



EpiCenter User Manual

Version 3.5.3

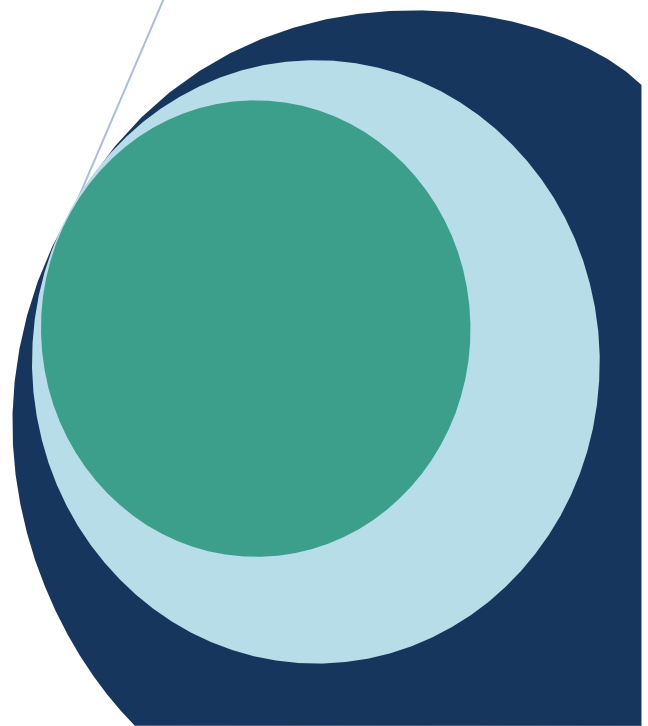


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1 Introduction

The EpiCenter system analyzes healthcare data for the purpose of detecting anomalies suggestive of public health threats, such as disease outbreaks and bioterrorism. EpiCenter provides automatic notification to appropriate health department personnel when anomalies are detected.

This user manual defines the components and describes functionality for EpiCenter Version 3.5.3 released in Spring, 2016.

EpiCenter 3.5.3 is accessible by both public health users and users at individual healthcare facilities.

All public health users are able to view the Anomalies, Charts, and Options Pages. Access may be available to the Summary, Investigations, Maps, Reports, Label, and Custom Classifiers Pages.

The functionality for healthcare facility users is limited to the Charts Page. Some facility users are also able to view the Reports Page.

2 Data Analysis Components

This section describes how EpiCenter models healthcare data and available analysis methods. The terminology introduced here is used throughout the user manual and in the EpiCenter product.

2.1 Data Types

2.1.1 Acute Care Interactions

Acute Care Interactions records typically include the following key data elements:

- Sending facility
- Registration date and time
- Encrypted patient ID
- Visit number
- Patient date of birth
- Patient gender
- Patient home zip code
- Free-text chief complaint

In most cases, this data is collected in real-time, meaning that a record is received at Health Monitoring Systems within minutes of a patient being registered at the facility.

EpiCenter is also capable of processing update messages in the form of A08 messages. Update messages can include updates to the original message, or elements such as patient temperature, discharge disposition, or preliminary diagnosis data.

2.1.2 Poison Control Center Call Data

Poison control center call data is available in the EpiCenter system in select areas. This data is obtained remotely from the National Poison Data System (NPDS) and provides information pertaining to incoming calls to poison control centers in a specific geographic area. The data provided to Health Monitoring Systems by the NPDS is already classified based on 131 clinical effects. No raw data is received; only counts by each NPDS clinical effect. The poison control center call classifiers available in EpiCenter use these clinical effects to provide classifications that may be suggestive of a public health threat.

2.1.3 Reportable Disease Cases

Reportable disease case data includes the occurrence of diseases that are mandated for reporting by a public health entity. These disease cases are available in various states, including suspected, probable, and confirmed.

Please note, the analysis tools associated with this data type are only available for regions where this data type is collected.

2.2 Classifiers

All incoming data is automatically classified by the EpiCenter system. The Infectious Disease Symptoms, Syndromes, Animal Related Injury, Influenza Related Illness, Traumatic Injuries, Immediate Notification, Alcohol Related (beta), Dental (beta), and Heat Related Illness (beta) Classifiers are used to classify the free-text chief complaints provided from Acute Care Interactions. The Discharge Disposition classifier is used to classify incoming discharge disposition information. The Bioterrorism/Agents, Body Systems, and Special Clinical Effects classifiers are used to group poison control center call data based on the clinical effects already assigned by the NPDS.

A description of each classifier is provided below. Keyword lists for each classifier are available for review by contacting Health Monitoring Systems directly.

The availability of classifiers varies by service area. Please contact Health Monitoring Systems directly for additional information.

Some areas may have access to a custom classification tool. See (Custom Classifier, Page 76) for more information.

2.2.1 Classifiers for Acute Care Interactions

2.2.1.1 Infectious Disease Symptom Classifier

The Infectious Disease Symptom Classifier classifies free-text chief complaints based on a specific symptom as opposed to the grouping of symptoms used by the Syndrome Classifier. This method of classification alleviates many of the inconsistencies seen with the Syndrome Classifier. For example, one group of system developers could associate a chief complaint of “fever” to a constitutional category while another group of developers might place this complaint in an influenza-like illness category. The Infectious Disease Symptom Classifier provides a solution for this issue by approaching the classification process with the symptoms of disease in mind rather than attempting to group symptoms into syndromic classifications.

2.2.1.2 Syndrome Classifier

The Syndrome Classifier classifies free-text chief complaints based on classifications that group together symptoms associated with the presentation of common diseases. The Syndrome Classifier contains seven syndromic classifications that are composed of one or more classifications from the Infectious Disease Symptom Classifier. A chief complaint can be classified into one or more classifications by this classifier.

2.2.1.3 Animal Related Injury Classifier

The Animal Related Injury Classifier classifies free-text chief complaints into classifications related to animal inflicted injuries. A chief complaint can be classified into one or more classifications by this classifier.

2.2.1.4 Influenza Related Illness Classifier

The Influenza Related Illness Classifier contains several classifications used to identify free-text chief complaints indicative of Influenza. A chief complaint can be classified into one or more classifications by this classifier.

2.2.1.5 Traumatic Injury Classifier

The Traumatic Injury Classifier classifies free-text chief complaints into classifications related to traumatic injuries. A chief complaint can be classified into one or more classifications by this classifier.

2.2.1.6 Immediate Notification Classifier

The Immediate Notification classifier classifies free-text chief complaints based on a list of keywords considered rare enough and serious enough to warrant immediate attention (e.g. “anthrax”). Because these keywords are exceedingly rare, time series of these classifications are typically analyzed differently for surveillance using the immediate qualification method. These classifications can also be analyzed using the standard (simple) method if preferred.

2.2.1.7 Alcohol Related Classifier (Beta)

The Alcohol Related Classifier classifies tracks alcohol-related Acute Care Interaction visits. This classifier contains only one classification. The Alcohol Related Classifier is currently in a beta state as it undergoes additional training to improve its accuracy.

2.2.1.8 Dental Classifier (Beta)

The Dental Classifier classifies free-text chief complaints related to dental issues. A chief complaint can be classified into one or more classifications by this classifier. The Dental Classifier is currently in a beta state as it undergoes additional training to improve its accuracy.

2.2.1.9 Diagnosis Classifier

The diagnosis classifier is used to classify preliminary diagnosis in the form of an ICD-9 code. This classifier contains multiple classifications, each composed of a grouping of ICD-9 codes. The Diagnosis Classifier is only available in areas where healthcare facilities are submitting this data type.

2.2.1.10 Discharge Disposition Classifier

The Discharge Disposition classifier is used to classify discharge dispositions based on the status of a patient when they are discharged from a healthcare facility. A discharge disposition can only be classified into one Discharge Disposition Classifier classification. The Discharge Disposition Classifier is only available in areas where healthcare facilities are submitting this data type.

2.2.1.11 Heat Related Illness Classifier (Beta)

The Heat Related Illness Classifier classifies free-text chief complaints related to heat illness. A chief complaint can be classified into one or more classifications by this classifier. The Heat Related Illness Classifier is currently in a beta state as it undergoes additional training to improve its accuracy.

2.2.2 Classifiers for Poison Control Call Center Data

2.2.2.1 Bioterrorism/Agents Classifier

The Bioterrorism/Agents Classifier is used to identify poison control center calls that could be suggestive of a bioterrorist threat. This classifier is based on groupings of clinical effects already assigned by the NPDS.

2.2.2.2 Body Systems Classifier

The Body Systems Classifier is used to group poison control center calls by the effected body system. This classifier is based on groupings of clinical effects already assigned by the NPDS.

2.2.2.3 Special Clinical Effects Classifier

The Special Clinical Effects Classifiers contains specific NPDS clinical effects that could be suggestive of public health threats and correlate with other data types available in the EpiCenter system. This classifier is based on the clinical effects already assigned by the NPDS.

2.2.3 Classifiers for Reportable Disease Data

2.2.3.1 Classifiers for Reportable Disease Data

Reportable Disease Classifiers are used to classify data based on disease identifier, which can be either text or alpha numeric code. Reportable diseases are diseases that are significantly concerning as they pose a threat to public health. (E.g. West Nile, Botulism, Cholera, Lyme disease)

2.3 Analysis Methods

EpiCenter provides multiple analysis methods used to identify data anomalies and trends. Analysis methods are available on both the Charts and Maps pages. The analysis methods on the Charts page are used to generate a threshold line viewable on a chart. Additionally, automated surveillance tasks can be created using these analysis methods. On the Maps Page, the analysis methods are used to project a probability of data anomalies geographically. The parameters for each analysis method can be adjusted by selecting the settings icon on both the Charts and Maps Pages.

A description of each analysis method available on the Charts and Maps Pages is offered below. A guide for adjusting the parameters for each analysis method is provided in Appendix 1: Analysis Method Parameters.

2.3.1 Constant Threshold (Charts Page)

The Constant Threshold, as its name implies, is used to set a fixed threshold. The default threshold used by this analysis method is 0. The Constant Threshold is most commonly used to detect immediately reportable conditions as it can be configured to detect a single instance of a condition.

2.3.2 CuSum EMA (Charts Page)

The Cumulative Sum with Exponential Moving Average (CuSum EMA) algorithm uses the same procedure as EMA to compute predicted counts. However, the threshold is the current predicted count plus a certain number of standard deviations of the prediction errors from the past. The exact number of standard deviations is determined by a set threshold multiplier (default value is 4), a cumulative sum of prediction errors, and a weighting parameter k (default value is 0.5). The threshold calculation requires an additional training period, which is set to 14 days by default.

2.3.3 Exponential Moving Average (EMA) (Charts Page)

The Exponential Moving Average (EMA) algorithm computes the predicted count for the current day as a weighted average of the actual counts for a certain number of days in the past. The weight for the most recent day is set by the weighting exponential parameter (default value is 0.2). The weight for days in the past is calculated from that parameter and decay exponentially as they recede further into the past. The length of the training window is computed from the weighting exponential and a significance level parameter (default value is 0.9). The default values yield a training window of 17 days.

To determine the threshold for the current day, the algorithm calculates the standard deviation of a certain number of past prediction errors (i.e. the difference between the predicted count and the actual count). The standard deviation is weighted to place greater weight on recent errors, in a manner very similar to how the predicted value is computed. The exact number of past prediction errors used depends on two user-specified parameters: the weighting exponential (default value is 0.2) and the level of significance (default value of 0.9). Just as with the predicted value, these defaults lead to a window of 17 days. The threshold is then the predicted count plus N standard deviations; N defaults to 4 but can be adjusted.

2.3.4 Moving Average (Charts Page)

The Moving Average (MA) algorithm, also called Simple Moving Average (SMA), computes the predicted count for the current day as the average of the actual counts for the past N days. The user can specify the number of past days to use; the default value is 14.

To determine the threshold for the current day, the algorithm calculates the standard deviation of a certain number of past prediction errors (i.e. the difference between the predicted count and the actual count). The standard deviation is weighted to place greater weight on recent errors. The exact number of past prediction errors used depends on two user-specified parameters: the weighting exponential (default value is 0.2) and the level of significance (default value of 0.9). These defaults lead to a window of 17 days. The threshold is then the predicted count plus N standard deviations; N defaults to 4 but can be adjusted.

2.3.5 Recursive Least Squares (Charts Page)

The Recursive Least Squares (RLS) algorithm computes a predicted count for the current day from a weighted sum of the actual counts of the current day and the past $p - 1$ days, where p is the average

period parameter set by the user (default value is 7 days). The weights for the weighted sum are calculated in a way that they will minimize the sum of the absolute value of the errors. This sum of errors is computed to give more weight to more recent errors. The exact weighting is controlled by the lambda parameter, which defaults to 0.99. RLS also has a training period which can be adjusted by the user; the default is 60 days.

The threshold for the current day is simply the predicted count for the current day plus a constant number of standard deviations of the prediction errors; this number defaults to 4 standard deviations.

2.3.6 Poisson Threshold (Charts Page)

The Poisson algorithm computes the predicted count for the current day as the average of the actual counts for the past N days. The user can specify the number of past days to use; the default value is 14. The threshold for the current day is then calculated from a Poisson distribution with a mean equal to the predicted value for that day. The user specifies a number of standard deviations, as with the other methods. However, since the variance of a Poisson distribution is equal to the mean, the threshold cannot be just that number of standard deviations from the mean. Rather, to be consistent with other thresholds, the cumulative probability for that number of standard deviations above the mean is calculated for a standard normal distribution. The value from the Poisson distribution that corresponds to the same cumulative probability is then used as the threshold.

2.3.7 Exponential Moving Average Probability (Maps Page)

The Exponential Moving Average (EMA) algorithm computes the predicted count for the current day as a weighted average of the actual counts for a certain number of days in the past. The weight for the most recent day is set by the weighting exponential parameter (default value is 0.2). The weight for days in the past is calculated from that parameter and decay exponentially as they recede further into the past. The length of the training window is computed from the weighting exponential and a significance level parameter (default value is 0.9). The default values yield a training window of 17 days.

The percentile calculated by this algorithm is for the difference between the actual count and the predicted count. It is based on the distribution of differences seen over the past D days, where D defaults to 60 days. These differences are assumed to follow a normal distribution with the observed mean and standard deviation. The percentile for the current difference is then the probability of observing a difference as close or closer to the mean as the current difference is, under that normal distribution. When these differences do not follow a normal distribution, hatching is added to the map shading to indicate that the calculated probability may be slightly skewed.

2.3.8 Poisson Visit Frequency (Maps Page)

The Poisson algorithm computes the predicted count for the current day as the average of the actual counts for the past N days. The user can specify the number of past days to use; the default value is 14.

The threshold for the current day is then simply the probability of observing a count smaller than or equal to the current count given a Poisson distribution with a mean equal to the predicted count.

2.3.9 Recursive Least Squares Probability (Maps Page)

The Recursive Least Squares (RLS) algorithm computes a predicted count for the current day from a weighted sum of the actual counts of the current day and the past $p - 1$ days, where p is the average period parameter set by the user (default value is 7 days). The weights for the weighted sum are

calculated in a way that they will minimize the sum of the absolute value of the errors. This sum of errors is computed to give more weight to more recent errors. The exact weighting is controlled by the lambda parameter, which defaults to 0.99. RLS also has a training period which can be adjusted by the user; the default is 60 days.

The percentile calculated by this algorithm is for the difference between the actual count and the predicted count. It is based on the distribution of differences seen over the past D days, where D defaults to 60 days. These differences are assumed to follow a normal distribution with the observed mean and standard deviation. The percentile for the current difference is then the probability of observing a difference as close or closer to the mean as the current difference is, under that normal distribution. When these differences do not follow a normal distribution, hatching is added to the map shading to indicate that the calculated probability may be slightly skewed.

2.3.10 Simple Moving Average Probability (Maps Page)

The Simple Moving Average (SMA) algorithm computes the predicted count for the current day as the average of the actual counts for the past N days. The user can specify the number of past days to use; the default value is 14.

The percentile calculated by this algorithm is for the difference between the actual count and the predicted count. It is based on the distribution of differences seen over the past D days, where D defaults to 60 days. These differences are assumed to follow a normal distribution with the observed mean and standard deviation. The percentile for the current difference is then the probability of observing a difference as close or closer to the mean as the current difference is, under that normal distribution. When these differences do not follow a normal distribution, hatching is added to the map shading to indicate that the calculated probability may be slightly skewed.

2.4 Data Conditioning

By default, EpiCenter displays the actual counts received from data sources. However, EpiCenter also provides the ability to condition data for day-of-week effect, such as the weekly increase in emergency department visits on Mondays. This data conditioning technique uses a Wavelet analysis method to minimize the effect this recurring pattern when calculating the threshold value.

Wavelet analysis can be used to filter out undesirable signals in data. In this instance, the "signal" that needs to be filtered out is the human behavioral tendency to seek healthcare at convenient times during the weekly cycle rather than at the first onset of symptoms. Thus, the wavelet analysis looks for patterns in the data that repeat every seven days. These patterns are then removed from the data. What remains should more closely resemble how the counts would appear if patients sought healthcare uniformly throughout the week.

Data conditioning can be applied on the options dropdown menu on the Charts and Maps pages. When applied to charts, the conditioned counts will appear as a solid blue line while the actual value will be displayed as a dotted blue line (See Figure 1 and Figure 2).

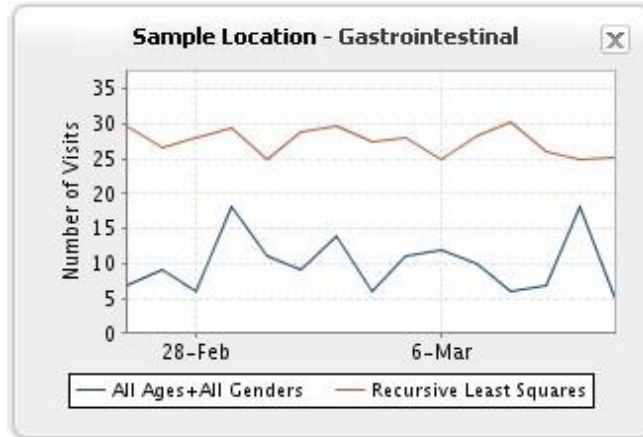


Figure 1: Data not conditioned for day-of-week effect

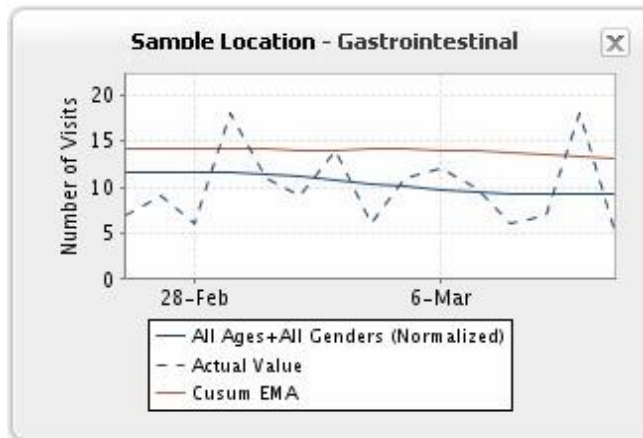


Figure 2: Data conditioned for day-of-week effect

2.5 Data Representation

Three methods of data representation are available in EpiCenter. These include:

- The “number of visits/actual value” data representation displays counts as raw data.
- The “percentage of all visits” data representation displays counts as a percentage of total visits.
- The “rate per 100,000 population” data representation displays counts as a rate based on 2000 census data.

2.6 Totaled By

The totaled by selector is available at the bottom of the left control panel on the Charts and Maps pages. It is used when generating counts by geography and when configuring surveillance tasks.

When data is “totaled by home,” the patient’s home zip code is used to define a geography. For example, if the location is set to Pennsylvania and the data is totaled by home, results will return for all patients with a home zip code in the state of Pennsylvania.

When “totaled by facility,” the zip code of the facility is used to define a geography. For example, if the location is set to Pennsylvania and the data is totaled by facility, results will return for all visits that took place at a facility with a zip code in the state of Pennsylvania.

Totaled by defaults to “totaled by facility” when viewing data from a specific facility as opposed to a geography.

2.7 Predicted Value

The predicted value is enabled and disabled on the Charts page under Advanced Options. When enabled, the predicted value appears as a green line on the chart. The predicted value automatically appears on all anomaly charts in the bottom right quadrant.

The predicted value is the expected number of visits for a particular time period given what was observed in the recent past. The exact calculation depends on the analysis method that was applied; refer Section 2.3 for more details on how each method calculates predictions.

3 Surveillance

The EpiCenter system conducts automated surveillance on incoming data for the purpose of detecting data anomalies. In the event that a data anomaly is detected, a notification is distributed.

In order for an anomaly to be recognized by the system, a series of qualifications must be met based on the method of qualification selected when the surveillance task is scheduled.

3.1 Simple

The simple qualification method uses a rolling 24-hour historic window and requires that the following conditions be met before an anomaly is generated by EpiCenter:

1. The observed count is greater than or equal to 10
2. The observed count is greater than the threshold
3. If other threshold(s) are applied (i.e. normalized or day-of-week), these threshold(s) are exceeded
4. No anomaly using identical parameters has been created in the past 24 hours

If any latent visits are received that fall within the parameters and 24-hour historic window used to detect a specific anomaly, these additional visits will be noted on the anomaly detail page; however, additional notification will not be generated. Any patient visits falling within the parameters of a specific anomaly that are received after the anomaly was generated will potentially be included in a future anomaly if requirements 1-3 above are met 24 hours after the initial anomaly was generated.

The simple qualification method can be used to detect anomalies for all classifications.

3.2 Immediate

The immediate qualification method uses a set 24-hour window based on a calendar day (midnight to midnight) and requires that the following conditions be met before a new anomaly is generated by EpiCenter:

1. The observed count is greater than the threshold
2. No anomalies using the same parameters has been created for the same calendar day

In the event that one or more visit matching the parameters of a specific anomaly are received after the anomaly is generated and that occur either on the same calendar date of the anomaly or the occurred on the date prior (latent data), the case(s) will be added to the existing anomaly and an updated email notification will be generated following the hourly running of surveillance. This addition will also be noted on the anomaly detail page. If applicable visits are received on the calendar date following the initial anomaly, an additional new anomaly will be created.

4 User Interface

4.1 Logging In

The EpiCenter user interface is accessible at: <https://epicenter.hmsinc.com>.

EpiCenter is supported for use with Internet Explorer, versions 9 and above, and with Chrome version 34.0.1847.116m.

4.1.1 Username and Password

Each EpiCenter user is assigned a unique username. This username is the same as your email address. Users are also given a password, which can be changed following instructions in the section on the Options page. Enter your assigned username and password combination into the corresponding boxes on the login page to gain access to EpiCenter. The login page will signify an incorrect entry by outlining the problematic field in red and displaying an exclamation icon (See Figure 3).



Figure 3: EpiCenter login page – password error

Selecting the “Remember Me” checkbox will keep you logged into the user interface until you logout via the logout button located in the top right corner of the interface. Do not use the ‘Remember Me’ checkbox if you are accessing EpiCenter on a shared computer.

4.1.2 Forgotten Password

You can request a new password by selecting the “Forgot Password” button located on the bottom right portion of the login box. After selecting this button, you will be asked to enter your email address (See Figure 4). All users should enter the email address that corresponds to their username.



Figure 4: Forgot password e-mail input

You will then receive an email that contains a direct link to the password reset page (See Figure 5). After entering and confirming a new password, you will be routed back to the login page. You can now enter your username and new password.



Figure 5: Reset password

Please note, if you contact Health Monitoring Systems directly to request that your password be reset, a temporary password will be given and you will be prompted to reset your password upon login.

4.1.3 Time Zone Settings

EpiCenter requires the time zone setting on a user's PC to match the time zone assigned to their EpiCenter user account. These settings dictate the time zone that is used for data display for each individual user. If there is an inconsistency between the PC and EpiCenter time zone settings, an error message will be received upon login (See Figure 6). Before proceeding with EpiCenter use, either the PC or EpiCenter time zone settings must be updated so that they match. Visit the Options page to update the EpiCenter time zone settings.



Figure 6: Time zone error

4.2 Navigating the User Interface

4.2.1 Tabs

The EpiCenter user interface contains multiple pages accessible by selecting the corresponding tab located on the top portion of the interface. These tabs include Summary, Anomalies, Investigations,

Charts, Maps, Reports, Labels, Custom Classifier, Options, and Administration. The availability of tabs may vary based on a user's permission level.

4.2.2 Control Panel

A standard control panel is available on each page in EpiCenter, with the exception of the Options page. The control panel is located on the left portion of the user interface. The pieces of functionality included on the control panel are enabled on certain pages throughout the application and disabled on others.

The image below identifies each piece of functionality (See Figure 7). Descriptions follow.

