

RADV

Risk Adjustment Data Validation Tool



Software Documentation and User Guide

April 2016

FHIRed_Up

Augusto Burgos aburgos3@gatech.edu

Spiro Ganas spiroganas@gmail.com

Anja Guillory anjag1993@gmail.com

Jamie Richgels jrichgels3@gatech.edu

Daniel Stoneburner dstoneburner3@gatech.edu

Tala Suidan tmsuidan@gatech.edu

Table of Contents

Statement of Goals	1
Background Information	1
Functional Description	2
Future of the Application	2
System Architecture.....	3
System Requirements	3
User Interface	4
Acronyms & Abbreviations	5
User Access Levels	5
Constraints.....	5
GitHub Repository.....	5
Using RADV	6
Login	6
Patient Lookup	6
Patient Display	7
Candidate Risk Score Meter	9
Viewing Current Year HCCs	9
Viewing Candidate HCCs.....	10
Adding an HCC.....	11
Rejecting HCCs	12
Look up another patient	14
Logout	14
Data Recording	14
Future Improvements	14
References	15

Statement of Goals

The Affordable Care Act requires health insurance companies to offer insurance to people with pre-existing conditions. By only offering policies with high co-pays and high-deductibles, insurance companies can discourage ill patients from purchasing their products. Risk adjustment prevents this by transferring premiums from insurers with healthy members to those organizations that are insuring for a more ill population.

Risk scores are used to determine the average level of illness in an insurers' population. A risk score is calculated using the list of diagnoses recorded for a patient during the previous calendar year and is a relative score against the average patient (risk score for an average patient=1). This gives providers and insurers a strong financial interest in making medical records accurate and complete.

The RADV tool was designed to help providers validate medical records by identifying health care conditions that may be missing from a patient's recent medical record.

Background Information

Risk Scores are an estimate of an individual's future medical costs. Recent diagnostic history is the most important data in determining an individual's risk score. Other predictors include the individual's geographic area, age/gender and the type of insurance policy (high-deductible, low co-pays, etc.)

Risk Selection occurs when insurers try to avoid enrolling unhealthy people by making their products unattractive to people requiring costly medical care.

Risk Adjustment discourages risk selection by transferring premiums from insurers with healthy members to those with members who are more ill.

If a member has an illness, but the diagnosis code is not reported to the insurance carrier during the calendar year, their risk score will be artificially low.

This data quality issue can substantially reduce an insured's premiums. When provider payments are on a percent-of-premium basis, it also reduces payments to hospitals and doctors.

As doctors and hospitals move to a pay-for-performance structure, correct risk assessment and diagnostic codes ensure appropriate payment for treatment of patients with multiple chronic diseases.

The American Health Lawyers Association recommends the following strategies:

- Know high revenue HCCs that are often undiagnosed or undercoded
- Review missing diagnoses from prior years' HCCs and send reminders to MDs
- Audits of records vs. codes for missing codes: last year and this year.
- Conduct annual comprehensive exams for members who have not yet been seen early in the year.

Example of Risk Score Error and consequences:

68-year-old man with pneumonia, emphysema, diabetes with retinopathy, and respiratory failure has the following risk profile

ICD-10 Code	Relative Risk Score	ICD-10 Code	Relative Risk Score
J13: Pneumococcal pneumonia	0.200	J13: Pneumococcal pneumonia	0.200
J43.9: Other emphysema	0.346	J43.9: Other emphysema	0.346
E13.39: Diabetes with ophthalmic manifestations	0.368	E11.9: Diabetes mellitus without mention of complication	0.118
J96.00: Acute respiratory failure	0.329	J96.00: Acute respiratory failure	0.329
Demographic Component		Demographic Component	
68-Year-Old Male	0.288	68-Year-Old Male	0.288
Relative Risk Score	1.531	Relative Risk Score	0.935

If this member's risk score is 1.531, he is 53 percent more complex than the average patient.

One missing diagnosis code and one unspecified code reduces the relative risk score by 61 percent!

