Health Resources and Services Administration (HRSA)
Maternal and Infant Health Mapping Tool User Guide

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Introduction

Maternal and Infant Health Mapping Tool Purpose

The Maternal and Infant Health Mapping (MIHM) Tool is an interactive online tool that allows users to create and customize county-level maps on maternal and infant health. Users can explore the geographic relationships between maternal and infant health indicators, health resources, and demographics. The tool was designed to help federal, state, and local decision-makers and others visualize maternal and infant health factors to assist in understanding need and targeting resources.

Potential Uses of the MIHM Tool

- Display the geographic relationships between maternal and infant health indicators, health resources, and demographics
- Identify areas with lower and higher rates of maternal and infant health indicators (bright spots and hot spots)
- Explore county-level maternal and infant health resources
- Provide context and perspective on maternal and infant health indicators and health resources across the country
- Provide a reference on maternal and infant populations and HRSA and other health resources, for use when preparing for emergencies and responding to them
- Identify service area gaps and possible areas for additional resources

MIHM Tool Limitations

- ***Analyze relationships between the data layers that are not based on location.*** The MIHM Tool allows users to explore and compare data based on where things occurred or are located. The tool displays the layers that users select but does not analyze the data for users.
- ***Indicate causation.*** The MIHM Tool will not tell you that one data layer's value are higher or lower because of another layer, or whether having a service present or not present is related to an indicator. The data are cross-sectional and correlational in nature.
- ***Include all maternal and infant health indicators and resources.*** Ideally, all data related to maternal and infant health would be included in the map tool. However, many data measures or resource locations are not available at a county or location-specific level or may not even exist. For example, pregnancy-related death and severe maternal morbidity, two very important measures of maternal health and well-being, are not currently available at a county level across the whole US, so they cannot be included in a map with county-level data. States, counties and communities may have their own data sources on maternal or infant health that are not available publicly or are not available on a national basis.[1] Services and funding that are distributed through or managed at the state level may not be reflected in the mapping tool.
- ***Tell users why a resource is or is not available*.** The MIHM Tool focuses on resources funded by HRSA or with data available through HRSA programs, such as the Area Health Resources Files (AHRF) released by the HRSA Bureau of Health Workforce. There are many reasons why a location may not have a resource or service shown on the map, even if it appears to need it. For example, a community may have resources and services funded by other organizations, or the community may not have the interest or capacity to establish or support a service. The map tool can spur users to ask questions and find out more.

[1] Organizations with county-level data that they would like to add to the map can include it in maps they build using the "Your Data - Add Data" feature. See the "Using the "Add Data" Feature" section of the User Guide for more information.

Recommended Citations

Map citation:
Health Resources and Services Administration. Maternal and Infant Health Mapping Tool: *https://data.hrsa.gov/maps/mchb/*. Accessed on [date].

Downloaded data citation:
Data downloaded from the Maternal and Infant Health Mapping Tool, a website developed by the Health Resources and Services Administration, Maternal and Child Health Bureau. *https://data.hrsa.gov/maps/mchb/*. Accessed on [date].

Getting Started

Common Terms

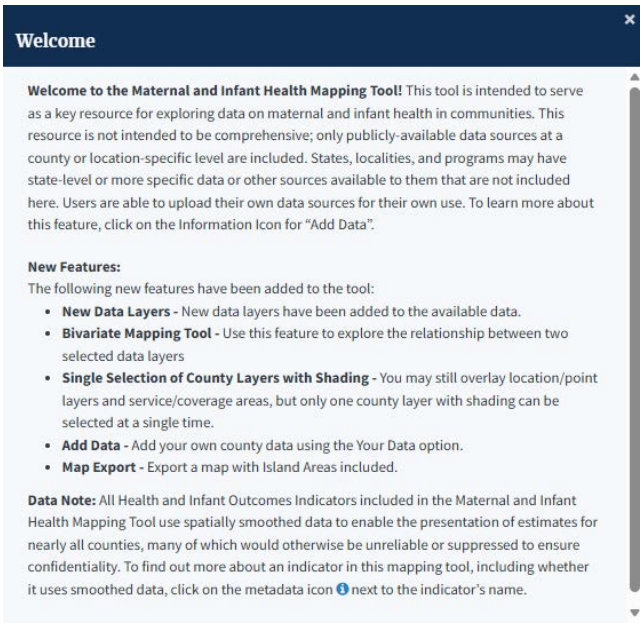
- ***Basemap*:** "Basemaps serve as a reference map on which you overlay data from layers and visualize geographic information. Basemaps are the foundation for your maps and provide context for your work".[2] For example, a basemap may show roads and highways, topography, town, and city locations, etc. Click on  to find the basemap options.
- ***Data layer*:** A data measure or source that can be added to the map. In the Maternal and Infant Health Mapping Tool, data layers are added and removed by clicking the checkbox next to the data layer, for example: 

- ***Data table*:** The data table opens when a user clicks on a data layer to add it to the map. It appears below the map and shows the values and other details for each geographic location included in the data layer. Each additional layer will appear as a new tab in the data table. The data table can be collapsed or expanded by clicking on the arrow in the top left corner of the table.
- ***Metadata*:** An information box you can open that provides more detail about the data layer. The metadata for a data layer can be accessed by clicking  next to the layer name.
- ***Legend*:** The legend shows the meanings of colors and/or symbols used to represent data values, service locations, or other features in the map. It appears when a data layer is turned on.

[2] Esri; ArcGISPro, Basemaps. Available at: https://pro.arcgis.com/en/pro-app/latest/help/mapping/map-authoring/author-a-basemap.htm Accessed Aug 8, 2023.

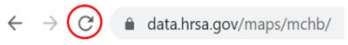
Welcome Message

Upon accessing the mapping tool website (https://data.hrsa.gov/maps/mchb/), you are greeted with the Welcome message. Read through the message and then close it to access the mapping tool.



User Tips and Notes

➔ To clear out all of your data layer selections and other changes to the mapping tool and start over, click on the "reload" button at the top of your browser next to the web address.



or use the "Reset" button at the bottom of the data layer list on the left hand side of the mapping tool.

➔ When data for an area are not available or are suppressed, the map legend will show "No Data" and the data value column in the data table below the map will be blank.

➔ To avoid confusion with multiple data layers presenting muddled map colors, the map only allows a single county-level layer to be turned on at a time. Users can turn on a county layer in addition to multiple location or coverage/service area layers. Users have other options for displaying data for multiple layers at one time:

- Use the Multi-Criteria Selection feature to identify areas with the relevant combination of values.
- Use the Bivariate Mapping feature to compare the values of two variables within a single layer and view the relationship between the variables.

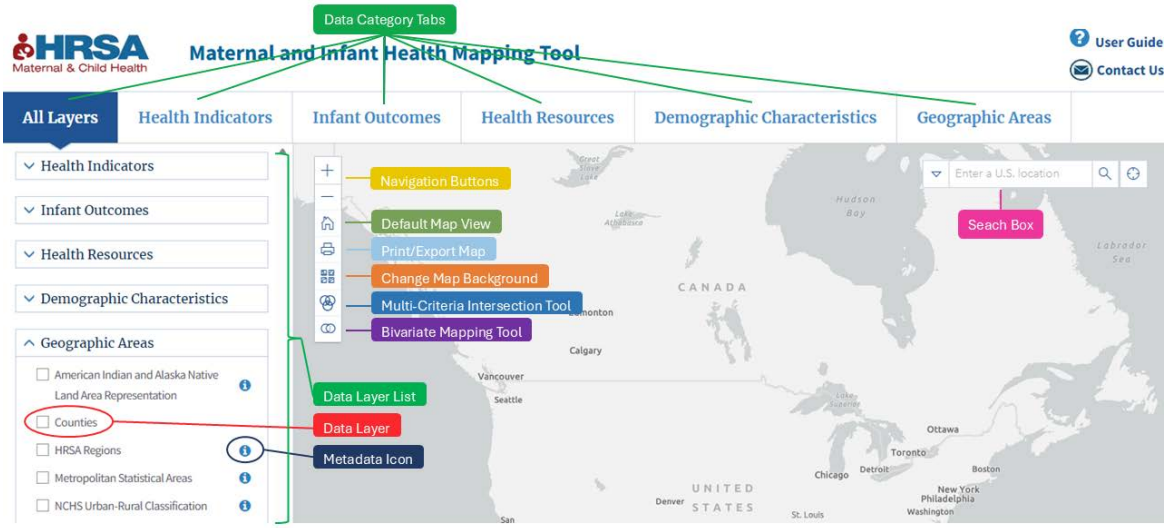
➔ Customization of color schemes and changes to the base layer in the map (click on to find the basemap options) can provide more contrast between layers.

➔ Filtering data using the data table will update the map and may change the legend groupings unless there are too few values to regroup. Filtering data using the data table can also show targeted values or areas of interest.

Map Toolbar and Navigation Overview

The Map Toolbar includes buttons for multiple map functions and the search box helps you find specific locations. Tooltips (text that tells you what a button does) should appear as you hover over buttons.

- Click on the **Navigation Buttons**  to zoom in and out.
- Type a location into the **Search Box**. The map should automatically zoom in to the location you selected.
- Click on the **Default Map View** icon  to return to the original map size.
- Click on the **Print/Export** icon to create a PDF of the map you've created.
- Click on **Change Map Background**  to see the other possible map backgrounds (also called basemaps). Click "Close background menu"  to close the list.
- Explore the different ways to access the data layers by:
  - Opening the **Data Category Tabs** at the top of the map (click on a tab to show the list of **Data Layers** in that category) and
  - Unfolding the sections of the **Data Layer List** on the left side of the map (click on the arrow next to the category name to unfold).
- The **Metadata Icon**  next to each data layer name provides more detail about the data layer, including source and timeframe.
- The **Multi-Criteria Selection (MCS**) tool  allows more complex filtering for data exploration and analysis than the filtering options in the data tables
- The **Bivariate Mapping** tool  allows data exploration of two variables as a single layer that characterizes the level of agreement between the two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Seattle
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Toronto
Chicago
Detroit
Boston
New York
Philadelphia
Washington
Denver
St. Louis
UNITED STATES

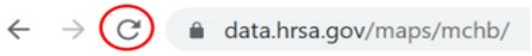
Turning Data Layers On and Off

By clicking and unclicking in the square box next to the layer name, you can turn layers on and off. When you turn on a data layer, a legend will appear and the data for the layer will be displayed in a table below the map.

The MIHM Tool allows users to turn on a single county-based layer at a time along with any number of location-based or service area layers. Options for customizing the appearance of the maps to make multiple layers more visible include:

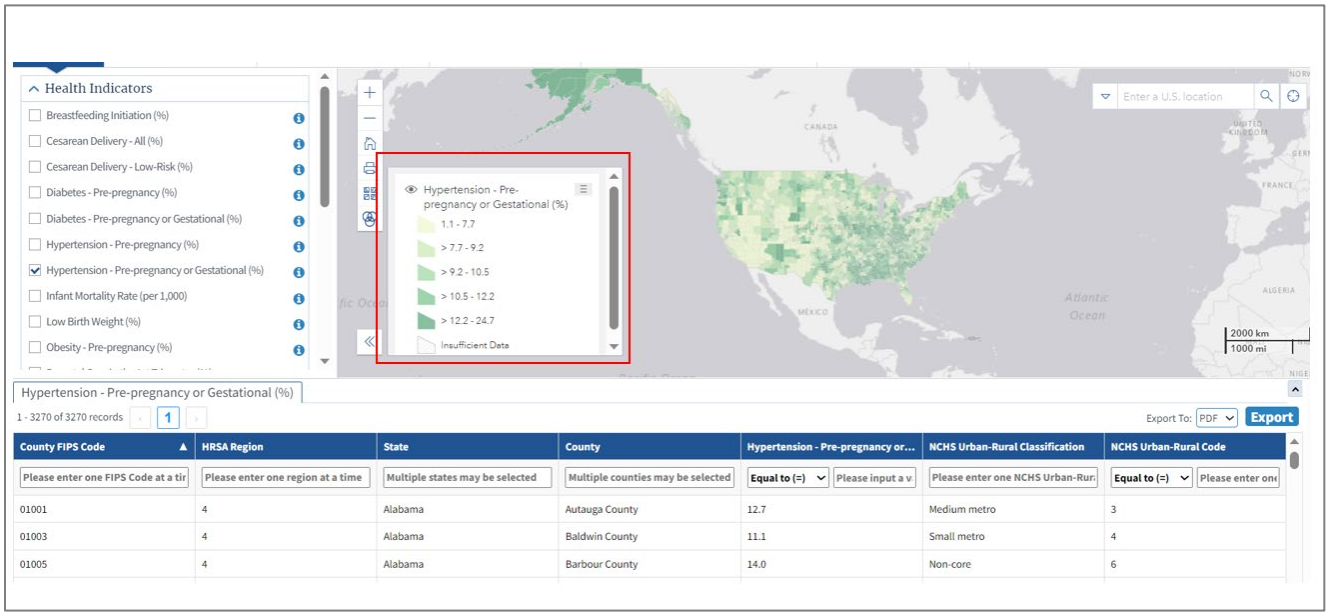
- Change the color scheme for a data layer or change the basemap to improve contrast.
- Change the order of the data layers (select the "Open Actions" icon ☰ on the legend and choose "Move layer above" or "Move layer below").
- Filter values using the data tables.
- Use the Multi-Criteria Selection feature to identify areas with the relevant combination of values.
- Use the Bivariate Mapping feature to view two variables and the level of agreement between their values in a single layer.

To clear out all of your data layer selections and other changes to the mapping tool and start over, click on the "reload" button at the top of your browser next to the web address.



or use the "Reset" button at the bottom of the data layer list on the left-hand side of the mapping tool.

