
Slides @ bit.ly/chc_learning_lab



ignite change.



TOMORROW
TODAY

SMART on FHIR Intro & Ecosystem @ Cerner

Kol Kheang



Agenda

- ❖ What is SMART on FHIR?
- ❖ SMART app examples
- ❖ SMART on FHIR app launch sequence
- ❖ SMART community
- ❖ Cerner code console
- ❖ Cerner supported launch points
- ❖ Cerner SMART on FHIR community
- ❖ Cerner SMART on FHIR tutorial app
- ❖ Q & A

Substitutable **M**edical **A**pplications & **R**Reusable **T**echnology

Fast Healthcare Interoperability Resources

SMART Standards



Provides standards to build **healthcare applications**



Applications can **run against any vendor** implementing SMART



Open source (licensed under Apache License 2)



Generally **web apps**
(though **native apps** are supported too)

SMART > Platform Benefits



Defines how apps are launched



Authorization (OAuth 2)



Authentication (OpenID Connect)



Context sharing between container and app



Discover FHIR service endpoint

SMART > Platform Benefits



Defines how apps are launched



Authorization (OAuth 2)



Authentication (OpenID Connect)

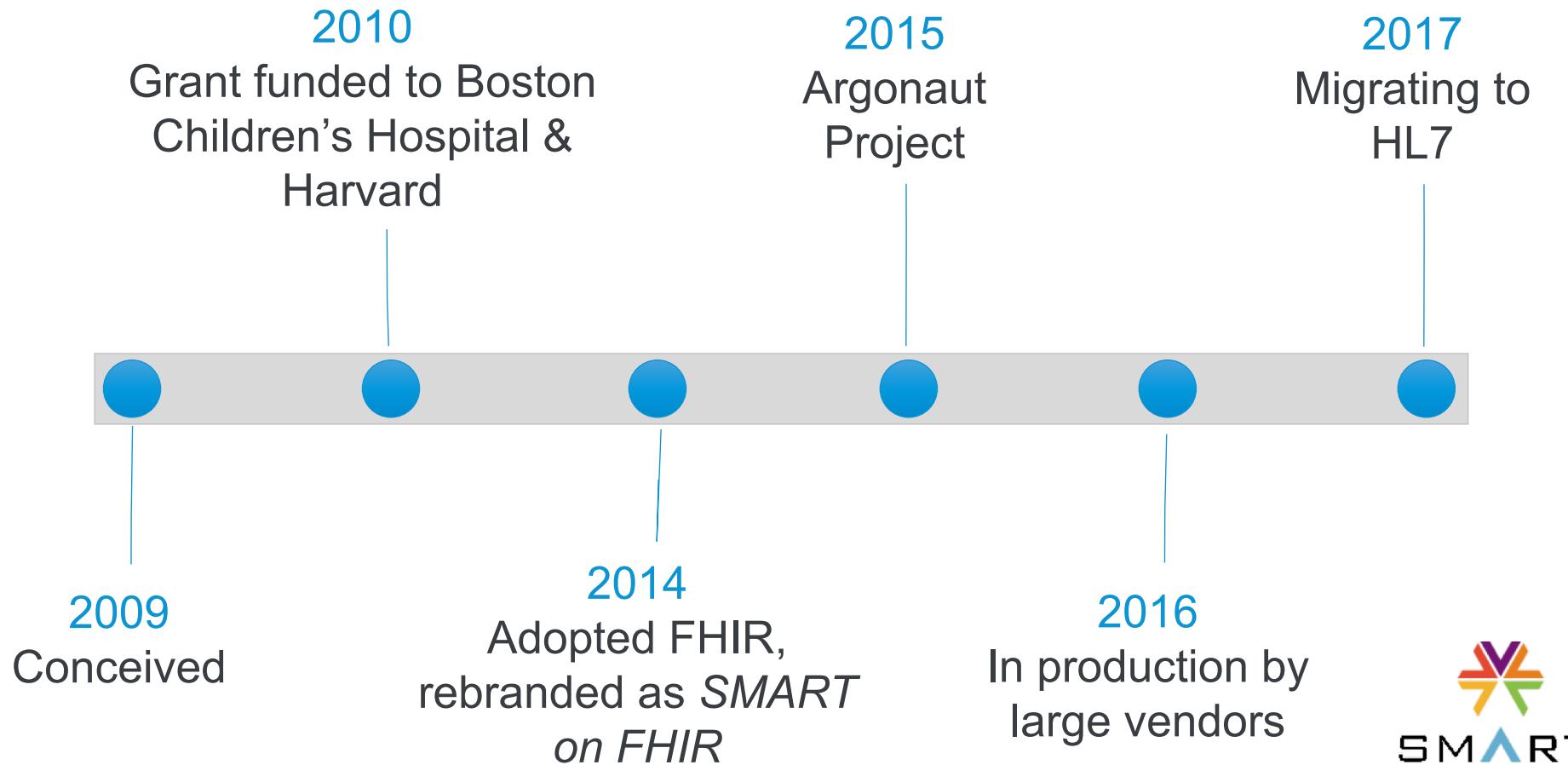


Context sharing between container and app



Discover FHIR service endpoint

SMART > Trajectory



Example Apps



Boston
Children's
Hospital

SMART®



ePreop™



KRAMES
ON FHIR



SMART Cardiac Risk App by Cerner

ASCVD Risk Calculator 

[Results](#) [Risk Factors](#) [Recommendations](#)

Sex	Total Cholesterol (mg/dL)	Diabetes
<input type="button" value="Male"/> <input type="button" value="Female"/>	130	<input type="button" value="No"/> <input type="button" value="Yes"/>
Age	HDL - Cholesterol (mg/dL)	Current Smoking
37	90	<input type="button" value="No"/> <input type="button" value="Yes"/>
Race	Systolic Blood Pressure	Treatment for Hypertension
<input checked="" type="radio"/> White <input type="radio"/> African American <input type="radio"/> Other	90	<input type="button" value="No"/> <input type="button" value="Yes"/>

