SAFI CLINICAL INFORMATICS GROUP, LLC

Better Information...Better Outcomes...Saving Lives

Proud to participate at TexMed 2025

May 10, 2025

Under the Hood of your EHR

IS IT ON FHIR®?

Presented by: Fredric Santiago MD MBA CPE

SAFI CLINICAL INFORMATICS GROUP, LLC

Disclaimer

This presentation is intended for a non-developer audience, who may have little or no technical knowledge of Fast Healthcare Interoperability Resources (**FHIR®**). The lecture is designed to introduce FHIR concepts in an accessible way, using creative license to simplify and describe features of HL7 and the FHIR specification.

This presentation is for educational purposes only and should not be considered technical training or legal advice. The presenter has no financial conflicts of interest or affiliations that could influence the content.

About Dr Santiago

History and training:

- Founder & President SAFI Clinical Informatics Group
- Dual Boarded Internal Medicine and Clinical Informatics (ABPM)
- Internal Medicine 30 years and CI since 2009
- Associate CMIO (regional and system-level)
- Associate Director Health IT (Southern US and Caribbean zones (Big Pharma)
- Chief Medical Officer -Regional Individual Practice Association SE Texas
- FHIR Proficiency Badge from Health Level 7 (HL7)
- HL7 FHIR training Fundamentals course
- HL7 FHIR training Intermediate course
- HL7 FHIR Implementer course
- Supervised and Unsupervised AI: Application in Healthcare (MIT completion certificates)
- Principle Investigator Moderna, Pfizer, GSK

LEARNING OBJECTIVES

a. Describe the core features of the HL7®FHIR® standard and its impact on improving healthcare data exchange and workflows.
b. Identify current real-world use cases of FHIR.
c. Determine key roles and responsibilities, across both technical and non-technical areas, to effectively contribute to FHIR implementations using your existing knowledge and skills

Topical Outline

- Where did this stuff come from? (Brief history)
- FHIR fundamentals: What is it and how does it work?
- Who is adopting FHIR and why?
- Selected Use Cases: What's in it for us clinicians?
- Is FHIR Ready for Primetime?
- How to get involved

The Acronym: FHIR®

F =FAST

Fast for developers to build

H =

Human, Veterinary & Medical Research

R =

Templates that developers use to build specific components describing a patients experience….more later!

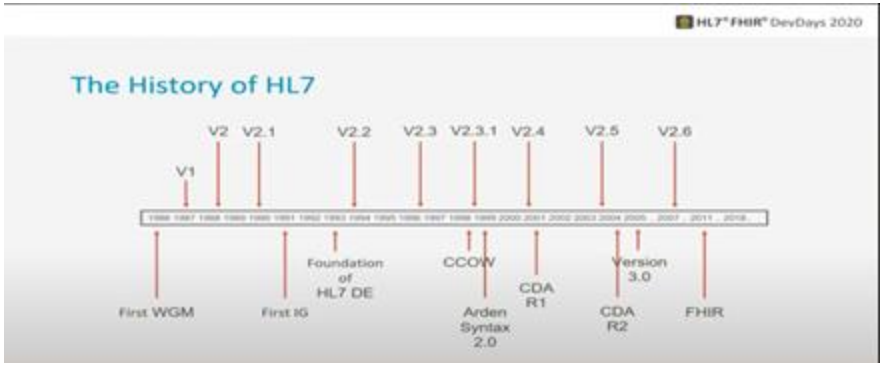
I =

A game changer! Setting the stage for "intelligent augmentation" (IA) or even AI to our workflows. Share information without changing the systems (costs)

Where did this stuff come from?

HL7 International

Healthcare standards development organization… Global volunteer work groups who create and vote on maturity of all additions to FHIR



Product timeline

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MSH|^~\&|EPIC|EPICADT|REG|REGADT|201410011301|SEC|ADT^A01|187|P|2.2|
PID||0123456^^^2^|0123456||SIMPSON^HOMER^^^^||19651225|M||B|123 FAKE
ST^^SPRINGFIELD^OR^97478^USA||(503)123-4567|||M|NON|403403|
NK1||SIMPSON^MARGE^^^^|ABC||(503)123-4567||EC|||||||||||||||||||||||||
PV1||I|312-B^^||||02^SIMPSON^MARGE^^^^|||||||||||
|2688684|||||||||||||||||||||||||201410011301|||||0123553
PV2|||||||20141009|
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V2 message format older than WWW fancy fax - with no brains

