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Setting the World on FHIR: The Changing Landscape of Information Exchange in Healthcare

Pharmacy Grand Rounds
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Objectives

1. Identify the advantages of HL7 FHIR® over other methods of information exchange in healthcare
2. Describe the core components of FHIR®
3. Explain the application of FHIR® to medication management

Scenario: Anti-Seizure Medication Algorithm

You are providing medication-related expertise to a group building an algorithm to recommend the best anti-seizure medication for a patient considering the following factors:

Seizure characteristics	Comorbidities (i.e. obesity, kidney failure)	Lab tests (i.e. liver function enzymes)	Potential drug interactions
Current/attempted anti-epileptics	Pharmacogenomics	Insurance coverage	Allergies

Other requirements:

- Viewable via desktop and mobile device
- Other institutions can adopt and integrate their data

Standard Syntax

Description

Standard structure and format of exchanged data

Analogy of Language:

English: Adjective-Noun

Spanish: Noun-Adjective

Examples

- HL7 Version 2 (HL7v2)
- HL7 Version 3 (HL7v3)
- FHIR®

Standard Vocabulary

Description

Standard vocabulary to describe data

Analogy of Language:

Cat (English)= Gato (Spanish)

Big (English) = Grande (Spanish)

Examples

- ICD-10: Diagnosis codes
- RxNorm: Meds
- SNOMED-CT: Meds, med classes & other clinical terms

Need Both Standard Syntax and Standard Vocabulary for Semantic Interoperability

Standard syntax without standard vocabulary

- The grande gato crossed the street

Standard vocabulary without standard syntax

- The cat big the street crossed

Standard syntax and standard vocabulary

- The big cat crossed the street

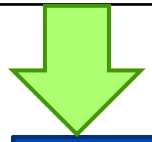
Visualizing Interoperability

EHR #1

Patient First Name	John
Patient Last Name	Doe
Date of Birth	1-22-1955
Medication	Levetiracetam 500 milligram tablet
Route	Orally
Frequency	Twice Daily
Reported By	Self

EHR #2

Patient Name	Smith, Jane
Birthday	1/21/1945
Medication	Keppra 250 mg oral tablet [2]
Route	PO
Frequency	Every Morning and Evening
Source	Patient-Reported



External App/Database

Name	DOB	Medication	Dose	Dose Unit	Route	Frequency	Brand	Informant
John Doe	01/22/1955	Levetiracetam	500	Mg	Oral	BID	0	Patient
Jane Smith	01/21/1945	Levetiracetam	500	Mg	Oral	BID	1	Patient

Timeline of Health Level Seven (HL7) International Standards

HL7 Version 2 Description and Example

```
MSH|^~\&|EPIC^RDE TALYST|PXMHSP|ARZ||200200
```
Pharmacy Encoded Order (RDE) Message Header

```
PID|||298989394^^^MC^MC||DOE^JOHN^^^MS.^^D||19550518|F||B|410 S SADDLE
ST^^GILBERT^AZ^85233-6810^USA^L^^MARICOPA|MARICOPA|(999)999-
4051^P^H^^^205^9974051~^NET^Internet^dDOE9999@yahoo.com||ENG|
6-61-7865|||N
```
PID: Patient Identification

```
PV1||IP|ARZ PXMH 03 W IMC 3C^PX 328^28-
P^PXMHSP^R^^^^^^DEPID|||||20905670^MUNSTER^JULIA^^^^^^PERID^^^^PERID~15353460^JILL^H
ANDER^G^^^^^PERID^^^^PERID||15939758^MILLER^KATIE^M^^^^^PERID^^^^PERID~153233460^JI
LL^HANDER^G^^^^^PERID^^^^PERID|||||||||20905670^MUNSTER^JULIA^^^^^^PERID^^^^PERID|||
|||||||||||||||||||||||||20200207213055
```
PV1: Patient Visit Segment

```
ORC|NW|2222592898234^EPC|||||^2 times
daily&0800,2000^^20200208090000^^R^^|22224849859832^|20200208031057|IDMPROD21231796
^MCKEEN^ANALISA^J^|15723445^RINGER^SARA^A^^^^^PERID^^^^PERID|15353460^JILL^HANDER^G
^^^^^PERID^^^^PERID|||||||||ARZ MCH Arizona Hospital|5777 E MAYO
BLVD^^PHOENIX^AZ^85054-4502^|515-6296^^^^^^5156296|5777 E MAYO
BLVD^^PHOENIX^AZ^85054-4502^USA|||||I
```
ORC: Common Order Segment

```
RXE|^2 times daily&0800,2000^^20200208090000^^R^^|E119989001 ^TOPIRAMATE 200 MG
TABLET ^ADS^^^^^^topiramate 200 mg tablet (TOPAMAX)|200||mg^mg|200|^Administer on
an empty stomach (1 hour before or 2 hours after eating).~^Swallow whole. Do NOT
crush, chew, or split
tablet.|||1|Each^each||^JILL^HANDER^G^||||1|||||||||
DISP|^TOPAMAX|||||||||^ARZ PXMH TALYST-PYXIS LOAD
```
RXE: Pharmacy Encoded Order Segment

```
RXR|oral^oral
RXC|| E119989001^TOPIRAMATE
```
RXR: Pharmacy Route Segment/ RXC: Pharmacy Component Order

```
ZRX|N|200200202020003|JZ2222592898234-3019|||1|||HAZARDOUS - Non-Antineoplastic \F\
PPE 1 \F\ Disposal Haz |20200208090000
```
ZRX: Custom Segment (Hazardous Banner)

