Welcome to today's Coffee Break, presented by the Evaluation and Program Effectiveness Team in the Division for Heart Disease and Stroke Prevention at the Centers for Disease Control and Prevention. We are fortunate to have Joanna Elmi and Sophia Greer as today's presenters. Joanna is a health scientist from the CDC's Division for Heart Disease and Stroke Prevention and is on the Evaluation Program Effectiveness Team. Sophia is also from the Division for Heart Disease and Stroke Prevention and is an epidemiologist on the Small Area Analysis Team. My name is Rachel Davis and I am today's moderator. I am also a member of the Evaluation Team.

Disclaimer: The information presented here is for training purposes and reflects the views of the presenter. It does not necessarily represent the official position of the Centers for Disease Control and Prevention.

The information presented here is for training purposes and reflects the views of the presenter. It doesn't necessarily represent the official position of the Centers for Disease Control and Prevention.
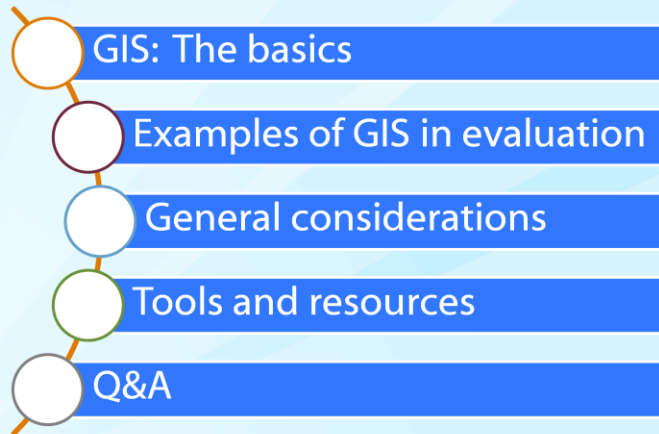
To give a quick overview of the presentation today: Sophia is going to start us off with GIS basics, and then I'll share some examples of how GIS has been used in Evaluation. Then we'll discuss some general considerations, tools and resources, and question and answer.

What are Geographic Information Systems (GIS)?

- Computer-based systems that allow users to capture, store, analyze and display geographically referenced data. [1]
- Examine patterns of population health characteristics along with physical and social environmental characteristics. [2]

- Systematic
- Holistic
- Analytic
- Quantitative
- Visual

Analyzing Visualizing Designing/Planning Decision Making Acting Geoaccounting Measuring

A Science-Based Approach

1- Miranda ML, Casper M, Tootoo J, Schieb L. Putting Chronic Disease on the Map: Building GIS Capacity in State and Local Health Departments. *Prev Chron Dis* 2013; 10:120321.
2- Rushton G. Public Health, GIS, and Spatial Analytic Tools. *Annu Rev Public Health* 2003; 24: 43-56.

I'll just give a brief overview of what GIS is without getting into a lot of details. Geographic Information Systems, or GIS, are computer-based systems that allow users to capture, store, analyze, and display geographically referenced data. There are a lot of components involved with GIS, but the most common way that it's used is to map data, especially in chronic disease, mapping population data, health data, and social and demographic data. Historically it's been used more commonly in infectious disease and environmental health, but it's increasingly used in chronic disease settings.

