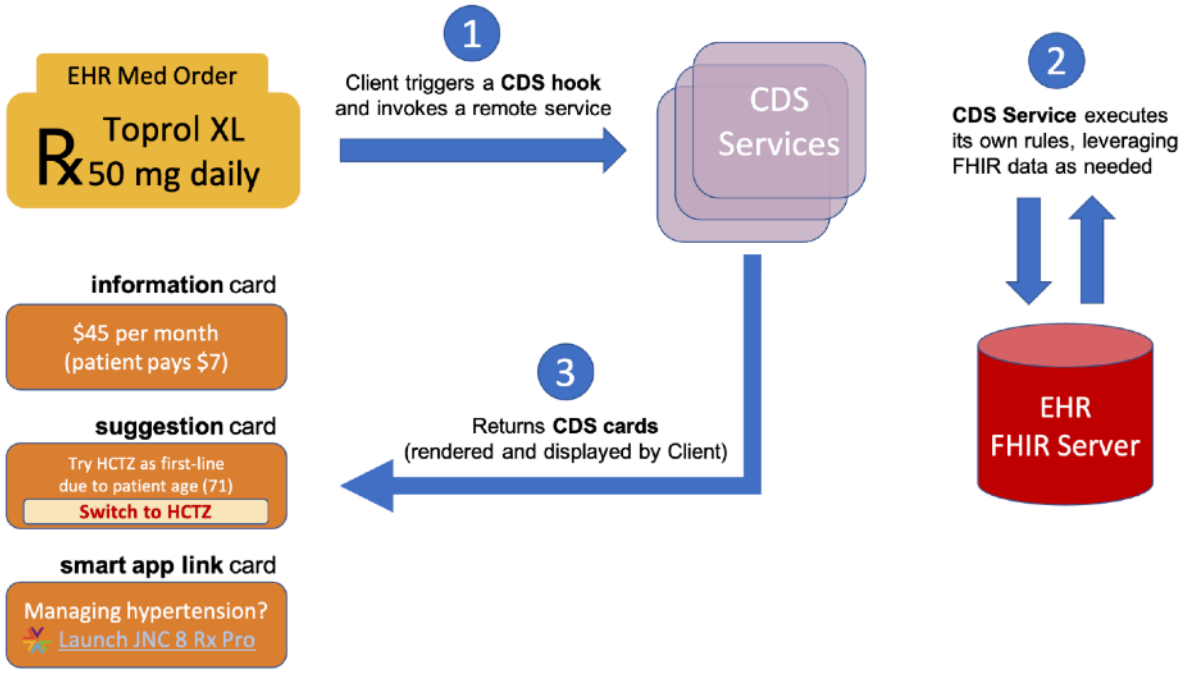
Overview

How it works

User activity inside the clinician's workflow triggers **CDS hooks** in real-time. For example:

- `patient-view` when opening a new patient record
- `order-select` when selecting one or more orders to place for a patient
- `order-sign` immediately before an order is signed

When a triggering activity occurs, the CDS Client notifies each CDS service registered for the activity. These services must then provide near-real-time feedback about the triggering event. Each service gets basic details about the clinical workflow context (via the `context` parameter of the hook) plus whatever service-specific data are required (via the `pre-fetch-template` parameter).



Support for CDS Hooks is Growing

Cheat Codes for AI Innovation in Health

Semantically interoperable health data at scale

Bulk

Simple export of big FHIR data (e.g. for model training)

CDS Hooks

Workflow-integrated interaction with CDS (including AI)