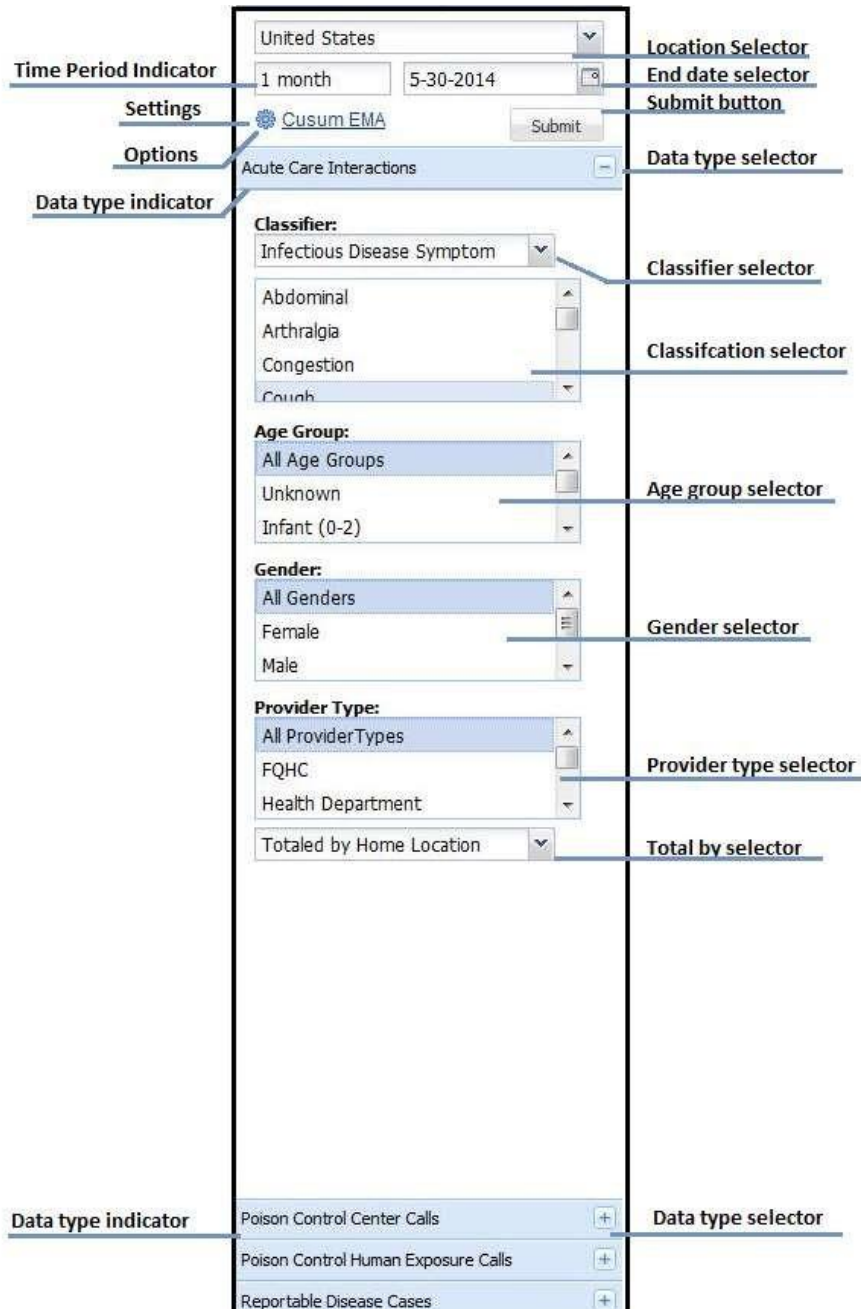


Figure 7: Control Panel

4.2.3 Location Selector

The location selector is a free-text box used to indicate the location for which data is viewed. To use this feature, select the text box and begin typing a location. A location can be a geography (i.e. state, county, zip code, or custom region) or the name of a healthcare facility (available on the Charts page only). The system will auto-complete your entry and provide a listing of all matches in a dropdown box. You can then make a selection by highlighting your desired location.

When searching for a geography, if only one match is available, the dropdown box will also contain geographies within that larger geography. This includes a county listing if a state name is entered in the location text box or a zip code listing if a county name is provided (See Figure 8).

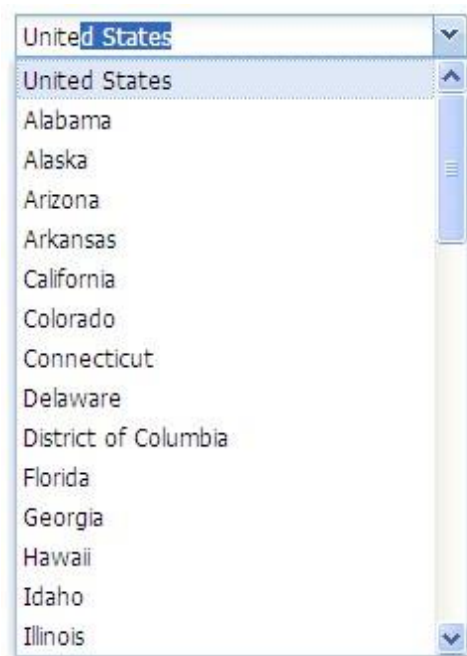


Figure 8: Location selector

If no matches are available, the location text box will become outlined in red. Further, if a valid location is entered but it is outside of a user's authorized region, a red asterisk will appear next to the location name.

The location selector is enabled on the Summary, Anomalies, Investigations, and Charts pages.

4.2.4 End Date Selector

The end date selector is used to specify the **end date** of a date range for viewing data. If the hour selector is enabled, the end date selector is also used to define the 24-hour sliding window applied to the data. The end date can be entered as free-text or by using the calendar popup tool. To activate the calendar popup tool, click on the calendar image to the right of the date (See Figure 9).



Figure 9: Calendar popup tool

Use the arrows located to the left and right of the month and year label to move to the previous and next months, respectively. A date is selected by clicking directly on the calendar. The down arrow immediately to the right of the month and year label provides an additional popup allowing for the selection of a specific month and year. After selecting the month and year, click “OK” to return to the calendar. The “Today” button located on the bottom of the calendar popup will automatically set the end date to today’s date.

The end date selector is enabled on the Anomalies, Investigations, Charts, and Maps pages. The selector is disabled on the Summary page as an automatic default of seven days from the current date is used.

The end date can be replaced with an MMWR week on the Charts page to produce a chart using MMWR week instead of calendar date. This is done by entering the following text into the date selector: “MMWR [week #] [year]” (See Figure 10). The year does not need to be specified if you are using the current year. The time period indicator can then be updated to indicate how far back you want to go from the MMWR week entered. Please note, the analysis methods currently available in EpiCenter on the Charts page are intended for use on daily counts as opposed to the aggregated weekly data produced by using the MMWR week feature.

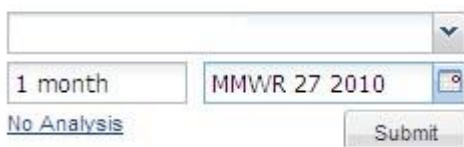


Figure 10: Charting by MMWR week

4.2.5 Time Period Indicator

The time period indicator is a free text box used to indicate the time period from the end date for which data is viewed. The time period can be entered as days, weeks, months, or years. The numerical portion of the time period must be entered as a number as opposed to text (e.g. “2” instead of “two”). For example, to view data from one month prior to May 1, 2008, set the end date to 5/1/2008 and enter “1 month” in the time period indicator text box.

The time period indicator is enabled on the Anomalies, Investigations, Charts, and Maps pages. The time period indicator is disabled on the Summary page as an automatic default of seven days from the current date is used. The time period indicator is also disabled on the Maps page as data is only displayed for the date indicated in end date selector.

4.2.6 Submit Button

The submit button is used to generate results once all settings have been specified. Clicking the submit button will produce results in the user interface. The submit button is enabled on the Summary, Anomalies, Investigations, Charts, and Maps pages.

4.2.7 Options

The contents of the options dropdown menu vary per page throughout EpiCenter. It is accessible by clicking on the blue underlined text below the time period indicator. Selecting this text will produce a dropdown menu, the contents of which vary with the page selected.

On the Charts and Maps pages, the first portion of the dropdown menu contains a listing of analysis methods. An analysis method is selected by clicking directly on the text on the dropdown menu. A bullet will appear to the left of the selected method and the blue underlined text below the time period indicator will display the name of the selected method (See Figure 11).

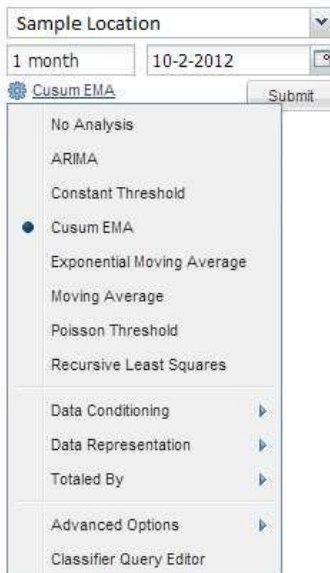


Figure 11: Analysis method selection on the Charts and Maps pages

The next feature on the options dropdown is data conditioning. This is enabled on the Charts and Maps pages. By highlighting data conditioning on the options dropdown menu, you can apply conditioning for day-of-week effect. This is selected by clicking on the corresponding text. A bullet will appear to the left of the selected conditioning method (See Figure 12).

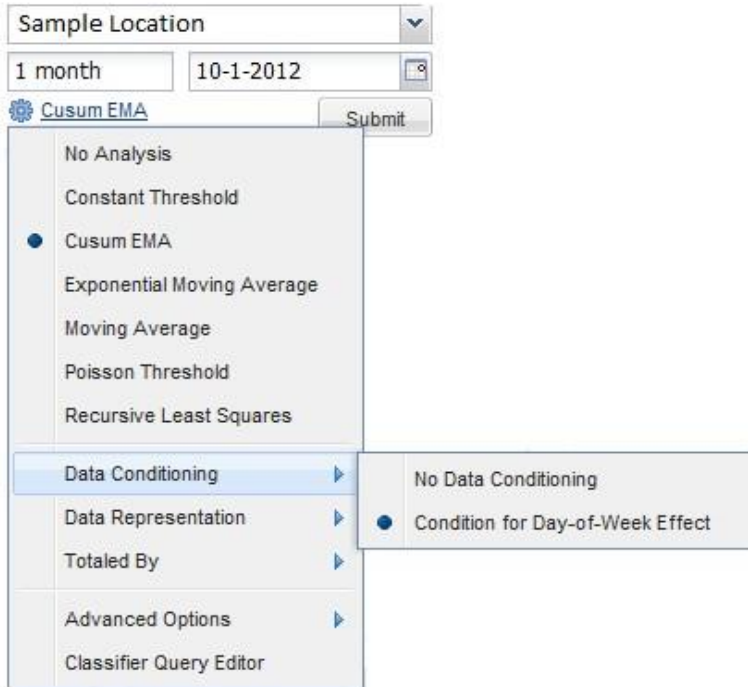


Figure 12: Data conditioning selection

The next feature on the options dropdown is data representation. This is enabled on the Charts and Maps pages. By highlighting data representation on the options dropdown, you can represent data as number of visits, a percentage of all visits, or as a rate per 100,000 population. A data representation method can be selected by clicking directly on the corresponding text. A bullet will appear to the left of the selected representation method (See Figure 13).

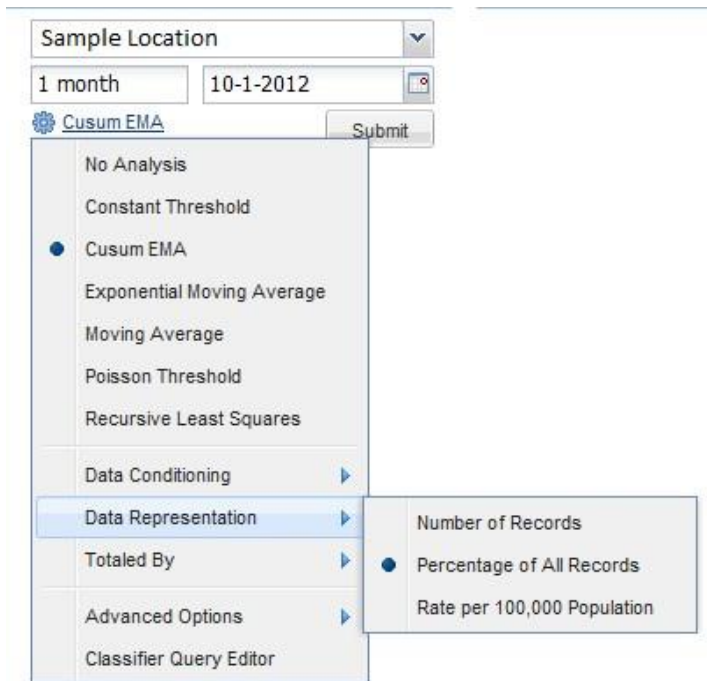


Figure 13: Data representation selection

The next feature on the options dropdown is Total By. This is enabled on the Charts and Maps pages and allows for the specification of totaling counts by hour, day, week, or month (See Figure 14).

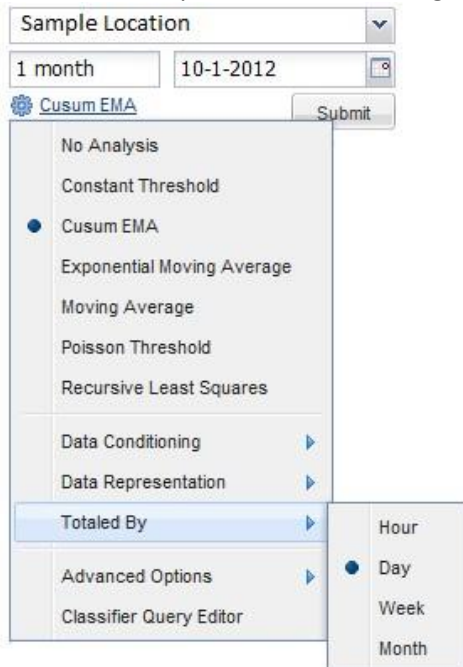


Figure 14: Total by hour, day, week, or month

On the Charts page, advanced options allow you to combine results, enable the hour selector, and plot predicted values. Select the checkbox contained in the dropdown menu to select and deselect combined results, the hour selector, and plot predicted values (See Figure 15).

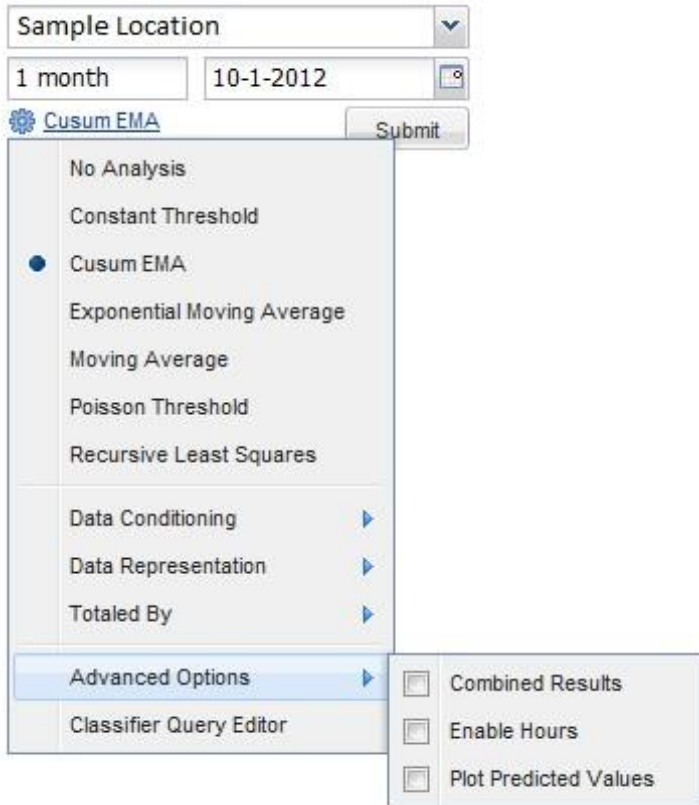


Figure 15: Advanced options, Charts page

If Combined Results is active and more than one classification from the classification selector is selected, one chart will display showing the number of records that are classified into one or more of the applicable classifications. Please note, each record is only counted once. If Combined Results is deselected, a chart returns for each individual classification showing only the counts for that specific classification.

If the hour selector is enabled, an hour will appear to the right of the date in the end date selector. This hour then defines the 24-hour sliding window used to define one “day” when querying data (See Figure 16).

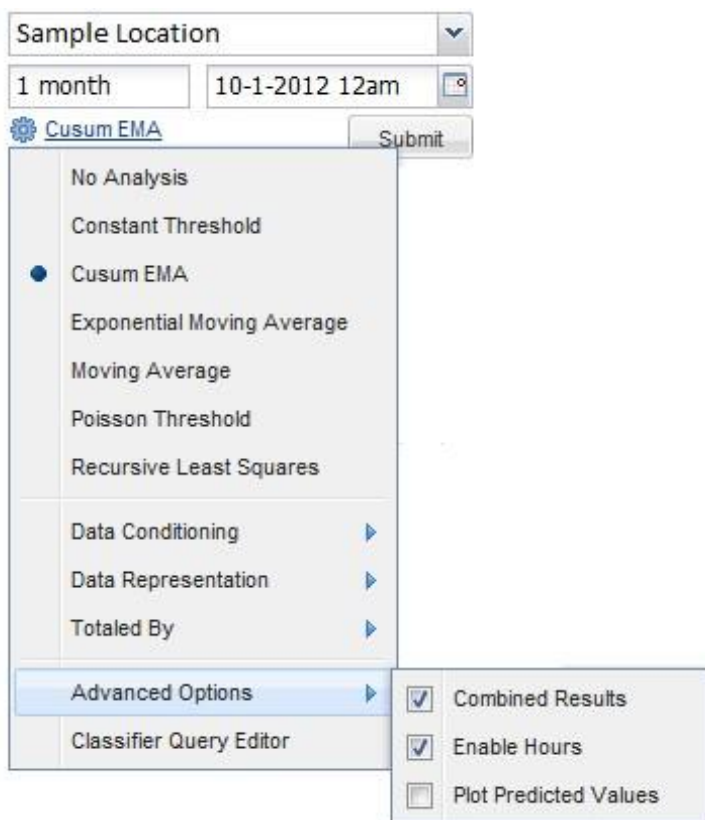


Figure 16: Hour selector

When the hour selector is first enabled, the hour shown in the end date selector field defaults to the last full hour. If the current date is entered as the end date, the next hour following the current time is the maximum hour available for selection.

If the hour selector is disabled, only a date appears in the end date selector and the 24-hour sliding window automatically defaults to use 12:00am to 11:59pm to define one “day.” The hour selector utilizes the time zone specified on the Options page.

If plot predicted values is enabled, a green predicted value line will display on all charts plotted (See Figure 16).

The final feature on the options dropdown is the Classifier Query Editor. This feature is enabled on the Charts and Maps pages. The Classifier Query Editor allows for the creation of a query using one or more classifiers. Selecting this feature will display the Classifier Query Editor pop-up window. To select a classifier, simply click on the desired option. Clicking on the “plus” button will display another classifier and classification selector. To remove a classifier from the query, click the “minus” button directly to the left of the classifier.

When the desired classifiers are selected, click Apply. The chart associated with the Classifier Query Editor feature represents an ‘and’ relationship between the chosen classifiers.

To disable this feature and display the default Classifier selector tool in the control panel, click Remove Query.

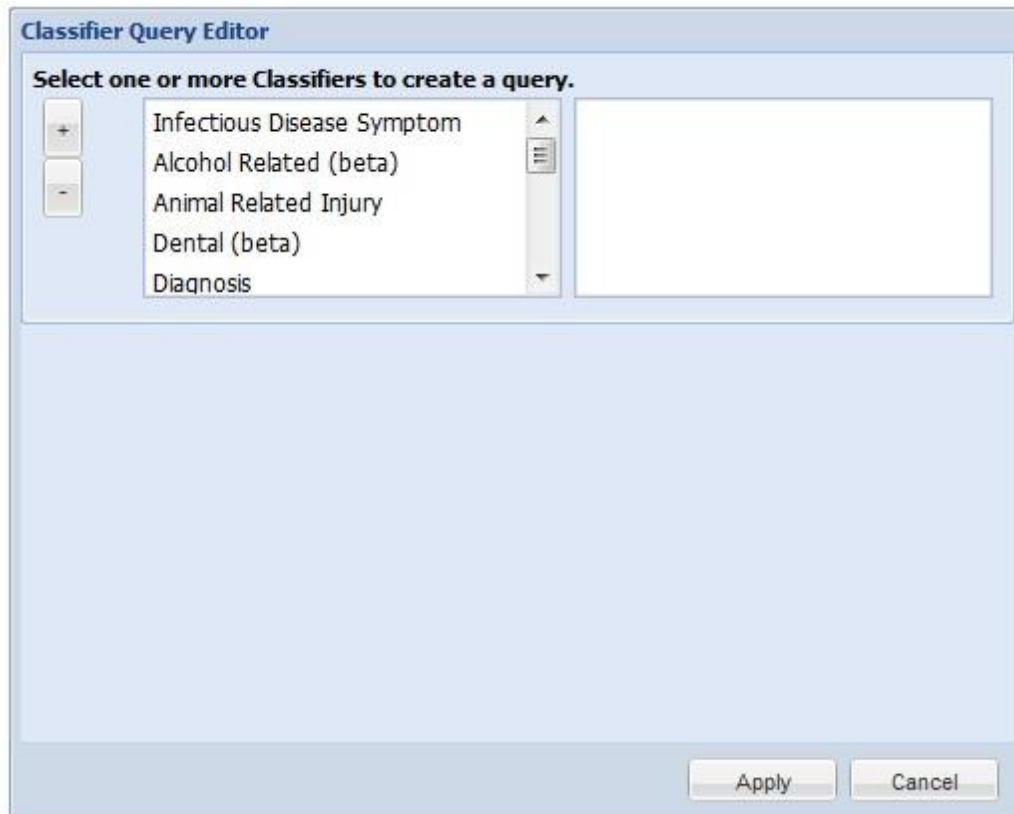


Figure 17: Classifier Query Editor

On the Anomalies page, the filter anomalies control panel allows for the viewing of both active and inactive anomalies. Select the checkbox contained in the control panel to include inactive anomalies in a search (See Figure 18).

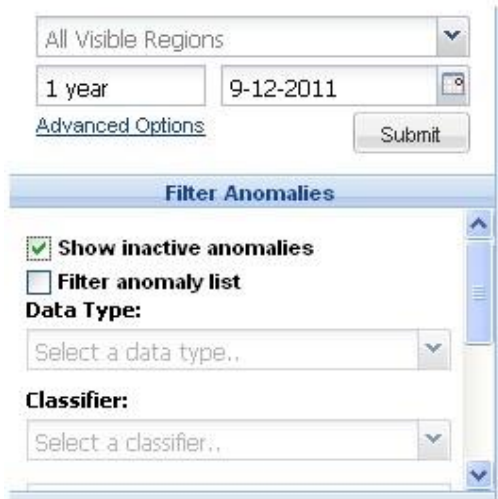


Figure18: Advanced options, Anomalies page

On the Investigations page, the Options dropdown provides the ability to display inactive investigations and to show only investigations assigned to the user logged into the system (See Figure 19).



Figure19: Advanced options, Investigations page

4.2.8 Settings

On the Summary page, the magnifying glass icon located to the left of the options dropdown menu text allows for the creation of surveillance tasks based on a selected surveillance view (See Figure20). This feature is available on the Summary page for organizational administrator level users. Clicking on this icon produces the surveillance task set-up window for the surveillance view currently displayed.



Figure20: Settings icon on Summary page

On the Charts and Maps pages, the tool icon located to the left of the options dropdown menu text allows for the configuration of parameters for an analysis method. This is enabled on the Charts and Maps pages. Clicking on this icon produces a popup window containing all applicable parameters. If adjustments are made to an analysis method, “custom” will appear next to the analysis method name. To restore default parameters, open the parameter popup window and click “reset.”

4.2.9 Data Type Indicator

The data type indicator is a header that specifies the type of data used for analysis. Available data types will vary by area and may include:

- Acute Care Interactions
- Poison control center call data
- Reportable disease data

The data type indicator is enabled on the Charts and Maps pages.

4.2.10 Data Type Selector

The data type selector is used to open or close the attributes for a specific data type. The data type selector appears as a plus sign (+) for an open data type and a minus sign (-) for a closed data type. To open a data type, click directly on the minus sign. The data type opened previously will automatically close. The data type selector is enabled on the Charts and Maps pages.

4.2.11 Classifier Selector

The classifier selector allows for the view of all data associated with the defined attributes or to apply filtering by a specific classifier. Click the down arrow on the right side of the classifier dropdown box to produce a list (See Figure21). To view all data, select “Total Counts.” To use a classifier, click directly on the name of the desired classifier. If a classifier is selected, the classification selector below will populate accordingly.



Figure21: Classifier selector dropdown menu

The classifier selector is enabled on the Charts and Maps pages.

4.2.11.1 Classification Selector

The classification selector allows for the selection of one or more classifications contained within a particular classifier. Selecting a classifier name in the classifier selector dropdown menu populates the classification selector with all available classifications. A classification is selected by clicking directly on the name contained in the scrolling list. Pressing and holding the CTRL key on your keyboard allows for the selection of more than one classification. To select a consecutive list of classifications, click on the first and last classification while holding the SHIFT key on your keyboard. This highlights the first and last classifications as well as those in between. Please note, when multiple classifications are selected, the resulting counts are for visits that meet the criteria for any of those classifications; each visit will be counted only once.

The classification selector is enabled on the Charts and Maps pages.

Age Group Selector

The age group selector is used to define the age groups for which data is viewed. EpiCenter contains the following age groups:

Age Group	Age Range
Infant	0-2
Preschool	3-5
Child	6-12
Adolescent	13-17
Adult	18-64
Geriatric	65+

Selecting “all age groups” includes all records, regardless of the patient’s age. The “unknown” age group contains patients where the age is not provided. These patients are included when “all age groups” is selected.

Pressing and holding the CTRL key on your keyboard allows for the selection of more than one age group. To select a consecutive list of age groups, click on the first and last age group while holding the SHIFT key on your keyboard. This highlights the first and last age group as well as those in between.

The age group selector is enabled on the Charts and Maps pages.

4.2.11.2 Gender Selector

The gender group selector allows for the viewing of data for all genders or for a specific gender or set of genders. The “unknown” gender contains patients where the gender is unknown or not provided. These patients are included when “all genders” is selected.

Pressing and holding the CTRL key on your keyboard allows for the selection of more than one gender. To select a consecutive list of genders, click on the first and last gender while holding the SHIFT key on your keyboard. This highlights the first and last gender as well as those in between.

The gender selector is enabled on the Charts and Maps pages.

4.2.11.3 Provider Type Selector

The Provider Type selector allows for the viewing of data for all provider types or for a specific provider type or set of providers. The default selection is Hospitals and Urgent Cares. The provider type options are All Provider Types, Hospital, Urgent Care, FQHC, Health Department, Health Information Exchange, Health System, Medical Group, Nurse Call Center, OTC, Physician, Physician Office, Physician Practice, and Poison Control.

Pressing and holding the CTRL key on your keyboard allows for the selection of more than one provider type. To select a consecutive list of provider types, click on the first and last provider type while holding the SHIFT key on your keyboard. This highlights the first and last provider type as well as those in between.

The provider type selector is enabled on the Charts and Maps pages.

4.2.11.4 Totaled by selector

The totaled by selector allows for the totaling of patients by either the patient's home zip code or by the zip code of the facility visited. Use the down arrow on the right side of the totaled by dropdown box to switch between these two methods.

5 Summary

The Summary page is displayed upon logging into EpiCenter. It provides a snapshot of incoming data for the past seven days. The Summary page can be set to display the default "Classifier Summary View" or a predefined custom surveillance view. The options dropdown menu on the Summary page allows for the selection of a custom surveillance view or the default Classifier Summary View for display. A view is selected by clicking directly on the text contained in the dropdown menu. A bullet appears to the left of the selected view when it is selected. The blue underlined text below the time period indicator displays the name of the selected view (See Figure22).

