

Transitioning to Interoperability

Learnings from Converting a CDS System to FHIR

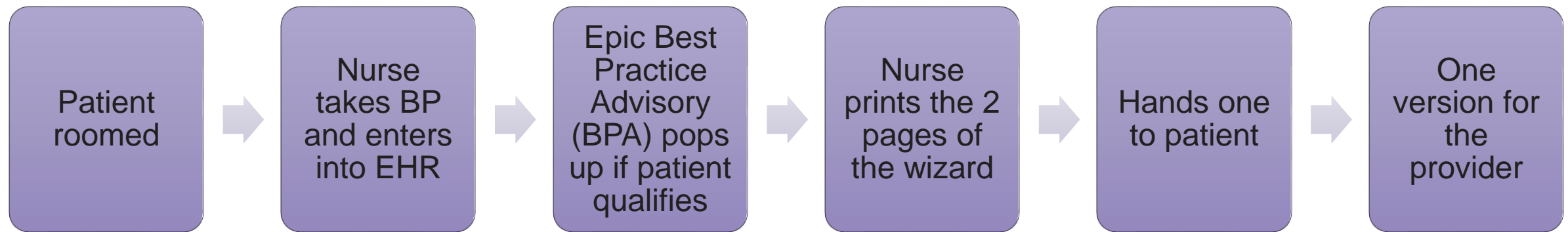


Priorities Wizard CDS

- Powerful CDS System integrated into Epic at point of care
- Multiple domains
 - Diabetes,
 - Hypertension,
 - Lipids
 - Smoking,
 - Weight
 - Aspirin
 - CKD
 - Adherence
 - OUD
 - Cognitive Impairment
 - Cancer prevention
- 4M patients across 30 states
- Improved Care Quality
- Dental, ED, Teens



Workflow



Clinician View

- Clinician print view includes lab values, treatment considerations, and safety alerts
- Can be given to patients with high literacy and numeracy

Provider
Patient
Print
Print CKD Pt Ed - English
Print CKD Pt Ed - Spanish

Relevant Conditions: Hypertension, Diabetes

10-year Cardiovascular Risk : 8.0% (Risk of stroke or heart attack over the next 10 years)




#1 DEPRESSION	Results	Current Medications															
<p>Important</p> <ul style="list-style-type: none"> • Patient's PHQ9 indicates thoughts of suicide. Assessment recommended. <p>Treatment Considerations</p> <ul style="list-style-type: none"> • Consider medication management. • See the printed page for medication treatment options. <p>Other Alerts</p> <ul style="list-style-type: none"> • PTSD codes have been identified. • Anxiety codes have been identified. • Consider involving a behavioral health consultant. 	<table border="1"> <tr> <td>PHQ9</td> <td>22</td> <td>10/21/24</td> </tr> <tr> <td>PHQ9Q9</td> <td>2</td> <td>10/21/24</td> </tr> <tr> <td>PHQ2</td> <td>6</td> <td>3/13/24</td> </tr> <tr> <td>BMI</td> <td>37.3</td> <td>1/16/24</td> </tr> <tr> <td>Smoking Status</td> <td>NEVER</td> <td>3/13/24</td> </tr> </table>	PHQ9	22	10/21/24	PHQ9Q9	2	10/21/24	PHQ2	6	3/13/24	BMI	37.3	1/16/24	Smoking Status	NEVER	3/13/24	<p>Duloxetine HCl Enteric Coated Pellets Cap 60 MG (Base Eq) MIRTAZAPINE TAB 30 MG</p>
PHQ9	22	10/21/24															
PHQ9Q9	2	10/21/24															
PHQ2	6	3/13/24															
BMI	37.3	1/16/24															
Smoking Status	NEVER	3/13/24															
#2 BMI (WEIGHT)	Results	Current Medications															
<p>Treatment Considerations</p> <ul style="list-style-type: none"> • Discuss advantages of reducing weight by 10-20 lbs. Consider referring to a weight loss program. • Based on BMI and/or other comorbid conditions, consider discussing bariatric surgery. 	<table border="1"> <tr> <td>Weight(lbs)</td> <td>231</td> <td>1/16/24</td> </tr> <tr> <td>BMI</td> <td>37.3</td> <td>1/16/24</td> </tr> </table>	Weight(lbs)	231	1/16/24	BMI	37.3	1/16/24	<p>No relevant medications</p>									
Weight(lbs)	231	1/16/24															
BMI	37.3	1/16/24															
<p>Quick actions to consider : <input type="checkbox"/> Referral <input type="checkbox"/> SHOW ALL</p>																	
#3 CHRONIC KIDNEY DISEASE	Results	Current Medications															
<p>Treatment Considerations</p> <ul style="list-style-type: none"> • To prevent progression of kidney disease, pay attention to: <ul style="list-style-type: none"> * Consider starting an SGLT2 inhibitor medication. * Lowering blood pressure *Avoiding NSAIDs 	<table border="1"> <tr> <td>eGFR(ml/min)</td> <td>54</td> <td>2/14/24</td> </tr> <tr> <td>eGFR(ml/min)</td> <td>55</td> <td>1/16/24</td> </tr> <tr> <td>eGFR(ml/min)</td> <td>52</td> <td>8/10/23</td> </tr> <tr> <td>UMACR</td> <td>7</td> <td>1/16/24</td> </tr> </table>	eGFR(ml/min)	54	2/14/24	eGFR(ml/min)	55	1/16/24	eGFR(ml/min)	52	8/10/23	UMACR	7	1/16/24	<p>Losartan Potassium Tab 25 MG</p>			
eGFR(ml/min)	54	2/14/24															
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eGFR(ml/min)	52	8/10/23															
UMACR	7	1/16/24															

