# I - Tour of the Web Client

## Introduction

The functionality described in Part I of the user guide assumes that you have received the necessary prior authorizations to access a SHRINE network at your institution. The process for this authorization varies according to your institution and network.

For example, the Harvard SHRINE network uses a tool called the Data Steward Application to request and approve access to SHRINE. These and other details on the authorization process used specifically for the Harvard network are included in a separate guide ("the Harvard SHRINE network"), which may also be a useful example for other networks to reference when setting up their own SHRINE implementations.

Details of shots presented in this document may vary from network to network. Each network uses a different ontology and may be uniquely configured. We have attempted to note where these from this document may be expected. If you have questions, please contact your local SHRINE representative.

## User Interface

The SHRINE web client user interface  (UI) is based on the web client developed for i2b2 and RPDR. The UI is divided into four modules: **1** Terms, **2** Query Tool, **3** Query Status, and **4** Previous Queries. The main menu is in the upper right **5**.
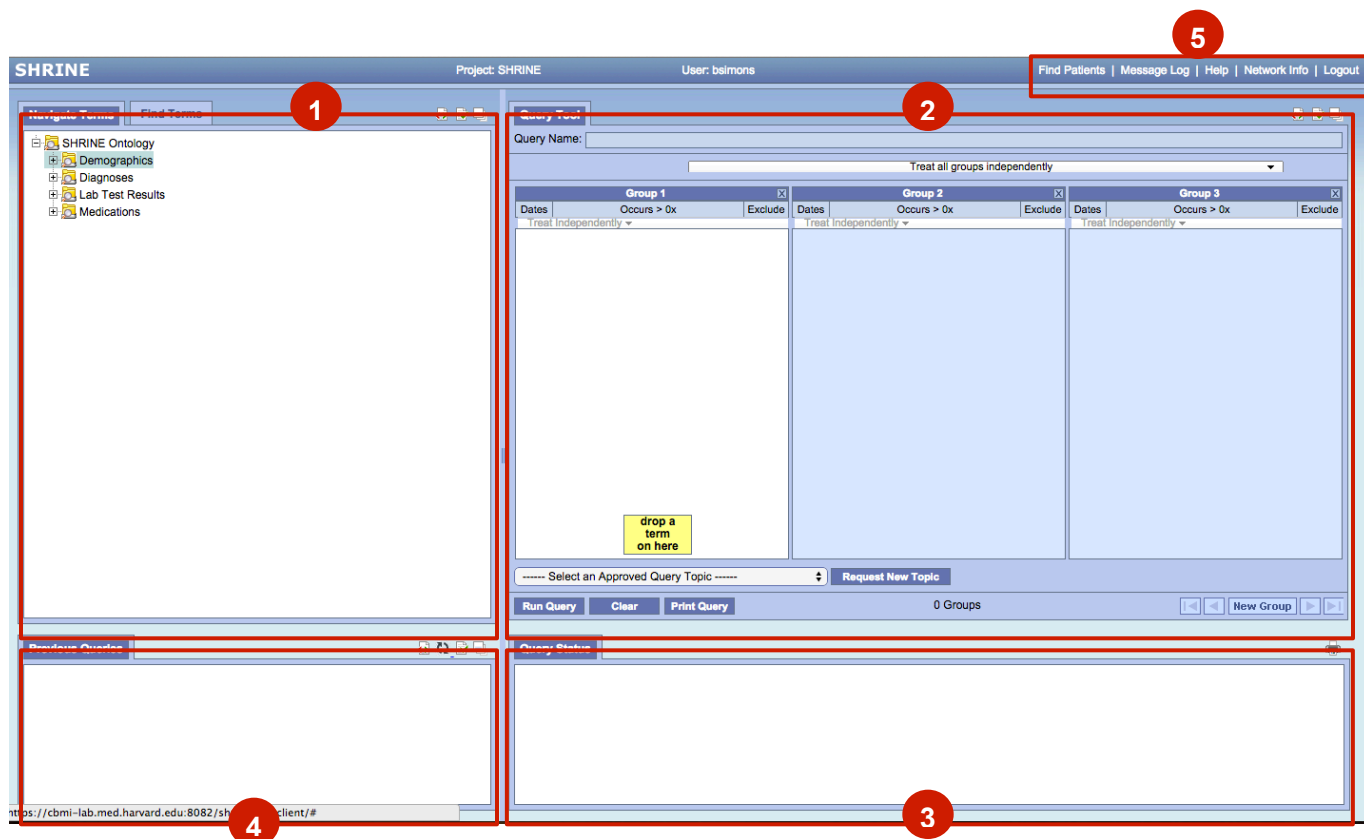
# 1 - Terms Module

Choosing between the two tabs in the Terms module allows you to browse (**Navigate**) or search (**Find**) the medical terms you wish to query.
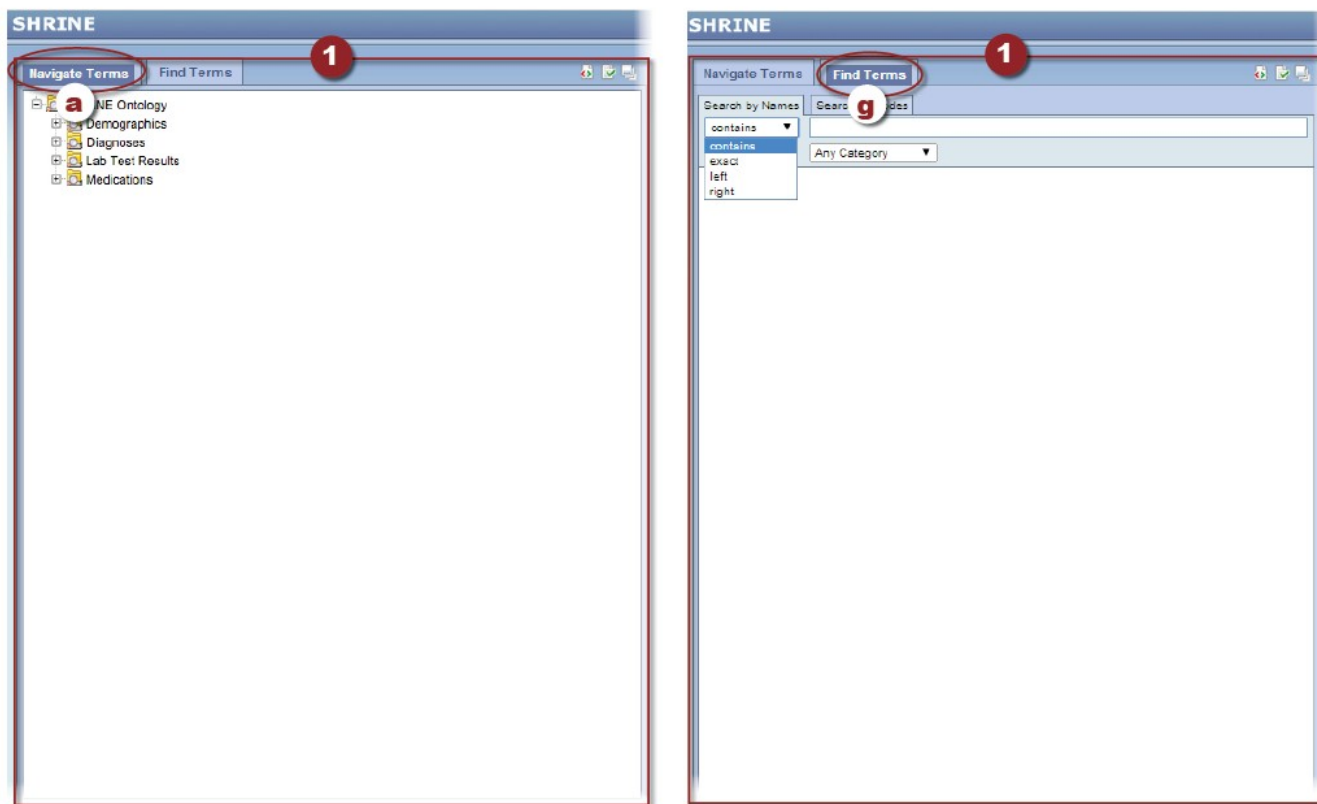


*Two tabs of the Terms module: **Navigate Terms** (left; see **a–f** below) and **Find Terms** (right; see **g–i** below). Only one tab is visible at a time in the web client.*

**a** **Navigate Terms tab –** This is the default tab of the Terms module. Use Expand (+) and Compress (-) buttons to browse through available patient characteristics in the SHRINE Ontology, which are organized into four main folders:

> **b** Demographics
>
> **c** Diagnoses
>
> **d** Lab Tests
>
> **e** Medications