Joanna will touch on the GIS state training that comes out of our division in which we have trained a lot of state health departments to integrate GIS into their work. When you're thinking about GIS and using it if you're new to GIS in general, it's a good idea to touch base with people in your organization that are probably using these tools.
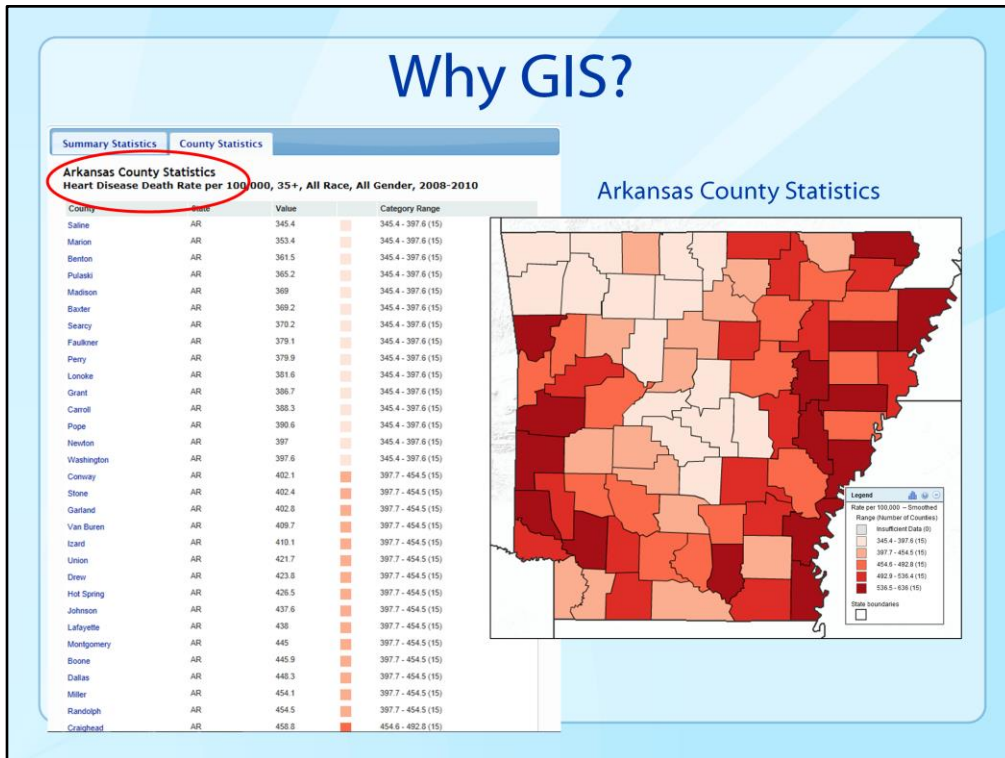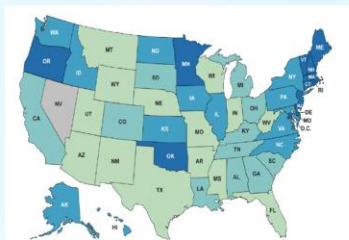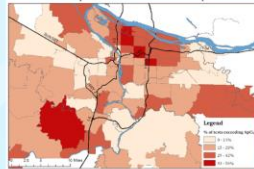
This is a slide that shows a brief example of what GIS can do. On the left you will see a table of county level data, and it's heart disease death rates by county. Typically if these data are displayed on a table you'd scroll and find your county and look at the rate. This information can also be represented in a map. On the right you'll see that same data represented in a map by categories that are represented by color. As you move from the lightest color to the darkest color, you're moving from county with the lowest rates to counties with the highest rates. As you move through that gradient you'll see where the counties are that have the highest rate information. The rates are just categorized within each color group. This allows users and viewers to see where the highest burden of heart disease death rates are and where to focus their programs.
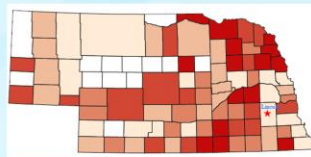
Commonly Used Geographies

- State
- County
- Census Tract or Block
- Zip Code
- Point Location

Radon Exposure by Zip Code
Portland, OR

Breast Cancer Incidence Rates by State

Heart Disease Mortality Rates by County
Nebraska

Poverty by Census Block Group
Washington County, Minnesota

Now I'm going to talk about some of the commonly used geographies when displaying this type of information. When you're thinking about data collection tools, you can collect this information by these different geographies. Also there is a lot of publically available data such as from the U.S. Census or survey data that is already categorized into these geographies. I'll go through a few of them, but this is not a comprehensive list.

One way to display health information or demographic information is by state; you'll see that in the lower left hand corner. The next is by county; you'll see that immediately to the right. Above that you'll see a map by zip code. To the far right you'll see by census block. You can also display data by census tract or census block group.