Source: <https://www.bcbsal.org/providers/pdfs/riskAdjustment.pdf>

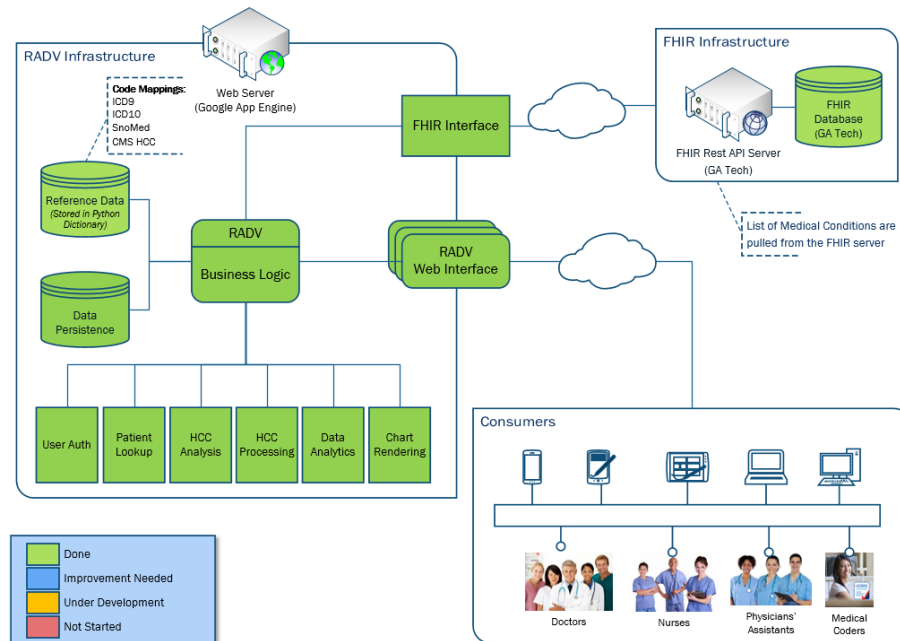
Functional Description

For systems that use a Fast Healthcare Interoperability Resources (FHIR) Server or another centralized data source, RADV allows clinical staff and doctors to search a patient's available clinical history for any conditions that are not listed in the current year. Upon finding any missing conditions or hierarchical condition categories (HCCs), clinical staff can add the HCC to the patient's record. This facilitates accurate risk scoring and financial accounting and payments.