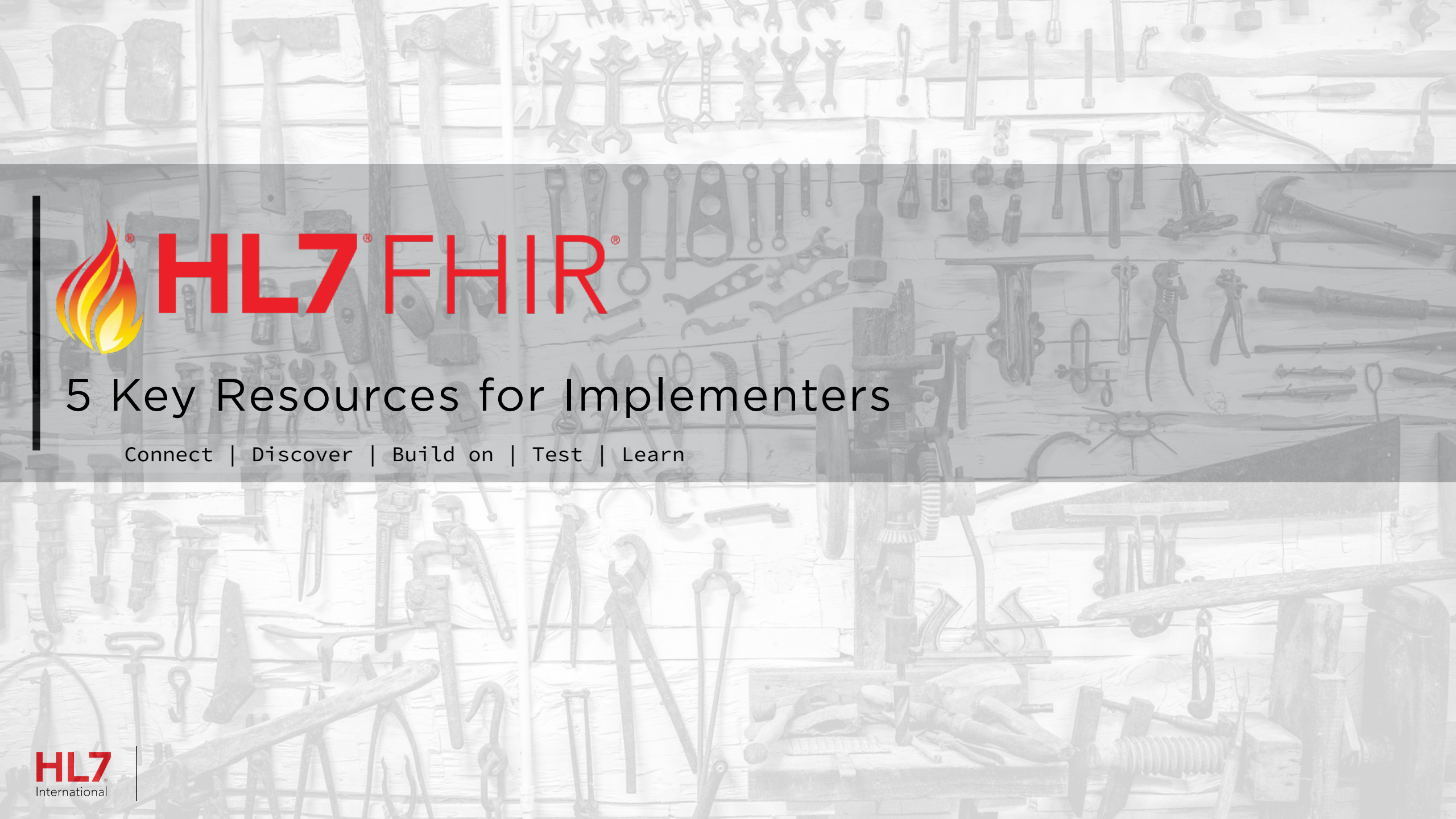
CQL

Standardized clinical knowledge and metrics

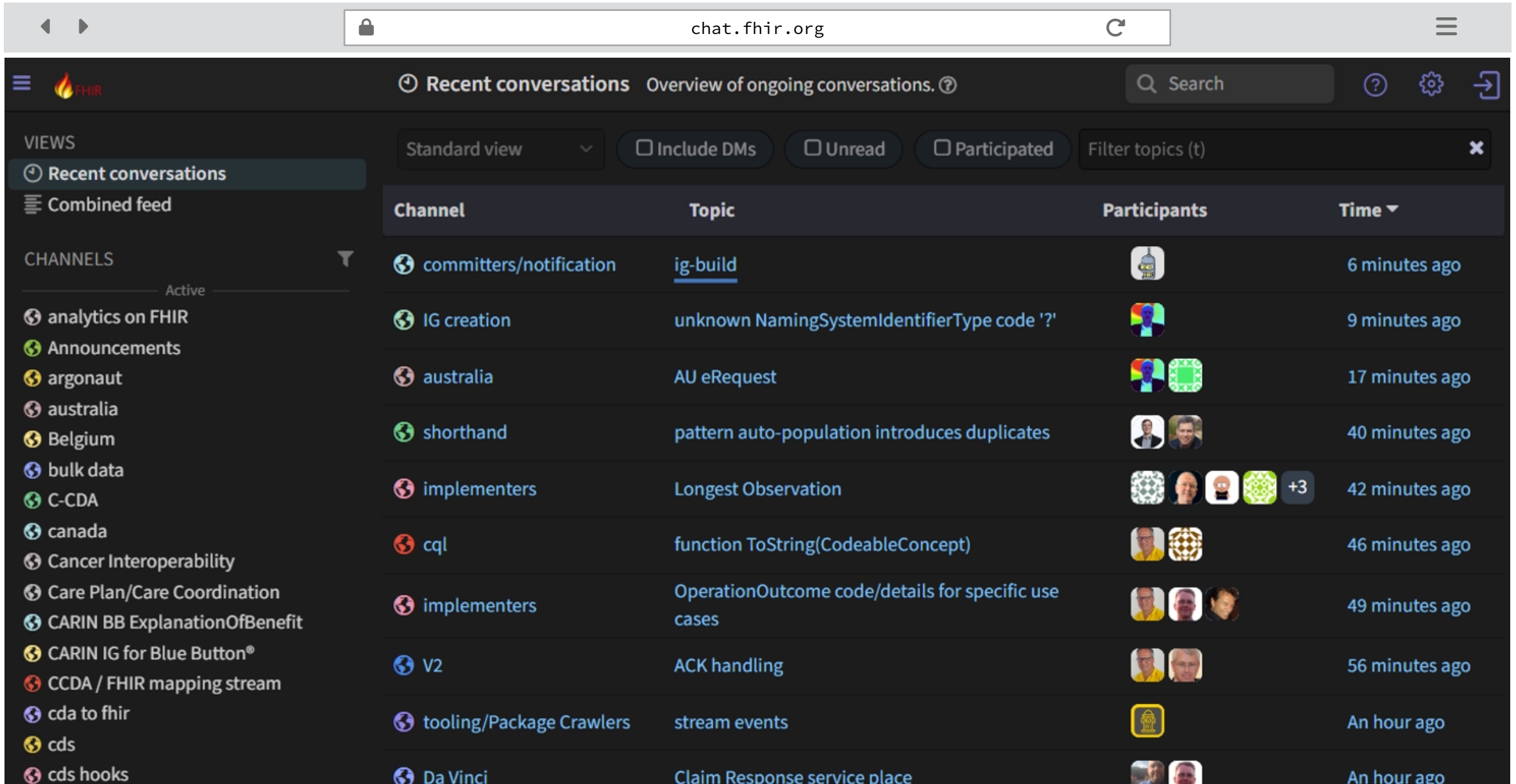
SMART App Launch

Standard integration for apps interacting with FHIR data