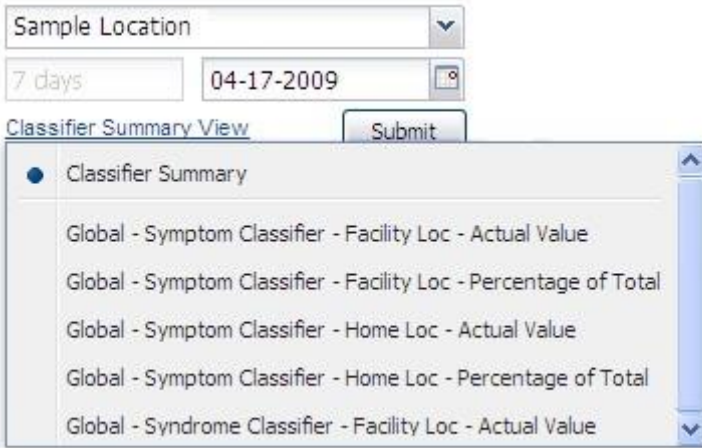


Figure22: Option dropdown menu for the Summary page

The Classifier Summary View contains a chart displaying all Acute Care Interactions, located in the upper left portion of the screen, as well as a breakdown by classification for each classifier and by data type. Each classifier-based chart shows the seven classifications with the highest counts for the past seven days. All classifications are shown when a classifier contains less than seven classifications. Each chart contains a legend below the x-axis. The data displayed on the charts is automatically totaled by home location for geographies and by facility if a specific facility name is entered into the location selector.

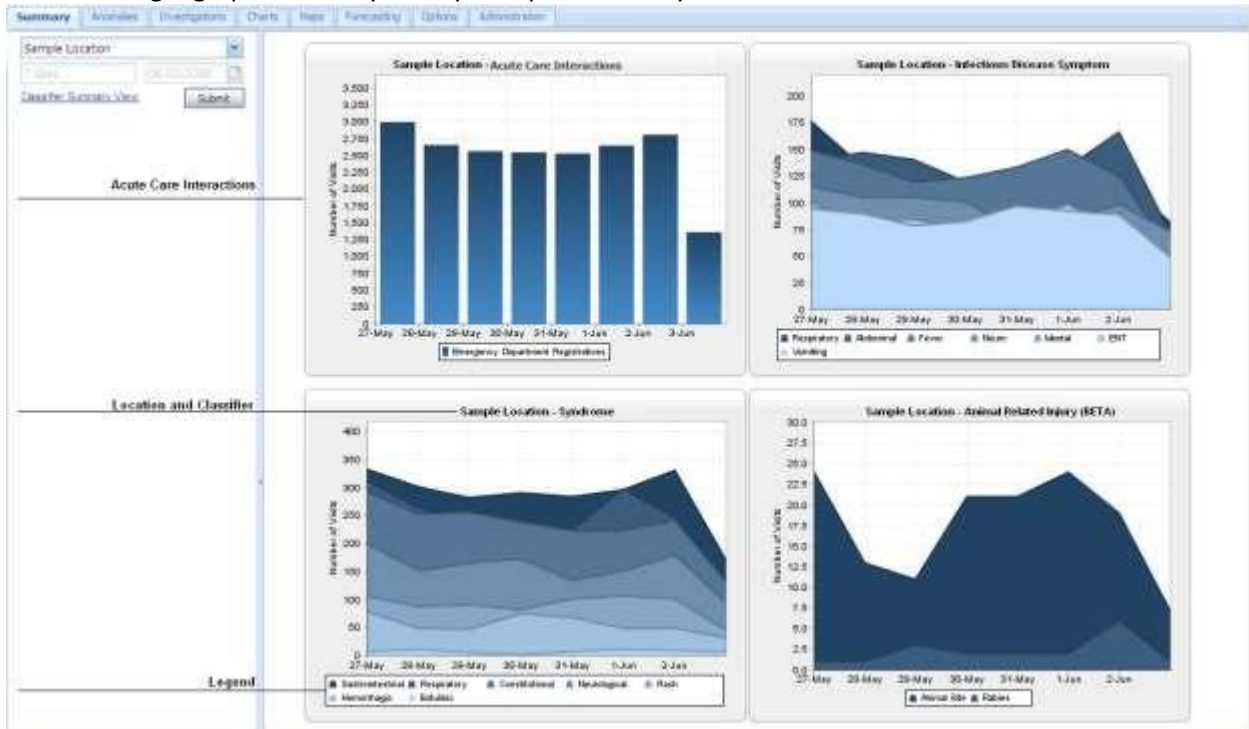


Figure23: Summary page – Classifier summary view

A custom surveillance view is displayed on the Summary page using the options dropdown menu. Once selected, the charts contained within the surveillance view display on the left portion of the screen. An

individual chart is removed from a surveillance view by selecting the X located in the upper right corner. If all charts are removed from a surveillance view, the surveillance view will be deleted. Charts are added to the surveillance view through the tools available on the Charts page.



Figure24: Summary page – Custom surveillance view

The location selector on the Summary page defaults to a user’s accessible region. The location can be changed to any area within that accessible region. Use the submit button to update the charts after a new location is entered.

5.1 Creating and Editing Surveillance Tasks

Some organizational administrator level users are able to create a surveillance task for a particular surveillance view on the Summary page by selecting the settings icon next to the options dropdown text. Selecting this icon produces a popup window containing the surveillance task parameters.



Figure25: Create and edit surveillance tasks

To add a new surveillance task, click on the “Add Surveillance Task” button located on the top left portion of the popup box. A new entry will be added to the surveillance task listings in the bottom portion of the popup box. Please note, a maximum of 30 surveillance tasks can be created per organization. Please contact Health Monitoring Systems if you require tasks beyond this limit.

To edit an existing surveillance task, change the parameters as desired and select the “save” button.

The following parameters must be set through the surveillance task popup up box:

Parameter	Available Options	Description
Geography	A user’s accessible region or a subset of that region	A surveillance task can be set for a user’s entire accessible region or for a smaller area within that region. Ex: A user permitted to access data for Florida could create a task for the entire state, a specific county, zip code, or custom region within Florida.
Aggregate by	State County Zip code Region Facility	“Aggregate by” determines the aggregation level applied to the geography. Ex: If the geography for a surveillance task is Florida, and aggregate by county is selected, surveillance will be run separately for each county in Florida. Aggregating by facility runs surveillance on a per facility basis for all facilities submitting data in the indicated geography.
Recurrence	Every 10 minutes Hourly Daily at noon Daily at midnight	Recurrence indicates how frequently the surveillance task is run.
Organization	The user’s organization	The organization field will default to the user’s organization. If a user’s organization is a sponsoring organization, sponsored organizations are available for selection in this

		field.
Qualifier	Immediate Simple	The qualifier dictates the conditions that must be met in order for an anomaly to be generated.
Delay	Default No Delay One Hour Two Hours Three Hours Four Hours	The delay indicates the time period allotted between the time the surveillance task is run and 24-hour sliding window is applied. The purpose of the delay is to account for reporting latencies. For example, if a delay of one hour is selected and the recurrence is daily at noon, the surveillance task will run at noon for all records received between 11:00 am on the current day and 11:00 am on the previous day. Please note, if “default” is selected, the delay is automatically set based on the qualifier used. For “immediate,” no delay is used as the default. For “simple,” a one-hour delay is used as the default.
Expiration Date	Any future date	Surveillance tasks must be assigned an expiration date. Surveillance will stop running after this expiration date has passed.
Inherited (applies only to sponsoring organizations)	Checkbox is checked or unchecked	This checkbox is unchecked by default indicating that the surveillance view is not viewable by organizations sponsored by the user’s organization. A surveillance task is made viewable to the sponsored organizations by checking the checkbox.
Enabled	Checkbox is checked or unchecked	This checkbox is checked by default indicating that the surveillance task is enabled. A surveillance task is disabled by unchecking the checkbox. A disabled surveillance task will remain on the list of tasks associated with a surveillance view. It can be re-enabled at a later time.
Trigger on File Receipt	Checkbox is checked or unchecked	This checkbox is unchecked by default. It is used only for surveillance tasks requiring immediate notification.
Active Monitoring	Checkbox is checked or unchecked	This checkbox is unchecked by default. It is used for active monitoring tasks causing surveillance to run every 10 minutes with the possibility to generate an anomaly every hour.
Delete	Click on icon to delete	Clicking on this icon disables a surveillance task and permanently removes it from the task list.

Once all parameters are set, click “save” to add the surveillance task. The “reset” button is used to return fields to their default values.

In addition to the values set in the surveillance task popup box, the attributes selected for the charts contained in the surveillance view will also be applied to the surveillance task. This includes analysis method, data conditioning, data representation, classifier and classification, age group, gender, totaled by. Please note, the “actual value” data representation is used for all surveillance tasks. If a data representation other than actual value is selected as a part of the surveillance view, it will be applied **in addition to** actual value. As such, the selected threshold must be exceeded for both data representations in order for an anomaly to be detected.

Surveillance tasks utilizing the same analysis method and data set will only trigger once every 24 hours. Immediate notification anomalies are an exception to this rule as they notify as detected.

For surveillance tasks set to run every 10 minutes, only one anomaly will generate per hour.

6 Anomalies

Anomalies detected in the data collected appear in the Epicenter interface on the Anomalies page. A notification is sent to public health users when an anomaly is detected. Anomalies are detected by surveillance tasks.

On the Anomalies page, the control panel allows for the export of the matching anomalies list as well as various filtering options.

The matching anomalies list can be exported as a CSV file by selecting “Download List as CSV” from the options dropdown. Selecting this option initiates the download process. Continue to follow the prompts from your computer’s default application to open the file.

Filtering options include active/inactive status, data type, classifier, and totaled by. Select the checkbox contained in the control panel to include inactive anomalies in a search. The filter anomalies list check box allows users to filter anomalies based on data type, classifier, and totaled by. Selecting “total counts” from the classifier selector will display all data regardless of classification (See Figure26).

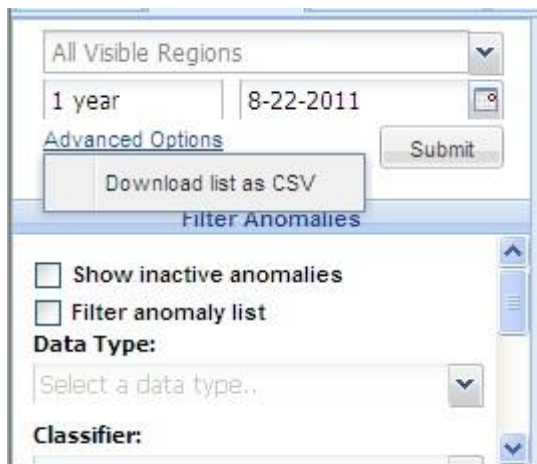


Figure26: Advanced options for Anomalies page

6.1 Surveillance Tasks

A surveillance task is a set of defined parameters used to identify data anomalies. Surveillance tasks are configured by creating a surveillance view on the Charts page and subsequently entering a new surveillance task based on the surveillance view on the Summary page. Health Monitoring Systems recommends that users follow our Default Notification Configuration when creating surveillance tasks (See Appendix 2: Default Notification Configuration).

6.2 Notifications

Standard Notifications

In the event that an anomaly is detected, automatic notification (See Figure27) is sent via email to all users with notification subscriptions for the geography and classifier/classification of the anomaly.

Users in an area that have purchased the mobile notification feature will be provided with a link at the bottom of the notification that allows them to access either an Excel spreadsheet and customized user interface via their mobile device depending on the device type.

Please contact Health Monitoring Systems to create or update notification subscriptions for your area.

Fever Anomaly at Sample Location

Monitoring of acute care interactions at Sample Location identified 22 interactions. Fever includes the following classifications: fever (infectious disease symptom). All interactions occurred between April 30, 2009 3:12 AM and May 01, 2009 3:12 AM.

Using Exponential Moving Average analysis, these 22 interactions exceed the predicted value of 10.60 and the threshold of 20.58.

The time of the anomaly was 3:12 AM.

Summary

Time of Anomaly	May 1, 2009 3:12:07 AM EDT
Time Detected	May 1, 2009 3:12:09 AM EDT
Indication	Acute Care Interactions
Classification(s)	fever (infectious disease symptom)
Location	Sample Location
Analysis Method	Exponential Moving Average
Data Conditioning Method	No Data Conditioning
Results of Analysis	22 (Number of Visits)
Records Totaled By	Facility Location

[Click here to view this anomaly in EpiCenter.](#)

Download cases in [Excel](#) or [mobile web](#)

Figure27: Notification email text

Update Notifications

In the event that an immediate notification has been issued for a particular location, an update notification will be issued if additional visits falling within the window of the initial anomaly are received. The subject line and body of an update notification contain the term “update” and the current count versus the count seen at the time of the initial anomaly is provided (See Figure28).

IMMEDIATE NOTIFICATION UPDATE - Anthrax Anomaly in Sample Location

Monitoring of Acute Care Interactions for residents of Sample Location identified 1 additional interaction. Anthrax includes the following classifications: anthrax (immediate notification). All interactions occurred between April 29, 2009 11:59 PM and April 30, 2009 11:59 PM.

Using Constant Threshold analysis, these 4 interactions (current total) exceed the threshold of 0.00.

The time of the anomaly was 11:59 PM.

Please note, the purpose of this notification is to inform you that one or more emergency department registration was classified into the classification indicated above. This does not signify a confirmed diagnosis or actual case.

Summary

Time Detected	April 30, 2009 10:08:04 AM EDT
Last Occurrence	April 30, 2009 4:17:39 PM EDT
Indication	Acute Care Interactions
Classification(s)	anthrax (immediate notification)
Location	Sample Location
Analysis Method	Constant Threshold
Data Conditioning Method	No Data Conditioning
Results of Analysis	4 (Number of Visits) (current total)
Records Totaled By	Home Location

[Click here to view this anomaly in EpiCenter.](#)

Figure28: Update notification email text

6.3 Anomaly Listing

The anomaly listing view of the Anomalies page provides a list of all matching anomalies based on the search terms entered in the upper portion of the control panel. The time period criteria used in the anomaly listing view defaults to display the oldest active anomaly for a particular location.

Each anomaly contained in the list is represented with an orange marker at the location of the anomaly on the map. The letter indicated on the matching anomalies list corresponds to the letters provided on the map. Multiple anomalies for the same location are grouped under one marker. The left and right arrows located on the bottom portion of the control panel are used to move between multiple pages of matching anomalies (See Figure29).

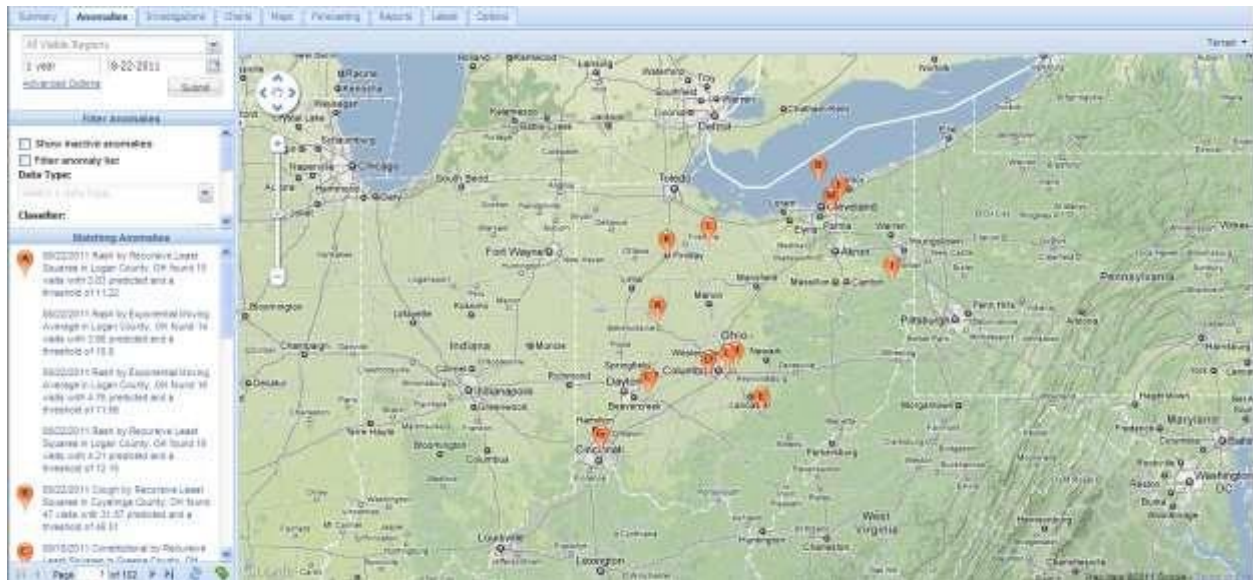


Figure29: Anomalies page – overview map

Each entry contained in the matching anomalies list provides the date of the anomaly, the classification used, the location, the analysis method used, the actual count, and the maximum count threshold. Clicking on a marker on the map will produce a popup containing the same information. If more than one anomaly is associated with one marker, all anomalies will be listed in a scrolling window.

Use the options dropdown menu located under the time period selector to show inactive anomalies or to download a list of matching anomalies. The download file is based on the parameters defined in the control panel.

Clicking directly on the text provided on the matching anomalies list will return the anomaly detail view for that particular anomaly.

6.4 Anomaly Detail

The anomaly detail view of the Anomalies page provides additional information for a specific anomaly. This view is accessible by clicking on an anomaly contained in the matching anomaly list included in the anomaly listing view. In addition, this view is automatically displayed when EpiCenter is launched from a link contained in a notification email.

Each section of the anomaly detail view is intended to provide tools to evaluate the anomaly. After conducting an initial evaluation, a disposition can be selected for the anomaly or it can be assigned to an investigation.

A disposition is selected by clicking the underlined portion of the sentence stating the current disposition contained in the narrative. A new investigation is started by clicking “new investigation.” When starting a new investigation, a popup window will appear to enter a free text name for the investigation. An anomaly is assigned to an existing investigation by clicking “existing investigation” and selecting an investigation from the list. The dropdown list contains all active investigations within a user’s accessible region. After providing a name for a new investigation or after selecting an existing investigation, the Investigations page will automatically return.

The anomaly detail view contains four sections (moving clockwise from upper left):

6.4.1 Narrative (Upper Left)

The top left portion of the anomaly detail view includes a narrative describing the anomaly as well as available actions for investigating the anomaly. Descriptive text components are indicated in red, available actions are blue:

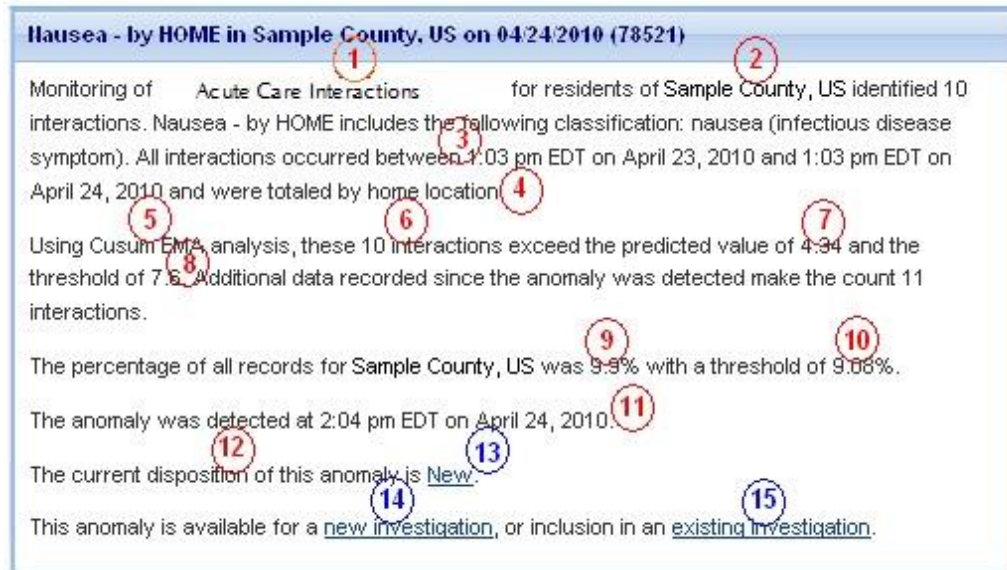


Figure30: Anomaly detail narrative

- | | | |
|--------------------|-----------------------------------|-----------------------------------|
| 1. Data Type | 6. Number of interactions | 11. Detection date and time |
| 2. Location | 7. Predicted value | 12. Anomaly disposition |
| 3. Time period | 8. Threshold | 13. Update disposition |
| 4. Totaled by | 9. Percentage of total | 14. Create new investigation |
| 5. Analysis method | 10. Percentage of total threshold | 15. Add to existing investigation |

All investigations with which the anomaly has been associated are listed in narrative portion of the anomaly detail view. Clicking on the name of an investigation will automatically return that particular investigation.

If an anomaly was generated as an immediate notification, the narrative portion of the anomaly detail page indicates the number of times the anomaly has been “triggered.” Surveillance for an immediate notification occurs hourly. If an additional case(s) falling within the window of the anomaly are detected during the hourly surveillance run, the trigger will increase by one. The current count indicating the total number of patients associated with the anomaly is also provided.

6.4.2 Map (Upper Right)

The top right portion of the anomaly detail view provides a map showing the location of the anomaly and the surrounding area. Clicking on the orange marker will produce a popup containing the date of

the anomaly, the classification used, the geographical location, the analysis method used, the actual count, and the maximum count threshold.

This map functions similarly to the map on the Maps page. The label on the bottom portion of the map indicates the analysis method used.

6.4.3 Chart (Lower Right)

The bottom right portion of the anomaly detail view contains a chart. The blue line on the chart represents data for the classification and location of the anomaly. The red line shows the threshold based on the analysis method used to detect the anomaly. The data on this chart can be displayed as a percentage of total visits, as actual values, or per 100,000 population rate. This representation is changed by clicking on the underlined portion of the chart header. A dark blue bullet located to the left of a representation indicates that it has been selected.

The chart on the anomaly detail view displays data for 30 days prior to the date the anomaly was detected. Five days of post detection data is also displayed on the chart. This appears as a blue dotted line on the far right portion of the chart. The dotted blue line provides a visualization of data trends following the time of the anomaly and also accounts for latent messages (See Figure31). A chart from the anomaly detail view can be reproduced on the Charts page by applying the same attributes and 24-hour sliding window using the hour selector.

Clicking directly on the chart will produce an identical popup chart. This larger chart functions similarly to the popup charts seen on the Charts page (See Charts, Page 46). One notable difference is that in the Patients tab, rows highlighted in yellow will indicate data that came in after the anomaly was initially detected.

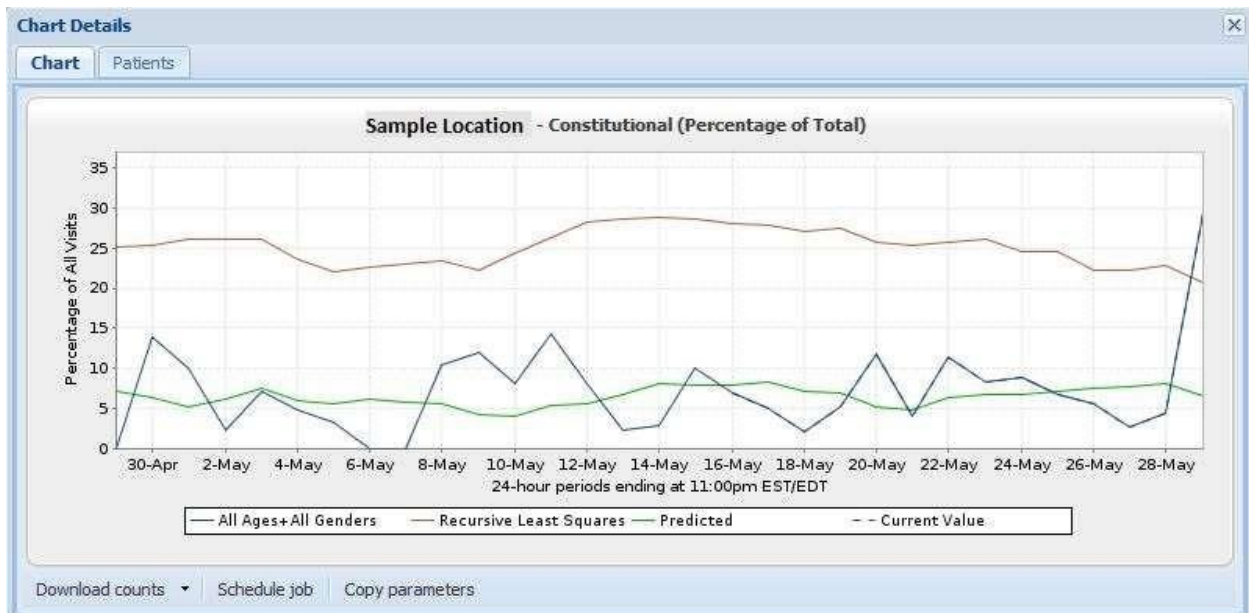


Figure31: Anomaly detail popup chart

6.4.4 Descriptive Analysis (Lower Left)

The bottom left portion of the anomaly detail view contains a descriptive analysis bar chart. This chart displays the distribution of data by attribute, including age group, facility name, gender, and zip code. These distributions can be viewed as a percentage of total visits, as actual values, or per 100,000 population rate. The different attributes and data representations are selected by clicking on the underlined portion for the chart header. The dark blue bullet seen to the left of attributes and representation indicates that they have been selected (See Figure33).

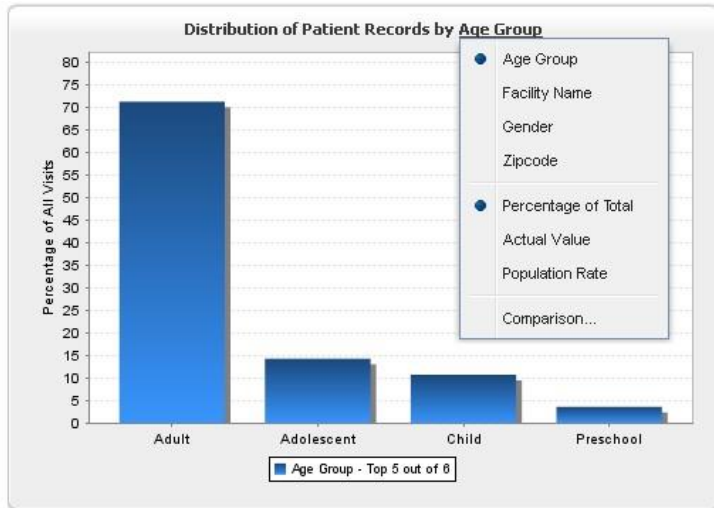


Figure33: Descriptive analysis

The descriptive analysis tool also provides a comparison feature. A comparison is conducted by selecting “Comparison” at the bottom of the dropdown menu from the chart header. A comparison is displayed as a second set of bars displayed on the descriptive analysis chart (See Figure34). The second set of bars represent the distribution of the selected attribute from registrations received during the specified interval.