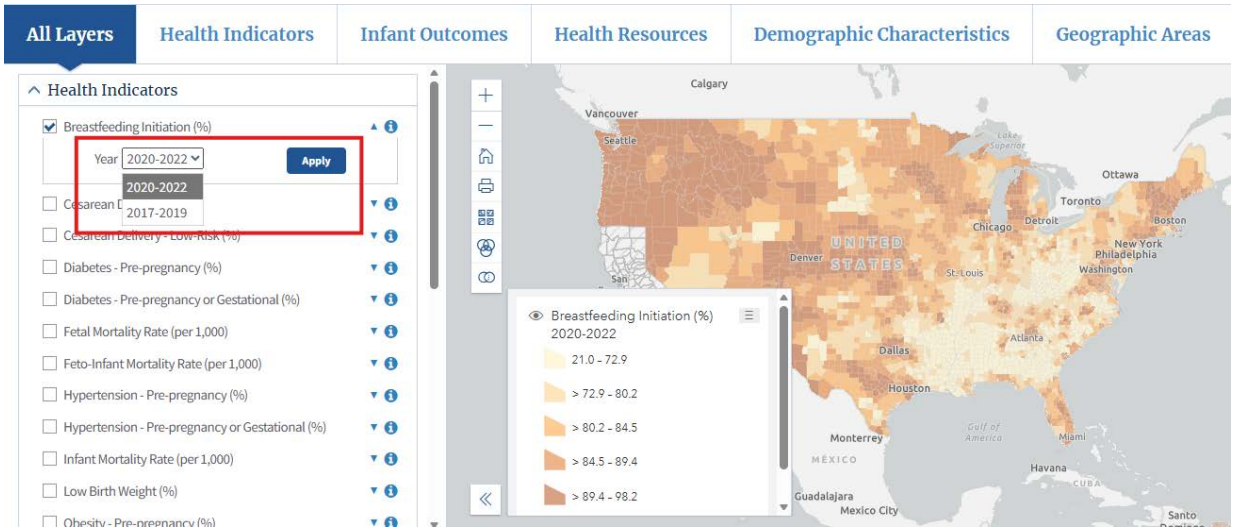
Below is an example of the data layer called **Hypertension – Pre-pregnancy or Gestational (%)** being turned on. When the layer is turned on the data appear on the map. Notice that the layer draws with a green color scheme and that a legend appears when you turn on the data layer. The legend shows the data values associated with each color.



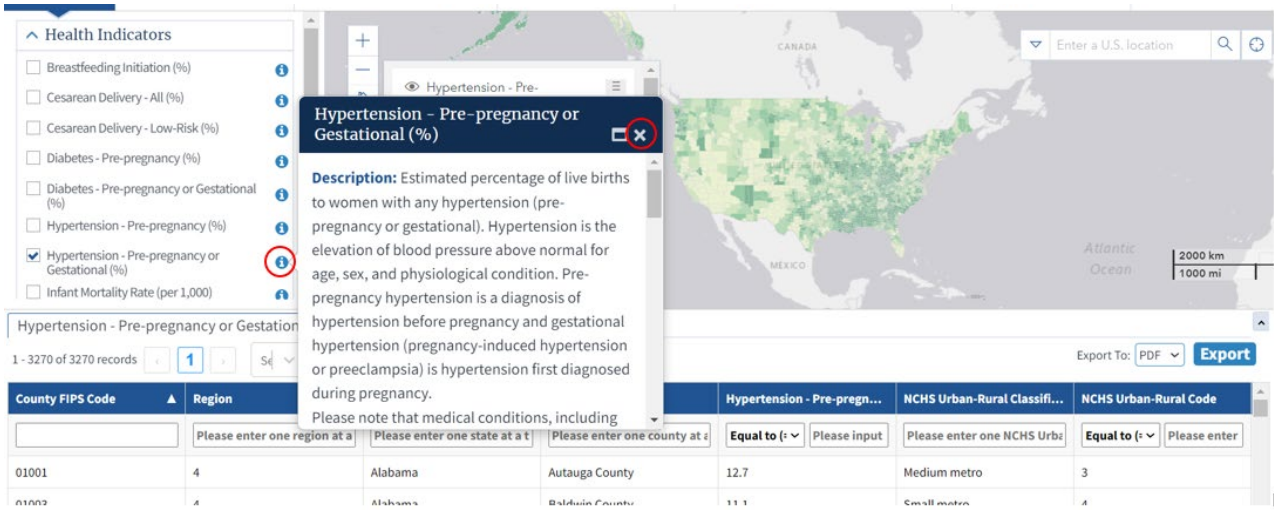
Selecting Time Period for Data Layers (Health Indicators and Infant Outcomes Layers Only)
When using map layers within the Health Indicators and Infant Outcomes categories, users can select the time period of the data they want to view. When enabling these layers, the most recent time period is selected by default. Users can select a different time period using the drop-down below the layer name on the left-hand menu and clicking "Apply" to see the change reflected. The titles of these layers where they appear in the tool reflect the selected time period. For example, "Breastfeeding Initiation (%) 2020-2022".

Layers that only have one time period of data available will not prompt the user to make a time period selection.

The ability to select the time period of data described above applies to the individual selection of map layers as well as the Multi-Criteria Selection and Bivariate Mapping features.

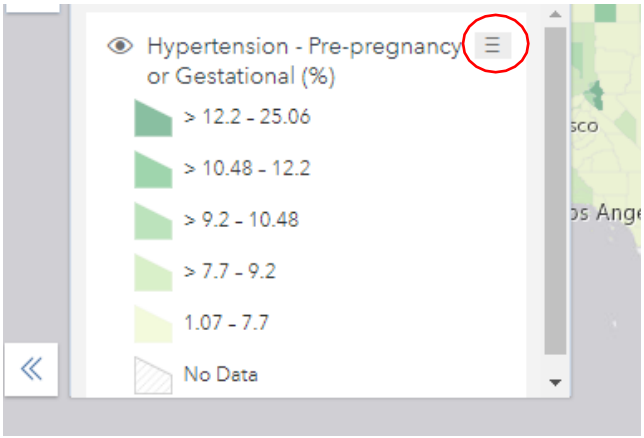


Accessing Information on Data Layers (Metadata)
To find information about the data sources, definitions, and timeframes for the data layers you can open what is called the "metadata." The metadata is available by clicking on the blue "i" icon next to the data layer name. The example below shows the metadata opened for the **Hypertension – Pre-pregnancy or Gestational (%)** data layer. To close the metadata box click on the "X" on the top right corner of the metadata box.

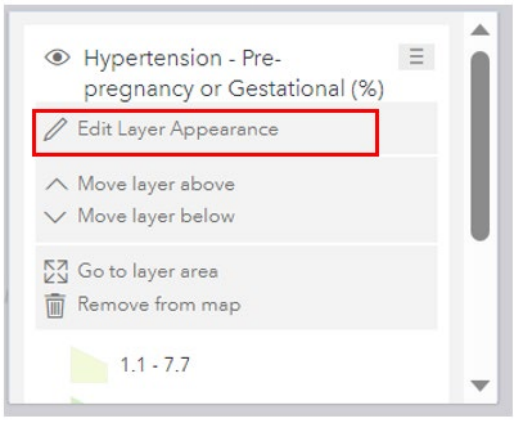


Editing the Appearance of Data Layers

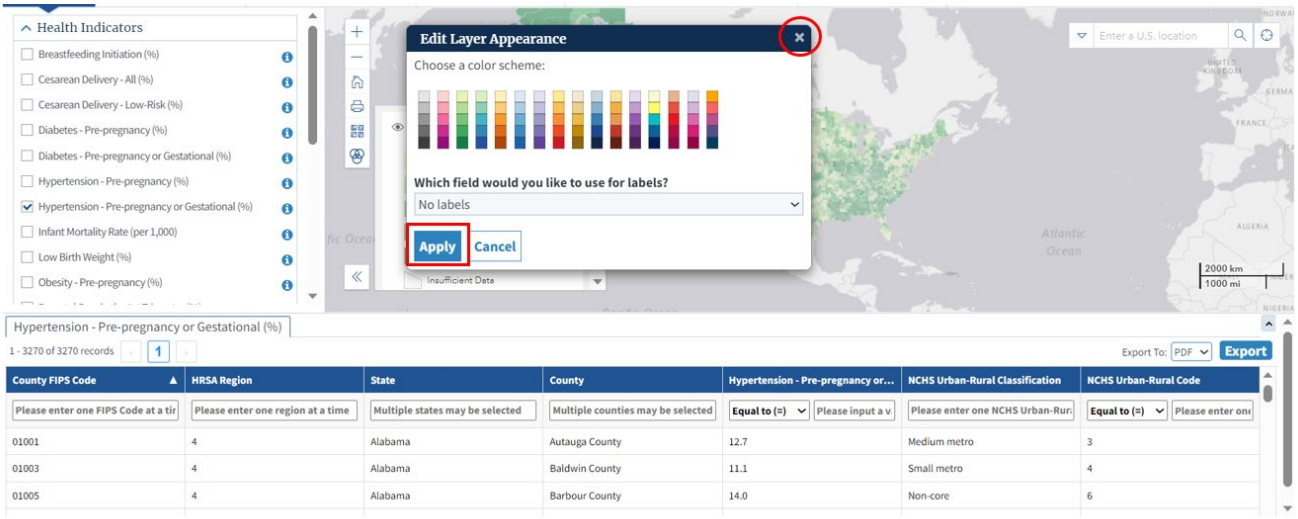
You can change the color scheme to a different color by selecting the "Open Actions" icon ☰ on the legend. An example using the **Hypertension – Pre-pregnancy or Gestational (%)** layer is below.



Then, choose the "Edit Layer Appearance" option:

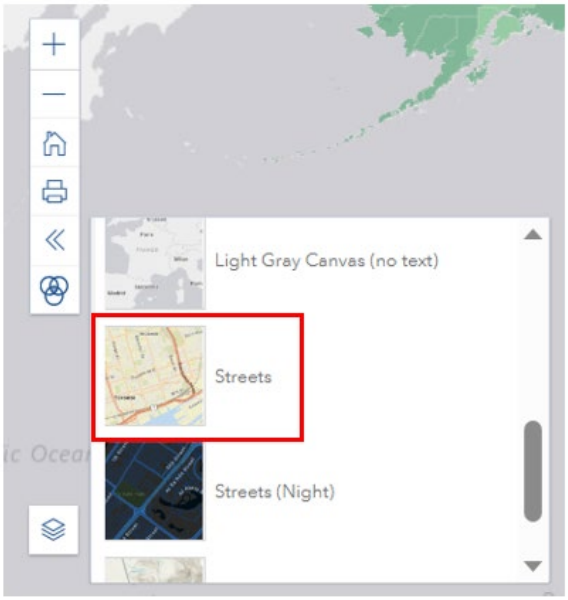


The box that opens gives you multiple color scheme choices and several labeling options. Choose the color scheme you prefer, or one that best contrasts with other layers in the map. If you would like labels to appear select the label option that you prefer. Click "Apply" and take a look at how the data on the map changed. If you would like to choose another color scheme, this box will stay open for you to do so. When you are happy with your color scheme and labeling choices, click the "X" at the top to close this box.



Changing Map Backgrounds/Basemaps

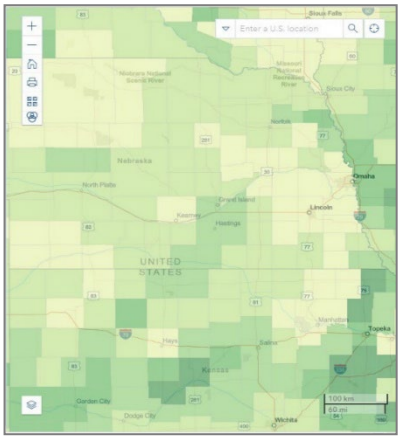
The data layers are somewhat transparent to allow you to see features through the shading. This is most evident when you have a background layer with features like streets, highways, and waterways. To change a basemap, click on the "Change Map Background" icon on the Toolbar. Choose the background that best suits your map (the "Streets" layer is chosen in the example below).



Note: "Light Gray Canvas" is the default basemap option.

When you have selected a basemap, click on the double arrows « to close the basemap options.

Zoom into the map (by searching for a location or clicking the "zoom in" button + at the top of the tool bar) to see the details of the new basemap. For example, you can see the "Streets" basemap is visible beneath the data layer in the example below.

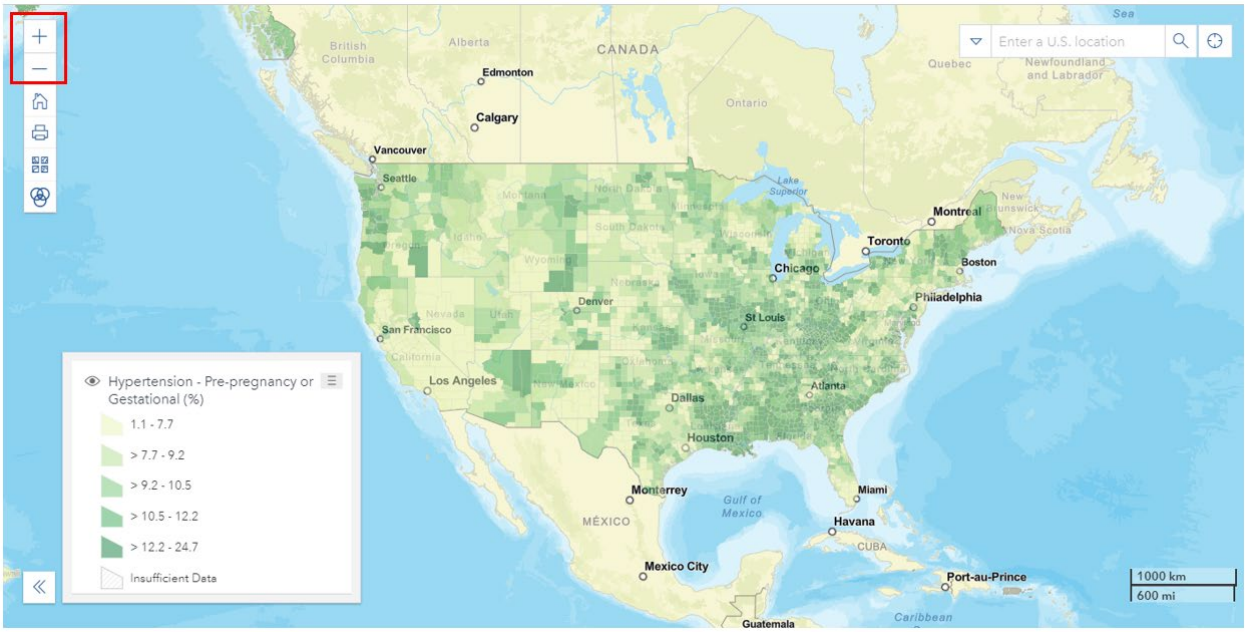


Viewing Data Layer Detail for a County

With a data layer selected you can click on a county in the map to view more detailed information about that county (the example shows Hamilton County, Iowa). If more than one data layer is turned on there will be an option at the bottom of the detail box to flip between detail pages for that location. Click "X" to close the information box when you are done looking at the detail.