- Helps connect hospital systems
- Message-oriented
  - Example: Epic to carousel or Epic to Pyxis
- Cons
  - Extensive interface design needed
  - Lack of human readability without translation

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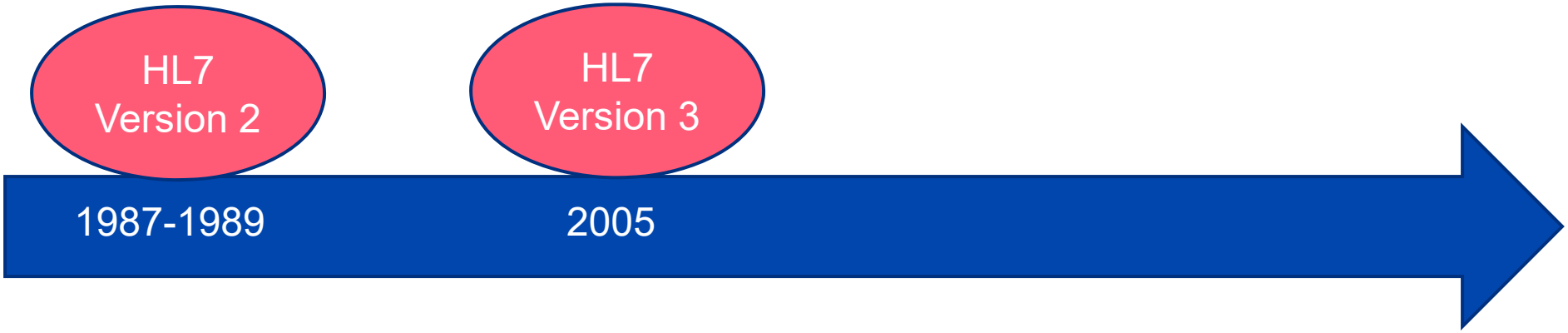
Fictitious patients and users

Timeline of Health Level Seven (HL7) International Standards



- Supports messaging **within** hospitals
- Well adopted

- Not well adopted

Assessment Question

Which of the following is <u>true</u>?