Each folder contains multiple categories that are displayed in subfolders containing more specific terms by which you can refine your query. The contents of these folder may vary by SHRINE network, and may thus deviate from As you navigate through the folders and locate a term or category of terms that you would like to include in your query, drag that entry to the Query Tool and drop it in a Group panel. For more information see the section, **2-- Query Tool Module**.
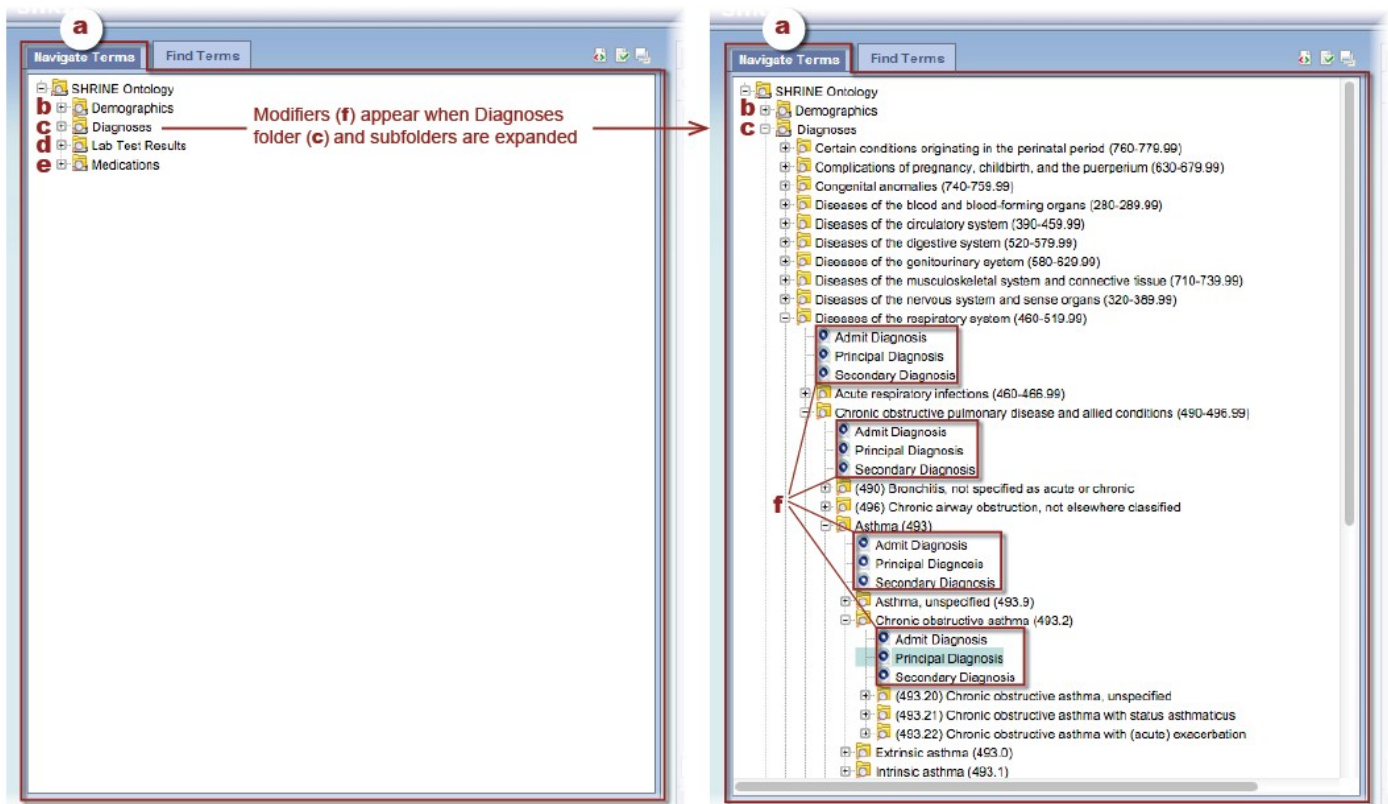
> **f** Modifiers

A term may also contain modifiers, which are subsets of that term that allow you to further refine your query.

Modifiers are indicated by a blue dot [ 🔵 ] in place of a folder icon. For example, as shown below, terms within Diagnoses might contain the following three modifiers:

- Admit Diagnosis
- Principal Diagnosis

- Secondary Diagnosis



*The **Navigate Terms** tab of the Terms module, shown here with the four main term categories collapsed (left) and with four levels of Diagnoses categories expanded (right). Modifiers (**f**) are also shown within the expanded categories.*

**g** **Find Terms tab** – To search for specific characteristics on which to query, click the Find Terms tab and then search by either Names or Codes.
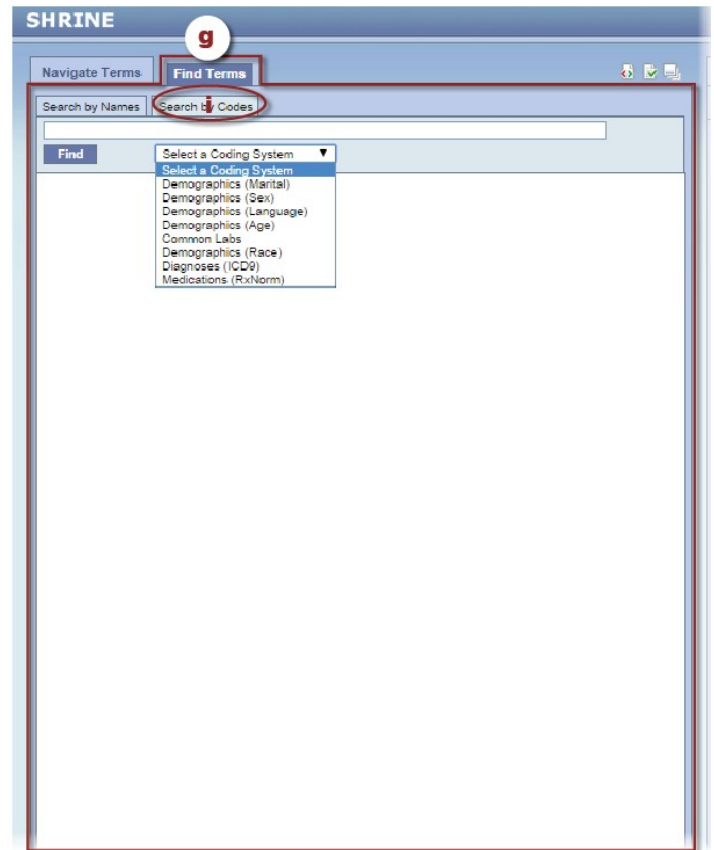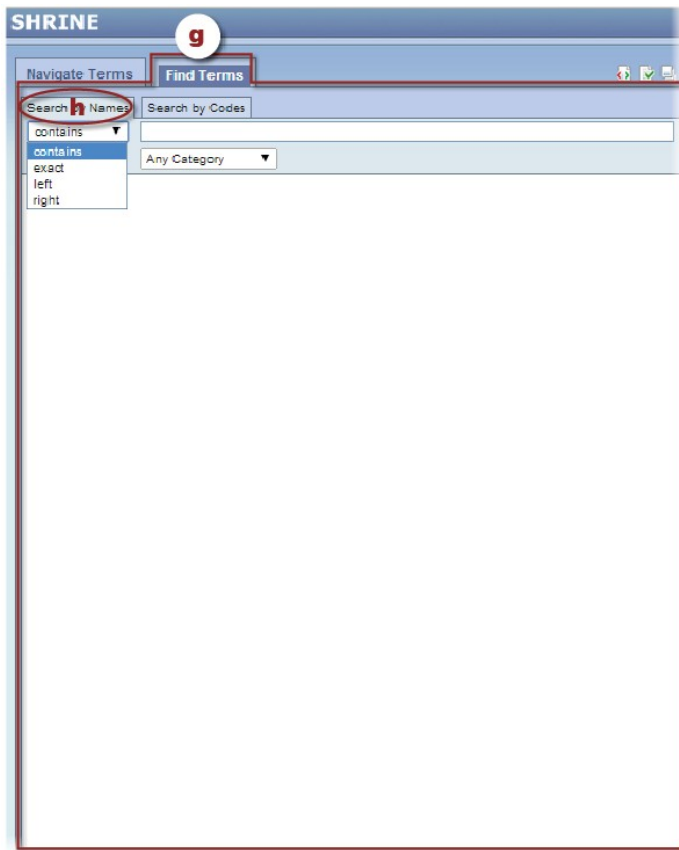
**h** **Search by Names**

1. Click the pull-down list to select the logical search operator. Options are: Contains, Exact, Left (starts with), or Right (ends with).
2. Enter your search string in the text field beside the operator pull-down list.
3. Click Find.

Note: the Category pull-down list under the text field can be left at Any Category because SHRINE is the only choice.