Future of the Application

We hope to enter it in the HealthIT Techlab: Innovation Contest

System Architecture



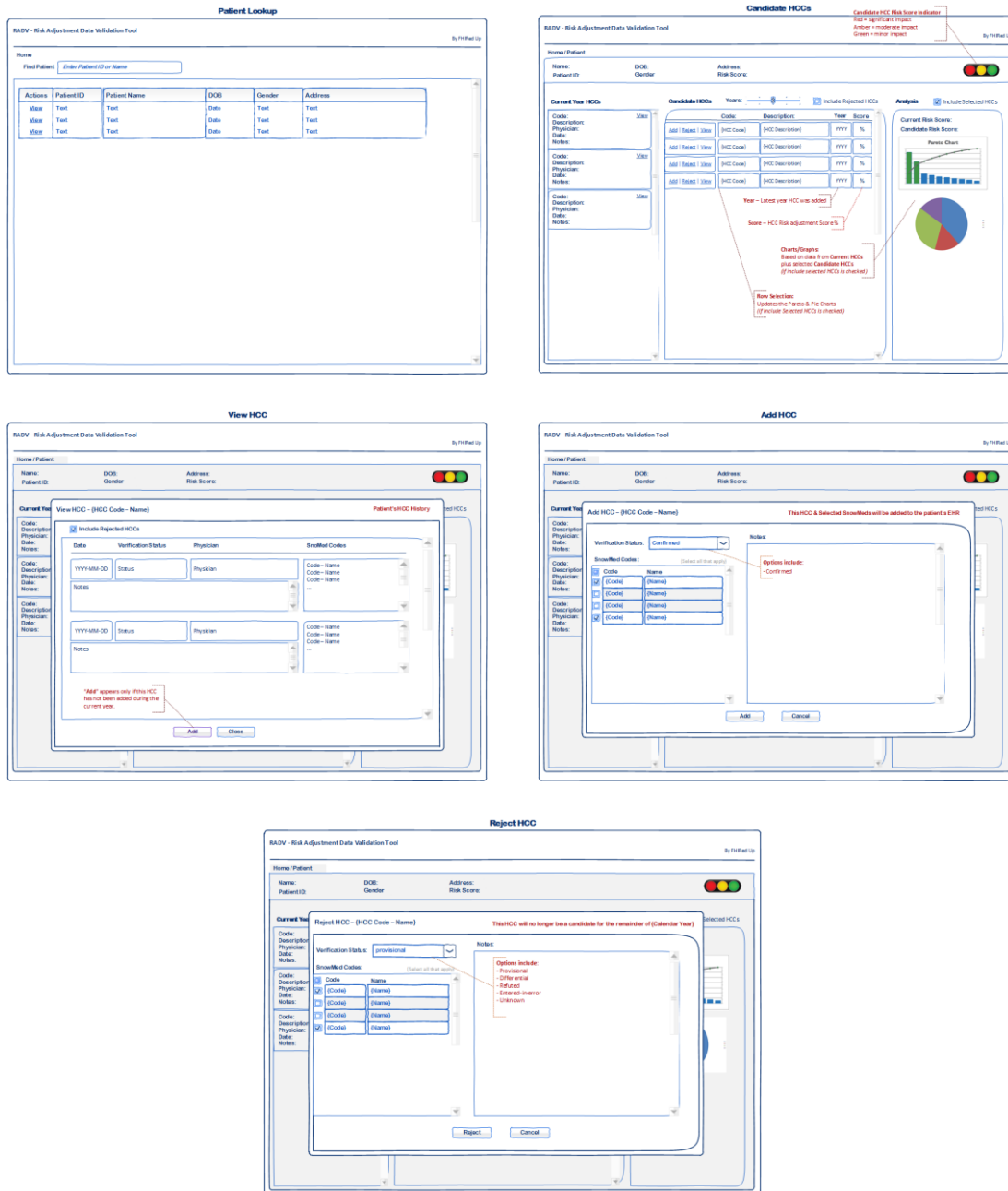
System Requirements

RADV itself has been built in Google App Engine and system requirements are deferred to needing to be deployed in that Platform.

In order for a user to gain access to the RADV tool they will need a machine with a modern operating system installed (tested on Windows 8, Windows 10, OS X, Ubuntu 16.04, CentOS 7, and Chrome OS) with a modern browser installed (tested on Internet Explorer 11, Safari, Firefox, Chrome, and Microsoft Edge). The minimum specs tested 4 GB of RAM and a dual core 1.70 GHz processor although lower specifications should also work as the client machine does not perform processing in the application.

User Interface

RADV is accessible via <https://focus-appliance-122323.appspot.com/login>. It connects to and directly parses the Georgia Institute of Technology's FHIR server. Original wireframes are displayed below.



Acronyms & Abbreviations

EHR	Electronic Health Record
FHIR	Fast Healthcare Interoperability Resources
HCC	Hierarchical Condition Categories
RADV	Risk Adjustment Data Validation
SNOMED	Systematized Nomenclature of Medicine

User Access Levels

All users have the same permissions in this implementation.

Constraints

- A real-world implementation would employ Role-Based Access Control or other permissions and workflows to ensure that a medical doctor confirms all additions or deletions to patient's Electronic Health Record in the FHIR server.
- The application server's cache is flushed automatically every 5 minutes to ensure the patient's record is obtained with the most recent information.
- There is a persistence API to store all changes made through RADV. A real world application would add data to the FHIR server itself, making entries on the FHIR server's audit trail.
- There is limited patient data in the FHIR server used. Patients 4 and 725 have entries that demonstrate features of the RADV application.