The most commonly used are state, county, census tract, and point level locations. If you have the address of your program or any other activity that you have an address for, you can actually display that point level data on a map. Zip code is less commonly used as these boundaries do not correspond with some of the administrative or jurisdictional boundaries such as state and county.

Often you have state or county level governments to correspond with those boundaries; but with zip code level data, the zip code boundaries are created by the postal service. Those don't correspond with some of the other boundaries and can often cross state lines. In describing the data by zip code, that can involve a little bit more work in describing what those boundaries mean. However, if that's the only method that you have to collect data, that's still an appropriate way to display it.
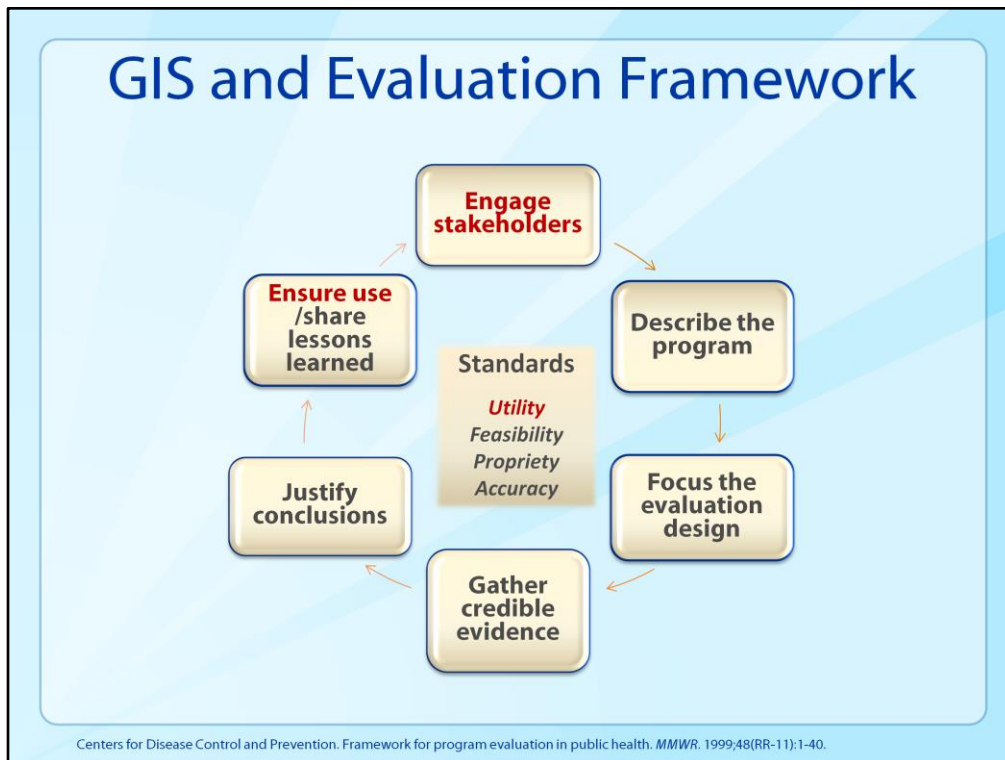
Intersection of GIS and Program Evaluation

- Technological tools transform evaluation practice
- Programs and evaluations don't happen in a vacuum
- Data visualization can improve data utility

Thanks for that foundation of GIS. I'm going to speak a little bit about GIS in evaluation. We've seen how technology and evaluation can alter and even streamline how we do some of our work. Online surveys and interactive data displays and statistical analysis software have really changed the way we conduct evaluations and how we report out our findings. These advancements have improved the field and have made it possible for us to do more with less, and allowed evaluators to transform our data to make a greater impact with stakeholders. Now we have GIS. I, as well as others, would claim that GIS will soon be as common in our work as SurveyMonkey or SPSS, for example.

Public health programs and our evaluations don't happen in a vacuum or controlled environment. They are always in a setting or a context with social, geographic, economic, and political factors that influence and might be influenced by the program and the evaluation. Maps can help display all of these contextual and programmatic variables in one place and show the relationships and patterns that might exist.

Data visualization or graphic representations of data like mapping are more likely to grab people's attention. It can help the viewer digest information, allowing them to retain the information in their longer term memory. Sometimes we collect a lot of data in our evaluations. With this technology we can make those data more accessible to stakeholders to make decisions and take action.

