

# CDC Science Ambassador Workshop

## 2014 Lesson Plan

# Spatial Analysis of Obesity: Geographic Information Systems and Descriptive Epidemiology

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The findings and conclusions in this Science Ambassador Workshop lesson plan are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

## Contents

Summary .....	1
Learning Outcomes .....	2
Duration .....	2
Procedures .....	3
Day 1: Introduction to the Geographic Inquiry Process (45 minutes) .....	3
Preparation .....	3
Materials .....	3
Online Resources .....	3
Activity .....	4
Day 2: Exploring Geographic Data (45 minutes) .....	5
Preparation .....	5
Materials .....	5
Online Resources .....	5
Activity .....	5
Day 3: Analyzing Data to Guide Further Inquiry (45 minutes) .....	6
Materials .....	6
Online Resources .....	6
Activity .....	6
Conclusion .....	7
Assessments .....	7
Educational Standards .....	8
Appendices: Supplementary Documents .....	10
Appendix 1A: Worksheet 1: Displaying Obesity Data in ArcGIS Online .....	11
Appendix 1B: Worksheet 1: Displaying Obesity Data in ArcGIS Online, Answer Key .....	16
Appendix 2A: Worksheet 2: Applying the Geographic Inquiry Process .....	18
Appendix 2B: Worksheet 2: Applying the Geographic Inquiry Process, Answer Key .....	19
Appendix 3A: Activity 1: Geographic Inquiry Process Sort .....	20
Appendix 3B: Activity 1: Geographic Inquiry Process Sort Key, Answer Key .....	21
Appendix 4A: Worksheet 3: Steps for Exploring Obesity Rates in Georgia .....	22
Appendix 4B: Worksheet 3: Steps for Exploring Obesity Rates in Georgia, Answer Key .....	27
Appendix 5: Worksheet 4: Exit Ticket .....	32
Appendix 6A: Worksheet 5: Scavenger Hunt .....	33
Appendix 6B: Worksheet 5: Scavenger Hunt, Answer Key .....	35
Appendix 7: Teacher Handout: Assumption Buster .....	37
Appendix 8A: Summative Assessment .....	38
Appendix 8B: Summative Assessment, Answer Key .....	40

# Spatial Analysis of Obesity: GIS and Descriptive Epidemiology

## Summary

GIS, the abbreviation for geographic information systems, is a collection of science and technology tools used to manage geographic associations and integrate information. GIS helps analyze spatially referenced data and make well-informed decisions about the basis of the association between data and geography. GIS refers to both the software and hardware that create the system of digital databases and layered maps. However, it is more than that; GIS is used for making decisions. At the Centers for Disease Control and Prevention (CDC), GIS plays an important part in health promotion and protection.

For example, CDC's Division for Heart Disease and Stroke Prevention has an interactive atlas that is based on GIS data (Figure 1). This application allows users to view county-level maps of heart disease and stroke, along with maps of social environmental conditions and health services for the entire United States or for a chosen state or territory. Congressional boundaries and health care facilities can be added with an overlay. The map in Figure 1 displays heart disease death rates/100,000 persons aged  $\geq 35$  years by Georgia county, during 2008–2010. This information can be used for health promotion activities (e.g., tobacco, and obesity prevention programs) in the counties that are most in need.

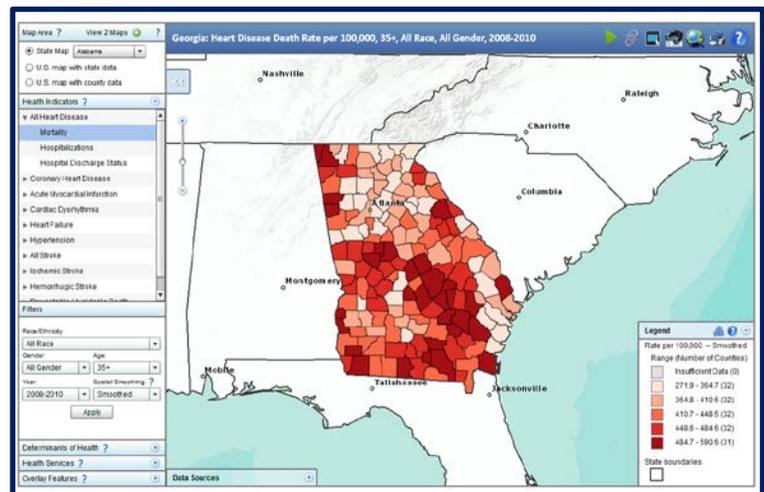


Figure 1. CDC's Division for Heart Disease and Stroke Prevention interactive atlas for all heart disease mortality/100,000 persons aged  $\geq 35$  years, for all races, and both sexes, by Georgia county during 2008–2010 (<http://nccd.cdc.gov/DHDSAtlas/viewer.aspx>).

In this lesson, students use the geographic inquiry process to explore potential associations among obesity, income, and physical activity in Georgia. Students use ArcGIS Online, to layer and analyze data to observe potential patterns. Students explore the role of epidemiologists in asking questions and testing hypotheses to determine the associations among variables. The concepts and activities are appropriate for students in grades 6–8, but can be used with older students.

**An important note:** Teachers are able to request free access to ArcGIS Online through Esri as part of the ConnectED Initiative prior to using this lesson plan: <http://www.esri.com/connected>. In June 2013, President Obama announced the ConnectED initiative, designed to enrich K-12 education for every student in America (<https://www.whitehouse.gov/issues/education/k-12/connected>). Esri partnered with the Association of American Geographers to provide free access to ArcGIS Online accounts to every K-12 school in the U.S. through the ConnectED initiative as well as training resources and a mentor program (<http://geomentors.net/>) to support teachers and students.