Patient View











- Patient print view designed for low literacy and numeracy
- Uses symbols to relay risk and what would be of most benefit to your health if actions taken

TALK TO YOUR DOCTOR ABOUT HOW YOU CAN IMPROVE YOUR HEALTH

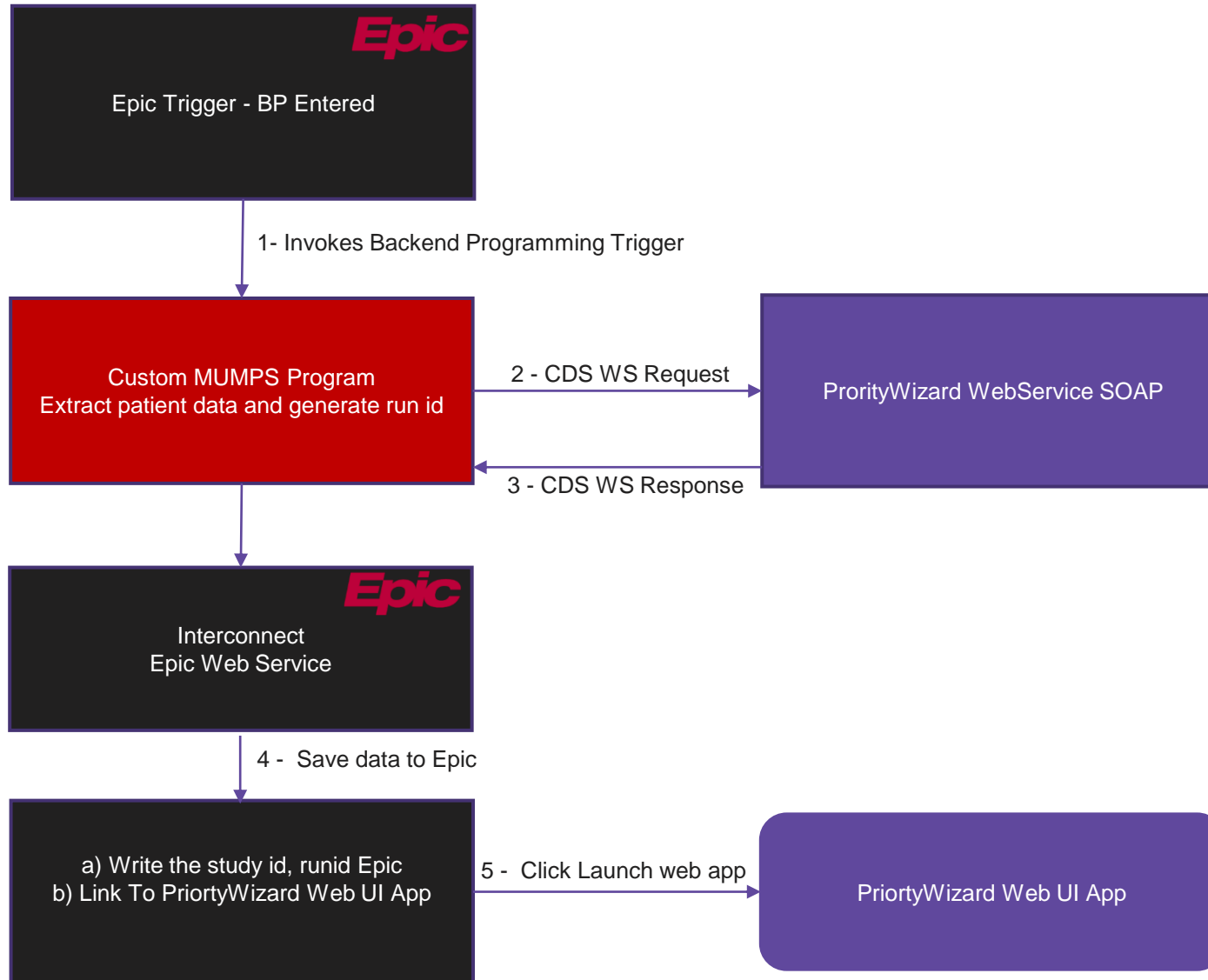
Start the conversation! Use the priorities below as a guide to take action to better your health.