GIS and Evaluation Framework

Engage stakeholders

Ensure use /share lessons learned

Describe the program

Standards
Utility
Feasibility
Propriety
Accuracy

Justify conclusions

Focus the evaluation design

Gather credible evidence

Centers for Disease Control and Prevention. Framework for program evaluation in public health. *MMWR*. 1999;48(RR-11):1-40.

To help us get more specific, I'd like to encourage you to think about how maps can be used during each of the six steps of the CDC evaluation framework. During this presentation I will highlight four state health state department map examples that describe the need for a program, that communicate evaluation design, justify program expansion, and demonstrate program reach. Before I share these examples, I'd like to highlight two areas of the framework in particular where the use of geospatial visuals such as maps by their nature closely align. These are engaging your stakeholders, ensuring use, and the utility standard.
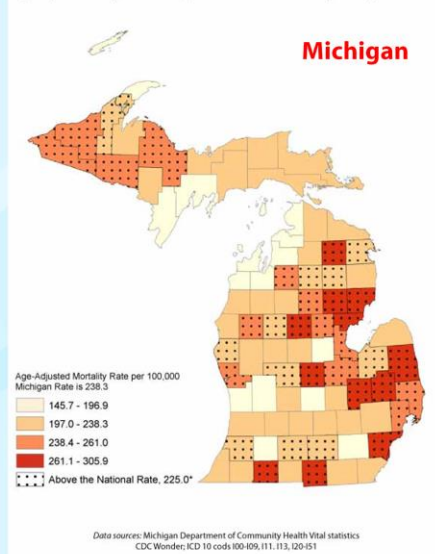
With engaging stakeholders we often speak of this as the first step, but if you can visualize that there's an outer circle, this really illustrates that this activity happens throughout the evaluation process. The published material on GIS as well as some discussions with our GIS trained health department staff indicated that evaluators can engage and affect stakeholders with maps at a more profound level because the use of local data often makes a more personal plea to stakeholders about the state of their community, cultivating a deeper level of commitment and involvement.

Similarly with the utility standard, this is a thread also woven throughout the steps of the framework. Maps are a great tool to share multiple pieces of complex data in a timely, simple, and digestible format. The audience can comprehend and process data more quickly, facilitating future decision-making and program improvement.

Our first example we'd like to share with you is from Michigan. This map displays the age adjusted death rates for heart disease by county from the years 2002 to 2006. The more intense color, moving to a darker red, indicates a higher death rate. The placement of the dots indicate counties with a higher death rate than the national rate of 225.

The data for this map comes from the Michigan Vital Statistics and the CDC Wonder Database. This map was part of a series of maps included in the 2008 report on surveillance called the Impact of Heart Disease and Stroke in Michigan, and conveys the need for state and federal partners to act and prioritize the issue of heart disease in Michigan, particularly in areas where there are geographic disparities in the higher burden of heart disease mortality.