Teachers may also sign up for an ArcGIS Public Account at <https://www.arcgis.com/home/signin.html>, which is a personal account with limited usage and capabilities and is meant for non-commercial use. A public account provides enough capability to complete this lesson plan.

## **Learning Outcomes**

After completing this lesson, students should be able to

- use GIS as a model to overlay data regarding obesity rates, income, and physical activity in the state of Georgia to identify patterns;
- analyze patterns in data to develop questions and generate hypotheses between obesity and variables that affect obesity in Georgia, specifically income and physical activity; and
- explain epidemiologists' role in descriptive epidemiology by asking who, what, and where questions, and testing hypotheses to determine causes of disease among a population.

## **Duration**

This lesson can be conducted as one-, 135-minute lesson, or divided into three-, 45-minute lessons.

## Procedures

### Day 1: Introduction to the Geographic Inquiry Process (45 minutes)

#### Preparation

Before Day 1,

- Ensure access to ArcGIS online. Teachers are able to request free access to ArcGIS Online through Esri as part of the ConnectED Initiative: <http://www.esri.com/connected>.
- Post pictures at regular intervals around the room for a gallery-walk activity. See introduction activity for more details.

#### Materials

- Computers and Internet access to ArcGIS for each pair of 2 students.
- Select 5–10 pictures for gallery-walk activity. Pictures should be of different scenes (e.g., roads, trains, homes, people exercising) and can be from different sources, including online or from magazines and newspapers.  
Description: Students will think about what is in each picture and how they could measure different aspects (e.g., length of a road, how people exercise, how tall something) to prompt a discussion about the different way something could be measured and the potential problems if things are measured different. This will lead into a discussion about the concept of BMI as one way to standardize measuring someone's body mass.
- Defining Obesity Materials  
Description: Obtain information about obesity and how it is defined, including medical complications of obesity and related costs. Suggested website: <http://www.cdc.gov/obesity/adult/defining.html>
- Geographic Inquiry Image: Geographic Inquiry Process.  
Description: A visual representation of the geographic inquiry process that will be presented to the class. Access PDF image online at: [http://edcommunity.esri.com/~/.media/Files/EdCommunity/Lesson%20Files/g/Geographic\\_Inquiry\\_Process.pdf](http://edcommunity.esri.com/~/.media/Files/EdCommunity/Lesson%20Files/g/Geographic_Inquiry_Process.pdf)
- Worksheet 1: Displaying Obesity Data in ArcGIS Online (Appendix 1A).  
Description: A set of instructions to follow as students add data to ArcGIS online.
- Worksheet 2: Applying the Geographic Inquiry Process graphic organizer (Appendix 2A).  
Description: A visual representation of the geographic inquiry process that students will complete as they explore each stage of the process

#### Online Resources

- Website 1: Esri, ArcGIS, available at: <http://www.arcgis.com/home/>.  
Description: ArcGIS is a collaborative, cloud-based platform that allows students to use, create, and share maps, web applications, and data, including authoritative basemaps. Students will overlay data related to obesity in Georgia in a GIS to determine associations among the data. If requesting free access to ArcGIS Online through Esri as part of the ConnectED Initiative, please follow directions provided with the account.

## Activity

1. Begin the lesson with a picture-gallery walk. Divide students into groups and tell them to start at a picture and as a pair, study the photos of different scenes (e.g., roads, trails, homes, people exercising) and think about what is in each picture and how they could measure different aspects (e.g., length of a road, how people exercise, how tall something is). After 1 minute, have groups rotate to the next picture. Continue the rotation until all groups have seen all of the pictures.
2. Prompt a discussion about measurement. Have students share the different ways something could be measured. Discuss how many different ideas are generated. Then, ask students to think about the potential problems if things are measured differently. Have students discuss how they would make sure everyone is measuring in a similar way.
3. Discuss the definition of *obese* for adults and the lesson plan objectives. Introduce concept of BMI as one way to standardize measuring someone's body fatness. Explain to students that obesity is measured using BMI. Emphasize the importance of body mass index in the definition.
4. Discuss the medical complications and the costs associated with obesity. Prompt a discussion about potential health effects of obesity and how they might be measured. Have students generate ideas about what factors could impact obesity (e.g., environment, food choices, genetics, activity levels, location) and how they could be measured.
5. Focus on location as a factor that could impact Obesity. Ask students, "What are the obesity levels in the United States and how does it differ by location (e.g., state, county, region)?" Tell students that this is an example of a geographic question. Geographic questions are about spatial associations in the world. Explain that the geographic inquiry process is the method used to answer geographic questions.
6. Project an image of the geographic inquiry process and review the steps of the geographic inquiry process. Tell students they will be following this process to answer the question "In what areas of Georgia are persons the most obese?" Explain that they have completed the first step of the process by asking the question. Explain that today they will be using GIS to complete Step 2, acquiring geographic resources.
7. Introduce ArcGIS Online and explain how to open the program, display a map of the United States, and search for obesity data.
8. Direct students to select a partner and sit in front of a computer. Distribute Worksheet 1: Displaying Obesity Data in ArcGIS Online (Appendix 1A), and have students work in pairs at their computers to produce their own maps by following worksheet directions.
9. Distribute Worksheet 2: Applying the Geographic Inquiry Process graphic organizer (Appendix 2A), and have students complete the first 2 steps of the geographic inquiry process by describing what they did.
10. Review Steps 1 and 2 on the graphic organizer with the class.

