Department of Veterans Affairs

**Automated Surgical Risk Calculator (ASRC)**

User Guide



**September 2015**

Version 0.09

Revision History

| Date | Version | Description | Author | Reviewer | Issue Date |
| --- | --- | --- | --- | --- | --- |
| 08/31/2015 | 0.09 | Updated to include new reports and Discrete Numeric variables. Refreshed all screen shots with the most current version of the ASRC tool | B. Frey | S. Ambrose | 09/04/2015 |
| 07/14/2015 | 0.08 | Updated to include new Administrator functions (e.g., adding/editing rules, updating procedures, and models, etc.) | B. Frey | S. Ambrose | 07/14/2015 |
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| 12/17/2014 | 0.02 | Updated to include the following:  Pop-up list Variables (e.g., Procedure)  Manual Entry Variables (e.g., Age)  Checkbox Variables (e.g. DNR)  Radio Button Variables (e.g., Functional Status)  Custom Variables | B. Frey | S. Vetzel | 12/17/2014 |
| 11/21/2014 | 0.01 | Creation  Tailored for ASRC and provided guidance for:  Login and system exit  Selecting surgical specialty  Manually entering gender  Manually entering age  Selecting a surgical procedure | B. Frey | S. Vetzel | 11/21/2015 |

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# Introduction

## Purpose

The Automated Surgical Risk Calculator (ASRC) User Guide will provide a reference for users of the “ASRC Tool” being developed as a Department of Veterans Affairs (VA) Innovations program.

The purpose of this document is to provide clear and easy to follow instructions and associated screen shots to facilitate sufficient understanding to effectively use the ASRC tool. The User Guide will reflect updates as new functionality is developed and is accessible to system users.

## Overview

The tool is used at the time the patient is considered for surgical referral by a primary care provider, and when a surgeon is requesting a surgery. This Tool will support clinical decision-making regarding perioperative risk (includes preoperative, intraoperative, and postoperative). Providers will verify patient-specific data that is automatically pulled from available data sources, enter remaining fields, and be provided with a real-time individual risk calculation of perioperative surgical mortality based on historic Veterans Affairs Surgical Quality Improvement Program (VASQIP) data and current VASQIP risk-adjusted models that are specialty-specific. The data entered and the calculated results will be available for viewing in the Computerized Patient Record System (CPRS) as a progress note. The data will also transfer and store as discrete fields in Veterans Health Systems and Technology Architecture (VistA) and a Structured Query Language (SQL) database for use by the National Surgery Office (NSO).

### Major Functions

The ASRC Tool has the following Major Functions/Features

* Accessible through CPRS
* Automatic Patient and User Context sharing with CPRS
* Selection of Surgical Specialties
* Pop-up list selection of Current Procedural Terminology (CPT) codes with long description and Relative Value Unit (RVU). Search for Procedure includes “All of these words”, “Any of these words”, and “CPT Search”
* Manual entry of numeric variables such as Age and Body Mass Index (BMI)
* Check Box entry of variables such as Do Not Resuscitate (DNR)
* Radio Button selection of variables such as Functional Status
* Administrator access provided to add and modify surgical risk model variable names, help text, variable grouping, and VistA retrieval
* Automatic retrieval of values from VistA
* Text Integration Utility (TIU) Note saved with model calculation inputs and results available in CPRS
* Associated patient, CPT code, date and time of calculation, user, and actual outcome results from the calculation saved as discrete data in SURGICAL RISK CALCULATIONS FILE (#136.1)
* Model Input variable reuse through a button on the Results page
* Available Utilization and Summary reports allow analysis of tool usage and performance

### Characteristics

ASRC is:

* A web-based application with a simple Graphical User Interface
* Integrated with VistA and CPRS
* A decision support system providing calculated surgical risk using NSO approved and validated risk models

## Project References

The reference document for the ASRC Tool is the VA’s Transformation Twenty-one Total Technology (T4), ASRC Performance Work Statement (PWS), executed out of the NSO and Dated, 08-31-2014 (TAC-14-16044).

### Contact Information

Primary development Team Point of Contact (POC),

* David Tombs, JAVA Developer, 321.608.0919, [David@libertyITS.com](mailto:David@libertyITS.com)
* Jeff Swesky, VistA Developer, 904.207.8560, [Jeff.Swesky@hp.com](mailto:Jeff.Swesky@hp.com)
* Bill Frey, Tester, 321.608.0924, [Bill.Frey@libertyITS.com](mailto:Bill.Frey@libertyITS.com)

### Help Desk

Although there is not a Help Desk established for the ASRC Innovations program, members of the development team may be contacted with system operation/function questions. The POC recommended for the initial call is Bill Frey (Tester).

# System Summary

## System Diagram and Data Flows

Figure 1 shows a simplified diagram of the ASRC system components and data flow. Whereas CPRS displays, please note that its integration is a future enhancement.

ASRC System Components


Figure 1 - ASRC System Components

## User Access Levels

The ASRC tool users are limited to those that can access CPRS.

# Getting Started

## Logging On

To access the ASRC tool (also referred to as the ASRC application) login into CPRS and launch ASRC from the CPRS Tools Menu.

The ASRC user is either atomically authenticated via Single Sign On with CPRS or through the entry of the user’s Access/Verify codes and Division (Figure 2). The Division is needed because ASRC can connect to many VistAs and the tool needs to know which division’s data is appropriate.

ASRC LOGIN Screen


Figure 2 - ASRC LOGIN Screen

### CPRS Patient Context Sharing

The patient selected, as part of the “Login” to CPRS, is automatically shared with the ASRC Application so that the user does not need to look up the patient from within the tool. The patient’s name selected in CPRS is shown as the “Patient” in ASRC and all data retrieved from VistA will be associated with this patient. If a new patient is selected in CPRS while the ASRC tool is already displaying another patient, the previously selected patient (and any already entered data) will be retained. However if ASRC is launched again after the selection of a new patient, that new patient will now be the active, displayed patient.

## Select Surgical Specialty Menu

Select a Surgical Specialty as shown in Figure 3 below. Please note that this screen may reflect updates as the program progresses but should still provide a good reference until the User Guide is updated to support the next version of the tool.

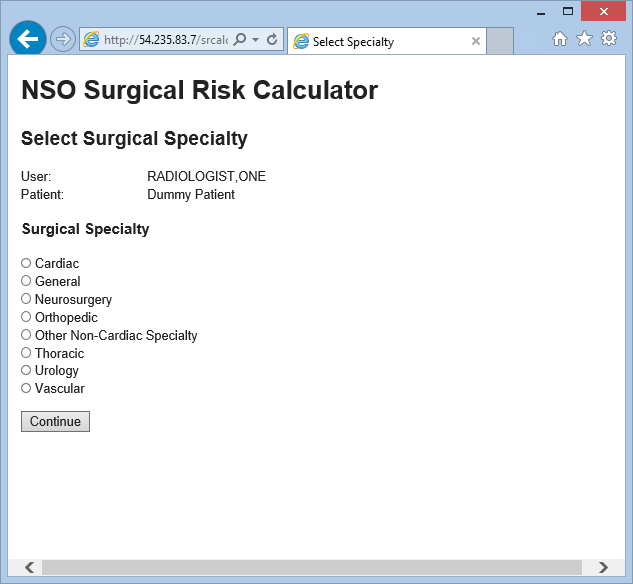


Figure 3 - Select Surgical Specialty

## Risk Variable Entry

In order to run risk calculations there are surgical specialty and risk model dependent variables that need to be entered. This section provides guidance for the different variable types that are available.

### Pop-up Selection List Variables

Currently only the surgical procedure is selectable from a pop-up list. Any future pop-up selection variables will work in the same manner.

#### Surgical Procedure Selection

To select a surgical procedure click on the Procedure “Select” Link (available only on the non-cardiac surgical specialties). The below pop-up window is displayed (Figure 4). Scroll through the available codes, select the CPT code by clicking the “Select” link located to the right of the desired code. The selected CPT code & short description will display on the surgical specialty screen.

#### Procedure Searching

Search for Procedures by using three different methods simultaneously or individually:

* “All of these words” - results include every word entered in the search box that is also in the CPT long description (they do not need to be in the exact order) (for example if “initial exam” was entered then results would include CPTs that had both “initial” AND “exam”)
* “Any of these words” - results include any word entered in the search box that is also in CPT long description (for example if “initial exam” was entered then results would include CPTs with either “initial” OR “exam”)
* “CPT Search” - results include and CPT that starts with the numbers entered up to 5 (5 digits entered would be an exact match)

When the Run Calculation executes, the selected code and long description will display on the results screen. An appropriate error message is displayed if Run Calculation is executed and a procedure is not selected (this is a required entry).

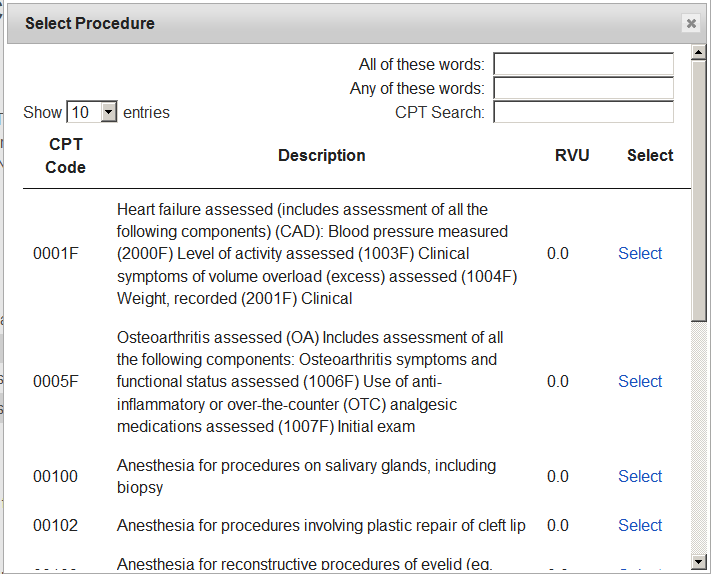


Figure 4 - Surgical Procedure Popup

ARSC only allows calculations for procedures that warrant a risk calculation. If a procedure is selected that does not warrant a risk calculation the user is warned and the “run Calculation” feature is greyed out.