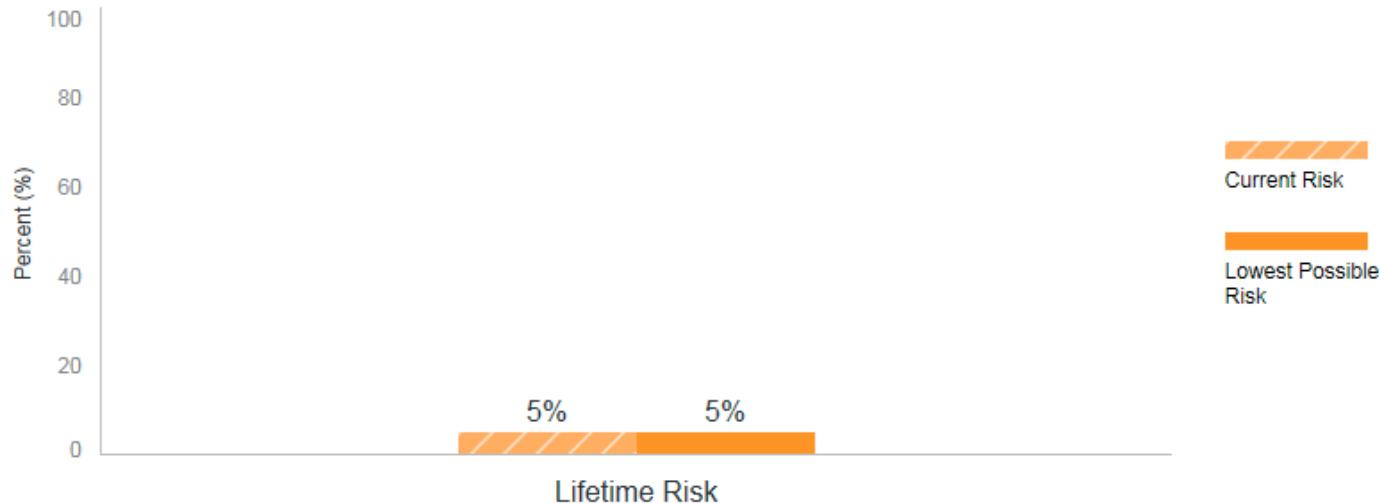
SMART Cardiac Risk App by Cerner



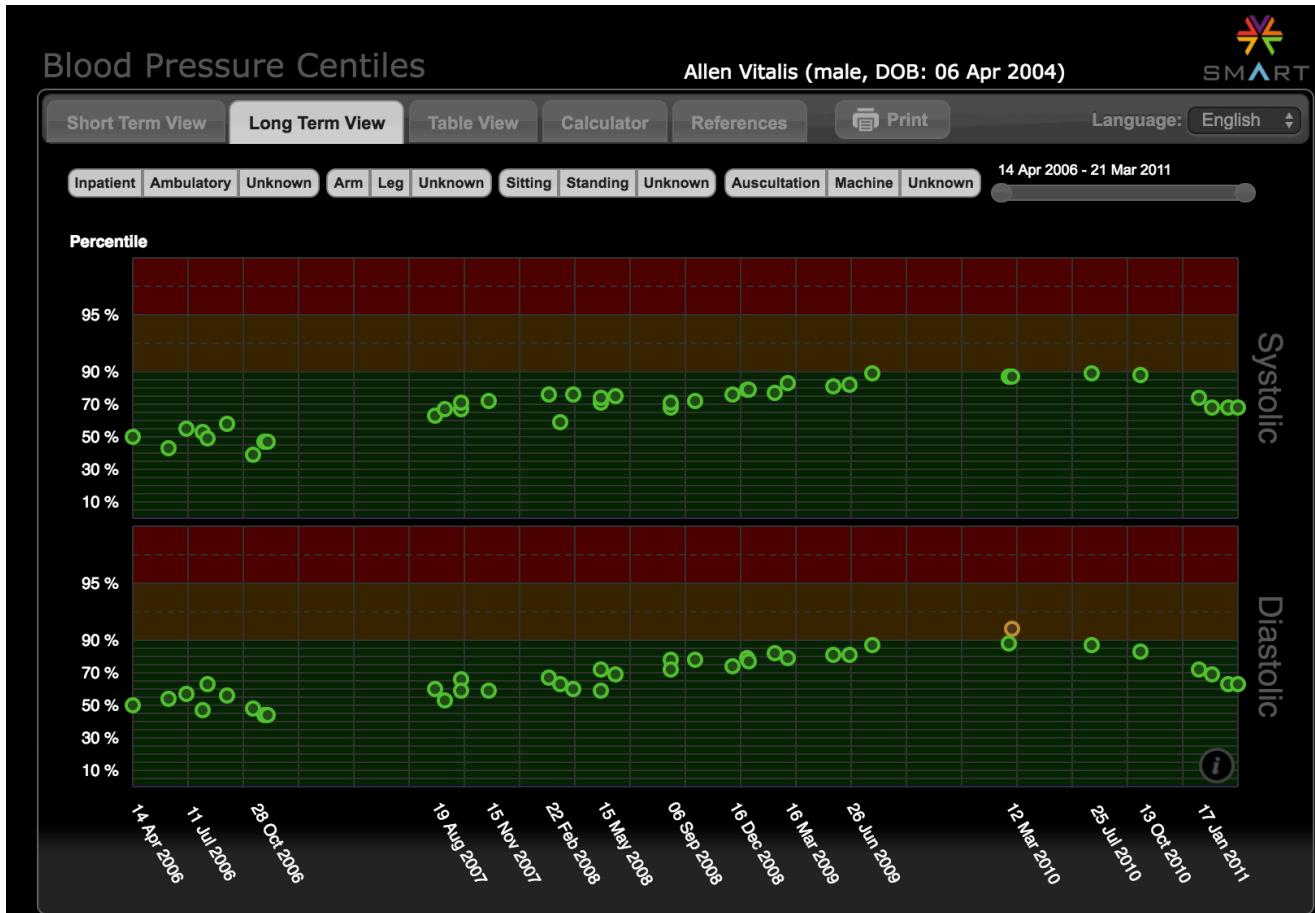
Results Risk Factors Recommendations



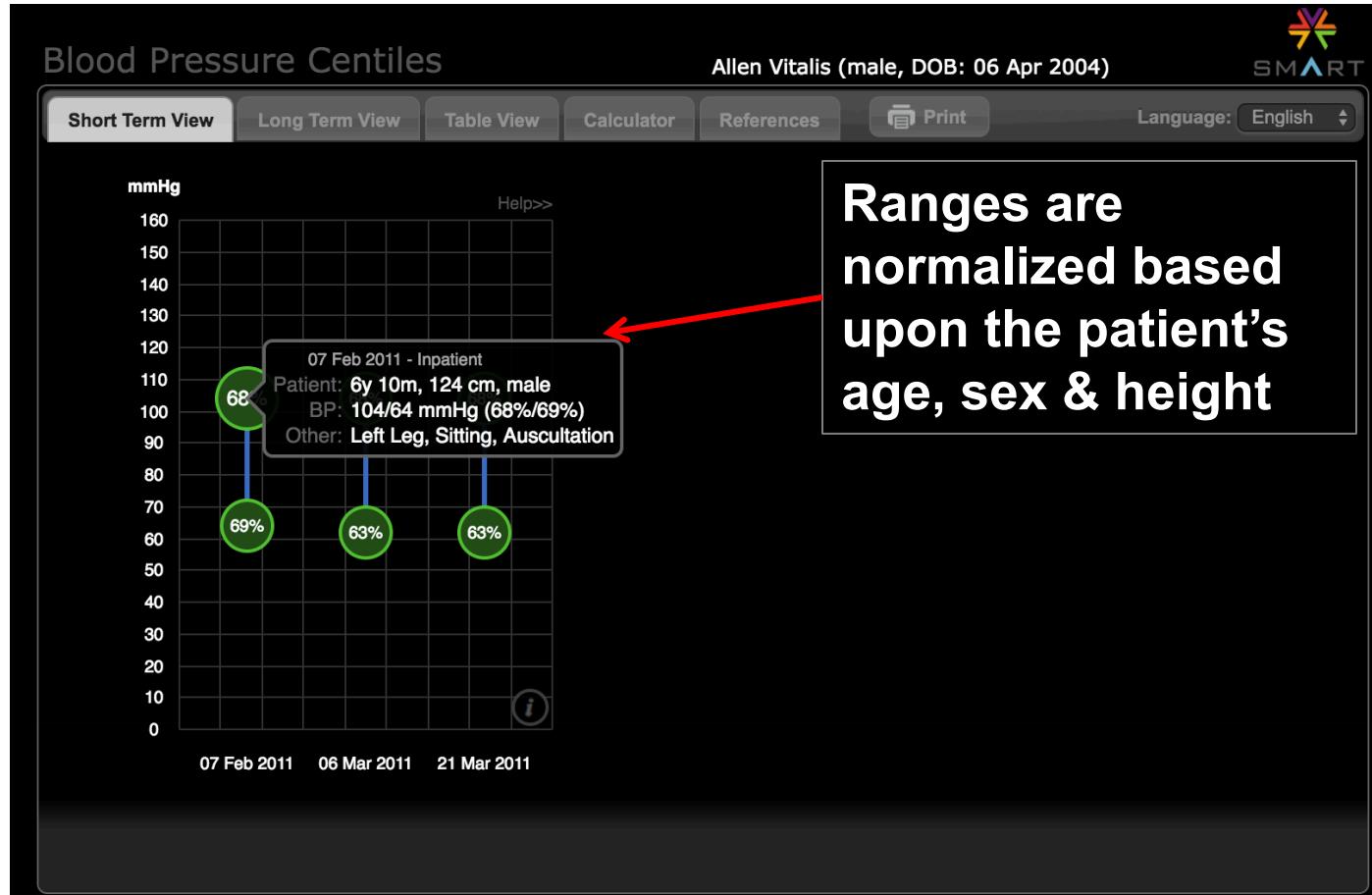
Chance of heart attack or stroke



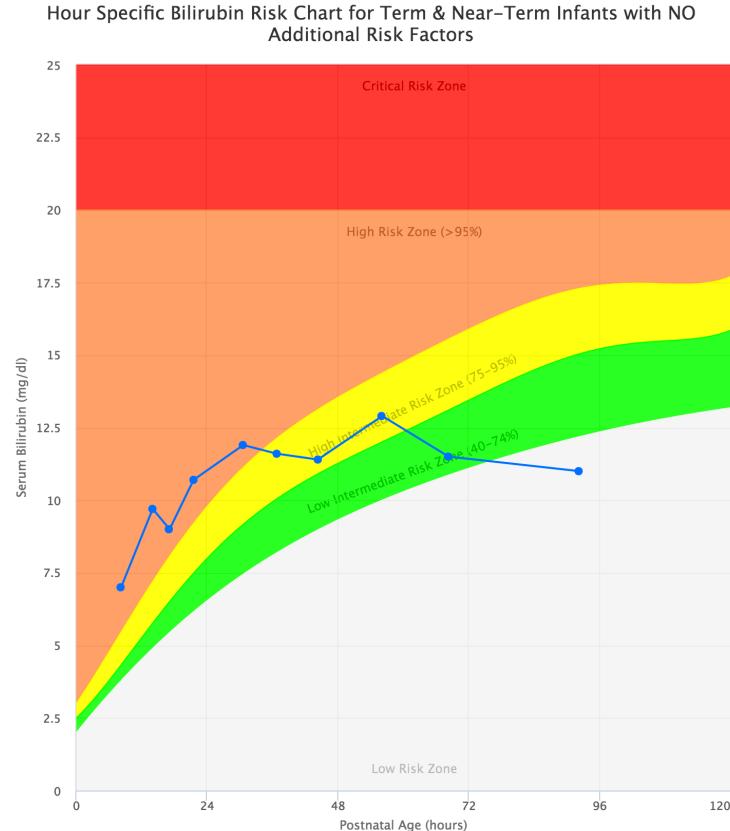
SMART BP Centiles by Boston Children's Hospital