## Day 2: Exploring Geographic Data (45 minutes)

### Preparation

Before Day 2,

- Make copies of Activity 1: Geographic Inquiry Process Sort (Appendix 3A). Cut out the statements at the top. Place the statements in an envelope. Create 1 envelope for each pair of students.

### Materials

- Activity 1: Geographic Inquiry Process Sort (Appendix 3A), 1 copy per student.  
Description: Statements that describe each step of the geographic inquiry process, and an answer key that includes the correct placement of the statements in the geographic inquiry process.
- Worksheet 3: Steps for Exploring Obesity Rates in Georgia (Appendix 4A), 1 copy per student.  
Description: A set of instructions to follow as students explore obesity, income, and physical activity data across Georgia by using ArcGIS online. An answer key is available (Appendix 4B). Please note that in this activity students are asked to compare 2007 obesity data with 2012 income and physical inactivity data. Comparing data across years has several limitations. As you guide students through this activity, consider addressing this as a class and discuss how those limitations could affect their analysis in this activity.
- Worksheet 4: Exit Ticket (Appendix 5), 1 copy per student.  
Description: A closing activity to summarize student learning and interest inventory.
- Computer and Internet access for each pair of 2 students.

### Online Resources

- Website 1: Esri, ArcGIS, available at: <http://www.arcgis.com/home/>.  
Description: ArcGIS is a collaborative, cloud-based platform that allows students to use, create, and share maps, web applications, and data, including authoritative basemaps. Students will overlay data related to obesity in Georgia in a GIS to determine associations among the data.

### Activity

1. Review the steps of the geographic inquiry process by having students do a sort activity. Place students in pairs of 2 and distribute an envelope containing a set of statements from Activity 1: Geographic Inquiry Process and match the sort activity (Appendix 3A) with each pair. Instruct students to match the steps of the geographic inquiry process with each statement describing the process by using their desktops as a working surface. Give students time to sort and match the statements with the correct step, then review placement of the statements with the entire class.
2. Tell students to locate their partner from Day 1 and sit in front of a computer. Briefly, review how to access ArcGIS and retrieve their maps. Tell students they will complete adding income and physical inactivity data to their GIS. Explain to students that they are working with physical inactivity data (e.g., time watching television or on the computer). Note that high physical inactivity data are not the same as low-physical activity and cannot be assumed.
3. Ask students to complete Step 3 of the geographic inquiry process, exploring geographic data as they add more data to their maps. Distribute Worksheet 3: Steps for Exploring Obesity Rates in Georgia (Appendix 4A), 1 copy per student. Give students time to follow the steps to overlay income and physical activity data on their maps and follow the instructions for overlaying and digitizing areas of interest about their data. Direct students to save their maps after analysis completion.
4. Distribute Worksheet 4: Exit Ticket (Appendix 5), 1 copy per student, and have students turn in the assignment before they leave class.

## Day 3: Analyzing Data to Guide Further Inquiry (45 minutes)

### Materials

- Worksheet 5: Scavenger Hunt (Appendix 6A).  
Description: A self-paced guide for students to search and collect information about epidemiologists from Science Buddies website.
- Teacher Handout: Assumption Buster (Appendix 7).  
Description: A copy of the data that dispel certain assumptions that students might have about the associations between obesity and income.
- Assessment 1: Summative Assessment (Appendix 8A).  
Description: An assessment of what the students have learned throughout the lesson.

### Online Resources

- Website 2: Epidemiologist  
Link: <http://www.sciencebuddies.org/science-engineering-careers/health/epidemiologist>.  
Description: This website includes science resources and information about science-related careers.
- Website 3: Obesity and Socioeconomic Status in Adults: United States, 2005–2008  
Link: <http://www.cdc.gov/nchs/data/databriefs/db50.pdf>.  
Description: Data are not always what they appear. Obesity is based on multiple factors and caution is needed before drawing conclusions without the entire data set. In the assumption-buster activity, students will read the journal article and compare findings with the GIS activity.

### Activity

1. Direct students to Worksheet 2: Applying the geographic inquiry process graphic organizer (Appendix 4A) and review Steps 3 and 4 of the geographic inquiry process they completed with ArcGIS on Day 2. Ask students about the associations they discovered among obesity, income, and physical activity. (The majority of students should respond that they determined that obesity is high in areas where income and physical inactivity is high.)
2. Review Step 5 of the geographic inquiry process by telling students that they have used GIS to integrate data from multiple sources and to assemble information into knowledge that enables them to act. Explain that epidemiologists are scientists who follow a similar inquiry method to answer questions by determining associations involving a medical condition and such factors as human behavior, other diseases, and geographic location.
3. Explain to students that epidemiologists do not make assumptions about individual behavior from data on the basis of populations (e.g., what they gathered about obesity). Epidemiologists use the inquiry process to identify and establish associations that are supported by data.
4. Tell the students they probably have made certain assumptions about obesity-related factors. Emphasize that they would have to do much more investigating and data collection before they could say with any certainty whether associations among the data are causal or not.
5. Project Teacher Handout: Assumption Buster (Appendix 7) for the class to view additional obesity data collected by epidemiologists. The data indicate that the majority of obese persons are not among low-income persons. Emphasize that these data might have dispelled assumptions they had made about obesity and income.
6. Distribute Worksheet 5: Scavenger Hunt (Appendix 6A). Explain that students, with their partner, will perform a scavenger hunt to locate additional information about epidemiologists..
7. Distribute Assessment 1: Summative Assessment (Appendix 8A) and have students complete it before leaving class.