 Important	 Consider Action	 Doing well
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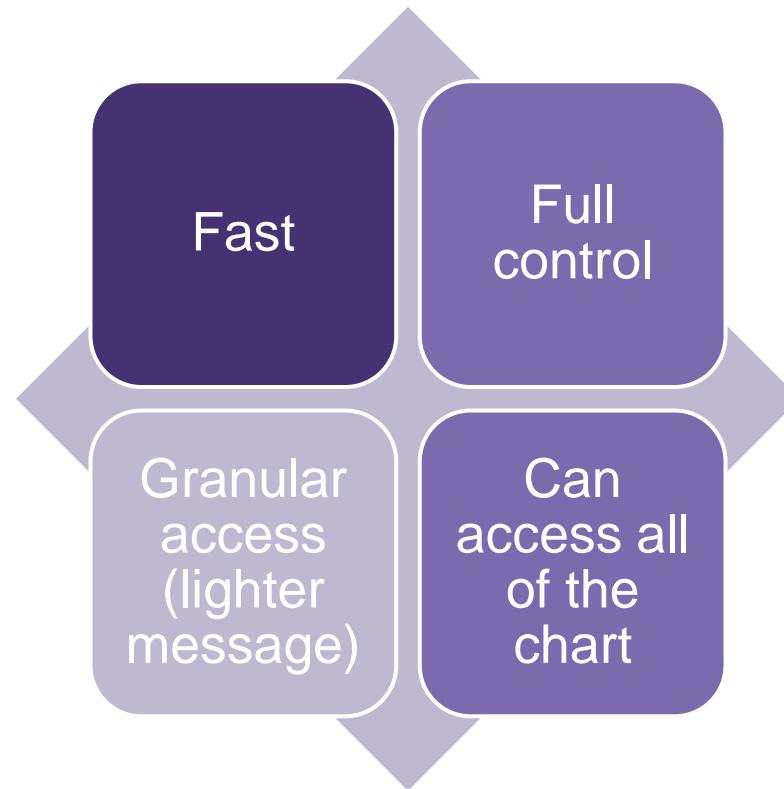
 Medications can be costly. We encourage you to talk with your care team about the cost of your medications.

 DEPRESSION		Consider discussing depression with your clinician. For strategies for managing your mood, go to https://www.myhealthwizard.org
 WEIGHT	 Your Weight: 231	Weight loss is recommended. For support with weight management, contact Park Nicollet Nutrition Services (952-993-3333).
 KIDNEY HEALTH		Talk to your doctor about what you can do to keep your kidneys working well. Avoid long-term use of nonsteroidal anti-inflammatory medications such as ibuprofen and naproxen.
 BLOOD SUGAR	 Your A1C: 5.4	Your Goal: A1C less than 7
 BLOOD PRESSURE	 Your Blood Pressure :(120/80)	BP is higher than recommended goal. Talk with your clinician about your blood pressure goal. Maintain a healthy lifestyle and recheck your blood pressure (home or office) within 3 to 6 months.

Legacy Design



Advantages



Custom Code Challenges

Resources



Resource-Intensive
Implementation



Local experts



Dependence on
Niche Skillsets



Reluctance in
introducing custom
code



Security Concerns



Maintenance and
upgrades are
resource-intensive

Dissemination Limitations

- Designed for single Epic site
- Limited adaptability for other EHR platforms
- Substantial redevelopment needed for broader contexts

FHIR Architecture



Why FHIR?