SMART BP Centiles by Boston Children's Hospital



SMART Neonatal Bilirubin Alerts by Intermountain



Date/Time	Result (mg/dL)	Age (Hrs)	Value:Test	Risk Zone
01/04/2016 02:12	7	8.20	Transcutaneous Bilirubin	High Risk Zone (>95%)
01/04/2016 08:00	9.7	14.00	Transcutaneous Bilirubin	High Risk Zone (>95%)
01/04/2016 11:06	9	17.10	Transcutaneous Bilirubin	High Risk Zone (>95%)
01/04/2016 15:30	10.7	21.50	Transcutaneous Bilirubin	High Risk Zone (>95%)
01/05/2016 00:36	11.9	30.60	Transcutaneous Bilirubin	High Risk Zone (>95%)
01/05/2016 06:48	11.6	36.80	Transcutaneous Bilirubin	High Intermediate Risk Zone (75-95%)
01/05/2016 14:18	11.4	44.30	Transcutaneous Bilirubin	High Intermediate Risk Zone (75-95%)
01/06/2016 02:06	12.9	56.10	Transcutaneous Bilirubin	High Intermediate Risk Zone (75-95%)
01/06/2016 14:18	11.5	68.30	Transcutaneous Bilirubin	Low Intermediate Risk Zone (40-74%)
01/07/2016 14:18	11	92.30	Transcutaneous Bilirubin	Low Risk Zone (<40%)



Medication by Polyglot

medication® XZR26WX3

Demos | Tutorial | Feedback

Med List	Calendar	Add Med	Print PMI	English	Regular	Options
Drug Name	SIG Instructions	Links	Med Type	Category	<input checked="" type="checkbox"/> Cal	<input checked="" type="checkbox"/> PMI
Aspirin Tablet 81mg	1 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Carvedilol Tablet 25mg	1 twice daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fish Oil Capsule 1000mg	2 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flovent 100mcg/inh	1 puff every 12 hours	 	Inhalant	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Irbesartan Tablet 300mg	1 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Metamucil Sugar-Free	1 teaspoon three times daily	 	Oral Liquid	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Omeprazole Delayed Release Tablet 20mg	1 once daily	  	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ProAir HFA	2 puffs every 4 hours for asthma	  	Inhalant	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Synthroid Tablet 50mcg	1 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Systane ophthalmic solution	1 drop each eye twice daily	  	Ophthalmic	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Vitamin D3 Capsule 5000 iu	1 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zetia Tablet 10mg	1 once daily	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Blue SIG: SIG not recognized

 Edit unrecognized data

 View PMI (Personal Med Instructions)

 View demonstration

Blue Drug: Medicine not recognized

 Modify SIG instructions

 Med detail unavailable

 View FDA Med Guide

Medication by Polyglot

Print header

Print

Mandarin (Simplified)

Regular

Carvedilol Tablet 25mg

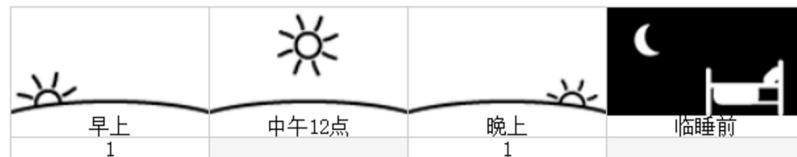
用法用量（服药说明）

口服，每天两次。

Take the medicine by mouth twice a day.

每次服一粒/片。

Take one (1) pill each time.



重要：以下是给您的具体说明。若该说明与您收到的其他信息不同，包括以下说明，请洽询您的处方医生或药师。

服用说明

吞服，请勿压碎或嚼碎药片/丸以后吞服。

此药须跟食物同服。

很重要的是要请您在每天的同一时间服药，这样药效最佳。

请在室温下储存此药，避热及避免阳光直射。

按时服用此药的每次剂量极其重要，就算感觉很好，也请准时服药。

如果您忘记了而错过（漏服）了一次剂量，请在想起来以后马上补服。如果想起来的时间已经差不多到了下一剂量的服药时间，请跳过（忽略）漏服的剂量。请继续按正常的服药时间安排服药。此药不可两剂（两次剂量）同时服用。

请告知您的医生、护士或药剂师您服用的所有药物。包括处方药和非处方药。同样告知他们您服用的任何维生素、中草药或其他保健食品。

如果您患有糖尿病，此药可能会隐藏某些低血糖的症状，比如心跳过速。请定期检测您的血糖水平并留意其它低血糖的症状。

低血糖的症状可能包括恶心、颤动、出汗、皮肤冰冷、心率过快、饥饿或易怒。

请勿突然停止服用此药。停止之前，请咨询您的医生。

注意事项

如果您曾对该药物过敏，请告知您的医生和药剂师。症状可能包括呼吸困难、皮疹、瘙痒、肿胀或者严重头晕。

KRAMES Patient Education by StayWell

KRAMES Patient Education

Conditions | 12 Medications | 5 Procedures | 0

Aortic valve stenosis... 60573004 Benign prostatic hyp... 266569009 Community acquired... 385093006 Coronary arterioscler... 53741008 Diabetes mellitus (dis... 73211009 Essential hypertensio... 59621000 >

Images Off 25 titles

ShareWIK: Expert Insight (EN)	Aortic Valve Disease: Explaining Aortic Stenosis	Download	Print	Share	Heart
HealthSheets (EN)	Diabetes and Heart Disease	Download	Print	Share	Heart
HealthSheets (EN)	Diagnosing Heart Valve Problems	Download	Print	Share	Heart
HealthSheets (EN)	Eating Heart-Healthy Foods	Download	Print	Share	Heart
Videos (EN)	Eating Well with High Blood Pressure	Download	Print	Share	Heart
HealthSheets (EN)	Exercise for a Healthier Heart	Download	Print	Share	Heart
Exit-Writer (EN)	Heart Disease Education	Download	Print	Share	Heart
HealthSheets (EN)	Heart Valve Problems	Download	Print	Share	Heart
HealthSheets (EN)	Heart Valve Problems: Aortic Stenosis	Download	Print	Share	Heart

Filter and sort

Sort by

- All Relevant
- Newest Relevant
- Favorites
- Name
- Content Type

Gender

- All
- Male
- Female

Age

- All
- Infant (0-11 mo)
- Child (1-12 yrs)
- Teen (12-18 yrs)
- Adult (18-65 yrs)
- Senior (65+ yrs)

Content Type

- All
- Greystone - Adult
- Videos
- Cancer
- Knowledgebase
- Diseases and Conditions
- PDF
- Lab Tests
- Alchemy Drug Sheets
- Client Custom Content
- Exit-Writer
- HealthSheets
- Medications
- VA Videos
- KidsHealth
- ShareWIK: Patient Perspective
- ShareWIK: Friday Flyer
- Video Healthsheets
- ShareWIK: Expert Insight
- ShareWIK: Caregiver Perspective
- ShareWIK: Why the Health?

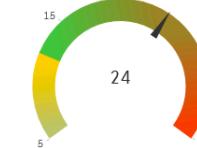
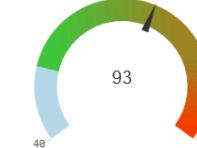
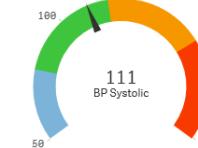
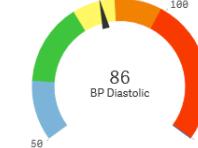
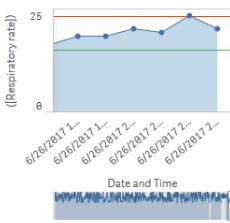
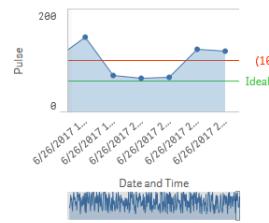
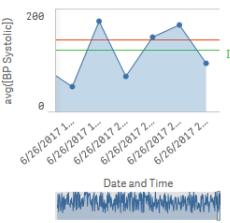
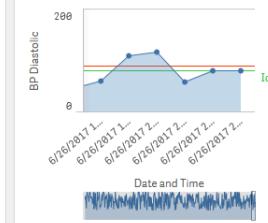
Qlik Analytic

CernerQlik_Adapter

Patient Encounter Analysis 3881400

Patient Encounter Analysis

Qlik

Patient LACE Score 12	Respiration 	Pulse 	BP Systolic 	BP Diastolic 
BMI 19.6				
Customer Encounters 16				
Press Ganey Score 24				
Star Rating for Physician 4	Care Provider <ul style="list-style-type: none">Abate, GaleAbbate, CosmoAbbots, MickyAbbey, GaryAbbie, GualterioAbbis, SheffieldAbbison, Benedicto	Patient <ul style="list-style-type: none">Smolin, Ivan RomanovichAarika SteptoeAaron KeerAb EspyAbbe CheethamAbbey DovidianAbbie Ambrosini	Patient Encounter ID <ul style="list-style-type: none">3881400 ✓27434771101	HRRP Conditions <ul style="list-style-type: none">COPD
	All Encounters			

DoseMeRx

 DoseMeRx

HELP

ID: 3850798	Name: Mead, Daniel (M)	Most Recent Dose: 09/29/2017 09:00 AM
DOB: 07/15/1980	Height: 175 cm	Most Recent Response: 09/27/2017 8:17 PM
Weight: 70 kg	Drug: Vancomycin (Adult)	