### Numeric Variables

There are variables that are populated from VistA data or manually entered in cases where the data is not available in VistA or the user has information that is more recent. Examples of these variables are “Age:” and “BMI:” and they will all work in the same manner. An editable box will be displayed in which a user will manually enter the desired value (see Figure 5). Click in the entry box and enter the value. An appropriate error message will be displayed if the entry is not valid (e.g., an age of -1) or if a value is not entered. When Run Calculation executes, the entered value will display on the results screen.

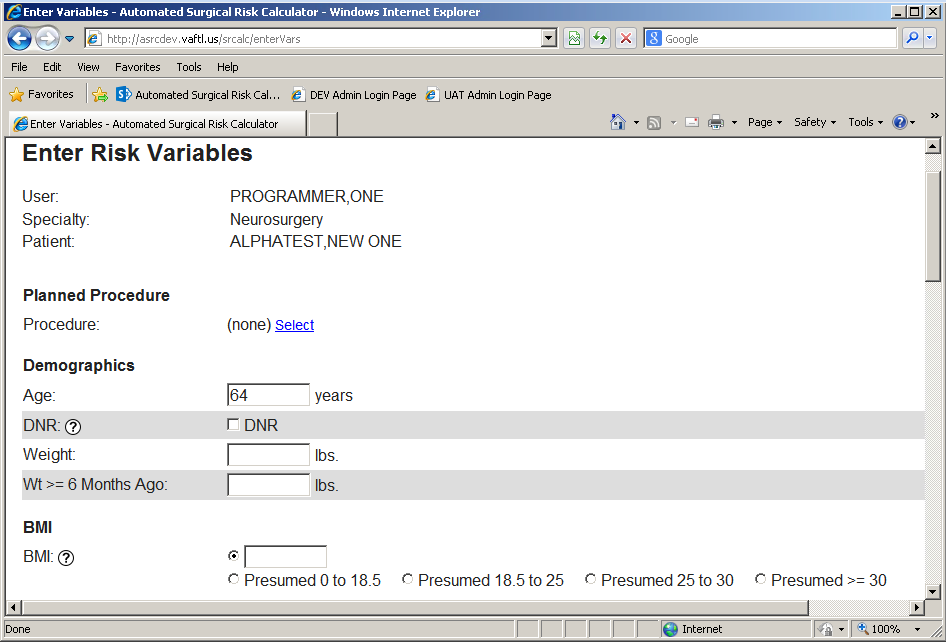


Figure 5 - Manual Numeric Entry

### Discrete Numeric Variables

There are discrete numeric selections for variables such as BMI. For example the user can select “Presumed 0 to 18.5”, “Presumed 18.5 to 25”, “Presumed 25 to 30”, or “Presumed >=30”. One of these entries can be selected in place of the numeric entry box displayed above the variables Discrete Numeric selections (Figure 6).

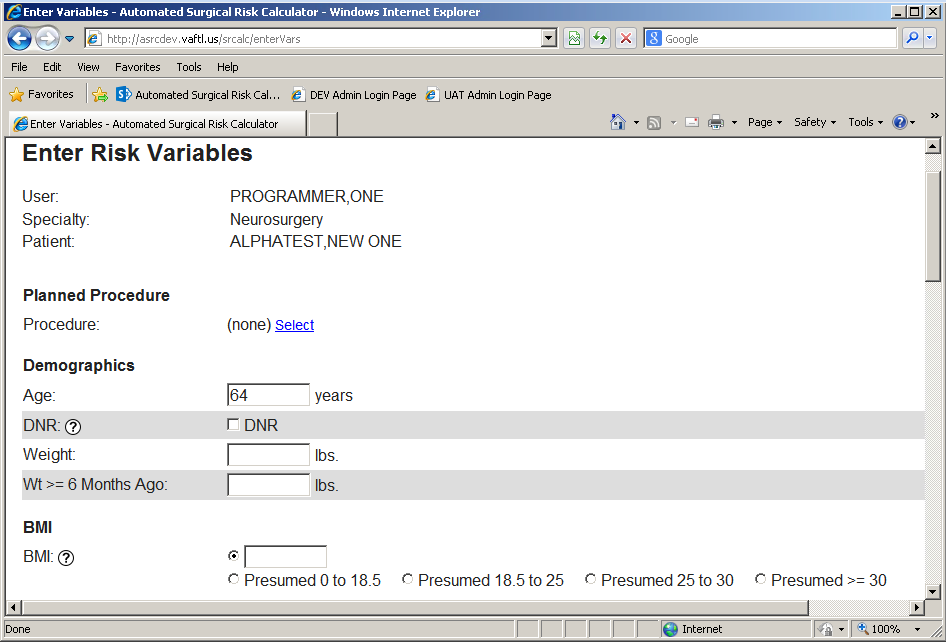


Figure 6 - Discrete Numeric Variables

### Check Box Variables

There are variables that can be selected by clicking a checkbox. Examples of these variables are “DNR” and “Preop Pneumonia” and they will all work in the same manner. These type of variables are shown as a small box on the display (see 7) that can be left unchecked (indicating a “No” for that variable) or checked (indicating a “Yes” for that variable). When Run Calculation is executed, the corresponding value (“No” if unchecked, “Yes” if checked) will be displayed on the results screen.

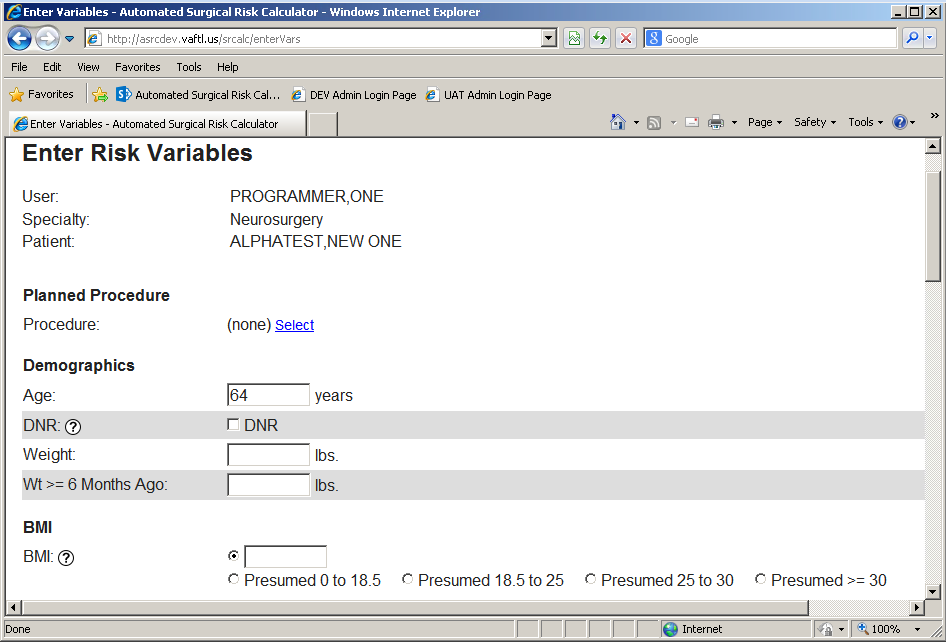


Figure 7 - Checkbox Variable

### Multi-Select Variables

There are multi-select variables that are selected by clicking a Radio Button or selecting an entry from a drop down menu. Examples of Radio Button variables are “American Society of Anesthesiology (ASA) Classification” and “Functional Status” and they will all work in the same manner. Radio Button variables are shown as a small circle next to a selection on the display (8) that can be clicked to select (when clicked the circle will fill with black). If a radio button variable is not selected an appropriate error message will be displayed. Drop Down variables will display as a small selection box with a down arrow that when clicked shows the available selections. Mutli-select variables in the FY2013 Risk Model configurations use Radio Buttons. However, the Administration function can be used to modify the Radio Button to use the Drop Down style. When Run Calculation executes, the selected value will display on the results screen.

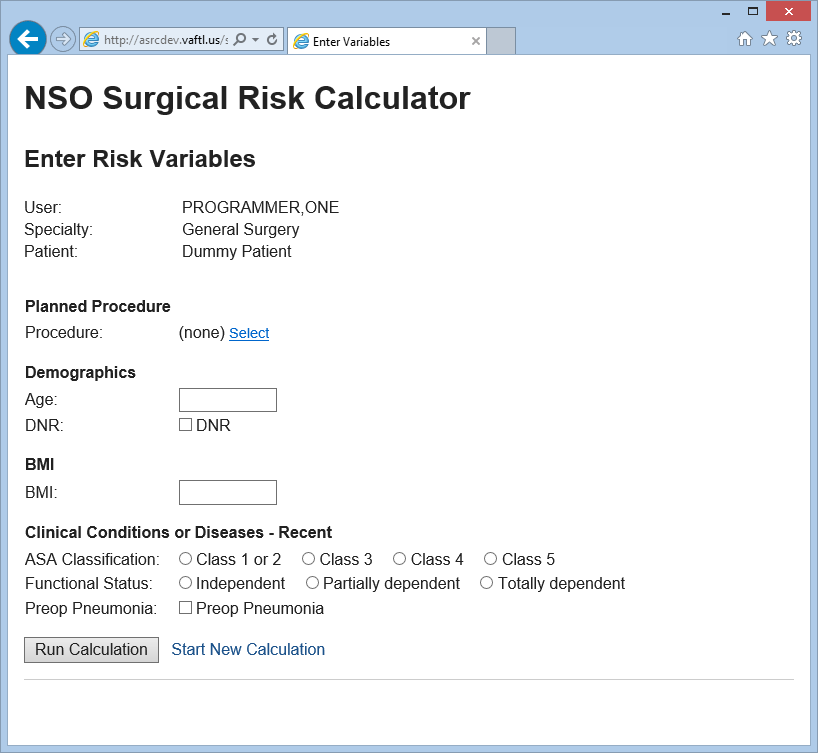


Figure 8 - Radio Button Variable

### Automatically Retrieved Variables

Some Variables’ values are automatically retrieved from VistA if they are available for the selected patient. Examples of these variables are Gender, Age, BMI, Weight, and Weight 6 months prior. The values retrieved from VistA are displayed as the default values. The ASRC user can overwrite any automatically retrieved values if necessary.