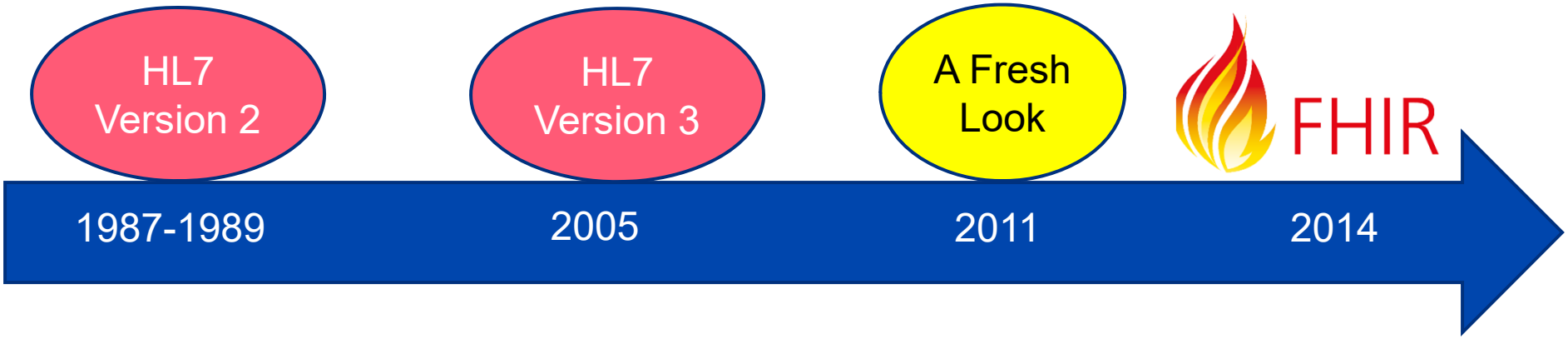
A. HL7v2 was designed primarily for readability

B. HL7v3 is not widely adopted

C. RxNorm defines the structure of exchanged data

D. HL7v2 was designed to support messaging between hospitals

Timeline of Health Level Seven (HL7) International Standards



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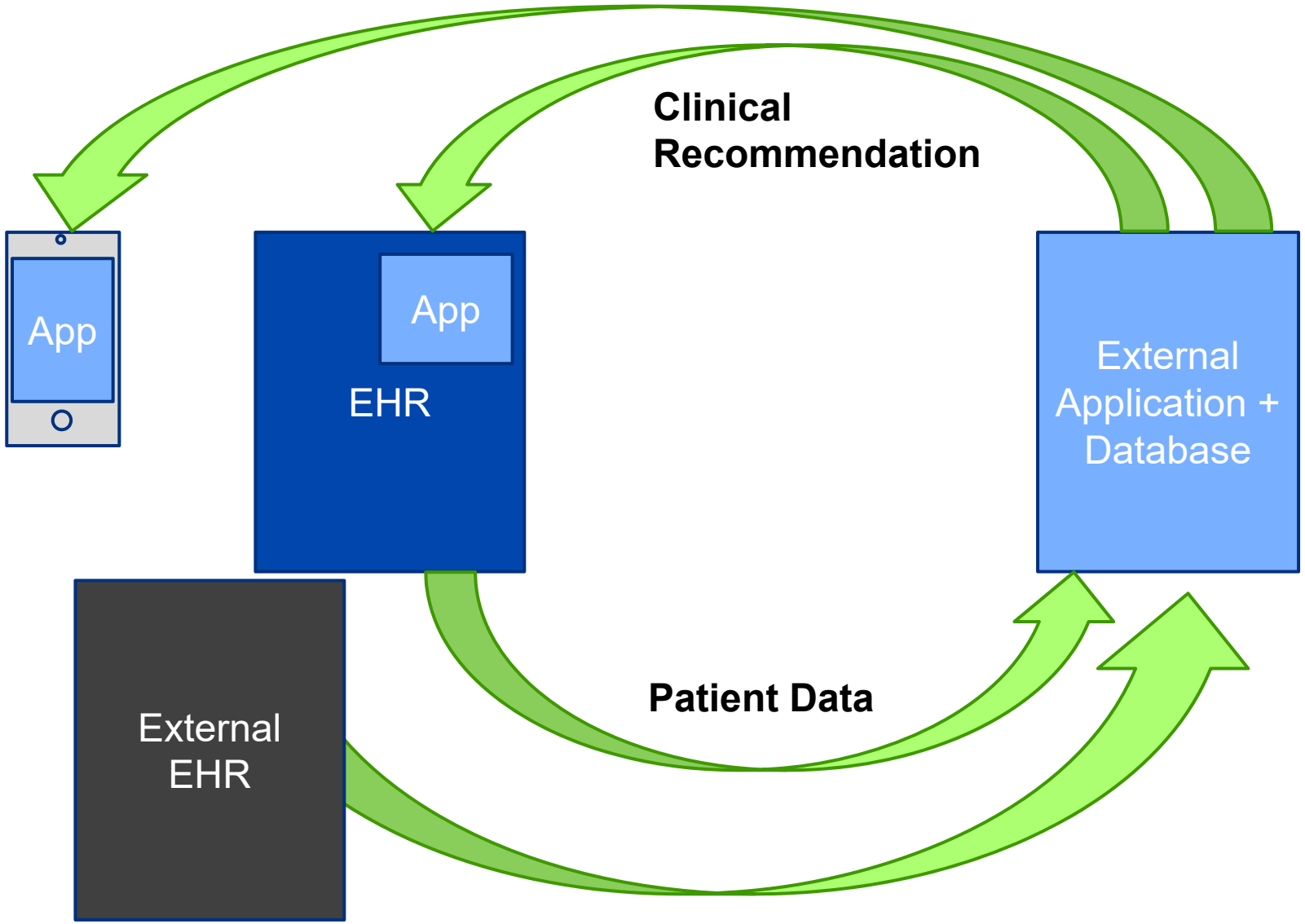
Ideal State of Information Exchange Using an External Application