## Conclusion

Students will use the geographic inquiry process to explore potential relationships among obesity, income, and physical inactivity in the state of Georgia. Students will use ArcGIS, a geographic information system (GIS), to layer data and analyze data to observe potential patterns. Students will explore the role of epidemiologists in asking questions and testing hypotheses to determine the relationship between variables. Then, students will identify public health promotion strategies based on the information collected.

## Assessments

- Worksheet 3: Steps for Exploring Obesity Rates in Georgia (Appendix 4A), 1 copy per student.  
Learning Outcome(s) Assessed:
  - use GIS as a model to overlay data regarding obesity rates, income, and physical activity in the state of Georgia to identify patterns;
  - analyze patterns in data to develop questions and generate hypotheses between obesity and variables that affect obesity in Georgia, specifically income and physical activity; andDescription: Students explore obesity, income, and physical activity data across Georgia by using ArcGIS online. Then, they analyze patterns to develop hypotheses about physical activity, income, and obesity.
- Worksheet 5: Scavenger Hunt (Appendix 6A).  
Learning Outcome(s) Assessed:
  - explain epidemiologists' role in descriptive epidemiology by asking who, what, and where questions, and testing hypotheses to determine causes of disease among a population.Description: Students research information about epidemiologists and the role they play in public health.
- Assessment 1: Summative Assessment (Appendix 8A).  
Learning Outcome(s) Assessed:
  - use GIS as a model to overlay data regarding obesity rates, income, and physical activity in the state of Georgia to identify patterns;
  - analyze patterns in data to develop questions and generate hypotheses between obesity and variables that affect obesity in Georgia, specifically income and physical activity; and
  - explain epidemiologists' role in descriptive epidemiology by asking who, what, and where questions, and testing hypotheses to determine causes of disease among a population.Description: An assessment of what the students have learned throughout the lesson.

## Educational Standards

In this lesson, the following CDC Epidemiology and Public Health Science (EPHS) Core Competencies for High School Students<sup>1</sup>, Next Generation Science Standards\* (NGSS) Science & Engineering Practices<sup>2</sup>, and NGSS Cross-cutting Concepts<sup>3</sup> are addressed:

**HS-EPHS1-2.** Discuss how epidemiologic thinking and a public health approach is used to transform a narrative into an evidence based explanation.

<b>NGSS Key Science &amp; Engineering Practice<sup>2</sup></b>
<b>Obtaining, Evaluating and Designing Solutions</b> Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically)
<b>NGSS Key Crosscutting Concept<sup>3</sup></b>
<b>Cause and Effect</b> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

**HS-EPHS2-3.** Use models (e.g., mathematical models, figures) based on empirical evidence to identify patterns of health and disease in order to characterize a public health problem.

<b>NGSS Key Science &amp; Engineering Practice<sup>2</sup></b>
<b>Analyzing and Interpreting Data</b> Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
<b>NGSS Key Crosscutting Concept<sup>3</sup></b>
<b>Patterns</b> Mathematical representations are needed to identify some patterns.

**HS-EPHS2-4.** Use patterns in empirical evidence to formulate hypotheses.

<b>NGSS Key Science &amp; Engineering Practice<sup>2</sup></b>
<b>Asking Questions &amp; Defining Problems</b> Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information, that arise from examining models or a theory, to clarify and/or seek additional information and relationships, to determine relationships, including quantitative relationships, between independent and dependent variables, and to clarify and refine a model, an explanation, or an engineering problem.
<b>NGSS Key Crosscutting Concept<sup>3</sup></b>
<b>Patterns</b> Empirical evidence is needed to identify patterns.

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\*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

- <sup>1</sup>Centers for Disease Control and Prevention (CDC). Science Ambassador Workshop—Epidemiology and Public Health Science: Core Competencies for high school students. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. Not currently available for public use.
- <sup>2</sup>NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix F—Science and Engineering Practices). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at:  
<http://www.nextgenscience.org/sites/ngss/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf>
- <sup>3</sup>NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix G—Crosscutting Concepts). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at:  
<http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf>

## Appendices: Supplementary Documents

## Appendix 1A: Worksheet 1: Displaying Obesity Data in ArcGIS Online

# Displaying Obesity Data

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Sign In

1. Access ArcGIS Online (available at: <http://www.arcgis.com/home/>).
2. Click *Sign In* button (top right). You will need to log in to your class' Esri account. Your teacher will provide you with this information. Type the username and password that your teacher gives you exactly as written. Note: Username and passwords are case-sensitive!

### Find a Location

3. Choose *Map* option.
4. Find Atlanta by entering *Atlanta* in the search bar (top right). This is the *Find* Window. You have now zoomed in on Atlanta, Georgia, in the United States.

### Change the Basemap

5. A *basemap* is a noneditable layer that provides background (reference information) in your map. It is typically designed to provide a visual reference to help orient the map user. Click the *Basemap* button.
6. Select the different basemaps, and list the 12 different basemaps you can choose.

### Move around the Map

7. Move around the map by panning (i.e., clicking and dragging) the map.
8. Zoom in to view greater detail of the Atlanta area. Try zooming in to a location by holding down the Shift key, left clicking your mouse, and dragging a box.
9. Type *United States* into the search bar.

### Add Data to the Map

10. Click *Add* button in the toolbar.
11. In the drop-down menu, click *Search for Layers*.
12. Type *obesity* in the *Find* function. Leave the *In* function as ArcGIS Online. Click *Go*.
13. Find the layer that is titled *USA\_Obesity\_Rates* by Esri Training Service. Click *Add*.  
Note: This thematic map presents the adult obesity rate in the United States in 2007 [Behavioral Risk Factor Surveillance System (BRFSS), 2007]. In this map, overweight and obesity are both labels for ranges of weight that are greater than what is generally considered healthy for a given height. Please also note that more recent data are available at:  
[http://nccd.cdc.gov/NPAO\\_DTM/IndicatorSummary.aspx?category=28&indicator=29](http://nccd.cdc.gov/NPAO_DTM/IndicatorSummary.aspx?category=28&indicator=29).
14. Click *Done Adding Layers* (bottom left).
15. Click *Map Legend* button below in the toolbar.