### Running Risk Model Calculations

To run a calculation for a specialty risk model, enter all information displayed for that specialty and click “Run Calculation” (9). The instructions for each variable type entry are in Section 3.3.1-3.3.5.

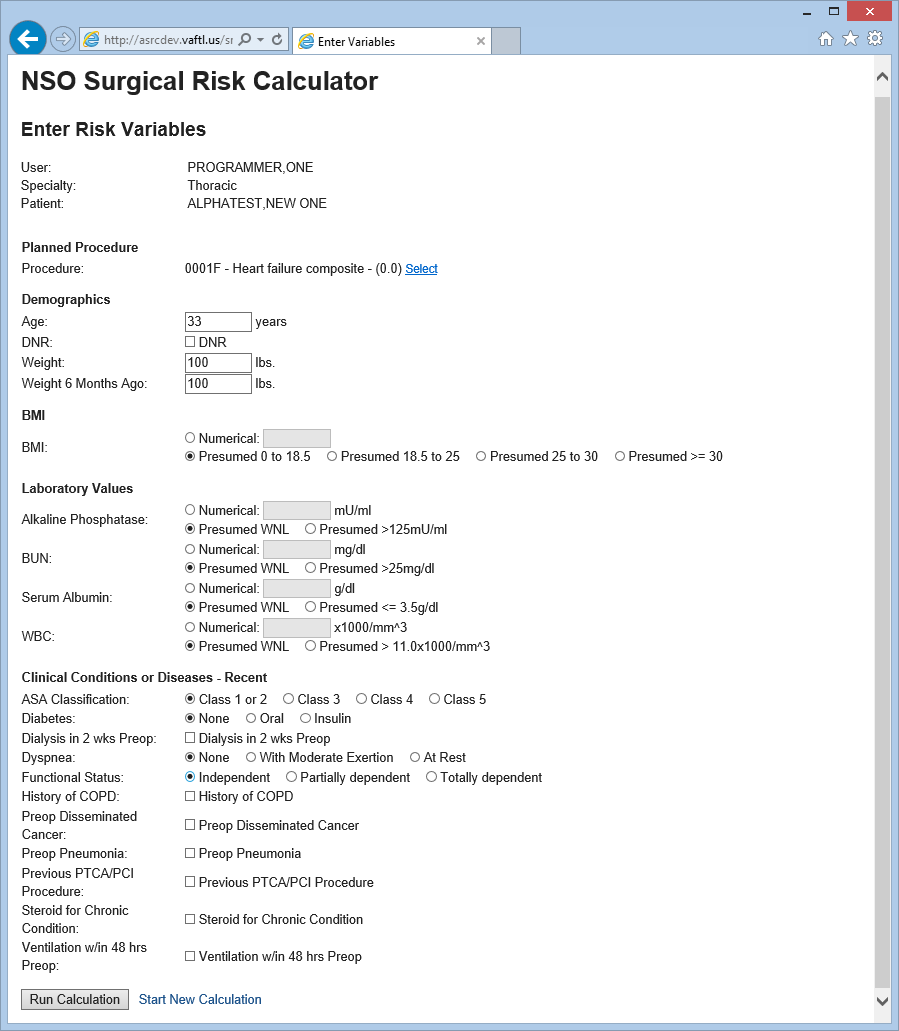


Figure 9 - Run Calculation

A results page (10) displays with all of the entered variables and the calculated risk shown as a percentage (%).

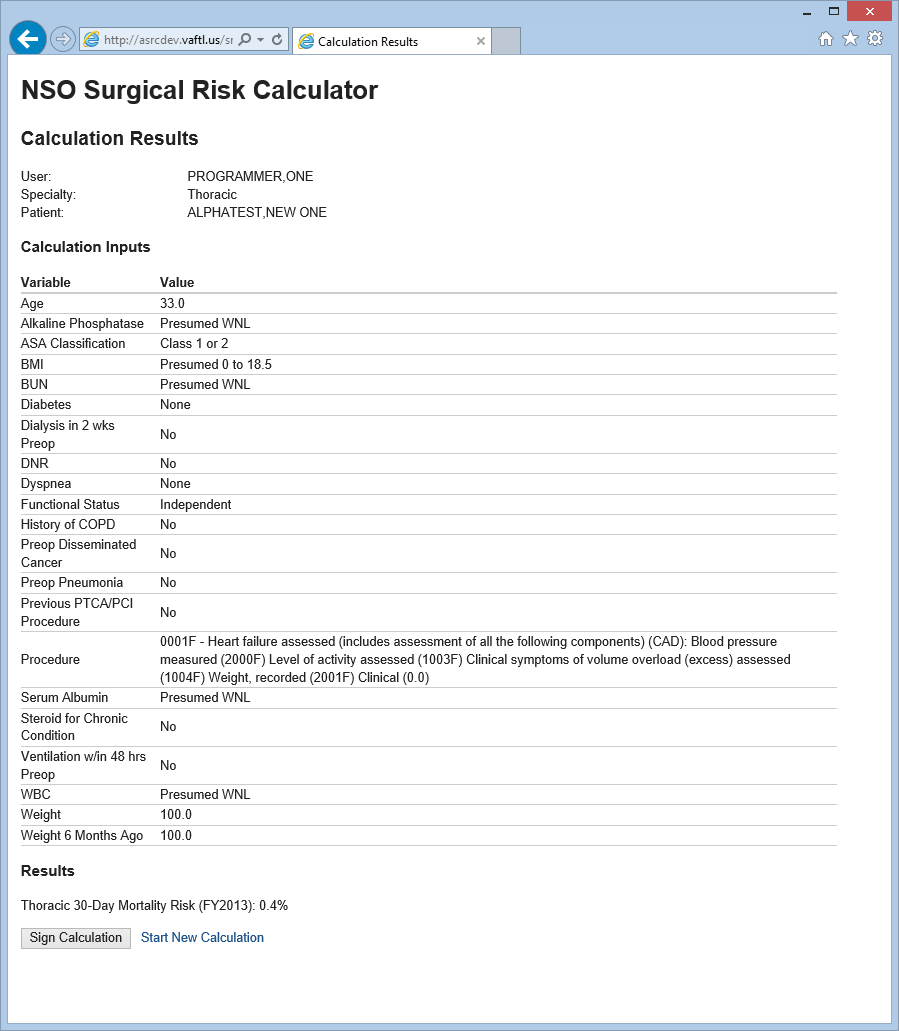


Figure 10 - Results Page

## Re-run Calculation with Modified Inputs

To re-run the calculation with modified inputs, click the “Return to Variable Input Form” button located on the results page. Clicking the back button does not display any inconsistent data to the user. The “Return to Variable Input Form” button returns to the variable input page, which preserves the current values.

## Signing the Risk Calculation

To sign the risk calculation for a specialty risk model, click the “Sign Calculation” button located on the results page (Figure 10 above). The tool will warn the user before signature that the data will be saved in Electronic Health Records (EHR). When signing the risk calculation the signature must be via the user’s electronic signature code. If the user signs the risk calculation with an invalid signature code, an appropriate error message will appear. When successfully signed, the tool brings the user to a success page indicating that the calculation has been saved as a note and they may close the browser window.

### Saving the Result as a TIU Note

After signing the risk calculation, the TIU Note with input values and outcomes is visible in the CPRS Notes tab. Once signed, a calculation may not be altered.

### Saving the Results as Discrete Data in VistA

After signing the risk calculation, the associated Patient, CPT code, date and time of calculation, user, and actual outcome results from the calculation are saved as discrete data to the SURGICAL RISK CALCULATIONS FILE (#136.1).

## ASRC Tool Administration

### Accessing the Administration Function

Use Internet Explorer to access the ASRC Administration function (Figure 11). During development of the Prototype, the administration function is available at <http://asrcuat.vaftl.us/srcalc/admin>. Administrator usernames and passwords are required. Figure 12 shows the home page of the ASRC Administrative function.

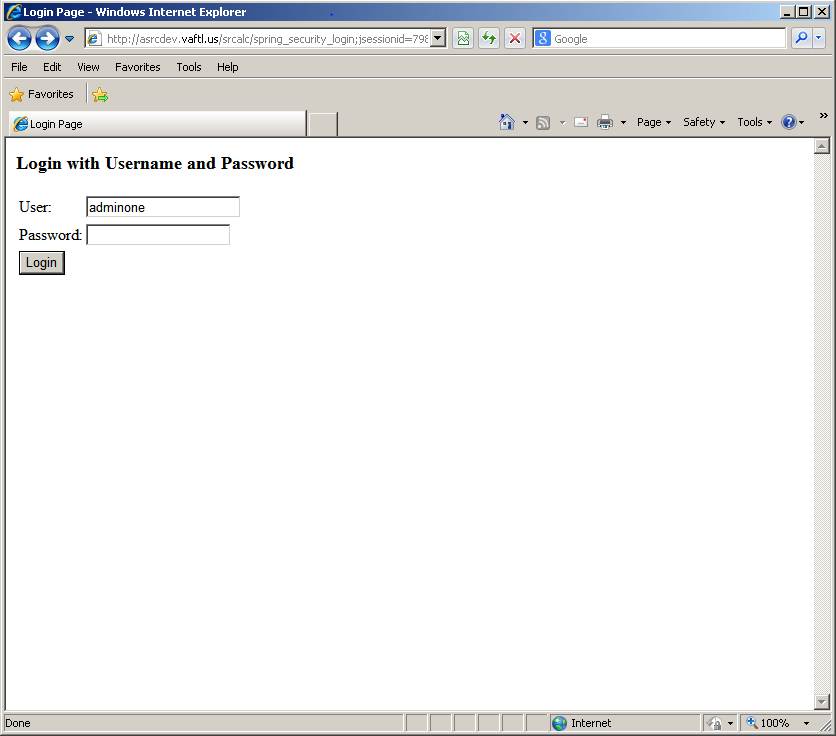


Figure 11 - Administrator Login

Administration Home Page


Figure 12 - Administration Home Page

### Model Administration

#### Model Definitions

The ASRC Administrator can “Edit” existing ASRC Risk Models. Figure 13 shows a Model Definition administration selection example.