Living Interoperability

- Standardized way to describe ticketing information
- Central place to view combined information
- Anyone can write an app to pull ticket information
- Modeling/forecasting to inform best time to buy

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Image: Free for commercial use- No attribution required

The Promise of FHIR®

- **“Simplify implementation without sacrificing information integrity”**
  - Free documentation
  - Easy for developers to understand
- **“Plug and play” app integration**
  - Rich information at fingertips of patients and providers

Next Steps

- Your team decides to build a FHIR® application

Objectives

1. Identify the advantages of HL7 FHIR® over other methods of information exchange in healthcare
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What is FHIR®?

Fast Healthcare Interoperability Resources

- **F**ast= speed at which implementation occurs
- **H**ealthcare= focus of FHIR®
- **I**nteroperability standard for the exchange of healthcare information electronically
- **R**esources= building blocks of FHIR®

FHIR® Resource Examples

Non-Medication Related

- Patient
- Practitioner
- Schedule
- Encounter
- Procedure
- ServiceRequest
- Claim
- ResearchStudy

Medication Related

- MedicationRequest
- MedicationAdministration
- MedicationDispense
- MedicationStatement
- Medication
- MedicationKnowledge
- Immunization
- ImmunizatonEvaluation
- ImmunizationRecommendation

FHIR® Resource Index. http://hl7.org/fhir/resourcelist.html

FHIR® Example Resource


```
{
  "resourceType": "MedicationStatement",
  "id": "2672522",
  "meta": {
    "extension": [
      {
        "url": "http://hapifhir.io/fhir/StructureDefinition/resource-
meta-source",
        "valueUri": "#XGsJFAW1Ja74NLPf"
      }
    ],
    "versionId": "1",
    "lastUpdated": "2020-02-09T22:43:17.441+00:00"
  },
  "text": {
    gabapentin 600mg twice daily</div>"
  },
  "status": "active",
  "medicationCodeableConcept": {
    "coding": [
      {
        "system": "http://snomed.info/ct",
        "code": "323021008"
```


Resource Identity

Standard Data

Human Readable Summary

Extensions

- Ability to “extend” scope of base resources in a standard and defined way
- FHIR® resource always includes URL describing extension

Examples:

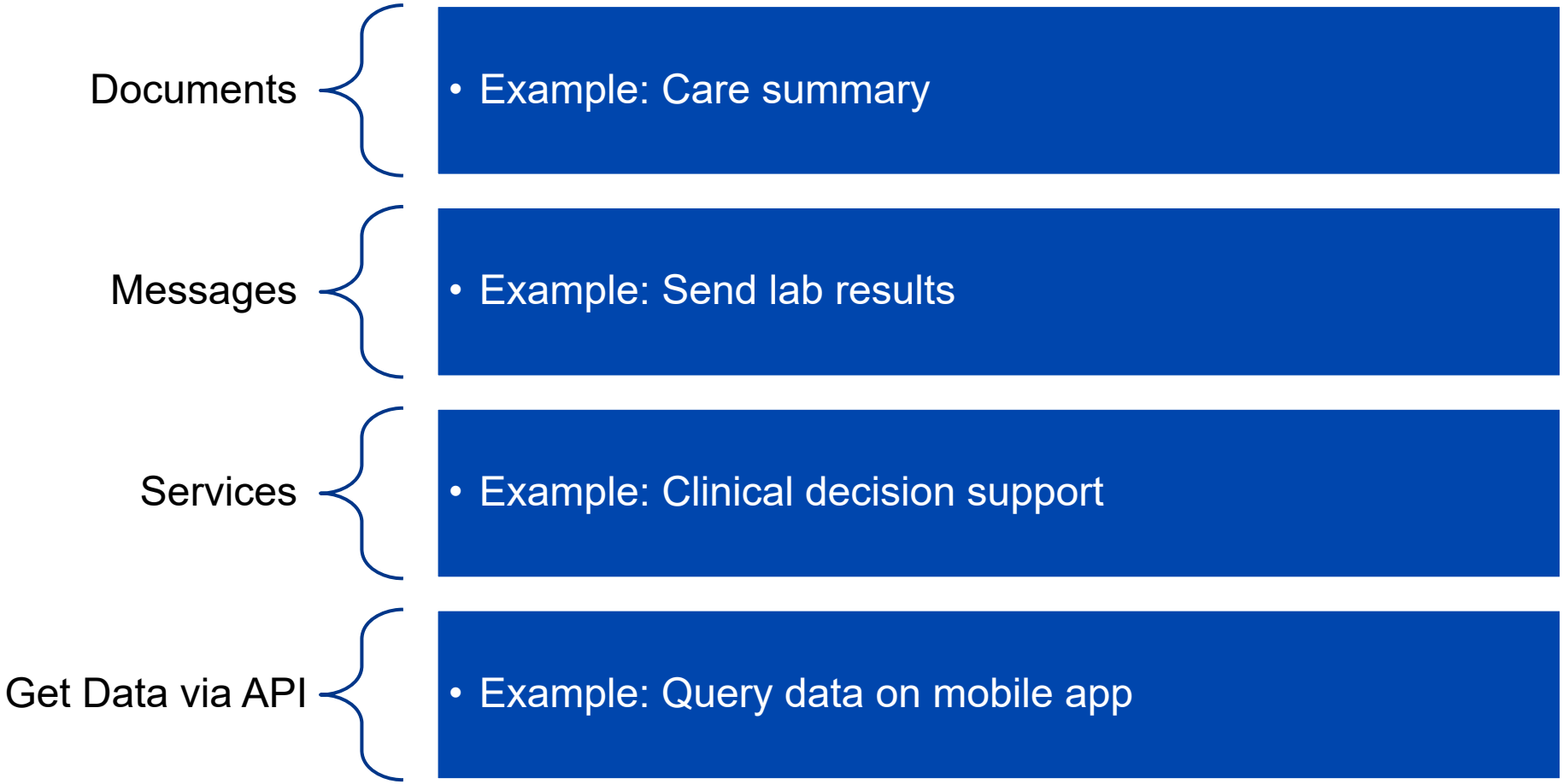
FHIR® Core-defined Extension Registry. https://www.hl7.org/fhir/extensibility-registry.html

Profiles

- A specific set of customized base resources
  - Agreed upon syntax and vocabulary
- Implementation guides specific to use case

- Example: US Core-MedicationRequest Profile Requirements
  - A status
  - An intent code
  - A medication (using RxNorm)
  - A patient
  - A date for when written
  - A prescriber

What FHIR® Can Do



FHIR® is Executable: Example Operations

- Generate questionnaire
- Last N observations
- Fetch patient record
- Care gaps reports
- Submit claim resource
- Generate a document

Example:
GET[base]/Observation/$lastn?patient=Patient/123&category=laboratory

FHIR® is More than a Data Standard

HL7v2 analogy: Standard messaging

Hi John - are you free to go to dinner on Friday night at Grand Rounds at 7 pm?