**i** **Search by Codes**

1. Use the "Select a Coding System" pull-down list to select the specific code type for the specific code on which you are searching. Coding system options include:
   - Demographics (Marital)
   - Demographics (Sex)
   - Demographics (Language)
   - Demographics (Age)
   - Demographics (Race)
   - Lab Tests
   - Diagnoses (ICD9)
   - Medications (RxNorm)

2. Enter the search term in the text field above the list.
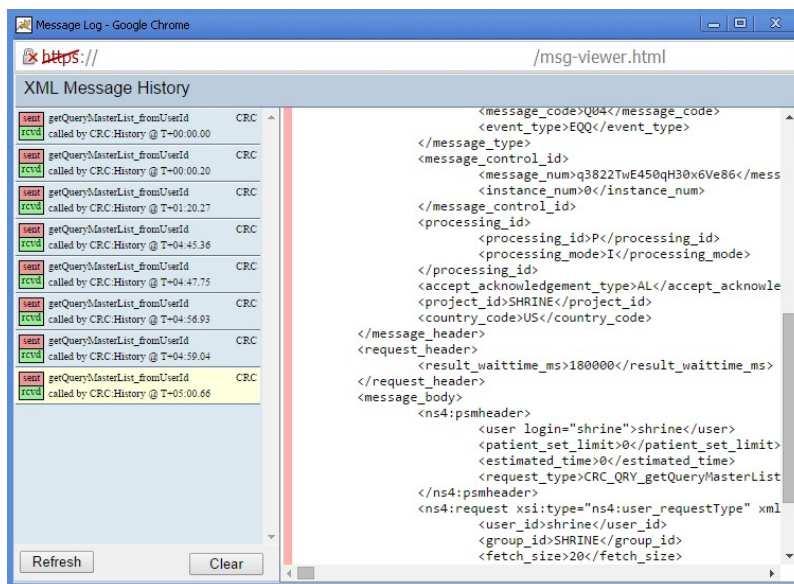
3. Click Find.

*The **Find Terms** tab of the Terms module; **Search by Names** tab (left) and **Search by Codes** tab (right).*

## Terms Module Icons

The three icons at the top-right corner of the Terms module, labeled **j – l** below, offer additional viewing options specific to the module.
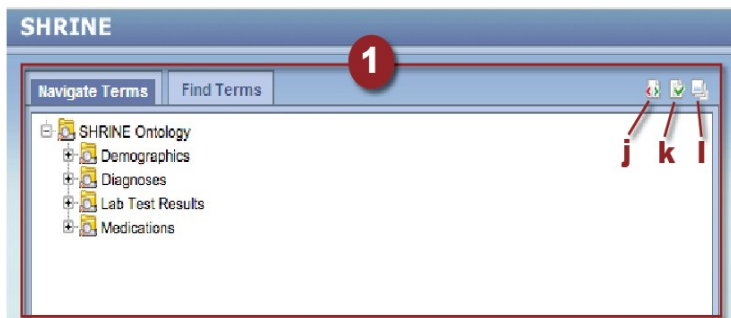


**j Show XML icon** – Click ⬚ to show XML Message History. A popup window like the one below appears.

**k** **Show Options icon** – Click [icon] to open the dialog box shown below, where you can select from the following options for navigating and finding terms:

- Maximum Number of Children to Display – Default is 200
- Show Hidden Terms
- Show Synonymous Terms
- Enable Patient Counts
- Use Short Tooltips
- Show Concept Codes in Tooltips
- Disable Modifiers

The options are the same for both the Navigating and Finding tabs, but each tab retains its own individual selections as you click from one to the other. If you go from Navigating to Finding and change options for Finding, the Navigating options will not automatically change along with them.
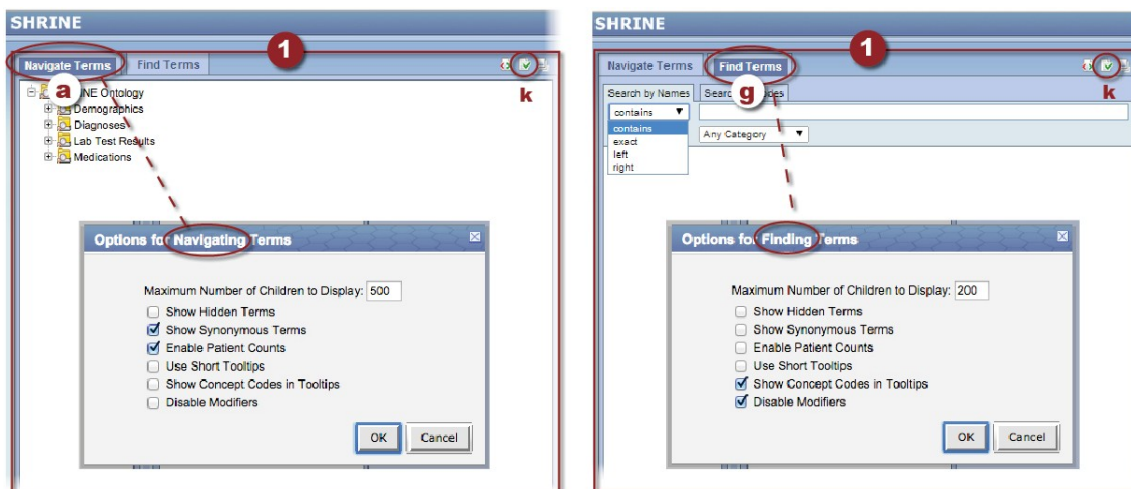


**l** **Resize Workspace icon** – Click [icon] to toggle between expanded and compressed (default) views of this module. When expanded, the Terms module will extend to the bottom of the web client window and the Previous Queries module will disappear. Clicking the icon a second time will return both modules to their default sizes.

# 2 - Query Tool Module

The Query Tool enables you to create simple and complicated queries. The following overview describes the Query Tool fields and functions. For more information about **constructing a query** see the section, Constructing a SHRINE Query.

**a** **Query Name** – Each time you click Run Query. You can name the query or use the default name inserted by the tool, which is a string constructed from your term selections at the time at which you run the query. Once you run the query, you cannot change its name. The name will also be used to identify your query parameters in the Previous Queries module.

> **Harvard users:** Note the difference between Query Name, which applies to an individual query instance, and Query Topic (**e** below), which is a label describing the broader subject of inquiry that is your purpose for using SHRINE.

**b** **Group** panels (Group 1, Group 2, etc.) – This is where you drag and drop terms from the Terms module to add them to your query. Query groups represent a set of patients defined by the terms within them and by any constraints applied to the terms. Terms within a group operate as OR logic, while terms in separate groups operate as AND logic. Right-click a term to delete it from your query or to set a specific value.

**c** **Constraints** – Dates and Occurrences options are located below the Group label. Click **Dates** to specify a date range for the terms in that Group, or the **Occurs > 0x** button to specify the number of times the term must appear for the same patient. Note: not all terms accept all constraints.

**d** **Exclude** –  Each group has an Exclude button.  Use this constraint to exclude the group.  The green box reading "one or more of these" will change to a red box that reads "none of these."

> **e** – **f** **Harvard users**:
>
> > **e** **Query Topic** pull-down list – Before you can run a query, you must select a preapproved general Query Topic to which this specific query relates. (For a detailed description of the approval process for Harvard SHRINE, see Section 2 of the separate Harvard SHRINE guide, on the Data Steward Application.)
> >
> > **f** **Request New Topic** button – Clicking this button opens the Data Steward application in a new window. To run a query that does not conform to any of your approved Topics in the drop-down list, you first must request and receive approval for a new Topic. The Data Steward administrator monitors query activities. If you select query terms that do not apply logically to your topic, the administrator can suspend your access to SHRINE, **and a review of your activities will be required.**

**g** **Run Query** button – When you complete construction of your query using the terms, constraints, and options available, click Run Query to start the query process. You can run additional queries by retaining the existing terms in the Query Tool fields, and then adding new criteria to the query.

**h** **Clear / New Query** button – Clears all Query Tool fields and starts a new query. To remove an individual query term, right-click on the term.

**i** **Print Query** button – Opens a printable view of your query and its results. When the new window opens displaying the query information, press Ctrl+P (on a PC) or Command+P (on a Mac) to invoke your web browser's Print dialog, and proceed as usual.

**j** **New Group** button – Click to add additional groups of terms to your query.

**k** **Group page controls** – If you add new groups to the three default groups displayed in the tool, they may exceed the space in the window you have open. If so, use the page controls to navigate to your additional groups.