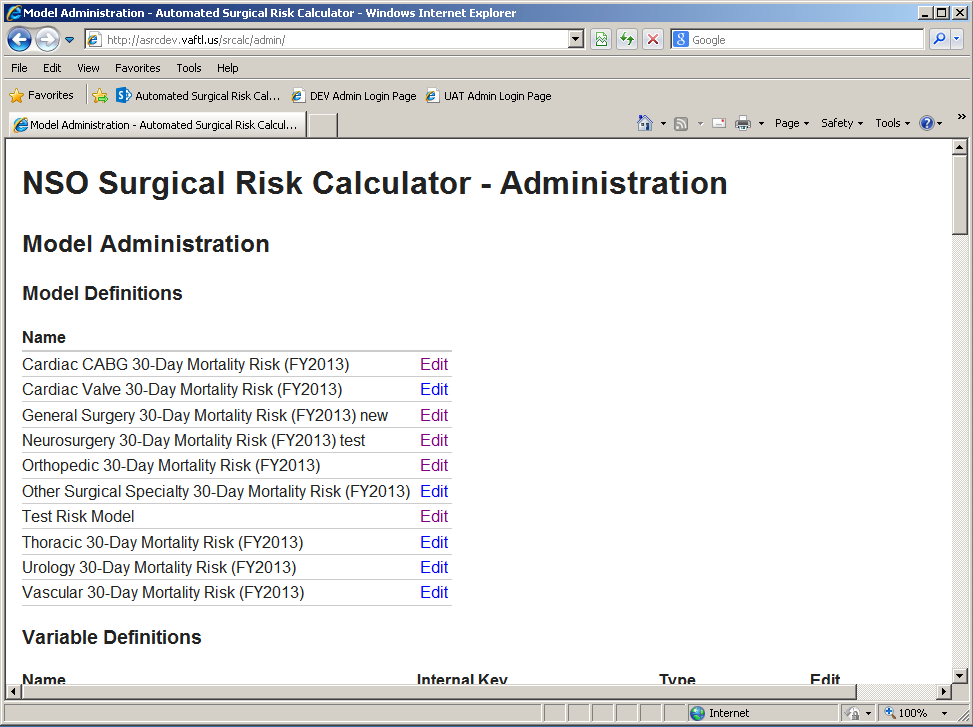


Figure 13 - Model Definitions

#### Model Definition – Edit

The ASRC Administrator uses the Edit Model Administration function (Figure 14) to

* See and Edit the Model name
* View the current model Terms, Term Type, and Coefficient
* Import a new model definition through a Comma Separated Values (CSV) file
* Save the changes

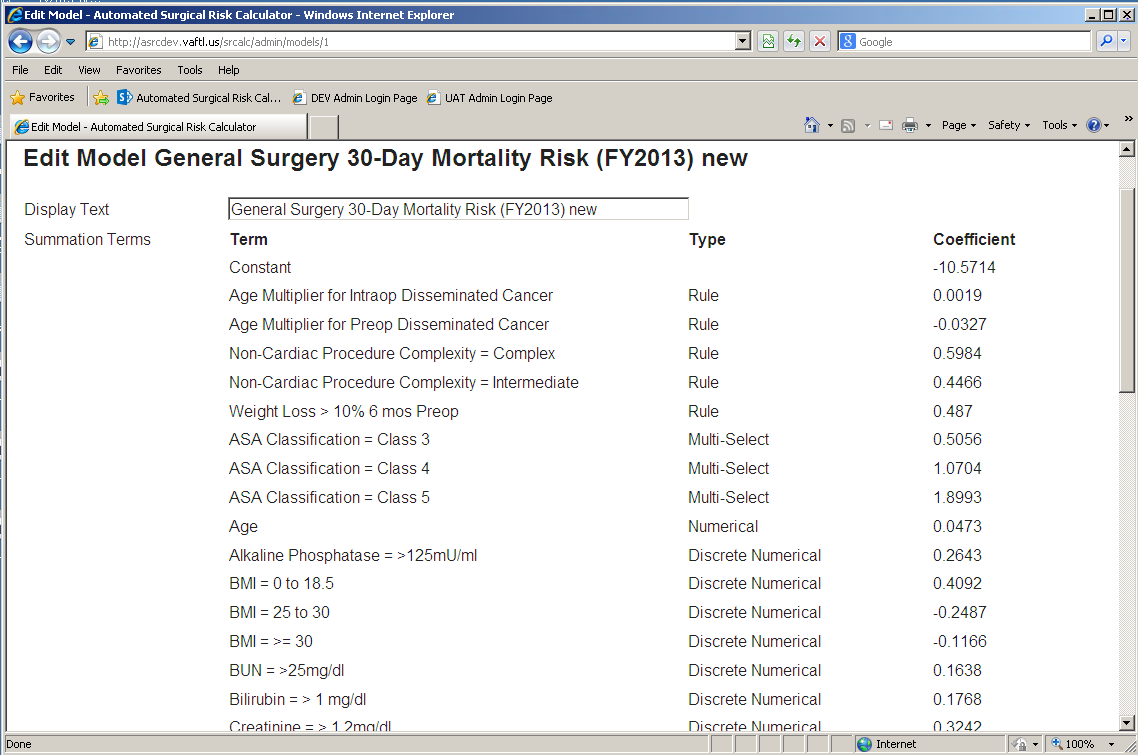


Figure 14 - Edit Model Definition

Figure 15 shows a sample of a correctly formatted model definition CSV file. ASRC validates the entries during the import process, displaying validation error messages to the Administrator. Changes are not made to the database until “Save Changes” is selected.

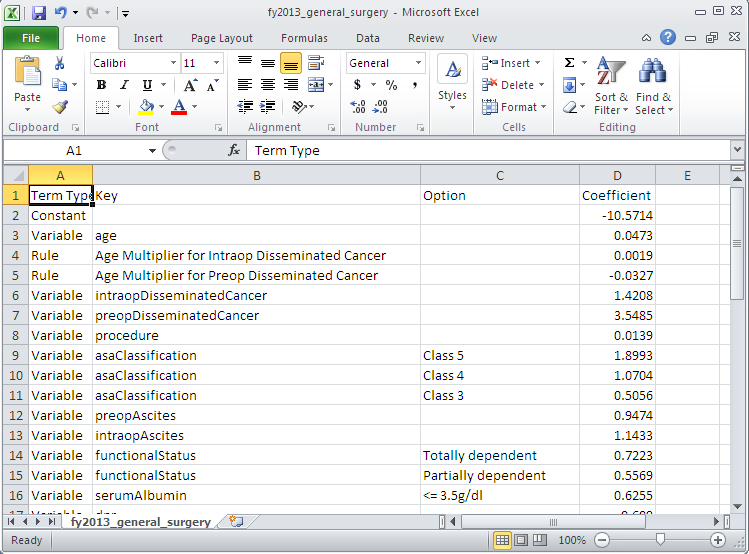


Figure 15 - Model Definition CSV Example

#### Variable Definitions

The ASRC Administrator can “Add” new variables or “Edit” existing ones. Figure 16 shows a Variable Definition administration selection example.

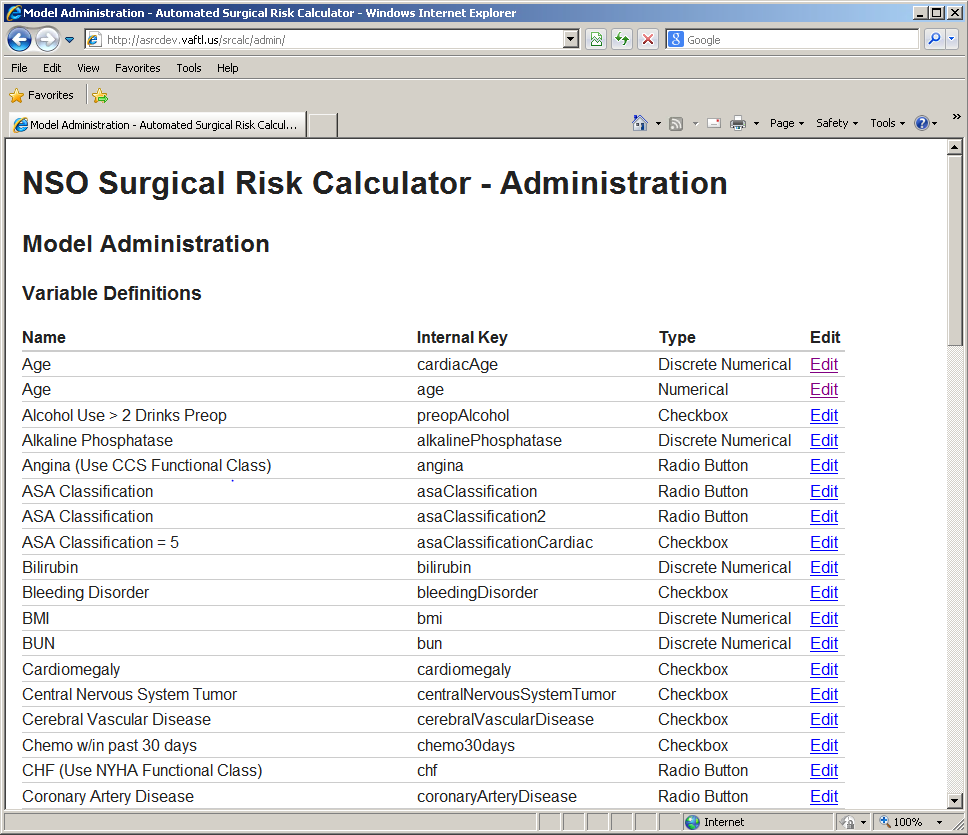


Figure 16 - Variable Definition

#### Variable Definition - Add

Add new variables by clicking the “Add New” button for the following variable types at the bottom of the ASRC Administration window (Figure 17):