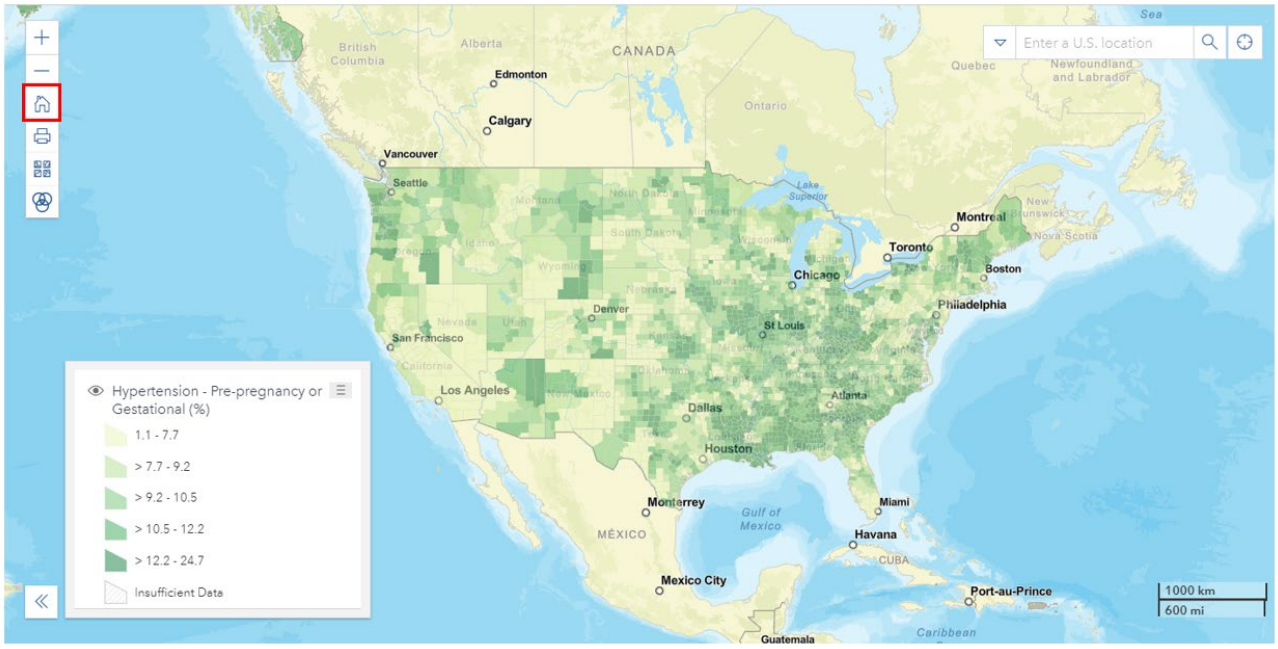
Zoom Buttons

You can zoom out of an area by using your mouse scroll or by clicking the zoom out button a few times on the Toolbar. To zoom in, use the mouse scroll in the opposite direction or click the plus button. The example below shows the map after clicking the zoom in button a few times.



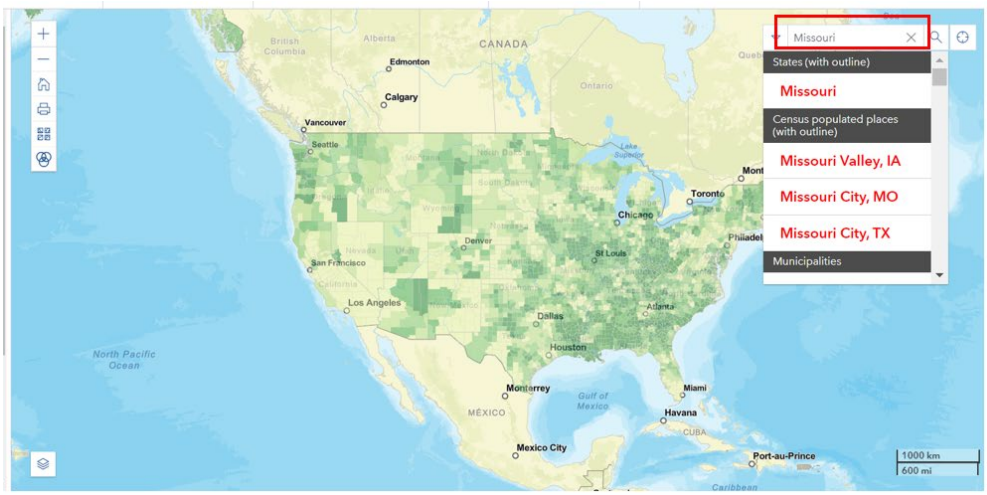
Home Button

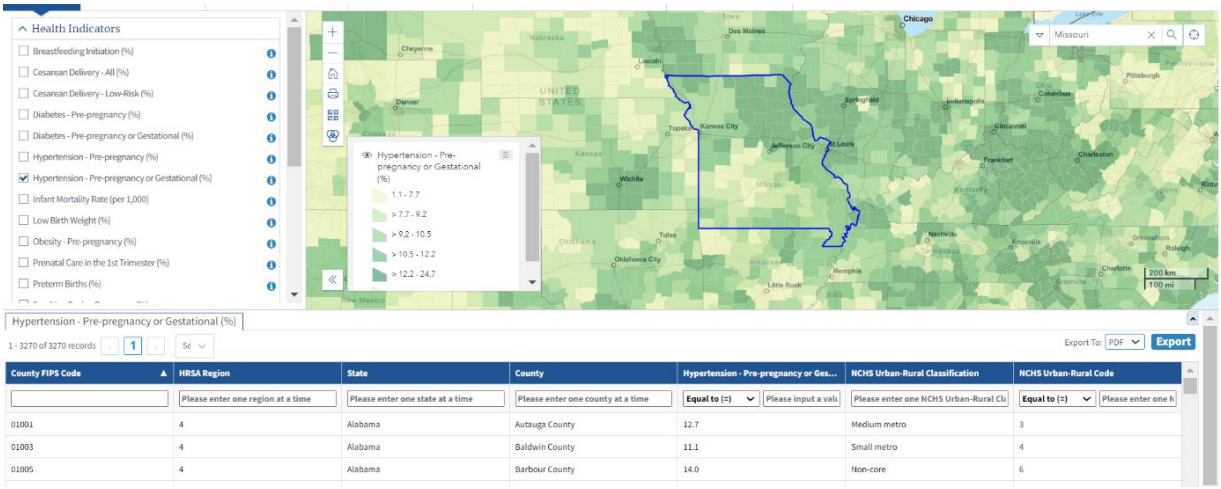
You can return to the default view by clicking the “Home” button on the Toolbar.



Search Box

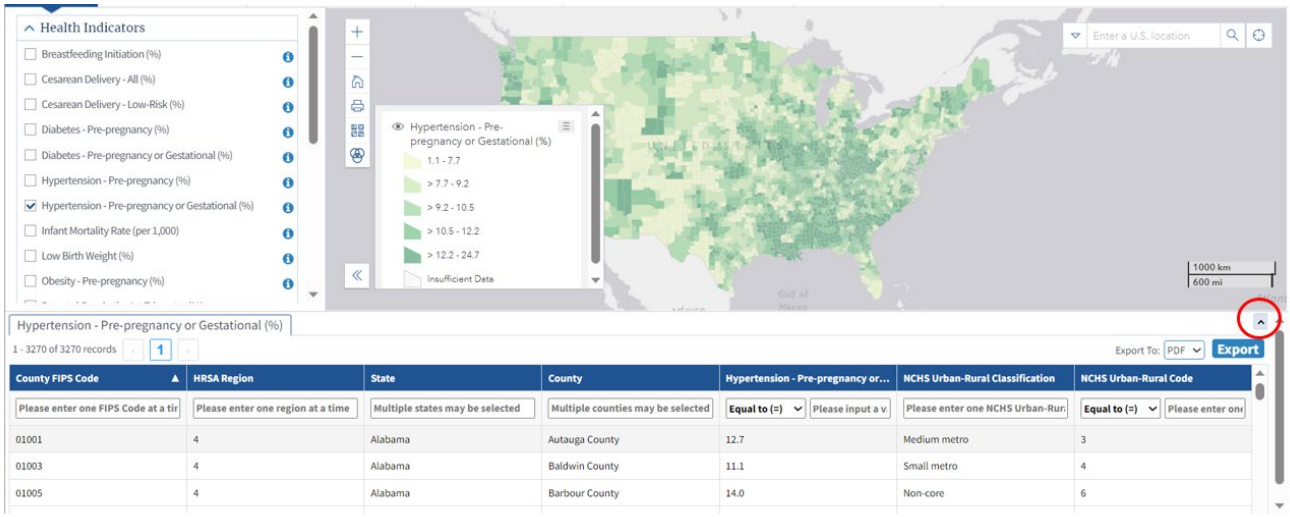
Another option for zooming directly to an area of interest is to type the name of the state, county, town, or area of interest in the Search Box. Once you have typed in the name, select the area of interest from the dropdown list of locations with similar names that appears below the Search Box. When an area is selected, the map will zoom to that location. If the area has an identified outline (such as a county or state) it will be outlined in blue. The areas with outlines available are identified in the dropdown list of options.





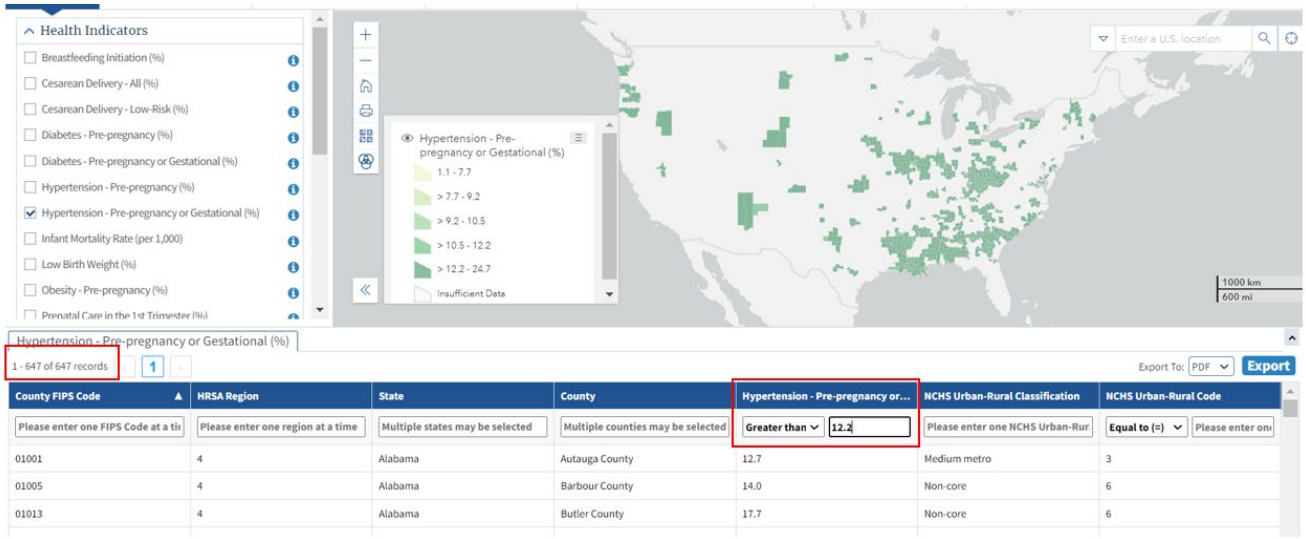
Filtering with the Data Table

The data table will appear below the map when the first data layer is added to the map. A new data table will be added for each additional layer. Navigate to the data table for each layer using the tabs with the layer names at the top of the data table. To collapse the data table and show more of the map click on the arrow at the top right side of the table. To re-expand the data table, click on the arrow again. An example of the data table for the Hypertension – Pre-pregnancy or Gestational (%) layer is below with the "collapse" arrow circled.



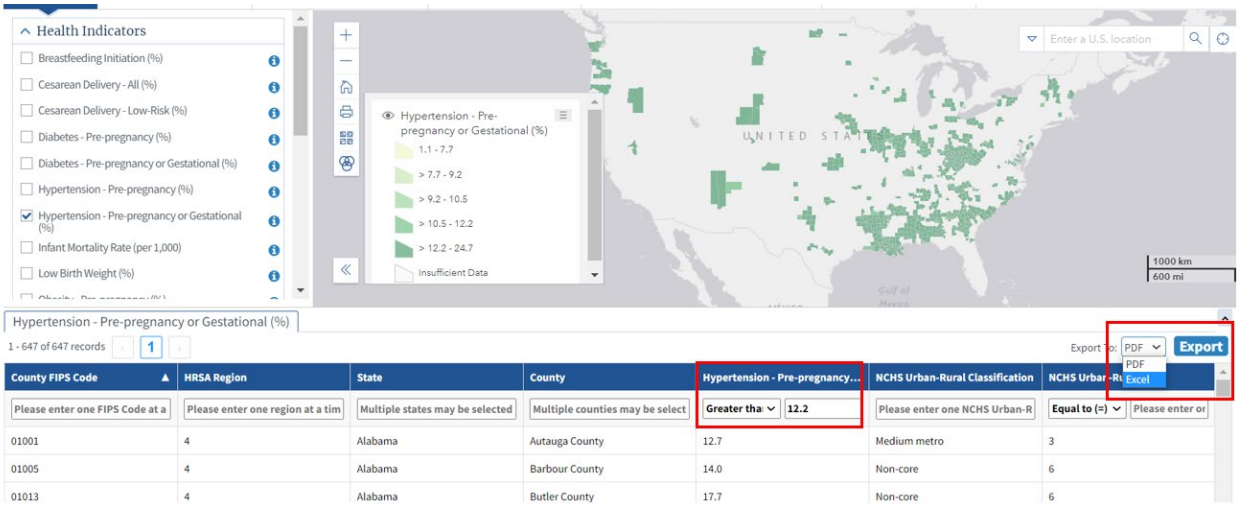
You can use the data table to filter the data and change what is shown on the map. For example, if you want to filter the dataset to just show areas with certain values for an indicator, select an expression from the drop-down beneath the far-left columns and enter the value of interest. The example below shows this process for finding locations with **Hypertension – Pre-pregnancy or Gestational (%)** greater than or equal to (>=) 12.2. When you have filtered the data the map and legend will adjust to only include the records you have selected. The number of records on the far-right side of the table will change to show you how many

are included (647 using the example below for **Hypertension – Pre-pregnancy or Gestational (%)** greater than or equal to 12.2).



Exporting Data

At the top-right of the data table you have the option of exporting to PDF or CSV. If you have filtered the data, the export will only include the records you have selected and a note will be included in the export indicating what values are included. Once you click on the blue "Export" button the link for the exported document will appear at the bottom of your window. Click to open the exported data table in the format you chose.



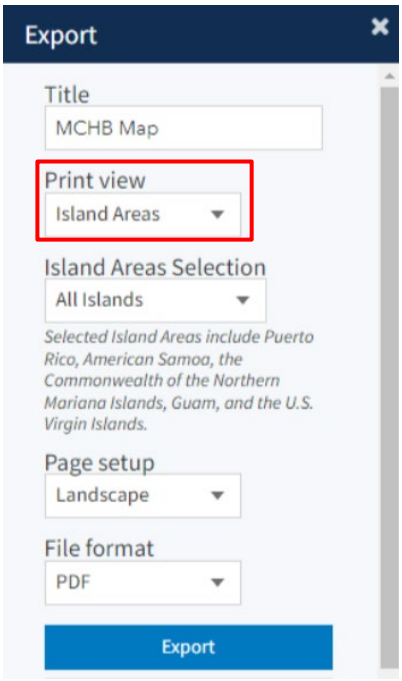
Printing/Exporting a Map

To print the map or to export it to a PDF that can be used in documents or presentations, Click on the "Print" icon on the toolbar.