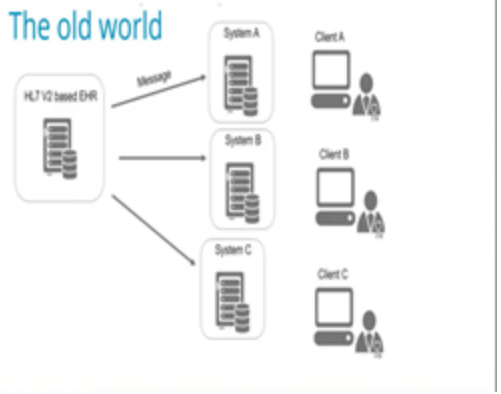
HL7 FHIR

Next generation interoperability Standard

- ➢ DataTypes W3C compliant
  - ➢ XML, JSON, RDF
  - ➢ REST API
  - ➢ HTTPS, OAuth, etc. for security functions

Ewout Kramer Grahame Grieve, Lloyd McKenzie

mobile phones tablets watches cloud solutions !



*Adaptations from HL7 and affiliated practitioners thank you!

FHIR Manifesto

- The Goals of FHIR
- **Implementer Focus**
  - **80/20 Rule** (common stuff)
  - Use today's **web technologies**
  - Support **human readability**
  - Messaging, REST Exchange, Documents, Bulk data, Storage and Operations
- **Open Source**

How FHIR® works

Scenario:

- Three systems that have coded and stored data differently from each other want to share information. Today the total number of interfaces needed = n * (n - 1), where 'n' is the number of systems...so 3*(3-1)= 6

nextgen healthcare

Mapping each system to FHIR creates one common language between all three.

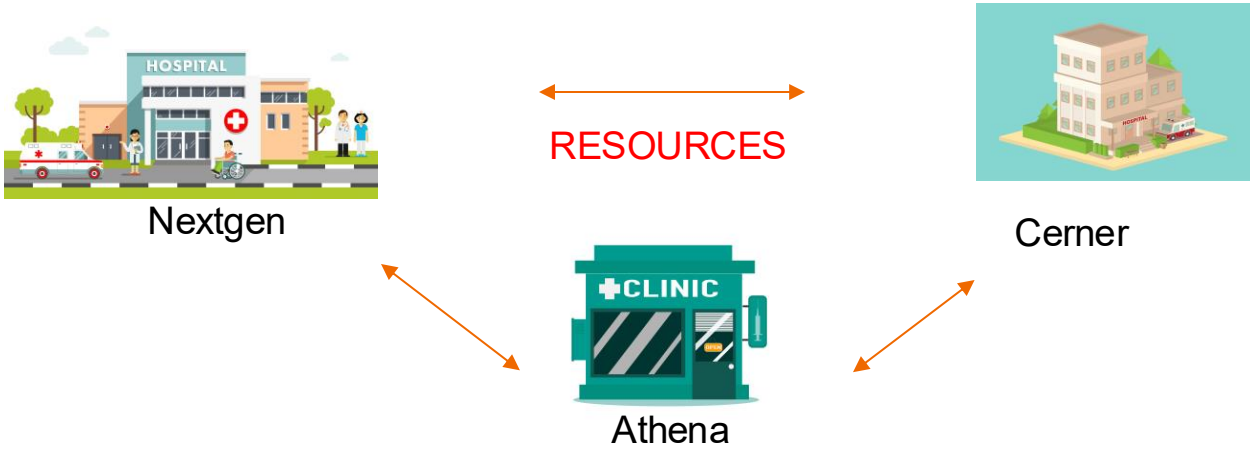
Cerner

athenahealth

How FHIR® works

Now that we have an “interpreter” in place:

- Each system can READ, CREATE, UPDATE, DELETE and QUERY the other system by working with FHIR RESOURCES .



What is a FHIR® Resource?

The most basic format of information that's exchanged

The concept was not intuitive to me initially…but should have been !

An analogy: you need resources to build a house?