- ❖ Universal standard for healthcare data exchange
- ❖ Modular, resource-oriented framework
- ❖ Regulatory Compliance and Industry Alignment
 - ONC and CMS Mandates: CMS Interoperability and Patient Access final rule.
- ❖ Enhanced Interoperability, Scalability and Flexibility
- ❖ Implementation Efficiency
 - Reduced Custom Development: By adhering to a standard, there is less need for custom interfaces and protocols, reducing development and maintenance costs.
 - Future-Proofing
 - Eliminates redevelopment for diverse implementations
 - Streamlined Data Modeling and Communication
 - Seamless integration across healthcare systems
- ❖ Security

Objectives and Goals

❖ Key Objective

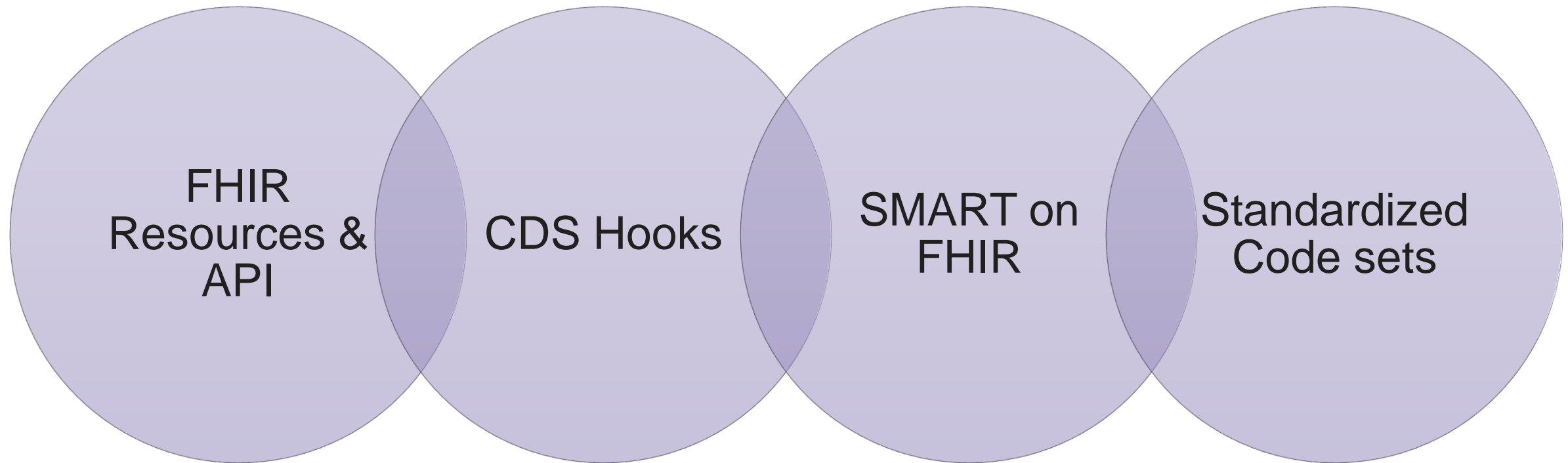
- Preserve clinical workflows optimized in the legacy system
- Achieve a response time under 300ms

❖ User Experience

- Maintain the same user experience
- Mitigate workflow interruptions
- Ensure successful CDS implementations