### Start to Analyze the Data

16. Circle the correct answer for what the darker color means in the legend.
  - a. lower rate of obesity
  - b. higher rate of obesity
  
17. Identify the 8 states that had the highest rates of obesity in 2007. Hint: Make sure to zoom out so that you can see Hawaii and Alaska in your map viewer.
  
  
18. Identify the 5 states that had the lowest rates of obesity in 2007.

### Save Your Map

19. Click *Save*. You will have to give your map a title (team name is preferable), a tag, and a brief summary of your map to save it. Click *Save Map*.

## Appendix 1B: Worksheet 1: Displaying Obesity Data in ArcGIS Online, Answer Key

# Displaying Obesity Data

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_ Date: \_\_\_\_\_

### Sign In

1. Access ArcGIS Online (available at: <http://www.arcgis.com/home/>.)
2. Click *Sign In* button (top right). **Create a username and password for your class.** You will need to log in to your class' Esri account. Your teacher will provide you with this information. Type the username and password that your teacher gives you exactly as written. Note: Username and passwords are case-sensitive!

### Find a Location

3. Choose *Map* option.
4. Find Atlanta by entering *Atlanta* in the search bar (top right). This is the *Find* Window. You have now zoomed in on Atlanta, Georgia, in the United States.

### Change the Basemap

5. A *basemap* is a noneditable layer that provides background (reference information) in your map. It is typically designed to provide a visual reference to help orient the user of the map. Click the *Basemap* button.
6. Select the different basemaps, and fill in the following blank lines by identifying the 9 different basemaps you can choose.  
**Answer:** Imagery, Imagery with Labels, Streets, Topographic, Terrain with Labels, Light Gray Canvas, Oceans, National Geographic, Open Street map, Dark Gray Canvas, USA Topo Maps, USGS National Map

### Move around the Map

7. Move around the map by panning (i.e., clicking and dragging) the map.
8. Zoom in to view greater detail of the Atlanta area. Try zooming in to a location by holding down the Shift key, left clicking your mouse, and dragging a box.
9. Type *United States* into the search bar.

### Add Data to the Map

10. Click *Add* button in the toolbar.
  11. In the drop down menu, click *Search for Layers*.
  12. Type *obesity* in the *Find* function. Leave the *In* function as ArcGIS Online. Click *Go*.
  13. Find the layer that is titled *USA\_Obesity\_Rates* by *Esri Training Service*. Click *Add*.
- Note: This thematic map presents the adult obesity rate in the United States in 2007 [Behavioral Risk Factor Surveillance System (BRFSS), 2007]. In this map, overweight and obesity are both labels for ranges of weight that are greater than what is generally considered healthy for a given height. Please also note that more recent data are available at:  
[http://nccd.cdc.gov/NPAO\\_DTM/IndicatorSummary.aspx?category=28&indicator=29](http://nccd.cdc.gov/NPAO_DTM/IndicatorSummary.aspx?category=28&indicator=29)
14. Click *Done Adding Layers* (bottom left).
  15. Click *Map Legend* button below in the toolbar.

### Start to Analyze the Data

16. Circle the correct answer for what the darker color means in the legend.

- a. lower rate of obesity
- b. higher rate of obesity (Answer)**

17. Identify the 8 states that had the highest rates of obesity in 2007. Hint: Make sure to zoom out so that you can see Hawaii and Alaska in your map viewer.

**Answer:** Mississippi (31.7%), Alabama (30.1%), West Virginia (30.6%), Louisiana (29.5%), South Carolina (29.2%), Tennessee (29%), Kentucky (28.4%), Alaska (27.3%) Note: Percentages represent the percentage of people in that state having a BMI greater than or equal to 30, or about 30 lbs overweight for 5'4" person. More information about historical state data on obesity can be found at: <http://stateofobesity.org/states/>.

18. Identify 5 states that have the lowest rates of obesity in 2007.

**Answer:** Colorado (18.4%), Massachusetts (20.9%), Connecticut (20.8%), Rhode Island (21.4%), New Mexico (23.3%). Note: Percentages represent the percentage of people in that state having a BMI greater than or equal to 30, or about 30 lbs overweight for 5'4" person. More information about historical state data on obesity can be found at: <http://stateofobesity.org/states/>.

### Save Your Map

19. Click *Save*. You will have to give your map a title (team name is preferable), a tag, and a brief summary of your map to save it. Click *Save Map*.