**l** **Query Constraints –**The options on this list are used to define group encounters and construct temporal queries. Defining encounter groups and creating temporal queries are explained in more detail in Part II.
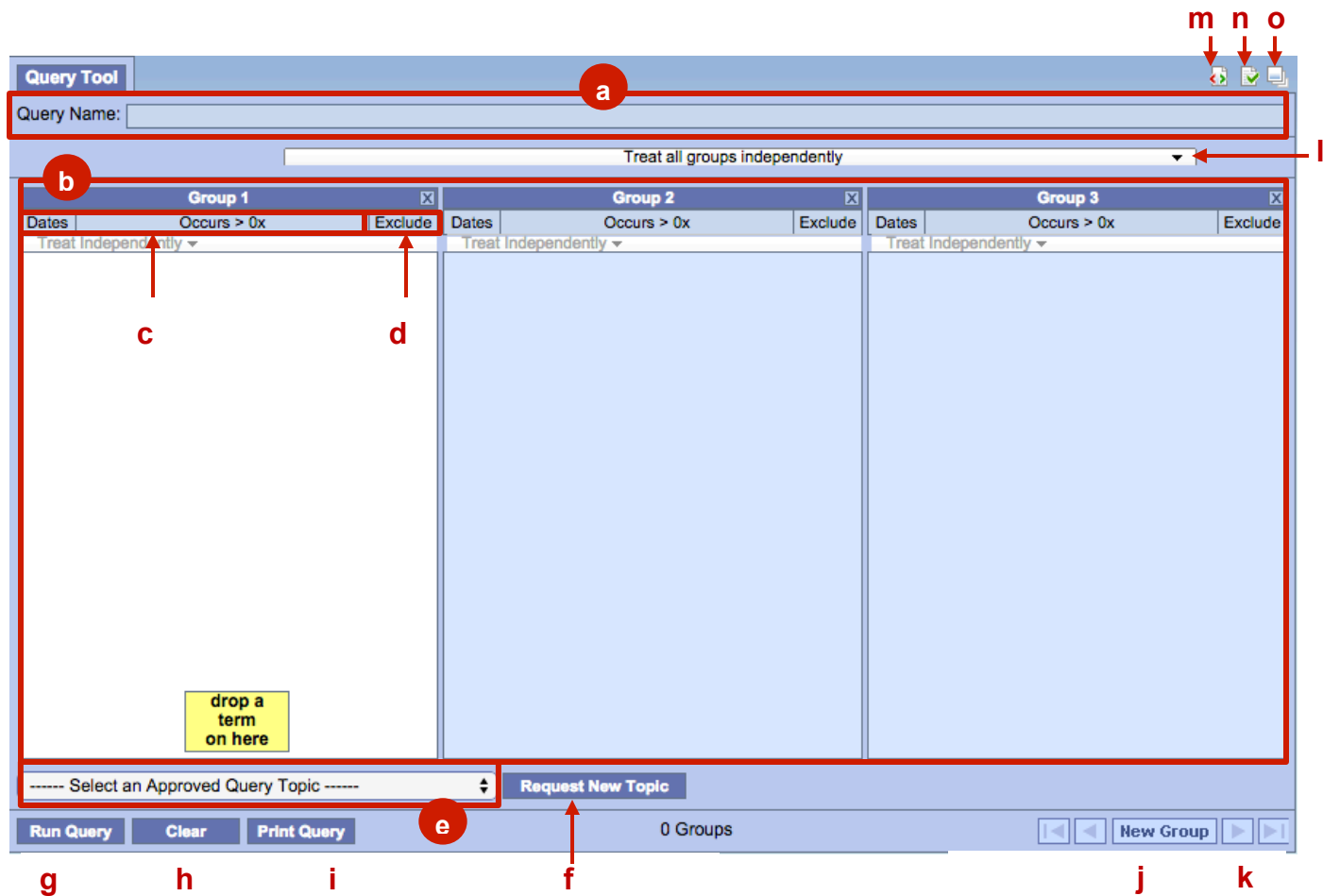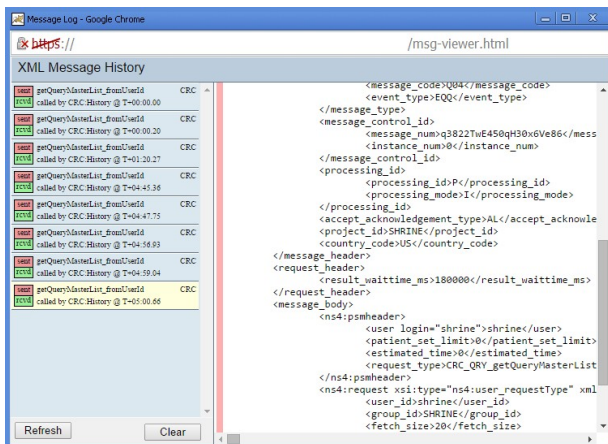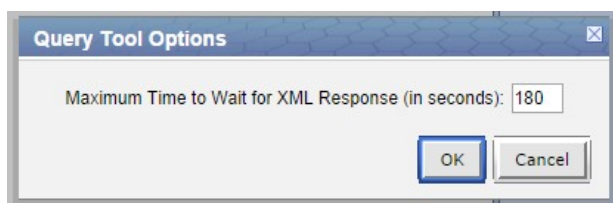
## Query Tool Module Icons

The three icons at the top-right corner of the Query Tool module offer additional viewing options specific to the module:

**m Show XML icon** – Click to show XML Message History in a window that is similar to the one below.



**n Show Options icon** – Click to select the Maximum Time to Wait for XML Response (in seconds). This is the length of time the system will wait for query results. If your query does not process completely within this length of

time, it returns only those results that completed processing, which may only be for a subset of the institutions being queried. If no institution's data completed processing, the query does not return any results.



o **Resize Workspace icon** – Click  to toggle between expanded and compressed views of the module. When expanded, the Query Tool module will extend to the bottom of the web client window and the Query Status module will disappear. Clicking the icon a second time will return both to their default sizes.

# 3 - Query Status Module

The results of your query are displayed in the Query Status module. These results are saved when you log out of SHRINE and can be accessed during future sessions in the **Previous Queries module** described in section 4.

View and/or download your results by selecting from the tabs at the top of the module, seen below:
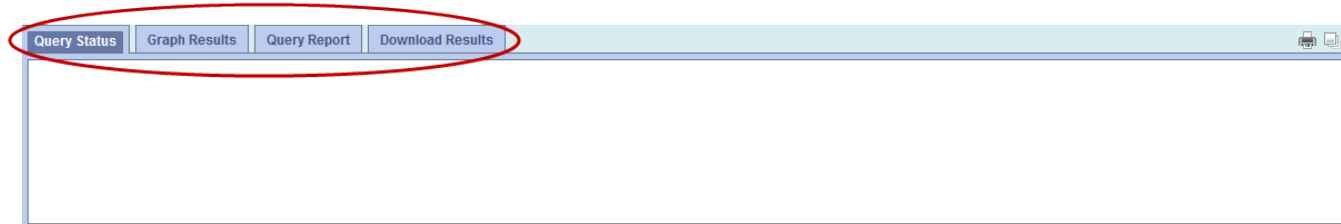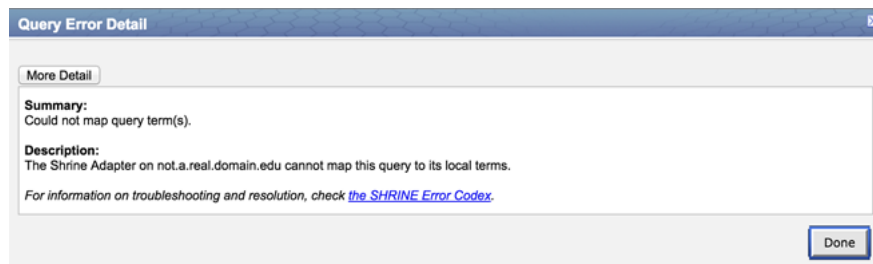


## Query Status tab

Search results open by default in the Query Status tab. Information provided can include:
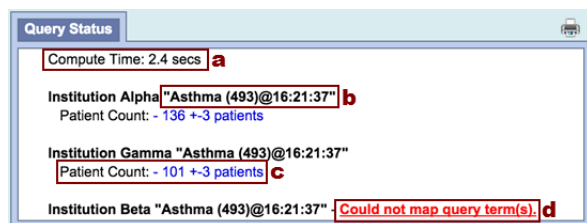


a **Elapsed execution time**
b **Query name**
c **Aggregated query results** from each participating hospital
d **Query error**

If your query returned between zero and 10 patients, your results display as "10 patients or fewer."



Click any query errors (**d**) to pull up a **Query Error Detail panel** with more information, including a description of the error and a link to troubleshooting help.