An "Export" window will appear where you can change the title of the map, set up the page, and choose an output format. Click "Export" after you have made your selections and changes.

Print View and Island Areas Selections

There are two options for selection of the print view: Custom Zoom or Island Areas. Selecting Custom Zoom will reflect the user's selected zoom level. Selecting Island Areas will prompt a second choice for the user between "All" Island Areas and "Selected" Island Areas. The Island Areas exports will reflect the choice of map layers, but will not display the user-selected zoom. Instead, the export will display the United States at the full extent.



All Island Areas will generate a PDF output including a first page with the Continental United States plus Alaska and Hawaii and a second page with all of the United States Island Areas (American Samoa, Guam, Federated States of Micronesia, Marshall Islands, Northern Mariana Islands, Puerto Rico, Republic of Palau, U.S. Minor

Islands, and the U.S. Virgin Islands).

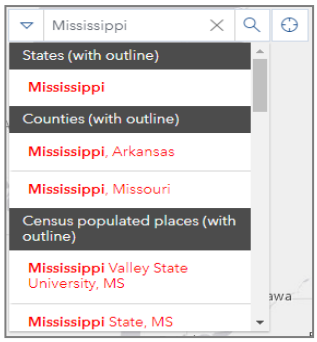
Selecting “Selected” Island Areas will generate a PDF output including a first page with the Continental United States plus Alaska and Hawaii and a second page with a selected set of the United States Island Areas (American Samoa, Guam Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands).

After the map is generated, the PDF link will show up at the bottom of the print options window under “Exported files”. Click on the link to download the PDF (the download will show up at the bottom of your window).

Exploring Overlapping Data Layers

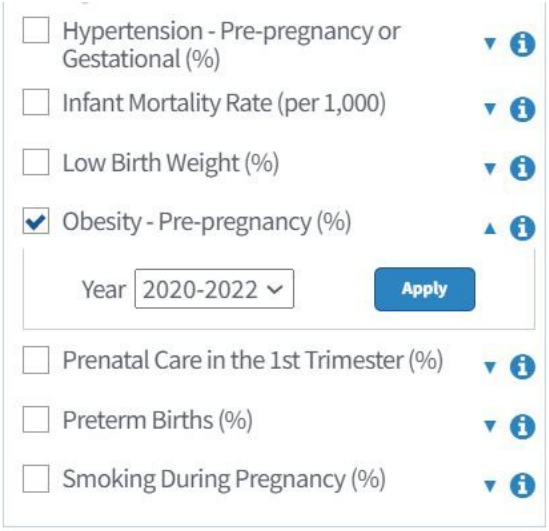
The Multi-Criteria Selection and the Bivariate Mapping features allow users to explore more than one factor in a single layer. However, users have other ways to explore more than one data layer for an area of interest. The example below uses the location search option, filtering, and color schemes to explore a health indicator layer (Obesity – Pre-Pregnancy (%)), and a location layer (Health Center Service Delivery Sites) for a specific area of the country (Mississippi).

Type in **Mississippi** in the “Enter a U.S. location” box. Select from the drop down:

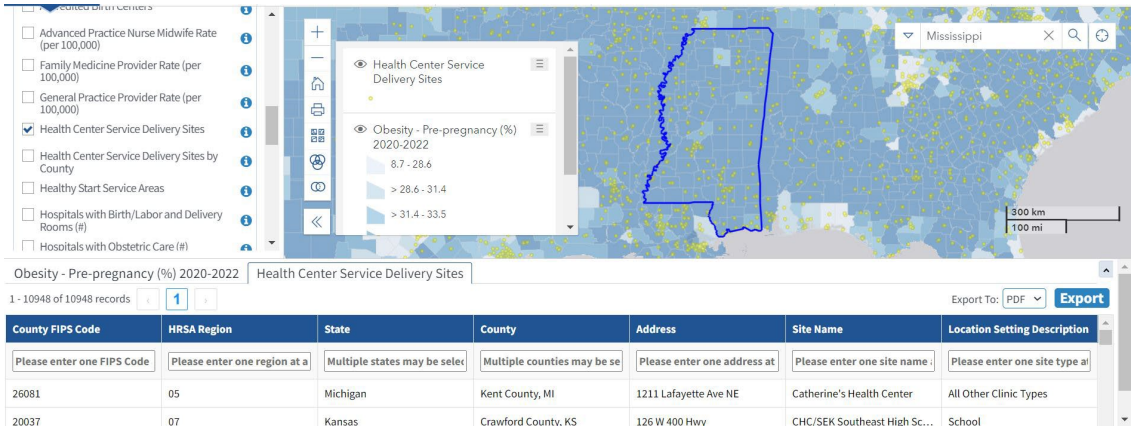


The outline of **Mississippi** will be displayed in blue:

Next, under the tab “Health Indicators”, select Obesity – Pre-pregnancy (%). Note that 2020-2022 has been selected for the Year.



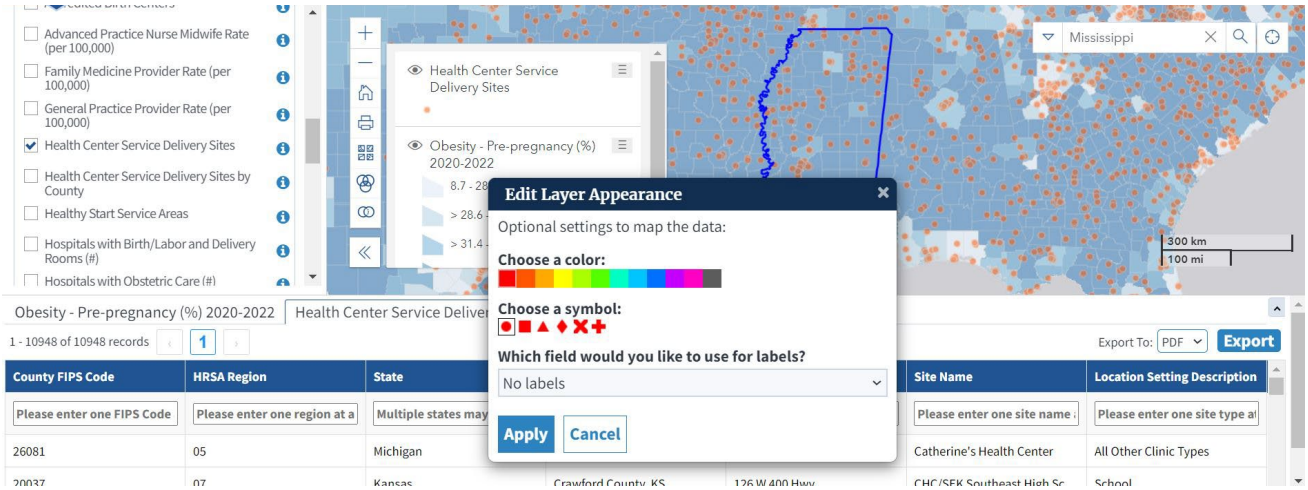
With the "Obesity – Pre-pregnancy (%)" layer turned on, navigate to the "Health Resources" tab. Select and turn on "Health Center Service Delivery Sites". Notice there are two layers on the map view and their respective legends are shown and the data table below the map includes a tab for each layer.



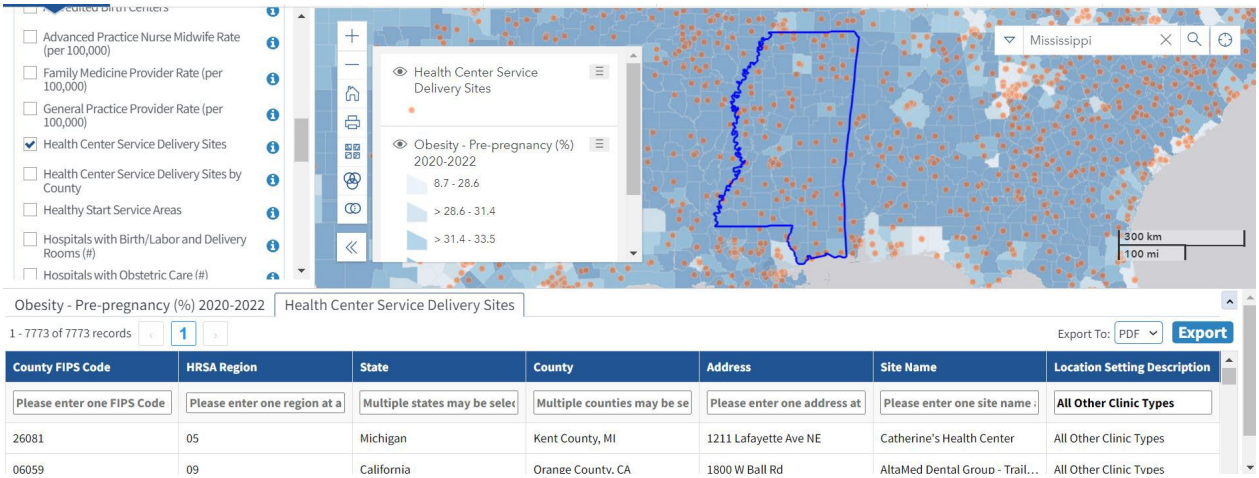
Helpful Tip: To remove the outline at any time, click the "X" to the right of "Mississippi" in the search box.

Applying Diverging Color Schemes to Optimize Map View

To customize the map layer appearance, change the color scheme to orange for the "Health Center Service Delivery Sites." Select "Open Actions" (three horizontal lines) on the legend, choose "Edit Layer Appearance," select the orange color scheme, and click the Apply button. Click the "X" or "Cancel" to close the "Edit Layer Appearance" box.

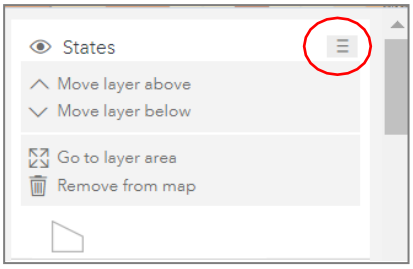


In the data table at the bottom of the map for "Health Center Service Delivery Sites," enter "All Other Clinic Types".



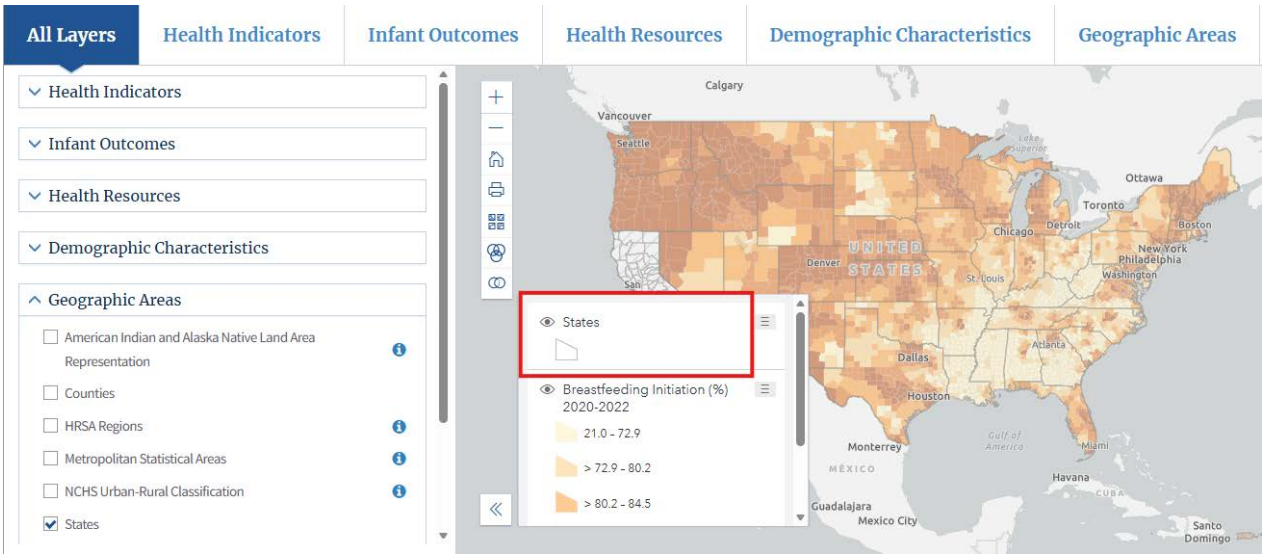
You can also add boundaries for all states, regions, or counties to better contextualize the data on the map.

Helpful Tip: If your layer of interest ever falls below another layer, you can always make it more visible by clicking on the "Open actions" button next to the layer name in the legend and selecting "Move layer above." Click the "Open actions" button again to close the options and return to the legend.



Turning on Geographic Boundary Areas

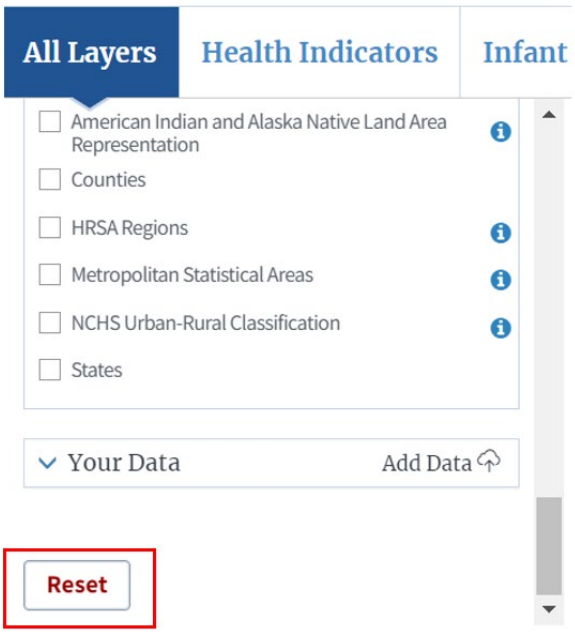
Navigate to the "Geographic Areas" tab and turn on the data layer for the geographic boundaries you are interested in. The example below shows this process for the "States" layer.



The new data layer will appear at the top of the legend box because it was the most recent data layer to be added to the map.