GitHub Repository

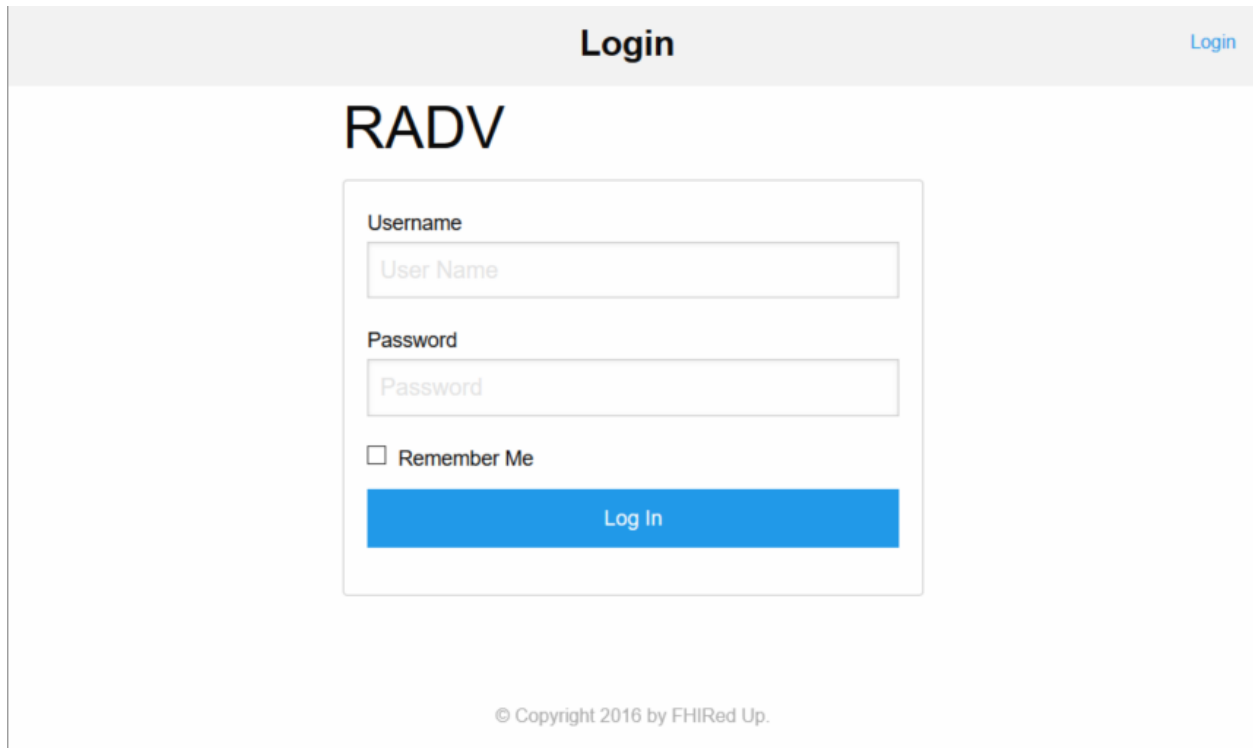
FHIRed_Up used the following GitHub repository for collaboration and file storage:

https://github.gatech.edu/sganas3/FHIRed_Up/

Using RADV

Login

Using your web browser, navigate to <https://focus-appliance-122323.appspot.com/login>.

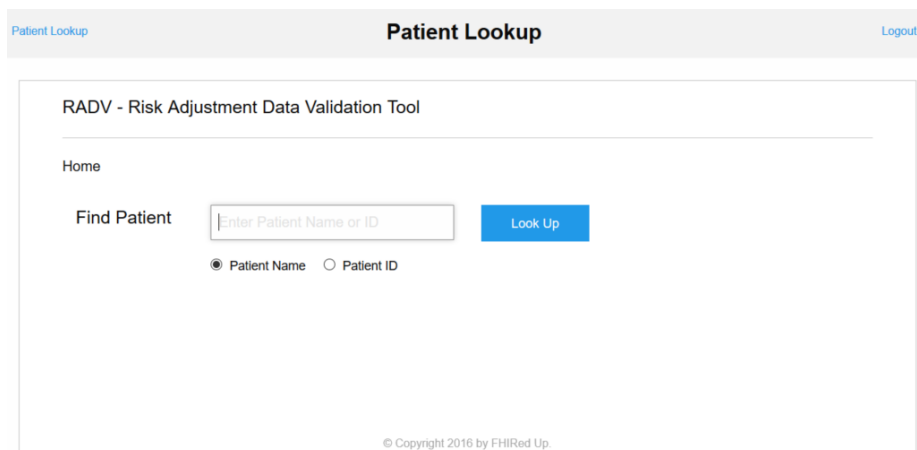


The image shows the RADV login interface. At the top, there is a grey header bar with the word "Login" in the center and a "Login" link on the right. Below the header, the word "RADV" is displayed in a large, bold, black font. Underneath "RADV" is a white rectangular box containing the login form. The form has two input fields: "Username" with a placeholder "User Name" and "Password" with a placeholder "Password". Below these fields is a checkbox labeled "Remember Me". At the bottom of the form is a blue button labeled "Log In". At the very bottom of the page, there is a small copyright notice: "© Copyright 2016 by FHIRed Up."

