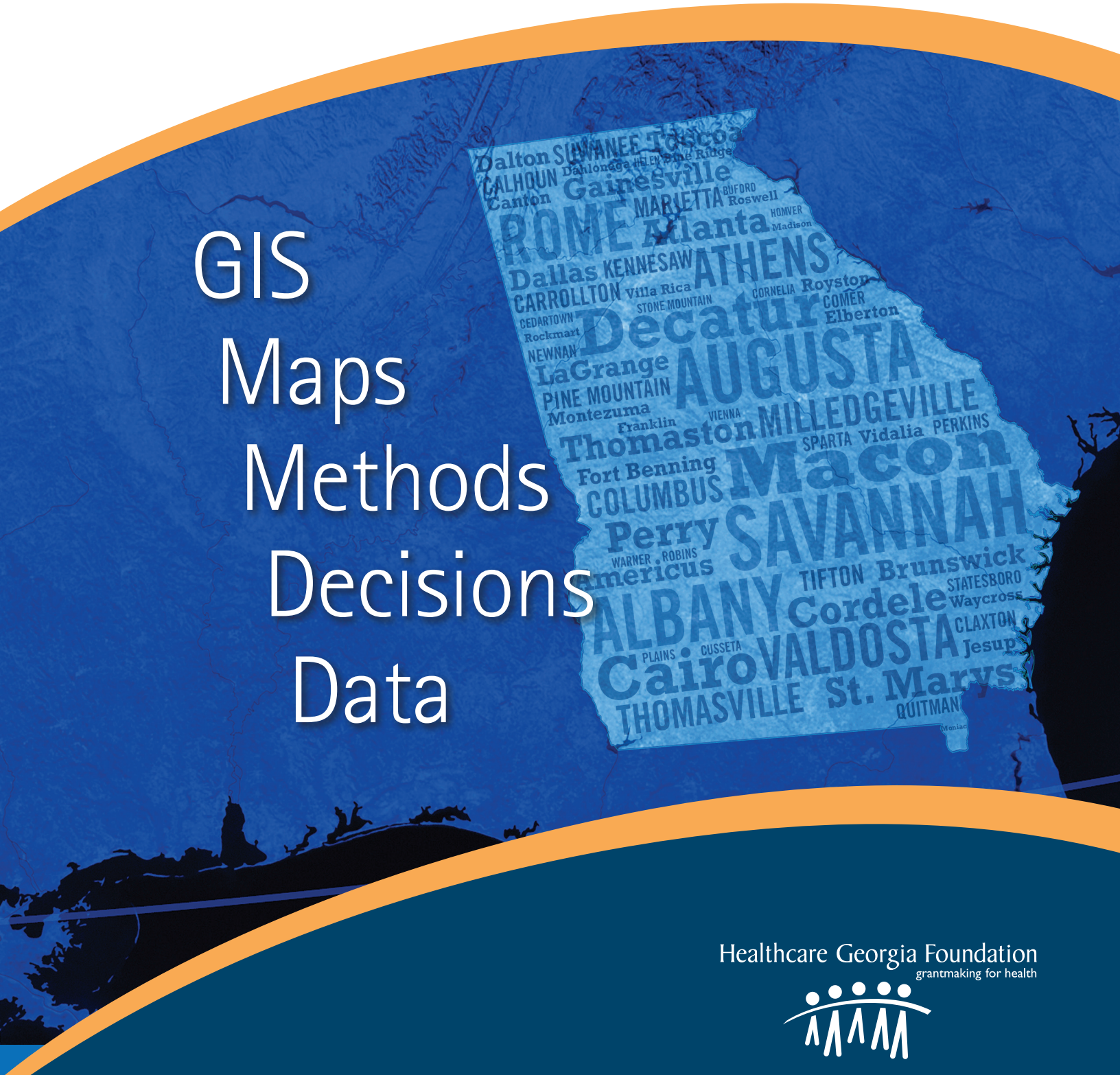
GIS and the Power of Maps



Healthcare Georgia Foundation
grantmaking for health

GIS and the Power of Maps

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Introduction

If a picture is worth a thousand words, then a map is worth a million data points. Maps are dense with information, and they can tell certain kinds of stories better than any other medium. If the information you want to get across has a spatial element, a map may be your best choice.

Maps can show:

- Locations, features, and routes: Where is Appling County? Is it home to any rivers, lakes, and streams? What towns are in the mountains of Georgia? How do I get to the nearest hospital?
- Distributions, relative distributions, and changes over time: How is the population distributed in Lee County? Where are health care providers in relation to residents? How have obesity rates in Georgia's counties changed over the past 40 years?

To make sense of information, we are always comparing, connecting, relating one bit of data to another. When the data have a spatial element, maps can help us quickly make those connections and comparisons.

What is GIS?

Any specific location on the planet can be mathematically represented (**geocoded**) by three numbers: longitude, latitude, and elevation. **Geographic information systems (GIS)** allow detailed mapping and mathematical analysis of large sets of geocoded data.

You can put the power of GIS or the simple visual power of maps to use whether or not you have the technical skills and software to do GIS analysis.

There are online applications, many of them free, that offer user-friendly ways to produce maps backed by large, publicly available datasets. Spatial visualizations as simple as a map sketched on a piece of paper can serve valuable purposes as well.

This primer describes a range of uses for maps and methods for creating them, from low-tech to high-tech, with an emphasis on options that are accessible to most health nonprofits. Some cautions and limitations are included, especially with regard to data for maps in rural areas.

How Can Maps Be Used?

To convey complex information intuitively

A map provides a birds' eye perspective of a large amount of information, and it focuses in on the most pertinent of that information. Between my house and the grocery store there are lots of trees, small and large roads, houses and other buildings. If I wanted to give someone directions, I would sketch a map with only the most relevant and essential information they would need to get from here to there. Once they looked the map over, they might not even have to refer to it again. The complex landscape was distilled into just the key points needed for the purpose at hand (**Figure 1**).

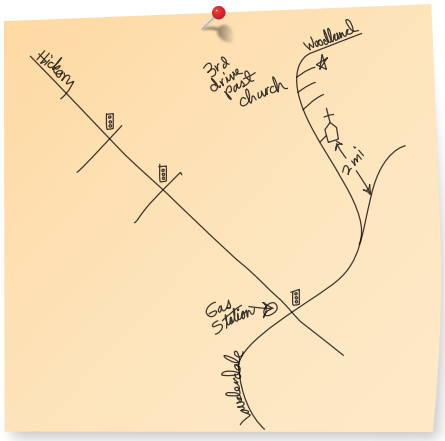


Figure 1.
A hand-drawn map can quickly and effectively convey only the essential information.

To plan and prioritize

When important information such as a health factor or health outcome is depicted on a map, it can help decision-makers plan programming or prioritize where to direct resources. **Figure 2** contains color-coded lines indicating high or low "broken windows index"—a measure of neighborhood physical conditions drawn from assessments conducted by residents in walking surveys. The map was part of the information the area's development authority used in deciding where to target redevelopment funding.