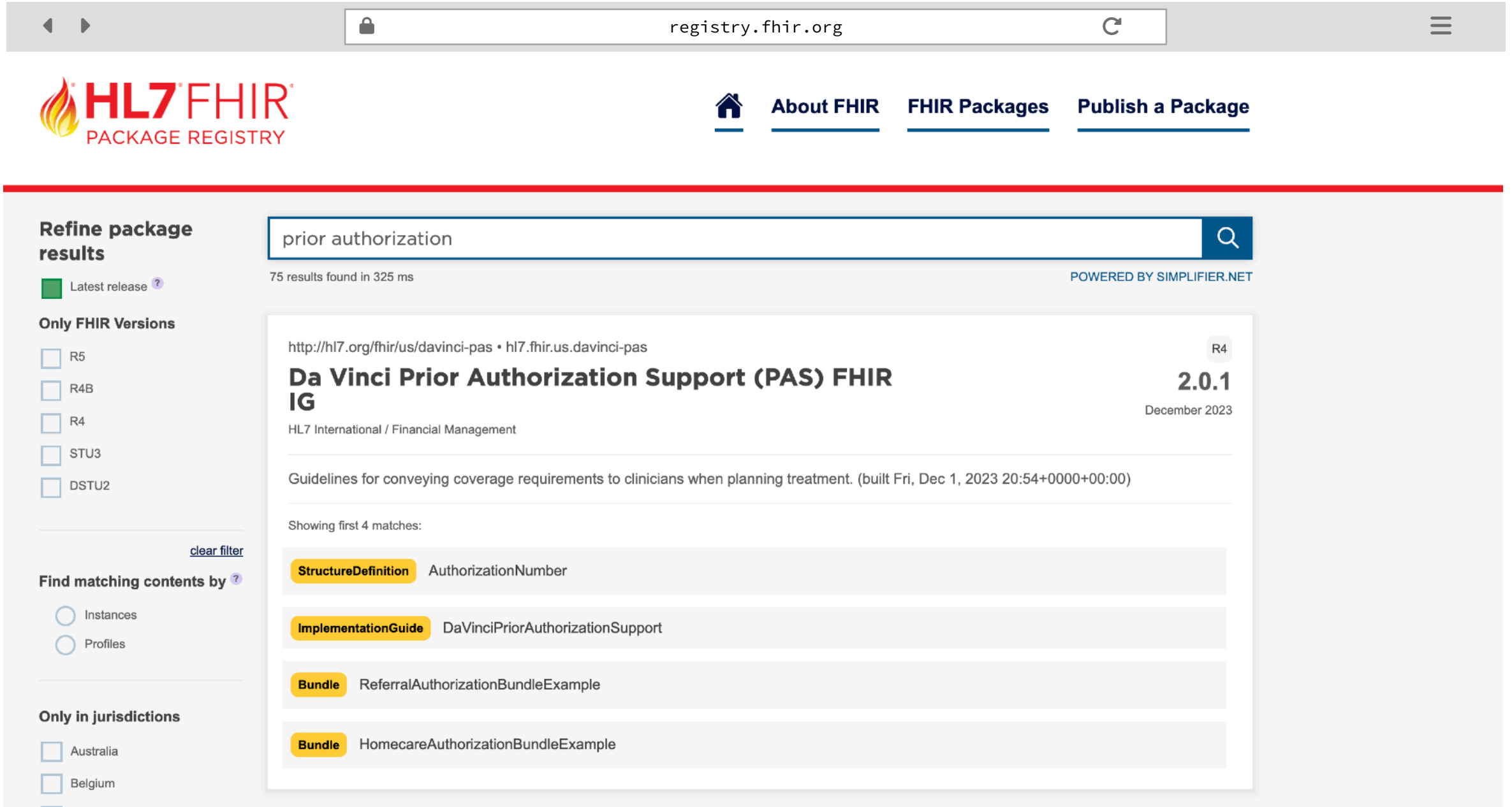
Endless Possibilities


HL7 FHIR
5 Key Resources for Implementers
Connect | Discover | Build on | Test | Learn
HL7 International