Calculate Next Dose At

Next Dose at: 29 Sep 2017 9:00 PM Calculate

Next dose should be between 2017-09-29 21:00 and 2017-10-02 09:00

Default Individualized Target	Guideline Dose	Label Dose
750 mg over 1.5 hours twice daily for 3 days	1250 mg over 2.5 hours every 18 hours for 3 doses	500 mg over 1.5 hours twice daily for one day
Target: AUC24: 400 mg.h/L		
Predicted: AUC24: 363.59 mg.h/L		
⚠ Warning: Historical report. Dose date is in past.		
Peak 20.64 mg/L	Peak 25.71 mg/L	Peak 13.32 mg/L
Trough 10.62 mg/L	Trough 9.64 mg/L	Trough 6.85 mg/L
AUC12 181.80 mg.h/L	AUC18 298.13 mg.h/L	AUC12 117.15 mg.h/L
<input checked="" type="checkbox"/> Plot	<input checked="" type="checkbox"/> Plot	<input type="checkbox"/> Plot
Select	Select	Select

Customize

Individualized Dose Profile



MyLegacy Disease Risk Reference



MyLegacy Disease Risk Reference

Patient Name: Jake Boxer

MRN: 3772357

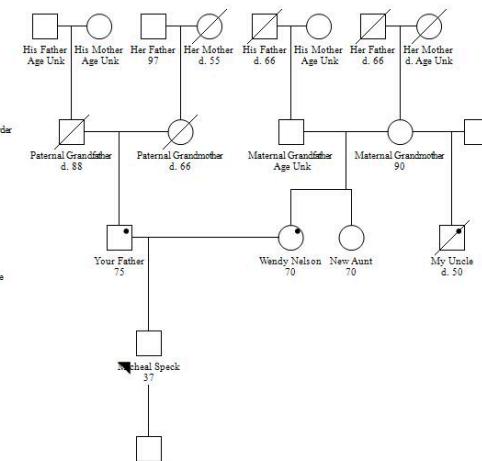
Date Submitted: 09/30/2017

Pedigree

Abdominal Aortic Aneurysm

7/19/2017

- Abdominal Aortic Aneurysm
- Aneurysm, Cerebral
- Aneurysm, Other
- Aneurysm, Peripheral
- Aneurysm, Thoracic
- Carotid Artery Disease
- Connective Tissue Disorder
- Coronary Heart Disease
- Heart Attack
- Heart Failure
- Ischemic Stroke
- Peripheral Artery Disease



SMART embedded launch workflow



SMART App One-Time Setup

- SMART Apps must be published at Transport Layer Security (TLS)-protected URL (https)
- Register a launch URL with the EHR
- Register an authorization redirect URL with EHR



Launch SMART app
with FHIR endpoint +
opaque launch id

EHR

Launches SMART app via the app's
launch URL

Captures the context (e.g. patient id,
encounter id) and associate this data with
an opaque launch id

The FHIR endpoint URL and an opaque
launch id are given as parameters



Launch SMART app
with FHIR endpoint +
opaque launch id

Calls FHIR /metadata service

SMART App

Calls FHIR conformance
resource (GET /metadata)
to obtain the OAuth
endpoint



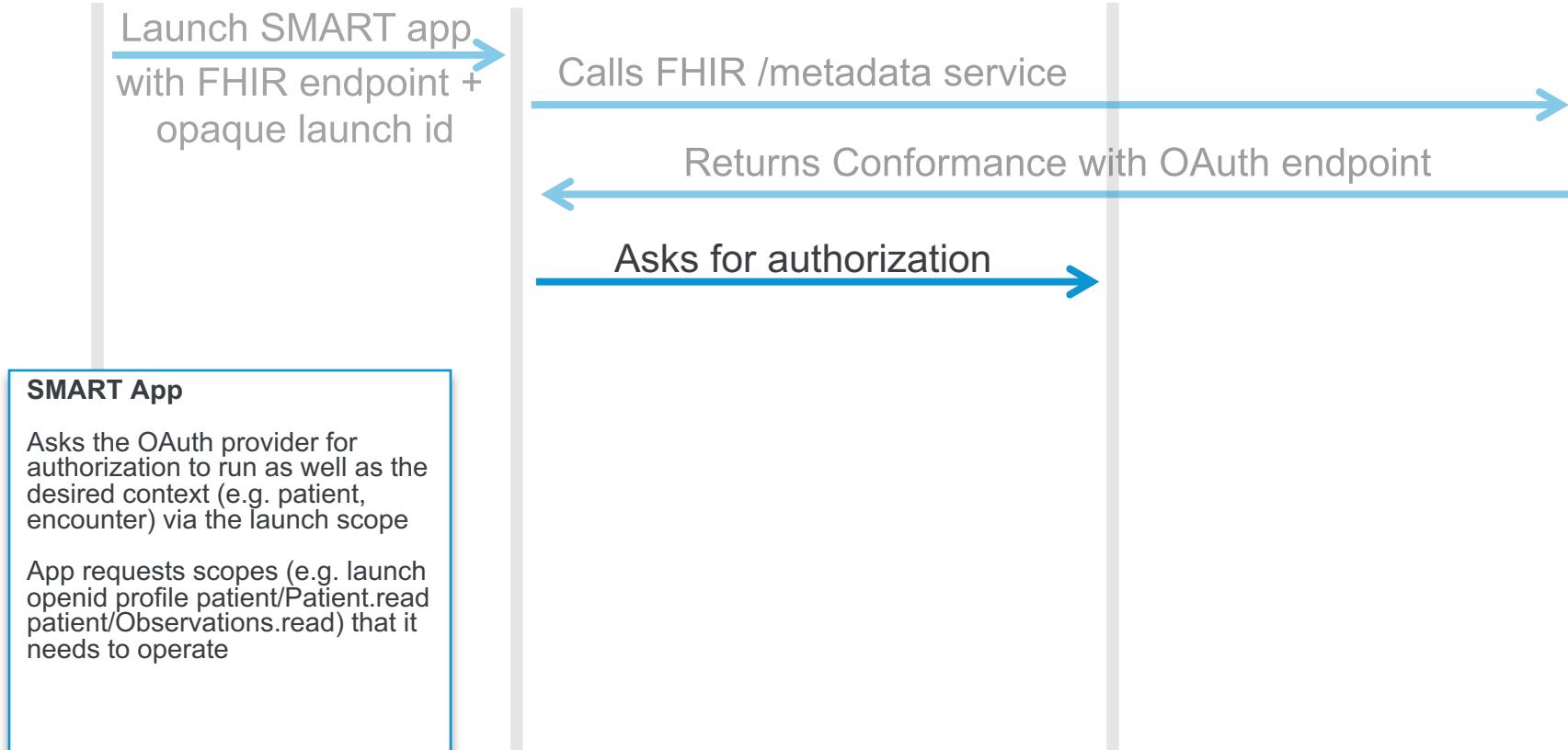
Launch SMART app
with FHIR endpoint +
opaque launch id