Figure 2. Volunteers collected data on neighborhood physical conditions to produce block-level "broken windows index" scores. These were coded into GIS to produce the map below, and used along with socio-demographic and health data to determine the highest priority areas for receiving redevelopment funding. (From: Georgia Health Policy Center)

To communicate value or urgency

Maps are often used to show where the most urgent needs are. The map series in **Figure 3** shows the effect of the 2008 recession and subsequent recovery on unemployment in Georgia. From 2007 to 2010, county-wide unemployment rates rose across the state, more in some areas than others. By 2014 the rates had dropped again in much of the state, although not yet back to pre-recession levels. The recovery lagged noticeably in several counties, especially Macon and Wheeler.

The maps in **Figure 4** from the County Health Rankings website focus attention on two other health-related measures. The one on the left shows the counties with the most severe housing problems, defined as the percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs, or lack of kitchen or plumbing facilities. On the right, the most heavily shaded counties are those in which the smallest portion of diabetic Medicare enrollees age 65 to 75 receive HbA1c monitoring. According to these data, Wilkes County has an especially acute housing situation, with 25% of households in poor housing conditions, and Webster County, with only 64% coverage of the state population, needs solutions to its shortage of diabetes monitoring.

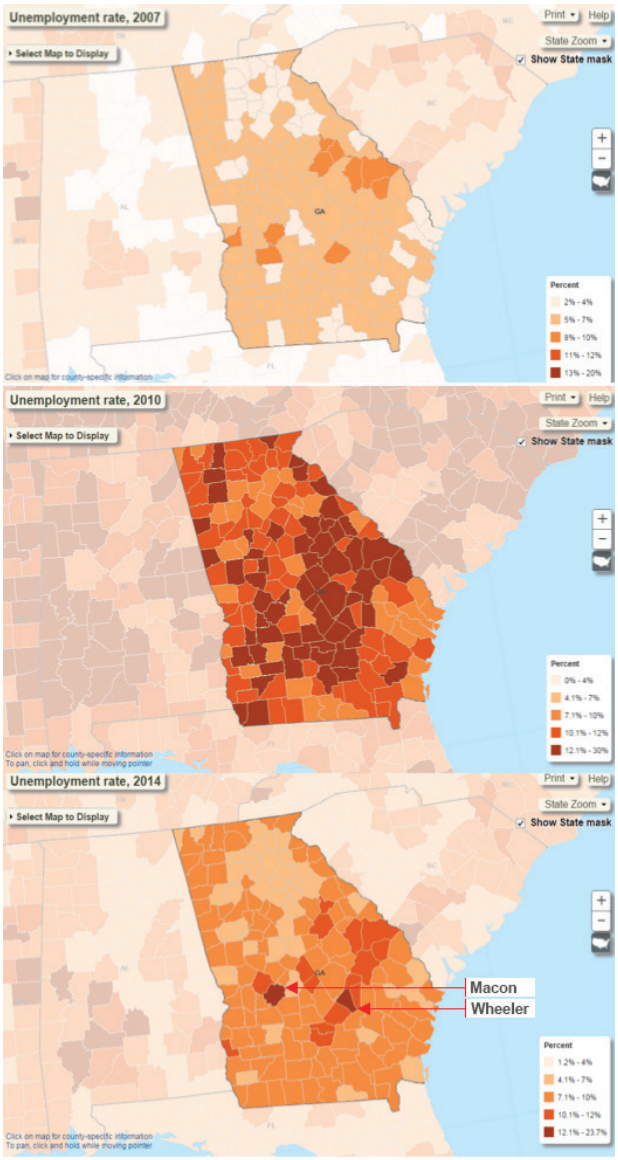
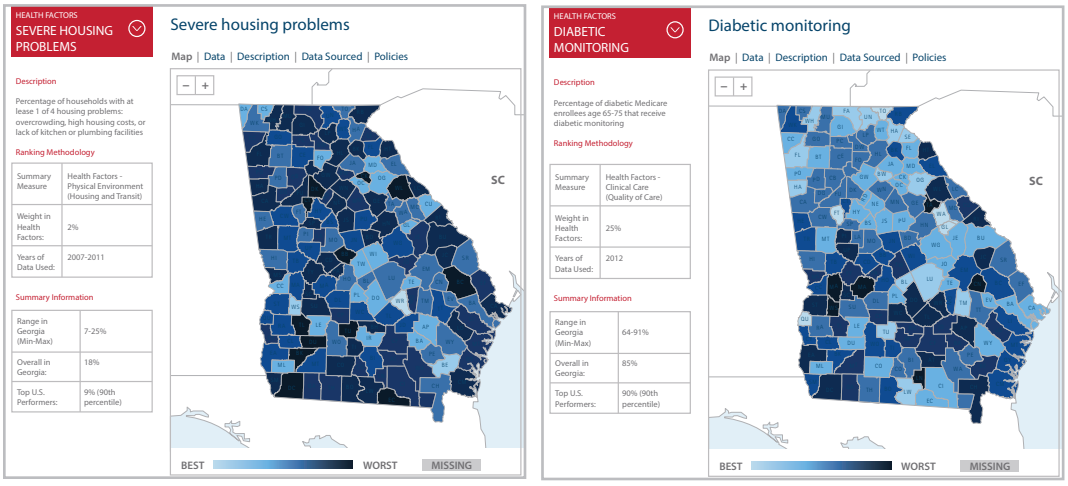


Figure 3. Unemployment rates in Georgia counties before, during, and after the 2008 recession. (From: USDA Atlas of Rural and Small-Town America: http://www.ers.usda.gov/data-products/atlas-of-rural-and-small-town-america/go-to-the-atlas.aspx)

Figure 4. These maps draw attention to counties with particular needs. (From: County Health Rankings, www.countyhealthrankings.org)