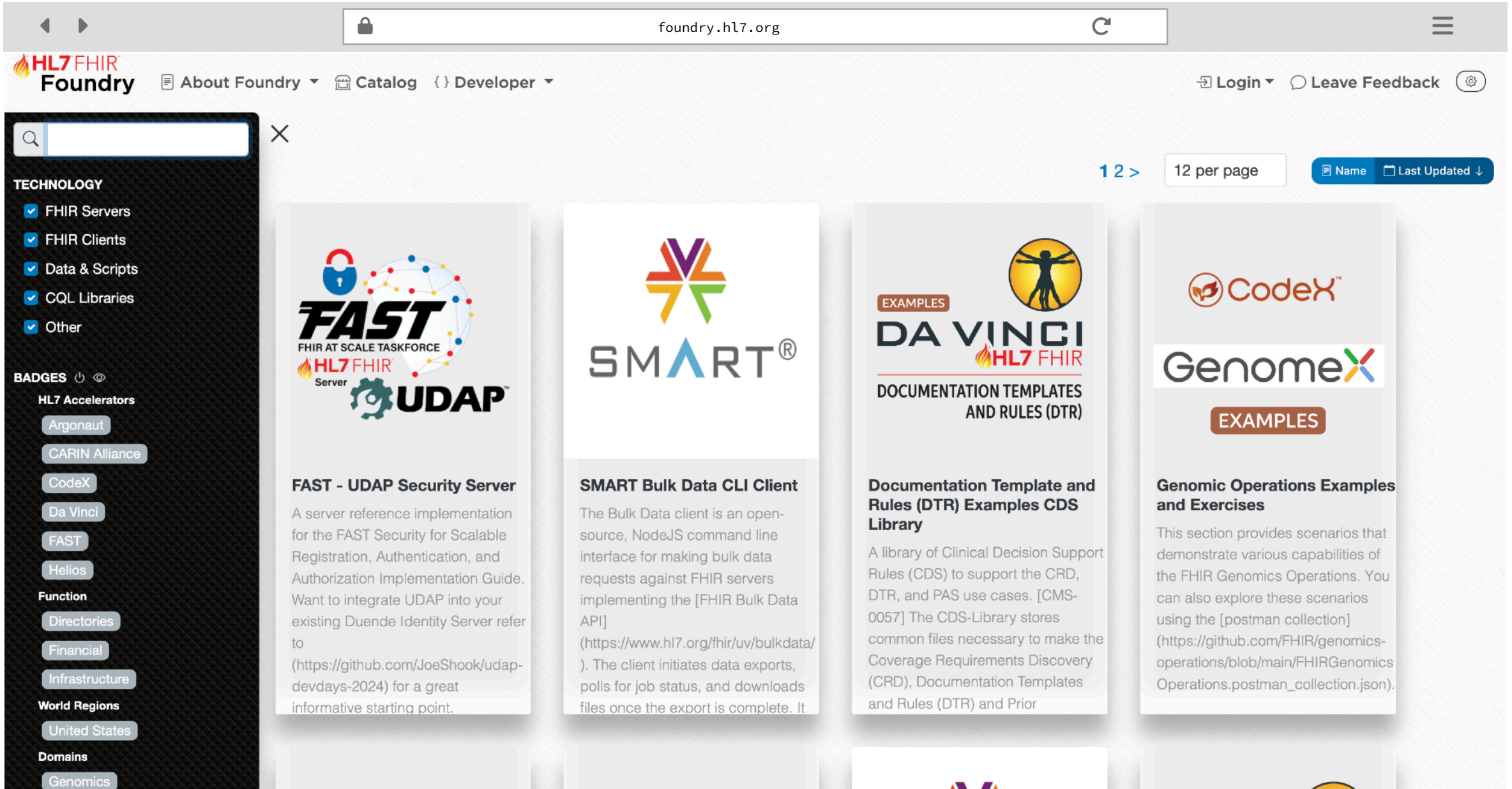
Connect: join the FHIR community online

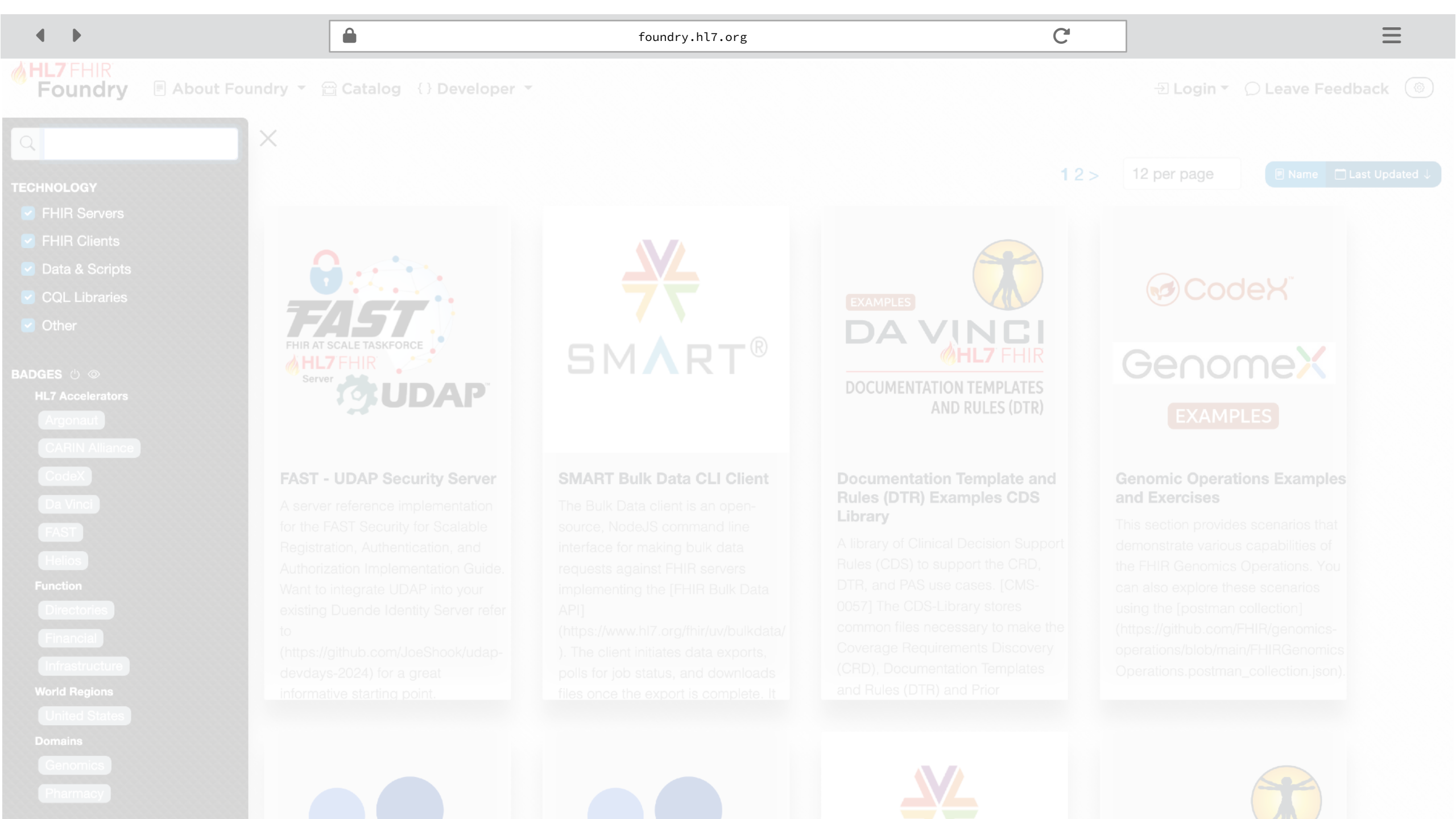


Discover: find FHIR specifications



Build on: use open source reference implementations




foundry.hl7.org
HL7 FHIR Foundry
About Foundry
Catalog
Developer
Login
Leave Feedback
TECHNOLOGY
FHIR Servers
FHIR Clients
Data & Scripts
CQL Libraries
Other
BADGES
HL7 Accelerators
Argonaut
CARIN Alliance
CodeX
Da Vinci
FAST
Helios
Function
Directories
Financial
Infrastructure
World Regions
United States
Domains
Genomics
Pharmacy
1 2 >
12 per page
Name
Last Updated
FAST - UDAP Security Server
A server reference implementation for the FAST Security for Scalable Registration, Authentication, and Authorization Implementation Guide. Want to integrate UDAP into your existing Duende Identity Server refer to (https://github.com/JoeShook/udap-devdays-2024) for a great informative starting point.
SMART Bulk Data CLI Client
The Bulk Data client is an open-source, NodeJS command line interface for making bulk data requests against FHIR servers implementing the [FHIR Bulk Data API] (https://www.hl7.org/fhir/uv/bulkdata/). The client initiates data exports, polls for job status, and downloads files once the export is complete. It
Documentation Template and Rules (DTR) Examples CDS Library
A library of Clinical Decision Support Rules (CDS) to support the CRD, DTR, and PAS use cases. [CMS-0057] The CDS-Library stores common files necessary to make the Coverage Requirements Discovery (CRD), Documentation Templates and Rules (DTR) and Prior
Genomic Operations Examples and Exercises
This section provides scenarios that demonstrate various capabilities of the FHIR Genomics Operations. You can also explore these scenarios using the [postman collection] (https://github.com/FHIR/genomics-operations/blob/main/FHIRGenomicsOperations.postman_collection.json).