Resetting the Map

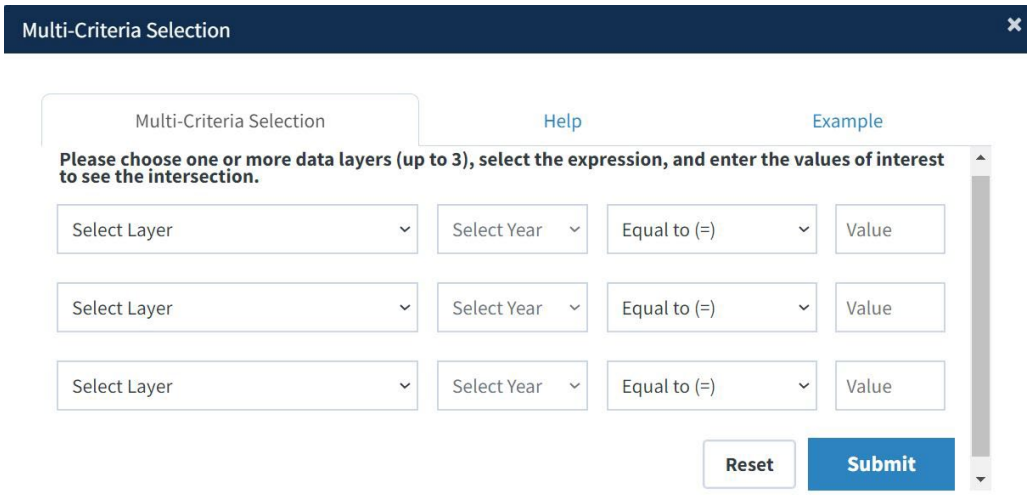
The Reset button allows you to refresh the mapping tool and remove all of the data layers, filters, and customization from the map. To find the button, scroll to the bottom of the list of data layers on the left-hand side of the tool. Click on the Reset button to return everything to the default settings.



Filtering and Data Exploration with the Multi-Criteria Selection (MCS) Feature

The Multi-Criteria Selection feature allows more complex filtering for data exploration and analysis than the filtering options in the data tables. To start, select the "Multi-Criteria Selection" feature from the toolbar.

The Multi-Criteria Selection (MCS) feature window will open.



Use the drop-down fields to identify the layers you are interested in.

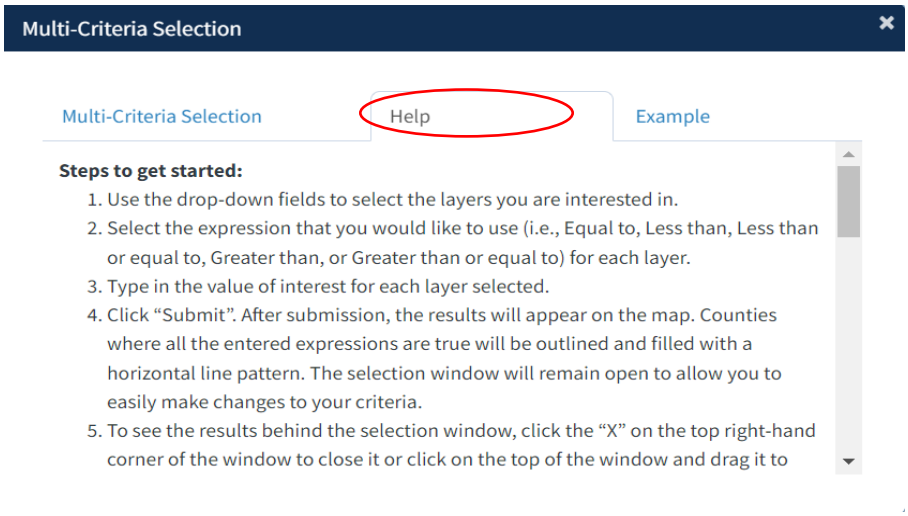
If the selected layer has more than one data time period option, users can use the drop-down field to the right of the layer name to select the time period of data to display. The most recent time period for the layer will be selected by default. If there is only one time period option for the layer selected, the "Select Year" drop-down will be grayed out.

Please note, the MCS feature only includes layers from the Health Indicators, Infant Outcomes, Health Resources, and Demographic Characteristics sections that have county-level information. Data

layers that are location-specific are not included but can be added to the map in addition to the MCS results.

The Help and Example tabs within the MCS feature provide more information on how to use the tool. The information included in those sections of the MCS feature is repeated below.

"Help" Steps Added for the Multi-Criteria Selection Feature



1. Use the drop-down fields to select the layers you are interested in.
2. Use the drop-down to select the year range you are interested in.
3. Select the expression that you would like to use (i.e., Equal to, Less than, Less than or equal to, Greater than, or Greater than or equal to) for each layer.
4. Type in the value of interest for each layer selected.
5. Click "Submit". After submission, the results will appear on the map. Counties where all the entered expressions are true will be outlined and filled with a horizontal line pattern. The selection window will remain open to allow you to easily make changes to your criteria.
6. To see the results behind the selection window, click the "X" on the top right-hand corner of the window to close it or click on the top of the window and drag it to the side.
7. In addition to what is shown in the map, the results will also appear in a new data table below the map. The top of the data table will include a "Filtered By" note so you can see what is included and excluded from the map and data table.

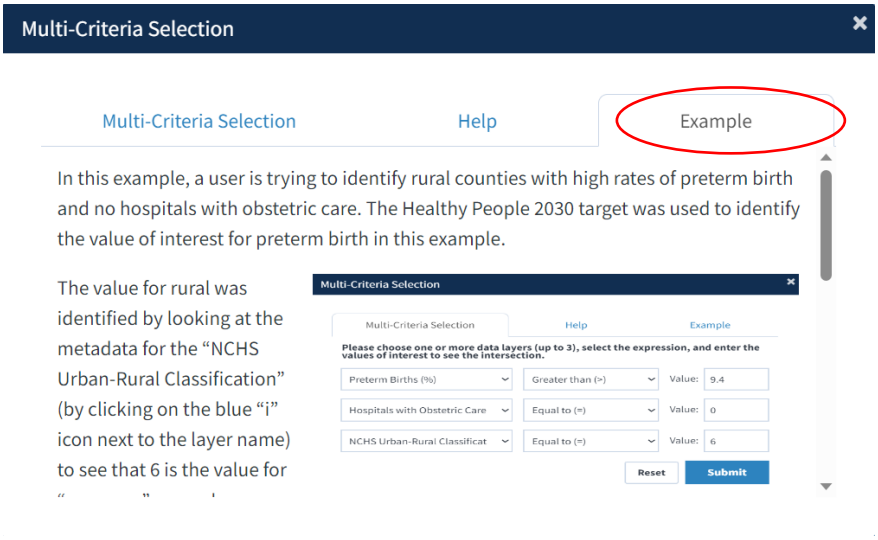
Notes:

- To see where values of interest intersect, select two or three layers in the tool. The tool will also allow you to do a simple data filter by selecting just one layer.
- Layers are in alphabetical order in the drop-down list for each "Select Layer" box.
- To make it easier to identify the value(s) of interest, we recommend exploring the value ranges for the layers you are interested in by selecting them one at a time. Look at the legend and note the minimum and maximum values, use the data table that appears below the map to sort and filter values, look at any geographic areas of interest (click on a county to open a detail sheet, or filter the data for a state or county using the data table), review data definitions (click on the blue "i" icon next to the data layer name to see more detail on the layer) and explore reference values available from external sources (such as Healthy People 2030). To clear the map before using the multi-criteria selection tool turn off the layers by unchecking the box next to the layer name or clicking the "Reset" button at the bottom of the "Data Layer" list.
- The Multi-Criteria Selection (MCS) feature only includes layers from the Health Indicators, Infant Outcomes, Health Resources, and Demographic Characteristics categories that have county-level information.
- Data layers that are location-specific (like health center locations) are not included but can be added to the map in addition to the MCS results by selecting the layer from the main layer list.
- The "Reset" button will allow you to reset and clear the entries in the window and the web map

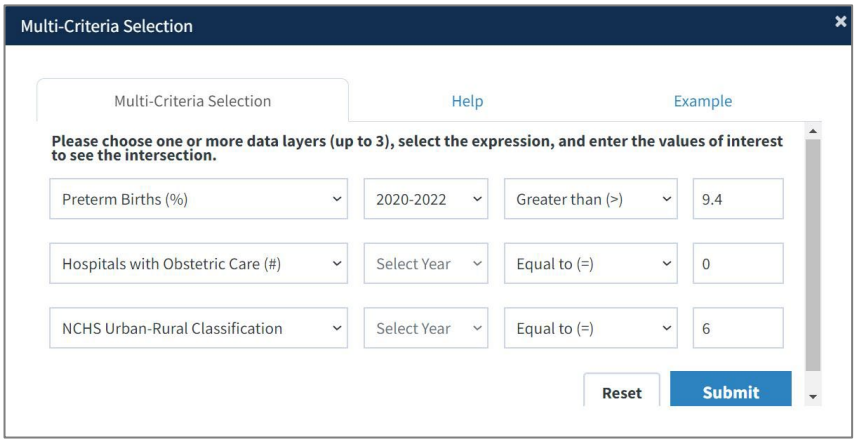
results.

- When deciding which layers to include, consider whether relationships already exist between layers and what might or might not make them good combinations. For instance, rural designations (or "non-core" in the NCHS Urban-Rural Classification) are often based on population size, so selecting both rural or "non-core" areas and areas with high populations may filter out most counties.

Exploring the Multi-Criteria Selection Feature through an Example



In this example, a user is trying to identify rural counties with high rates of preterm birth and no hospitals with obstetric care. The Healthy People 2030 target was used to identify the value of interest for preterm birth in this example. The value for rural was identified by looking at the metadata for the "NCHS Urban-Rural Classification" (by clicking on the blue "i" icon next to the layer name) to see that six is the value for "non-core" or rural areas,

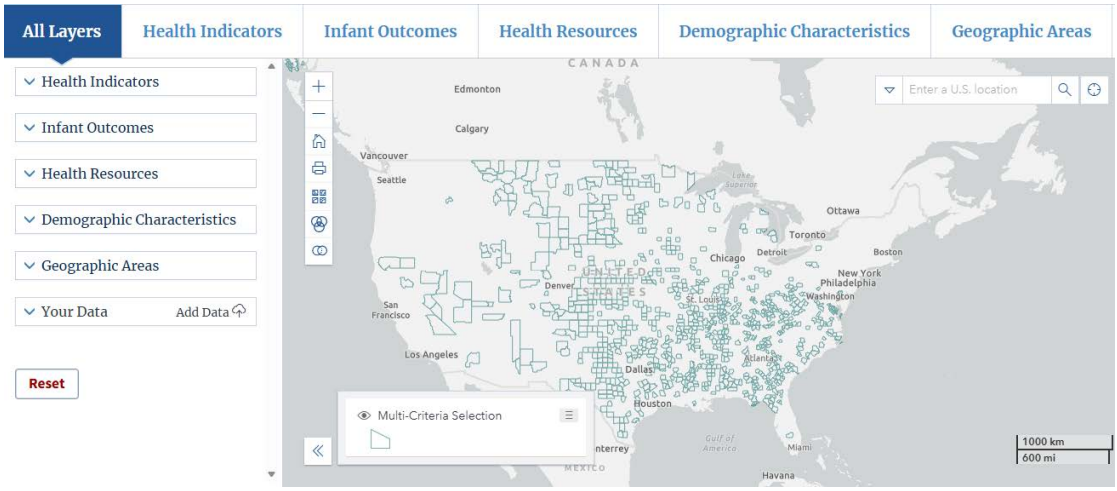


1. For the first layer choose "Preterm Births (%)" from the "Select Layer" drop -down. Note that the

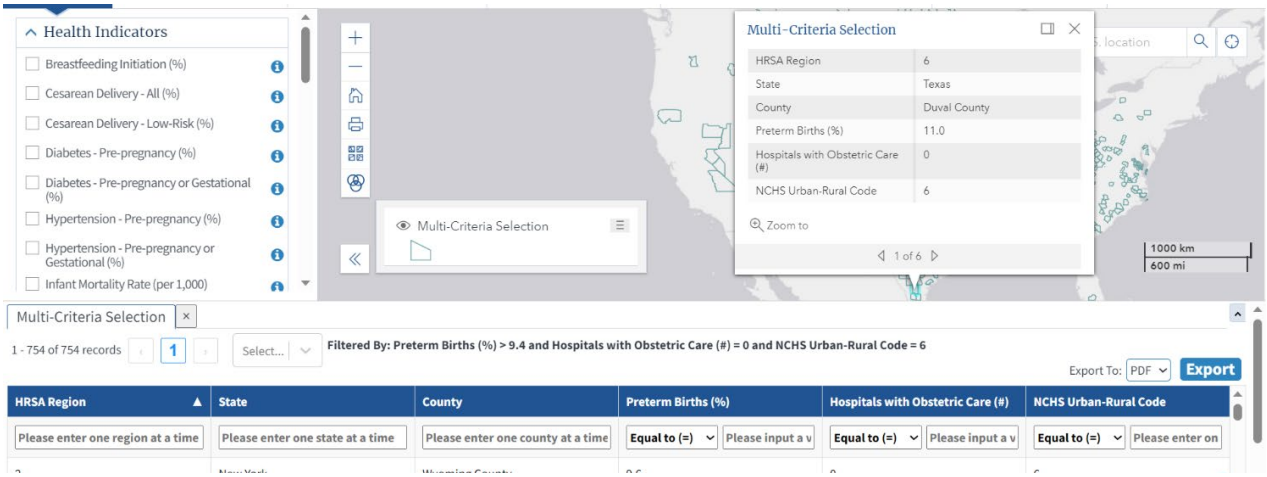
'Select Year' drop-down automatically selected the most recent time period of data. If an older data time period is desired, users can make that selection.

2. Choose "Greater than (>)" from the middle drop-down box in this row.
3. Enter 9.4 (the Healthy People 2030 target) in the "Value" box.
4. For the second layer, choose "Hospitals with Obstetric Care (#)" from the second "Select Layer" drop-down box.
5. Choose "Equal to (=)" from the middle drop-down box in this second row.
6. Enter 0 in the "Value" box.
7. For the third layer, choose "NCHS Urban-Rural Classification" from the third "Select Layer" drop-down box.
8. Choose "Equal to (=)" from the middle drop-down box in this third row.
9. Enter 6 in the "Value" box.
10. Click "Submit". After you click "Submit", you will see the counties that meet these query criteria on the map. You can click "X" at the top-right to close out the Multi-Criteria Selection window box or move the box to the side to better view and explore your selections. A Multi-Criteria Selection data table will open below the map that allows you to explore the selected data in more detail and filter by columns. The top of the table shows the criteria applied to the data filtered in the table.