To detect or diagnose a problem

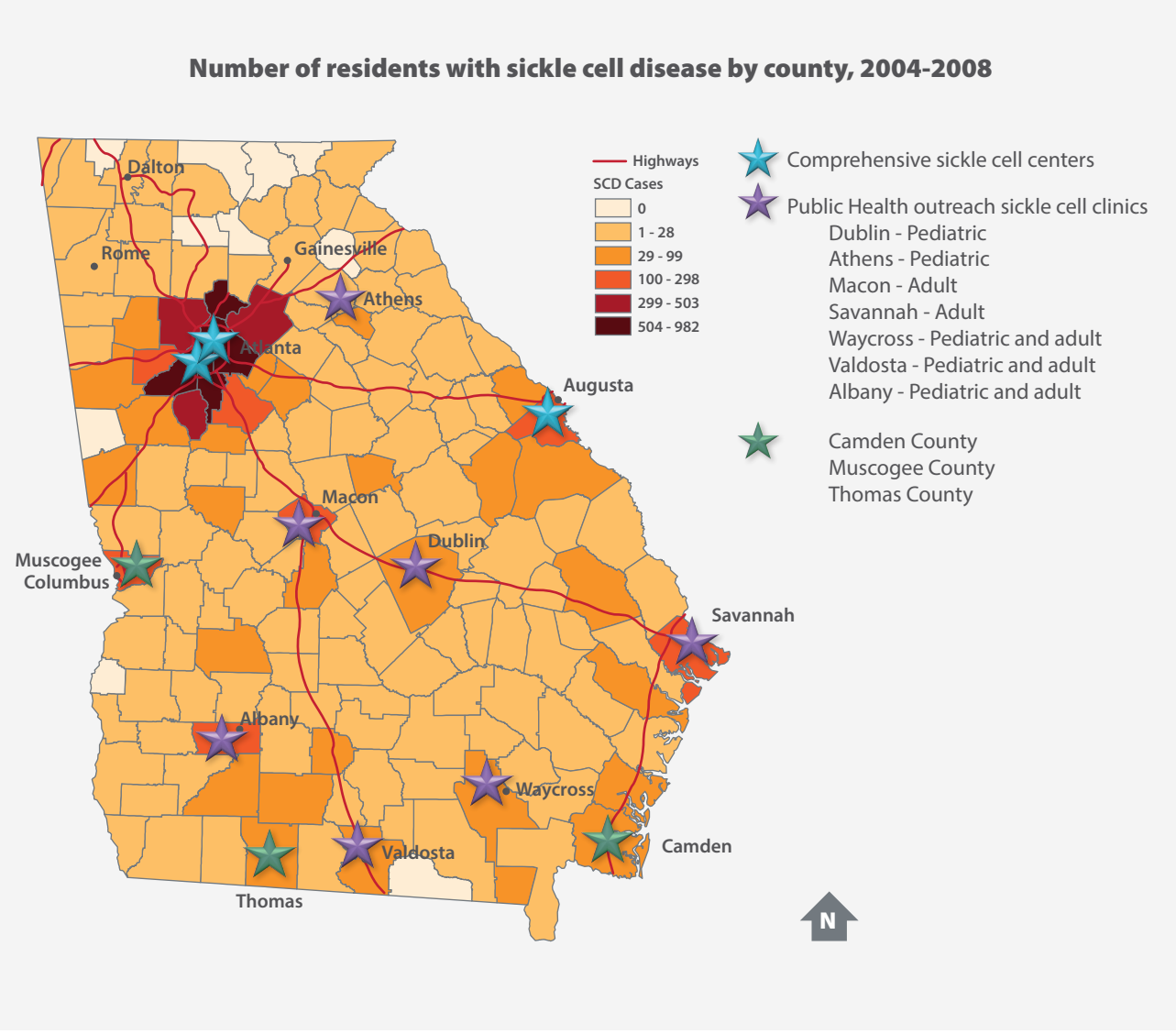
Sometimes maps can even point to what may be causing a problem. The classic story of Dr. John Snow and the London cholera outbreak of 1854 is a great example. At the time, germ theory was unknown, and "bad air" was commonly believed responsible for the illness. Snow placed a dot on a map of SoHo indicating the residence of each cholera victim, and an **X** for each public water pump (**Figure 5**). The obvious clustering around a particular pump led to his theory that contamination of that well could be a primary cause. The map strongly suggested that the pump was to blame, even without an understanding of how it was contributing to the spread of the disease. The pump was closed, cholera began to subside; and scientists began to think in a new way about routes of contagion by seeing, spatially, how cases were connected.

Figure 5. Map of the SoHo, London cholera outbreak of 1854. Cholera deaths are highlighted in red; green dots show public water pumps. Deaths are highly concentrated around the Broad Street pump. (From: https://commons.wikimedia.org)

To identify assets and barriers

Maps can be used to show the locations of services or amenities in addition to challenges; and combining multiple variables on one map can tell a story about health-related assets and barriers. **Figure 6** shows the locations of sickle cell clinics and comprehensive sickle cell centers in Georgia in relation to the prevalence of the condition in the population. It confirms that those resources are appropriately located in counties where the largest numbers of people with sickle cell disease live. At the same time, it shows that hundreds of people with sickle cell disease in counties like Camden, Thomas, Muscogee, and other rural counties in Georgia have a long way to go to for specialized care.

Figure 6. Specialized health care services for people with sickle cell disease are available in many of the counties where the condition is most prevalent; still, hundreds of people with sickle cell disease have a long way to go for the care they need. (From: Georgia Health Policy Center and the Georgia RuSH collaborative, www.ghpc.gsu.edu/affiliates-initiatives/phresh/)



The Parts of a Map

All maps need visual reference points to help the viewer quickly recognize the geographic area they are seeing. The **base map** provides this background information. Commonly used base maps are those identifying jurisdictions—city, county, or state boundaries, public health districts, etc., streets and highways, topographic contours, or "birds' eye" photographic views such as satellite images. The base map in Figure 7 contains only county boundaries.

The geographic area, or **extent**, of the map in Figure 7 is the state of Georgia. Depending on the subject and purpose, extent can be anything from a room or building to a neighborhood, state, country or beyond.

The information that tells the story the map is intended to communicate is added in **layers**. Think of illustrations you may have seen, say, of a human skeleton, with transparent sheets that can be placed on top showing different organs and systems. In GIS programs, different sets of geocoded data might be used to add multiple layers. Figure 7 has only one layer: the percentage of adults who smoke. More could be added. For example, if you wanted to understand something about the population characteristics in the counties with higher and lower smoking rates, counties could be cross-hatched in different patterns based on the percentage of population by race or income. Figure 2 has two layers in addition to the base map: one showing the project area and selected sites, and one showing the block-level broken windows index.

Any information coding used in a map, such as different line styles or colors, symbols, shading, etc., needs to be explained in a **legend** or key. In Figure 7,