Login using username, FHIRedUp, and password, PjV7kGTD.

Patient Lookup

The Patient lookup screen should display. A user can search by patient name or by patient ID by selecting the appropriate radio button. This user guide employs patient 4 for examples.



The image shows the RADV Patient Lookup interface. At the top, there is a grey header bar with "Patient Lookup" in the center, "Patient Lookup" on the left, and "Logout" on the right. Below the header, the text "RADV - Risk Adjustment Data Validation Tool" is displayed. Underneath this text is a "Home" link. Below the "Home" link is a "Find Patient" section. This section contains a text input field with the placeholder "Enter Patient Name or ID" and a blue button labeled "Look Up". Below the input field are two radio buttons: "Patient Name" (which is selected) and "Patient ID". At the very bottom of the page, there is a small copyright notice: "© Copyright 2016 by FHIRed Up."

A user can enter either the patient's name or ID in the search bar.

Patient Lookup

Patient Lookup

Logout

RADV - Risk Adjustment Data Validation Tool

Home

Find Patient

4

Look Up

☐ Patient Name
 ☒ Patient ID

Actions	Patient ID	Patient Name	DOB	Gender	Address
View	4	Carter K Adkins	1972-04-13	male	559 Hyannis Circle Atlanta, GA, 30324

Actions	Patient ID	Patient Name	DOB	Gender	Address
---------	------------	--------------	-----	--------	---------

Show 10 entries

Previous 1 Next

© Copyright 2016 by FHIRRed Up

After searching for patient 4, the patient appears below the search entry field with a blue hyperlink to view the patient.

On each internal page, the Patient lookup and logout links are displayed in the top left and right corners. Any active links are displayed in blue. Selection buttons are displayed as blue buttons with white text as the look up button above.

Patient Display

To select a patient, click on the view hyperlink. The patient's record displays with their information at the top, their current year's Hierarchical Condition Categories (HCCs) on the left pane, the candidate missing HCCs in the middle panel with each HCC's risk score, the year in which it previously appeared on the patient's EHR, the HCC code, and a link for adding to or rejecting from the patient's EHR. The Risk score information and graphical display appear on the right panel with the ability to see the impact of adding the candidate HCCs. The gauge at the top of the right panel indicates the severity of the patient's candidate risk score relative to their current risk score.

Candidate HCCs

RADV - Risk Adjustment Data Validation Tool

Current Year: 2016

Home / Patient

Name: Carter K Adkins
Patient ID: 4

DOB: 1972-04-13
Gender: male

Address: 559 Hyannis Circle
Atlanta, GA, 30324

Risk Score: 2,214

Current Year HCCs

View

Code: 51
Name: Drought/Heat Psychosis
Date: 2016

View

Code: 117
Name: Major Eye Infection/Inflammation
Date: 2016

Candidate HCCs

4 Year

Include Rejected HCCs

Code	Name	Risk Score	Date
Add/Reject	3 Central Nervous System Infection	2,071	2013
Add/Reject	19 Diabetes with No or Unspecified Complications	5,321	2013
Add/Reject	30 Gallbladder and Biliary Tract Disorders	1,978	2014
Add/Reject	37 Bone/Joint/Muscle Infection/Inflammation	2,963	2014
Add/Reject	85 Heart Infection/Inflammation, Except Rheumatic	3,358	2013

Show 10 entries

Analysis

Include Candidate HCCs

Current Risk Score: 2,214

Candidate Risk Score: 10,681

Bar chart showing Current and Candidate Risk Scores for various HCCs.

Pie chart showing the distribution of HCCs by category.

Legend:

- Group/Residual Psychosis
- Major Eye Infection/Inflammation
- Heart Infection/Inflammation, Except Rheumatic
- Diabetes with No or Unspecified Complications
- Bone/Joint/Muscle Infection/Inflammation
- Gallbladder and Biliary Tract Disorders
- Central Nervous System Infection

After clicking the view link, the patient's condition record is displayed.

Name: Carter K Adkins
Patient ID: 4

DOB: 1972-04-13
Gender: male

Address: 559 Hyannis Circle
 Atlanta, GA, 30324
Risk Score: 2.214

At the top, a patient's information is always displayed.