It takes these resources to build a house

FHIR® uses Resources (templates) in the same way

Some folks equate Resources to rigid Lego Pieces

Resources cannot be used out of the box like Lego pieces..
They need to be tailored to meet your need.

Patient Resource

Encounter Resource

Condition Resource

Observation Resource

Medication Resource

Allergy Intolerance Resource

A bundle of resources creates a medical document

Building a clinical document with FHIR Resources

Mr. Davis is 99-year-old-man who presents with vague chest discomfort, cough, low grade fever, and purulent sputum for 24 hours. On examination , he appeared in no respiratory distress with BP 107/60 and pulse rate 100. Temp was 101° F, O2 Sat 92%, asymmetric breath sounds with egophony and vocal fremitus in the RLL. Clinical impression was RLL community acquired pneumonia. Patient was prescribed Amoxicillin-clavulanate 875/125 twice a day and azithromycin 500 mg on day one, then 250 mg daily as directed.

24 hours later he returned with an itchy skin rash with welts. On examination, a generalized urticarial rash was noted. Diagnosis of penicillin allergy was suspected.

Resources that construct this note

- Patient Resource
- Encounter Resource
- Condition Resource
- Observation Resource
- Medication Resource
- Allergy Intolerance

Adapted from HI7 & FHIR contributors

FHIR Specification: What does a resource look like?

Level 1 Basic framework on which the specification is built

Foundation	Base Documentation, XML, JSON, Data Types, Extensions

Level 2 Supporting implementation and binding to external specifications

Implementer Support	Security & Privacy	Conformance	Terminology	Exchange
Downloads, Version Mgmt, Use Cases, Testing	Security, Consent, Provenance, AuditEvent	StructureDefinition, CapabilityStatement, ImplementationGuide, Profiling	CodeSystem, ValueSet, ConceptMap, Terminology Svc	REST API + Search Documents Messaging Services Databases

Level 3 Linking to real world concepts in the healthcare system

Administration	Patient, Practitioner, CareTeam, Device, Organization, Location, Healthcare Service

Level 4 Record-keeping and Data Exchange for the healthcare process

Clinical	Diagnostics	Medications	Workflow	Financial
Allergy, Problem, Procedure, CarePlan/Goal, ServiceRequest, Family History, RiskAssessment, etc.	Observation, Report, Specimen, ImagingStudy, Genomics, Specimen, ImagingStudy, etc.	Medication, Request, Dispense, Administration, Statement, Immunization, etc.	Introduction + Task, Appointment, Schedule, Referral, PlanDefinition, etc	Claim, Account, Invoice, ChargeItem, Coverage + Eligibility Request & Response, ExplanationOfBenefit, etc.

Level 5 Providing the ability to reason about the healthcare process

Clinical Reasoning	Library, PlanDefinition & GuidanceResponse, Measure/MeasureReport, etc.

Example: Drill down Patient Resource

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 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 MaritalStatus (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	I	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 Patient Contact Relationship (Extensible)
name		0..1	HumanName	A name associated with the contact person
telecom		0..*	ContactPoint	A contact detail for the person
address		0..1	Address	Address for the contact person
gender		0..1	code	male | female | other | unknown AdministrativeGender (Required)
organization	I	0..1	Reference(Organization)	Organization that is associated with the contact
period		0..1	Period	The period during which this contact person or organization is valid to be contacted relating to this patient
communication		0..*	BackboneElement	A language which may be used to communicate with the patient about his or her health
language		1..1	CodeableConcept	The language which can be used to communicate with the patient about his or her health Common Languages (Preferred but limited to AllLanguages)
preferred		0..1	boolean	Language preference indicator
generalPractitioner		0..*	Reference(Organization | Practitioner | PractitionerRole)	Patient's nominated primary care provider
managingOrganization	Σ	0..1	Reference(Organization)	Organization that is the custodian of the patient record
link	?! Σ	0..*	BackboneElement	Link to another patient resource that concerns the same actual person
other	Σ	1..1	Reference(Patient | RelatedPerson)	The other patient or related person resource that the link refers to
type	Σ	1..1	code	replaced-by | replaces | refer | seealso LinkType (Required)

Documentation for this format

Who's Adopting FHIR and WHY?

Everybody who's anybody ……and it's not going away !