Now

Sure, that will work for me. Go ahead and make a reservation

Now • SMS

FHIR® analogy: A much more expansive framework

Check John's calendar to see if he is free

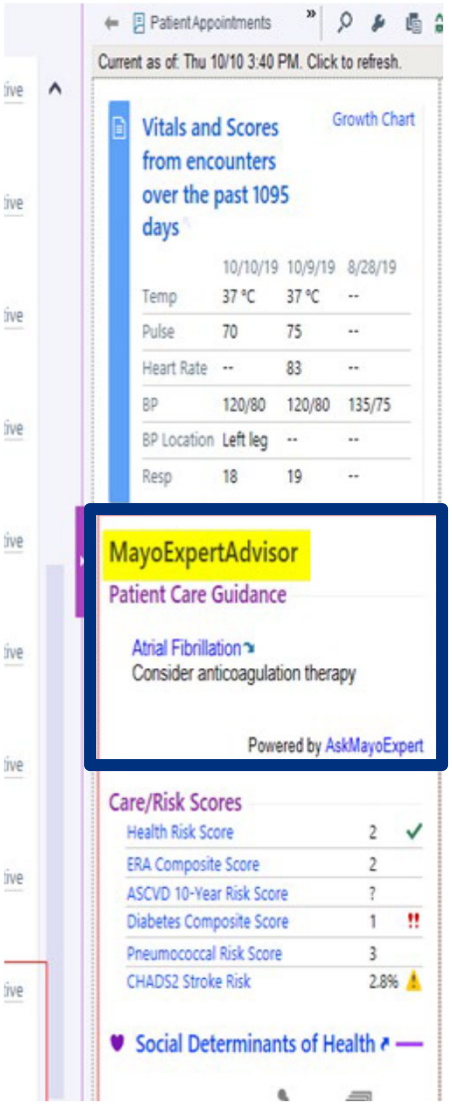
Book a reservation at Grand Rounds if they have availability. If not, find another place