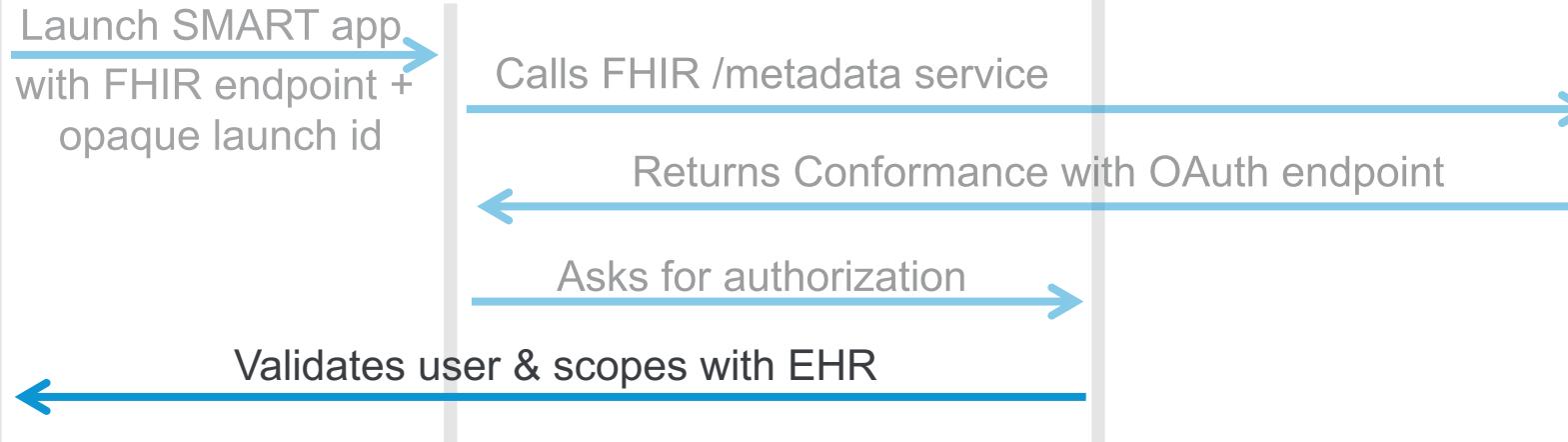
Calls FHIR /metadata service

Returns Conformance with OAuth endpoint

FHIR Service

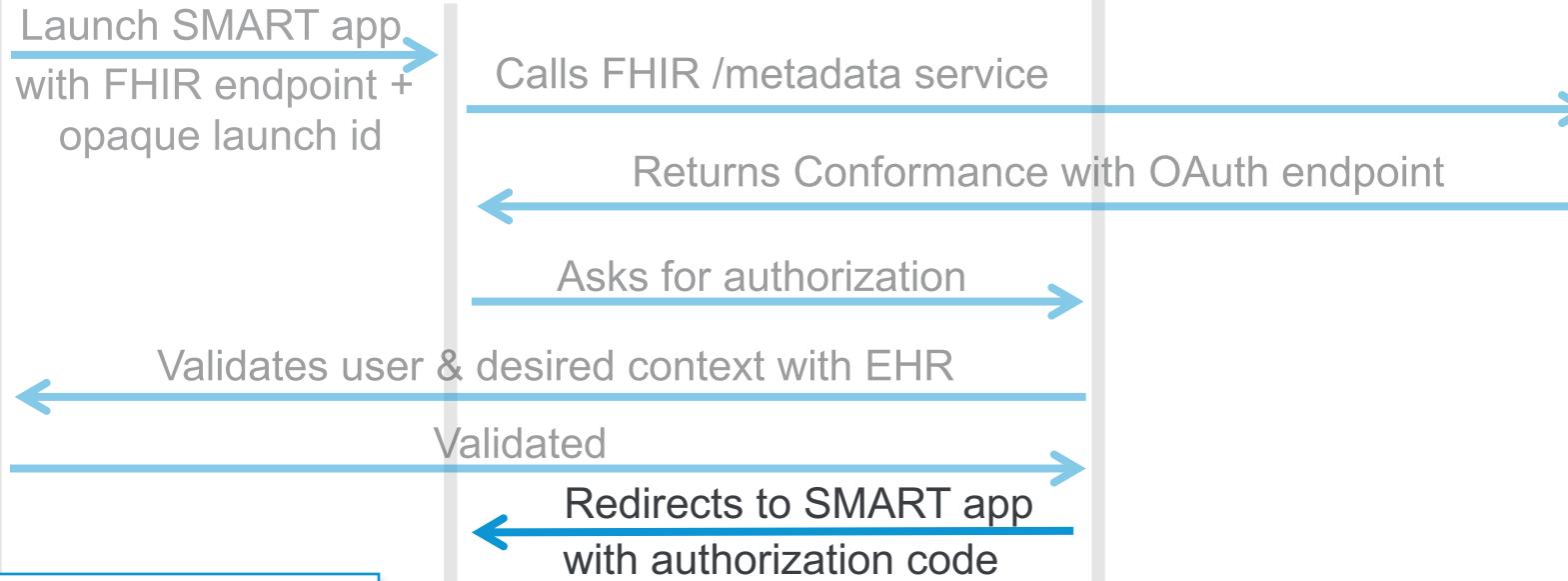
Returns the Conformance
document containing the
OAuth endpoint





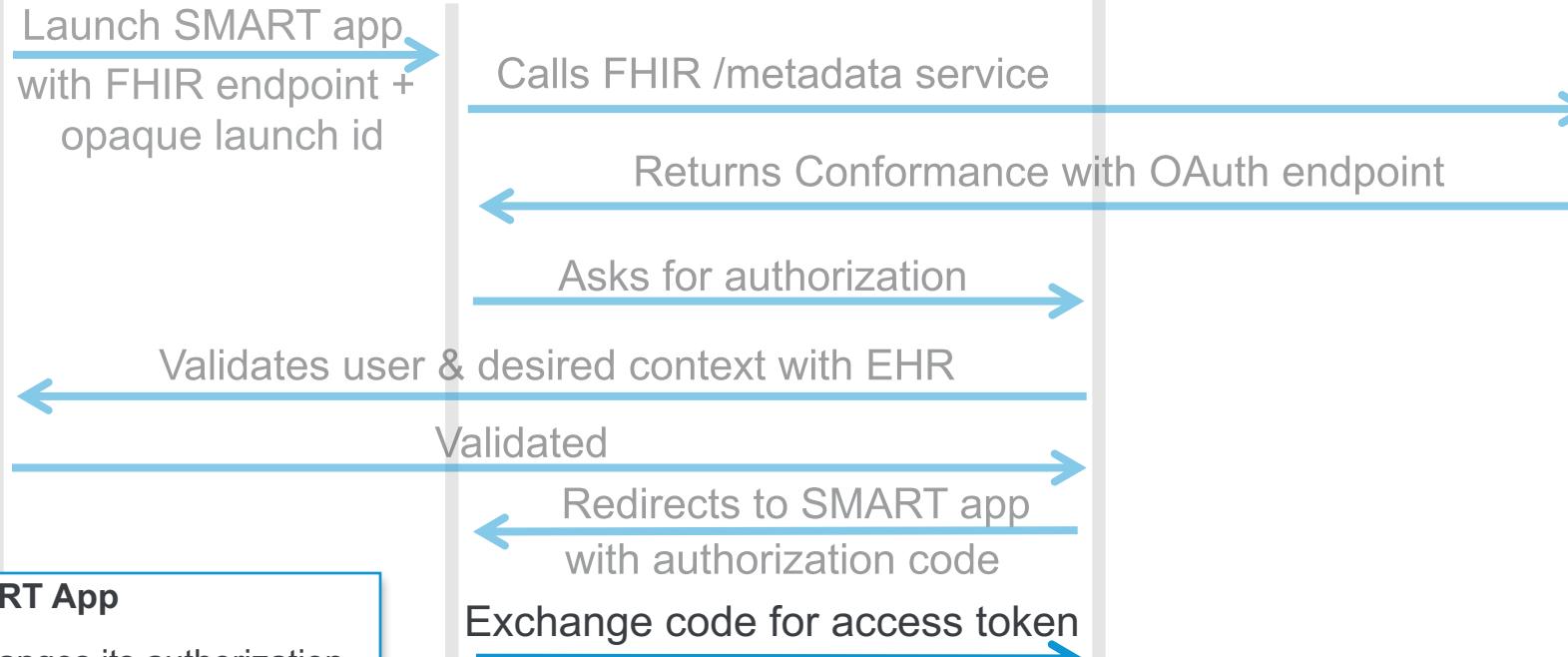
OAuth Provider

Contacts the underlying EHR to validate the authorization request from the SMART app