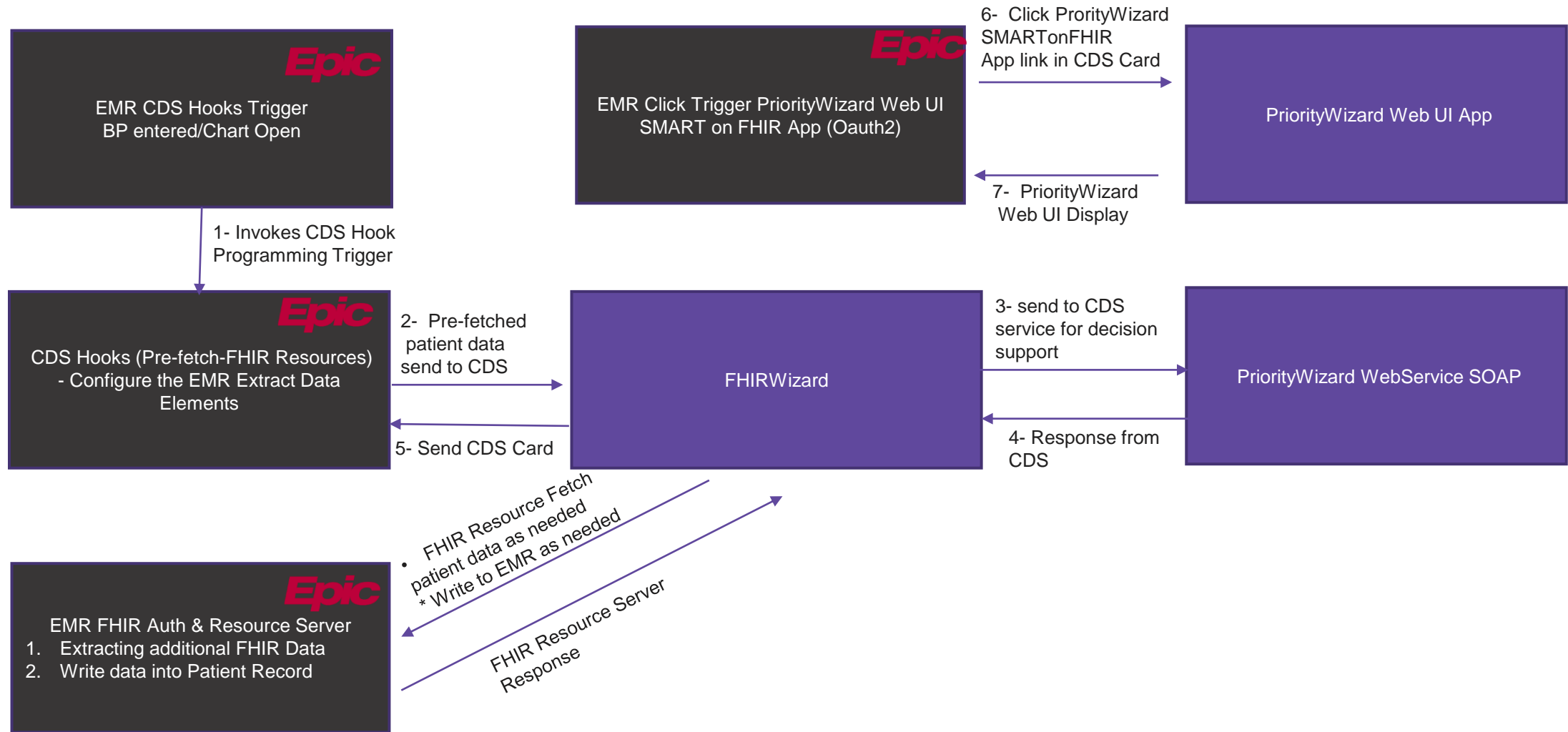
Core Elements of FHIR-Based CDS



Technical Components

- The PrioritiesWizardWS
 - Core processing engine executing guideline-based algorithms and AI/ML models
 - Generates clinical risk scores and actionable recommendations
- FHIRWizard
 - Acts as a bridge between FHIR-based inputs and legacy infrastructure
 - Uses HAPI APIs to parse FHIR payloads and convert them into SOAP requests
 - Ensures seamless communication while preserving existing workflows
- CDS Hooks Configuration in the EMR
 - Chartopen: Transmits static historical patient data at encounter initiation
 - Vitals: Sends updated encounter-specific data upon submission of vital signs
 - Dot Phrase: Activated by physicians, integrates insights into clinical documentation
 - Manual Refresh: Activated by physicians to get updated UI
- SMART on FHIR UI Launch from CDSHooks Card
- Deployment in Epic EHR App Market

FHIR Architecture



Mapping to FHIR Resources and API

Steps

- ❖ Identified FHIR Resources
- ❖ API Discovery and Performance Profiling
- ❖ Testing and Verification

Data Requirements

- Patient demographics
- Problem list
- Encounter diagnosis list
- Labs
- Vitals
- Medications
- Procedures
- Referrals
- Allergies
- Assessments

Limitations and Mitigations

❖ Referrals

- ❖ FHIR defines a ReferralRequest resource
- ❖ Not implemented in the EHR system
- ❖ Algorithms modified to exclude or tolerate absence of referral data