GIS trained health department evaluators have noted to us that once they created these burden maps they were able to save the template and use reproduce the maps every year with current data, thereby streamlining the process of generating and reporting critical data to partners and the public.
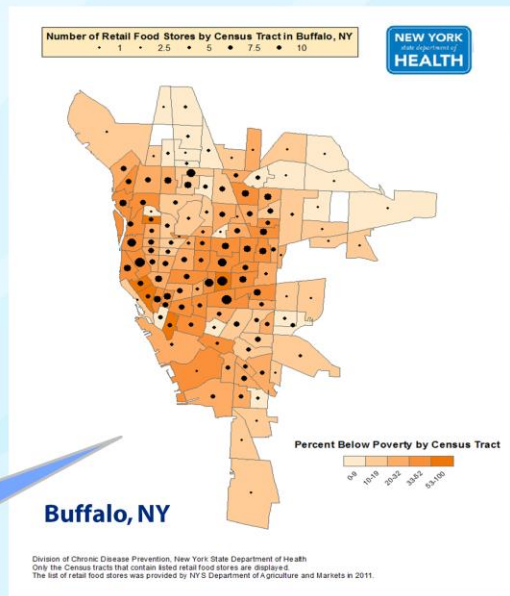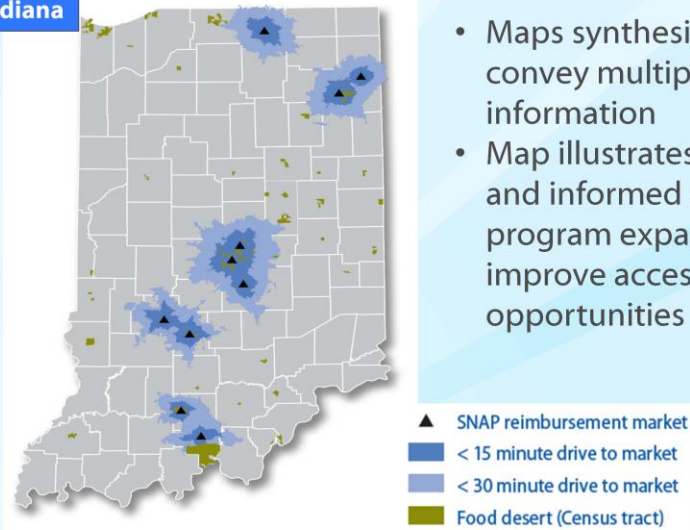
This map is of Buffalo, New York ,which is one of my hometowns where I grew up as a teenager. The New York State Health Department was conducting a multi-site data collection project looking at the availability and cost of sugar sweetened beverages in retail food stores. They wanted to access whether there are variations in availability of the types of sugar sweetened beverages, the size of the beverage containers, the look of the packaging, and the cost by neighborhood. The New York evaluators had a list of 1,000 stores at the census tract level from the New York State Department of Agriculture and Markets. They plotted the location of the stores that would be surveyed and overlayed this onto the poverty level at the census tract level. This map enabled the evaluators to disseminate their data collection design for this project.

They were able to combine a long list of stores and information about each neighborhood and could explain the design in a useful, simple, and understandable way to program partners. New York also reported that they have plans to present the findings of the project using GIS as well. The maps will allow them to show the patterns and variability across neighborhoods and portray relationships between costs of sugar-sweetened beverages and high poverty areas.

This map from Indiana displays the location of food deserts and farmers markers that accept SNAP reimbursement as well as the 15 and 30 minute drive times to each market. This is all in one map. This 2011 data was provided by the Indiana Department Agriculture. Although the map includes a lot of different information, it's easy to identify the areas in need for future SNAP expansion and where to direct resources to improve access to fresh produce.

Document Program Reach

- Maps can document the projected and actual reach of a program
  - MN shows the proportion of the state population served by Coverdell stroke hospitals
- Utilize interim performance or program monitoring data to show reach of policy or environmental changes
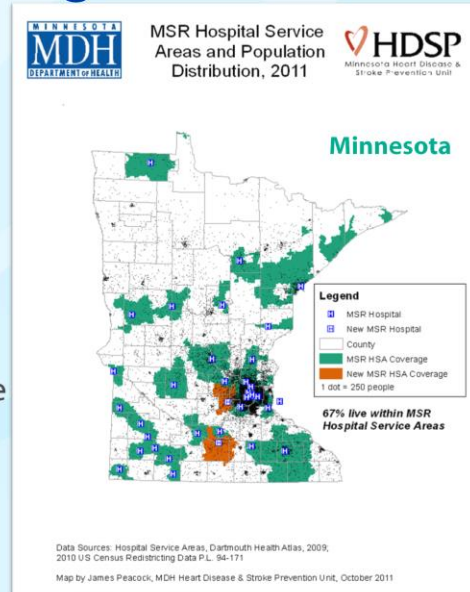
Maps can be used by programs to show accountability and to document reach. Evaluations calculate reach in order to identify who is being affected by the intervention. This is often reported as a percentage or proportion of people affected.

This map from Minnesota Coverdell Program clearly shows that in 2011 67% of the state population lived within the area serviced by Minnesota's Stroke Registry Hospitals. The data used to create this map are from the Dartmouth Health Atlas, U.S. Census data, and Coverdell Hospital participation program data.