Drivers and Barriers of Adoption

-Global perspective

-US perspective

HL7® Firely® Global Survey 2024

PARTICIPATING COUNTRIES

38 responses were received from 29 unique countries. Multiple responses were received from five countries.

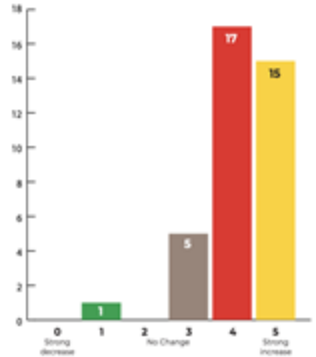
The response was approximately 20% higher than in 2023, when 32 responses were received from 24 countries.

Argentina
Australia
Belgium
Brazil
Canada
Croatia
Cyprus
Estonia
Finland
France
Germany (3)
Iceland
India
Israel
Italy (4)
Japan
Lithuania
Luxembourg
Netherlands
New Zealand
Norway
Philippines (2)
Slovenia
Sweden
Switzerland (3)
Taiwan
Thailand (2)
United Kingdom
United States

Adopted from HL7 Firely Global survey 2024

HL7 Firely Global Survey 2024

FHIR ADOPTION RATE CHANGE



Q. What change do you expect in the rate of adoption of FHIR in the coming years in your country?

84% of the respondents (32 of 38) expect the rate of adoption of FHIR to increase in the coming years. This is the same percentage as was reported 2023 (84% – 27 of 32.) None of the respondents said they expect a strong decrease.

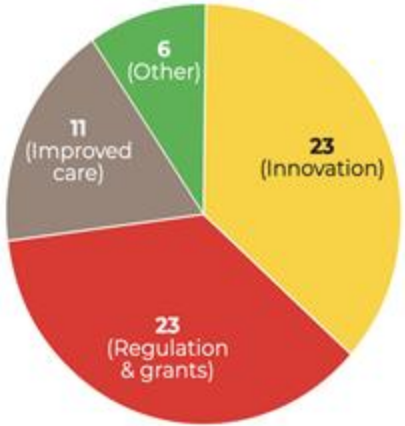
1 – Thailand*

3 – Croatia
Germany*
Iceland
Slovenia
Thailand*

4 – Canada
Estonia
Finland
Germany*
Israel
Italy (3)*
Norway
Philippines (2)
Sweden
Switzerland (3)
United Kingdom
United States

5 – Argentina
Australia
Belgium
Brazil
Cyprus
France
Germany*
India
Italy*
Japan
Lithuania
Luxembourg
Netherlands
New Zealand
Taiwan

PRIMARY DRIVERS OF FHIR ADOPTION



Q. What are the main drivers for FHIR adoption in your country?
(multiple choice; multiple answers accepted)

Respondents most often mentioned Innovation (23) and Regulation and grants (23) when given multiple-choice options about the main drivers for FHIR adoption. Improved care as a cited driver of FHIR adoption decreased in 2024 (11 of 38) compared to 2023 (16 of 32).

HL7 Firely Global Survey 2024

FHIR adoption challenges

Nearly everyone (29 respondents) said lack of FHIR knowledge is the biggest challenge for FHIR adoption. Sixteen respondents also noted unclear regulations, 13 said high investment cost, and 12 mentioned unclear benefits.

"Almost all considered lack of FHIR knowledge to be the biggest barrier to FHIR adoption."

Respondents also mentioned: competing short-term priorities, multiplicity of health systems, variability in clinical practices and vendor solutions, basic technological infrastructure (hardware and software), resistance to change, existing working interfaces, legacy, inconsistent use of FHIR by different organizations, and lack of experienced implementers.

What about US Adoption

United States is leading the world laying the foundation!

Influential players in the Argonaut Group driving adoption since 2014

HL7 FHIR: US ADOPTION

2013
JASON (advisory group)
Report on: "**A Robust Health Data Infrastructure**"
An independent group of elite scientists who advise the government on science and technology issues.

Highly critical on the state of affairs and made suggestions to modernize exchange.