❖ Encounter Diagnosis List

- ❖ Encounter-specific diagnosis data not retrievable across multiple encounters directly
- ❖ Workaround: Extract individual encounters and retrieve diagnosis lists iteratively
- ❖ Limitation: Encounter diagnosis data could not be pre-fetched
- ❖ Potential impact on latency during runtime

CDSHooks Implementation

- Triggers
 - Vitals
 - Dot phrase
 - Manual Refresh
- Prefetch

EHR Med Order

Rx Toprol XL
50 mg daily

information card

\$200 per month
(patient pays \$30)

suggestion card

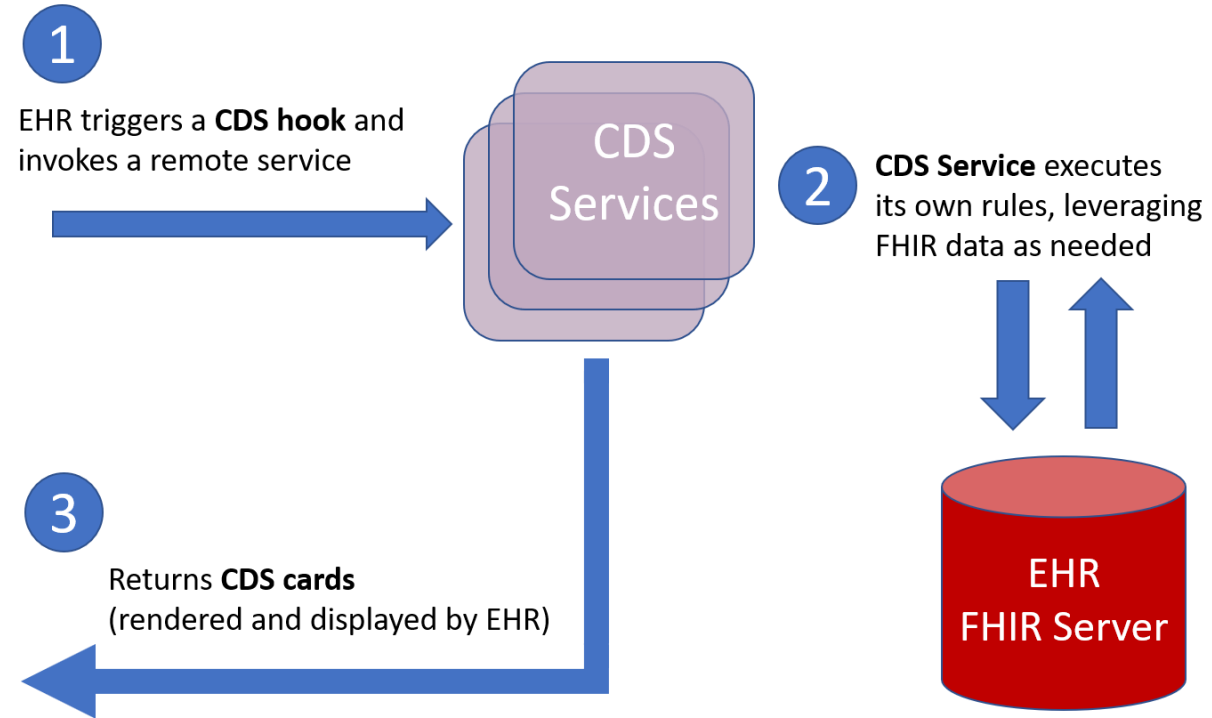
Try HCTZ as first-line

Switch to HCTZ

smart app link card

Managing hypertension?

 [Launch JNC 8 Rx Pro](#)



CDS Hooks - Limitations and Mitigations

- Initial Data Extraction Challenges
 - Vitals trigger required 30 seconds for data retrieval
 - Chartopen trigger introduced to prefetch and save historical data
 - Chart open was made asynchronous to reduce latency
 - Recent data extracted at Vitals
 - Reduced vitals system response time to under one second
- Optimization of Triggers
 - Manualrefresh and Dotphrase triggers required additional processing - unsolved
- CDSHooks Implementation
 - Most recent lab - Supports 'sort' and 'count' parameters
 - Date limited
- CDSHooks Date Parametrization