Evaluators can utilize interim performance or program monitoring data such as hospital recruitment or participation data to show the reach of some of the environmental or policy or programmatic changes.

General Considerations:
Getting Started

- Datasets with location information (e.g., county, ZIP codes, street addresses, or other)
- GIS Software (e.g., ArcGIS, Quantum GIS, MapInfo, Geocoder)
- Interdisciplinary team
- Iterative process

We hope that these few examples have inspired some thoughts of how you might use GIS to enhance your evaluation. Some considerations to keep in mind before getting started are:
- Ensure that your program evaluation data sets contain local information.
- You'll need to secure a GIS software program license.
- We highly recommend taking an interdisciplinary team approach, bringing together your epidemiologists, evaluators, maybe some IT folks, and program folks to really produce the maps together.
- Plan for ample time for an iterative process of preparing your data sets and creating the maps. As one of the GIS trainees stated, a map is never finished and there is always more you can do to improve it.

Building GIS Capacity

- Annual GIS training for state/local health departments
  - Evaluator members of GIS team
- Goal: To produce maps used to inform programs and facilitate collaboration among chronic disease units
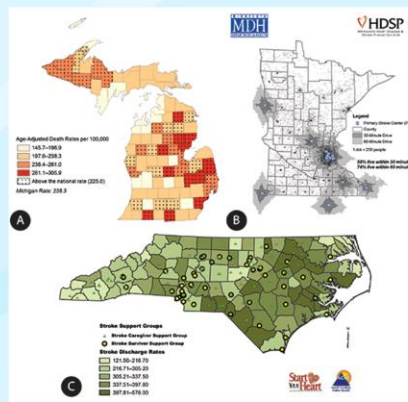
GIS is an underutilized tool in the evaluation field and even in the chronic disease prevention arena. That's why DHDSP collaborates with NACDD and the University of Michigan to offer an annual training for state and local health departments in order to build GIS capacity. It's a competitive application process and selected health departments are awarded funds to travel to the trainings and to purchase a software license.

Building GIS Capacity
Available Resources

- GIS Training and Chronic Disease GIS Snapshots
  http://www.cdc.gov/dhdsp/programs/gis_training.htm

- Highlights Reports
  http://cehi.snre.umich.edu/projects/building-gis-capacity-state-health-departments

- GIS Exchange website and training modules
  http://www.cdc.gov/dhdsp/maps/gisx/training/

- Miranda ML, Casper M, Tootoo J, Schieb L. Putting Chronic Disease on the Map: Building GIS Capacity in State and Local Health Departments. *Prev Chron Dis* 2013; 10:120321.

This slide highlights some resources that are available related to the GIS training, if you'd like to learn more.

- **Chronic Disease GIS Snapshots:** A series of one-page fact sheets featuring maps produced by graduates of the GIS training with details about how the maps were created and how they are being used.
- **Highlights Reports:** A series of reports highlighting the maps produced by each of the health department that has participated in the GIS Capacity Building project.
- **Chronic Disease GIS Exchange:** An online forum for showcasing chronic disease maps, downloading GIS training modules, and exploring a vast array of GIS resources. You are invited to submit your own maps to the map gallery.
- The article by Miranda describes a little bit about the training strategy.

Summary

- Promising future contributions of mapping for the evaluation field
- GIS enhances and strengthens standard evaluation practices
  - Tool to engage stakeholders
  - Facilitate decision making
  - Effectively share data and results in a meaningful way
- Geographical depictions of local data create a greater impression and impact

In summary, there is a promising future for maps to be adopted and integrated into standard evaluation practices. Applying this advanced technology and technical skill can strengthen our evaluations by better engaging our stakeholders, facilitating timely decision-making, and effectively sharing evaluation data and results in a meaningful way, producing a greater impression and impact.