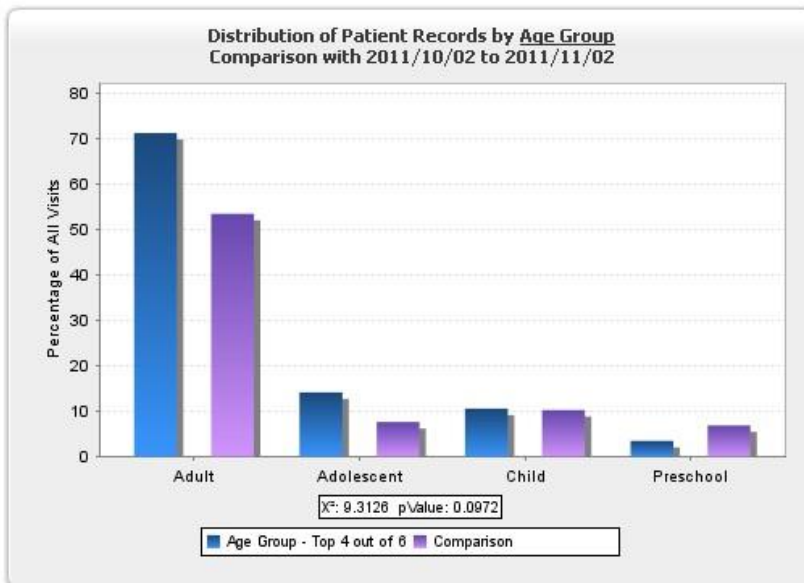


Figure34: Descriptive analysis with comparison

An interval is defined using the popup box that appears after selecting “Comparison” from the dropdown menu (See Figure35).



Figure35: Interval popup box

The comparison chart also displays a χ^2 statistic and p value indicating whether the difference between the anomaly distribution and the historical distribution are significantly different.

The comparison feature is removed from the descriptive analysis chart by producing the interval popup and selecting “cancel.”

7 Investigations

The Investigations page is a tool to manage the overall workflow and processes followed when investigating anomalies and potential public health events.

7.1 Investigation Listing

The investigation listing view of the Investigations page provides a list of all matching investigations based on the search terms entered in the upper portion of the control panel. The time period criteria used in the investigation listing view defaults to display the oldest active investigation for a particular location.

Each investigation contained in the list is represented with a blue marker at the location of the investigator’s organization on the map. The letter indicated on the matching investigations list corresponds to the letters provided on the map. Multiple investigations for the same organization are grouped under one marker.

Use the advanced options menu located under the time period selector to show inactive investigations or to view only investigations assigned to the current user (See Figure36).



Figure36: Investigation page advanced options

The left and right arrows located on the bottom portion of the control panel are used to move between multiple pages of matching investigations. A refresh button is also included in the bottom portion of the control to reload the matching investigation list as well as a button to create an investigation directly, without associating an anomaly (See Figure).

Each entry contained in the matching investigations list provides the date that the investigation was started, the name of the investigation, and the investigator's organization. Clicking on a marker on the map will produce a popup containing the name of the investigation, the investigator, and the investigator's organization. If more than one investigation is associated with one marker, all investigations will be listed in a scrolling window.

Clicking directly on the text provided on the matching investigations list will automatically return the investigation detail view for that particular investigation.

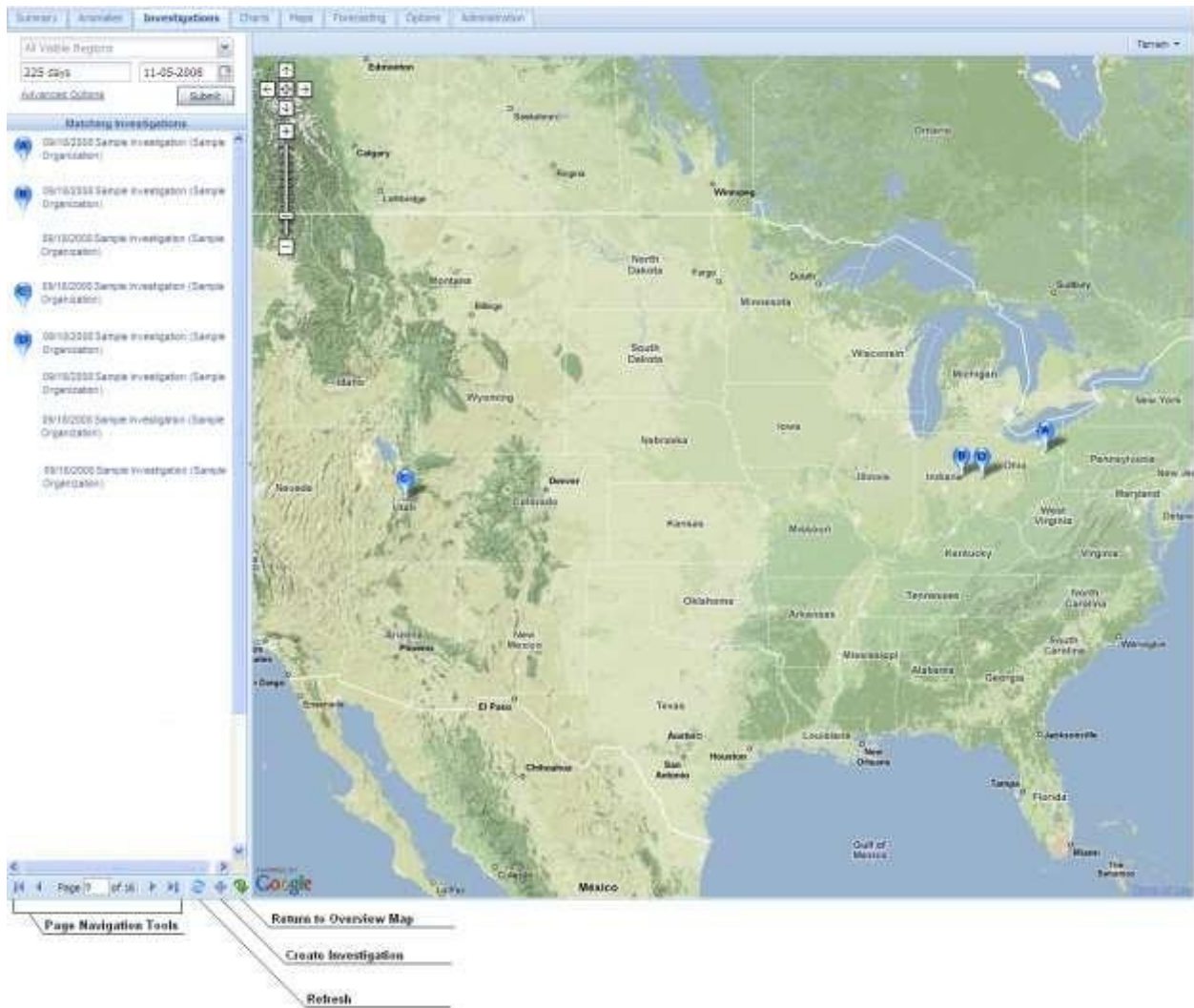


Figure37: Investigation overview

7.2 Investigation Detail

The investigation detail view of the Investigations page provides additional information for a specific investigation. This page is automatically displayed when creating a new investigation directly from an anomaly or when adding an anomaly to an existing investigation.

Functionality available on the investigation detail view may vary by organization. Both the standard and enhanced views are described below.

7.2.1 Standard Investigation Detail View

The standard investigation detail view contains four quadrants (moving clockwise from upper left):

Narrative (Upper Left)

The top left quadrant of the standard investigation detail view contains the investigation header providing the date the investigation was created, the name of the investigation, and the investigation identification number. Below the header, a narrative describing the investigation as well as available actions for conducting the investigation is available. Descriptive text components are indicated in red, available actions are in blue:

1. Start time of investigation
2. Individual starting investigation
3. Organization of individual starting investigation
4. Current investigator
5. Number of anomalies associated with the investigation
6. Current investigation state
7. Update the investigator
8. Change the investigation name
9. Associate additional anomalies
10. Add comments
11. Edit permissions
12. Update the state of the investigation

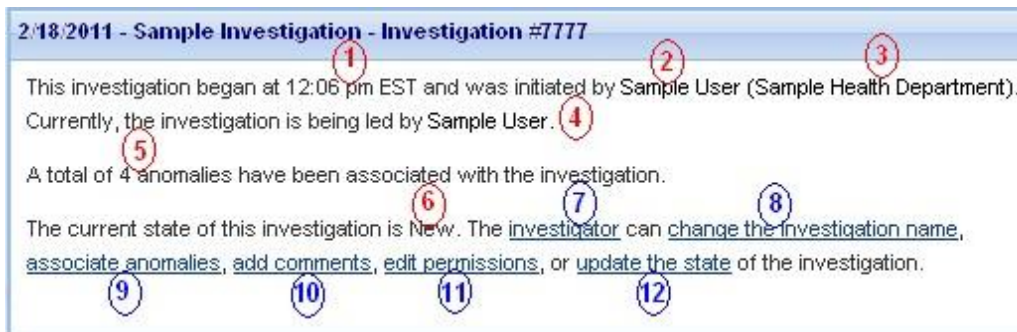


Figure38: Investigation detail narrative

Update the investigator: Clicking directly on “Investigator” will produce a popup of all available investigators. This list includes all EpiCenter users within your organization. Depending on a user’s preference settings for assignment emails, an email may automatically be sent to a newly assigned investigator notifying them that they have been assigned an investigation. Settings for assignment emails can be adjusted on the options page.

Associate additional anomalies: Clicking directly on “associate anomalies” produces a popup of all active anomalies in your accessible region. Selecting an anomaly from the list will automatically associate it with the investigation.

Add comments: Free-text comments can be added to the comments portion of the Investigation Detail screen by clicking directly on “add comments.” A popup window will appear after selecting this text (See Figure39). Enter a free-text comment and click “Add Comment” to populate the comments portion of the investigation detail page.

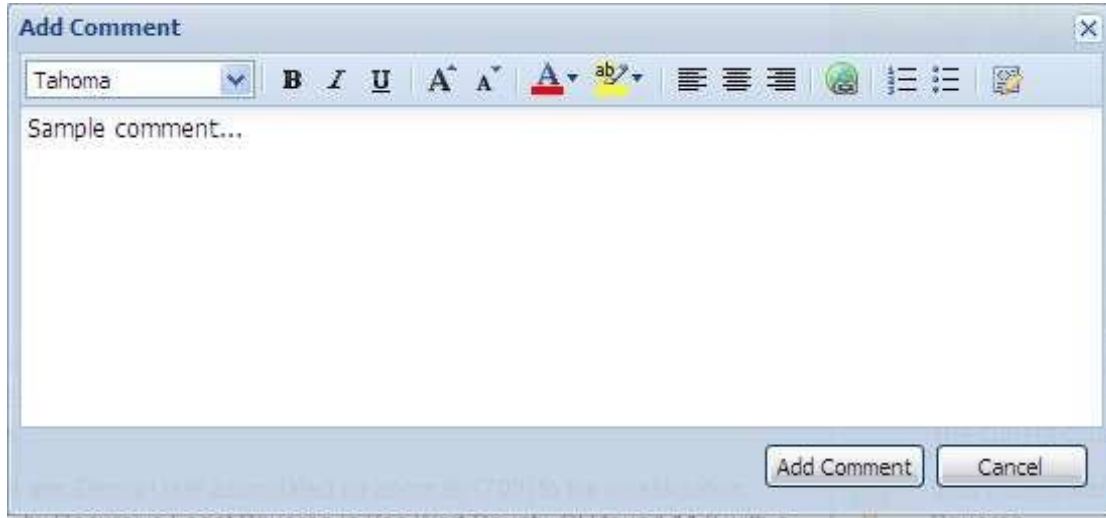


Figure39: Add comment box

Edit Permissions: Organizational administrator level users are able to share investigations with EpiCenter users outside of their organization by clicking on “edit permissions.” A popup window appears after selecting this text (See Figure40). An investigation is shared by following these steps:

1. Click on the “Add Permission” button to create a new entry in the Edit Permissions popup window.
2. Choose an organization from the “Granted To” dropdown box. This dropdown box is populated with all organizations with which your organization is authorized to share investigations. Please contact Health Monitoring Systems directly if you wish to share an investigation with an organization that is not contained in this list.
3. Assign a permission level
4. Repeat steps 1-3 to add additional organizations
5. Click the “Save” button in the bottom right corner of the popup window

To delete an entry, click on the green garbage bin located to the right of the entry. Clicking on the “Reset” button will reset the entries back to the settings last saved.

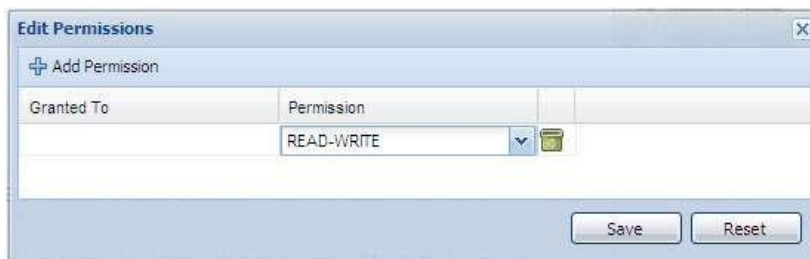


Figure40: Edit permissions box

Update the state of the investigation: Clicking directly on “update the state” will produce a popup of all available states. Select a state to transition the investigation and ultimately assign an end state. The states contained in this list may vary by region.

Map (Upper Right)

The top right portion of the investigation detail view provides a map with two types of markers. The blue marker represents the location of the initial investigator’s organization. The other markers, either orange or red, indicate the location of all associated anomalies. Clicking on the blue marker will produce a popup containing the name of the investigation, the current investigator, and the investigator’s organization. Clicking on the orange or red marker(s) will display the date of the anomaly, the classification used, the geographical location, the analysis method used, the actual count, and the maximum count threshold for each anomaly associated with the investigation.

Anomaly Status (Lower Right)

The bottom right portion of the investigation detail view contains a listing of all anomalies associated with the investigation. Each listing indicates the date of the anomaly, the classification, location, and analysis method used to detect the anomaly. It also provides the current count for that classification and location and indicates if that value exceeds the detection threshold in place at the time of the anomaly. The detection threshold is shown in parentheses.



Figure41: Associated anomaly list

The marker located to the left of each anomaly listing changes color based on the current counts in relation to the detection threshold. If the marker is:

Color	Definition
Red	The current counts exceed the detection threshold
Orange	The current counts do not exceed the detection threshold

Clicking directly on the text shown for each anomaly listing returns the anomaly detail view for that particular anomaly. Clicking the name of the investigation indicated in the narrative portion of the anomaly detail view will return the investigation detail view for the investigation selected.

To remove an anomaly from an investigation, right-click directly the text contained in the associated anomaly list and select “Remove this event.”

Comments (Lower Left)

The bottom left quadrant of the investigation detail view contains all comments logged and activities conducted for an investigation (See Figure). An entry is automatically inserted each time any action is taken on the investigation. This includes starting the investigation, updating the state of the investigation, changing the investigator, editing permissions, or associating or removing an anomaly to the investigation. Free text comments are entered by clicking on the underlined text “add comments” in the narrative portion. All comments update in real-time.

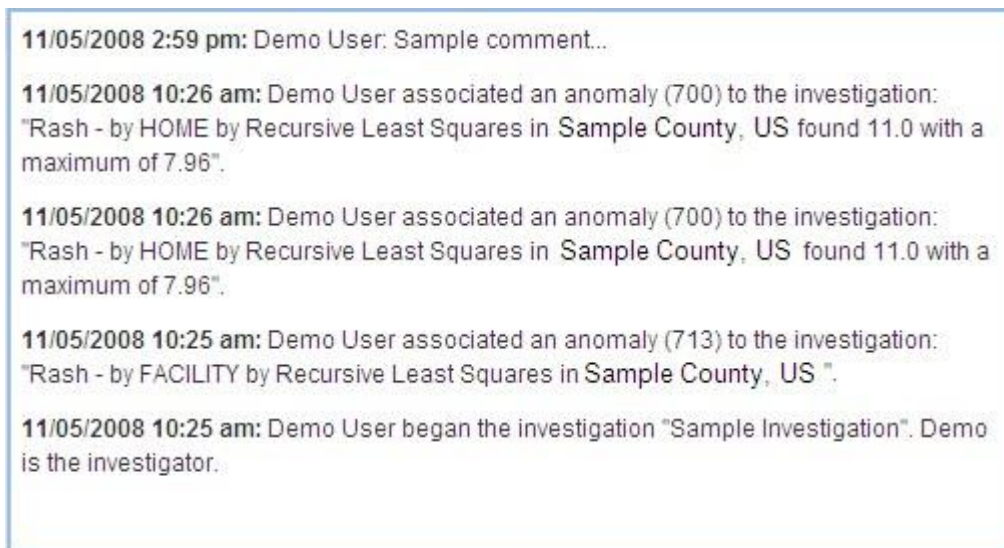


Figure42: Investigation detail comments

8 Charts

The Charts page is available for both public health and healthcare facility users. Healthcare facility users are limited to viewing data for their facility (or facilities in the event of a health system). The Charts page allows users to plot and compare charts based on the specifications provided in the left control panel. The case listings associated with the parameters selected are also available for display on the Charts page. Charts created on the Charts page can be added to a new or existing surveillance view, viewable on the Summary page.

Analysis of chart data is a two-step process. The first step is to generate a predicted count for the current day based on the actual counts from a specified number of days in the past. The exact number of days used is unique to each algorithm; it can either be specified directly by the user or calculated from other user-defined parameters depending on the algorithm.

The second step is to generate a threshold for the current day; actual counts above the threshold will generate an alert. Predicted counts are rarely perfect; there is always some error associated with them. Therefore, a certain amount of deviation is expected between the predicted count and the actual count. Using information on how the prediction errors are distributed under normal conditions, a threshold can be calculated which indicates a level of deviation from the predicted count that unexpected under normal conditions. This threshold can also be adjusted by the user; generally, a lower threshold will

result in greater sensitivity (detecting more anomalies) but reduced specificity (more false positive alerts) while a higher threshold will have the opposite effect.

Computing predicted counts and thresholds are related but separable processes; the methods for one can be combined in different ways with the methods for the other. The analysis methods in EpiCenter represent some of the most common combinations.

8.1 Plotting Charts

Follow these steps to plot a chart:

1. Enter a location in the free text location selector.
2. Specify an end date using the end date selector.
3. Define the 24-hour sliding window if the hour selector is enabled.
4. Enter a historic time period in the time period indicator.
5. Click on the options dropdown menu to choose an analysis method. Adjust analysis method parameters if desired. **If parameters are adjusted, “custom” will appear next to the analysis method name.**
6. Apply data conditioning.
7. Specify a data representation.
8. Opt to combine results.
9. Opt to plot the predicted values.
10. Expand the appropriate data type using the data type selector.
11. Select a classifier from the classifier selector.
12. Choose one or more classifications from the classification selector. **PLEASE NOTE**, if you wish to view *all visits*, regardless of classification, select “Total Counts” from the classification selector.
13. Choose one or more age groups from the age group selector.
14. Choose one or more genders from the gender selector.
15. Select a totaled by method using the totaled by selector.
16. Click on the submit button to generate a chart based on the defined attributes. The chart will appear to the right of the control panel.

Example #1: State Level View of Vomiting and Diarrhea with CuSum EMA Analysis and Day-of-Week Data Conditioning

Plot charts for “Sample Location” showing Acute Care Interactions that were classified as either vomiting and/or diarrhea by the symptom classifier between April 1, 2008 and May 1, 2008. Use a standard 24-hour sliding window. Display data for all age groups and genders and totaled by the patient’s home location. Use the CuSum EMA analysis method with default parameters to generate a threshold. Condition data to account for day-of-week effect. Represent data as number of visits. View each classification on a separate chart.

You would take the following actions to create this chart (See Figure 50):

1. Type “Sample State” into the location selector. Select “Sample State” from the drop down box once a match is provided.
2. Use the popup calendar tool located on the end date selector to display May 2008. Select the 1st from the calendar.

3. Ensure that the hour selector is disabled to use the standard 24-hour sliding window.
4. Type "1 month" into the time period indicator.
5. Click on the option dropdown menu and select "CuSum EMA" from the dropdown list. A dark blue bullet will appear next to CuSum EMA to indicate that it has been selected.
6. Click on the options dropdown menu, highlight "Data Conditioning," and click on "Condition for Day-of-Week Effect." A dark blue bullet will appear next to Condition for Day-of-Week Effect to indicate that it has been selected.
7. Click on the options dropdown menu, highlight "Data Representation," and click on "Number of Visits." A dark blue bullet will appear next to "Number of Visits" to indicate that it has been selected.
8. Click on the options dropdown menu, highlight "Advanced Options," and deselect the checkbox next to "Combined Results." The box next to Combined Results will be empty indicating that it is not selected.
9. Click on the options dropdown menu, highlight "Advanced Options," and deselect the checkbox next to "Plot Predicted Values." The box next to Plot Predicted Values will be empty indicating that it is not selected.
10. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
11. Click on the classifier selector dropdown menu and select "Infectious Disease Symptoms."
12. Highlight "vomiting" and "diarrhea" in the classification selector list by clicking on the terms and holding the CTRL key on your keyboard.
13. Highlight "All Age Groups" in the age group selector list.
14. Highlight "All Genders" in the gender selector list.
15. Click on the totaled by selector and click on "Totaled by Home Location."
16. Click on submit to produce the chart.



Figure 50: State level view of vomiting and diarrhea with CuSum EMA analysis and day-of-week data conditioning

Example #2: County Level View of Cough with Exponential Moving Average Analysis based on an anomaly.

Produce an actual value chart to mirror an anomaly detail chart for the purpose of applying adjusted analysis method parameters. The anomaly was detected for patients with a home zip code in Sample County at 11:00AM on June 26, 2008 for Acute Care Interactions classified as cough (infectious disease symptom) occurring between 10:00AM on June 25, 2008 and 10:00AM on June 26, 2008. The Exponential Moving Average analysis method was used. No data conditioning was applied.

You would take the following actions to create this chart (See Figure51):

1. Type “Sample County” into the location selector. Select “Sample County” from the drop down box once a match is provided.
2. Use the popup calendar tool located on the end date selector to display June 2008. Select the 26th from the calendar.
3. Click on the options dropdown menu, highlight “Advanced Options,” and select the checkbox next to “Hour Selector.” An hour will now appear to the right of the end date. Select 10am for the 24-hour sliding window.
4. Type “1 month” into the time period indicator.
5. Click on the options dropdown menu and select “Exponential Moving Average” from the dropdown list. A dark blue bullet will appear next to “Exponential Moving Average” to indicate that it has been selected. Click on the tool icon to generate the parameters popup window. Adjust parameters as desired. Click “Apply.”

6. Click on the options dropdown menu, highlight “Data Conditioning,” and click on “No Data Conditioning.” A dark blue bullet will appear next to “No Data Conditioning” to indicate that it has been selected.
7. Click on the options dropdown menu, highlight “Data Representation,” and click on “Actual Value.” A dark blue bullet will appear next to “Actual Value” to indicate that it has been selected.
8. Combined results are not applicable when viewing one chart.
9. Click on the options dropdown menu, highlight “Advanced Options,” and deselect the checkbox next to “Plot Predicted Values.” The box next to Plot Predicted Values will be empty indicating that it is not selected.
10. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
11. Click on the classifier selector dropdown menu and select “Infectious Disease Symptom.”
12. Highlight “Cough” in the classification selector list.
13. Highlight “All Ages” in the age group selector list.
14. Highlight “All Genders” in the gender selector list.
15. Click on the totaled by selector and click on “Totaled by Home Location.”
16. Click on submit to produce the chart.

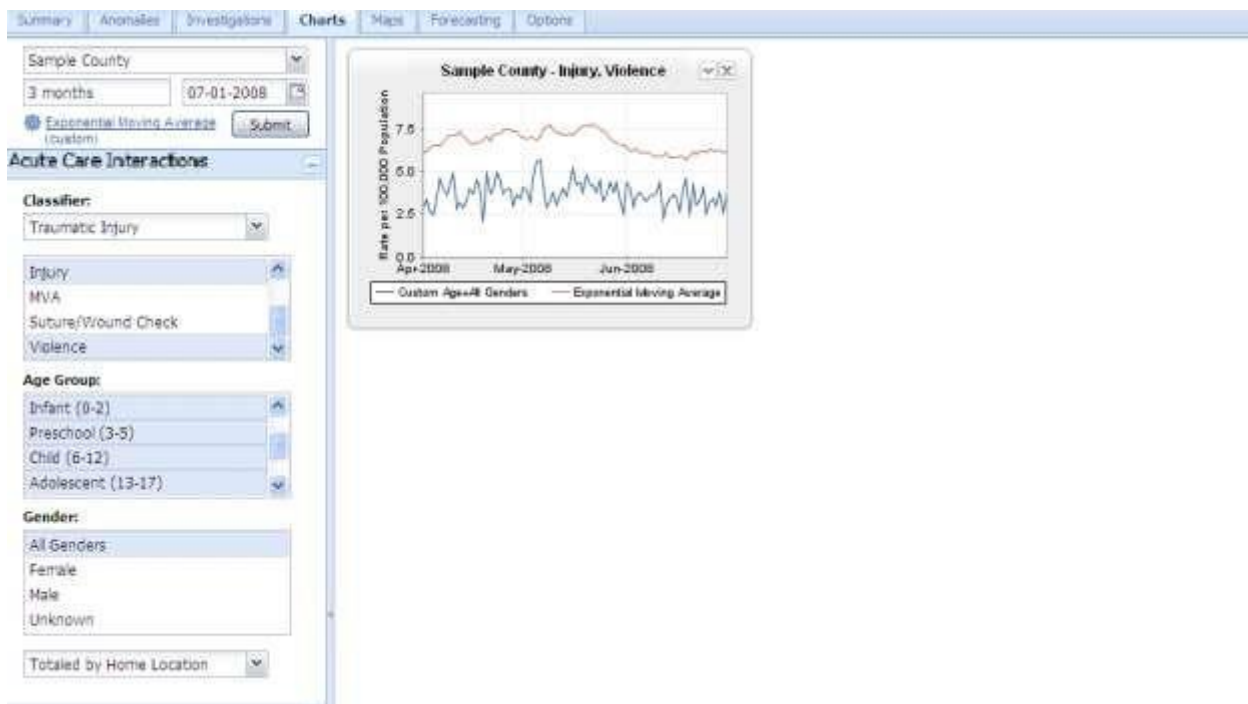


Figure51: County level view of cough with exponential moving average analysis based on an anomaly Level View of Cough with Exponential Moving Average Analysis based on an anomaly

Example #3: Facility Specific View of Animal Attacks, Bites, and Scratches with Moving Average Analysis

Plot one chart for “Sample Hospital” showing Acute Care Interactions for that facility that were classified as either animal attack, animal bite, or animal scratch by the animal related injury classifier between September 1, 2008 and September 21, 2008. Use a standard 24-hour

sliding window. Display data for all age groups and genders. Use the Moving Average analysis method with default parameters to generate a threshold. Do not apply data condition. Represent data as number of visits. View the data on one combined chart.