## Graph Results tab

The Graph Results tab displays the total patient counts (with obfuscated numbers) for each institution in a pie chart. Any breakdown criteria (Vital Status, Gender, Age, and Race) selected when performing the query will be displayed in graphs below the patient count chart, with different colors representing the results from each of the institutions queried.
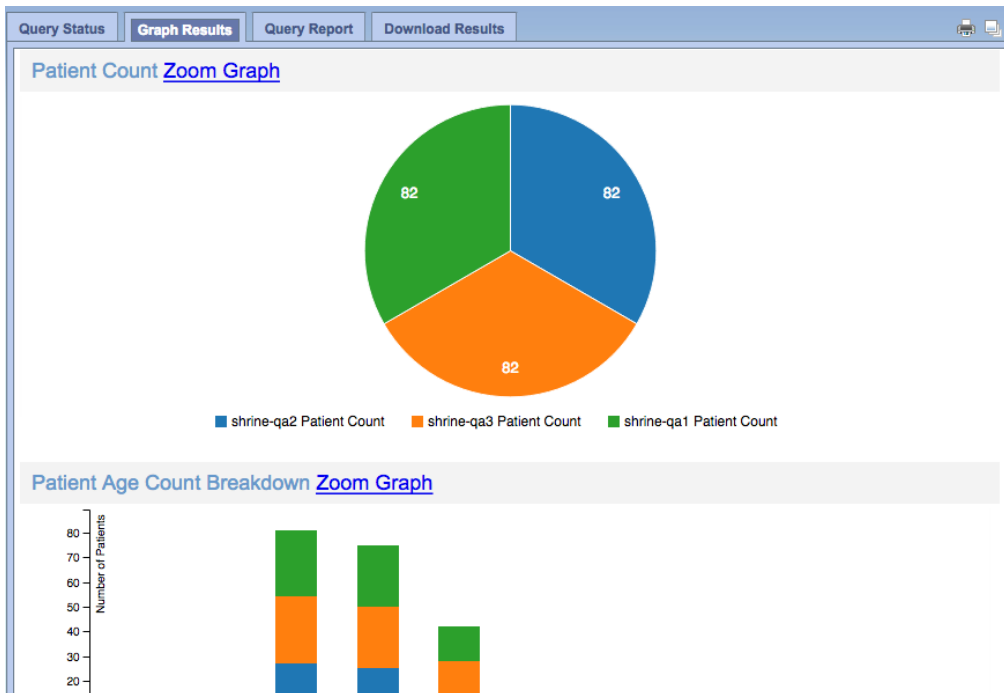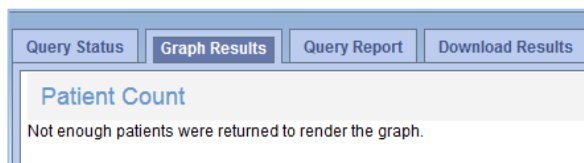
Click on the **Zoom Graph** link to open a larger view of a graph.
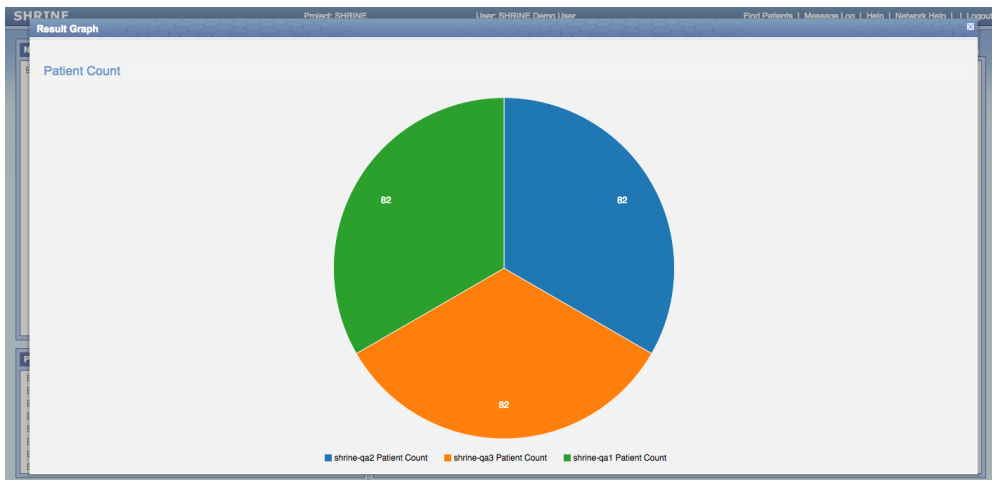


If your query returned between zero and 10 patients, instead of a pie chart, you will see the message: "Not enough patients were returned to render the graph."

## Query Report tab

The Query Report tab displays a printable summary of both the query details and results. Click the **Print Report link** in the top or bottom left corner of the module to print the content of the Query Report.

The top of the report lists: the name of the query, how long it took to complete, and the user who performed it. The following sections are beneath it:

**Query Definition** – contains a summary of all query criteria selected:

1. Temporal constraint
2. All Groups
    a. Name of all search term(s)
    b. Path of all search term(s)
    c. Exclusion constraint
    d. Date range
    e. Occurrence constraint
3. All Events (if selected)
    a. Name of all search term(s)
    b. Path of all search term(s)
    c. Exclusion constraint
    d. Date range
    e. Occurrence constraint
4. Order of Events (if selected)

**Query Results** – contains separate tables listing the patient counts and counts for each of the breakdown criteria selected, with one column for each institution queried, as well as graphs of results.

## Download Results tab

The Download Results tab displays the patient counts and any breakdown results in a single table, with one column for each institution queried. Click the **Download CSV File** link at the top left corner of the module to open or save the results table as a CSV file.
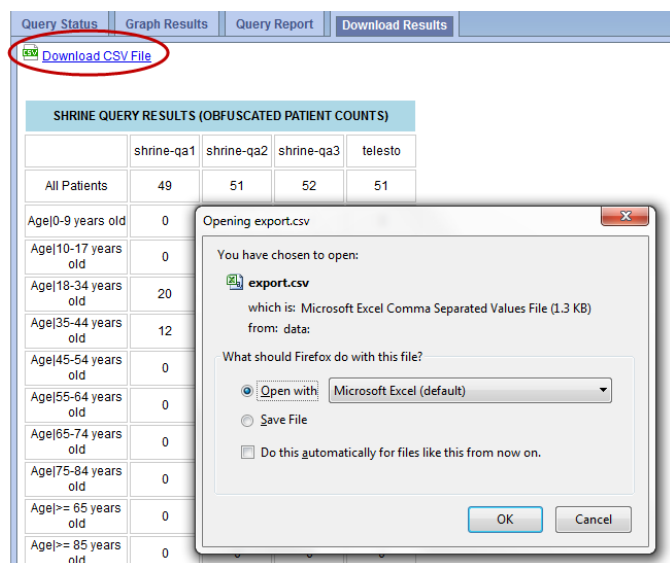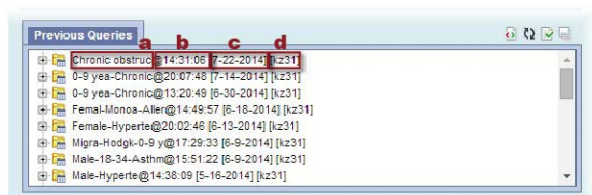


# 4 - Previous Queries Module

The Previous Queries Module is designed to display the most recent queries run by a user. A previous query [▦] is created when a query is run from the *Query Tool*. All queries are stored and displayed in the Previous Queries Module. These previous queries can be used to run new queries or to view the results of the queries in the Query Status Module.

A "(t)" preceding the query name indicates a temporal query.



In addition to query name and time stamp (**a** and **b** carried over from Query Status module), the entry also contains: **c Date stamp** [mm-dd-yyyy] and **d Username** [xxnn]

## To View the Results of a Previous Query

There are two ways in which you can view the results of a previous query.

1. Expand the previous query to view the results in the results folder [🕐].
2. Drag the previous query to the Query Tool to view the results in Query Status

The results associated with a previous query are determined by the query result type(s) that are selected when the query is run in the Query Tool view.

## Expanding a Previous Query

1. Double-click the name of the previous query or click [+] to open the previous query folder [▦]

2. Open the results folder [🕐] to display the results available for the previous query.

For more information on the different result types refer to the section on "Breakdowns".
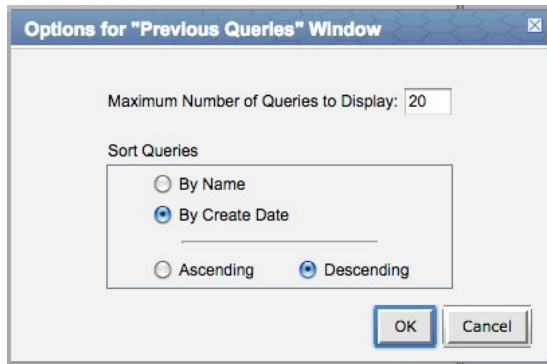
## Previous Queries Module Icons

The four icons at the top-right corner of the Previous Queries module offer additional viewing options specific to the module:

**e Show XML icon**  – Click to show XML Message History.

**l Refresh icon**  – Click to refresh your previous queries list

**g Show Options icon**  – Click to specify the Maximum Number of Queries to Display (default is 20) and select how to Sort Queries (Name or Create Date, Ascending or Descending).



**h Resize Workspace icon**  – Click to toggle between expanded and compressed views of the module. When expanded, the Previous Queries module will extend to the top of the web client window and the Terms module will disappear. Clicking the icon a second time will return both to their default sizes.

# 5 - Main Menu

The main SHRINE menu is located in the top-right corner of the web browser window. Options include:

- **Find Patients –** The default web client page containing the four modules
- **Message Log –** A development tool used by technical staff to track system functions
- **Help –** The link to this guide
- **Logout –** Exit SHRINE

# II How to Construct a SHRINE Query

The following sections describe the basic components of a SHRINE query.  Temporal queries are covered in more detail in the section, **Constructing Temporal Queries**.