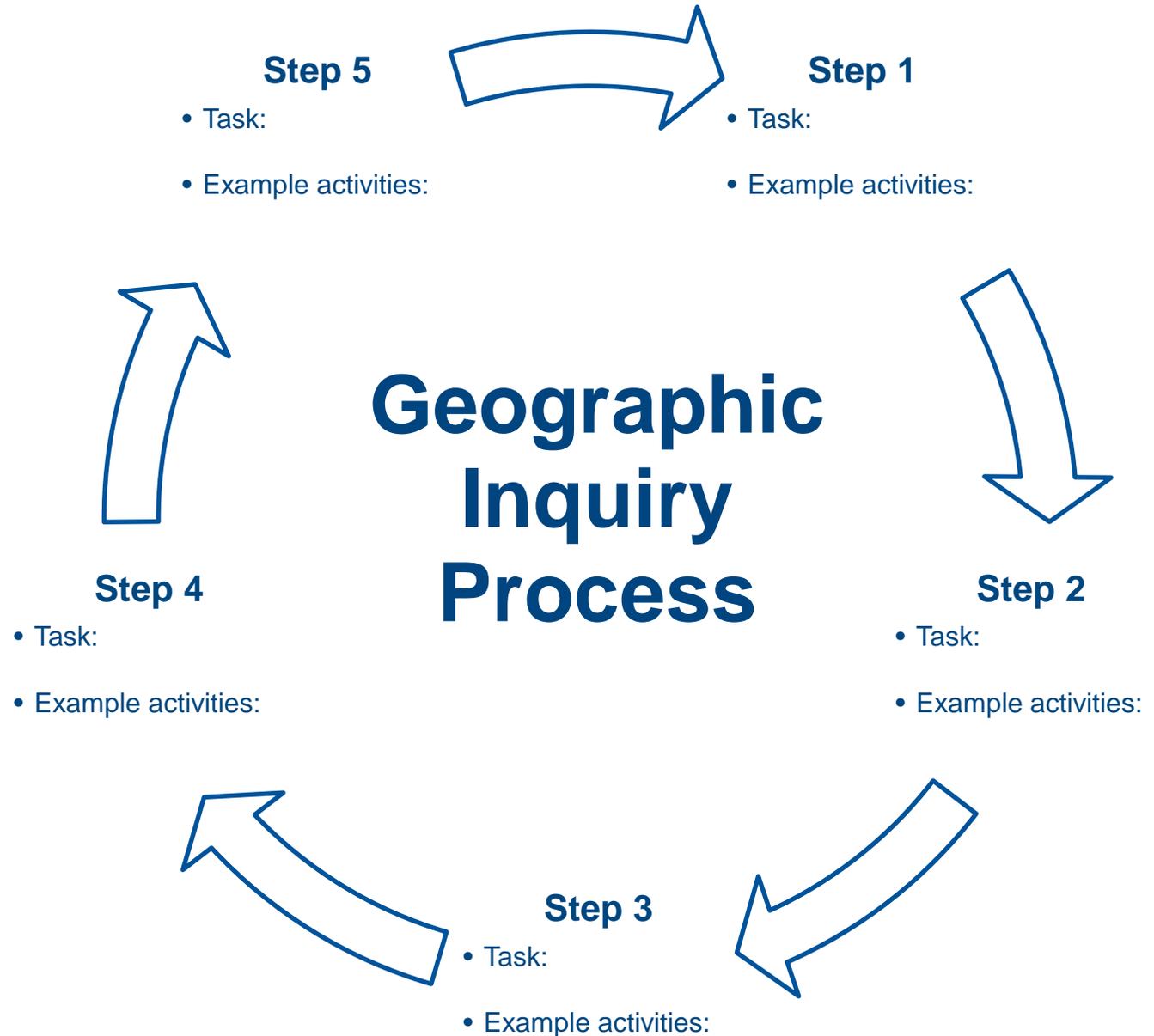
Appendix 2A: Worksheet 2: Applying the Geographic Inquiry Process

# Applying the Geographic Inquiry Process

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Fill in the steps of the geographic inquiry process and provide example activities that you completed for each step.