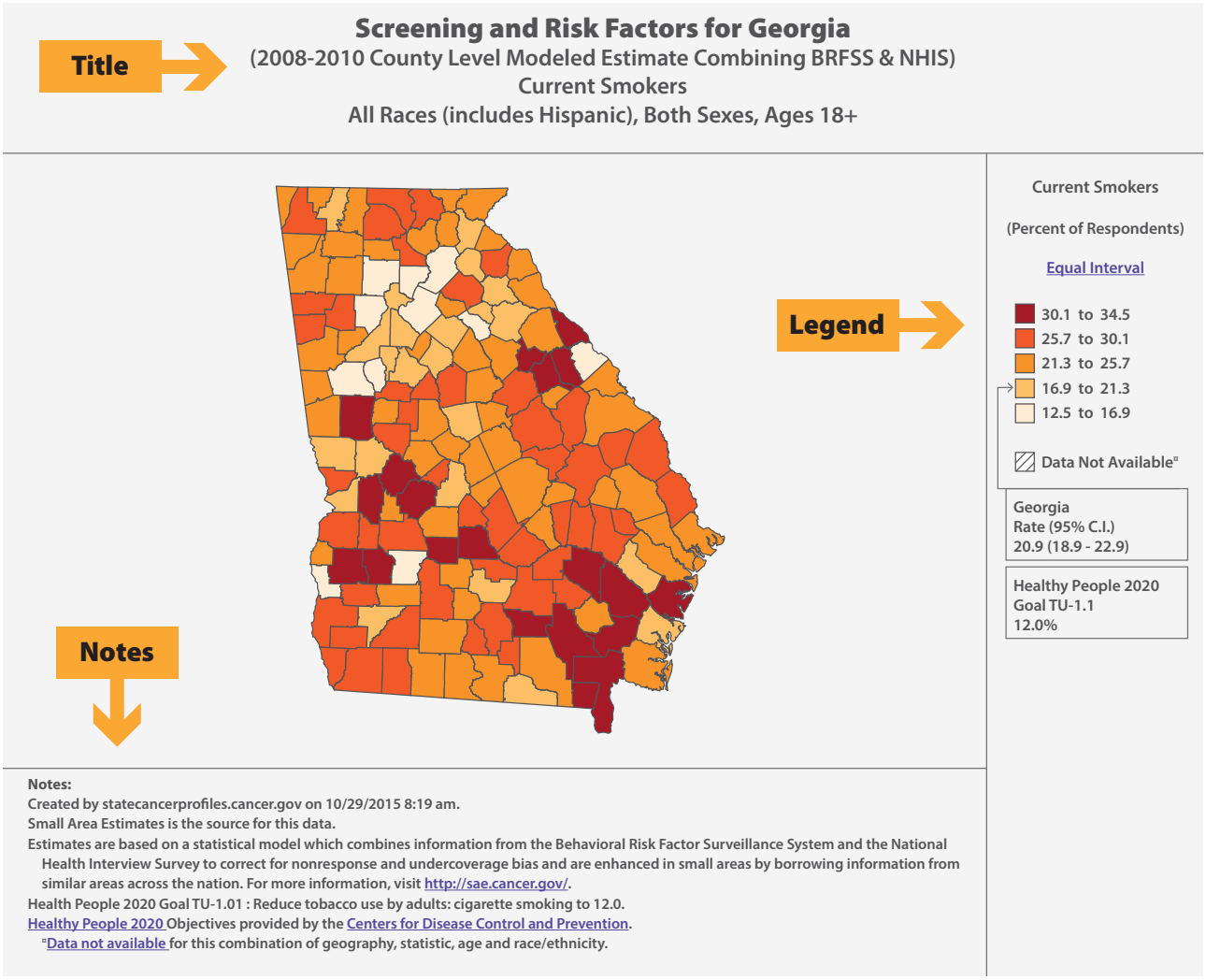


Figure 7. The title and legend are important to include for most maps. There may also be a need for additional notes. (From: www.statecancerprofiles.cancer.gov)

the legend specifies the range of percentages of survey respondents (the data sources are public health surveys) saying they are current smokers that are represented by each shade of orange on the map.

Important supporting information is added to maps in two other places: the title, and notes. A title should clearly identify the "what" of the pertinent information on the map: the subject or variable depicted and enough specifics about the variable for clarity. The highly detailed title in **Figure 7** includes the overall topic (screening and risk factors in Georgia), a description of the data used (2008-2010 county level modeled estimate combining BRFSS & NHIS), the specific variable shown (current smokers), and the population reflected in the data (all races with Hispanic ethnicity included, both sexes, and ages 18 and older).

Map-Making Methods

Low-tech

Sometimes a map simply needs to provide a background for specific information that can be added by hand. For this you might find a paper map or one on the internet that you can start with. For example, you might print a large map of a neighborhood for a community meeting in order to collect residents' input about assets or challenges, asking them to put sticky notes or markings directly on the map (**Figure 8**). Or you might ask stakeholders to place their "vote" on a map for where they would like to see some improvement, change, or facility.

Figure 8. Using a map for a community discussion or planning meeting
Photo: City of Dublin, Ohio, USA

You also could create a useful map for a meeting or report with some basic software skills. Web-based map programs like Google Maps let you place a marker on a location ("drop a pin"), highlight various routes between addresses, or measure distances from one point to the other. If you have a map image that is not otherwise restricted by copyright, you can alter it manually in programs like Microsoft Word or Paint, or in a graphics program like Adobe Photoshop. For example, in Word you could insert shapes or text boxes and in Paint you can sometimes use the "fill" function to color sections outlined in the map image (**Figure 9**). The Google search engine can help you find maps and other images you can use without violating copyrights. When you search for images related to a given search term, select the level of "Usage Rights" you want included in results. This is found in the "Search Tools" menu below the search box.

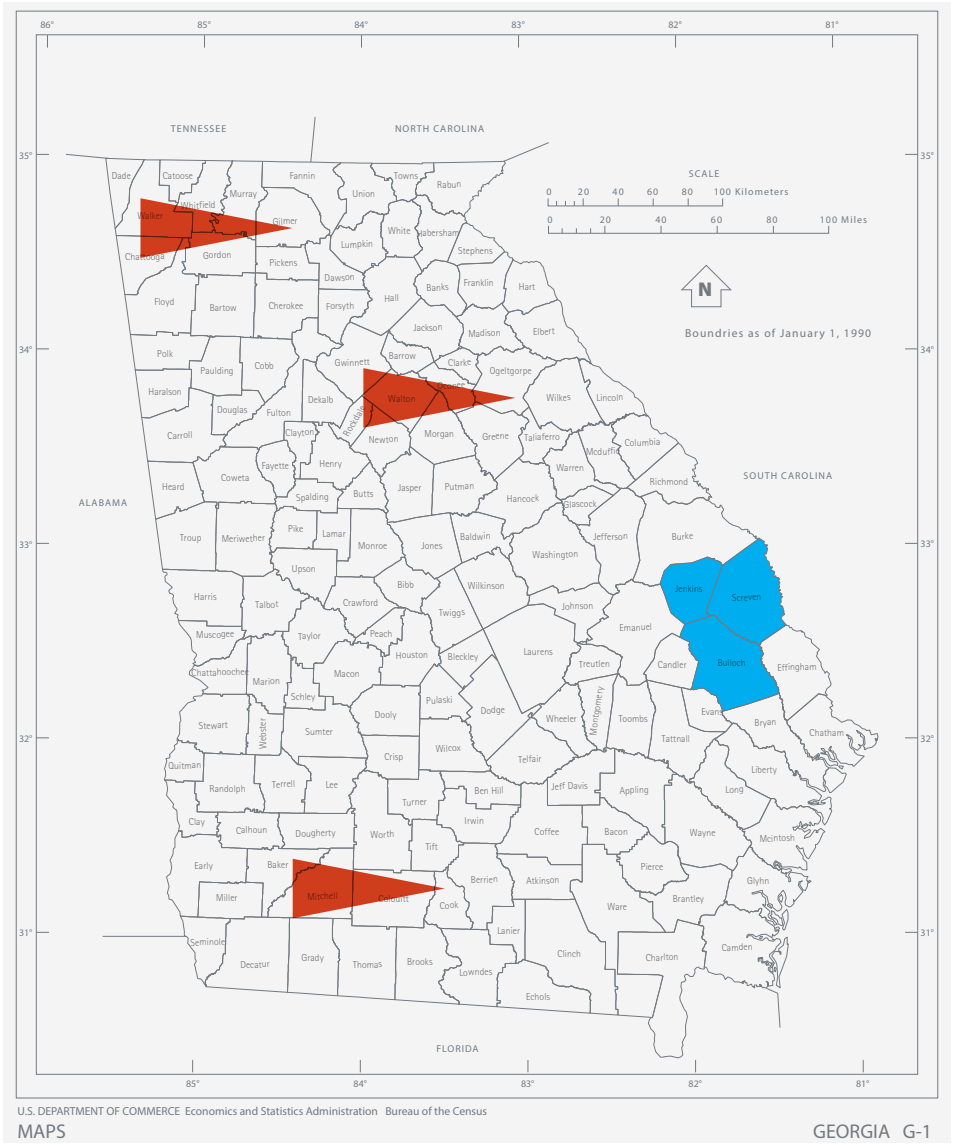


Figure 9. A U.S. Census Bureau map of Georgia (no copyright restrictions) with three counties highlighted using Microsoft Paint and three flags added using the "insert shapes" tool in Microsoft PowerPoint (markings for illustration only)

Online

Many websites offer embedded GIS software that lets users compose and export maps as image or PDF files. The benefits of online mapping are that no special software is required on your computer; you do not have to learn how to use a complicated new program; and you do not have to acquire and format data. The drawbacks are that formatting options are limited; results can sometimes be low resolution, not suitable for enlarging or printing; and there is no capacity for mathematical analysis of spatial relationships. Some online mapping tools are more user-friendly than others. As a general rule, the more complicated it is to use, the more flexible and powerful the options available.