## Hierarchy of Terms

Patient queries are composed using medical terms defined in the **SHRINE Core Ontology.** Because the Core Ontology contains a vast number of terms, including >13,000 diagnoses and >4,500 medications, hierarchical relationships are used to organize the terms into categories. These **term categories** are represented by folders [🗀], which you can navigate using the Terms module of the web client. Expand [⊞] folders to reveal increasingly specific term category subfolders and, ultimately, **discrete terms** (represented by document icons [📄]).

## Query Groups and Boolean Search Operators

As you locate each term you wish to search for, add it to your query by dragging and dropping its name to a Group panel in the Query Tool module. Boolean logic is applied as follows:

> **OR** – Place two or more terms in the **same Group** if the patients in your query are only required to match one or another of the terms, but not all of them.

> **AND** – If you have two or more terms that patients must match both/all of to be counted in your query, place each required term in its own **separate Group.**

> **NOT** – To make your query specifically include patients who do **not** match a selected term(s), drag that term(s) to a **separate Group** panel and click **Exclude** (at the top of the panel, under the Group label).

Note: AND logic is applied before OR logic. For example, if you drag a diagnosis of Asthma to Group 1 and then drag demographic terms of 10-17 years old and 0-9 years old to Group 2 (i.e., 10-17 years old OR 0-9 years old), the query first processes diagnosis of asthma AND demographics of 10-17 years old; it then processes diagnosis of asthma AND demographics of 0-9 years old. The two results sets are then added together to return the final query results.

## Term Specificity

In addition to discrete terms, you can also use term categories (folders or subfolders) as query items. However, dragging a folder to the Query Tool module is equivalent to dragging every discrete term within that folder (and/or its subfolders), which may be too broad and take the query too long to process. Therefore, the maximum number of discrete terms allowed in a folder to be selected for querying is 120. If it contains more, you must expand it and select something more specific.

## Constraints

Constraints are used to narrow down the search criteria to a specific time frame, occurrence, or value. There are three categories of constraints: **Query Timing** Constraints, **Group** Constraints and **Item** Constraints. These categories are described in the following sections.

Query constraints are accessed from the drop-down list, shown as (**a**), in the screen capture below.
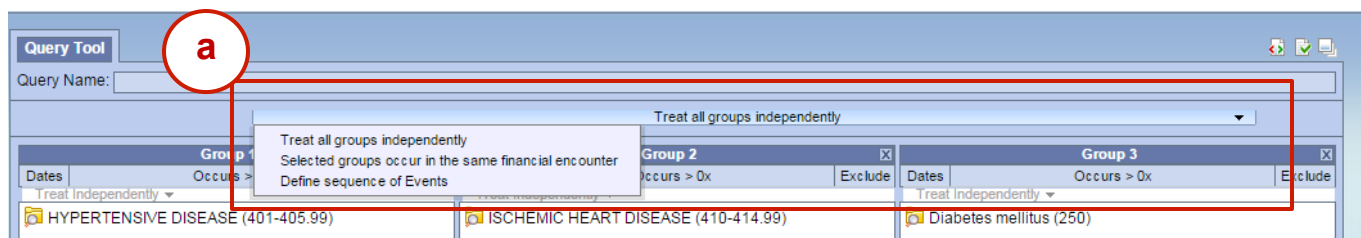
## Query Timing Constraints

Query timing constraints determine panel timing constraints used to constrain the query at the group level. Query timing options are 1) Groups that occur in the same **Financial Encounter** and 2) **Temporal** (events based) **Queries**. Encounter queries are described below. For more information about event based temporal queries see the section, **Temporal Queries.**

### Encounter Based Queries

Encounter based queries utilize the visit / encounter information (**b**) along with the terms defined to determine if a patient meets the search criteria.

In the following example, we are asking for all patients who have a diagnosis of Acute MI documented at *any time* (**c**) in their history. These patients also have to have a medication with a dose greater than 500 mg *and* a medication that is taken once a day documented during the *same encounter (***d***)*.
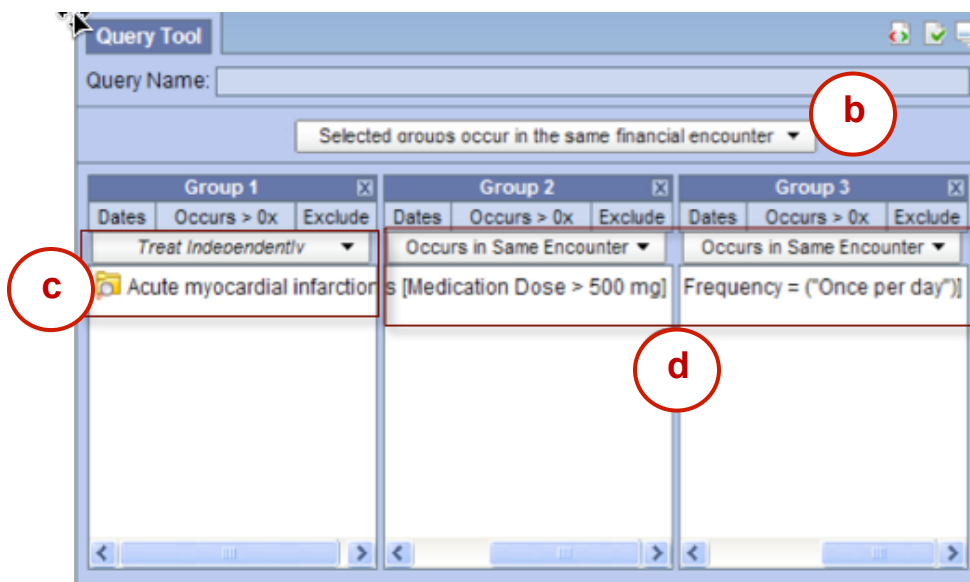


## Group Constraints

Group constraints are selected at the group level, and are shown as (**e**) in the screenshot below. There are four group constraints:

- **Date**
- **Occurrence**
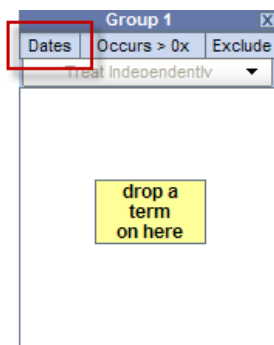- **Exclusion**
- **Panel Timing**
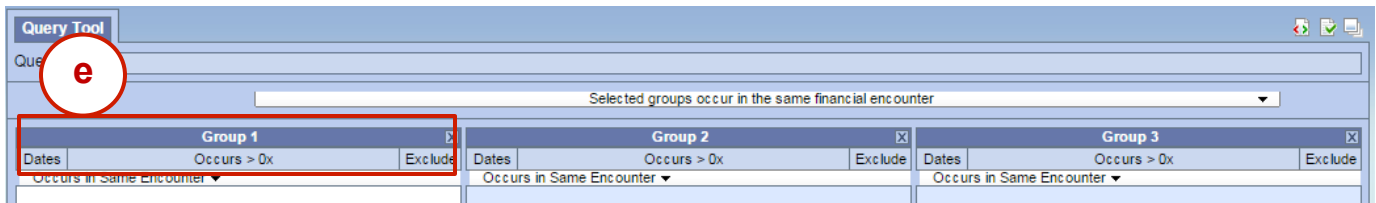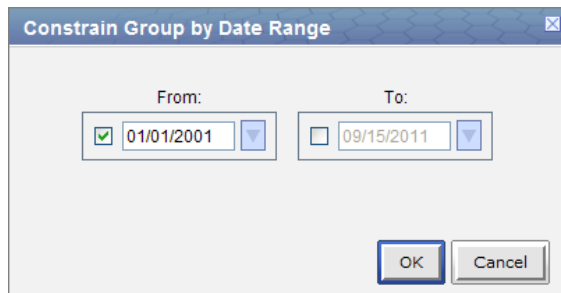
These constraints are described below.

## Date Constraint

A date range is used when determining eligibility.

Click **Dates** to open the *Constrain Group by Date Range* dialog. Specify a date range in which you want the term to appear in the patient record.



**Specified date range**: **To** and **From** dates are defined. Only data with activity within the defined date range will be used.



**Specific start date**: only the **From** date is defined. Data from the defined start date to the latest date available. No end date defined.
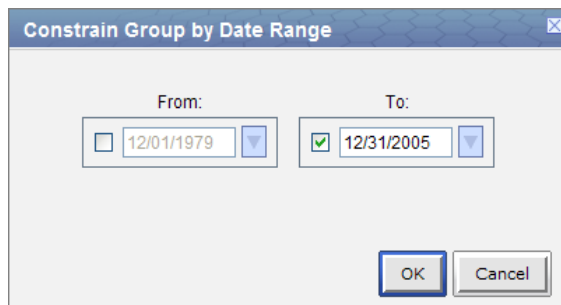


**Specific end date**: only the date to is defined. All data up until the defined end date - no start date defined.

## Occurrence Constraint

You can define the number of times the items listed in the group have to occur in order to be considered a positive "hit". This is done by clicking on the Occurs > 0x, which will open the Constrain Group by Number of Occurrences dialog. The number of occurrences of the items in the group are documented determines Eligibility.