Tools and Resources

- Program Evaluation Tip Sheet: Integrating GIS into Evaluation
  http://www.cdc.gov/dhdsp/evaluation_resources.htm

- Azzam T & Robinson D. GIS in Evaluation: Utilizing the Power of GIS to Represent Evaluation Data. *American Journal of Evaluation* 2013

- Training:
  Intermediate & Advanced Introduction to GIS in Evaluation (Robinson & Azzam). August 14 & 21, 12:00-1:30 pm Eastern. Register by Aug 7: http://www.eval.org/eStudy

Finally, these are some tools and resources that are more specific to GIS and program evaluation.
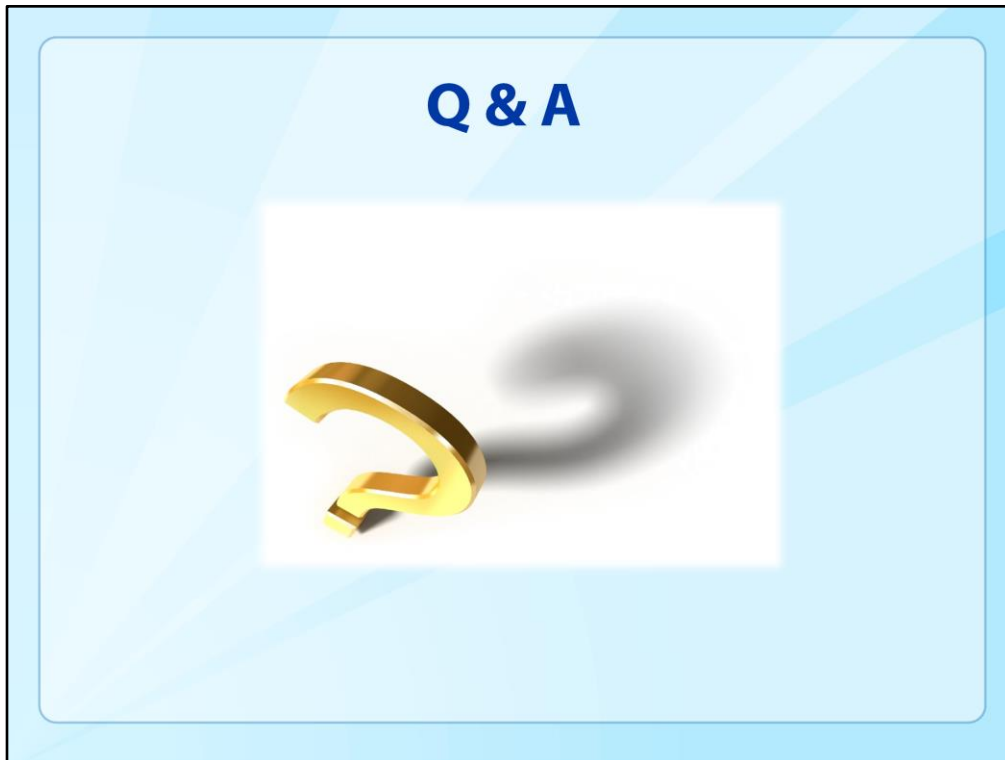
Question 1: Are there any potential limitations to keep in mind for using GIS in evaluation?

Response: There are a few things to keep in mind. There is a learning curve perhaps to learn the software and to learn to create a map, knowing that this takes time, and to get your data sets ready to create a map. Then there are some privacy issues: Sophia mentioned point level data, and that can bring about some privacy issues. Definitely consider your data confidentiality protocols. There are ways to get around this; say if you have address information for a participant in your program, there are ways to present that data without sharing too much personal information.

Question 2: What is the expense for the software?

Response: The expense is highly variable. That depends on a number of factors, such as if you are using an individual license or concurrent license, speaking about ArcGIS software specifically. It's something that you'll want to talk to your IT folks about. If you're interested in ArcGIS, you'll also want to get in touch with a regional representative of ESRI specifically, which is the company that makes the software. There are some others: The QGIS software (Quantum GIS) is actual open source, so that will minimize cost with it being of little or no cost to the user. There are some ways to get around it if you don't want to actually purchase ArcGIS software.

If anyone thinks of additional questions or topics related to reporting evaluation findings or ways you would like to receive more technical assistance about this topic, please feel free to email us at the address listed on the slide.