Current Year HCCs

[View](#)

Code: 51
 Name: Drug/Alcohol Psychosis
 Date: 2016

[View](#)

Code: 117
 Name: Major Eye Infections/Inflammations
 Date: 2016

Candidate HCCs 4 Year

☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	30	Gallbladder and Biliary Tract Disorders	1.978	2014
Add Reject	37	Bone/Joint/Muscle Infections/Necrosis	2.953	2014
Add Reject	85	Heart Infection/Inflammation, Except Rheumatic	3.358	2013

Show entries

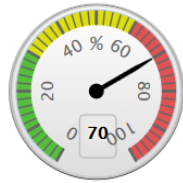
Previous **1** Next

As shown above, in the left panel, the HCCs on the patient's record for the current year display. In the center, candidate missing HCCs from previous years on the patient's EHR display with risk score information. Information regarding the dates and SNOMED codes are shown via links or on the page. Shown below, the right panel displays graphical information about the patient's risk score with or without missing HCCs.



Candidate Risk Score Meter

The candidate risk score meter (or gauge) indicates the severity of the patient's candidate risk score relative to their current risk score. It is used to quickly identify if a patient's candidate HCCs would make a significant impact to their current risk score if they were added to the patient.



Candidate Risk Score Meter

The formula for calculating this metric is:

$$x\% = \left(1 - \frac{\text{Current Risk Score}}{\text{Sum (Candidate HCC Risk Scores) + Current Risk Score}}\right) * 100\%$$

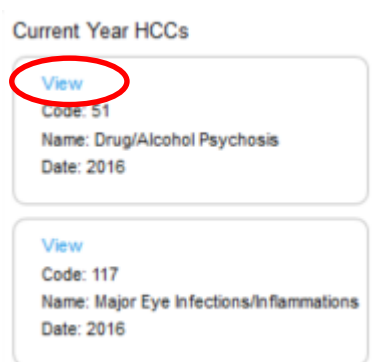
Example:

If a patient has a Current Risk Score of 0.723 and the sum of their Candidate Risk Scores is 1.687, the candidate risk score meter would register 70, indicating the patient's current risk score is 70% less than what it would be if candidate HCCs were included.

$$70\% = \left(1 - \frac{0.723}{1.687 + 0.723}\right) * 100\%$$

Viewing Current Year HCCs

To view information on a current year HCC, click on the View link for a particular condition.



A new window should open displaying the Code's status for that patient and the related SNOMED codes which were entered and translated to that HCC.

View Hcc 51 - Drug/Alcohol Psychosis

Verification Status: Confirm

Notes:

SnowMed Codes: (Select All that Apply)

<input type="checkbox"/>	Code	Name
<input checked="" type="checkbox"/>	10028000	Drug/Alcohol Psychosis
<input type="checkbox"/>	10327003	Drug/Alcohol Psychosis
<input type="checkbox"/>	11061003	Drug/Alcohol Psychosis
<input type="checkbox"/>	111480006	Drug/Alcohol Psychosis
<input type="checkbox"/>	11387009	Drug/Alcohol Psychosis
<input type="checkbox"/>	12380008	Drug/Alcohol Psychosis
<input type="checkbox"/>	135311000119100	Drug/Alcohol Psychosis
<input type="checkbox"/>	1383008	Drug/Alcohol Psychosis
<input type="checkbox"/>	1461000119109	Drug/Alcohol Psychosis
<input type="checkbox"/>	1471000119103	Drug/Alcohol Psychosis

save delete Cancel

A user may delete, but we advise that in a real-world implementation, only a doctor may perform this action while making supporting documentation.

Viewing Candidate HCCs

The center panel displays HCCs that were entered on the patient's EHR in previous years. Four years is the default, and a user may adjust the time by sliding the bar at the top of the panel.

Candidate HCCs

4 Year ☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	30	Gallbladder and Biliary Tract Disorders	1.978	2014

Adding an HCC

To add an HCC to a patient's EHR, select the add link to the left of the specific HCC.

Candidate HCCs 4 Year ☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	30	Gallbladder and Biliary Tract Disorders	1.978	2014

A new window should open allowing the user to select corresponding SNOMED codes, the verification status which should be confirmed by default, and to enter supporting reasons.