HAPI FHIR

Infrastructure

Close

HAPI FHIR is a complete implementation of the HL7 FHIR standard for healthcare interoperability in Java. It is maintained by an open community developing software licensed under the business-friendly Apache Software License 2.0. HAPI FHIR is a product of Smile Digital Health and maintained on GitHub.

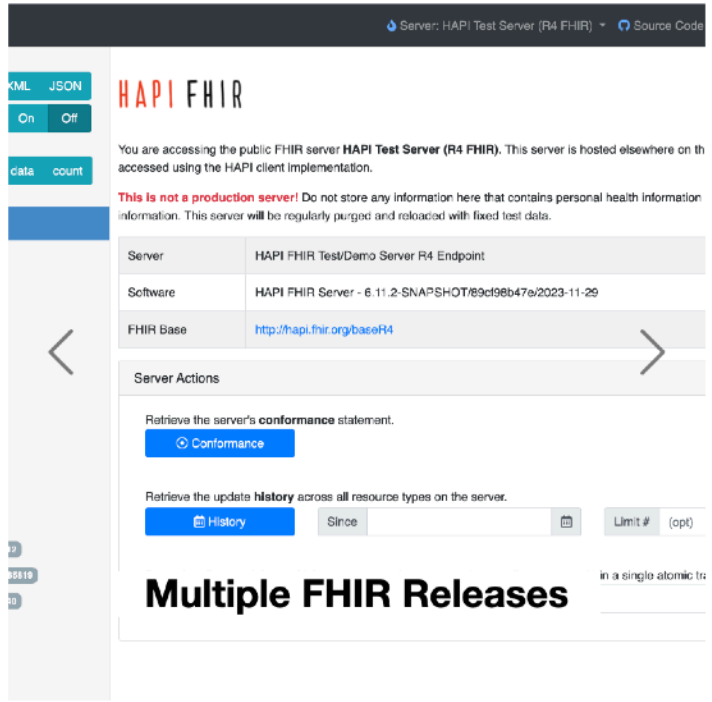
These configurations of HAPI will automatically transmit telemetry data if enabled in your platform configuration.

Try It Now | Support | Source Code | Leave Feedback

Standard

Licensing Options

Apache 2.0 (free)



Instructions | Configuration Wizard | Bundled Products | Included With

Now available in FHIR R4 and R5 configuration options!

Running HAPI FHIR on PostgreSQL

Price Cost Transparency (PCT) Payer Server

Close

Financial | United States | Da Vinci

This server is based on the HAPI FHIR JPA Starter server with modifications to support Patient Cost Transparency. This version of the reference Implementation supports the STU1 version of the Da Vinci Patient Cost Transparency Implementation Guide

The primary file for processing the Good Faith Estimate is GFESubmitProvider.java

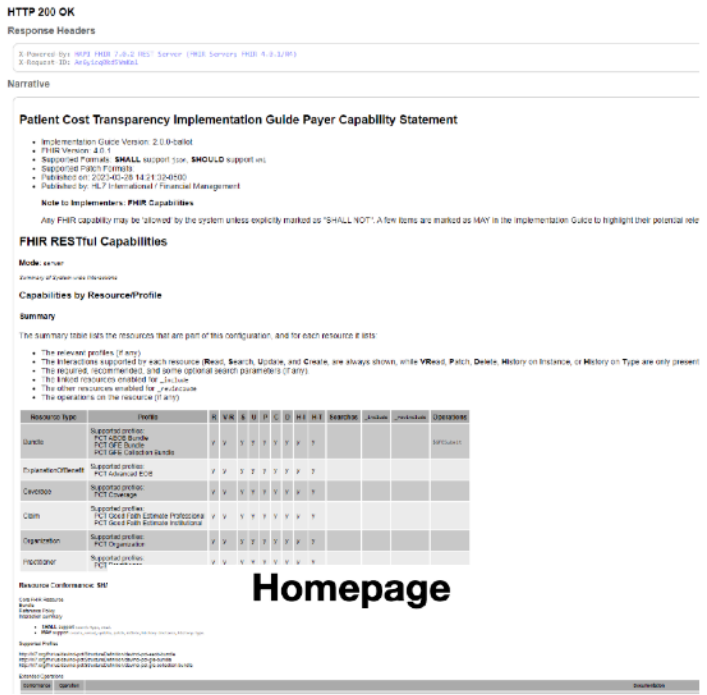
A payer server reference implementation for the Da Vinci Patient Cost Transparency (PCT) Implementation Guide. [US-116HR-133][CMS-9908] It provides the means to submit a Good Faith Estimate (GFE) Collection Bundle and retrieve the resulting Advanced Explanation of Benefit (AEOB) Bundle.