The default, "Occurs > 0x," means the term will appear at least once and possibly more.

The selected number of occurrences will appear in the selection criteria section of the Group headings.



## Exclusion Constraint

Patients with observations for any of the items listed in the group panel will be excluded from the results.



Click Exclude to exclude the group. The information box changes to indicate none of these.

## Panel Timing Constraint

The panel timing constraint provides a way of binding one or more groups by an occurrence such as a financial encounter.  "Treat Independently" is the default option for the Panel Timing constraints.  (**f**) This option means the items in this group will not be bound to the items in any other group.

When using multiple groups you can constrain two groups based on the timing of when the items occur in a patient's record.

Before you can change any panel timing constraints you must first select the query constraint that corresponds to the type of timing constraint you want to define on the panel level. For example, to bind two or more groups by the patient's encounters you must first change the query constraint to *Selected groups occur in the same financial encounter*. Once this is selected all the panel timing constraints will be updated to *Occurs in Same Encounter*.
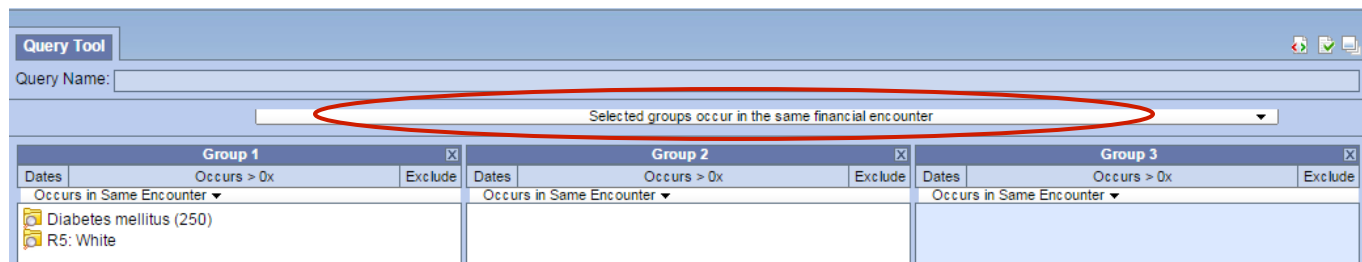


In the following example we are asking for all patients who have a diagnosis of Acute MI documented at *any time* in their history. These patients also have to have a medication with a dose greater than 500 mg *and* a medication that is taken once a day documented during the *same encounter*.

# Item Constraints

Item constraints are used to constrain a specific term within the group.
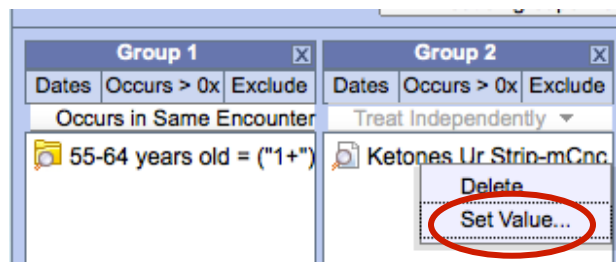
## Value Constraint

Some Ontology terms and modifiers can be further constrained by defining a value constraint.

Value constraints could be a numeric or text value, or a value flag.  For example:

- o High
- o Low
- o Abnormal

The value(s) associated to the item in the group panel will be used when determining eligibility.

When you drop one of these items into a **Group** panel, the **Value Constraint Editor** appears. You can use this editor to specify the values to use when the item is constrained. If an item that supports value constraints already exists in a **Group**, you can right click on the item and select "**Set Value...**" to launch the **Value Editor** for that term.



It is important to note that not all Ontology items (terms and modifiers) will have the ability to define a value constraint on them. Click on the drop-down arrow to change the operator or accept the default.

The type of value constraint and the options available for selection in the Choose Value dialog depend on the item selected.

Once you have defined the value constraint, it will appear next to the item in the group panel. You can either select a value or enter a value, pending on the Lab term selected.



# Constructing Temporal queries

Temporal queries are a specific type of query in which multiple events occur on a specific set of patients; these events are further defined by an interval of time. Components of a temporal query include:

1. Defining the set of patients to use when comparing events (*Population in which events occur*)

2. At least two events defined (*Event 1* and *Event 2*)

3. Define the interval or span of time in which the events occur in relation to one another (*Define order of events*)

The SHRINE web client is organized to facilitate defining the above components. The image below shows the starting point of the Temporal Query Tool view interface.

The steps for defining a temporal query are outlined below. First let us setup the example that will be used throughout these steps.

We will be asking for all **male** patients who are either **Asian**, **Black or African American**, or **White**. This set of

patients will have had their first event of **Hypertension** occurring before their first event of **Ischemic heart disease.**

## Step 1: Define a population

Before you can define your population you must first select *Define sequence of Events* from the list of available Query Constraints.
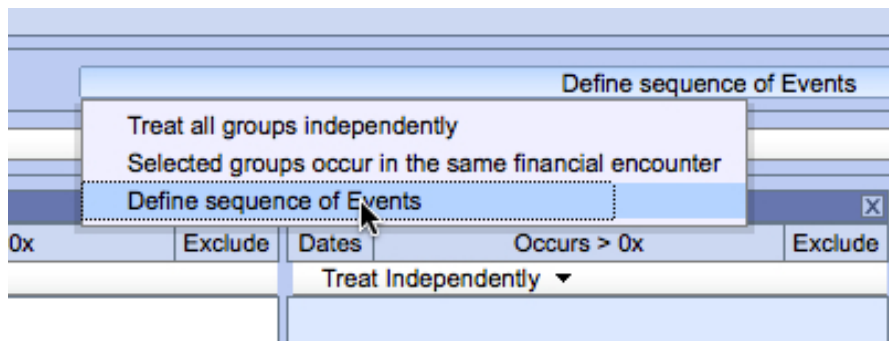


Selecting *Define sequence of Events* automatically opens additional temporal query options. The first step in the temporal query process is to define *the Population in which events occur*.
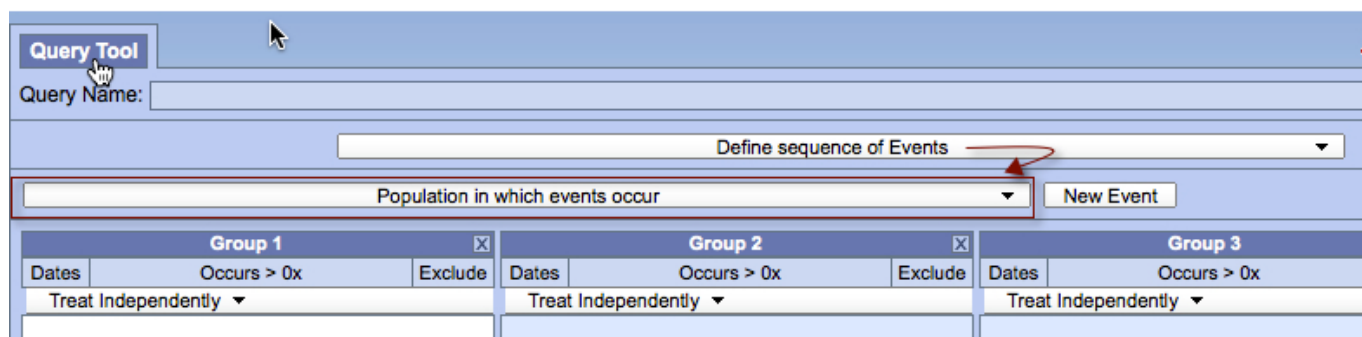


In the example, the population is going to be all males who are either Asian, Black or African American, or White. The first thing we need to do is add the gender of Male to the panel in the first group. Next we need to add the following races to the second group:

1. Asian

2. Black or African American

3. White

The query results will be limited to this population of patients.
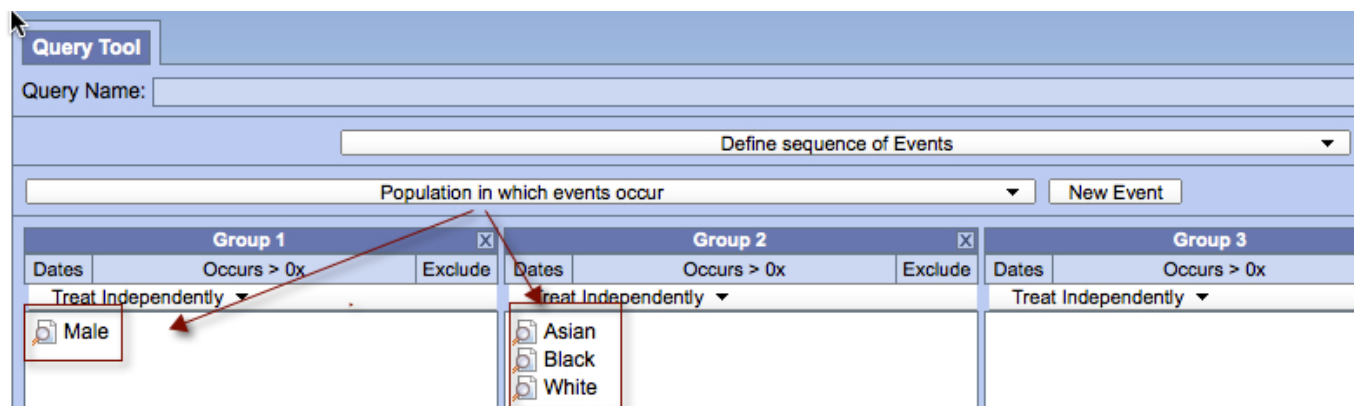
## Step 2: Define Events

All temporal queries have to have at least two events defined. Each event can have its own set of groups and constraints, all of which works in the same manner as a simple query.