After following the instructions in the example and clicking the "Submit" button, you should see an image like the one below:

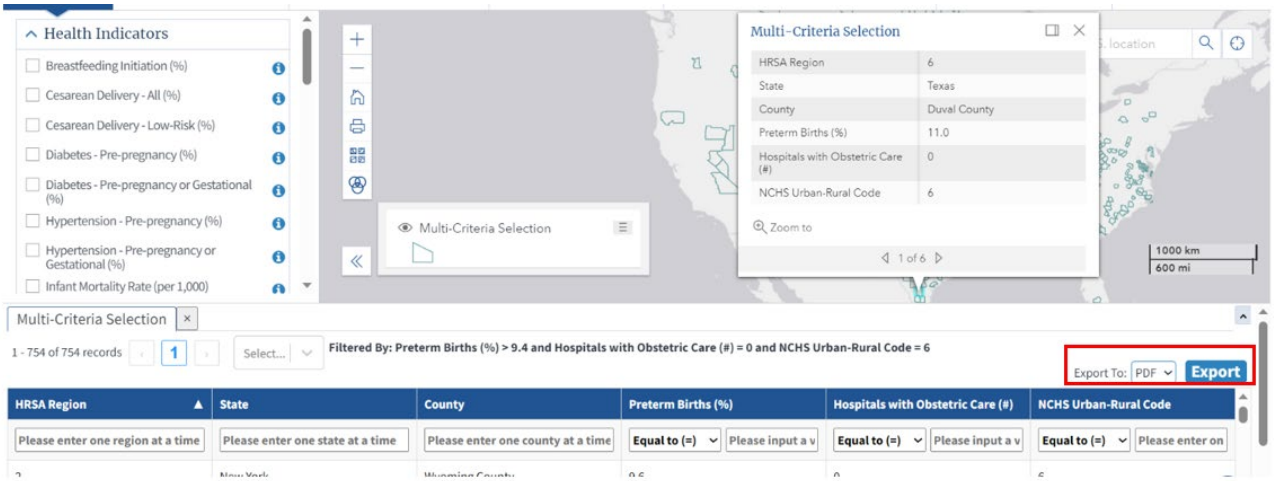


You can zoom in further to see the results better. You can also select a specific county to learn more about it.



Exporting the Multi-Criteria Selection Results

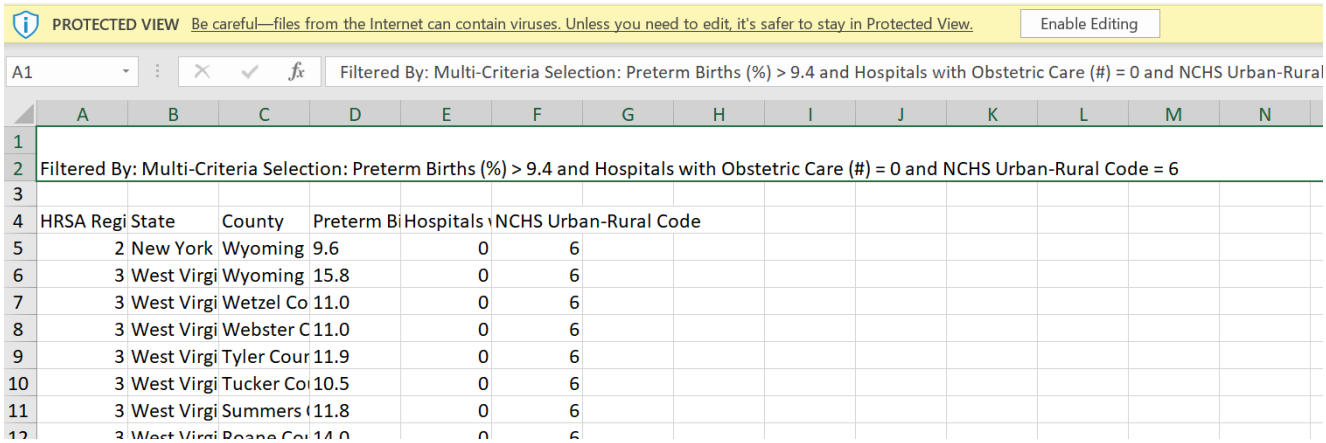
Export your Multi-Criteria Selection results by selecting PDF or Excel from the export options on the data table and clicking "Export".



Your export will contain columns for the data layers you selected to include in the MCS tool. For the example above, the following columns would be included in an export:

- HRSA Region
- State
- County
- Preterm Births (%)
- Hospitals with Obstetric Care
- NCHS Urban-Rural Code

Only counties that meet the conditions you established in the MCS tool will be included in the export. The filters that were used to create the export will show up in the Excel or PDF file (an example export with the filter criteria is shown below).

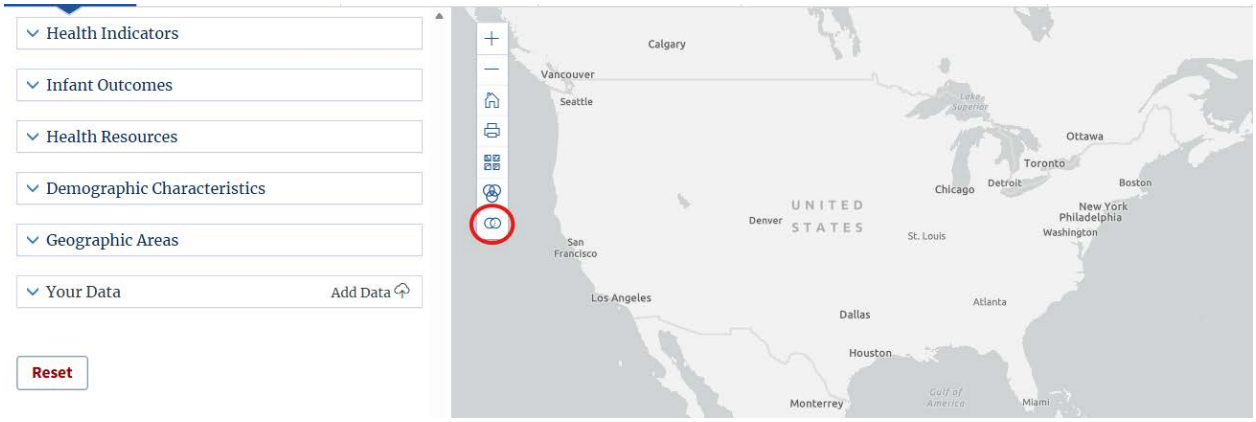


Filtering and Data Exploration with the Bivariate Mapping Feature

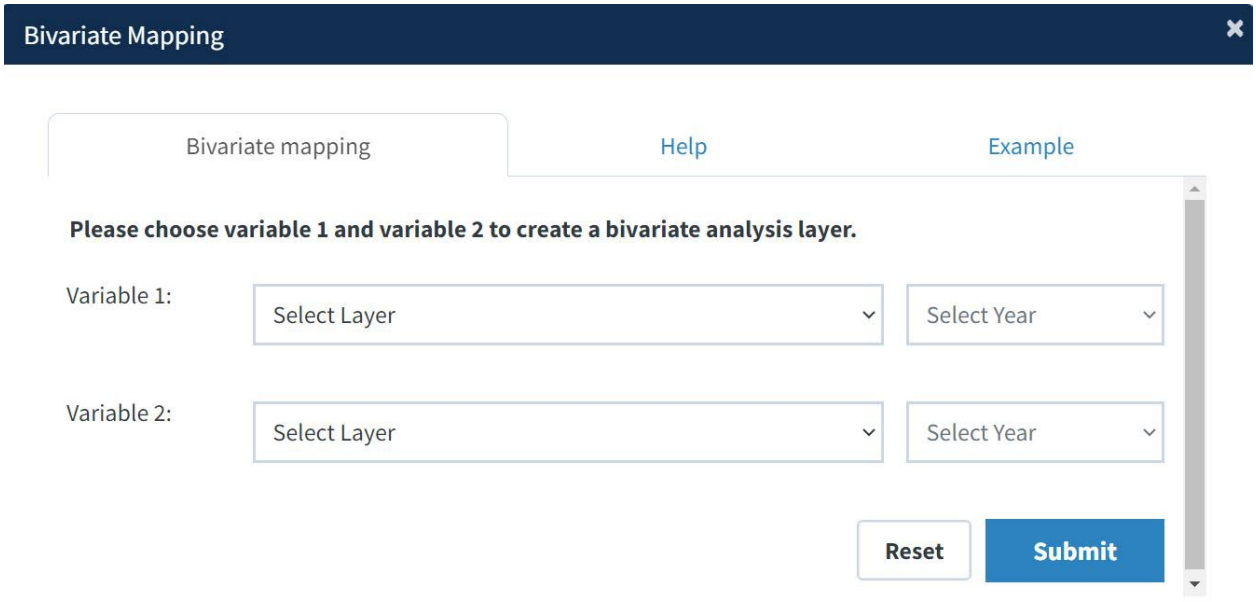
The Bivariate Mapping feature allows users to explore relationships between two variables in a single combined layer on the map tool. This functionality highlights the level of agreement between the values of the two variables selected.

Users should consider whether there are existing relationships between the pair of variables chosen and what a high or low value means for each. For example, low values for mortality rates can suggest less cause for concern while high values can suggest more cause for concern. Alternately, for breastfeeding initiation, low values may be of more concern than high values.

Use the Bivariate Mapping venn diagram icon to open the window.



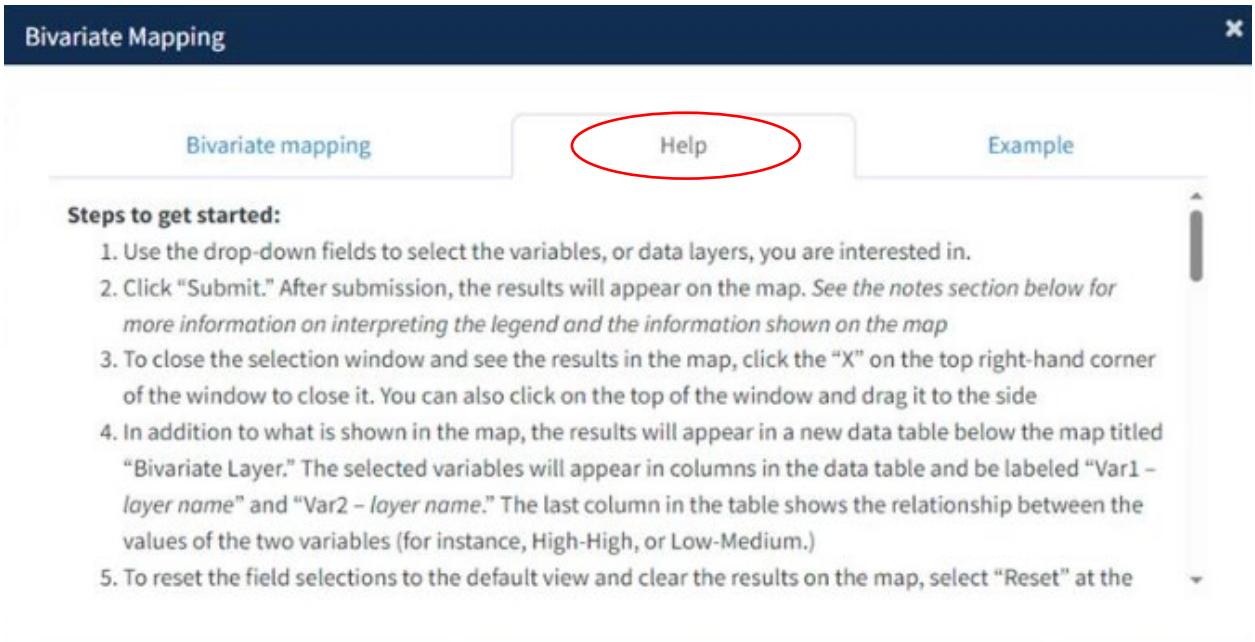
The Bivariate Mapping feature window will open.



Use the drop-down fields to select two layers of interest; Variable 1 and Variable 2. If the selected layer has multiple options for data time periods, use the “Select Year” drop-down field to the right of the layer to select the data time period .

The Help and Example tabs within the popup for the Bivariate feature provide more information on how to use the tool. The information included in those sections of the Bivariate feature is repeated below.

“Help” Steps Added for the Bivariate Mapping Feature



1. Use the drop-down fields to select the variables, or data layers, you are interested in.
2. Click “Submit.” After submission, the results will appear on the map. See the notes section below for more information on interpreting the legend and the information shown on the map.
3. To close the selection window and see the results in the map, click the “X” on the top right-hand corner of the window to close it. You can also click on the top of the window and drag it to the side.
4. In addition to what is shown in the map, the results will appear in a new data table below the map titled “Bivariate Layer.” The selected variables will appear in columns in the data table and be labeled “Var1 – layer name” and “Var2 – layer name.” The last column in the table shows the relationship between the values of the two variables (for instance, High-High, or Low-Medium.)
5. To reset the field selections to the default view and clear the results on the map, select “Reset” at the bottom of the bivariate mapping window.

Notes:

- **Variable/layer organization:**
    - Layers are alphabetically in the drop-down list for each “Select Layer” box.
    - The Bivariate Mapping tool only includes layers for Health Indicators, Infant Outcomes, Health Resources, and Demographic Characteristics that have county-level information and that are normalized, such as rates.

- **Understanding the results:**
    - The Bivariate Mapping tool allows you to see two variables on the map at the same time without overlaying the shading for one on top of the other. The results show whether the values of the two selected variables agree (for instance, both have high values.)
    - After selecting data layers in the drop-down fields and submitting the form, a legend will appear with a color grid that shows which color represents the level of agreement between the variable values (for instance, High-High, Low-Medium, etc.). The legend also shows which axis each variable corresponds with in the color grid.
    - Counties with data for the two selected variables will display with a solid color.
    - If there is insufficient data for one or both variables, a crosshatch line pattern will display for that county.