Try It Now | Support | Source Code | Leave Feedback

Implementation Guide (1.0.0) | Confluence

Licensing Options

Apache 2.0 (free)



Homepage

Instructions

Configuration Wizard

No instructions have been provided.

Build on: many other open source tools

Reference Libraries

JAVA

.Net

Delphi

R

Ruby

Python

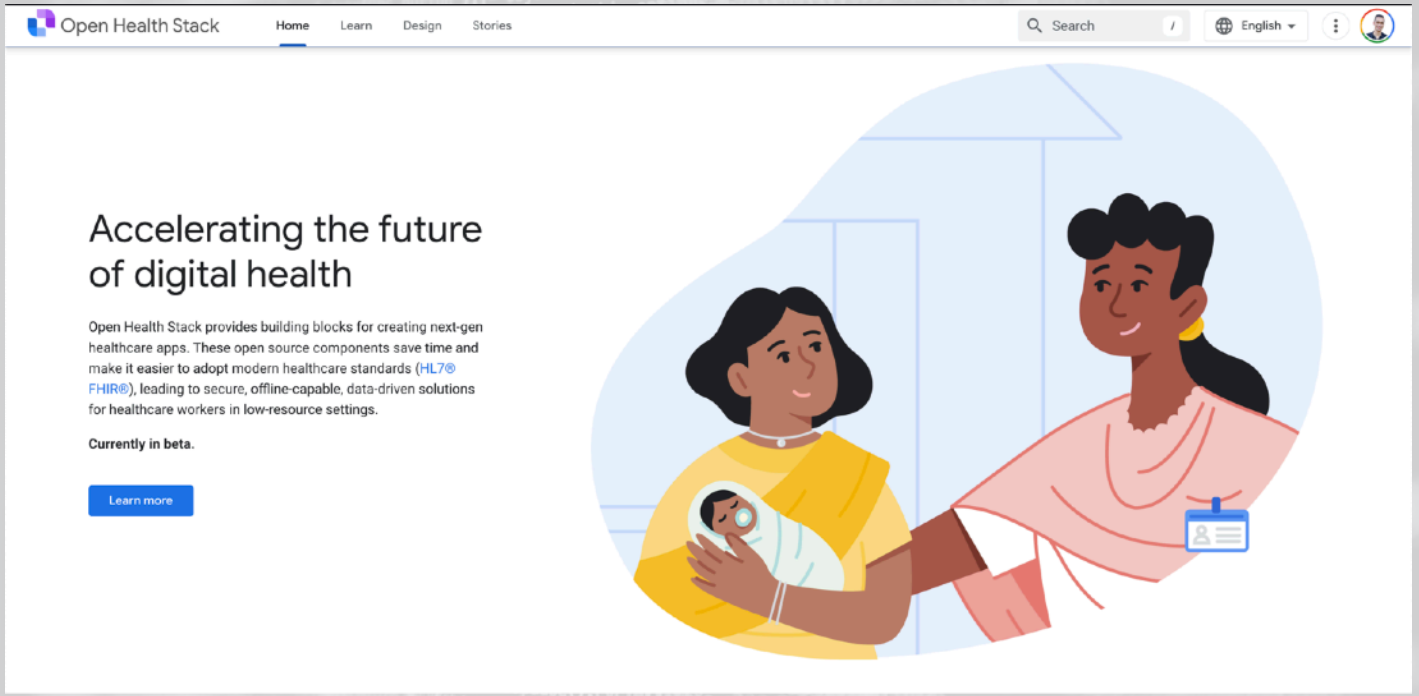
Swift

PHP

Dart/Flutter

Android

Clojure



Example: Open Health Stack

FHIR SDK for Android

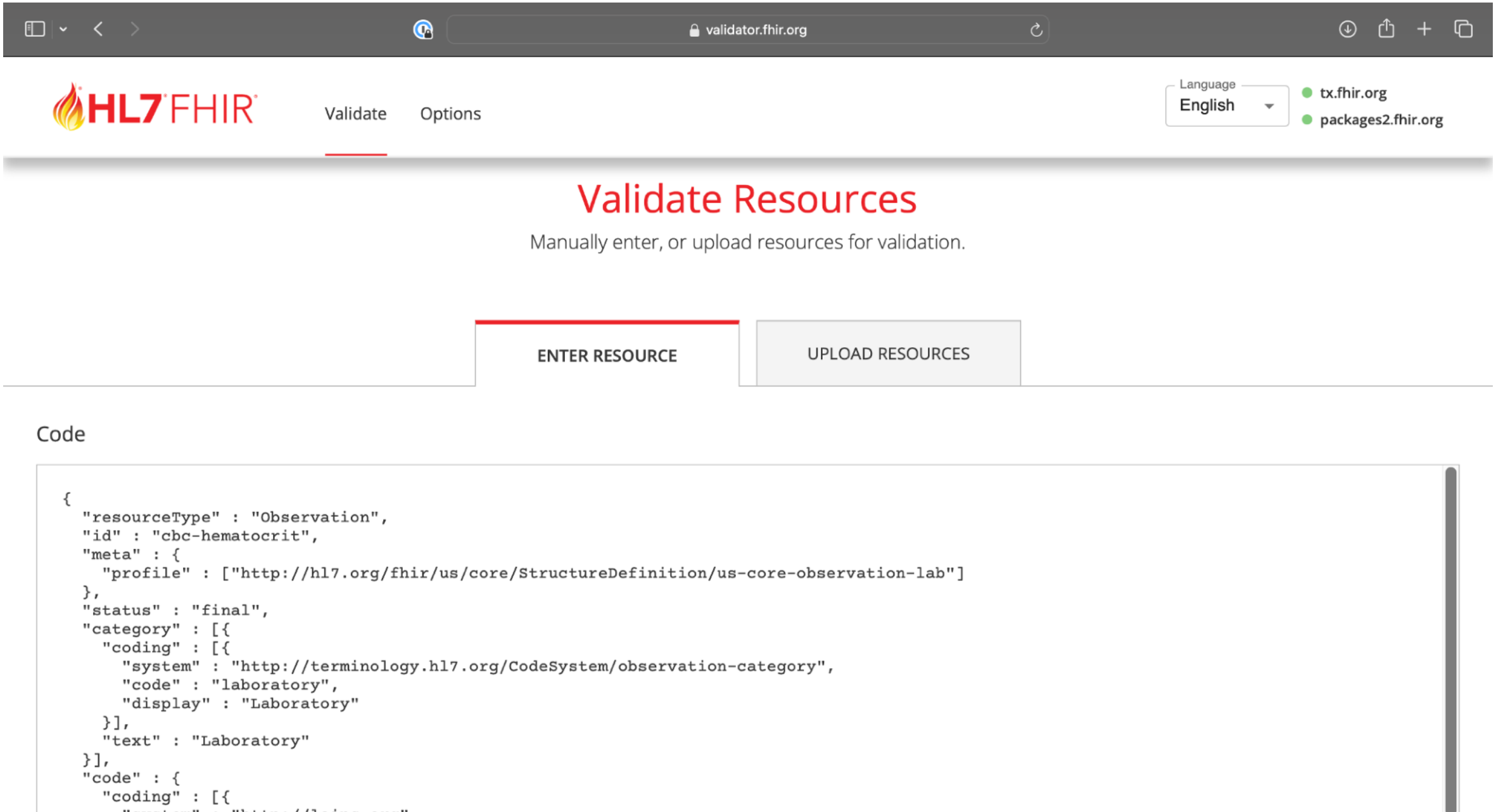
Offline-capable, mobile-first FHIR toolkit (including CQL!) allows developers to create applications helping community health workers in LMICs.

FHIR Analytics

Turn FHIR data into analytics-ready formats for on-prem or cloud processing