2014 The **Argonaut Group** was launched in response to this criticism.
They began promoting and adopting foundational pieces required to leverage FHIR-based solutions

2014 **JASON Task force** established to review report and agreed with suggestions about modernization

2023

The Trusted Exchange Framework and Common Agreement TM


FEDERAL REGISTER

21st Century Cures Act: Interoperability, Information Blocking, and the ONC Health IT Certification Program

a. Encrypt Authentication Credentials

b. Multi-Factor Authentication

9. Security Tags and Consent Management Criteria

a. Implementation With the Consolidated CDA Release 2.1

b. Implementation With the Fast Healthcare Interoperability Resources (FHIR®) Standard

10. Auditable Events and Tamper-Resistance, Audit Reports, and Auditing Actions on Health Information

2019

FHIR "Accelerators"

National coalitions of groups working to accelerate FHIR adoption in different healthcare domains

HL7 FHIR ARGONAUT PROJECT	Work to increase general adoption of FHIR	Decision support, Bulk data ,SMART apps, scheduling, authorization protocol, questionnaires, other
DA VINCI HL7 FHIR	Value Based Care concerns	Streamline prior auth process Pull relevant med record data from EHR quality monitoring, Identifying membership and gaps in care
FAST HL7 FHIR	Ensuring FHIR will scale up nationally by proactively addressing roadblocks	patient matching of digital Identities consent management, registration authorization and authentication at scale, other
CodeX	Leveraging FHIR to improve care in cancer, cardiovascular and genomics	mCode cancer data set used to fashion decision support for staging and treatment Breast Cancer
HELIOS	Focus on Public Health using FHIR	Improving bulk data flows using FHIR in public health emergencies Increased efficiency in public health investigations
gravity PROJECT	Addressing Social determinants of Health (SDOH)	Identify gaps in care
carin	Reducing friction in consumer access to their information by influencing government action	Digital insurance cards, Realtime pharmacy benefit checks, blue button access to claims data, other
VULCAN HL7 FHIR	Focused on research community	adverse event reporting, Real world data access for investigators, digitalization of protocols, and schedule of activities

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FHIR State of the Art

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FHIR Specification: Status

- R4 version is the first normative version
- Normative means it wont change enough to break what you have built
- However many resources in R4 are still immature
- Resource maturity levels (FMM levels 0-5) (5 = normative)
- Understand this to avoid breaking changes to your solutions
- R5 is the current release (includes R4 Normative content)


Future
NEXT
EXIT

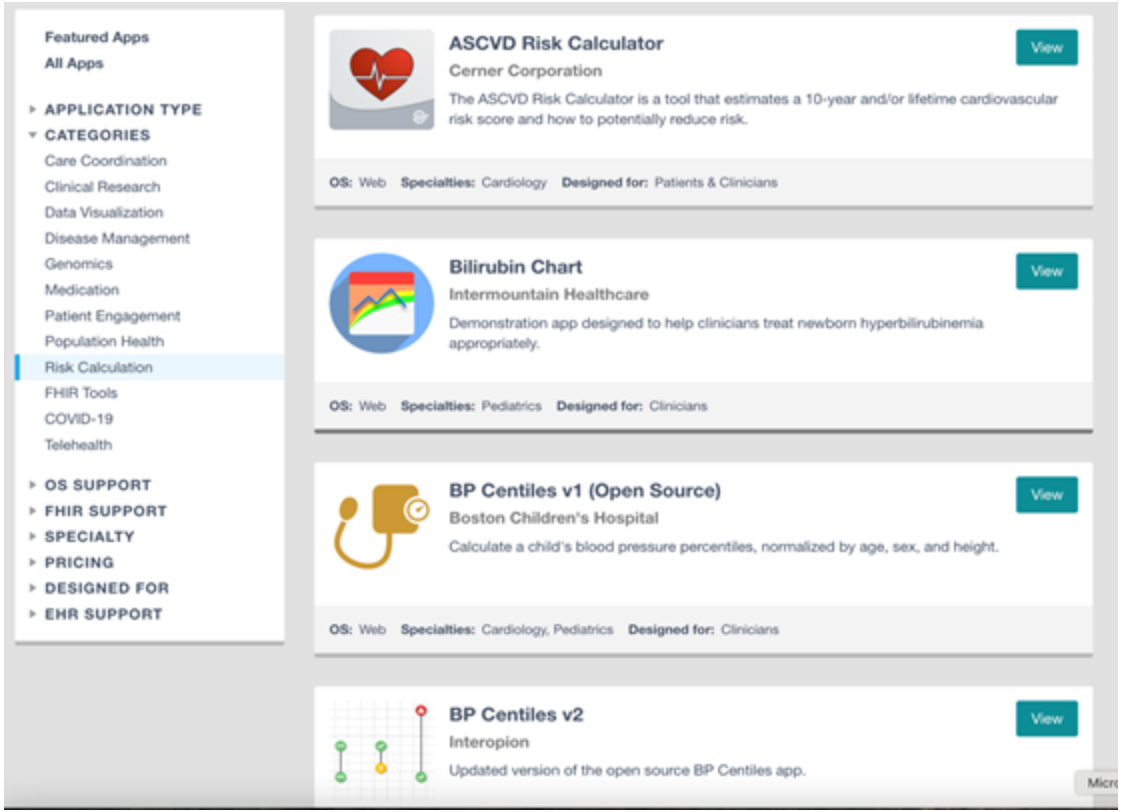
Selected Use Cases!