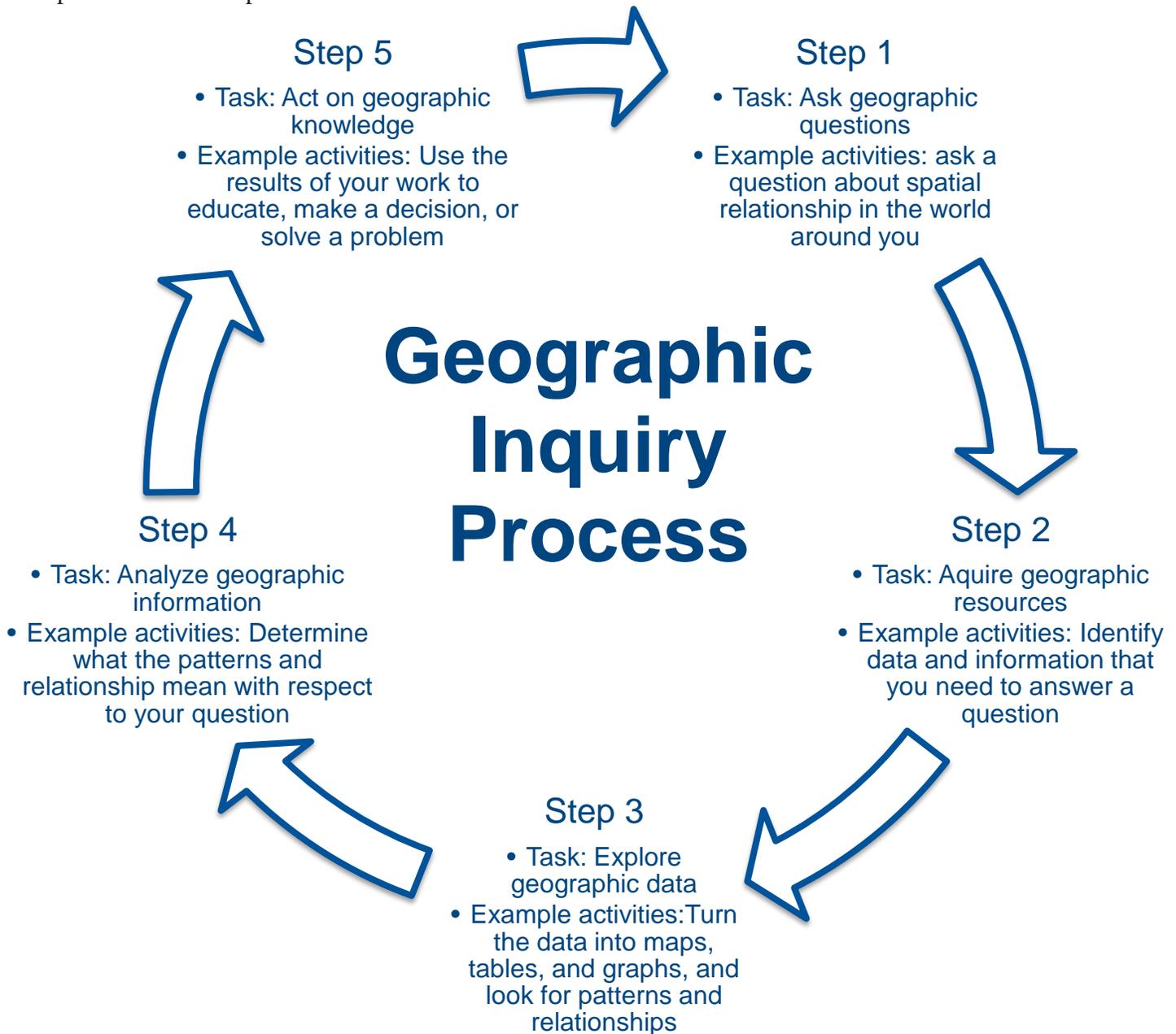


## Appendix 2B: Worksheet 2: Applying the Geographic Inquiry Process, Answer Key

# Applying the Geographic Inquiry Process

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_ Date: \_\_\_\_\_

Directions: Fill in the steps of the geographic inquiry process and provide example activities that you completed for each step.



Adapted from Ersi 2011, available at:  
[http://edcommunity.esri.com/~media/Files/EdCommunity/Lesson%20Files/g/Geographic\\_Inquiry\\_Process.pdf](http://edcommunity.esri.com/~media/Files/EdCommunity/Lesson%20Files/g/Geographic_Inquiry_Process.pdf)

**Appendix 3A: Activity 1: Geographic Inquiry Process Sort**

## Geographic Inquiry Process Graphic Organizer

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Sort the following statements into the correct steps of the geographic inquiry process.

- U.S. obesity rates.
- Acquire geographic resources.
- Analyze geographic information.
- Identify data and information needed to answer questions.
- Act on geographic knowledge.
- ArcGIS (or other mapping software).
- Where are the majority of the obese persons living in the United States?
- Determine patterns and associations with respect to your questions.
- Map of U.S. obesity rates by state.
- Use results of your work to educate, make a decision, or solve a problem.
- Ask a question about location-based associations in the world.
- Translate data into maps, tables, and graphs; look for patterns and associations.
- Explore geographic data.
- Ask geographic questions.
- Definition of obesity.

	Step 1	Step 2	Step 3	Step 4	Step 5
Task					
Activity					

**Appendix 3B: Activity 1: Geographic Inquiry Process Sort Key, Answer Key**

# Geographic Inquiry Process Sort Activity, Answer Key

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Sort the following statements into the correct steps of the geographic inquiry process.

- U.S. obesity rates.
- Acquire geographic resources.
- Analyze geographic information.
- Identify data and information needed to answer questions.
- Act on geographic knowledge.
- ArcGIS (or other mapping software).
- Where are the majority of the obese persons living in the United States?
- Determine patterns and associations with respect to your questions.
- Map of U.S. obesity rates by state.
- Use results of your work to educate, make a decision, or solve a problem.
- Ask a question about location-based associations in the world.
- Translate data into maps, tables, and graphs; look for patterns and associations.
- Explore geographic data.
- Ask geographic questions.
- Definition of obesity.

	<b>Step 1</b>	<b>Step 2</b>	<b>Step 3</b>	<b>Step 4</b>	<b>Step 5</b>
<b>Task</b>	Ask geographic questions	Acquire geographic resources	Explore geographic data	Analyze geographic information	Act on geographic knowledge
Activity	Ask a question about location-based associations in the world around you	Identify data and information needed to answer questions	Translate data into maps, tables, and graphs; look for patterns and associations	Determine patterns and associations with respect to your questions	Use results of your work to educate, make a decision, or solve a problem
Activity	Where are the majority of the obese persons living in the United States?	Definition of obesity	Map of U.S. obesity rates by state		
Activity		U.S. obesity rates			
Activity		ArcGIS (or other mapping software)			

## Appendix 4A: Worksheet 3: Steps for Exploring Obesity Rates in Georgia

# Exploring Obesity Rates in Georgia

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Sign In

1. Access ArcGIS Online available at: <http://www.arcgis.com/home/>.
2. Click the *Sign In* button (top right). You will need to log in to your class' Esri account. Your teacher will provide you with this information. Type the username and password that your teacher gives you exactly as written. Note: Username and passwords are case-sensitive!

### Display Your GIS Map

3. Click the *My Content* button (top middle of the page) or pull down menu under ArcGIS (top right).
4. Locate your map and hover over the drop-down arrow (located to the right of your map) to view display options.
5. Click *Open In Map Viewer*. Changes to the GIS map that you saved from your last session should now be displayed.