       Insufficient Data

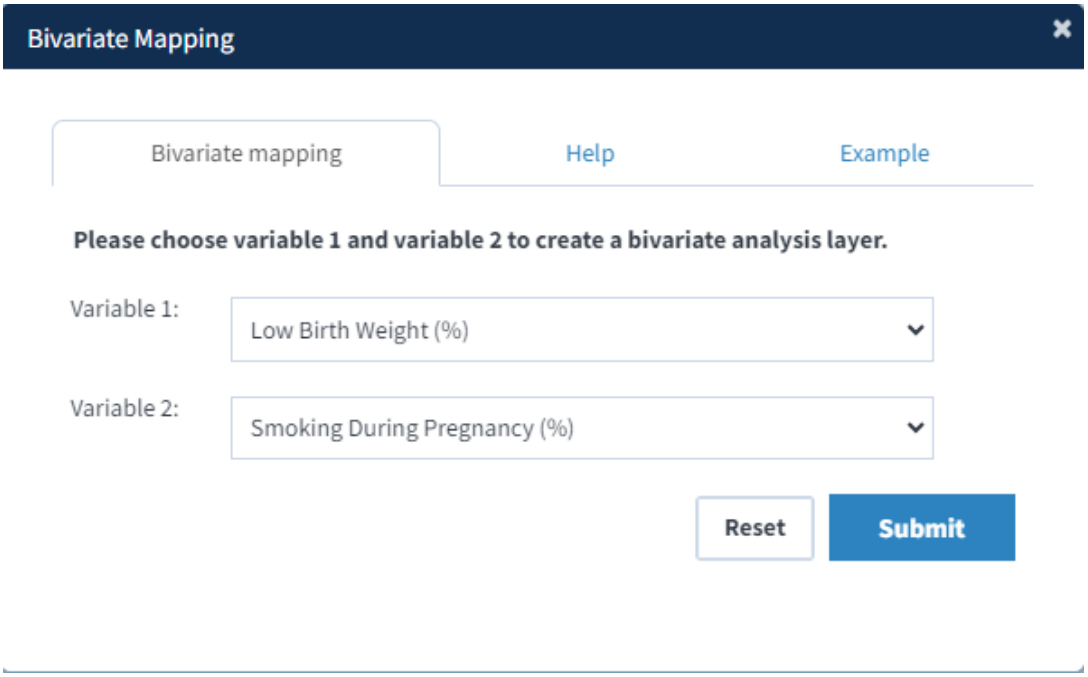
    - The Bivariate Mapping legend shows the colors that correspond with the value combinations for the variables. For instance, counties where both variables have low rates will show the color at the bottom left corner of the color grid and counties where both variables have high rates will show the color at the top right corner of the color grid.
- **Results of the Bivariate Mapping tool do not show causation**; they do not tell you whether one variable's values are lower or higher because of another variable.
- **Variables that are location-specific** (like health center locations) cannot be select in the Bivariate Mapping tool window, but can be added to the map in addition to the Bivariate Mapping results by selecting the layer from the main layer list.
- **Consider whether a low or high value means the same thing for both variables** you select. For instance, high rates of preterm birth are generally a concern, while high rates of breastfeeding initiation are not. If mapping these two variables, you may be interested in where there is not agreement between the values.
- **Use the data table** that appears below the map to sort and filter values, look at any geographic areas of interest (click on a county to open a detail sheet, or filter the data for a state or county using the data table), review data definitions (click on the blue "i" icon next to the data layer name to see more detail on the layer) and explore reference values available from external sources (such as Healthy People 2030).
- The bivariate mapping grid will be comprised of nine different colors. These nine colors represent the combinations of two variables that have each been classified into three defined categories.
- To clear the map before using the bivariate mapping tool, turn off the layers by unchecking the box next to the layer name or clicking the "Reset" button at the bottom of the "Data Layer" list.
- **When deciding which layers to include**, consider whether relationships already exist between layers and what might or might not make them good combinations.

Exploring the Bivariate Mapping Feature through an Example

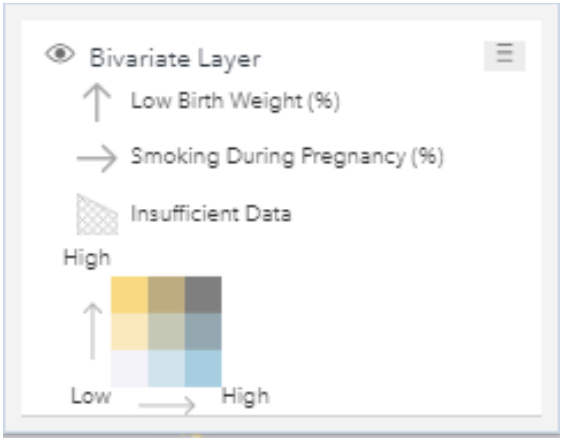
In this example, a user is trying to explore the relationship between low birth weight and smoking during pregnancy.

1. For the first variable, choose "Low Birth Weight (%)" from the "Select Layer" drop-down.

2. For the second variable, choose “Smoking During Pregnancy (%)” from the second “Select Layer” drop-down box.

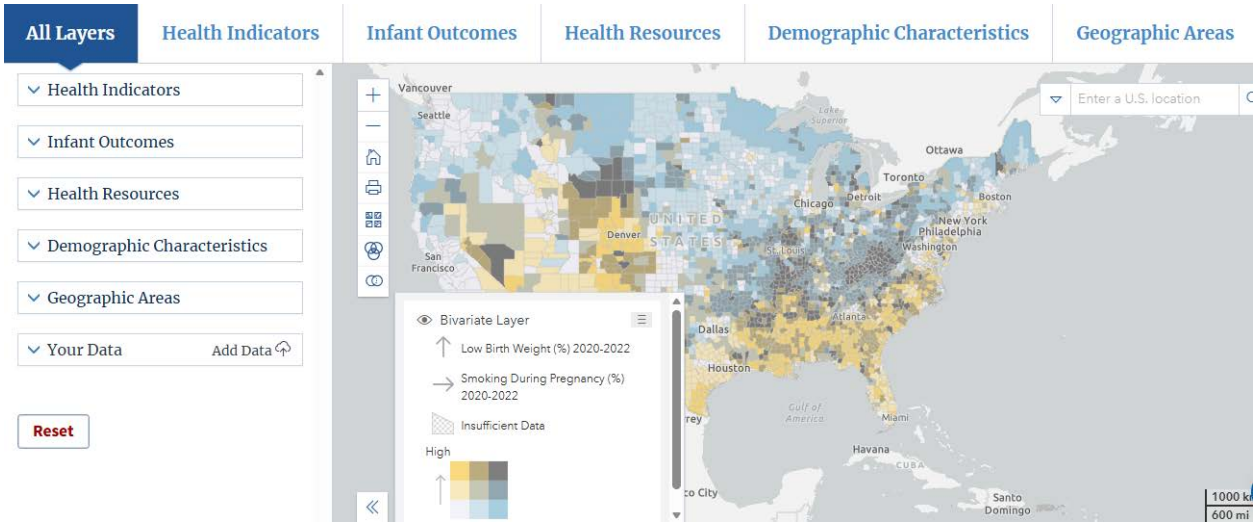


3. Click “Submit”. After you click “Submit”, the results will be displayed on the map. You can click “X” at the top-right corner to close out the Bivariate Mapping tool window box or move the box to the side to better view and explore your selections. A Bivariate Layer data table will open below the map, which will allow you to explore the selected data in more detail and filter by columns. The values for each layer selected will be available to filter in the Var1 – Low Birth Weight (%) and Var2 – Smoking During Pregnancy (%) columns. The relationship between the two variables’ values will be displayed in the Var1-Var2 Relationship column. The relationship values correspond with the high-low grid in the legend (for instance, High-High, Low-Medium, etc.).
4. Low Birth Weight (%) is represented on the Y-axis of the grid and Smoking During Pregnancy (%) is represented on the X-axis. Counties with the lowest percentages of low birth weight and the lowest percentages of smoking during pregnancy will be shaded with the color in the bottom left corner of the grid. In contrast, counties with the highest percentages of low birth weight and the highest percentages of smoking during pregnancy will be shaded with the color in the top right corner of the grid. The colors representing other combinations of values appear along the same low to high trajectory shown in the color grid in the legend. If there is insufficient data for one or both layers for a particular county, a crosshatch line pattern will display for that county.



5. For Montgomery County, Maryland, the relationship between Low Birth Weight (2020-2022) and Smoking During Pregnancy (2020-2022) is Low-Low. The “Low” relationship variable of 7.4 for Low Birth Weight indicates a positive outcome – a low percentage of babies in the county had a birth weight considered low. The “Low” relationship variable of 0.7 for Smoking During Pregnancy also indicates a positive outcome, with a low percentage of mother’s smoking during their pregnancy.

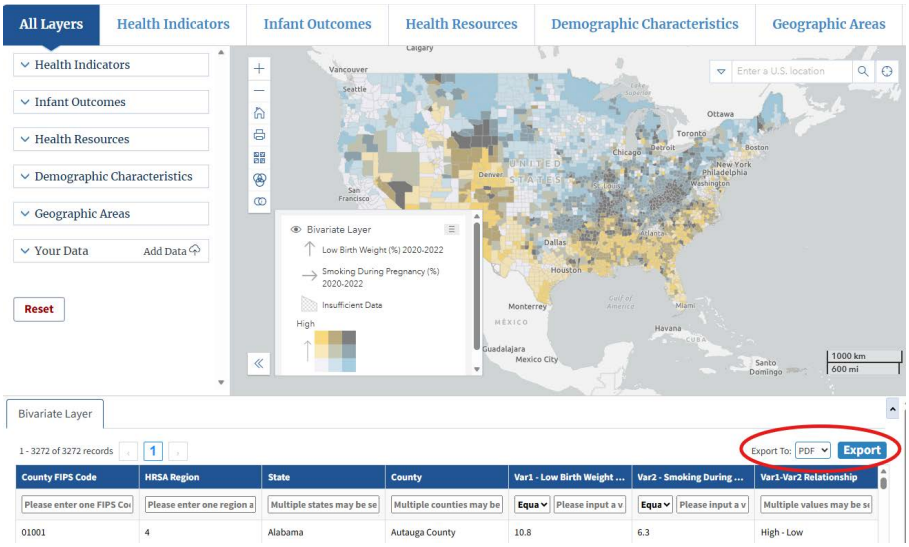
After following the instructions in the example and clicking the “Submit” button, you should see an image like the one below:



You can zoom in further to see the results on the map. You can also select a specific county from the map view to see associated data with the selected county.

Exporting the Bivariate Mapping Results

Export your Bivariate Mapping results by selecting PDF or Excel from the export options on the data table and clicking "Export".



Your export will contain columns for the data layers you selected to include in the Bivariate tool. For the example above, the following columns would be included in an export:

- County FIPS Code
- HRSA Region
- State
- County
- Var1-[Layer Name]
    - In this example, this field is titled "Var1 – Low Birth Weight (%) 2020-2022"
- Var2-[Layer Name]
    - In this example, this field is titled "Var2 – Smoking During Pregnancy (%) 2020-2022"
- Var1-Var2 Relationship

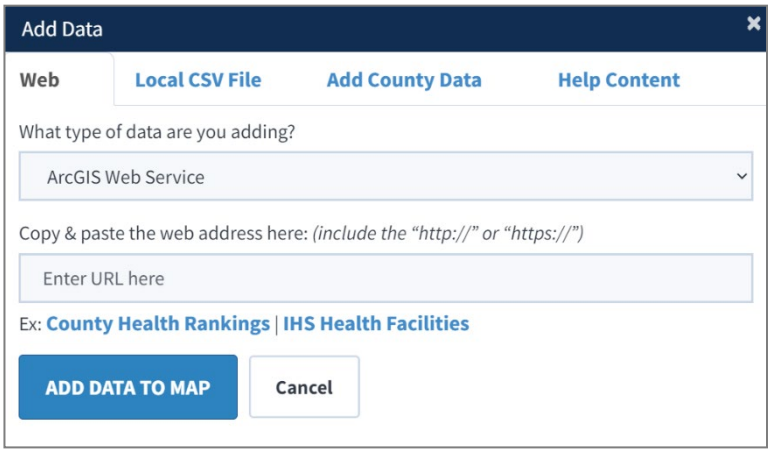
The filters that were used to create the export will show up in the Excel or PDF file (an example export with the filter criteria is shown below).

	A	B	C	D	E	F	G
1	County FIPS	HRSA Region	State	County	Var1 - Low Birth Weight (%) 2020-2022	Var2 - Smoking During Pregnancy (%) 2020-2022	Var1-Var2 Relationship
2	01001	4	Alabama	Autauga Co	10.8	6.3	High - Low
3	01003	4	Alabama	Baldwin Co	8.5	5.5	Medium - Low
4	01005	4	Alabama	Barbour Co	12.2	6.1	High - Low
5	01007	4	Alabama	Bibb Count	10.6	7.4	High - Medium
6	01009	4	Alabama	Blount Cou	8.6	7.4	Medium - Medium
7	01011	4	Alabama	Bullock Cou	13.0	3.0	High - Low
8	01013	4	Alabama	Butler Cour	12.6	7.4	High - Medium
9	01015	4	Alabama	Calhoun Co	9.2	11.9	High - High
10	01017	4	Alabama	Chambers C	12.5	5.9	High - Low
11	01019	4	Alabama	Cherokee C	8.5	14.8	Medium - High
12	01021	4	Alabama	Chilton Cou	8.7	6.8	Medium - Medium

Using the "Add Data" Feature

You can add your own data by using the Your Data > Add Data tool. Navigate to the "Your Data" section in the All Layers list on the left-hand side of the mapping tool. Select the "Add Data" option.

The “Add Data” window appears.

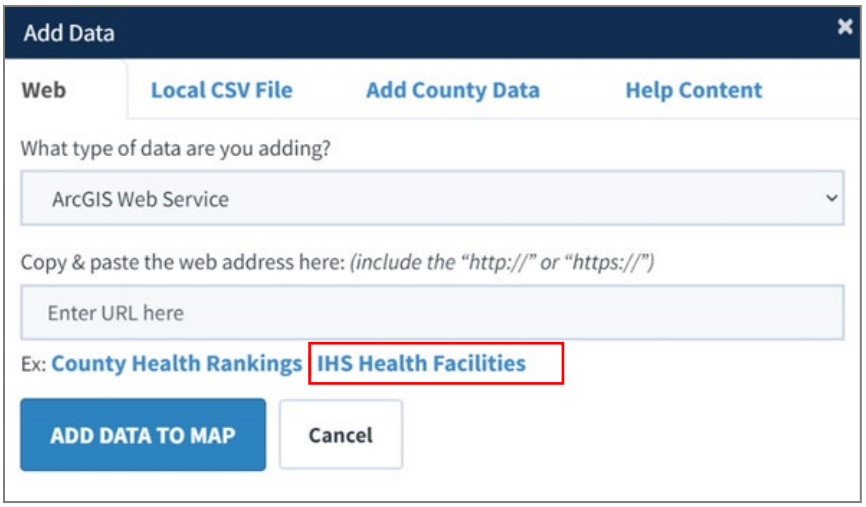


This feature allows you to add data from external sources such as other government agencies, non-profits, etc. on the same map with the data included in the MIHM Tool.