These are a few excellent sites with free mapping tools for health nonprofits and others:

- **Community Commons** is an initiative to support the sharing of health, equity, and sustainability data. It includes over 2,000 user-produced maps and hosts the Community Health Needs Assessment (CHNA) portal. The CHNA portal is a free, web-based platform built to help hospitals and other organizations understand the needs and assets of their communities. It was designed and sponsored by a collaborative effort in response to IRS hospital requirements outlined in the Affordable Care Act. The portal offers maps of vulnerable populations and key health indicators including health determinants.
- Georgia Department of Public Health data can be viewed and downloaded in maps or tables from the **Online Analytical Statistical Information System (OASIS)** website. Available data include frequencies of most causes of death, hospital discharges, emergency department and ambulatory care sensitive (out-patient) visits, and maternal and child health indicators. Demographic clusters and state legislative jurisdictions can also be viewed. It is often especially helpful to be able to see data at the census tract level. However, some data are only available at the county or public health district level.
- **Neighborhood Nexus** links to a range of demographic, social, economic, educational, and housing data for Georgia (with some additionally detailed data sets for the greater metropolitan Atlanta region). Some public health data can be mapped here, but they are not different from what is available in OASIS. The Maps tab on the Neighborhood Nexus website offers excellent training videos and step-by-step users' guides for various "portals", all of which use the same mapping software, called Weave, but divide the data into different geographic units. **Figure 10** was created using Neighborhood Nexus.
- In **ArcGIS** online, you can choose from a gallery of standard and user-submitted maps (the Living Atlas) that you can then customize. Or you can create a new map from an extensive set of templates and a large data library.
- In Georgia, sites such as the **Atlanta Regional Commission's** provide ready spatial data for viewing or download. In addition, Google and the Google Earth application allow users to view, upload, download, and share spatial data in standard GIS formats.

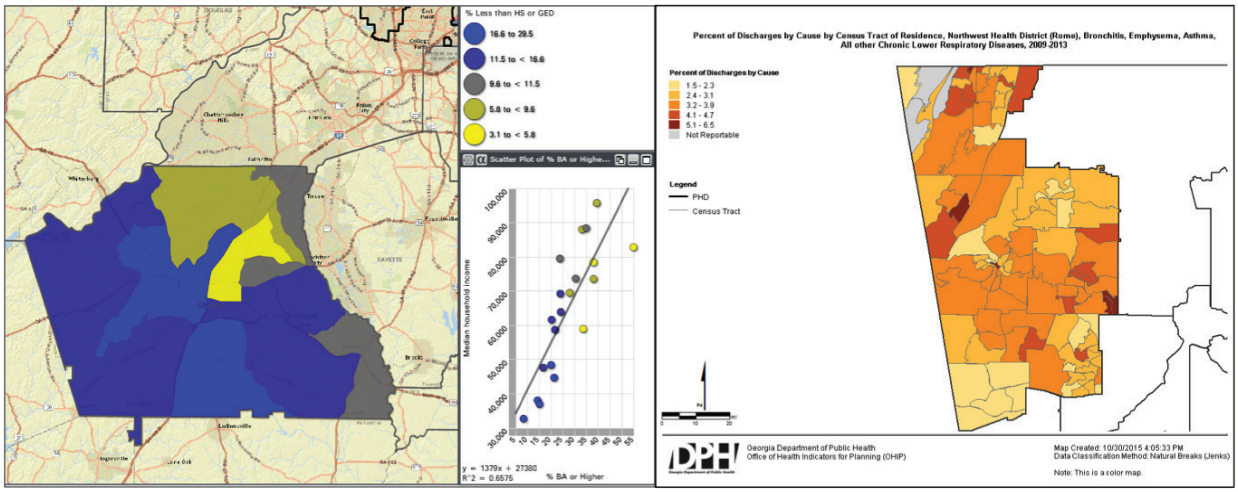


Figure 10. The map at left was made using the Neighborhood Nexus online tool. It shows the percent of residents with less than a high school diploma or equivalent by census tract. This application also provides an optional scatter plot for the same area and divisions. You can choose what to display: the chart here shows how the same education variable correlates to median household income. The map at right was made using OASIS. It shows census tract-level hospital discharge rates for respiratory illnesses in the Northwest Health District.