You would take the following actions to create this chart (See Figure52):

1. Type "Sample Hospital" into the location selector. Select "Sample Hospital" from the drop down box once a match is provided.
2. Use the popup calendar tool located on the end date selector to display September 2008. Select the 21st from the calendar.
3. Ensure that the hour selector is disabled to use the standard 24-hour sliding window.
4. Type "3 weeks" into the time period indicator.
5. Click on the options dropdown menu and select "Moving Average" from the dropdown list. A dark blue bullet will appear next to Moving Average to indicate that it has been selected.
6. Click on the options dropdown menu, highlight "Data Conditioning," and click on "No Data Conditioning." A dark blue bullet will appear next to "No Data Conditioning" to indicate that it has been selected.
7. Click on the options dropdown menu, highlight "Data Representation," and click on "Number of Visits." A dark blue bullet will appear next to Number of Visits to indicate that it has been selected.
8. Click on the options dropdown menu, highlight "Advanced Options," and select the checkbox next to "Combined Results." The box next to Combined Results will be checked indicating that it is selected.
9. Click on the options dropdown menu, highlight "Advanced Options," and deselect the checkbox next to "Plot Predicted Values." The box next to Plot Predicted Values will be empty indicating that it is not selected.
10. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
11. Click on the classifier selector dropdown menu and select "Animal Related Injury."
12. Highlight "Animal Attack," "Animal Bite," and "Animal Scratch" in the classification selector list by clicking on the terms and holding the CTRL key on your keyboard.
13. Highlight "All Age Groups" in the age group selector list.
14. Highlight "All Genders" in the gender selector list.
15. The totaled by selector will automatically be set to "Totaled by Facility."
16. Click on submit to produce the chart.

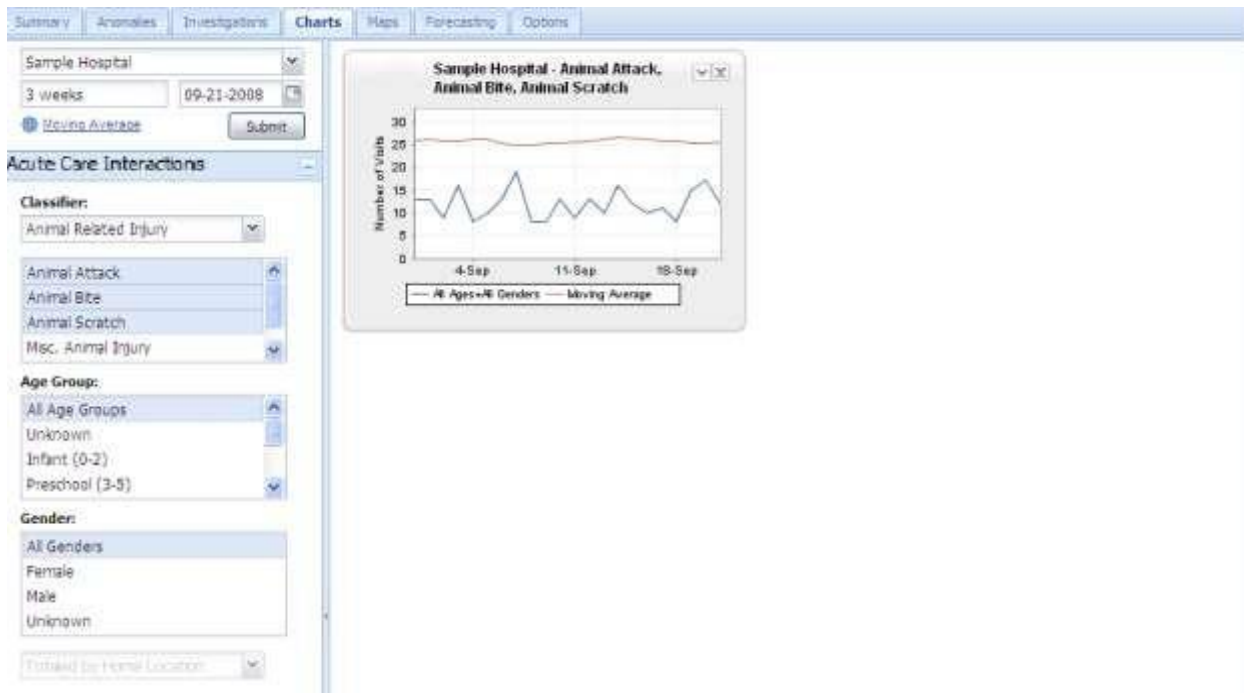


Figure52: Facility specific view of animal attacks, bites, and scratches with Moving Average Analysis Specific View of Animal Attacks, Bites, and Scratches with Moving Average Analysis

Example #4: All Acute Care Interactions for a Single Hospital

Plot one chart for “Sample Hospital” showing all Acute Care Interactions for that facility on August 31, 2008 and three days prior. Use a standard 24-hour sliding window. Display data for all age groups and genders. Do not apply data conditioning or an analysis method. Represent data as number of visits.

You would take the following actions to create this chart (See Figure53):

1. Type “Sample Hospital” into the location selector. Select “Sample Hospital” from the drop down box once a match is provided.
2. Use the popup calendar tool located on the end date selector to display August 2008. Select the 21st from the calendar.
3. Ensure that the hour selector is disabled to use the standard 24-hour sliding window.
4. Type “3 days” into the time period indicator.
5. Click on the options dropdown menu and select “No Analysis” from the dropdown list. A dark blue bullet will appear next to “No Analysis” to indicate that it has been selected.
6. Click on the options dropdown menu, highlight “Data Conditioning,” and click on “No Data Conditioning.” A dark blue bullet will appear next to “No Data Conditioning” to indicate that it has been selected.
7. Click on the options dropdown menu, highlight “Data Representation,” and click on “Number of Visits.” A dark blue bullet will appear next to Number of Visits to indicate that it has been selected.
8. Combined results is not applicable when viewing “Total Counts.”

9. Click on the options dropdown menu, highlight “Advanced Options,” and deselect the checkbox next to “Plot Predicted Values.” The box next to Plot Predicted Values will be empty indicating that it is not selected.
10. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
11. Click on the classifier selector dropdown menu and select “Total Counts.”
12. The classification selector is not applicable when viewing “Total Counts.”
13. Highlight “All Age Groups” in the age group selector list.
14. Highlight “All Genders” in the gender selector list.
15. The totaled by selector will automatically be set to “Totaled by Facility.”
16. Click on submit to produce the chart.

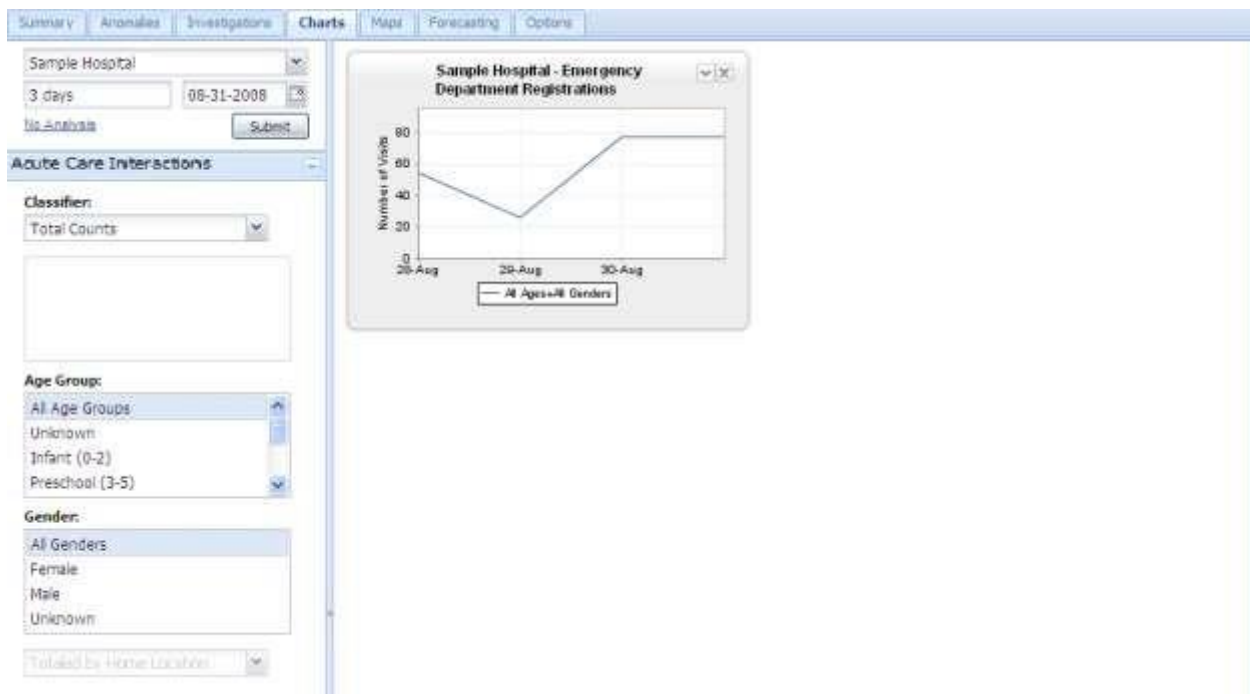


Figure53: All Acute Care Interactions for a single hospital

Example #5: State Level View of ILI Symptoms and Admissions with Exponential Moving Average Analysis

Plot charts for “Sample Location” showing Acute Care Interactions that were classified as ILI Symptoms by the symptom classifier and Discharge Dispositions that were classified as Admitted between September 1, 2012 and October 1, 2012. Use a standard 24-hour sliding window. Display data for all age groups and genders and totaled by the patient’s home location. Use the Exponential Moving Average analysis method with default parameters to generate a threshold. Condition data to account for day-of-week effect. Represent data as number of records.

You would take the following actions to create this chart (See Figure 54):

1. Type "Sample Location" into the location selector. Select "Sample Location" from the drop down menu once a match is provided.
2. Use the popup calendar tool located on the end date selector to display October 2012. Select the 1st from the calendar.
3. Ensure that the hour selector is disabled to use the standard 24-hour window.
4. Type "1 month" into the time period selector.
5. Click on the options dropdown menu and select "Exponential Moving Average" from the dropdown list. A dark blue bullet will appear next to "Exponential Moving Average" to indicate that it has been selected.
6. Click on the options dropdown menu, highlight "Data Conditioning," and select "Condition for Day-of-Week Effect." A dark blue bullet will appear next to "Condition for Day-of-Week Effect" to indicate that it has been selected.
7. Click on the options dropdown menu, highlight "Data Representation," and select "Number of Records." A dark blue bullet will appear next to "Number of Records" to indicate that it has been selected.
8. Click on the options dropdown menu and select "Classifier Query Editor." This will display the Classifier Query Editor popup. Select "Influenza Related Illness" in the Classifier menu and "ILI Symptoms" in the classification menu. "Influenza Related Illness" and "ILI Symptoms" will be highlighted in blue to indicate that they have been selected.
9. In the Classifier Query Editor popup, click on the "plus" symbol to the left of the Classifier selector. This will display an additional classifier and classification selector. Select "Discharge Disposition" from the classifier selector and "Admitted" from the classification selector. "Discharge Disposition" and "Admitted" will be highlighted in blue to indicate that they have been selected.
10. Click "Apply." This will close the popup. Note that on the control panel the Classifier Selector has been replaced by the parameters of the chosen Classifier Query.
11. Highlight "All Age Groups" in the age group selector list.
12. Highlight "All Genders" in the gender selector list.
13. Highlight "All Provider Types" in the provider type selector list.
14. Click on the totaled by selector and select "Totaled by Home Location."
15. Click on submit to produce the chart.

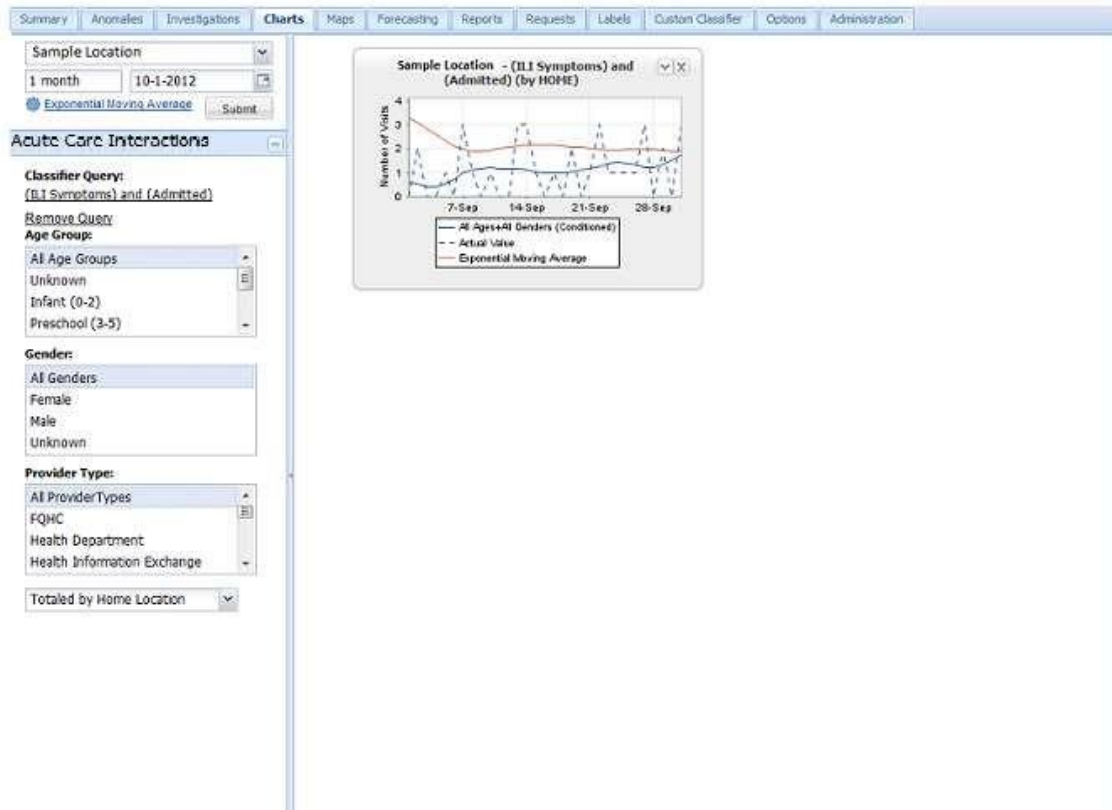


Figure 54: State Level View of ILI Symptoms and Admissions with Exponential Moving Average Analysis

8.2 Surveillance Views

Each chart plotted on the Charts page can be added to a new or existing surveillance view. To view the surveillance view drop down menu, click on the down arrow located in the top right corner of each individual chart (see Figure55).



Figure55: Surveillance view creation popup

To add the chart to an existing view, highlight “Add to Existing View.” A listing of all existing views will appear to the right. Click on the desired view.

To add the chart to a new surveillance view, click on “Create New View.” A popup box will appear prompting you to name the new surveillance view. The surveillance view must be given a unique name. Type the desired name of the surveillance view into the free text box on the popup and press “OK.” Selecting “Cancel” will terminate the request to create a new surveillance view. Confirmation of surveillance view creation will be given after clicking “OK” and the chart will automatically be added to the surveillance view. Additional charts can then be added to the newly created view by following the instructions in the previous paragraph.

A maximum of 37 charts can be added to a single surveillance view.

Surveillance views can be viewed and edited on the Summary page.

8.3 Labels

Labels can be created on the “Labels” page by selecting the plus sign located in the top of the left control panel. Labels can also be created directly from a chart by clicking the down arrow in the upper right corner of a chart. This opens a drop down menu that includes the option to apply an existing label or to apply a new label. Selecting apply new label opens a pop up window with blank text fields that prompt the user to create a name and an item description. Select save to create a new label. Labels can be viewed and edited on the “Labels” page.

8.4 Chart Details Popup Window

Clicking directly on a chart on the Charts page produces a popup window containing a larger version of the selected chart and line listings for the associated patients. The popup window contains two tabs, Chart and Patients. The Chart tab is the default view.

8.4.1 Chart Tab

The Chart tab contains a chart identical to the smaller chart selected on the Charts page. Attributes cannot be changed from the popup chart; only from the smaller chart. Daily counts displayed on the popup chart are available for automatic download by clicking on the “Download” button located in the bottom left corner of the popup window. The counts file can be downloaded as a CSV or Excel file for some organizations. (See Figure56). Selecting this option initiates the download process. Continue to follow the prompts from your computer’s default application to open the file.

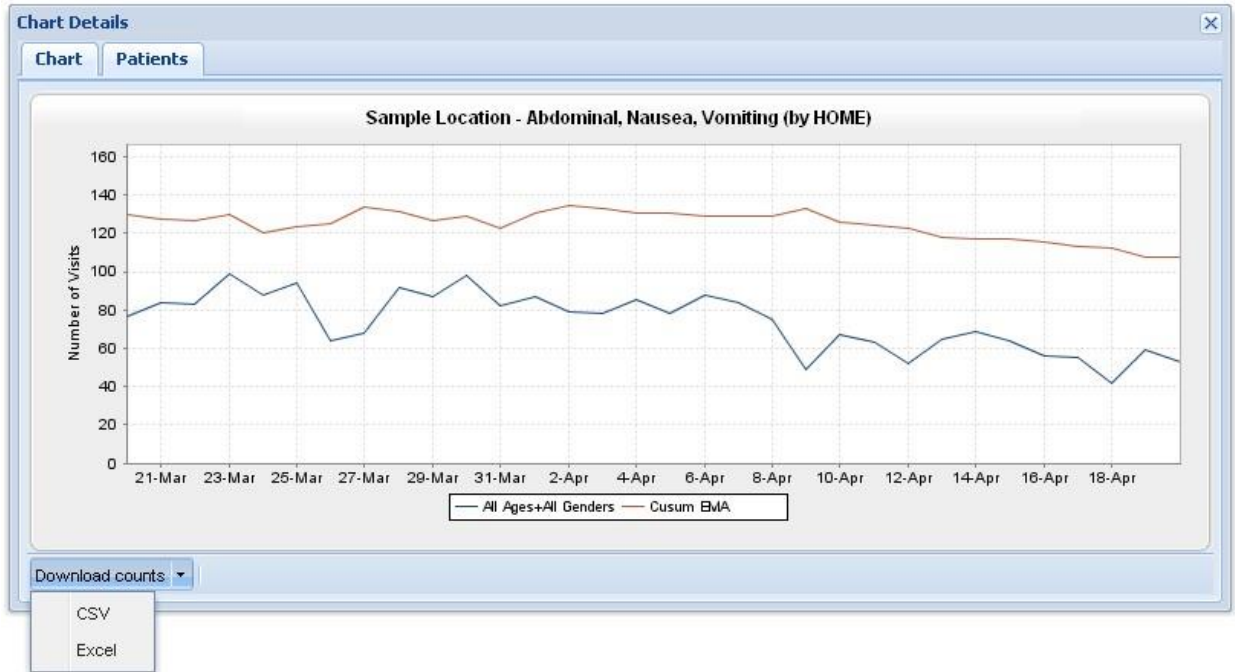


Figure56: Popup chart

8.4.2 Patients Tab

Individual line listings for all patients associated with the chart are available by selecting the “Patients” tab located in the top left portion of the popup window. The date and time associated with each event, the patient’s age, the patient’s gender, the patient’s home zip code, the facility name, visit number, free-text chief complaint, and classification(s) are displayed by default for each record. If a patient’s age is unknown, it will be displayed as “-1.” The patient’s date of birth, race/ethnicity, and country of origin are also available for display but must be turned on manually using the column display control. This control allows for the selection of which columns display in the popup patient list. The dropdown list is viewed by hovering over any of the column headers and clicking directly on the down arrow that subsequently appears. Moving the mouse cursor over “Columns” will then produce the list of visible columns. If the checkbox to the left of the column name is selected, it will appear on the popup Patients tab. (See Figure57: Column selector). When this data is downloaded as a CSV or Excel file, the file includes all data values viewable in the patients tab.

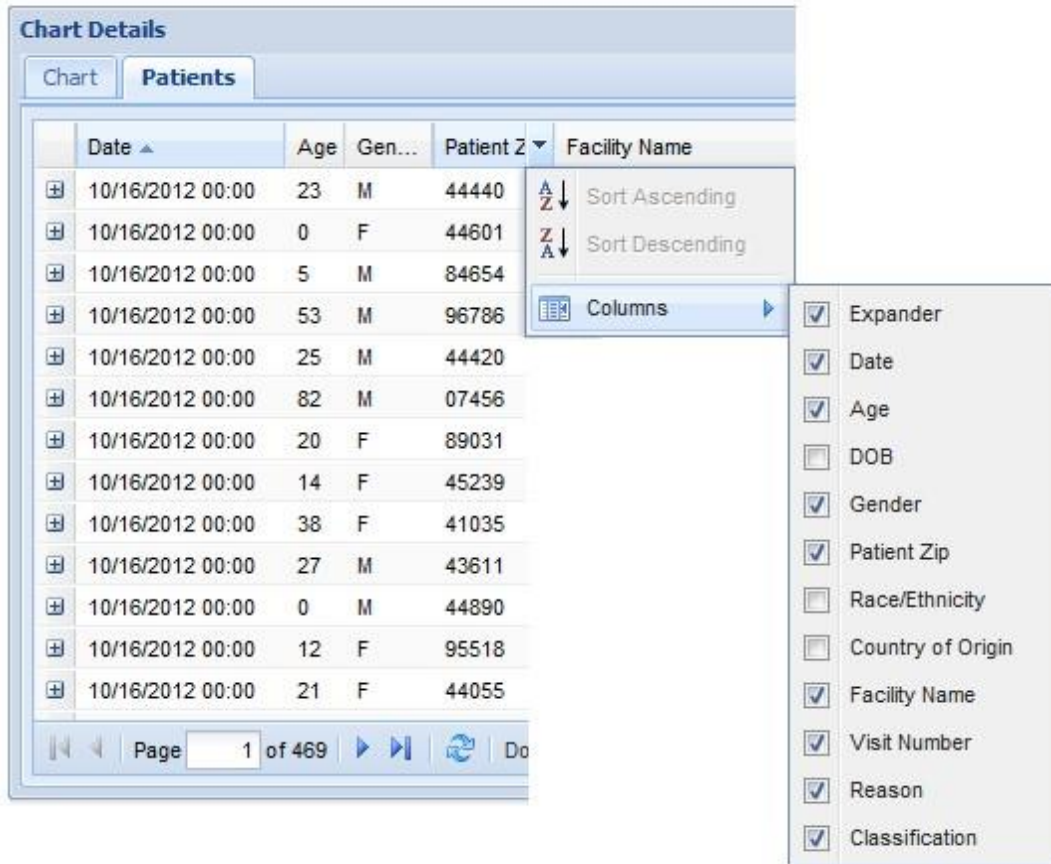


Figure57: Column selector

Use the page controls located in the bottom left portion of the popup window to navigate between multiple pages of line listings (applicable if more than 100 records are associated with the chart) (See Figure).

The line listings provided in the popup window are available for automatic download by clicking on the “Download” button located in the bottom middle portion of the popup window. The patient file can be downloaded as a CSV or as an Excel file for some organizations. (See Figure58). Selecting this option initiates the download process. Continue to follow the prompts from your computer’s default application to open the file.

For line listings where both a patient ID and visit number are available, additional information for that particular visit can be viewed by expanding the line listing. A line listing is expanded by clicking on the + located to the left of the entry on the popup window (See Figure58). Click on the “Expand All Rows” button in the bottom middle portion of the popup window to expand all line listings. All rows can be collapsed by clicking on the refresh button, also in the bottom middle portion of the popup window.

Where the user’s security permissions allow access to detailed case histories for a region, the expanded line listing contains all available registrations, admissions, or discharges related to the patient’s current visit as well as the visit number, patient ID, patient’s date of birth, and patient’s age group. The record

type, date and time, patient class, free text chief complaint (when applicable), diagnostic code (when applicable), and classifications are provided for each individual record.

If a patient ID and/or visit number are not available for a patient, the patient history will not be displayed. If these patient listings are expanded, the text “Patient history is not available for this record” will appear in place of the aforementioned details.

A patient’s full history from the facility indicated in the line listing is available by clicking on the “View Full History” button located in the right portion of the expanded line listing. Clicking this button opens an additional tab in the popup window. This tab contains all available line listings for the patient’s current visit as well as any past visits to this facility. Patient history is only available for visits that occurred after the facility began submitting data to EpiCenter. Full history can be opened for multiple patients by returning to the Patients tab and selecting “View Full History” for another patient. Full history tabs can be closed by selecting the X to the right of the tab name.

The popup window containing the Chart, Patients, and Full History (if available) can be closed by selecting the X located in the top right corner of the window.