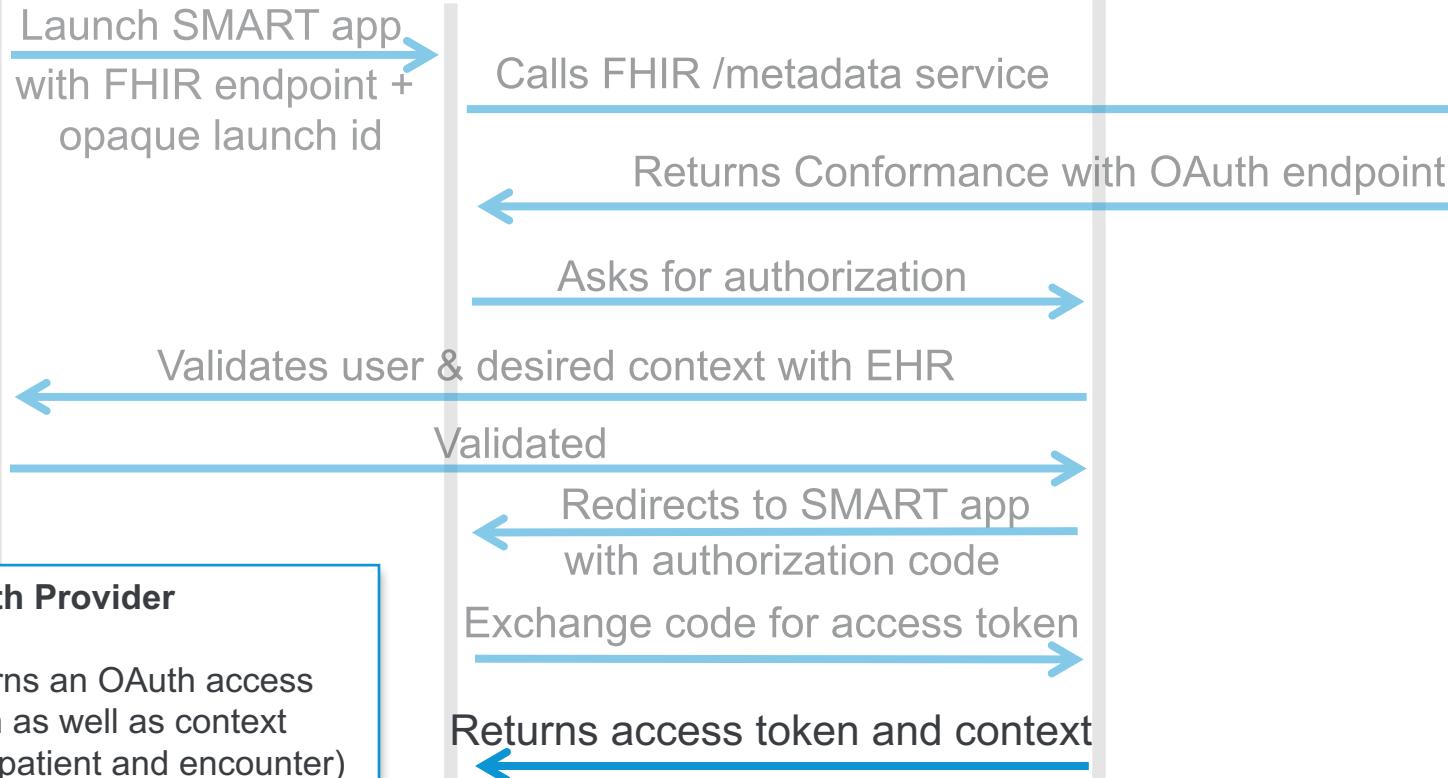
OAuth Provider

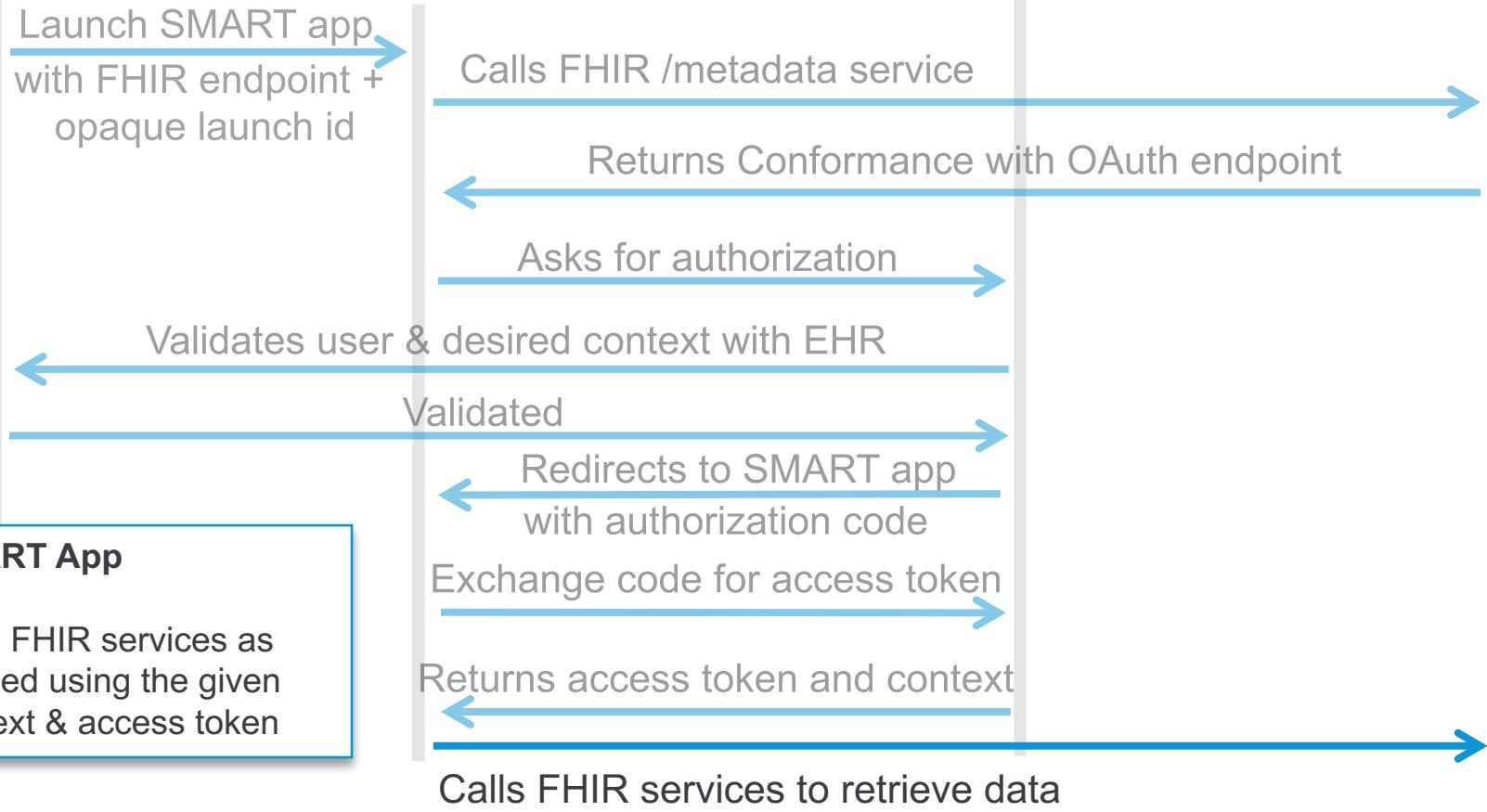
Redirects back to the SMART app using the app's registered redirect URL with an authorization code

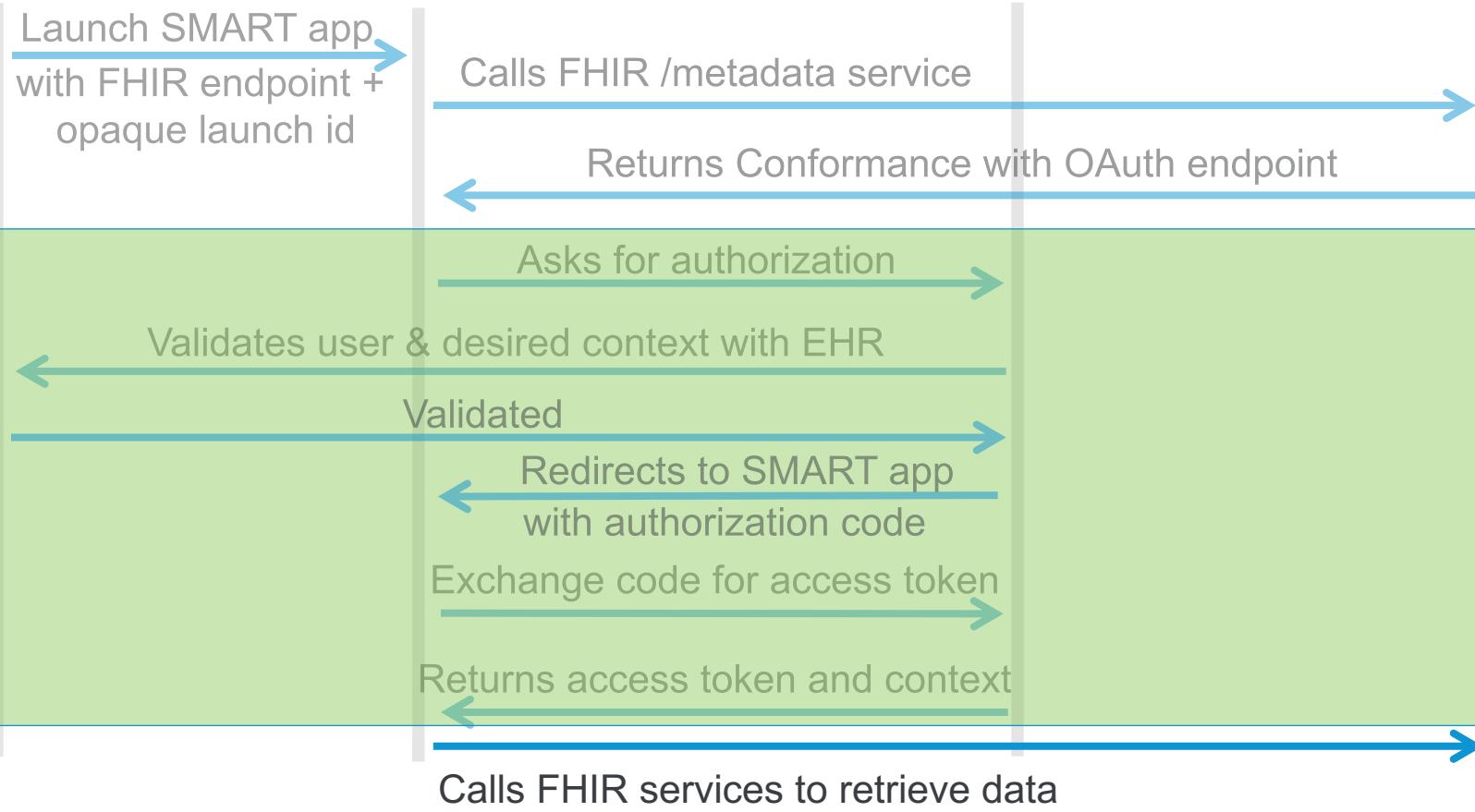


SMART App

Exchanges its authorization code for an access token that can be used to make subsequent FHIR calls