Put a calendar invite on both of our calendars

Figure out what time I need to leave from home and book my ride-share

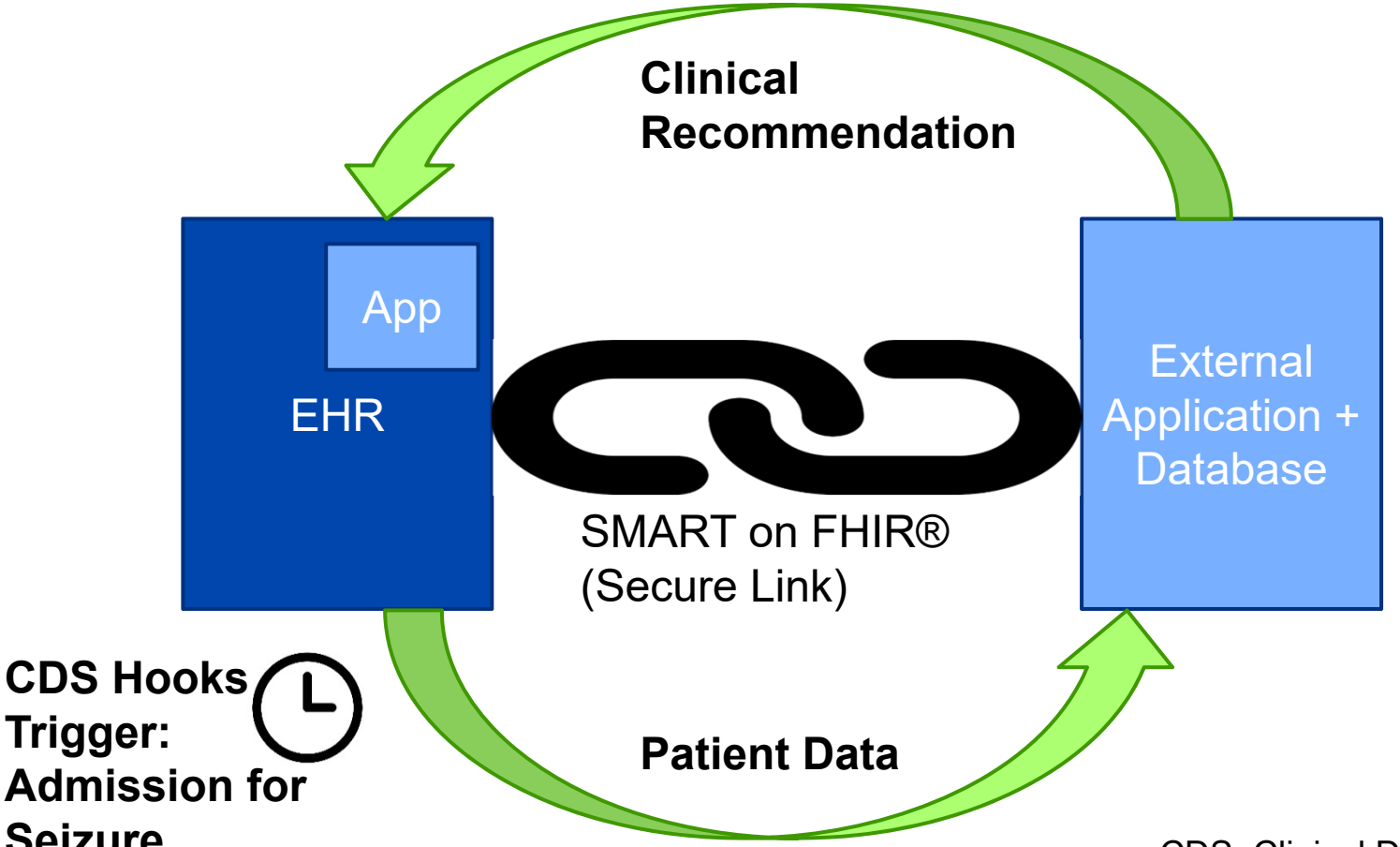
Adoption of FHIR®

- FHIR® has been a work in progress the past 8 years
- FHIR® is not required… yet
- Shared FHIR® profiles crucial to its success
  - Argonaut project
- Mayo example
  - Mayo Expert Advisor



CDS Hooks + SMART on FHIR®

CDS Hooks: Trigger to invoke app
SMART on FHIR®: Secure connection between EHR and app



CDS: Clinical Decision Support
SMART: Substituable Medical Applications, Reusable Technologies

Example

- View a patient on http://clinfhir.com/patientViewer.html

Assessment Question

Which of the following is <u>true</u> about FHIR®?