To define the first event, select Event 1 from the drop-down list of temporal components.
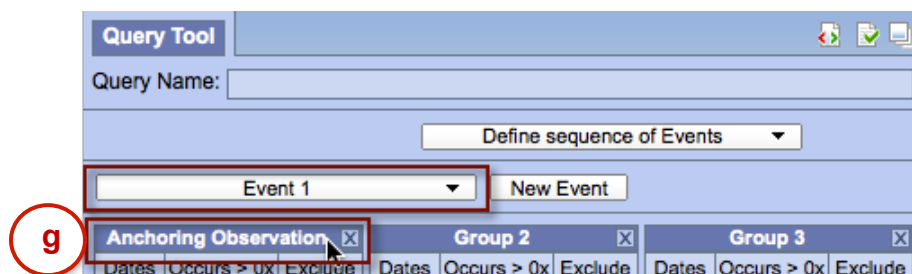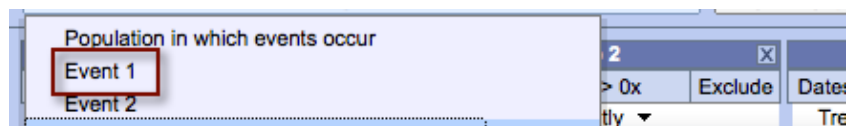


The only requirement when defining events is the first group will always be the anchoring observation group (**g**) and as such the panel constraint has to be defined, as *Items instance will be the same*. It is for this reason that the panel constraint on the first group is not available for selection when defining your events.

Following our example, we have now defined the first Event as those patients from our defined population who have at least one observation of Hypertensive disease noted in their record.
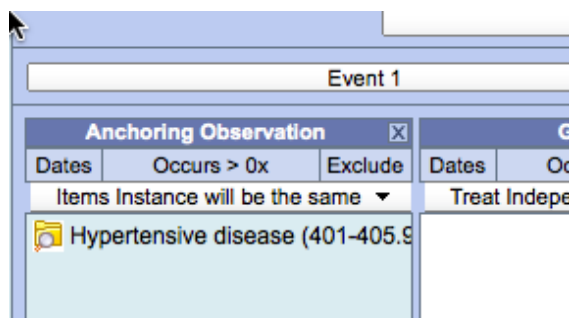


To define the second event, select *Event 2* from the drop-down list of temporal components. Following our example, we have now defined the second event as those patients from our defined population who have at least one observation of Ischemic heart disease noted in their record.
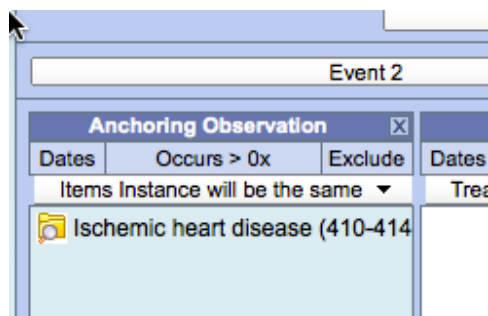


If you want to add a third event you can click on New Event and it will be added to the drop-down list of available temporal components.
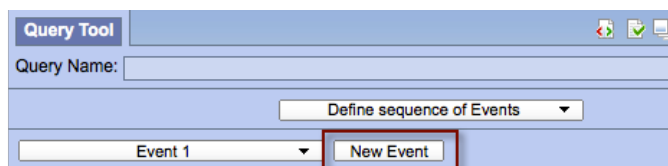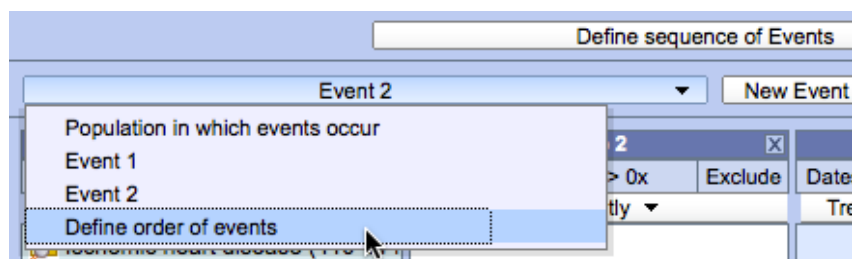
## Step 3: Define the Temporal Relationships

The last step in the temporal query process is to establish the temporal relationship between the events. At least one relationship must be defined before the query can be run. Using the example we previously outlined, the temporal relationship we will be defining is as follows:

The first occurrence of event 1 (Hypertension) has to occur before the first occurrence of event 2 (Ischemic heart disease).

To define relationship between events, select *Define order of events* from the list of available temporal query components.



The fields to define the temporal relationship will display on the screen.
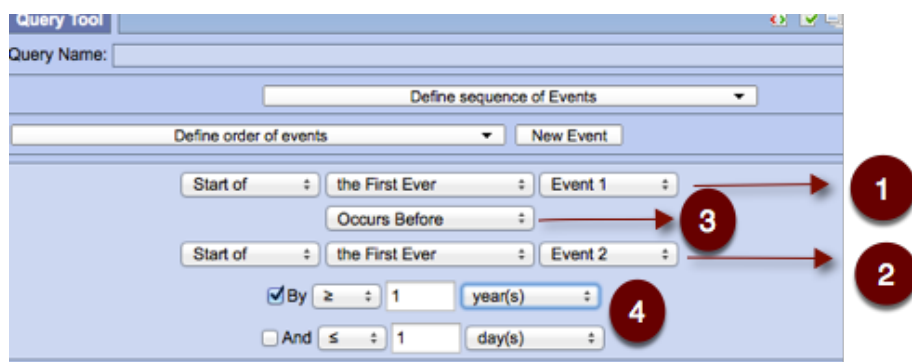


(**1**) Top Event definition

(**2**) Bottom Event definition

(**3**) Event ordering

(**4**) Time span

Time span allows you to specify the interval of time between the two events. For example, "Event 1 Occurs Before Event 2 By > 5 day(s)." This additional temporal constraint can be bounded by a range such as "By > 5 day(s) And < 10 day(s)." You must check the "By" checkbox to enable the drop-downs on that row. The "And" checkbox becomes enabled only when the "By" checkbox is checked. Checking the "And" checkbox enables the drop-downs in its row. In our example, the first ever occurrence of Event 1 (Hypertension) must occur at least one year before the start of the first ever occurrence of Event 2 (Ischemic heart disease).

An event must have at least one **Temporal Relationship** defined before the query can be submitted. This means that an event is defined in both the upper and lower drop-down box. An event must have at least one **Group** that contains at least one term (not empty).

# Breakdowns

When running a query you have the option to select from a number of result types that are known as breakdowns. These breakdowns will allow you to easily analyze your results based on the following options: Vital Status, Gender, Age, and Race.

In the example below, the patient counts are broken down per hospital and then per gender and per race.

**Run Query** ☒

Please type a name for the query:

Female-R3: Bla@13:04:16

Please check the query result type(s):

☑ Number of patients
☐ Vital Status patient breakdown
☑ Gender patient breakdown
☐ Age patient breakdown
☑ Race patient breakdown

[ OK ]  [ Cancel ]

**Query Status**

Patient Gender Count Breakdown:
  Female: - 34 +-3 patients
  Male: - 10 patients or fewer
  Unknown: - 10 patients or fewer

Patient Race Count Breakdown:
  Aleutian: - 10 patients or fewer
  American Indian: - 10 patients or fewer
  Asian: - 10 patients or fewer

# Query Optimization Tips

SHRINE runs your query in the order that you select and place terms in the Group panels. Tips for optimizing your query include the following:

- Select the most limiting terms first

  Demographic data is broader in scope than diagnoses or lab values. Therefore, if you select your diagnoses or lab value terms first and then select your demographic terms, SHRINE returns your query results more quickly.

- Add diagnoses and/or medication terms before lab test terms

  Queries that include lab values require a longer processing time than diagnoses or medications. Consider including either diagnoses or medication terms in your first groups before adding a lab test term to your query.

In other words, to make your query most efficient, make your selections in the following order

1. Diagnoses and/or Medications

2. Labs – Lab values require a longer processing time than diagnoses or medications but are more limiting than demographics

3. Demographics