- FHIR-based SMART APPs
- FHIR Subscriptions
- Clinical Decision support and CDS Hooks

SMART APPs

FHIR® is on FIRE : SMART APPs

SMART® APP Gallery based on FHIR



FHIR Subscriptions

FHIR Subscription Service: What is it?

Let’s discuss a few scenarios to answer that question.

Subscriptions: Is that Blood Gas or Electrolyte Panel ready?

- Results in excessive “polling” (i.e.. checking EHR, calling nurses station, or radiology for results etc.)
- Systems often don’t update a record until someone opens a chart
- Consumes resources and adds to burden of care
- Being aware of unanticipated changes in patient status could help prioritize your responses on rounds or in the clinic
- Get notified based upon your preferences (either a specific event or all events)

Clinical Decision Support

Clinical Decision Support: CDS HOOKS™

- Functioning under the hood (waiting for events or hooks)
- What hooks trigger the service are predetermined by you or your organization
- Hooks can be generic or very sophisticated
- When, how and what notification you get is determined by you
- Ideally, nothing would trigger (unless you deviate from your own guideline)

Types and Timing of Events (Hooks)

Types of Hooks	Action
Order-Select	Triggers when you select an order
Order-Sign	Triggers when you are ready to sign
Patient-View	Triggers when you open the chart

Clinical Decision Support (CDS HOOKS) Process

Order-Select hook is active. Toprol XL selected

EHR Med Order

Rx Toprol XL 50 mg daily

1

Client triggers a **CDS hook** and invokes a remote service

CDS Services

2

CDS Service executes its own rules, leveraging FHIR data as needed

EHR FHIR Server

3

Returns **CDS cards** (rendered and displayed by Client)

information card

$200 per month (patient pays $30)

suggestion card

Try Propranolol instead

Switch to Propranolol

smart app link card

Managing hypertension?

Launch JNC 8 Rx Pro

Card Indicator

Informational Warning Critical

What can we do? Getting involved


COMING
SOON

Clinician Leaders and Executives

The window is open to allow you time to get up to speed. I can't emphasize that enough!

Create a FHIR task force inside your IT governance structure (all stakeholders at the table)

- Identifying clinical champions
- Start to build FHIR competence in house (education)
- Identify business use cases
- Prepare for FHIR implementation (mapping etc.)

How can clinicians get involved ?

***Clinicians are going to be needed to:**

- **Participate** on teams that include clinical, IT, admin, quality and business stakeholders
- Become a clinical champion supporting FHIR deployments
- **Provide** clinical advice on decision support tools
  - Collaborating on what problems need to be addressed
  - Consultation on the logic/algorithms to be deployed
  - Deciding when and what and how decision support will compliment your workflows

Clinician Informaticists and FHIR Enthusiasts

- An emerging discipline available to clinicians ?
- Heavy on the clinical side (not so much technical)
- Requires education in the FHIR Standard (theoretical and practical application)
- Knowledge of basic:
    - JavaScript Object Notation (JSON) and
    - Extensible Markup Language (XML)


Everyone Counts
We Need You!
Make a Difference
Join the Movement
Do Your Part
Get Involved
Play a Role
YOU CAN HELP!

Questions ?

Contact info: fsantiago@safiinformatics.com