`Open Health Stack`

Test: validate your FHIR content



| **Learn:** advance *your* FHIR expertise

Education

On Demand

Virtual training events

In person training

Credentialing

Showcase your FHIR knowledge

Helps hirers find qualified people

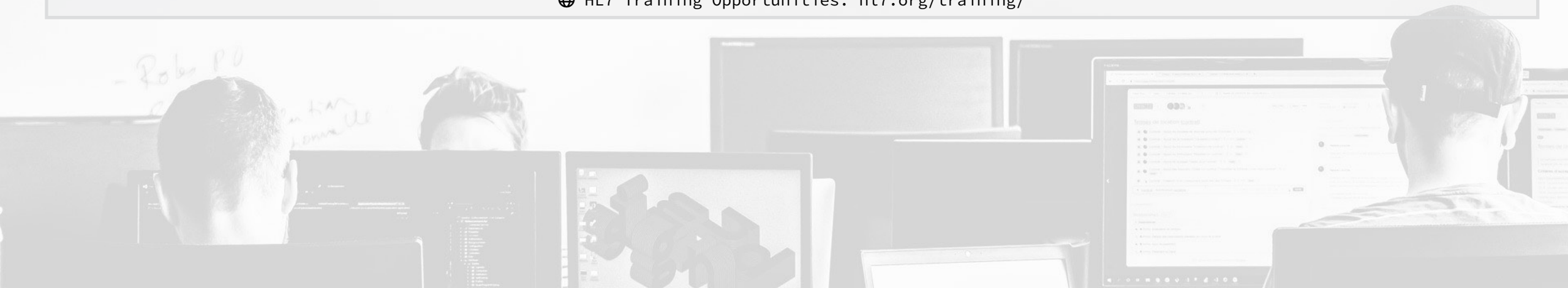
Events

HL7 Work Group Meetings

HL7 FHIR Connectathons

DevDays

HL7 Training Opportunities: hl7.org/training/



Take Home Messages

Why HL7® FHIR® ?

Accelerated development

Find top talent

Reduce dev costs

Interoperability + ease of integration

Regulatory compliance

Market access and scalability

Free to focus on innovation


Let FHIR be the rocket fuel
for your health innovations


HL7® FHIR®
Educate. Engage. Enable.