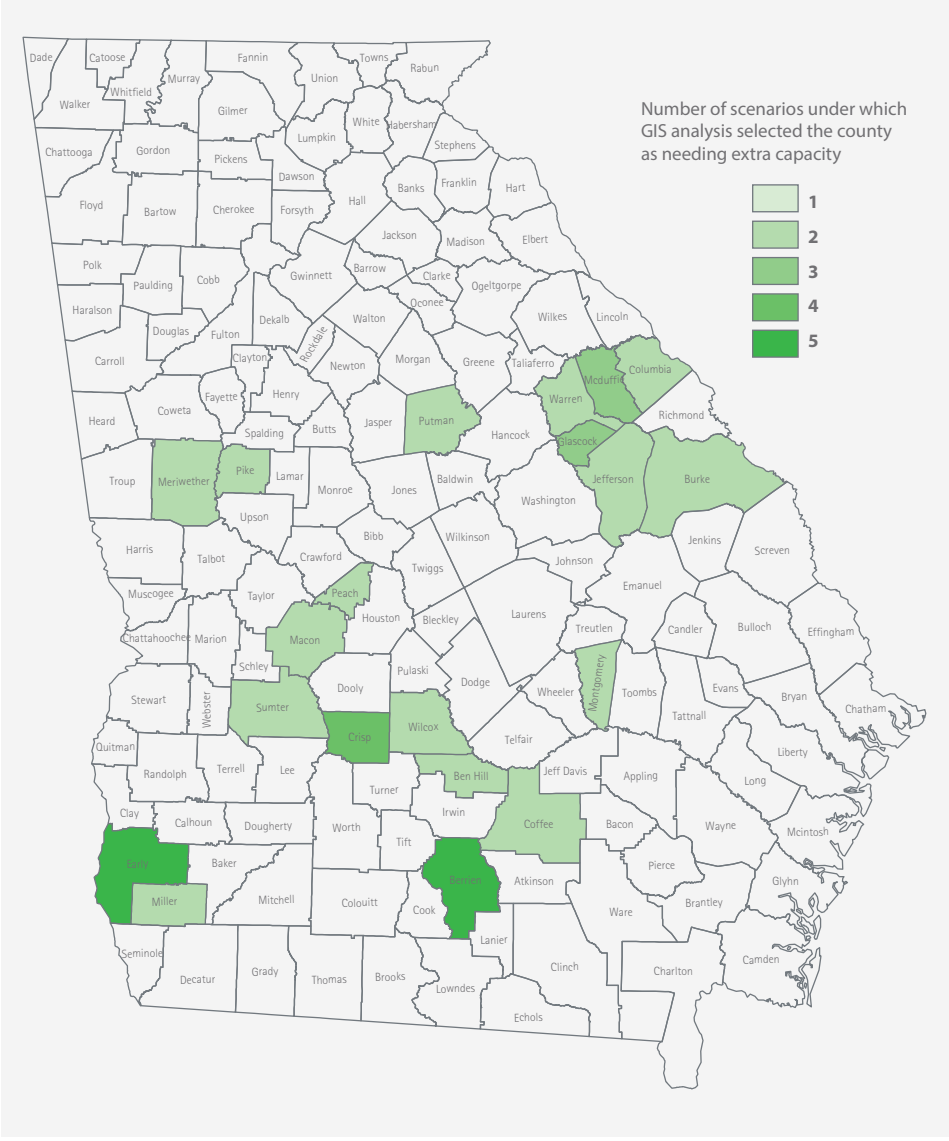
High-tech

The most technically advanced way to produce maps is using GIS software. These programs let users not only design and create visual representations of complex data, but conduct mathematical analysis of geographic relationships. For example, a 2009 assessment of domestic violence services in Georgia used GIS to calculate which counties need additional shelter capacity based on shelter demand and distance from existing facilities. **Figure 11** shows the results of that GIS analysis.

The most widely used GIS software is **ArcGIS**. It requires a purchase or license agreement. The **QGIS** geographic information systems is available as a free download.

Along with these advantages come drawbacks common to many advanced information technologies: they require special tools and knowledge. As a result, many health nonprofits may not have the capacity internally for GIS mapping. Some projects might warrant contracting with a GIS expert, or taking advantage of skills offered by a collaborative partner. **The information provided here should help prepare you to work effectively with a GIS consultant. If you want to consider building that capacity within your organization, the resources in the appendix offer a starting place for exploration.**

Figure 11. Counties that a 2009 GIS analysis identified as needing greater family violence shelter capacity. (From: Georgia Health Policy Center)



Decisions in Map-Making

Purpose

As previously described, there are many ways that maps might be able to enhance your work. But how do you get started? The first step is to **decide your audience and objective**. Maps to mobilize the public or policymakers should show the information with the greatest urgency for action, such as changes in infection rates over time, or the proximity of health hazards to at-risk populations. You will want to display the minimum amount of information needed for viewers to grasp the issue quickly and clearly.

For internal decision-making such as program planning, on the other hand, you might need a more extensive set of details shown on one map or a series of maps. Visual clutter is less of a concern because your team can take the time needed to study the information.

In either case, you could also consider whether there are any analytical approaches that would complement the visual representation and contribute to the purpose. For example, you could use GIS software to calculate the surface area of ponds, streams, and sewers in your service area, and then use evidence from reliable sources to estimate the risk of West Nile Virus at the neighborhood level.

Variables

What is the health factor you want to show, and what specific variable will most clearly tell the health story? There may be several that tell a part of it, each with a slightly different slant. For instance, suppose you want to describe fruit and vegetable affordability at the census tract scale. Data elements that might be available to you would include household fruit and vegetable spending, household grocery spending, WIC and SNAP recipient households, stores that sell fruits and vegetables, stores that accept SNAP benefits, and median household income. Household spending might provide an overview of consumption levels, but not whether affordability was a factor. A look at WIC and SNAP benefits places the focus on economically disadvantaged households, while a food market assessment would shine light on geographic—as opposed to financial—accessibility. The intent of your map will guide your choice of which variable to use.

Or it may be that you'd like to consider multiple variables at the same time. It's possible to combine multiple variables into one number, referred to as an index, and map that new variable. In the above example, for instance, you could create an index that represents the number of WIC and SNAP households relative to their distance from the nearest store that accepts these benefits. **Figure 2** mapped a broken windows index that was calculated from observed physical conditions like boarded up structures, trash accumulation, and plant overgrowth.

Cases or rates?

Once you know the quantity you are most interested in, you need to decide whether to show it as **cases**—the number of people, things or events—or as a **rate**. A rate is simply the number of cases per (divided by) something else: cases per square mile; incidents per month; dollars per hundred people, etc.

Cases—the number of flu cases in each school district, say—might be best to use if you are planning distribution of staffing, money, or other resources. In other applications, rates may be more helpful. If you are conducting a traffic safety audit, you will want to know which areas have the most pedestrian crashes per year, or per resident. **Figure 12** illustrates the importance of the distinction between cases and rates. Both tell meaningful stories, but often very different ones.

In using rates, it is also important to choose the appropriate denominator for your application or analysis. One example is related to age variation. An indicator about children, such as WIC utilization, will look quite different viewed as a percentage of the total population than a percentage of total households or a percentage of the population under age 5. In the traffic safety example, mapping crashes per resident, crashes per square mile, and crashes per vehicle will yield different results. You have to decide which is most meaningful in the situation. Sometimes you might want to compare different rates to get a deeper understanding of the story.