SMART > Community



smarthealthit.org



docs.smarthealthit.org



gallery.smarthealthit.org



chat.fhir.org | bit.ly/smarter-google-group



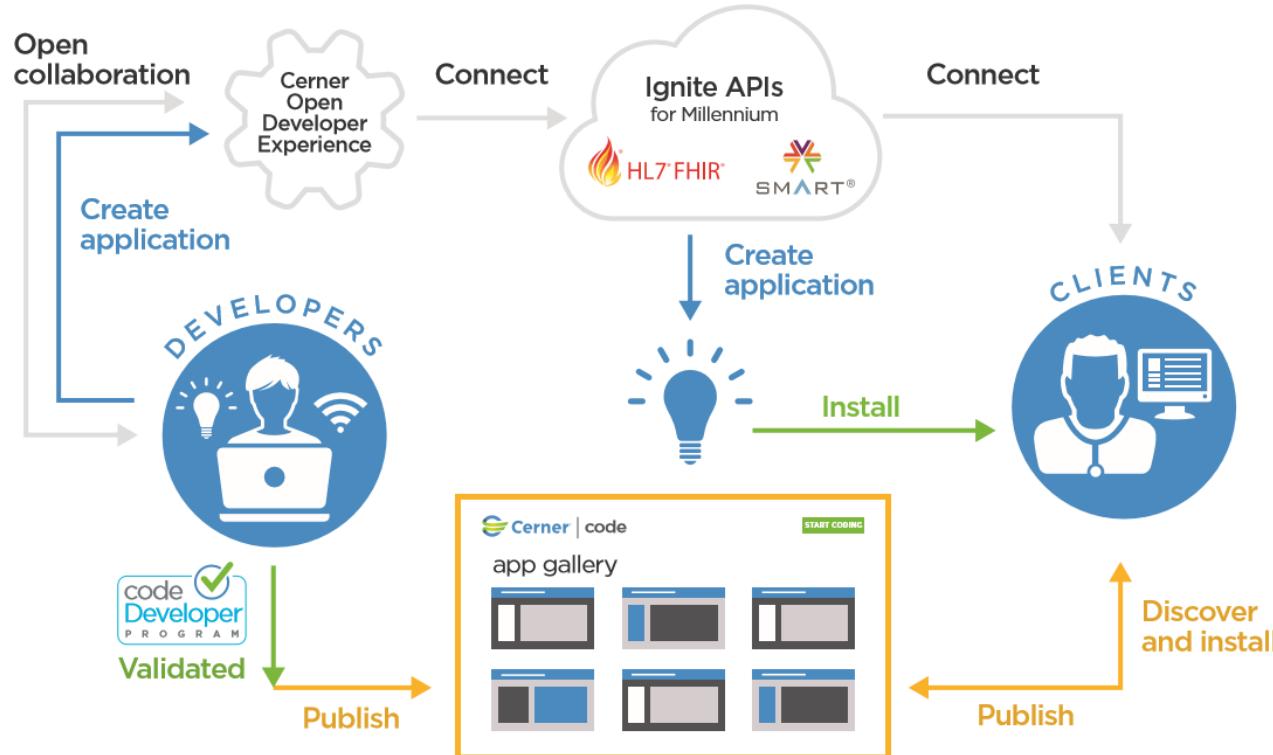
github.com/smarter-on-fhir

Developer ecosystem

*together we
anticipate. innovate. accelerate.*

Developer ecosystem

Developer ecosystem



code Console

*together we
anticipate. innovate. accelerate.*

code Console

CODE

The *Cerner Open Developer Experience* provides a developer everything they need to develop and test their applications and services against Cerner's open platforms.

Log in using **CernerCare**

Email Address

Password

Remember Me

Log In

[Forgot your password?](#)
[Mobile Website](#)

Don't have an account?

Create an account >>

bit.ly/cerner-code-console

code Console > My Apps

My Apps

kol.kheang@cerner.com | Logout

My Apps

+ New App

grid icon

list icon



[GitHub SMART App Tutorial](#)
App Type: provider
FHIR Spec: dstu2



[localhost - App Validator](#)
App Type: provider
FHIR Spec: dstu2



[App Validator DSTU2](#)
App Type: provider
FHIR Spec: dstu2



[SMART without FHIR - ABL Testing](#)
App Type: provider
FHIR Spec: dstu2

code Console > App Registration



App Registration

* Indicates a required field.

*** App Name**

SMART Launch URI

The URI to initiate the launch of your SMART app

*** Redirect URI**

The callback URI for the OAuth2 server to redirect to your SMART App

*** App Type**

Provider

Patient

System

*** FHIR Spec**

The FHIR version your SMART App will consume

dstu2

code Console > Launching App

My Apps | kcl.kheang@centric.com | Logout

GitHub SMART App Tutorial

Test GitHub SMART App Tutorial
Click Begin Testing to create a testing environment

Begin Testing

Testing Details

Does your application require a patient? Yes No

Select a Patient:

Patient	Description
SMART, Timmy Male DOB: 2012-02-19	Young male child
Peters, Tim Male DOB: 1961-04-30	
SMART, Wilma Female DOB: 1947-03-16	Communication language set to Hindi
SMART, Nancy Female DOB: 1980-08-11	Patient with pregnancy condition
SMART, Joe Male DOB: 1976-04-29	
SMART, Hallie	Delete App

Launch Points

*together we
anticipate. innovate. accelerate.*

SMART App > Organizer View

PowerChart Organizer for Kheang, Kol

Task Edit View Patient Chart Links Notifications Navigation Help

Message Center Ambulatory Organizer Staff Assignment Physician Handoff Home CareCompass Schedule Patient List Rounds List Links

New Sticky Note View Sticky Notes Change Charges Charge Entry Exit Calculator Message Sender AdHoc Medication Administration

Recent Name

Cardiac Risk App DSTU2

Full screen Print 9 minutes ago

ASCVD Risk Calculator

* Sex
 Male Female

* Total Cholesterol (mg/dL)
130-320

* Diabetes
 No Yes

* Age
20-79

* HDL - Cholesterol (mg/dL)
20-100

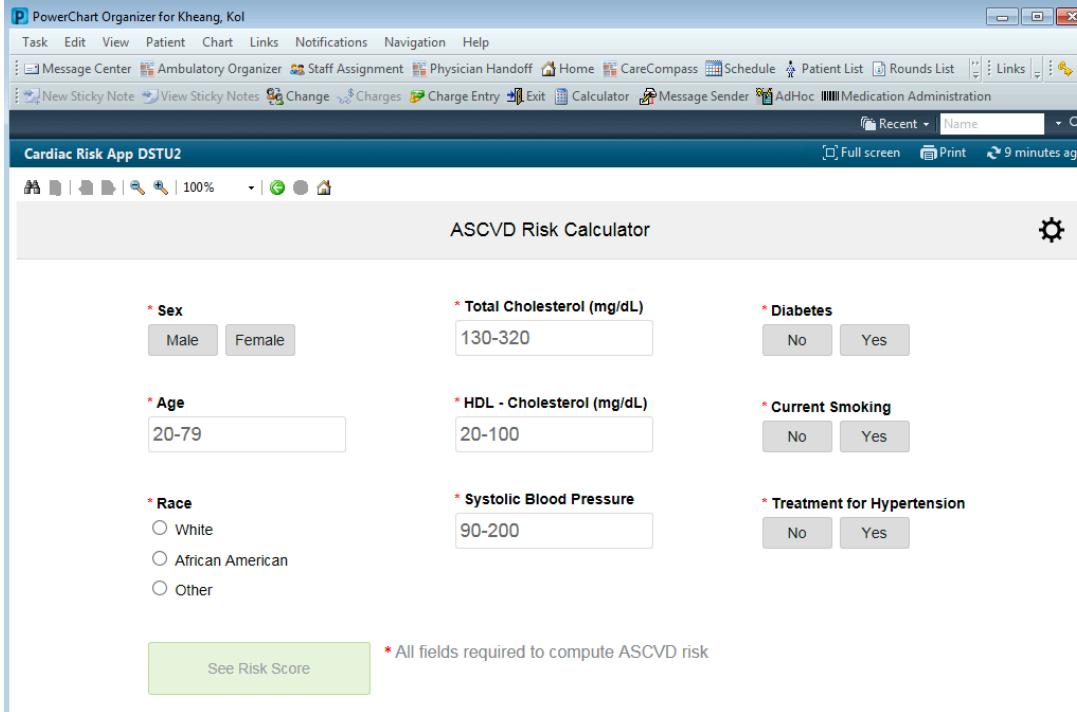
* Current Smoking
 No Yes

* Race
 White
 African American
 Other

* Systolic Blood Pressure
90-200

* Treatment for Hypertension
 No Yes

See Risk Score * All fields required to compute ASCVD risk



SMART App > Chart View

Smart, Hailey

Smart, Hailey PCP: McCurdy, Michael DOB: 12/2/2003 Pref. Labs/Diagnostics:
Allergies: calamine-diphenhydramine Phone: Wt: MRN: 10002703
IQHealth: No Age: 13 years Sex: Female Inpatient FIN: 20003414 [Admit Dt: 6/22/2016 2:11 PM] Loc: 1N, Baseline East