Mapping of Codes

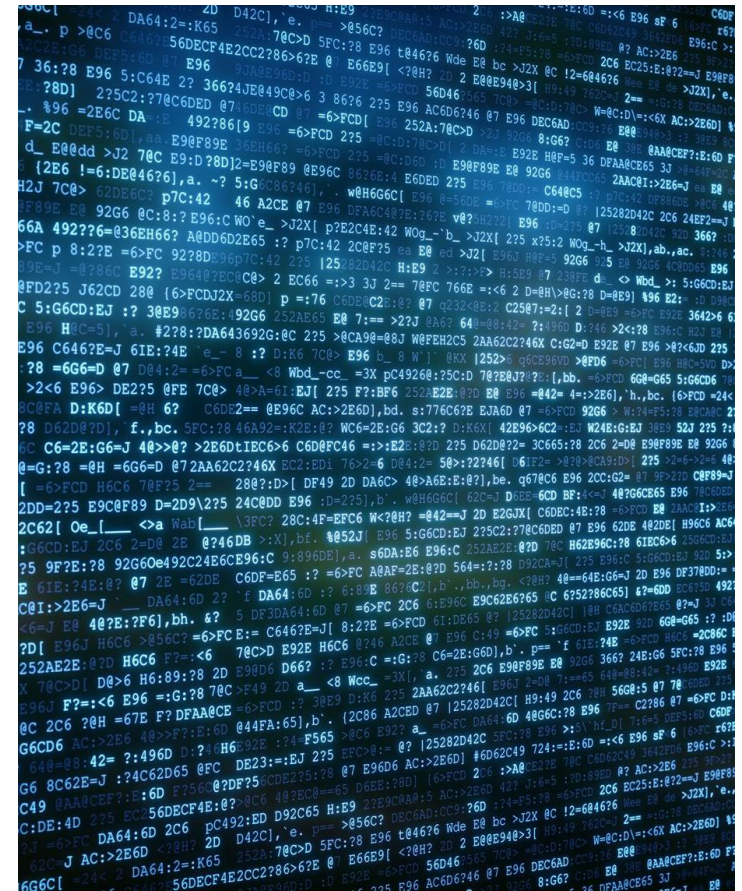
- Laboratory Tests
 - Mapped to Logical Observation Identifiers Names and Codes (LOINC)
 - Ensures unambiguous communication of lab data
 - Fosters interoperability across disparate systems
- Allergies, Procedures
 - Standardized using SNOMED CT
 - Supports accurate documentation, sharing, and retrieval of allergy-related data
- Diagnoses
 - Mapped to ICD-10 codes
 - Ensures accurate diagnosis mapping
- Medications
 - RxNorm

Unmapped Codes

- Unmapped Laboratory Tests
 - Substantial subset of labs lacked pre-existing LOINC mappings
 - Manual mapping initiative
 - Meticulous review and validation processes (labs and units)
 - Mitigated potential inconsistencies
 - Mapped assessments to LOINC
- Inconsistent RxNorm Medication Codes
 - Frequent absence of RxNorm codes in datasets
 - Custom mappings developed to bridge the gap
- OID Integration

Message Payloads and Efficiency

- Multiple associated code sets for each resource
- Inability to specify granular data
- Large and inefficient message payloads
- Standardize use of coding systems



Future

- Internal: Comprehensive FHIR Adoption
 - Rework legacy systems to accept FHIR inputs
 - Store data in FHIR-compliant formats in transactional and reporting systems

Key Takeaways



Wins

❖ Interoperability & Dissemination

- ❖ System fully operational and deployed to app marketplace (garden)
- ❖ Can migrate to other EHR vendors

❖ Reduced Resource Requirements at Implementation site

- ❖ Less time required from client-side staff
- ❖ Specialized technical expertise not required at implementation site

❖ Standardized Code Sets

- ❖ Minimized need for custom mappings

❖ Integration of FHIR's Security Protocols

- ❖ Ensures patient data protection
- ❖ Meets regulatory compliance requirements

❖ Trust Among Stakeholders

- ❖ Encourages acceptance of healthcare IT solutions

Limitations

- ❖ Incomplete EHR Vendor Implementation
 - ❖ Inconsistent data retrieval capabilities
 - ❖ Limited potential for leveraging FHIR benefits
- ❖ Latency and Message Overhead
 - ❖ Issues related to latency and excessive message payloads
 - ❖ Need for more granular queries
- ❖ CDSHooks Challenges
 - ❖ Limited trigger points
- ❖ Prefetch Limitations
- ❖ Encounter Data Limitations
- ❖ Dynamic Querying

Questions?