* Checkbox variables
* Radio Button variables
* Discrete Numerical variables

After selecting the new variable type, the Administrative user enters the required information:

* Internal Key: Internal Database key for variable (This must be unique – the tool will validate on Save)
* Display Text: Name displayed on the Model input page. This name can be up to 80 characters in length.
* Help Text: Help text provided for the variable. The help text can be up to 4000 characters in length.
* Group: Select the variable group from the Group pick list.
* VistA Value: Indicate if the variable can be automatically loaded from VistA (if appropriate)
* Option: Option Name (Radio Button – up to 20)
* Units: Units in text (Discrete Numerical)
* Valid Range: Lower and upper bounds of the variable range (Discrete Numerical)
* Category: Category name (Discrete Numerical – up to 20)

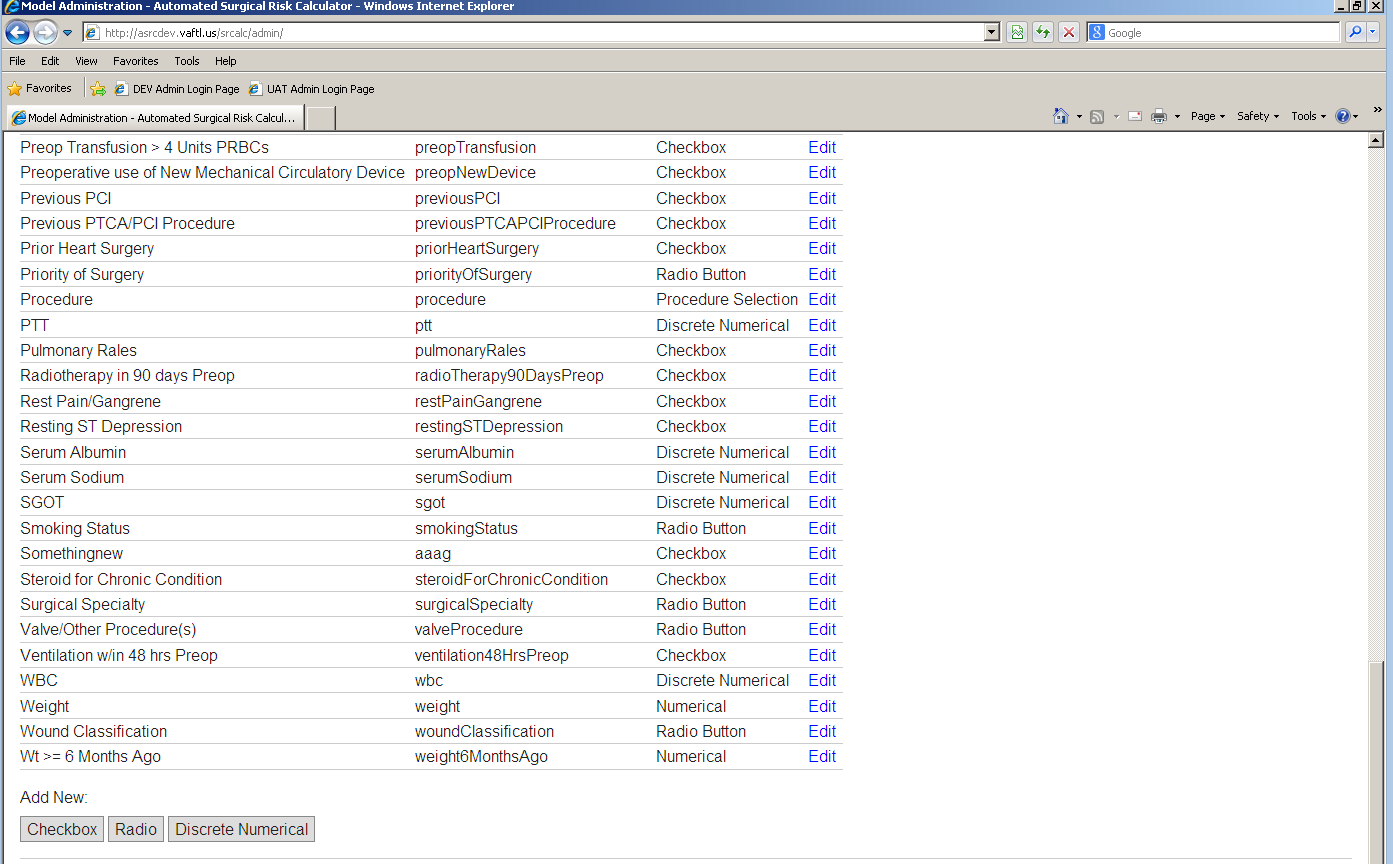


Figure 17 - Adding new variables

#### Variable Definition – Edit

In the ASRC Administration tool, Variable Definition section click on “Edit” (Figure 18) to modify existing variables. The following characteristics are modifiable for each variable,

* Display Text: Name displayed on the Model input page. This name can be up to 80 characters in length.
* Help Text: Help text provided for the variable. The help text can be up to 4000 characters in length.
* Group: Select the variable group from the Group pick list.
* VistA Value: Indicate if the variable can be automatically loaded from VistA (if appropriate)
* Option: Option Name (Radio Button – up to 20)
* Units: Units in text (Discrete Numerical)
* Valid Range: Lower and upper bounds of the variable range (Discrete Numerical)
* Category: Category name (Discrete Numerical – up to 20)

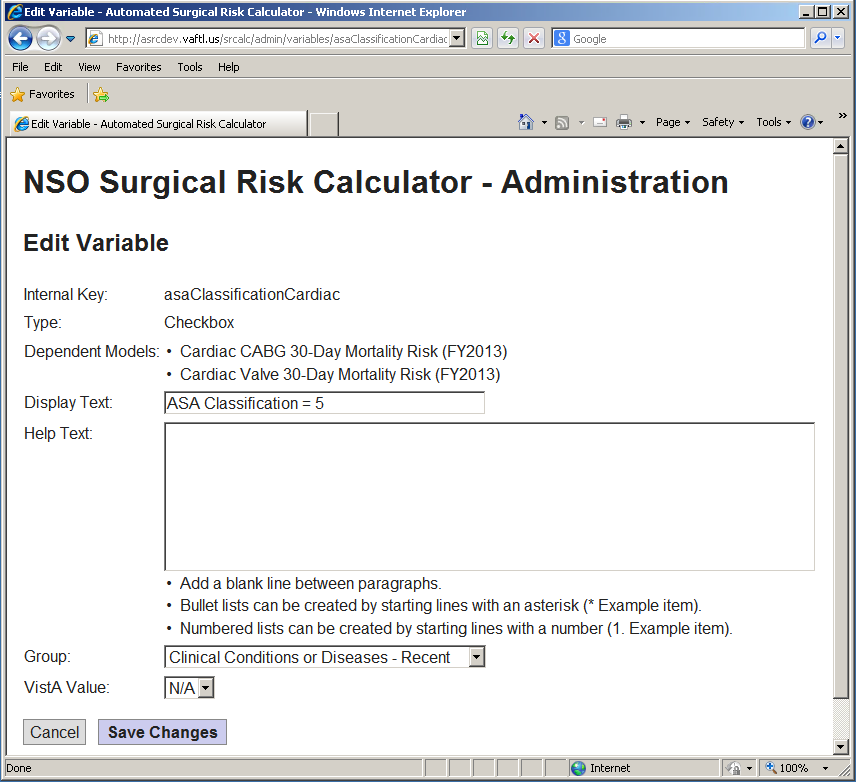


Figure 18 - Edit Variable Page

#### Rules

The ASRC Administrator can “Add” new rules or “Edit” existing ones. Figure 19 shows a Rule Definition administration selection example.

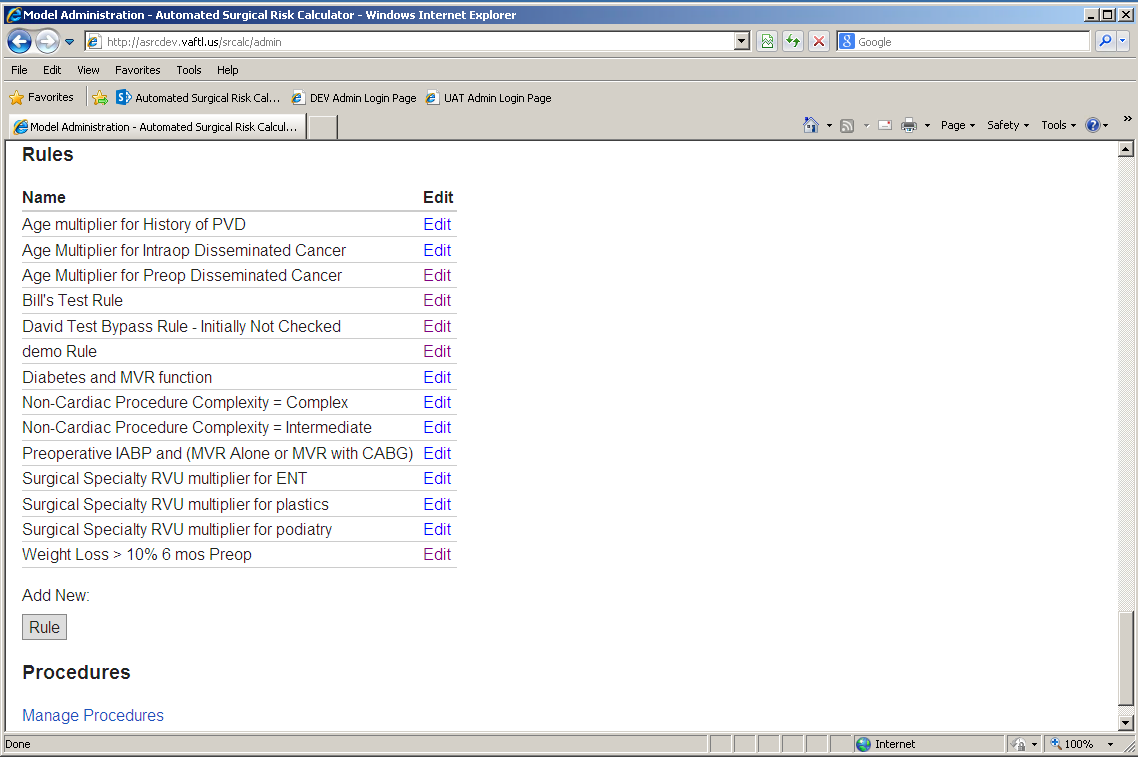


Figure 19 - Rule Definition

#### Rule Definition – Add

The ASRC Administrator can add a new rule by selecting Add New: Rule (Figure 19). The Administrator can then (Figure 20)