Menu

Medication

SMART App Validator DSTU2

Patient Information

Diagnoses and Problems

Histories

Medication List + Add

Clinical Notes + Add

Flowsheet

Document Viewing + Add

Medication

Finish [Click once to save to Depart Summary]

medication® WF4YT6ZG

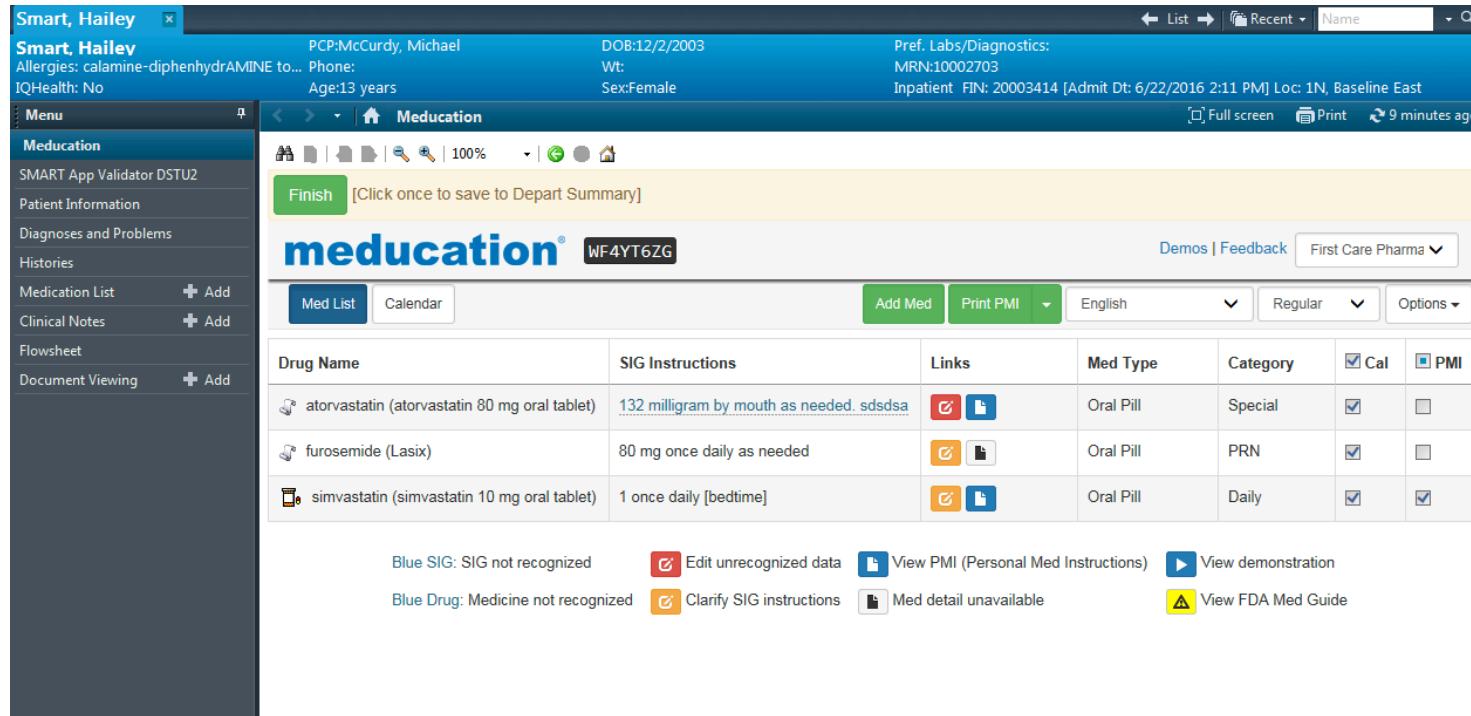
Demos | Feedback First Care Pharma

Add Med Print PMI English Regular Options

Drug Name	SIG Instructions	Links	Med Type	Category	<input checked="" type="checkbox"/> Cal	<input type="checkbox"/> PMI
atorvastatin (atorvastatin 80 mg oral tablet)	132 milligram by mouth as needed. sdsdsda	 	Oral Pill	Special	<input checked="" type="checkbox"/>	<input type="checkbox"/>
furosemide (Lasix)	80 mg once daily as needed	 	Oral Pill	PRN	<input checked="" type="checkbox"/>	<input type="checkbox"/>
simvastatin (simvastatin 10 mg oral tablet)	1 once daily [bedtime]	 	Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Blue SIG: SIG not recognized  Edit unrecognized data  View PMI (Personal Med Instructions)  View demonstration

Blue Drug: Medicine not recognized  Clarify SIG instructions  Med detail unavailable  View FDA Med Guide



SMART App > MPage Workflow

CLARK, ZACHARY x

CLARK, ZACHARY
Allergies: Allergies Not Recorded
IQHealth: No

PCP:Kolm, Margaret
Phone:(231) 564-6546
Age:81 years

DOB:3/3/1936
Wt:96 kg
Sex:Male

Pref. Labs/Diagnostics:
MRN:10002090
Emergency FIN: <No - Financial number> [Admit Dt: 3/5/2015 11:00 PM] Loc: BNMC ...

List Recent Name

SMART in MPage

MPages View

ASCVD Risk App

ASCVD Risk App

ASCVD Risk Calculator

Sex: Male

Total Cholesterol (mg/dL): 130-320

Diabetes: No Yes

Age: 65

HDL - Cholesterol (mg/dL): 20-100

Current Smoking: No Yes

Race: White

Systolic Blood Pressure: 90-200

Treatment for Hypertension: No Yes

See Risk Score

* The following are required to compute ASCVD risk: Total Cholesterol (mg/dL), HDL - Cholesterol (mg/dL), Systolic Blood Pressure

Full screen Print 3 minutes ago

SMART App > HealtheLife (Patient Portal)

Dashboard | English (United States) | Sign Out

Assessment Appointments Health Trackers Action Plan Health Record Messaging

 BaseWestHealth
Because we care

Health Profile Print

The information provided below is in the electronic medical record. If you believe any data is incorrect, please notify the office.

 [Redacted]

Current Medications

Your pharmacy may make changes, so be sure to ask your pharmacist for exact medication instructions.

Jantoven 2.5 mg oral tablet Learn more about this 

Date Started On: Jul 11, 2017

Ambien 5 mg oral tablet Learn more about this 

Date Started On: May 25, 2017

Allegra 30 mg oral tablet Learn more about this 

Date Started On: Apr 27, 2016

Show more info

Immunizations

-  **Health Profile**
-  **Results**
-  **Medications**
-  **Patient Documents**
-  **Procedures**
-  **Download & Send**
-  **Radiology**
-  **Pathology**
-  **Clinician Notes**
-  **Growth Chart**
-  **Medication**
-  **Comprehensive Record**

SMART App > Authorization

Authorization Needed

I, MANSOOR, GHALIB, (Not you? [Sign out](#)) request that VISN_MO USPres share the following health information with Meducation - Patient.

VISN_MO USPres will share this information until I log out:

- personal information i
- medications i

[View full list of information.](#)

The information you share may be subject to re-disclosure. Consult Meducation - Patient's terms of service and privacy policy.

I, as the authorized representative, am allowing access to the records of:

- MANSOOR, GHALIB (Self, 68)

[Expecting different people?](#)

Please email me a copy of this authorization.

Clicking **Deny** will not impact treatment, payments for treatment, enrollment, or eligibility for benefits at VISN_MO USPres.

Authorize

Deny

SMART App > HealtheLife (Patient Portal)

The screenshot shows a web browser window titled "Mededucation® - FHIR" with the URL "https://my meds.medicine.com/index". The page displays a table of medications under the heading "Import: Cedars-Sinai".

Tag	Name	Description	ID
<input checked="" type="checkbox"/>	benazepril (benazepril 5 mg oral tablet)	1 tabs, Oral, BID, 60 tabs, 11 Refill(s)	898723
<input checked="" type="checkbox"/>	donepezil (donepezil 10 mg oral tablet)	1 tabs, Oral, Once a Day (at bedtime), 30 tabs, 0 Refill(s)	997223
<input checked="" type="checkbox"/>	ibuprofen (ibuprofen 400 mg oral tablet)	1 tabs, Oral, q4hr, 180 tabs, 0 Refill(s)	197805
<input checked="" type="checkbox"/>	simvastatin (simvastatin 20 mg oral tablet)	1 tabs, Oral, Once a Day (at bedtime), 90 tabs	312961
<input checked="" type="checkbox"/>	warfarin	2 mg, Oral, Daily	11289
<input checked="" type="checkbox"/>	ceFAZolin	1 g, IV Piggyback, Once	2180
<input checked="" type="checkbox"/>	ceFAZolin	2,000 mg, IV Piggyback, Once	2180

Import Selected

Cerner SMART on FHIR Tutorial

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Cerner SMART on FHIR Tutorial

bit.ly/cerner-smart-on-fhir-tutorial

Community @ Cerner

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Community @ Cerner



code.cerner.com



fhir.cerner.com



bit.ly/cerner-code-console



bit.ly/cerner-smart-on-fhir-developers |
bit.ly/ignite-apis-community



github.com/cerner

Thanks!

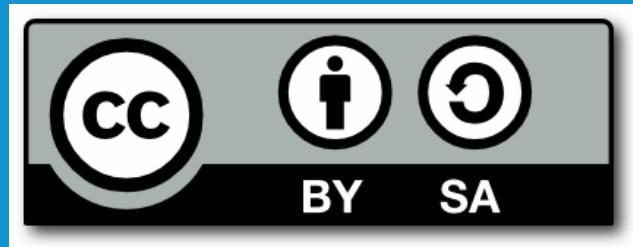
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Q & A

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