a. The customizable features of FHIR® are called resources

b. FHIR® resources cannot perform operations

c. FHIR® resources may employ SNOMED-CT or RxNorm

d. FHIR® does not allow mobile integration

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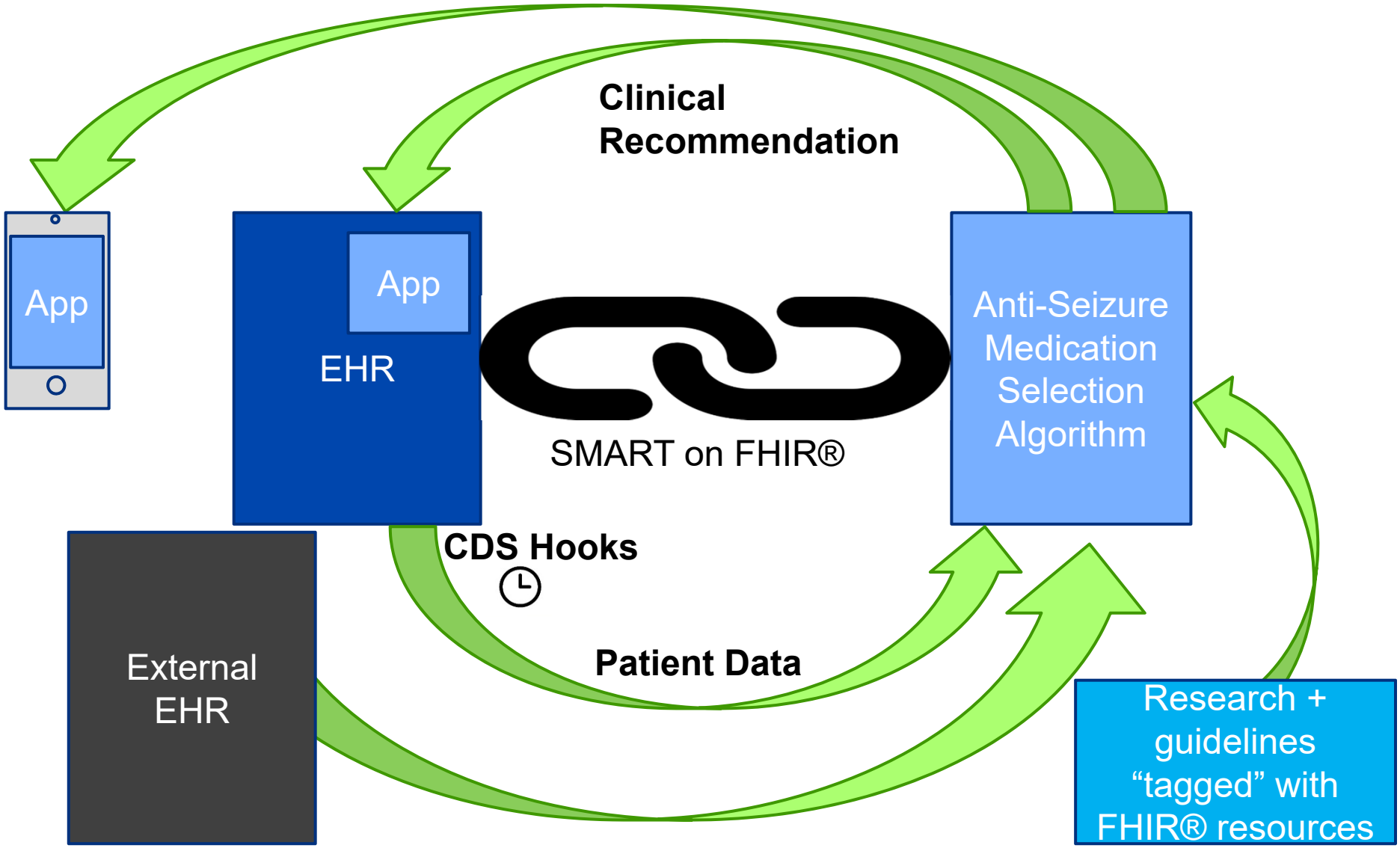
Anti-Seizure Medication App Resources

Seizure characteristics	Questionnaire Response
Lab tests (i.e. liver function enzymes)	Observation
Current/attempted anti-epileptics	MedicationStatement
Insurance coverage	Coverage
Comorbidities (i.e. obesity, kidney failure)	Condition
Potential drug interactions	MedicinalProduct Interaction
Pharmacogenomics	Observation
Allergies	AllergyIntolerance

FHIR® Resource Index. http://hl7.org/fhir/resourcelist.html

Anti-Seizure Medication Selection App Made Possible with FHIR®



Considerations for the Clinical Medication Expert with External Applications

Which medications are included in the external application?

What is the process to ensure new information is incorporated into the external application?

How can we ensure the recommendations provided to clinicians in the app are aligned with the EHR? (i.e. allergy, dosage alerts)

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The Path Forward

- Continuous improvements expected as adoption increases
- Use of FHIR® ≠ automatic interoperability
  - Shared profiles and understanding of how to use will be crucial
- Final rule to require EHR vendors to support specific FHIR® resources could occur any day

Assessment Question

Which of the following is <u>true</u> about FHIR®?

A. SMART on FHIR® provides a framework for triggers to invoke apps

B. Use of FHIR® does not guarantee interoperability

C. CDS hooks defines how EHRs can securely interact with FHIR® apps

D. FHIR® has not been adopted in the U.S.

Where to Learn More

- FHIR® documentation
- RxNorm
- SNOMED-CT

Conclusions

- Core FHIR® components include resources, extensions, profiles and operations
- FHIR® is fundamentally different than previous standards of information exchange
- FHIR® likely will accelerate the development of custom tools designed for patient care that may be accessed via various platforms