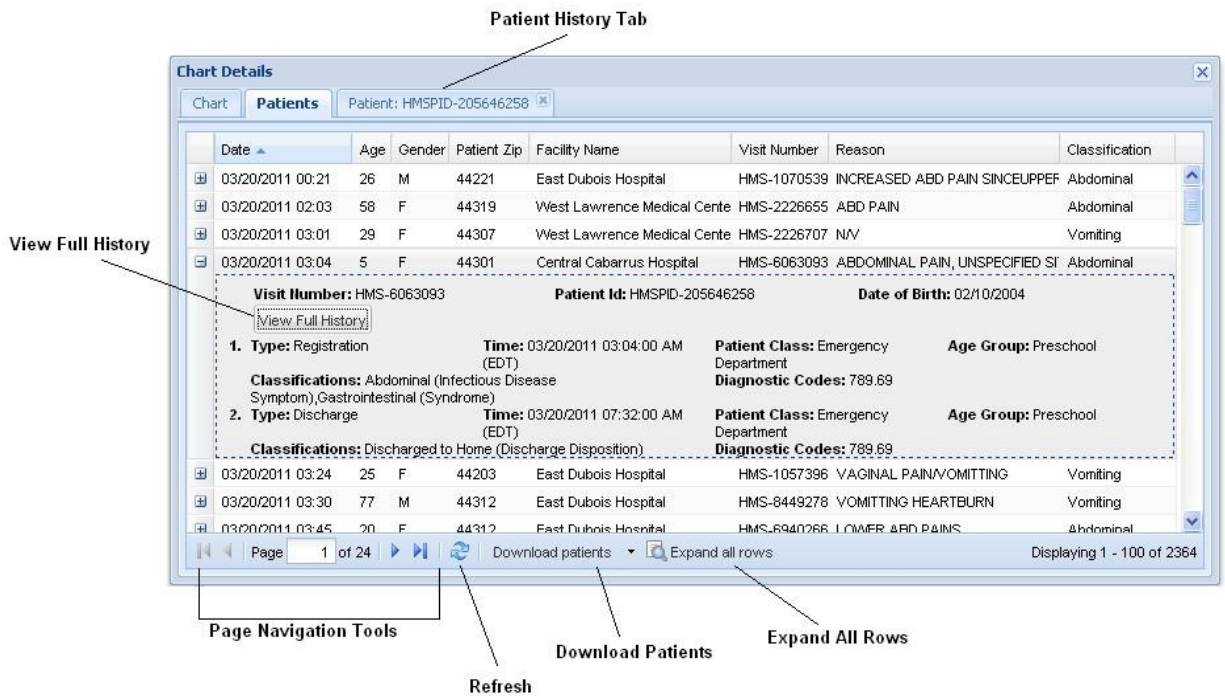


Figure58: Patients

If the enhanced investigation detail view (See, Page 46) is enabled, patients can be added directly to an existing investigation directly from the Patients tab on the popup chart. Clicking directly on a line listing will highlight it in blue. Use the Ctrl or Shift keys on the keyboard to make more than one selection. Right clicking with the mouse will then produce a popup menu containing an investigation list. Select the investigation name to add the highlighted patients to that investigation (See

Date	Age	Gender	Patient Zip	Facility Name	Visit Number	Reason	Classification
03/20/2011 00:21	26	M	44221	East Dubois Hospital	HMS-1070539	INCREASED ABD PAIN SINCEUPPEF	Abdominal
03/20/2011 02:03	58	F	44319	West Lawrence Medical Cente	HMS-2226655	ABD PAIN	Abdominal
03/20/2011 03:01	29	F	44307	West Lawrence Medical Cente	HMS-2226707	N/V	Vomiting
03/20/2011 03:04	5	F	44301	Central Cabarrus Hospital	HMS-5062002	ABDOMINAL PAIN, UNSPECIFIED SI	Abdominal
03/20/2011 03:24	25	F	44203	East Dubois Hospital		VOMITTING	Vomiting
03/20/2011 03:30	77	M	44312	East Dubois Hospital		RTBURN	Vomiting
03/20/2011 03:45	20	F	44312	East Dubois Hospital		INS	Abdominal
03/20/2011 04:14	20	M	44320	West Lawrence Medical C			Abdominal
03/20/2011 04:38	49	F	44314	East Dubois Hospital	HMS-9704693	REACTION TO MEDS VOMITTING DI	Vomiting
03/20/2011 04:57	24	F	44313	East Dubois Hospital	HMS-1006882	ABD PAINS SEVERE BACK PAINS	Abdominal
03/20/2011 05:00	24	F	44313	East Dubois Hospital	HMS-9398876	VOMITTING	Vomiting
03/20/2011 05:18	22	F	44301	Sunrise Hospital & Medical Cer	HMS-7104453	ABD PAIN	Abdominal
03/20/2011 05:24	75	M	44087	North Fulton Medical Center	HMS-4349553	VOMITING	Vomiting

Figure58). The highlighted patients will then display on the Patients tab in the enhanced investigation detail view on the Investigations page.

Date	Age	Gender	Patient Zip	Facility Name	Visit Number	Reason	Classification
03/20/2011 00:21	26	M	44221	East Dubois Hospital	HMS-1070539	INCREASED ABD PAIN SINCEUPPEF	Abdominal
03/20/2011 02:03	58	F	44319	West Lawrence Medical Cente	HMS-2226655	ABD PAIN	Abdominal
03/20/2011 03:01	29	F	44307	West Lawrence Medical Cente	HMS-2226707	N/V	Vomiting
03/20/2011 03:04	5	F	44301	Central Cabarrus Hospital	HMS-5062002	ABDOMINAL PAIN, UNSPECIFIED SI	Abdominal
03/20/2011 03:24	25	F	44203	East Dubois Hospital		VOMITTING	Vomiting
03/20/2011 03:30	77	M	44312	East Dubois Hospital		RTBURN	Vomiting
03/20/2011 03:45	20	F	44312	East Dubois Hospital		INS	Abdominal
03/20/2011 04:14	20	M	44320	West Lawrence Medical C			Abdominal
03/20/2011 04:38	49	F	44314	East Dubois Hospital	HMS-9704693	REACTION TO MEDS VOMITTING DI	Vomiting
03/20/2011 04:57	24	F	44313	East Dubois Hospital	HMS-1006882	ABD PAINS SEVERE BACK PAINS	Abdominal
03/20/2011 05:00	24	F	44313	East Dubois Hospital	HMS-9398876	VOMITTING	Vomiting
03/20/2011 05:18	22	F	44301	Sunrise Hospital & Medical Cer	HMS-7104453	ABD PAIN	Abdominal
03/20/2011 05:24	75	M	44087	North Fulton Medical Center	HMS-4349553	VOMITING	Vomiting

Figure59: Patient selection for grouping on investigations

9 Maps

Using Google maps, the Maps page provides a geographic representation of data anomalies and trends. Charts can be derived directly from the data displayed on the map. Spatial scan can also be applied to a geographic area on the maps page.

9.1 Plotting Data on a Map

The location text box on the Maps page automatically defaults to a user's assigned access level. This control is disabled as the map is navigated using the mouse cursor. The time period control is also inactive on the Maps page as data is viewed on the map for one day at a time. The end date selector is used to specify the date for which data is viewed. An analysis method can be selected on the Maps page. Additionally, several sub-tabs are available to further specify parameters (See Figure60).

Follow these steps to plot data on the map page:

1. Specify a date using the end date selector.
2. Click on the options dropdown menu to choose an analysis method. Adjust parameters if desired.
3. Select a method of data conditioning if desired.
4. Specify a data representation.
5. Expand the appropriate data type using the data type selector.
6. On the Shading tab contained in the left control panel, select a classifier from the classifier selector.
7. Choose one or more classifications from the classification selector. **PLEASE NOTE**, if you wish to view *all visits*, regardless of classification, select "Total Counts" from the classification selector.
8. Choose one or more age groups from the age group selector.
9. Choose one or more genders from the gender selector.
10. Select a totaled by method using the totaled by selector.
11. Click on the submit button to view data on the map based on your defined specifications.

United States

8-31-2011

Exponential Moving Average
Probability

Submit

Shading Markers View

Acute Care Interactions

Classifier:

Infectious Disease Symptom

Abdominal
Arthralgia
Congestion
Cough

Age Group:

All Age Groups
Unknown
Infant (0-2)
Preschool (3-5)

Gender:

All Genders
Female
Male
Unknown

Totaled by Home Location

Shading will appear on the map to the right of the control panel.

12. Markers can be added to the map showing the locations of healthcare facilities as well as air quality data and reportable disease data (as available by region).

13. Adjust the granularity, apply label features, or display point zip codes on the View tab contained in the left control panel.

14. Focus on the area of interest by clicking and dragging with your mouse to change the viewing area and by double clicking to zoom-in.

Shading Markers View

Facilities
 Air Quality
 Reportable Disease Cases
Options

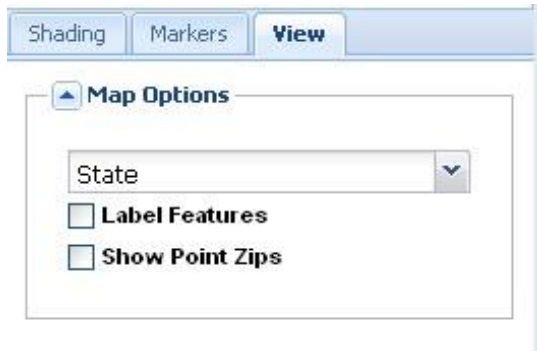


Figure60: Map control panel sub-tabs

9.2 Navigating the Map

To move to a new geographic area, you can click and drag directly on the map or use the navigation controls located in the upper left corner of the map. You can zoom-in on a specific area by double-clicking directly on the area. The zoom-in feature is also available on the navigation controls.

Data is available on the map for the granularity associated with your assigned access level and all applicable sub-granularities. The granularity is changed on the View tab located on the left control panel. Labels can be applied to the map by checking the check box next to “Labels” located on the Markers tab, also on the left control panel. Additionally, the map display can be changed between map and terrain view, using the map view dropdown, also located in the top right corner of the map (See Figure61).



Figure61: Map controls

Example #1: County Level View of Diarrhea, Fever, and Vomiting for Patients Under Age 18 with Poisson Visit Frequency Analysis and Percentage of All Visits Data Representation

View data on the map for a county within your state showing Acute Care Interactions that were classified as diarrhea, fever, and vomiting on June 30, 2008. Display data for only patients under the age of 18 and all genders, totaled by the patient’s home location. Use the Poisson Visit Frequency analysis method default parameters. Do not apply data conditioning. Represent data as a percentage of all visits.

1. Use the popup calendar tool located on the end date selector to display June 2008. Select the 30th from the calendar.
2. Click on the options dropdown menu and select “Poisson Visit Frequency” from the dropdown list. A dark blue bullet will appear next to “Poisson Visit Frequency” to indicate that it has been selected. Select the tool icon to the left of the options dropdown to adjust the analysis method parameters as desired.
3. Click on the options dropdown menu, highlight “Data Conditioning,” and click on “No Data Conditioning.” A dark blue bullet will appear next to “No Data Conditioning” to indicate that it has been selected.
4. Click on the options dropdown menu, highlight “Data Representation,” and click on “Percentage of all Visits.” A dark blue bullet will appear next to “Percentage of all visits” to indicate that it has been selected.
5. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
6. Click on the classifier selector dropdown menu and select “Infectious Disease Symptoms.”
7. Highlight “diarrhea,” “fever,” and “vomiting” in the classification selector list by clicking on the terms and holding the CTRL key on your keyboard.
8. Highlight “Infant,” “Preschool,” “Child,” and “Adolescent” in the age group selector list.
9. Highlight “All Genders” in the gender selector list.
10. The totaled by selector will automatically be set to “Totaled by Home.”
11. Click on the submit button to view data on the map based on your defined specifications. Shading will appear on the map to the right of the control panel.

12. Change the granularity dropdown on the View tab to “County” to view county level data.
13. Click and drag the map to center the desired county for viewing, double click on that county to zoom-in.

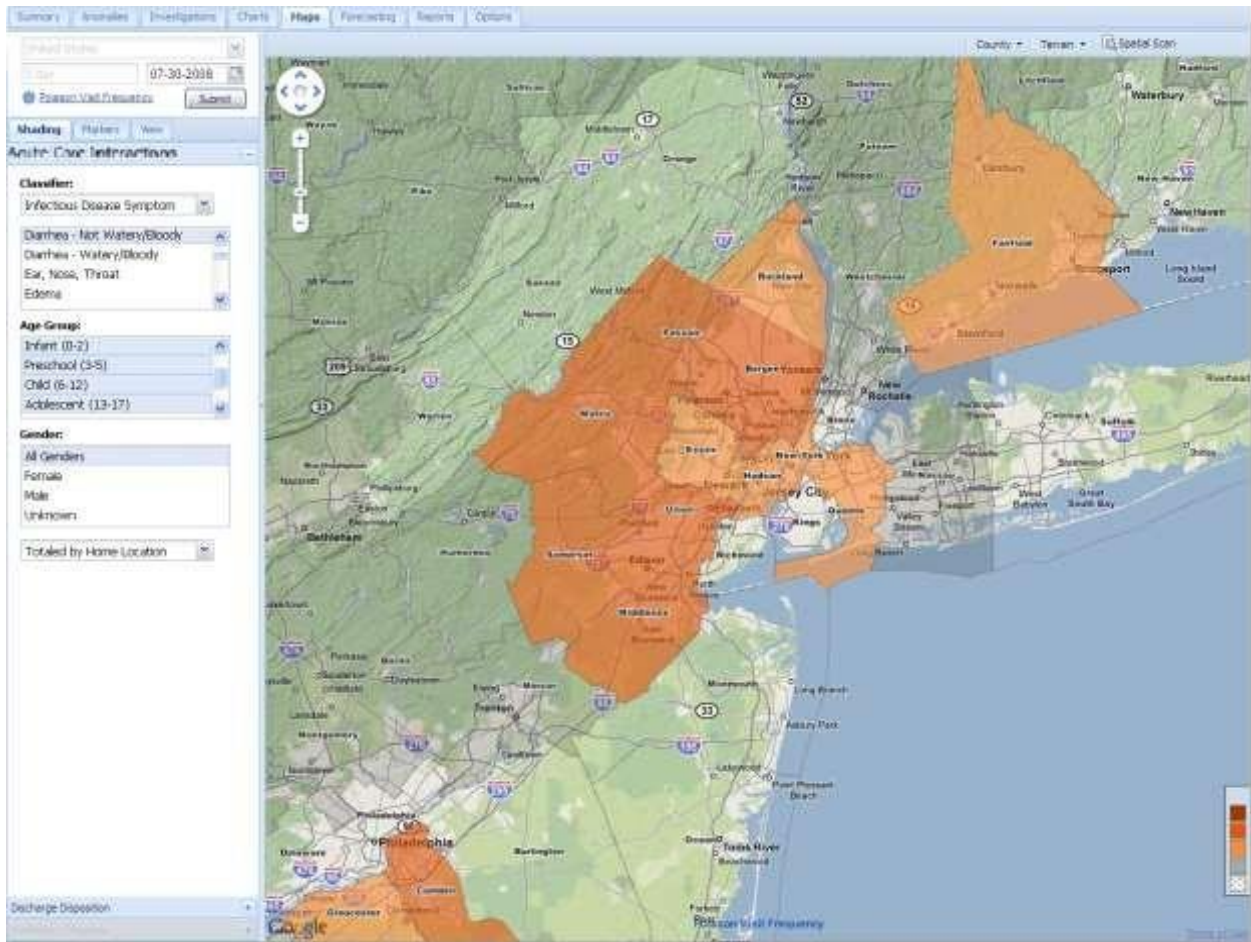


Figure62: County level view of diarrhea, fever, vomiting for patients under age 18 with Poisson Visit Frequency analysis and percentage of all visits data representation

Example #2: Zip Code Level View of All Acute Care Interactions with Exponential Moving Average Probability

View data on the map for a zip code within your county showing all Acute Care Interactions on August 15, 2008. Display data for all age groups and all genders, totaled by the patient’s home location. Use the Exponential Moving Average Probability analysis method with default parameters. Do not apply data conditioning. Represent data as number of visits.

1. Use the popup calendar tool located on the end date selector to display August 2008. Select the 15th from the calendar.
2. Click on the options dropdown menu and select “Exponential Moving Average Probability” from the dropdown list. A dark blue bullet will appear next to “Exponential Moving Average Probability” to indicate that it has been selected.

3. Click on the options dropdown menu, highlight “Data Conditioning,” and click on “No Data Conditioning.” A dark blue bullet will appear next to “No Data Conditioning” to indicate that it has been selected.
4. Click on the options dropdown menu, highlight “Data Representation,” and click on “Number of Visits.” A dark blue bullet will appear next to “Number of Visits” to indicate that it has been selected.
5. Ensure that specifications for Acute Care Interactions are expanded by noting the data type selector.
6. Click on the classifier selector dropdown menu and select “Total Counts.”
7. The classification selector is not applicable when viewing “Total Counts.”
8. Highlight “All Age Groups” in the age group selector list.
9. Highlight “All Genders” in the gender selector list.
10. The totaled by selector will automatically be set to “Totaled by Home.”
11. Click on the submit button to view data on the map based on your defined specifications. Shading will appear on the map to the right of the control panel.
12. Change the granularity dropdown to “Zip Code” on the View tab to view zip code level data.
13. Click and drag the map to center the desired zip code for viewing, double click on that zip code to zoom-in.

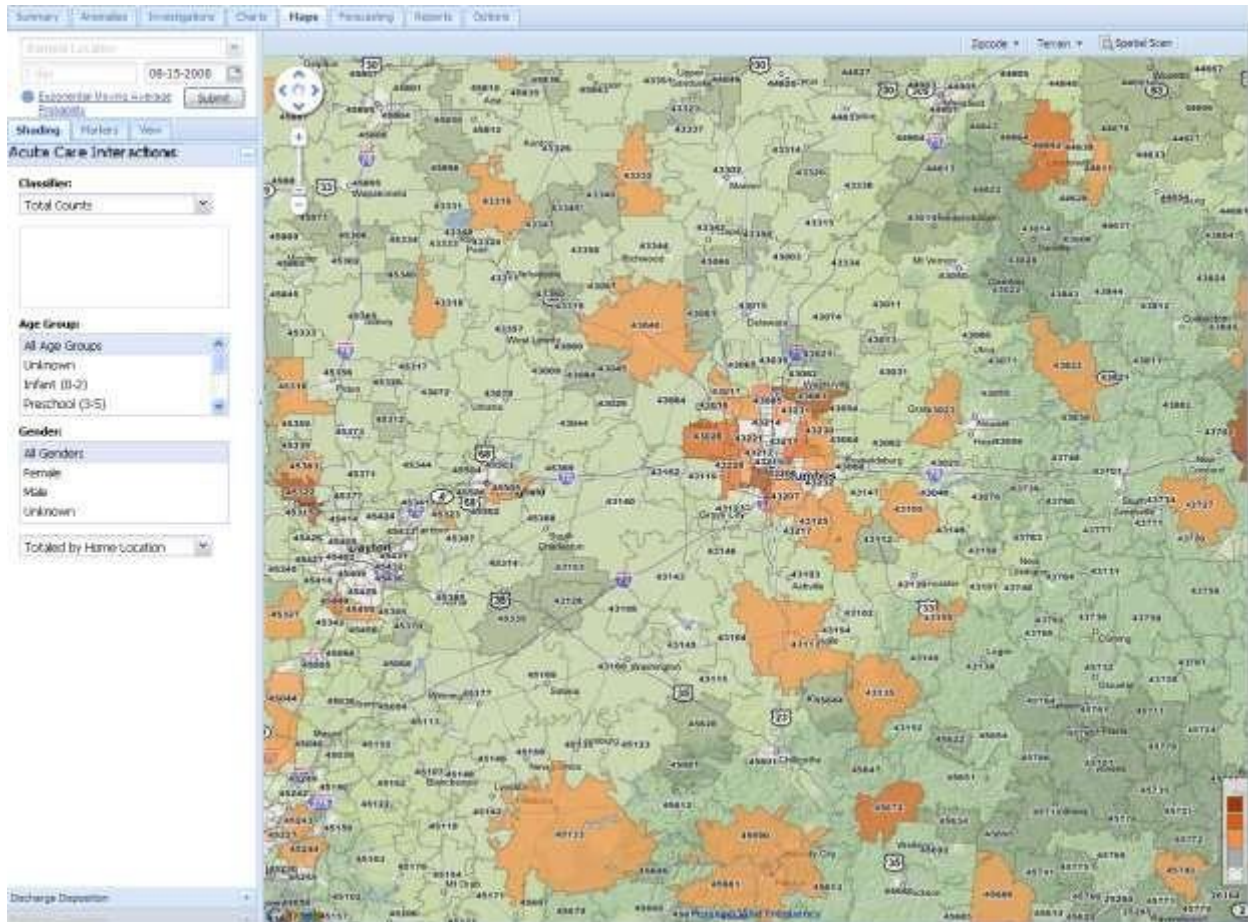


Figure63: Zip code level view of all Acute Care Interactions with Exponential Moving Average probability

9.3 Interpreting the Map

Analysis of map data is a two-step process. The first step is to generate a predicted count for the current day based on the actual counts from a specified number of days in the past. The exact number of days used is unique to each algorithm; it can either be specified directly by the user or calculated from other user-defined parameters depending on the algorithm.

The second step is to determine how unlikely the current actual count is based on actual values that have been seen in the past. This result is calculated; the lower the percentile, the more common the current actual count is relative to the past. The shading on the map represents the percentile, with darker shading indicating a higher percentile. The cutoff values for the shading levels are expressed in terms of standard deviations in a normal distribution; for example, two standard deviations is roughly the 97.7th percentile. These values are indicated on the map legend.

With the exception of the Poisson Visit Frequency method, all of the map analysis methods make the assumption that prediction errors are distributed normally. When calculating the percentile, these methods also check to see whether this assumption actually holds. When there is evidence that the normality assumption does not hold for a particular region, this will be indicated on the map by the addition of hatching to the shading for that region. This hatching is meant to indicate that the percentile calculated for that region may be skewed. In many cases, it means that percentile may be slightly underestimated; however, there may be circumstances where it is overestimated instead.

A skew in prediction errors is generally an indication that there is structure in the data (e.g. seasonality) that is not fully captured by the model used to make predictions. Choosing an alternative analysis method, for example changing from moving average to recursive least squares, may help to improve the model fit.

The map legend is located in the bottom right corner of the map. Unless selected, only a small portion of the left side of the legend appears. Positioning your mouse cursor over the legend will cause it to expand (See Figure64).

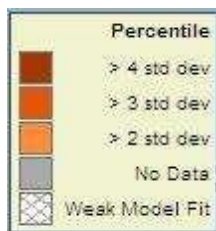


Figure64: Map legend

9.4 Additional Map Features

Right-clicking on a specific area on the map will produce a popup menu. The top portion of the menu provides the name of the location you have selected and also indicates the population of that location.

Selecting "Quick Chart" on the popup menu will generate a large popup chart for the area selected. The chart will automatically display counts for the parameters specified and area selected for the past 30 days. This popup window functions identically to the popup chart available on the Charts page (See Chart Details Popup Window, Page 56).

Selecting “Charts” or “Local Anomalies” on the popup menu will automatically navigate you to the Charts or Anomalies pages, respectively. All settings selected on the left control panel as well as the location selected on the map will be carried over when navigating to the new page.

9.5 Spatial Scan

Spatial scan can be applied to the entire geographic area displayed in the map window by selecting the “Spatial Scan” button located in the upper right corner of the map. Once applied, shading will appear on the map to indicate the probability of an outbreak within the area displayed. Additionally, the probability of an outbreak will display in the upper left corner of the map (See Figure).

Spatial scan, by its nature, is scale-dependent and will produce different results depending on what regions have been selected for the scan. In particular, the results may appear misleading when an extreme zoom contains only a few regions. When the scan contains only a few regions with similar occurrences, the scan may report that none of the regions are especially different from the others. In this case, better results can be achieved by zooming farther back to include more regions in the spatial scan.

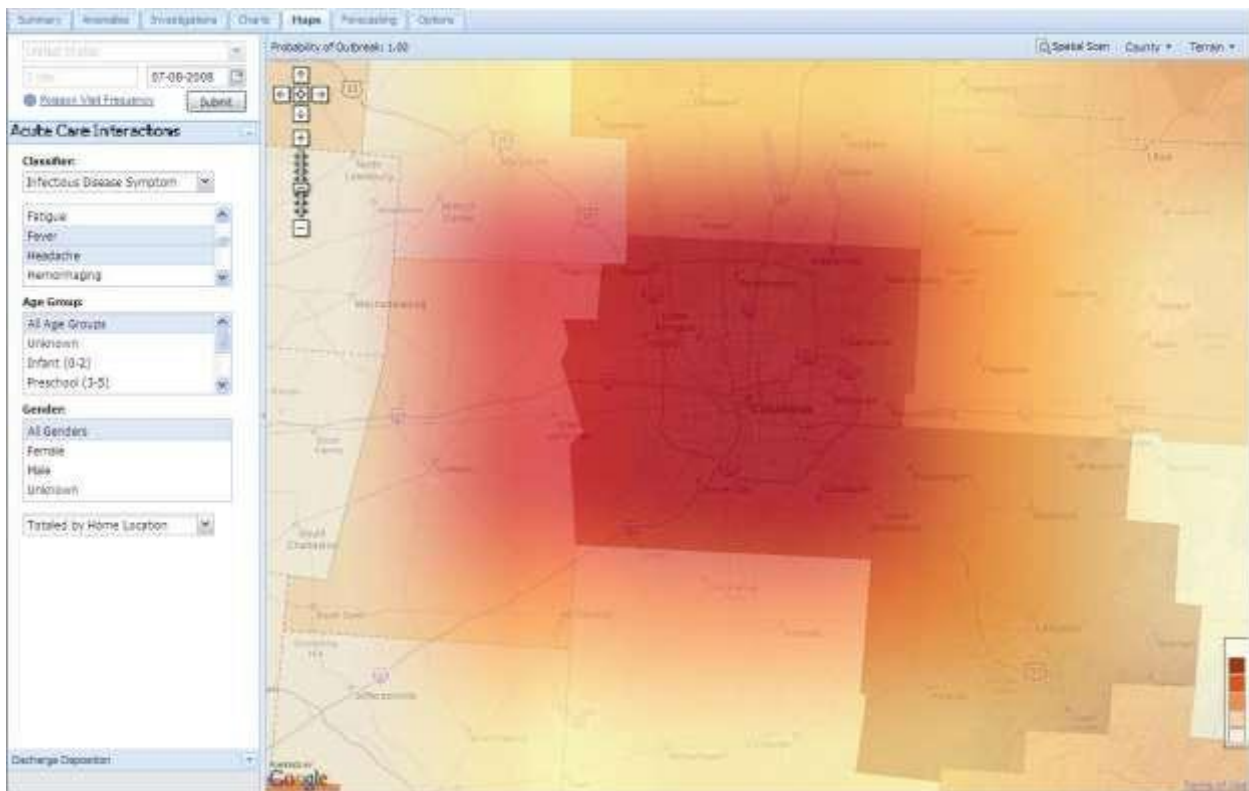


Figure65: Spatial Scan

The Spatial Scan feature is based on research conducted at Carnegie Mellon University and the University of Pittsburgh. Please see <http://www.cs.cmu.edu/~neill/papers/sss-nips05.pdf> for more information.