Add Hcc 3 - Central Nervous System Infection

Verification Status
Confirm

SnowMed Codes: (Select All that Apply)

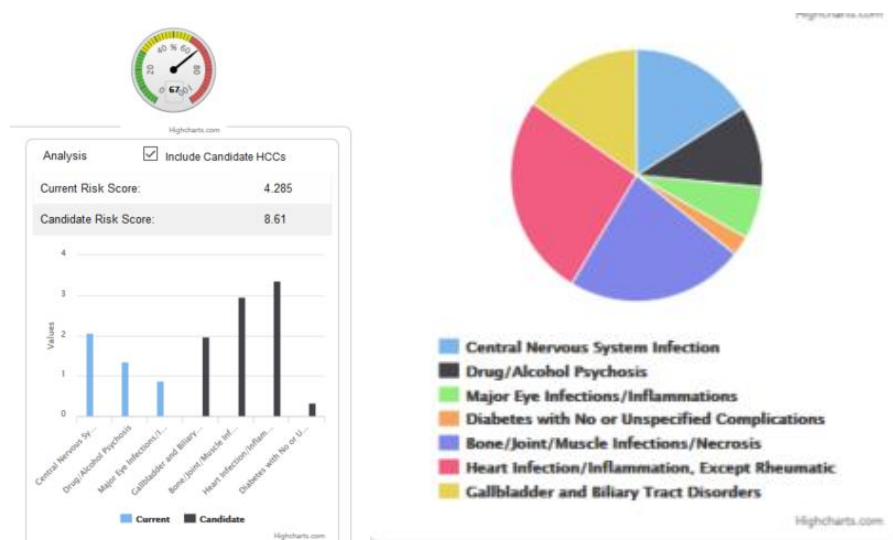
☐ Code Name

☐ 10082001 Central Nervous System Infection
☐ 10491005 Central Nervous System Infection
☐ 105016005 Central Nervous System Infection
☐ 109902004 Central Nervous System Infection
☐ 109903009 Central Nervous System Infection
☐ 110269000 Central Nervous System Infection
☐ 111850006 Central Nervous System Infection
☐ 111865007 Central Nervous System Infection
☐ 111868009 Central Nervous System Infection
☐ 111872008 Central Nervous System Infection

Notes:

Add Cancel

Once added, the graphical display at the right automatically updates showing the current HCCs in blue and candidate HCCs in black. The pie chart displays the percentage each HCC contributes to the total. To display the percentage, hover over the pie slice.



Rejecting HCCs

A user may also reject HCCs which are not accurate or no longer affect the patient although they appear in their EHR for previous years. The user has the option of displaying HCCs which have already been rejected that year in case there was an error.

To reject, a user clicks on the reject link to the left of the HCC.

Candidate HCCs 4 Year ☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	30	Gallbladder and Biliary Tract Disorders	1.978	2014
Add Reject	37	Bone/Joint/Muscle Infections/Necrosis	2.953	2014
Add Reject	85	Heart Infection/Inflammation, Except Rheumatic	3.358	2013

Previous [1](#) Next

A new window opens with showing corresponding SNOMED codes, a default verification status of refuted, and a free text field for notes.

Reject Hcc 30 - Gallbladder and Biliary Tract Disorders

Verification Status

Refuted

SnowMed Codes:

(Select All that Apply)

☐

Code

Name

☐

10184002

Gallbladder and Biliary Tract Disorders

☐

105997008

Gallbladder and Biliary Tract Disorders

☐

110995008

Gallbladder and Biliary Tract Disorders

☐

111372003

Gallbladder and Biliary Tract Disorders

☐

111373008

Gallbladder and Biliary Tract Disorders

☐

118926004

Gallbladder and Biliary Tract Disorders

☐

125661000119107

Gallbladder and Biliary Tract Disorders

☐

12932003

Gallbladder and Biliary Tract Disorders

☐

129587006

Gallbladder and Biliary Tract Disorders

☐

134402008

Gallbladder and Biliary Tract Disorders

Notes:

Reject

Cancel

To complete rejection, enter notes and select reject.

Reject Hcc 30 - Gallbladder and Biliary Tract Disorders

Verification Status

Refuted

Notes:

For demonstration purposes. |

SnowMed Codes: (Select All that Apply)

<input type="checkbox"/>	Code	Name
<input type="checkbox"/>	10184002	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	105997008	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	110995008	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	111372003	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	111373008	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	118926004	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	125661000119107	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	12932003	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	129587006	Gallbladder and Biliary Tract Disorders
<input type="checkbox"/>	134402008	Gallbladder and Biliary Tract Disorders

Reject Cancel

The HCC no longer appears in the candidate HCC list unless include Rejected HCCs is displayed. The graphs at the right are updated as well.