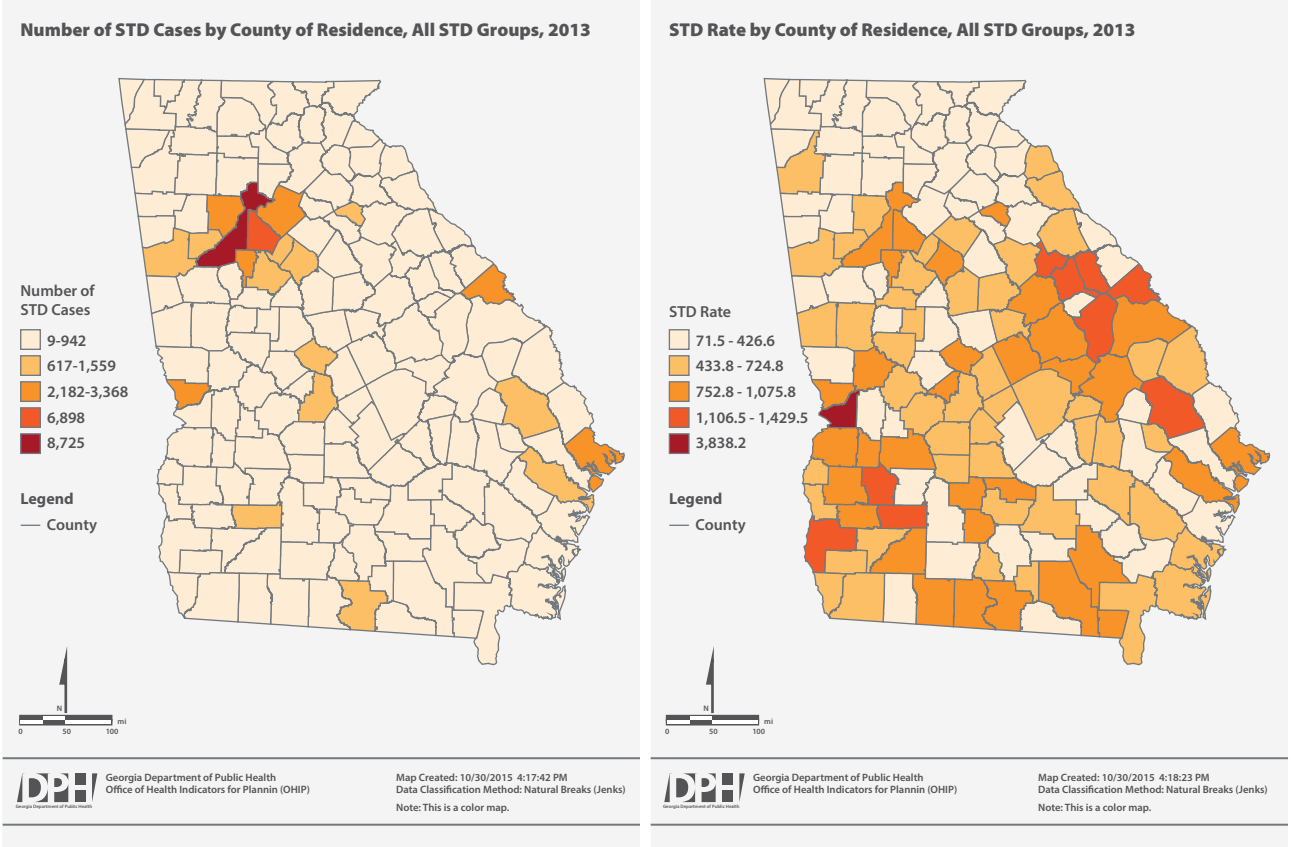


Figure 12. It is important to choose wisely whether to use cases or rates. In this example we see, not surprisingly, that the number of STD cases is far higher in the urban areas of the state; while the map at right shows that STD rates are distributed more evenly, but are generally lower in the northern and coastal counties. The cities may require greater total treatment capacity; but Middle Georgia counties need special attention to prevention strategies. (From: OASIS, www.oasis.state.ga.us)

Extent

As described above, the geographic scope of a map is referred to as its extent. How much of the surroundings are needed for recognition or context depends on what the key message of the map is and how familiar the audience is with the geographic area and its features. In mapping software, the user can easily zoom in and out to view tiny details or the big picture. GIS uses formulas to simplify lines and shapes and to change the size of markings as the view is altered in this way. With a printed or static map you have to choose one or the other, or show a large-scale map for context with an inset of a portion of it in greater detail.

There are two approaches for increasing the extent of a single map of a given area without sacrificing clarity of the information of interest. You can make the actual map large, even wall-sized, or you can limit the amount of detail you include. With just enough information in the base map for context, you can focus attention on the important data and avoid the clutter that can obscure a map's message.

Granularity

Granularity refers to the geographic precision of the data: Do you have the number of individuals with a high school diploma by state, by county, by zip code, by census tract? There are many more data available at the county level than at the city, zip code, or census tract level, and very few that are specific to a distinct location—that is, linked to exact geographic coordinates. Such highly granular data as those shown in **Figures 2** and **5** are more labor-intensive to collect and may result in large, unwieldy datasets. Also, in less densely populated areas where the number of cases may be quite small, data often are aggregated over a large area to preserve the anonymity of individuals or to achieve a statistically meaningful sample. But spatial variations in how opportunities and risks, exposures and health outcomes are distributed make it important to use sub-county data for many purposes, if possible.

In less densely populated areas where the number of cases may be quite small, data often are aggregated over a large area to preserve the anonymity of individuals or to achieve a statistically meaningful sample.

The full US Census is conducted every ten years. To provide more recent data in between, the Census Bureau conducts the American Community Survey (ACS) every year.

Time frame

The most recent data available are used when you want a map to approximate how things are now. Unfortunately, the most recent data from public sources may be as much as six years old because of how often it is collected and the time it takes to "clean," validate, and format it for public release. In addition, the unit of time reflected by data can vary. Values shown by year are common; but some data are available by month, week, day, or hour (think weather forecasts).

Aggregating data over a longer period of time, like aggregating it over a larger geographic area, is a way to preserve anonymity, reduce the size of the dataset, or get a statistically meaningful sample size when total numbers or rates are small.

The full US Census is conducted every ten years. To provide more recent data in between, the Census Bureau conducts the American Community Survey (ACS) every year. This smaller-scale effort collects data from a statistically representative sample of households and uses results to estimate values for the population as a whole. The numbers of some variables—teen births, say—may be too small at the census tract or county level to maintain confidentiality or statistical validity, so in order to report at that level of granularity the Census Bureau aggregates the data over three or five years and gives a statistical margin of error for estimates. You will find ACS data available as rolling, multi-year estimates: 2001-2003, 2002-2004, 2003-2005, etc.

Classes

To make a map with shading in different areas to represent a range of values—say, the distribution of household income across the county—you must decide where to cut off the ranges and how many different ranges, or **classes**, to display. You might choose to show two classes: below and above the federal poverty level, for example. Or you might show several groups: under 10,000, $10,000 to $20,000, $20,000-$40,000, etc. The dividing points between classes are called **cut points**.

Unless a map is otherwise uncluttered, it can be hard to convey more than about eight classes effectively because the coding (colors, shadings or markings) becomes visually confusing.

There are several acceptable ways to define the ranges or "cut" the data into the number of classes you choose. They include:

- **Equal steps**. This means the ranges are the same size; the difference between the highest and lowest values is divided into equally spaced steps. For two classes of household income level, this would mean grouping those above and below the county average. For example, suppose the difference between the lowest and highest incomes in the county is $100,000 ($10,000 low and $110,000 high). You would divide $100,000 into as many classes as you want, and add that number to the lowest for the lowest range, etc. A map with two equal step classes in this example would show areas with incomes from $10,000 to $60,000 and $60,000 to $110,000. Four classes would each have a $25,000 spread: $10,000 to $35,000; $35,000 to $60,000; $60,000 to $85,000; and $85,000 to $110,000.
- Quantiles. These are groups with the same number of observations, or data points, in each. Two quantiles in this example would be defined as the income range of the lower-earning half of households versus that of the higher-earning half.
- The **standard deviation** method. A standard deviation is a statistical measure of how "bunched" or spread out the data points are across the overall range. If most households have incomes close to the average, with just a few way above or below it, the standard deviation will be small. A large standard deviation indicates that there are households all across the income range, not concentrating around a single level. In this approach to cutting the data into classes for a map, then, the groups are determined by the number (or fraction) of standard deviations from the average. For example, classes might be from 0% to 50% of a standard deviation, 50% to 100%, and 1 to 2 standard deviations.
- The **Jenks or natural breaks method**. This is done by placing cut points at places in the data where there are gaps or fewer occurrences, grouping values together in clusters as they appear in the data. Groupings can be identified either statistically (Jenks) or by "eyeballing". For example, if there are many households with incomes around $5,000 to $25,000 and another cluster in the $75,000 to $150,000 range, but very few in between, you might choose $50,000 as the cut point for a two-class display.
- Evidence-based, manual cut-points. This method assigns breaks at specific values based on some pertinent factor. For income, it could be the limit for free and reduced-price lunch, the levels associated with Medicaid and federal premium subsidy eligibility, or the levels shown in the literature to be associated with good, fair and poor self-reported health.

Unless a map is otherwise uncluttered, it can be hard to convey more than about eight classes effectively because the coding (colors, shadings or markings) becomes visually confusing.