9.6 Air Quality Data

AIRNow air quality data is available as an add-on to the Maps page in EpiCenter. If available for your area, the air quality data is displayed by selecting the “Markers” tab in left control panel and checking the checkbox next to “Air Quality” (See Figure66).



The screenshot shows a web interface for the EpiCenter Maps page. At the top, there is a dropdown menu set to "United States" and a date input field containing "8-31-2011". Below these are two radio buttons: "Exponential Moving Average" (selected) and "Probability". A "Submit" button is to the right. Below the form is a tabbed interface with three tabs: "Shading", "Markers" (which is selected and highlighted in blue), and "View". Under the "Markers" tab, there is a list of checkboxes: "Facilities" (unchecked), "Air Quality" (checked with a green checkmark), "Reportable Disease Cases" (unchecked), and "Options" (with a dropdown arrow).

Figure66: Air quality checkbox

Air quality data is displayed as cloud icons on the map. Larger clouds represent reporting areas while smaller clouds are specific sampling sites where measurements are taken. A reporting area corresponds to a broader metropolitan area and includes all applicable sampling sites. Zooming in on a reporting area cloud will result in the display of the individual sampling sites. Clicking directly on a cloud icon will produce a popup window (See Figure67).

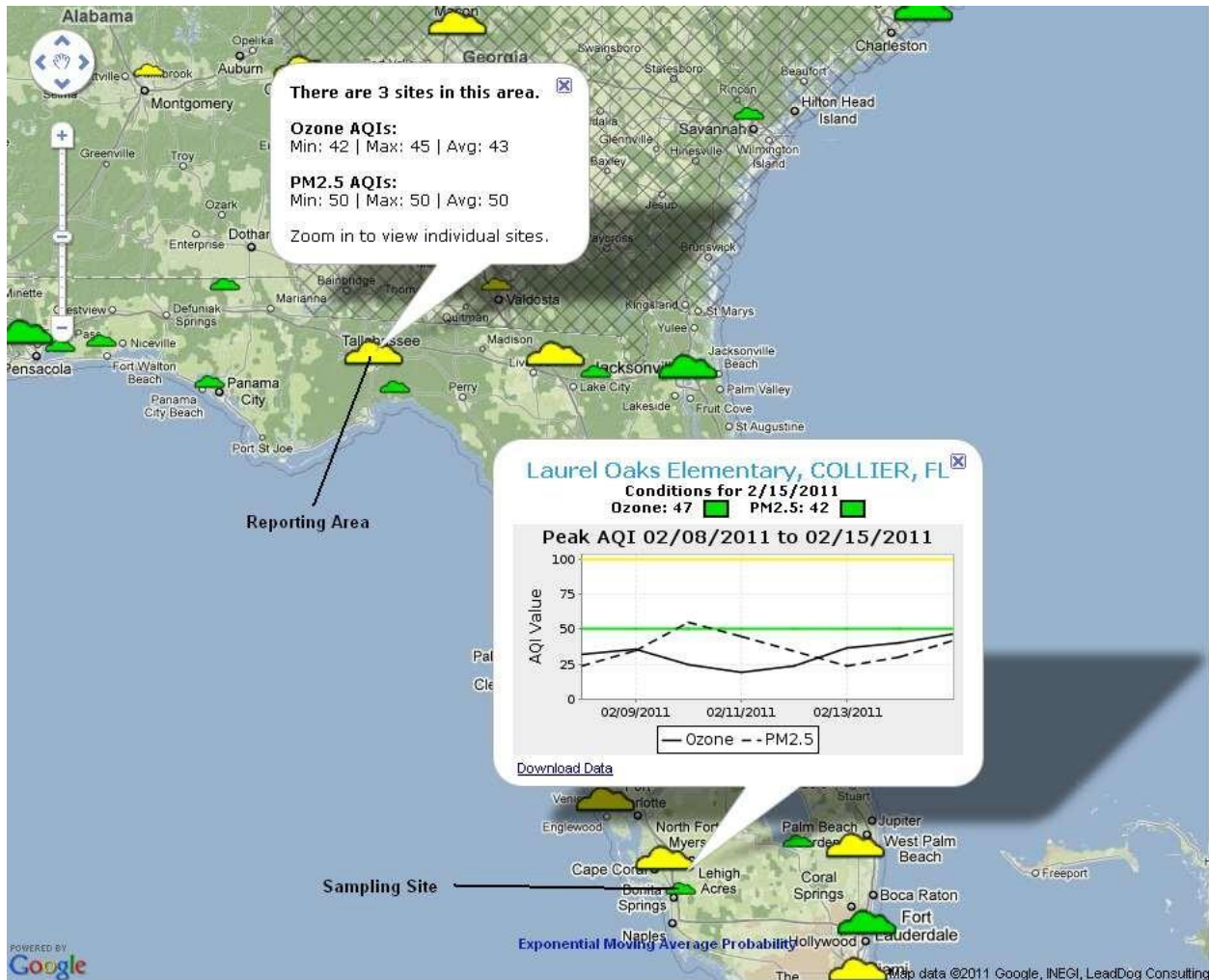


Figure67: Air quality data

Values for several data types are available on the popup window, including carbon monoxide (CO), sulfur dioxide (SO₂), ozone, particulate matter 2.5 (PM_{2.5}) particulate matter 10 (PM₁₀), wind speed (measured in m/s), and wind direction (measured in degrees). Available values will vary per sampling location. The peak air quality index (AQI) is calculated using an 8 hour moving average while PM_{2.5} uses a 24 hour moving average. To view wind direction and wind speed data click on the arrow to the right of peak AQI to display the dropdown menu and select Wind.

This data can be downloaded by clicking directly on the “Download Data” text located in the bottom left corner of the popup window.

For reporting areas, the minimum, maximum, and average ozone and PM_{2.5} AQIs for all sampling sites included is shown on the popup. This data is for the date selected in the left control panel. For sampling sites, ozone and PM_{2.5} AQIs are shown on a chart for the date selected and four days prior. The horizontal lines on the chart serve as a reference point to highlight significant changes in AQI.

A legend for the cloud icon shading is located in the bottom right corner of the map above the standard map legend. Unless selected, only a small portion of the left side of the legend appears. Positioning your mouse cursor over the legend will cause it to expand (See Figure68). The color of the cloud icon on the map is determined by the most severe AQI associated with the location.



Figure68: Air quality data legend

9.7 Reportable Disease Cases Data

Reportable disease cases data is available as an add-on to the Maps page in EpiCenter. If available for your area, the reportable disease cases data can be displayed as shading on the map using the Shading sub-tab. An analysis method must be selected to project this shading. Of note, if the data is totaled by week, on the Poisson Visit Frequency can be used. If totaled by day, all analysis methods are available.

To view actual counts of reportable disease cases data, select the "Markers" tab in left control panel and checking the checkbox next to "Reportable Disease Cases." Select the down arrow next to the Options label to expand options for viewing reportable disease markers. Parameters can then be selected for counts similarly to those available on the Shading sub-tab. The Days Before and After box text box at the top of the control is used to indicated how many days before and after the date in the End Date Selector should be included in the counts. The maximum value that can be used here is 14, for a total of 28 days (See Figure69).

Shading **Markers** View

Facilities

Air Quality

Reportable Disease Cases

Options

Days Before and After:

14

Classifier:

Total Counts

Age Group:

All Age Groups

Unknown

Infant (0-2)

Preschool (3-5)

Gender:

All Genders

Female

Male

Unknown

Case Status:

All Case Statuses

Confirmed

Probable

Suspected

Figure69: Parameters for reportable disease markers

Count markers appear on the map as triangles. Hovering over a triangle will show counts for an area (triangles can be viewed at the state, county and zip code level using the View sub-tab). Clicking directly on the triangle will produce a pop-up chart showing a history of counts (See Figure70).

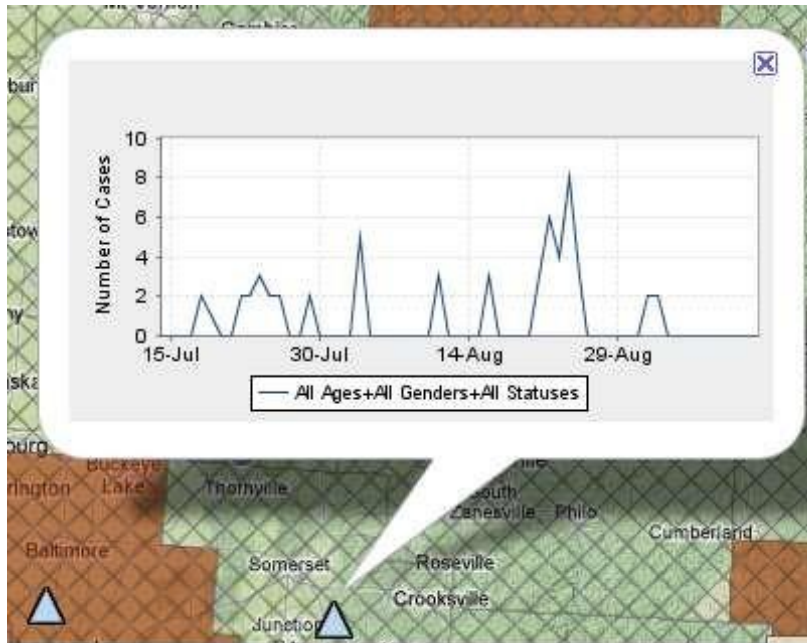


Figure70: Reportable disease triangle markers and popup

A legend is available to indicate the values that correspond to the triangle shading in the bottom right corner of the Maps page. It is viewable by hovering over the far left edge with the mouse cursor.

10 Reports

The Reports page contains a variety of reports pertaining to the healthcare data collected in a user’s region. Many of these reports were formerly accessible through the Pulse Monitoring System application.

10.1 Navigating Reports

A report is viewed by selecting it from the “Report” dropdown located on the left control panel. Some reports require additional input prior to submitting. Click “Submit” to view the results of a report.

Results for each report appear as a tab on the right portion of the page. New reports can be opened by clicking the “+” symbol to the right of the results tab. Click directly on these tabs to navigate between open reports. A report is closed by clicking on the X located on the right side of each tab. Report columns can be sorted in either ascending or descending order by selecting the down arrow to the right of column headings. The same drop-down menu contains an item called “Columns.” Checking or unchecking items in the “Columns” menu designates which columns are displayed in the report. Data in reports is paginated when needed; report pages can be navigated using the arrow keys on the bottom left side of a report.

If the text in a given field is too lengthy to be viewed within the report, double-clicking the row will open an expanded view of the text field. From the expanded view, text may be copied by highlighting it and using ctrl+c or right-clicking.

Select reports are linked via “pivoting” functionality. If more information is available via pivoting, a final column titled “Pivot” will appear to the right of the other columns. Clicking the “Pivot” link for a select line listing will open a menu with reports that are available to pivot to. Selecting one of those reports will open a new report tab with a report using the parameters you have pre-selected. In some cases, it is possible to multi-select line listings within a report to pivot to.

Finally, a report can be exported to a spreadsheet by clicking on the “Download” button located in the bottom left portion of each tab.

10.2 Report Charts

Users are able to generate an interactive chart based on a report result. If a report is designated for charting, a chart icon will appear next to the report title in the dropdown menu located on the left control panel. The right-hand side panel of the Report tab will show the chart, instead of the regular grid view. Users can toggle between chart and grid views by selecting “View” on the bottom left portion of the tab. User can specify the chart cursor type under “Chart Cursor” on the bottom left portion of the tab. Cursor choices are 'Pointer', 'Vertical Line' or 'Cross Hair', with default to 'Pointer'. Users can hover over a data point on the chart and the (x, y) values of that data point are displayed in a popup.

Finally, a chart can be downloaded in PNG pixel image, JPG pixel image, PDF document, or SVG vector image by clicking on the “Download” button located in the bottom left portion of each tab.

10.3 Types of Reports

The availability of reports may vary by user and/or region. Users should contact Health Monitoring Systems directly to request custom reports. The table below provides information about the standard reports contained on the Reports page.

Report Name	Description	Input	Output
ILI Admissions Report	A list of facilities, number of ED registrations, number of admissions from ED registrations, applicable ILI statistics	Begin Date End Date State	Facility Name Registration Date Total Registrations Total Admissions Admission % Fever + ILI Registrations Fever + ILI Admissions Fever + ILI Admissions % ILI Specified Registrations ILI Specified Admissions ILI Specified Admissions %
In-process facilities	A list of facilities, including current status, that are in the process of connecting to the EpiCenter system	N/A	Facility Name City State County Latest Note Date of Latest Note
Late Reporting	Number of facilities sending latent data (records sent more than 24 hours after the patient's admit date and time) by date	Begin Date End Date	Date Late Facilities Reporting Percent Late *Click on the date to automatically open the corresponding Late Reporting on Date Report
Late Reporting on Date	A list of facilities sending latent data on a specific date	Date	Facility Identifier Facility Name Total Late Percent Late
Less Than 50% Daily	A list of facilities sending less than 50% of their 20-day average for the 24-hour period prior to date specified	Date	Facility Name 20-Day Average Yesterday Percent

Live by State	A list of all facilities currently submitting data to the EpiCenter system	State (results are only available for facilities in the user's accessible region)	Facility Identifier Facility Name State Live Date Facility Type
Not Reporting	A list of facilities that have not sent data within the defined window	Hours back	Facility Name City State Last Reported Last Note Entered By Last Note Time
Over 80% Not Classified	A list of facilities with more than 80% of their records not receiving a classification for the 24-hour period prior to the date specified based on their 20-day average	N/A	Facility Name Total Received Total Others Percent Others
Triage Note Search	Free-text search triage notes and observations being sent by facilities within your region	Date Range End Date Search Key	OBX ID OBX Date Triage Note Context Facility Name Facility City Facility State Surveilled? Facility County Interaction Date Zip Code Age Group Gender Patient Class Visit Number Chief Complaint Discharge Disposition Interaction Type

11 Labels

The Labels page is used to create charts and descriptions of interest to be distributed to external systems via RSS feed. This functionality is only available in areas subscribing to this service. Health Monitoring Systems must work directly with an organization to enable communication between EpiCenter and the external system.

A chart can be added to a label using the dropdown menu in the upper right corner of a chart generated on the Charts page (See Figure 17: Surveillance view creation popup). A free-text name and description can be added for each label. The organization, creator, initial creation date and time, as well as updated data and time are automatically displayed. Additionally, the RSS URL is located below the free-text Item Description box (See Figure).

Only one chart can be added per label. If a chart is added to an existing label, it will replace the previously associated chart.

All current labels are listed in the left control panel. The plus sign (+) located at the top of the control allows for the creation of a label without a chart.

Any edits made to a label are saved by selecting the “Save” button in the lower right corner of the screen. A label is deleted by selecting the “Delete” button also in the lower right corner of the screen (See Figure76).

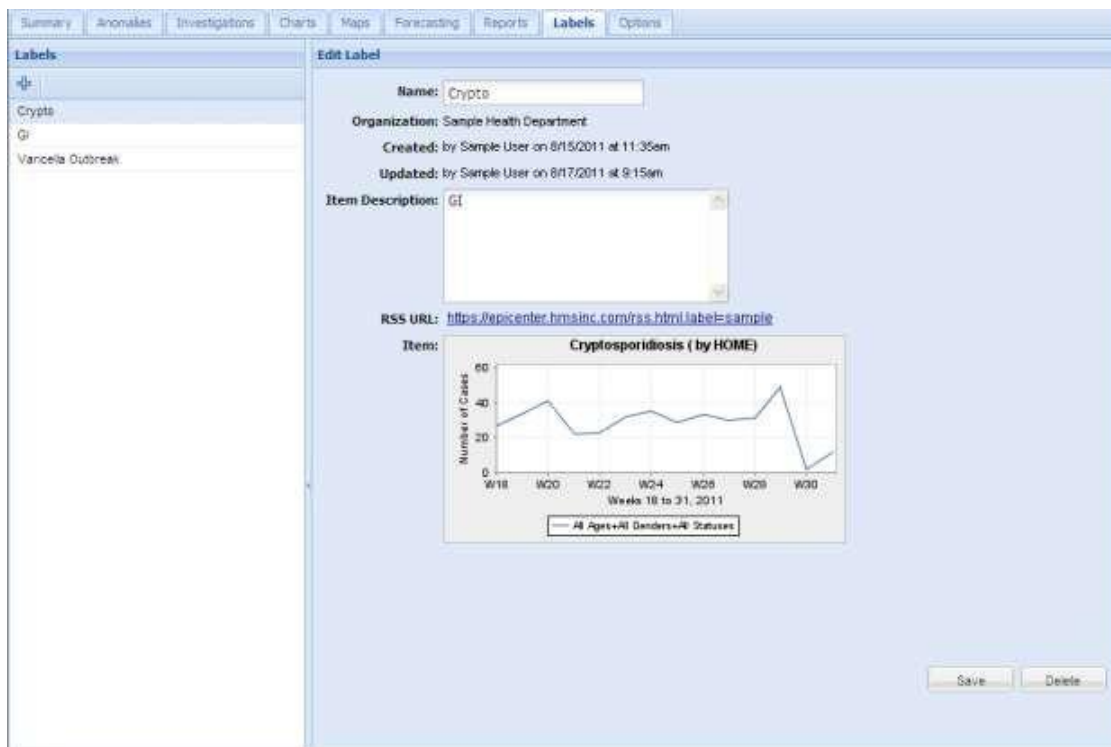


Figure76: Labels page

12 Custom Classifier

Subscribing organizations have access to custom classifiers in the EpiCenter system. Custom classifiers are created and updated on the “Custom Classifier” page. Each applicable organization is provided with one custom classifier that supports up to ten classifications; there is no requirement that these classifications be logically connected.

Custom classifications are created by first naming the classification followed by developing a keyword list. This is done on the “Customer Classifier” page. To create a classifier, click on the “Create” tab located at the bottom of the left control panel. This will produce a popup requesting a name for the classifier. The name is free-text and must be 80 characters or less. Once the classifier is named, a blank chart will appear in the middle of the screen and a blank chief complaint list will appear on the right side of the screen (See Figure77). The classifier is now in a working state, meaning that the classification is not yet published for use.

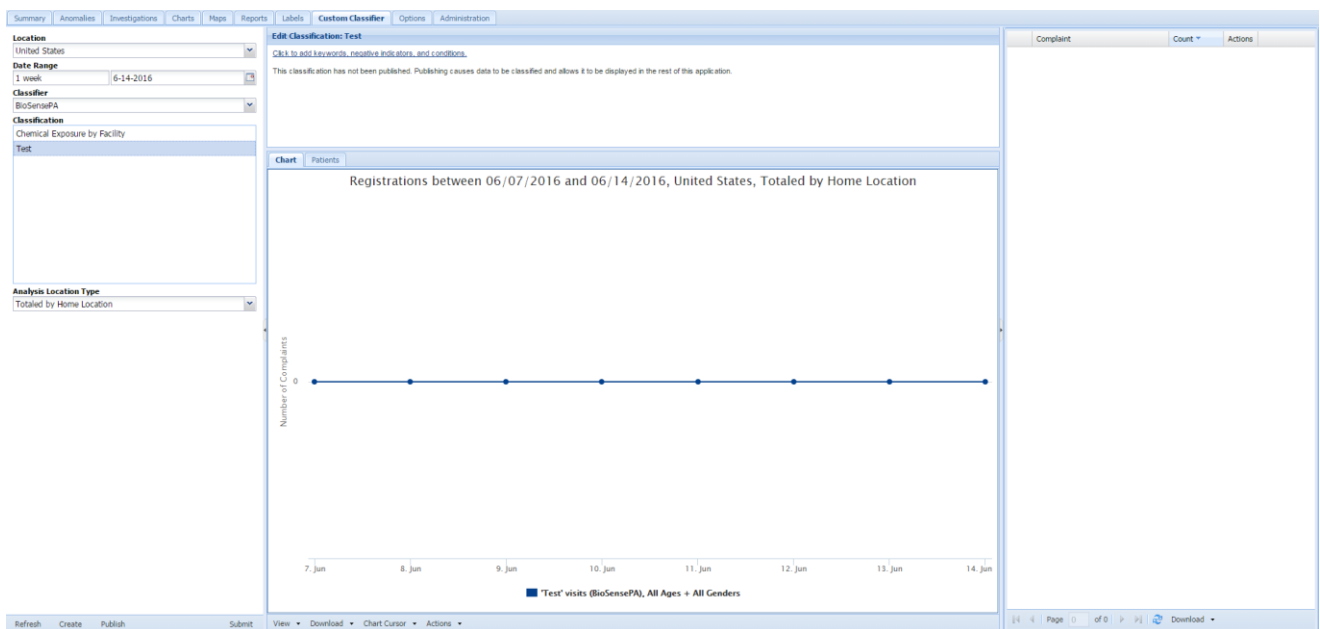


Figure77: Custom classifier page

To develop the keyword list associated with a customer classifier, click directly on the text “Click to add keywords and negative indicators.” Selecting this text will produce the Edit Classification popup window where keywords and negative indicators are defined (See Figure78).

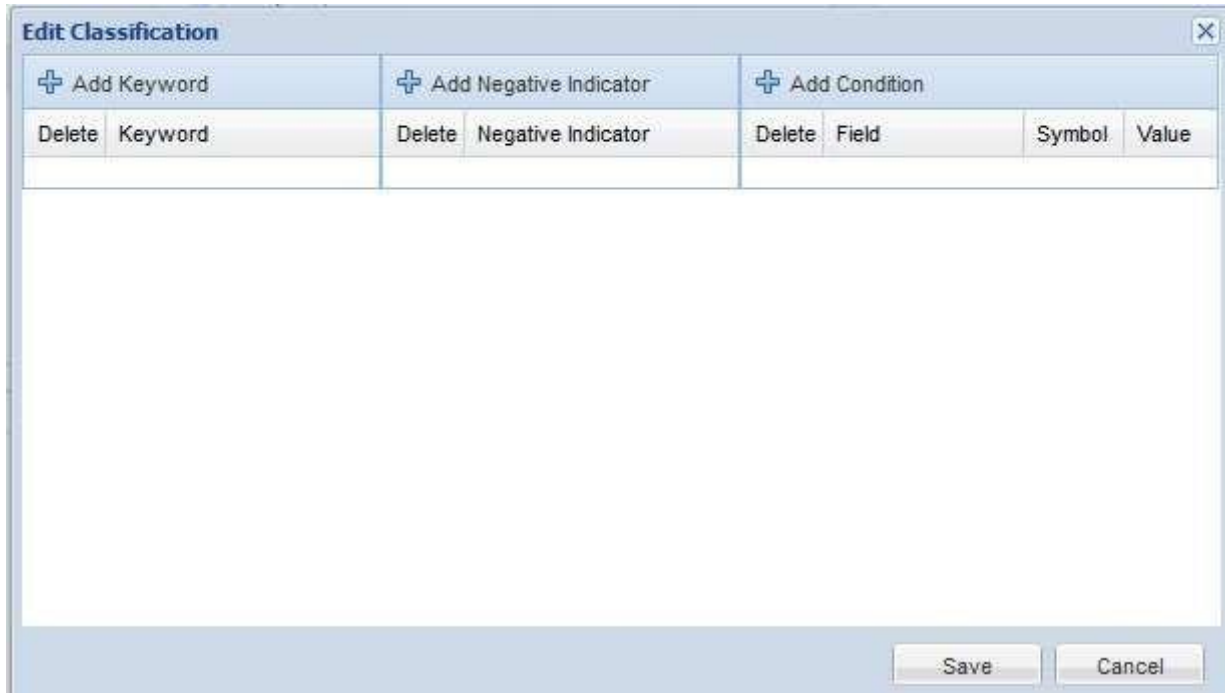


Figure78: Edit classification popup

In order for a free-text chief complaint to be classified by the custom classifier, it must contain any expression entered on the keyword list. Negative indicators are used to exclude chief complaints. The Add Condition option allows users to further define the data classified by age at interaction. Regular expression is used for both keywords and negative indicators. Additional information about regular expression is available here:

<http://download.oracle.com/javase/6/docs/api/java/util/regex/Pattern.html>

Keywords and negative indicators are added by either selecting the “Add Keyword” or “Add Negative Indicator” buttons respectively. These buttons are located at the top of the Edit Classification popup window. A keyword or negative indicator can be removed from the list by selecting the green icon located to the left of the entry in the delete column.

Once all keywords and negative indicators are defined, they are saved by selecting the “save” button in the lower right corner of the Edit Classification popup window. After selecting “save,” the previously blank chart will update with a time series based on the results of the custom classification. The text above the chart will update to indicate the expressions that have been specified. A chief complaint list is also provided on the right side of the screen indicating matching complaints and corresponding counts (See Figure79). The time series chart and complaint list are restricted to data received in the past week for a user’s visible region. This can be further restricted but not exceeded.

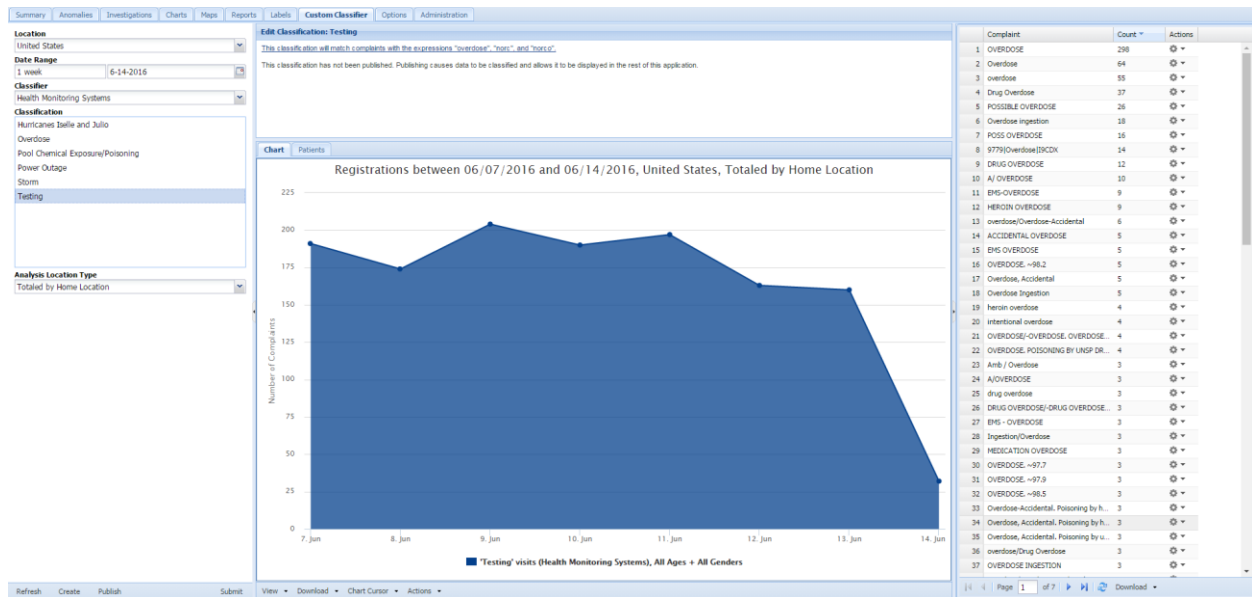


Figure79: Custom classification chart in process and complaint list

A user can continue to make edits to the classification by repeating the steps above involving the definition of keywords and negative indicators and a review of the time series chart and complaints list. Once satisfied with the custom classifier’s output, the custom classifier can be made available to other users accessing EpiCenter. This is done by selecting the “Publish” button located at the bottom of the left control panel.