* Create a Display name for the Rule (must be unique)
* Select is the Rule is bypassed if missing values by checking “Bypass rule if missing values”. See Rule Definition – Edit for an example of its usage.
* Create a Summand Expression (is applied to the model if all the variable expressions are true). For example, “#coefficient + 2” would add to the term’s coefficient if all of the evaluated expressions are true.
* Add variables from a drop down list
* For each variable, choose if that variable’s condition will be evaluated (check “Apply Condition to variable”. Entry in the Expression box requires selection of “Apply Condition to variable”.
* Up 10 ten variables can be added with a warning message generated if an 11th is attempted
* Reference variables by inserting a # in front of the variable name. For example, reference age as “#age”. The tool is case sensitive so enter the variable name exactly as shown in the Available Variable list.

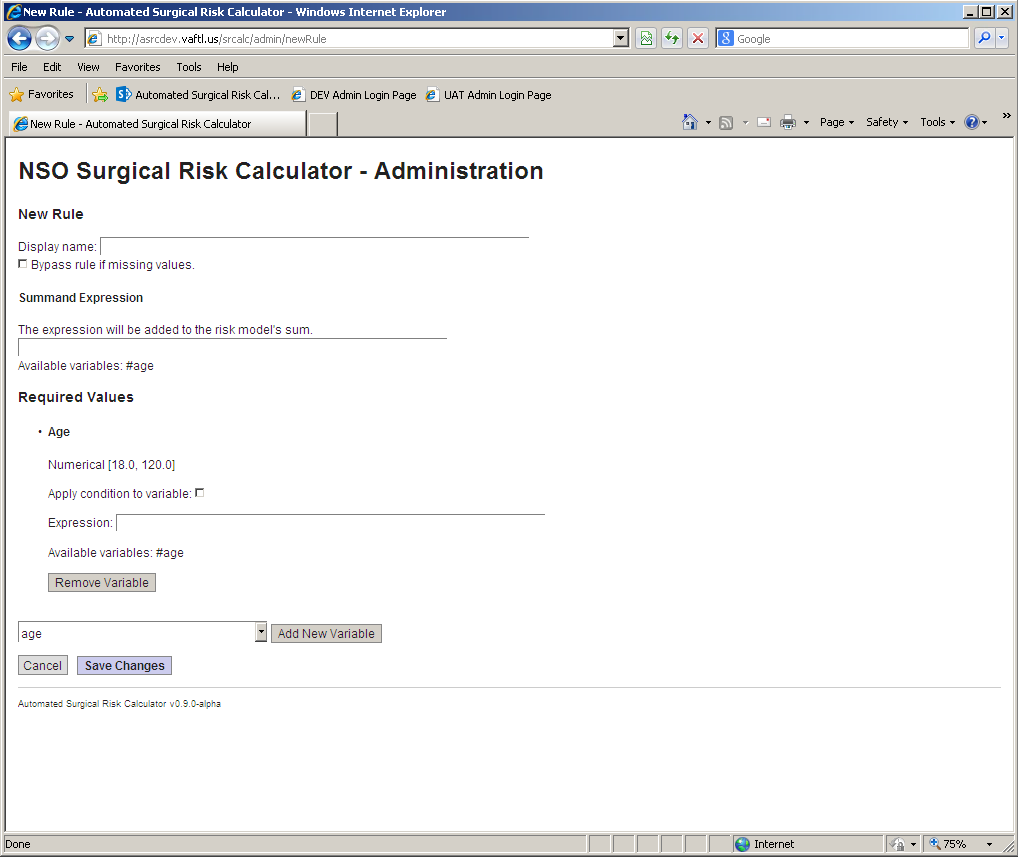


Figure 20 - Add New Rule

#### Rule Definition – Edit

The ASRC Administrator can add edit an existing rule by selecting Edit next to the rule name (see Figure 20 above). The Administrator can then

* (See Figure 21 for the below features)
* Modify the Display name for the Rule (must be unique)
* Select if numeric variables must have values (e.g., Weight and Weight 6 months ago would have the “Bypass rule if missing values” checked – Figure 21)
* Modify the Summand Expression
* Add variables from a drop down list (up to 10)
* Remove variables by selecting “Remove Variable”
* For each variable, modify if that variable’s condition will be evaluated (check “Apply Condition to variable”

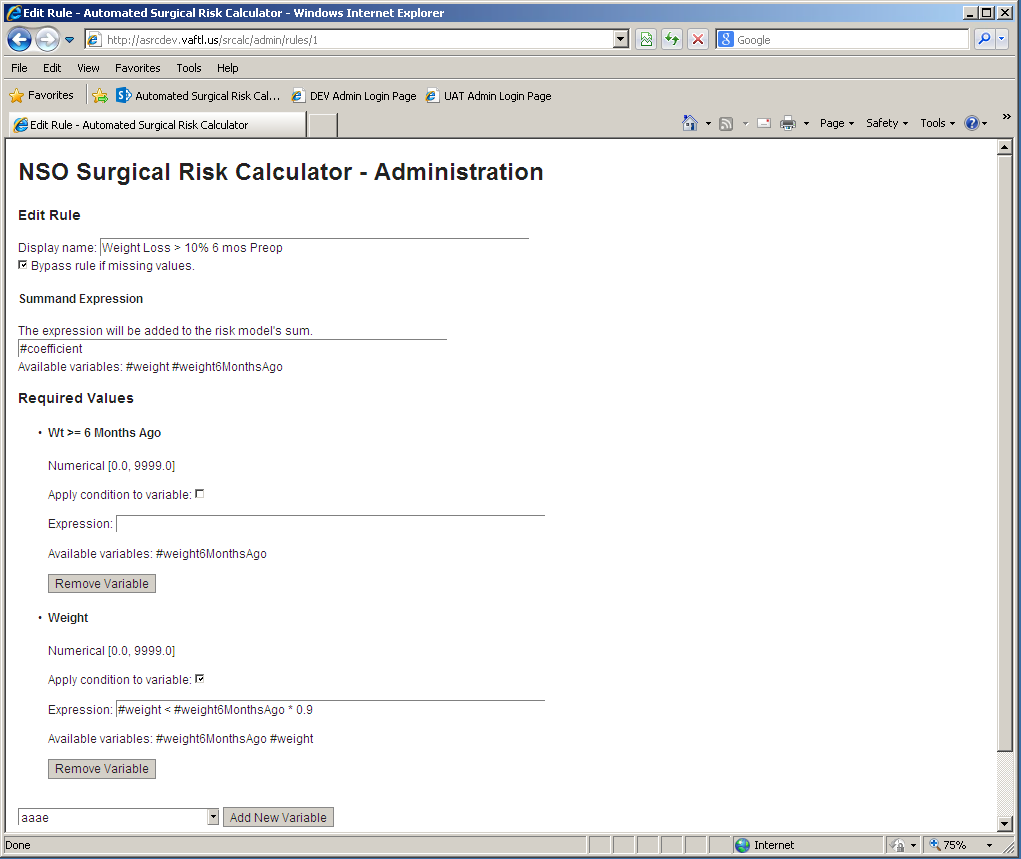


Figure 21 - Edit Existing Rule

#### Rule Definition Detailed Description

Much like typical math expressions, summand expressions must evaluate to a number and evaluate in a specified order of precedence. In this case, the summand expressions will follow this order of operations: operations inside of parentheses are evaluated first, then exponents, then multiplication and division going from left to right, then addition and subtraction going from left to right. If the expression “1+2-3\*8^2/2/2” were evaluated, the answer would be -45.

Mathematical operators that are available in both the summand expressions and the Boolean (true or false) expressions are:

* Parentheses to specify order
* Exponents
* Scientific notation (i.e. 2E+3 is equal to 2000)
* Multiplication
* Division
* Modulus (used to find the remainder of division, i.e. 8 % 5 is equal to 3)
* Addition
* Subtraction

Referencing variables by utilizing the # sign and then the key of the variable. In order to reference a variable, however, the rule using the expression must have the variable in the rule’s “Required Variables” list. A referenced variable, but has no attached Boolean expression should have the “Apply condition to variable” box unchecked. The maximum amount of variables in a single rule is 10. It should be noted that referencing a variable incorrectly or referencing a variable that does not exist will allow the rule to be saved, but will cause the calculation to fail when the expressions are evaluated later.