Look and details

Once you have considered all of the above factors, you might want to try out various ways of depicting the data to determine the best use of colors and patterns, extent, granularity, base map and other reference points. Then before you are finished, you will add relevant supporting information as described in the section earlier on map components: a clear, descriptive title, legend, North arrow, scale, data sources, and any explanatory notes on limitations and constraints of the data or your visualization of it.

The title is important for summarizing the content on display. The variable of focus is usually specified in detail in the title: "Average annual household income by zip code for Mitchell County, 2010." For the legend you may want to enter your own user-friendly data classification ranges and dataset titles. Notes might be needed if, for example, certain data that are missing have been suppressed. Depending on how important these notes are to interpreting the map, they could appear in the subtitle, the legend, or the fine print about data sources.

Where to Get Data for Mapping

In-house

Your organization may use many types of data, but not all of it is geographically coded in a useful way. For instance, you might have a database of patients' home addresses but no way to identify the places where injuries have occurred. On the other hand, there may be valuable spatial information within your in-house data. As you become familiar with using maps in your work, you may develop better ways to collect and store spatial data. For example, you could add a space in your patient intake form for the address where an injury or exposure occurred.

Open source

Extensive geospatial data are available from public agencies and open sources like the U.S. Census Bureau and County Health Rankings. Such sources provide essential base map data such as standard state, county, census tract, ZIP code, and congressional district boundaries. Topography and land cover images can be downloaded from the Georgia GIS Clearinghouse. There is also a wealth of spatial data regarding socio-demographic indicators, environmental hazards, health services, housing conditions, and much more. **Data.Gov** lists 13,075 federal and state datasets with geospatial data for Georgia. A list of some useful geospatial data sources and mapping tools is provided in the appendix, with links to websites.

By request

Many agencies and organizations have spatial data that is not publicly accessible but can be provided on request. Examples include:

- A city planning or tax department with data files regarding all of the public and private properties in the city, including grocery stores and convenience stores;
- A city police department with records of all police reports, such as violent crime: and
- A transportation department with spatial data regarding the location of traffic crashes.

In order to request data of this nature, you typically need to identify the person in the organization who has access to the data and the authority to release it. You also need to explain why you are requesting the data and how it will be used. If the dataset might contain sensitive data, such as the names of victims of violent crimes, you may need to consult with the data manager to have some variables removed from the dataset before it is sent to you.

Although these data may be required by law to be available to the public, some agencies charge a fee to offset the cost of extracting it to fulfill a request.

For purchase

Other datasets are only available for purchase from organizations that need compensation for the expenses they incur acquiring and assembling the data. Examples include de-identified health insurance coverage or claims data, and market data regarding purchasing habits. Finally, some systems offer data by subscription, such as Esri's Business Analyst Online, or enable online viewing by the public but require membership or subscription to manipulate or download it.

Data Format

The availability of data in spatial format is a key factor in its potential for mapping. The system for translating a street address into a point on a map is not necessarily easy or precise; so if your dataset includes addresses, you might ask yourself whether ZIP code level granularity is sufficient for your purpose.

If you do have data with geographic coordinates, it is fairly easy to translate them into one of the data file types used by geographic information systems. These include "shapefile" (.shp), "geodatabase," "map layer" (.lyr), "map package" (.mpk), and "keyhole markup" file (.kml or .kmz). If you receive geocoded data from one of the sources described above, it will likely be in one of these formats. In some cases, it will be in a table or other database format such as Microsoft Excel or Access rather than a GIS format, but will contain special fields designed to load the data accurately into GIS: latitude, longitude, and identifiers to 'join' the data to commonly available spatial data, for example.

Conclusion

Maps can be focused or broad, simple or complicated. All sorts of maps can be used to enrich presentations, conversations, and decisions. While the tools for technically complex maps are specialized, you can make useful maps even if your organization does not "own" the data or have the technical capacity in-house. Public access to data is growing rapidly, as is the availability of user-friendly tools for making maps. You can also engage a GIS specialist if you want to make precise, complex maps or do mathematical analysis of geospatial data. You just need to know the basic vocabulary and steps, which are summarized here.

Glossary

- **BASE MAP** – The "bottom layer" of a map that provides a frame of reference for the area and data layers depicted
- **CASES** – The number of people, things or events; a simple count
- **CLASSES** – Groupings of data to show the distribution of different ranges on a map
- **CUT POINT** – Place within the overall range of data where they are divided into separate classes
- **EQUAL STEPS** – A data classification system that produces classes with the same size range of values
- **EXTENT** – The total geographic area encompassed by a map
- **GEOCODED** – Tied to a specific geographic location by the three variables of longitude, latitude and elevation
- **GEOGRAPHIC INFORMATION SYSTEM** (GIS) – A computer program that works with location data in digital (computer-readable) form
- **GRANULARITY** – The level of geographic specificity of a data set
- **JENKS METHOD** – A way to mathematically divide a range of data into sub-classes where there is minimal variation among the values in a class and maximum variation between classes
- **LAYER** – A set of data/information shown on a map with a defined coding scheme
- **LEGEND** – Information added to a map to explain the coding scheme
- **RATES** – Cases per unit of time, distance, population, or other quantity
- **STANDARD DEVIATION** – A measure of how tightly grouped or evenly distributed the observations in a data set are

Online Mapping and Data Sources

- ArcGIS online: https://www.arcgis.com/home/
- Atlanta Regional Commission: http://arc.garc.opendata.arcgis.com/
- Community Commons: http://www.communitycommons.org/
- County Health Rankings: www.countyhealthrankings.org
- Georgia Cancer Registry: http://www.cancer-rates.info/ga/index.php
- Georgia Department of Public Health: https://oasis.state.ga.us/
- Georgia GIS Clearinghouse: https://data.georgiaspatial.org/index.asp
- Neighborhood Nexus: http://www.neighborhoodnexus.org/
- Searchable listing of federal and state datasets: www.Data.Gov
- US Census Bureau: http://www.census.gov/geo/maps-data/
- US Department of Agriculture Economic Research Service: http://www.ers.usda.gov/data-products.aspx
- USDA-ERS Atlas of Rural and Small-Town America: http://www.ers.usda.gov/data-products/atlas-of-rural-and-small-town-america.aspx
- US EPA Toxics Release Inventory: http://www2.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools
- US Health Resources and Services Administration Data Warehouse: http://datawarehouse.hrsa.gov/
- US Department of Housing and Urban Development: http://data.hud.gov/data_sets.html

No-cost ways to learn more

- ESRI: Over 100 free training seminars and online courses. Most require having ArcGIS software; a 60-day free trial of the software is available; and those with an institutional user account have additional options. http://training.esri.com/gateway/index.cfm?fa=search.results&searchterm=&search=Search&-cannedsearch=2&orderby=coursesubtypename%20asc
- Harvard University: Free Introductory tutorial video series with hands-on exercises requiring ArcGIS http://hcl.harvard.edu/libraries/maps/gis/tutorials.html
- iTunes U: Series of free lectures on Geographic Information Systems and Science from Oregon State University https://itunes.apple.com/us/itunes-u/geographic-information-systems/id430913514?mt=10

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About the Georgia Health Policy Center

The Georgia Health Policy Center (GHPC) at Georgia State University works to integrate research, policy, and programs to advance health and well-being. GHPC focuses on solutions to complex issues in health and health care today including insurance coverage, long-term care, health care reform, children's health, and the development of rural and urban health systems.

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