Prior to selecting “Publish,” the custom classification will not be available anywhere else in the EpiCenter system. Once the user is satisfied that the keyword list is ready for use, a custom classification can be published. This will cause the data in the system to be classified; once that process is complete, the classification will be available throughout the EpiCenter system and can be used just like any other classification. At that point, it can no longer be edited as this would result in inconsistency in the data over time. Publishing of classifications will be handled on a per-classification basis, so the custom classifier can contain both published and unpublished classifications.

In an attempt to prevent two users making simultaneous changes to the same custom classification, once a user begins working on the classification, it will automatically enter a locked state. If another user attempts to access the custom classification during this time, they will receive notice that it is currently

locked. A custom classification will automatically become unlocked when a user saves their changes or leaves user interface idle for a defined amount of time. The “unlock” button located in the bottom of the left control panel can be used to manually unlock a custom classification in an edit state if needed.

By policy, access to the classifier editing tab will be restricted to designated users within an organization and not rolled out to every user in that organization. However, all organizational users will be able to use published custom classifications throughout the EpiCenter system just as they would use any other classification.

The number of custom classifications is initially limited to 10. Once all 10 classifications have been published, the organization will need to contact HMS to discuss options for adding additional custom classifications.

13 Options

The Options page allows you to update your user information, change your password, set your preferences, and manage your notification subscriptions (See Figure80).

The screenshot shows the 'User Options' page with the following details:

- User Information:**
 - Email Address: sample@sample.com
 - First Name: Sample
 - Last Name: User
 - Middle Initial: T
 - Title: Epidemiologist
 - Address: 555 Main Street
 - City: Sample Town
 - State: Alabama
 - Zipcode: 55555
 - Phone Number: (555) 555-5555
 - Fax Number: (777) 777-7777
 - Time Zone: Eastern
- Change Password:**
 - Old Password: [input field]
 - New Password: [input field]
 - New Password (confirm): [input field]
- Preferences:**
 - Default Region: United States
 - Default View: Classifier Summary View
 - Assignment Emails: Never Notify Me of Investigation Assignm
- Subscriptions:**

Name	Destination (email)	Task	Digest	Actions
Sample Subscription	sampleuser@hmsinc.com	Sample Task	<input type="checkbox"/>	[edit] [delete]

Figure80: User options

13.1 User Information

Enter updates to user information directly into the free-text boxes associated with each field. Click “Save” to save the updates. Clicking “Reset” will return each field to its original value.

13.2 Changing Your Password

Your password can be changed by entering your existing password into the first field in the Change Password box. Please enter your new password in the middle field and confirm it in the bottom field. The security level of your new password is indicated under the “New Password” field, with red representing least secure and green representing most secure. Press “Change” to submit your password change. Confirmation will be given that the new password was accepted.

A password change will be denied if the password entered into the “Old Password” field is incorrect or if the text entered in the “New Password” and “New Password (confirm)” fields do not match. If the password change is denied, the problematic field will be highlighted in red. Selecting “Clear” will remove the text from all fields in the Change Password box.

13.3 Setting Preferences

The “Default Region” field indicates the default location that will appear in the Location selector upon login. The Default Region field can be set to your overall accessible region or a sub-region within the larger region.

The “Default View” field indicates the surveillance view that will appear on the Summary page upon login. All available surveillance views are listing in the “Default View” dropdown list.

The “Assignment Emails” field is used to adjust the settings for investigator notification emails. There are three assignment email settings:

- Never notify me of investigation assignments – Notification emails are not sent when an investigation is assigned to a specific user
- Notify when others assign investigations to me – Notification emails are sent to a user when an investigation is assigned to them by anyone else.
- Notify when anyone assigns investigations to me – Notification emails are sent to a user when an investigation is assigned to by anyone, including themselves.

Click “Save” to save the updated default region and/or default view. Clicking “Reset” will return each field to its original value.

13.4 Subscription Management

The subscription box will appear at the bottom of the Options page for limited users. Clicking “Add Subscription” in the top left portion of this box will produce the “Edit Subscription” popup window. Enter a meaningful subscription name in the “Subscription Name” text box and provide the email address to which notifications will be sent in the “Destination (email)” text box. The “Surveillance Task” dropdown menu contains a listing of all available surveillance tasks. Click directly on the surveillance task to which you want to receive email notifications.

After selecting a surveillance task, the “Surveillance Sets” text box will become populated with all surveillance sets associated with the surveillance view. Each chart that was associated with the surveillance view during creation is represented as a surveillance set. Pressing and holding the CTRL key

on your keyboard allows for the selection of more than one surveillance set. To select a consecutive list of surveillance sets, click on the first and last surveillance set while holding the SHIFT key on your keyboard. This highlights the first and last surveillance set as well as those in between.

The “Geographies” text box contains all available geographies based on the geography and aggregation method selected when the surveillance task was created. Pressing and holding the CTRL key on your keyboard allows for the selection of more than one geography. To select a consecutive list of geographies, click on the first and last geographies while holding the SHIFT key on your keyboard. This highlights the first and last geographies as well as those in between.

Check the checkbox next to “Digest” to receive only one email at 8:00am ET for all anomaly notifications generated during the prior 24 hours.

Click “Save” to submit the subscription or “Cancel” to close the popup window without submitting the subscription (See Figure81: Edit).

The screenshot shows a dialog box titled "Edit Subscription". It has the following fields and controls:

- Subscription Name:** A text box containing "Sample Subscription".
- Destination (email):** A text box containing "sampleuser@hmsinc.com".
- Surveillance Task:** A dropdown menu showing "Sample Task - By County - Symptom".
- Surveillance Sets:** A list box containing six items: "Cough - by HOME", "Diarrhea - by HOME", "Ear, Nose, Throat - by HOME", "Edema - by HOME", "Fever - by HOME", and "Headache - by HOME".
- Geographies:** A list box containing five items, all labeled "Sample County, US".
- Digest Mode (Daily Summary):** A checkbox that is currently unchecked.
- Buttons:** "Save" and "Cancel" buttons at the bottom right.

Figure81: Edit subscription

All subscriptions are listed in the “Subscriptions” portion of the Options page. An existing subscription can be edited by clicking on the left icon in the “Actions” column. Click on the right icon to delete a subscription.

Users without access to subscription management should contact their project sponsor or Health Monitoring Systems for more information on creating or editing their current notifications subscriptions.

13.5 Report Job File Download

Specific reports may be set up to run on a regular basis by working directly with HMS. Once the parameters for these reports have been established, these files are available for download under the “Options” tab.

Appendix 1: Analysis Method Parameters

Constant Threshold (Charts)

Value	Default	Range	Implications
Simple Constant Threshold			
The constant threshold to use	0	0 to ∞	The threshold selected indicates the value that must be exceeded to generate an anomaly notification.

CuSum EMA (Charts)

Value	Default	Range	Implications
Predicted Value (Exponential Moving Average)			
The weighting exponential, or smoothing factor, alpha	0.2	0 to 1, exclusive	Smaller values decrease the weight placed on the current count when calculating the predicted count, and increase the weight of past counts; larger values have the opposite effect. Smaller values also increase the length of the weighting window, while larger values decrease it.
Desired statistical significance, used to calculate the weighting window	0.9	0 to 1, exclusive	Smaller values decrease the desired statistical significance and thus the length of the weighting window; larger values increase the length of the weighting window.
CuSum Normalized Residual Threshold			
The training window	14 days	1 day to the number of days for which data is available	Smaller values decrease the training window and thus decrease the smoothness of the threshold calculations, while larger values increase the window and the threshold smoothness.
Threshold multiplier	4 standard deviations	0 to ∞	Smaller values will reduce the number of standard deviations from the predicted count used to define the threshold, leading

The allowed deviation from the reference value before impacting the cumulative sum	0.5 standard deviations	0 to ∞	to lower thresholds and more alerts. Larger values will increase lead to higher thresholds and fewer alerts. Smaller values generally decrease the tolerance of the method for deviations between observed and predicted counts, leading to lower thresholds and more alerts. Larger values generally increase this tolerance, leading to higher thresholds and fewer alerts.
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Exponential Moving Average (Charts)

Value	Default	Range	Implications
Predicted Value (Exponential Moving Average)			
The weighting exponential, or smoothing factor, alpha	0.2	0 to 1, exclusive	Smaller values decrease the weight placed on the current count when calculating the predicted count, and increase the weight of past counts; larger values have the opposite effect. Smaller values also increase the length of the weighting window, while larger values decrease it.
Desired statistical significance, used to calculate the weighting window	0.9	0 to 1, exclusive	Smaller values decrease the desired statistical significance and thus the length of the weighting window; larger values increase the length of the weighting window.
EMA Residual Threshold			
The weighting exponential, or smoothing factor, alpha	0.2	0 to 1, exclusive	Smaller values decrease the weight placed on the current error when calculating the standard deviation of the errors, and increase the weight of past errors; larger values have the opposite effect. Smaller values also increase the length of the weighting window, while larger values

Desired statistical significance, used to calculate the weighting window	0.9	0 to 1, exclusive	Smaller values decrease the desired statistical significance and thus the length of the weighting window; larger values increase the length of the weighting window.
Threshold multiplier	4 standard deviations	0 to ∞	Smaller values will reduce the number of standard deviations from the predicted count used to define the threshold, leading to lower thresholds and more alerts. Larger values will increase lead to higher thresholds and fewer alerts.

Moving Average (Charts)

Value	Default	Range	Implications
Simple Moving Average (Predicted Value)			
Window used for averaging results	14 days	1 day to the number of days for which data is available	Smaller numbers will decrease the amount of smoothing in the predicted counts and also decrease the lag between changes in the actual values and changes in the predicted values. Larger values will increase smoothing and increase this lag.
EMA Residual Threshold			
The weighting exponential, or smoothing factor, alpha	0.2	0 to 1, exclusive	Smaller values decrease the weight placed on the current error when calculating the standard deviation of the errors, and increase the weight of past errors; larger values have the opposite effect. Smaller values also increase the length of the weighting window, while larger values decrease it.
Desired statistical significance, used to calculate the weighting window	0.9	0 to 1, exclusive	Smaller values decrease the desired statistical significance and thus the length of the weighting window; larger values increase the length of the weighting window.

Threshold multiplier	4 standard deviations	0 to ∞	Smaller values will reduce the number of standard deviations from the predicted count used to define the threshold, leading to lower thresholds and more alerts. Larger values will increase lead to higher thresholds and fewer alerts.
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Recursive Least Squares (Charts)

Value	Default	Range	Implications
Recursive Least Squares			
Training period	60 days	1 to the number of days for which data is available	Smaller values decrease the training window and thus decrease the smoothing of the threshold calculations, while larger values increase the window and the threshold smoothing.
Average period	7 days	1 to the length of the training period	Smaller values will tend to decrease the amount of smoothing in the predicted counts, while larger values will tend to increase the amount of smoothing.
Threshold multiplier	4 standard deviations	0 to ∞	Smaller values will reduce the number of standard deviations from the predicted count used to define the threshold, leading to lower thresholds and more alerts. Larger values will increase lead to higher thresholds and fewer alerts.
The 'Forgetting factor', lambda, which controls the exponential decay of past value influence	0.99	0 (exclusive) to 1 (inclusive)	Smaller values decrease the influence of past counts on predicting the current count, while larger values increase it. A value of 1 means that all counts within the average period are treated equally.

Poisson Threshold (Charts)

Value	Default	Range	Implications
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Poisson			
Window to use for averaging results	14 days	1 day to the number of days for which data is available	Smaller numbers will decrease the amount of smoothing in the predicted counts and also decrease the lag between changes in the actual values and changes in the predicted values. Larger values will increase smoothing and increase this lag.

Exponential Moving Average Probability (Maps)

Value	Default	Range	Implications
Exponential Moving Average			
The weighting exponential, or smoothing factor, alpha	0.2	0 to 1, exclusive	Smaller values decrease the weight placed on the current count when calculating the predicted count, and increase the weight of past counts; larger values have the opposite effect. Smaller values also increase the length of the weighting window, while larger values decrease it.
Desired statistical significance, used to calculate the weighting window	0.9	0 to 1, exclusive	Smaller values decrease the desired statistical significance and thus the length of the weighting window; larger values increase the length of the weighting window.
Probability Analyzer			
Training window to use	60 days	1 day to the number of days for which data is available	Smaller values decrease the training window and thus tend to decrease the validity of the assumption that errors follow a normal distribution, which decreases the reliability of the probability estimate. The assumption of normality becomes completely invalid for values less than 5. Larger values increase the training window, which will tend to lower the probability calculated for the current count.
Kurtosis of training distribution must be $\leq \text{sekMultiplier} * \text{SEK}$	2 standard deviations	0 to ∞	In order to confirm the assumption of normality, the algorithm checks to see if the kurtosis of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will

Skew of training distribution must be $\leq \text{sesMultiplier} * \text{SES}$	2 standard deviations	0 to ∞	<p>increase the strictness of this check, while larger values make it less strict.</p> <p>In order to confirm the assumption of normality, the algorithm checks to see if the skew of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will increase the strictness of this check, while larger values make it less strict.</p>
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Poisson Visit Frequency (Maps)

Value	Default	Range	Implications
Poisson Window to use for averaging results	14 days	1 day to the number of days for which data is available	Smaller numbers will decrease the amount of smoothing in the predicted counts and also decrease the lag between changes in the actual values and changes in the predicted values. Larger values will increase smoothing and increase this lag.

Recursive Least Squares Probability (Maps)

Value	Default	Range	Implications
Recursive Least Squares			
Training period	60 days	1 day to the number of days for which data is available	Smaller values decrease the training window and thus decrease the smoothing of the threshold calculations, while larger values increase the window and the threshold smoothing.
Average period	7 days	1 day to the length of the training period	Smaller values will tend to decrease the amount of smoothing in the predicted counts, while larger values will tend to

			increase the amount of smoothing.
Threshold multiplier	*Not applicable for this analysis method		
The 'Forgetting factor', lambda, which controls the exponential decay of past value influence	0.99	0 (exclusive) to 1 (inclusive)	Smaller values decrease the influence of past counts on predicting the current count, while larger values increase it. A value of 1 means that all counts within the average period are treated equally.
Probability Analyzer			
Training window to use	60 days	1 day to the number of days for which data is available	Smaller values decrease the training window and thus tend to decrease the validity of the assumption that errors follow a normal distribution, which decreases the reliability of the probability estimate. The assumption of normality becomes completely invalid for values less than 5. Larger values increase the training window, which will tend to lower the probability calculated for the current count.
Kurtosis of training distribution must be $\leq \text{sekMultiplier} * \text{SEK}$	2 standard deviations	0 to ∞	In order to confirm the assumption of normality, the algorithm checks to see if the kurtosis of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will increase the strictness of this check, while larger values make it less strict.
Skew of training distribution must be $\leq \text{sesMultiplier} * \text{SES}$	2 standard deviations	0 to ∞	In order to confirm the assumption of normality, the algorithm checks to see if the skew of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will increase the strictness of this check, while larger values make it less strict.

Simple Moving Average Probability (Maps)

Value	Default	Range	Implications
Simple Moving Average (Predicted Value)			
Window to use for averaging results	14 days	1 day to the number of days for which data is available	Smaller numbers will decrease the amount of smoothing in the predicted counts and also decrease the lag between changes in the actual values and changes in the predicted values. Larger values will increase smoothing and increase this lag.
Probability Analyzer			
Training window to use	60 days	1 day to the number of days for which data is available	Smaller values decrease the training window and thus tend to decrease the validity of the assumption that errors follow a normal distribution, which decreases the reliability of the probability estimate. The assumption of normality becomes completely invalid for values less than 5. Larger values increase the training window, which will tend to lower the probability calculated for the current count.
Kurtosis of training distribution must be $\leq \text{sekMultiplier} * \text{SEK}$	2 standard deviations	0 to ∞	In order to confirm the assumption of normality, the algorithm checks to see if the kurtosis of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will increase the strictness of this check, while larger values make it less strict.
Skew of training distribution must be $\leq \text{sesMultiplier} * \text{SES}$	2 standard deviations	0 to ∞	In order to confirm the assumption of normality, the algorithm checks to see if the skew of the observed distribution is within acceptable limits for a normal distribution. This parameter defines the width of those limits. Smaller values will increase the strictness of this check, while larger values make it less strict.

Appendix 2: Default Notification Configuration

Approach to Notifications

The still somewhat novel methods of syndromic surveillance that have been developed are designed to monitor health-related events in entire populations at once and indicate the local occurrence of epidemic clusters or widespread increases of endemic disease. EpiCenter permits the monitoring of symptom trends using a symptom-based analysis of emergency department patient chief complaints as a proxy for disease.

While all categories of symptoms have the potential to indicate unexpected increases in health events in the population, Health Monitoring Systems recognizes that not all health events warrant immediate notification of public health authorities. Therefore, we have developed a tiered approach to anomaly notification based upon public health's tiered approach to notifiable/reportable diseases.

A. Immediate Notifications

The diseases of most concern to public health are those that are infectious and have the potential to result in serious illness or death in a significant portion of the population, generally those that are subject to national quarantine as established by the World Health Organization. Reporting of these diseases to public health is deemed immediate. The diseases on the resulting list are commonly referred to as immediately reportable or notifiable. A roster of these immediately reportable diseases that are common among various states appears in Table 1.

The default analysis and notification configuration within EpiCenter is designed to provide users more immediate awareness of health-related conditions that might be the result of one of these diseases. This is accomplished by frequent/regular, ZIP code-level analysis of (priority) symptom categories comprised of chief complaint key words associated with the signs and symptoms of these immediately notifiable diseases. Additionally, certain words and phrases entered as a chief complaint will also result in an immediate notification regardless of the number of patients involved (i.e. threshold = 1 case). These key words and phrases are associated with generally zero prevalence diseases that pose the risk of serious harm to people. They are listed in Table 2.

When analysis reveals an anomaly in the trends of any of these priority symptoms, EpiCenter makes an immediate notification to the user/s pre-designated by the Organizational Administrator. Notifications will not be repeated more frequently than once every 12 hours (i.e. subsequent anomalies of the same category, even if generated by different algorithms, will not result in another user notification until 12 hours has passed since the initial anomaly was detected). However, record of the subsequent anomalies will be recorded and viewable by users within EpiCenter.

Analyses of these trends in the priority symptom categories are completed using Exponentially Weighted Moving Averages- and Cumulative Sums-based algorithms on an hourly schedule. These methods are attractive because of their simplicity. They are likely to outperform methods that are more complex in situations where counts may be routinely low. Default threshold values are four standard deviations from the average value over 34 days (EWMA) and 31 days (CuSum).

1. Exponentially Weighted Moving Average (EWMA) – a simple and robust statistical process control method for surveillance of sparse data. Observed values are weighted with increased value given to those more recent counts. Where recent epidemics could seriously affect the accuracy of forecasts, it is possible to enhance the sensitivity of this method through the use of a short guard band to avoid contamination of the baseline.
2. Cumulative Sums (CuSum) – A CuSum chart is a type of control chart used to detect small changes. CuSum charts plot the cumulative sum of the deviations between each data point (actual count) and a reference value, expected count. A useful method for monitoring high prevalence conditions⁴, it detects smaller shifts in and from the mean. The method is made more robust by employing a two-in-a-row rule.

Disease	Primary Symptoms
Anthrax	fever, malaise, cough
Botulism	paralysis, weakness, dysphagia, dry mouth, diplopia
Brucellosis	fever, headache, weakness, sweating, arthralgia
Cholera	watery stools, nausea, vomiting
Diphtheria	sore throat, swollen neck
<i>Escherichia coli</i> O157:H7	watery to bloody diarrhea
<i>Haemophilus influenzae</i>	fever, vomiting, lethargy, stiff neck
Meningitis	stiff neck, fever, intense headache
Measles	fever, conjunctivitis, cough, red blotchy rash beginning on face
Pertussis	cough with “whooping” inhalations
Plague	eschar, fever, chills, malaise, myalgia, headache, sore throat
Rabies	headache, fever, paralysis, convulsions
Q Fever	fever, headache, weakness, sweats
Smallpox	Fever, malaise, headache, severe backache, deep-seated to maculopapular rash
Tularemia	Indolent ulcer at organism site, swollen regional lymph nodes, painful swollen throat, abdominal pain, diarrhea, vomiting
Typhoid (Salmonellosis)	headache, diarrhea, abdominal pain
Viral Hemorrhagic Fevers	fever, prostration, flushed face and chest, hemorrhaging

Table 1: Diseases, common among various states, which are immediately reportable to public health.

Anthrax
Plague
Eschar
Smallpox
Bioterror
Botulism
Ricin

Table 2: Words, roots, and phrases that will, as a chief complaint, generate an immediate notification

B. Daily Summary Notifications

Other diseases that appear on the various reportable lists do not create the same level of urgency that the immediately reportable diseases do. However, an epidemic of any of these diseases is a concern to public health and earlier awareness could still be of benefit. Examples of such diseases include mumps, cryptosporidiosis, and shigellosis. EpiCenter uses the same methods discussed in the previous section to analyze trends in the categories of symptoms associated with these diseases. However, the geographic base used for analysis of symptom categories associated with these diseases is at the County level rather than the ZIP code level to reduce the sensitivity of analysis and the number of risk of false positives. Anomalies in any of these categories of non-priority symptoms are reported to designated users in a summary style e-mail that is distributed once daily.

Certain variations that occur within symptom categories may be related to the seasonal variation of incidence that occurs in certain diseases, for example seasonal influenza or certain diarrheal diseases. Recognizing these seasonal trends requires the use of modeling techniques that are sometimes more advanced than the EWMA and CuSum methods routinely used to establish expected counts. Often times EWMA and CuSum analysis of these seasonal trends will generate anomalies that may indicate certain changes in these trends such as more rapid onset of a season, more severe season, or simply the increases expected with the seasonal trend.

C. No Notifications

An important capability is provided to public health users of EpiCenter; the ability to track health-related conditions that are associated with non-notifiable diseases within populations. As important as this function is, it does not require users to be notified of trend deviations in these related symptom categories. These deviations and the associated analyses remain available to EpiCenter users as an on-demand feature.

Summary of Default Notification Configuration

The EpiCenter default notification configuration has been developed under the premise that not everything detected by the system warrants immediate notification of public health users. Indeed, immediate notification of all anomalies in every category available in EpiCenter would most likely create

much more e-mail than desired by users and very quickly result in decreased satisfaction and sense of trust in the system. Therefore, only those categories associated with the most common of the more serious infectious diseases have been identified to generate immediate notifications when analysis reveals counts that are significantly above what is expected. Users are advised of above threshold counts in those other categories associated with less serious diseases in a single daily summary e-mail or not at all for diseases that are not reportable. The frequency of analysis for each symptom category is derived from this same hierarchy of urgency and is presented in Table 3.

Table 3. Frequency of category analysis and user notifications of significant deviations from expected values

Symptom Category	Frequency	Analysis		Notification Frequency		
		Threshold	Geographic Level	Immediate	Daily	None
Fever	Hourly	4.0 σ	ZIP code	X		
Paralysis	Hourly	4.0 σ	ZIP code	X		
Stiff neck	Hourly	4.0 σ	ZIP code	X		
Hemorrhaging	Hourly	4.0 σ	ZIP code	X		
Watery or Bloody Diarrhea	Hourly	4.0 σ	ZIP code	X		
Non-specific Diarrhea	Daily	4.0 σ	County		X	
Influenza-like Illness	Daily	4.0 σ	County		X	
Myalgia	On demand	UD	UD			X
Headache	On demand	UD	UD			X
Rash	Daily	4.0	ZIP code		X	
Malaise	On demand	UD	UD			X
Lymphadenitis	Hourly	4.0 σ	ZIP code	X		
Fatigue	On demand	UD	UD			X
Neurologic	Hourly	4.0 σ	ZIP code	X		
Cough	Daily	4.0 σ	County		X	
Vomiting	Daily	4.0 σ	County		X	
Vision	Hourly	4.0 σ	ZIP code	X		
Miscarriage	Daily	4.0 σ	ZIP code		X	
ENT	On demand	UD	UD			X
Arthralgia	Daily	4.0 σ	County		X	
Jaundice	Daily	4.0 σ	County		X	
Abdominal	Daily	4.0 σ	ZIP code		X	

*UD = User Defined

Deviations from Default Notification Configuration

Unique characteristics of certain areas (e.g. chemical manufacturing plant), or local interest in certain infectious disease (e.g. Sin Nombre virus in the southwest U.S.) may foster a desire to deviate from this default configuration and include automated notifications for unexpected changes in the trends of other symptoms. For example, a health department with a chemical manufacturing facility in their jurisdiction may desire EpiCenter to analyze respiratory, cough, and/or non-specific rash categories more frequently and have immediate notification of anomalies detected in the counts of these categories.

The functionality built into EpiCenter permits Organizational Administrators to deviate from the default analysis and notification configuration. This capability is intended to provide the level of customization desired by users by permitting focus on local and/or seasonal events of concern. Organizational Administrators that decide to deviate from these default settings should realize that the probability of the number of false positive notifications (i.e. statistical anomalies that result from other than true disease events) may significantly increase.

The staff at Health Monitoring Systems can assist Organizational Administrators considering deviations in identifying appropriate categories based on concerns and threshold levels given the historical trends of those categories.