Referencing a variable, such as “#age” will retrieve the value in that variable so that the user can use the value. In other words, if the age field was input as 55, then 55 replaces “#age” when evaluated. When using an explicit value do not use the # sign. For example, multiplying the coefficient by 10 would be done by using the expression “#coefficient \* 10.0”. When referencing the procedure variable by using #procedure, there must also be a qualifying value. The available values for procedure are “#procedure.rvu” (the RVU code for the procedure), “#procedure.cptCode” (the assigned CPT code), “#procedure.complexity” (the complexity of the procedure). Currently the procedure variable is the only variable that has multiple attributes.

#### Rule Boolean Expressions

Boolean expressions will evaluate to true or false. One example would be 6 + 3 < 10. This would evaluate to true. However, 6 + 3 would not have a true or false value after evaluation because there is no Boolean expression to evaluate.

Boolean operators that are available only in the Boolean expressions are:

* Relational operators
* < (less than)
* (greater than)
* <= (less than or equal to)
* >= (greater than or equal to)
* Equality
* == (the two operands are exactly equal to each other; the sign must be a double equal sign to test equality)
* != (the two operands are NOT exactly equal)
* Logical operators
* “and” (both of the operands need to be true for an “and” to be true)
* “or” (one of the operands needs to be true for an “or” to be true)
* Negate a Boolean result by using the exclamation point. For instance, “!true” would evaluate false and “!false” would evaluate true.

Putting a quote into an expression will denote a string of characters and will not be present in the final evaluation. As such, “#surgicalSpecialty == ‘ENT’” would mean that the value of the variable surgicalSpecialty evaluates to true if it equals “ENT”. This expression would evaluate to true if surgicalSpecialty was equal to “ENT”. This case would be equivalent to “’ENT’ == ‘ENT’”.

The values to which Boolean (checkbox) variables evaluate are always either true or false. Therefore, the expression “#dnr == true” is equivalent to “#dnr”.

#### Rule Examples

For the rule of 10% weight loss in the past 6 months, here is what we would expected to see in the expressions:

* Boolean expression for the variable Weight: “#weight < #weight6MoAgo \* 0.9”. Reference both variables by their unique keys. Using the reference with the number sign grabs the actual value of that variable, so if the patient’s weight was 190 and the weight 6 months ago was 220, then the expression is “190 < 220 \* 0.9” which would evaluate to true and would apply the summand expression.
* Summand expression would be “#coefficient” because we are only adding the coefficient tied to this rule if both of the Boolean expressions are true.

For the rule of an age multiplier when Preop Disseminated Cancer, there is no condition present for age, so the age variable is included, but disabled. Since we need to determine if the disseminated cancer has the value of “Preoperative” then we use the appropriate expression shown. The summand expression multiplies the aforementioned age variable by the coefficient if the cancer Boolean expression is true.

#### Procedures

The ASRC Administrator selects “Manage Procedures” (Figure 22) to

* See the number of procedures in the database (Figure 23)
* Import a new procedure definitions through a CSV file (file entries are validated with warning messages provided to the Administrator user) (see Figure 24 for CSV sample)
* Replace all of the Procedures
* Return Home to the Administration home page

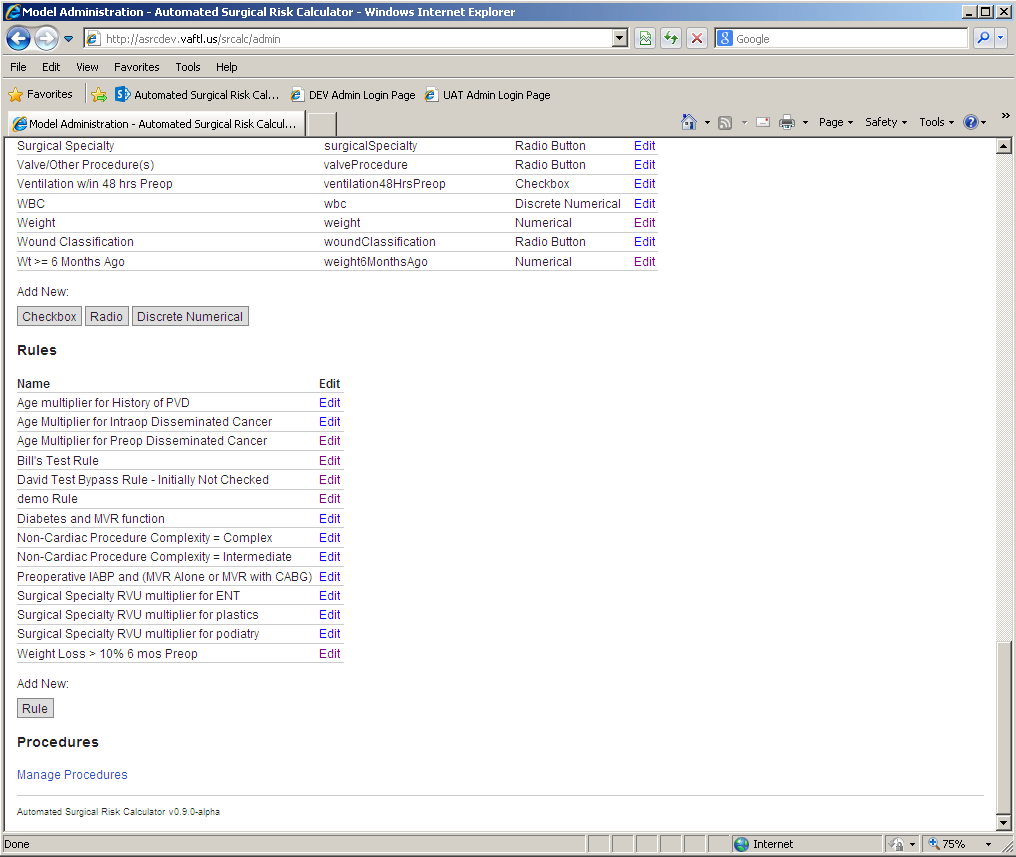


Figure 22 - Manage Procedures

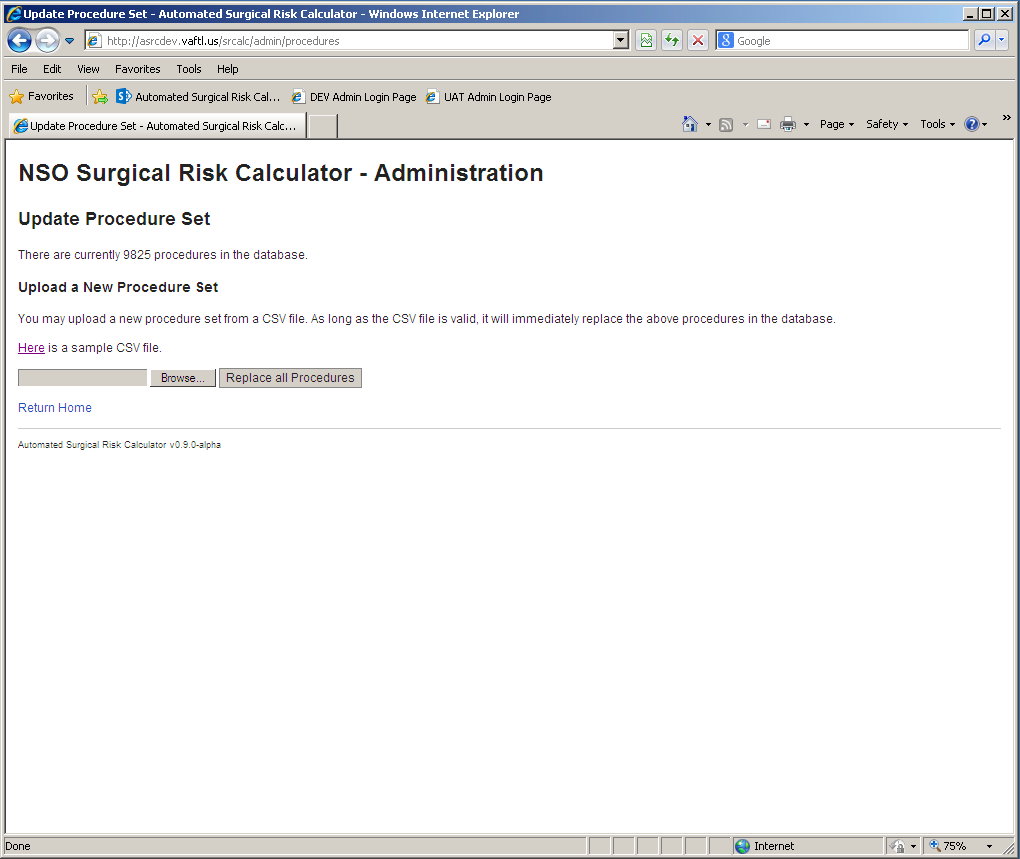


Figure 23 - Update Procedures

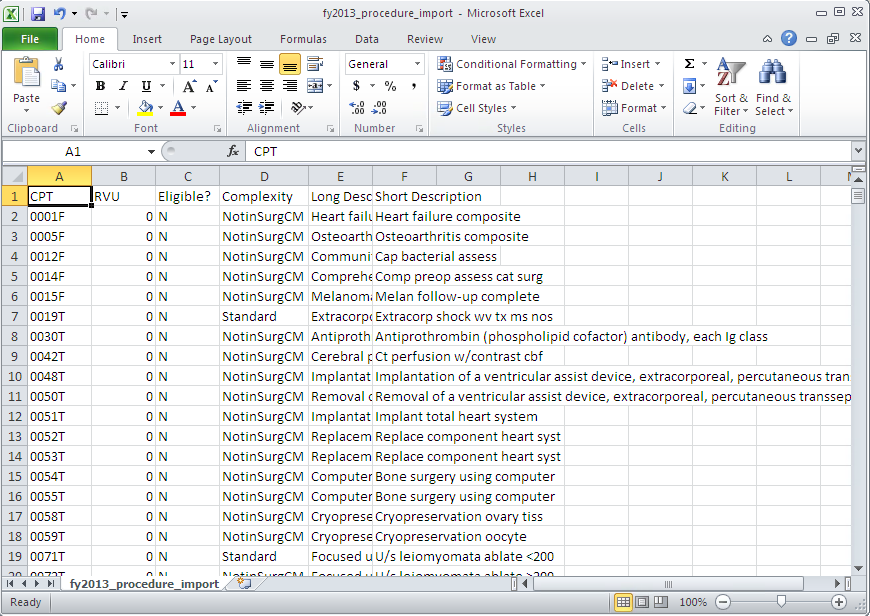


Figure 24 - Procedure CSV File Example

### Reports

There are two reports available within the ASRC Administration Function: Summary and Utilization. These are accessed by clicking the appropriate link below (Figure 25).