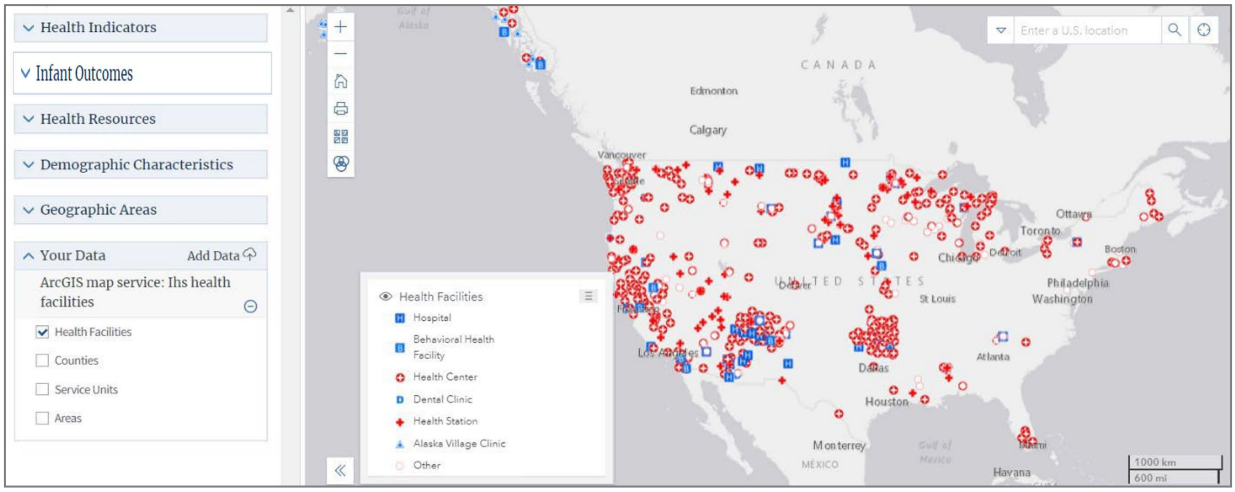
Adding ArcGIS Web Service Data

On the **"Web"** tab, you can add data from either an ArcGIS Web Service or a CSV file on the web. First select the type of data you would like to add, then type or paste the web address for the data and click "Add Data to Map." Example sources are provided for each of these data types. More data from local, state and federal government agencies can be found at www.data.gov.

To test out this feature, make sure ArcGIS Web Service is selected as the type of data. Click on “IHS Health Facilities” in the list of examples below the box where you can type in your own web address (outlined in red below). You should see the web address field became pre-populated and the window should look like this:



Click “Add Data to Map” to add the ArcGIS Map Service showing IHS Health Facilities. Turn on Health Facilities to see the features displayed. You can minimize your table to get a better view of the map data.

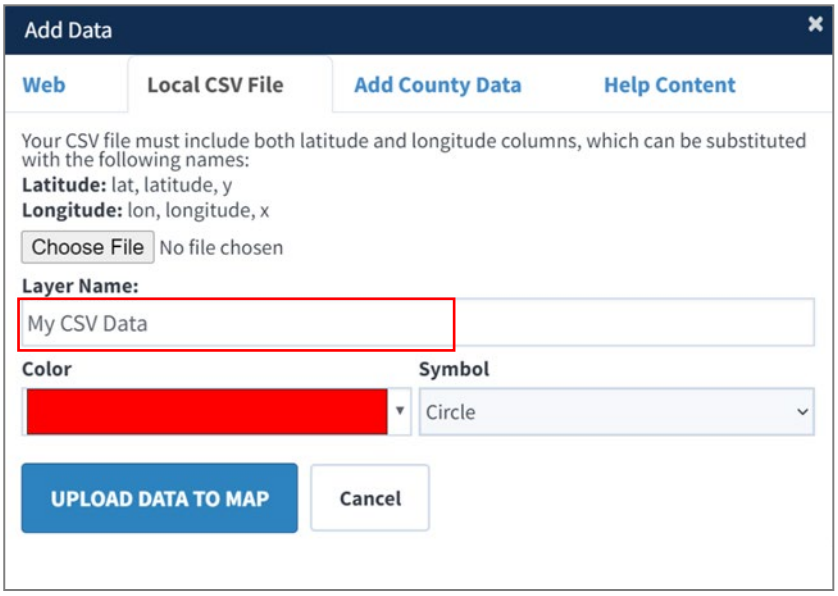


Adding Data from a CSV File

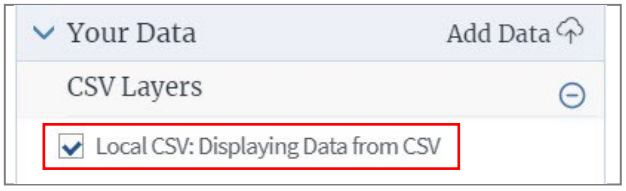
To upload location data using your own CSV file, click on the “Local CSV File tab in the “Add Your Data” window. Choose the file with data you want to add to the MIHM Tool using the “Choose File” button. Your file must already be geocoded and include both latitude and longitude columns. The “Help” tab can provide more information on uploading your own file.

	A	B	C
1	longitude	latitude	
2	-73.9762	40.69525	
3	-73.944	40.71209	
4	-73.9823	40.69173	
5	-73.941	40.69780	

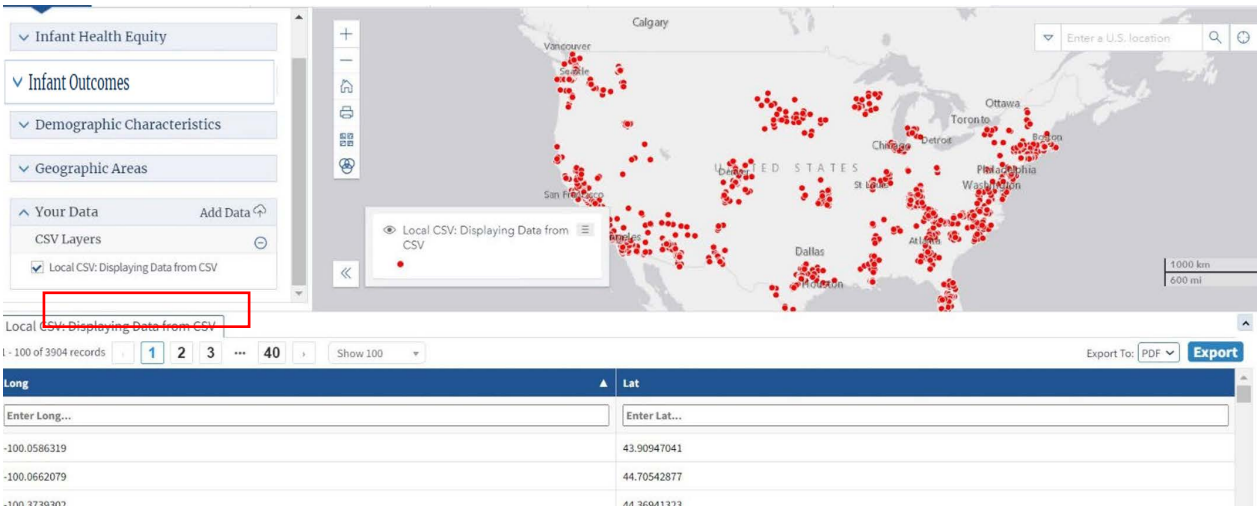
Once you have chosen the file to add, you can change the layer name, symbol color, outline color and/or symbol to use if you choose. The example below shows a change in change the Layer Name to “Displaying Data from CSV” and then click “Upload Data to Map”



Your data appears on the left-hand side and you can turn it on by checking it (the example below shows the default name; if you rename your data layer the name you entered will show up next to the check box):



You should then be able to view your CSV data layer with all records displayed in the map and table. An example is shown below.



Adding County Data with FIPS codes

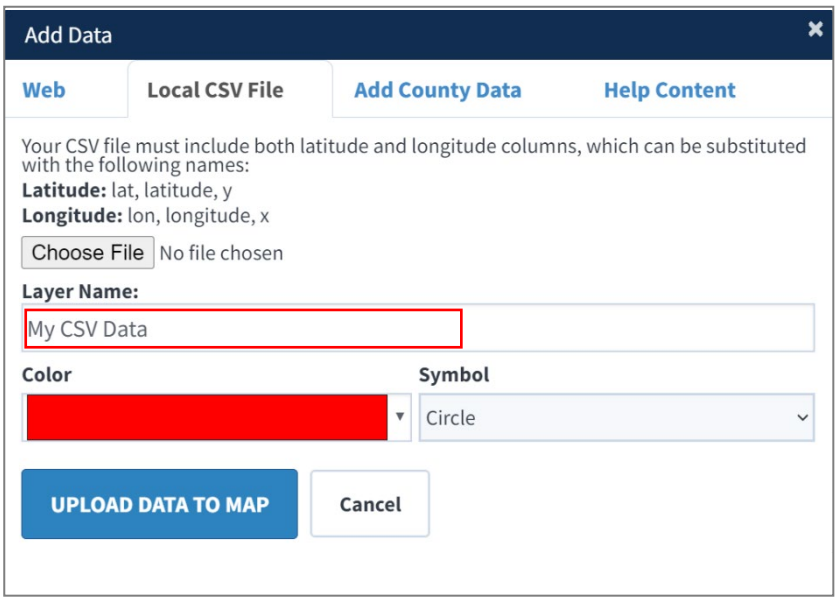
To upload County data using your own CSV file, click on the "Add County Data" tab in the "Add Your Data" window. Choose the file with data you want to add to the MIHM Tool using the "Choose File" button.

Your file must use the format described with two columns including titles for column headers.

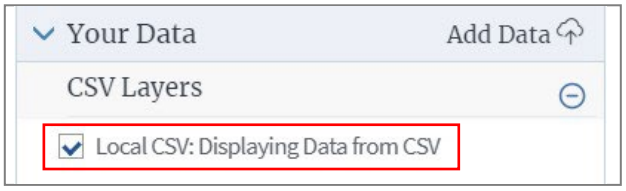
- First column:
  - Header titled "County FIPS"
  - Values must be 5-digit County FIPS codes. If you need more information on identifying your 5-digit County FIPS code, please see ANSI and FIPS Codes (census.gov).
    - First two digits identify the state
    - Last three digits identify the county
- Second column:
  - Header titled <Name of user provided data field>

	A	B
1	County FIPS	My Data
2	12113	5.6
3	12119	10.2
4	12133	11
5	13133	34.2
6	13139	23.8
7	13309	28.2

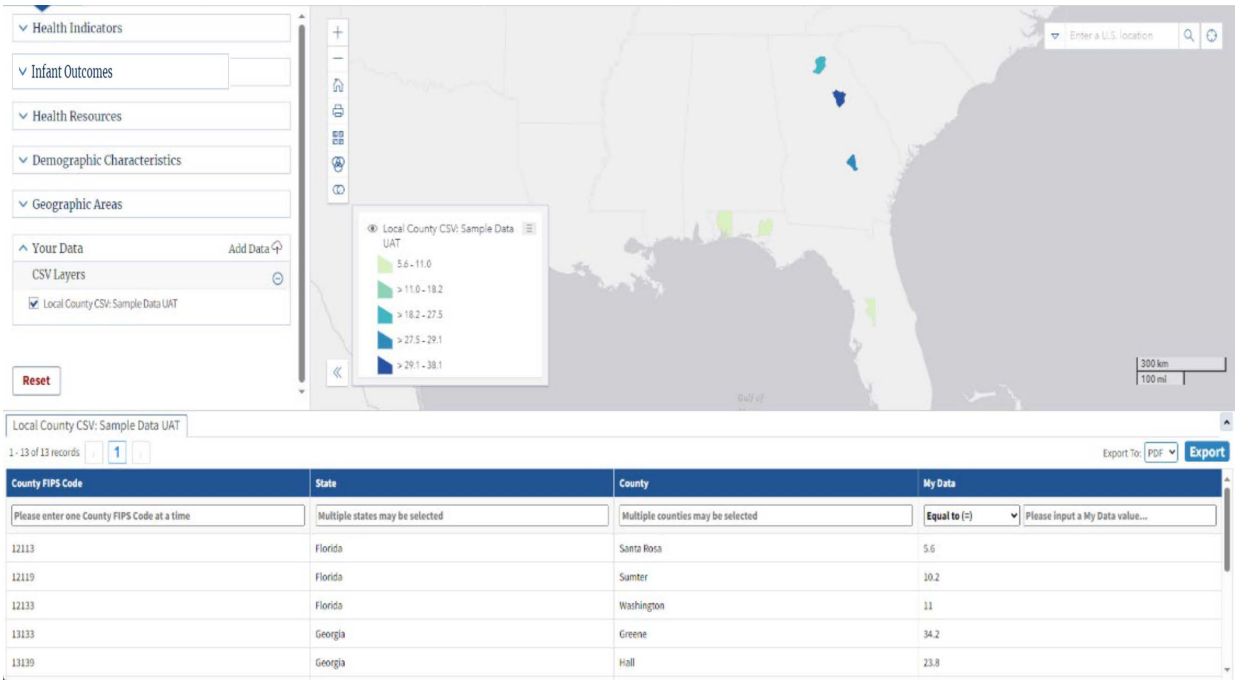
Once you have chosen the file to add, you can change the layer name, symbol color, outline color and/or symbol to use if you choose. The example below shows a change in change the Layer Name to "Displaying Data from CSV" and then click "Upload Data to Map"



Your data appears on the left-hand side and you can turn it on by checking it (the example below shows the default name; if you rename your data layer the name you entered will show up next to the check box):



You should then be able to view your County data layer with all records displayed in the map and table. An example is shown below.



Frequently Asked Questions

Q: Where can I find out the time period of the data?

A: Each data layer in the Maternal and Infant Health Mapping Tool has a blue "i" icon -  - next to the layer name. If you click on the icon a window will open with more detail on the data layer, including the time period for the data. The detailed information on the data layer is called the metadata and also includes information on the data source, definitions, and where to find more information about the data.

Q: How can users customize maps?

A: The following list includes examples of how users can customize their maps:

- Select measures of interest and view them for the entire U.S., or zoom in to specific regions, states, or counties.
- Create their own combinations of data layers.
- Click on a county or resource location to learn more about the measure or resource.
- Create and print maps with data of interest and save them as screenshots to include in presentations or documents.
- Change the color schemes and symbols of data layers to customize the presentation.
- Filter data layers to limit what is shown on the map to specific locations or data values.
- Export and download data tables as PDF or CSV files.

Q: How do I add state-level boundaries to my map when I have already turned on a data layer?

A: Under the "Geographic Areas" tab, you can select States to turn on these boundaries.

Q: If I turn on a data layer, is there a way for me to filter the data to a single state or county?

A: Yes, when you turn on a data layer, you can use the table below the web map to filter out information. You can type in the name of the state (or states) of interest to filter the data and show the selected state. You can do the same for a county of interest.

Q: What is the classification scheme used in the web map?

A: Quantiles is the classification that was applied throughout this application to show equal rank-based variation in a standardized approach across indicators. Quantiles are more accurately interpreted than other classification options that are less comparable across indicators with different units or distributions (e.g., equal interval, natural breaks, and standard deviations). For more information, refer to Brewer, C.A. and Pickle, L. (2002), Evaluation of Methods for Classifying Epidemiological Data on Choropleth Maps in Series. Annals of the Association of American Geographers, 92: 662-681.

Q: If I have questions not answered here in this User Guide, how can I get additional help?

A: Please send an email to MIHMapping@hrsa.gov