The images show the graphical display after rejecting an HCC.

Candidate HCCs

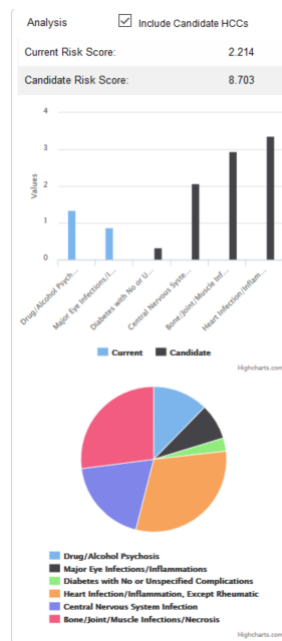
4 Year

☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	37	Bone/Joint/Muscle Infections/Necrosis	2.953	2014
Add Reject	85	Heart Infection/Inflammation, Except Rheumatic	3.358	2013

Show 10 entries

Previous 1 Next

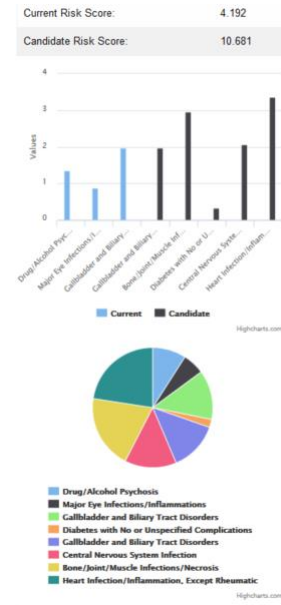


The images show the graphical display after rejecting an HCC and selecting include rejected HCCs.

Candidate HCCs 4 Year ☐ Include Rejected HCCs

	Code	Name	Risk Score	Date
Add Reject	3	Central Nervous System Infection	2.071	2013
Add Reject	19	Diabetes with No or Unspecified Complications	0.321	2013
Add Reject	30	Gallbladder and Biliary Tract Disorders	1.978	2014
Add Reject	37	Bone/Joint/Muscle Infections/Necrosis	2.953	2014
Add Reject	85	Heart Infection/Inflammation, Except Rheumatic	3.358	2013

Show 10 entries Previous 1 Next



Look up another patient

To look up another patient click the blue hyperlink in the top left of the window that says patient lookup. This will return the user to the patient lookup screen.

Logout

To logout, click the blue “logout” hyperlink in the top right of the screen.

Data Recording

All data entries are recorded via a persistence API without additional steps from the user. As stated in constraints, a real world implementation would make changes on the FHIR server under the current encounter and be recorded in the FHIR server’s audit trail.

Future Improvements

Some candidate features identified for the RADV tool include:

1. A report listing patients with a high “candidate” HCC risk score. This would help providers identify high risk patients with past medical conditions not yet recorded for the current calendar year.
2. Allow the selection of individual Candidate HCCs (instead of all Candidate HCCs listed) to review the net impact this subset would have on the patient’s calculated risk score.
3. Role-based access to control to determine which users can view, add, update and reject HCCs.

References

Information from:

Class Lectures

<https://www.bcbsal.org/providers/pdfs/riskAdjustment.pdf>

https://www.healthlawyers.org/Events/Programs/Materials/Documents/MM12/papers/EE_haley_sillman_slides.pdf

<http://www.modernhealthcare.com/article/20150701/NEWS/150709989>

<http://kff.org/health-reform/issue-brief/explaining-health-care-reform-risk-adjustment-reinsurance-and-risk-corridors/>

Images from:

<http://decompressionprosmarketing.com/blogs/decompression-pros/16891112-how-to-ask-for-referrals-from-medical-doctors>

<http://www.libertynursingagency.com/>

<http://allhealthcare.monster.com/training/articles/1822-5-steps-to-becoming-a-medical-assistant>

http://greenfieldcc.3dcartstores.com/Medical-Coding-and-Billing_p_1058.html

Graphing Tools:

Highcharts (<http://www.highcharts.com/>)

GitHub Repository

https://github.gatech.edu/sganas3/FHIRed_Up/