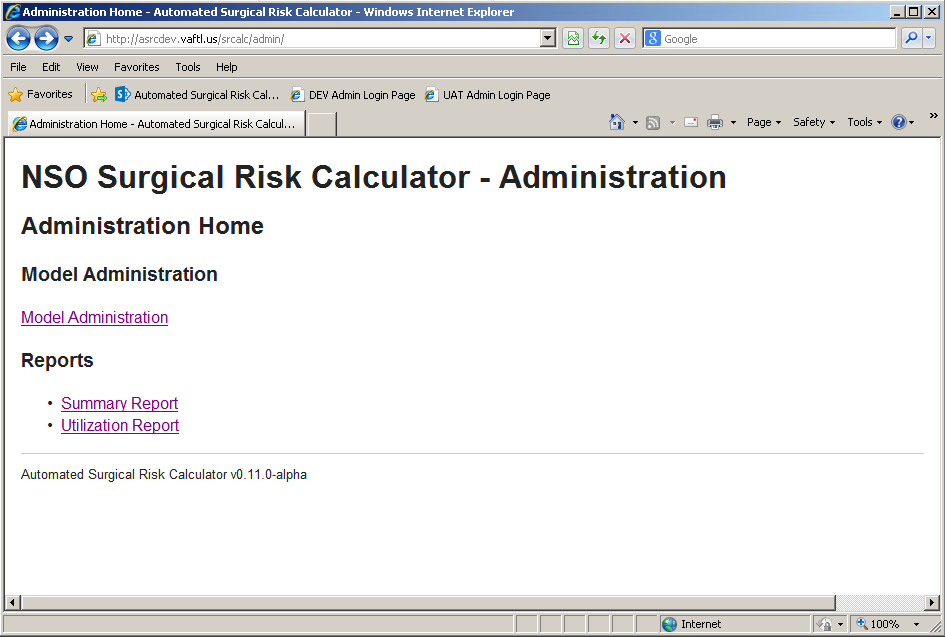


Figure 25 - Administration Home Page - Reports Section

#### Summary Report

The Summary Report provides individual calculation outcomes grouped by CPT Code, Surgical Specialty, Facility, User Type, and Risk Model Name. This report will allow statistical analysis on both outcomes and usage by certain user groups.

**Summary Report Parameters**

On the Summary Report parameters page the user can select a date range, surgical specialty, individual CPT code, and station number (Figure 26). Default fields will return all available data for that selection. For example if the user clicks “Generate Report” without making any selections it will return all data available for each category (all dates, specialties, CPT codes, and Facility (Station Number).

**Summary Report Format**

The Summary Report will display the following information (Figure 27),

* Date The Report was generated
* CPT Code
* Surgical Specialty
* Facility (Station Number)
* Provider Type
* Signed
* Risk Model
* Outcome (%)

Summary Report Parameters


Figure 26 - Summary Report Parameters

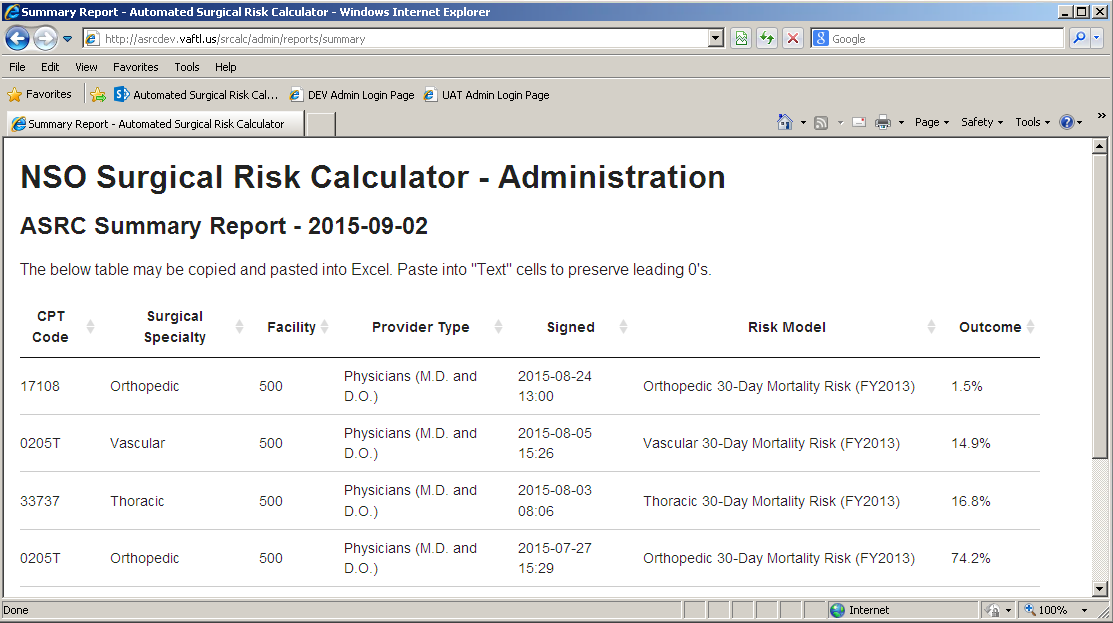


Figure 27 - Summary Report Sample

#### Utilization Report

The Utilization Report provides the number of uses and whether the calculation was signed or not. This report will allow the monitoring of the level of use in the field.

**Utilization Report Parameters**

On the Utilization Report parameters page the user can select the date range for the report (Figure 28). Default date fields will return all available data. For example if the user clicks “Generate Report” without indicating a date range the report will contain all available data regardless of date.

**Utilization Report Format**

The Utilization Report will display the following information (Figure 29),

* Date The Report was generated
* Date Range (if a Date Range was selected on the Utilization Report Parameters page)
* Specialty
* Total number of calculations
* Number of calculations that were signed
* Time to First Run Average (Minutes)
* Time to Sign Average (Minutes)

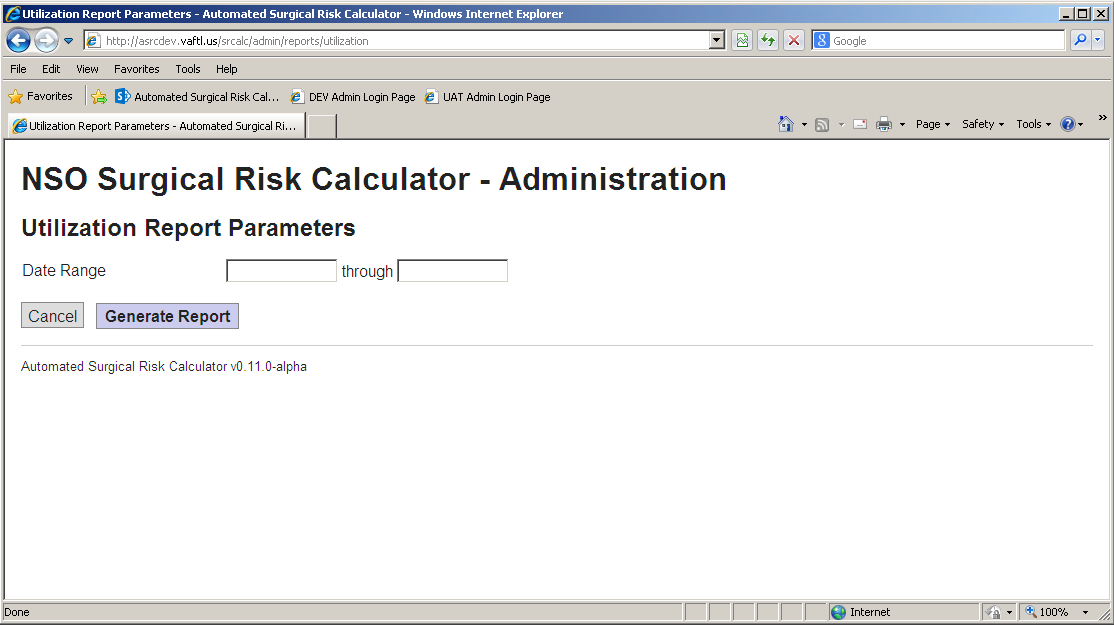


Figure 28 - Utilization Report Parameters

Utilization Report Sample


Figure 29 - Utilization Report Sample

## Changing User ID and Password

There will be no need to change User ID and Password specifically for the ASRC Tool.

## Exit System

To exit the system, simply close the browser window.

# Attachment A – Acronym List

Table 1 - Acronym List

| Term | Meaning |
| --- | --- |
| ASA | American Society of Anesthesiology |
| ASRC | Automated Surgical Risk Calculator |
| BMI | Body Mass Index |
| CPRS | Computerized Patient Record System |
| CPT | Current Procedural Terminology |
| CSV | Comma Separated Values |
| DNR | Do Not Resuscitate |
| EHR | Electronic Health Records |
| NSO | National Surgery Office |
| POC | Point of Contact |
| PWS | Performance Work Statement |
| RVU | Relative Value Unit |
| SQL | Structured Query Language |
| T4 | Transformation Twenty-One Total Technology |
| TIU | Text Integration Utility |
| VA | Department of Veterans Affairs |
| VASQIP | Veterans Affairs Surgical Quality Improvement Program |
| VistA | Veterans Health Systems and Technology Architecture |