### Zoom in on Your Map

6. Type *Georgia, United States* in the *Find* Window to zoom in to the state of Georgia. Add Data: As your map appears now, differentiating among Georgia counties and the surrounding state's counties can be difficult. To view counties more clearly, add a layer of data to highlight Georgia-only counties.
7. Click the *Add* button on the toolbar.
8. In the drop down menu, click *Search for Layers*.
9. Type *Georgia counties* in the *Find*: space. Leave the default for the *In*: space as *ArcGIS Online*. Click "Go."
10. Add the *GeorgiaCountyBoundaries* layer provided by Georgia Environmental Finance Authority (GEFA) to the GIS.
11. Click *Done Adding Layers*.

### Continue Analyzing Your Map

12. Click *Map Legend* button below in the toolbar.
13. View the map and try to identify patterns.
14. List 3 Georgia counties with the highest rate of obesity. In which area(s) of the state are these counties located (e.g., northwest, southeast, or midcentral)?

15. Identify 17 Georgia counties with the lowest rate of obesity. In which area(s) of the state are these counties located (e.g., northwest, southeast, or midcentral)?

Brainstorm

16. Why do you think the data are distributed this way?

17. What factors do you think affect this distribution?

18. What variables do you think are linked to obesity?

### Add More Data to Your GIS Map

19. Click the *Add* button in the toolbar.
20. In the drop down menu, click *Search for Layers*.
21. Type *physical inactivity* in the *Find* search bar. Leave the *In:* space as *ArcGIS Online*. Add the *Physical Inactivity* layer by “aileen\_buckley\_Learn GIS” to the GIS. Click *Go*.  
Note: Physical inactivity data are supplied by esri from the County Health Rankings & Roadmap [Behavioral Risk Factor Surveillance System (BRFSS), 2012].
22. Type *income* in the *Find* search bar. Leave the *In:* space as *ArcGIS Online*. Add the 2012 *USA Median Household Income (Mature Support)* by *esri* layer to the GIS. Click *Go*.  
Note: This map service shows the median household income in the United States in 2012. Information for the 2012 Median Household Income is an estimate of income for calendar year 2012. Income amounts are expressed in current dollars, including an adjustment for inflation or cost-of-living increases. The median is the value that divides the distribution of household income into two equal parts. The median household income in the United States overall was \$50,157 in 2012. This map shows Esri's 2012 estimates using Census 2010 geographies. More information about esri demographics can be found at:  
[http://www.esri.com/data/esri\\_data/](http://www.esri.com/data/esri_data/).
23. Click *Done Adding Layers*.
24. You should now have 5 data layers in your GIS, including *Physical Inactivity*, *Georgia County Boundaries*, *USA Median Household Income (Mature Support)*, *USA Obesity Rates*, and a basemap of your choice.

### Georgia Counties with the Highest Obesity Rates

25. Turn off (i.e., uncheck) the *physical inactivity* and *USA Median Household Income (Mature Support)* layers.
26. Zoom in on *Georgia* and center the map on the state. Now you will outline the counties in Georgia with the highest rates of obesity. Zoom in on the first county you want to highlight.
27. Click the *Add* button and select *Add Map Notes* option. Type *Georgia Counties with the Highest Obesity Rates* as the *Name*. Leave the *Template* as default *Map Notes*. Click *Create*.
28. Click the *Area* tool to prepare your GIS for drawing. Left click on the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around your area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area.
29. Title your map *Area with a High Obesity Rate*. Click *Change Symbol* and choose a warning color (e.g., red, yellow, orange). Click *Apply*, *Done*, and then *Close*.
30. Zoom out and locate your next area of interest. Repeat Steps 26-29 until you have outlined all Georgia areas with the highest rates of obesity.
31. After you finish outlining all Georgia counties with the highest rates of obesity, click the *Details* button on the basemap toolbar. Click the *Content* button to display a list of your layers.

### Georgia Tracts with the Lowest Median Income

32. Turn off (i.e., uncheck) your *Georgia Counties with the Highest Obesity Rates* layer and the *USA Obesity Rates* layer.
33. Turn on (i.e., check) the *USA Median Household Income (Mature Support)* layer. Zoom out to view the entire state of Georgia and click the *Map Legend* button. Now you will outline areas with the lowest median household income. These areas will not necessarily be confined to one county or fill an entire county.
34. Zoom in to the first area you want to outline. Click the *Add* button and select *Add Map Notes* option. Type *Georgia Tracts with the Lowest Median Income* in the *Name: space*. Leave the *Template: space* as default *Map Notes*. Click *Create*.
35. Click the *Area* tool to prepare your GIS for drawing. Left click on the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area. Title your areas *Areas with the Lowest Median Income*. Choose a different warning color to represent these areas than the one you chose for areas with high obesity rates. Click *Apply, Done*, and then *Close*.
36. After you finish outlining all Georgia areas with the lowest median incomes, click the *Details* button on the basemap toolbar. Click the *Content* button to show a list of your layers.

### Georgia Counties with the Lowest Physical Activity

37. Turn off (i.e., uncheck) your *Georgia Tracts with the Lowest Median Income* layer and the *USA Median Household Income (Mature Support)* layer.
38. Turn on (i.e., check) the *Physical Inactivity* layer. Zoom out to view the entire state of Georgia and click the *Map Legend* button. You will now outline areas with the lowest physical inactivity.
39. Zoom in to the first area you want to outline. Click the *Add* button and select *Add Map Notes* option. Type *Georgia Counties with the Highest Physical Inactivity* in the *Name: space*. Leave the *Template: space* as default *Map Notes*. Click *Create*.
40. Click the *Area* tool to prepare your GIS for drawing. Left click on the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around your area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area. Title your areas *Georgia Counties with the Highest Physical Inactivity*. Choose a different warning color to represent these areas. Click *Apply, Done*, and then *Close*.
41. After you finish outlining all Georgia areas with the lowest physical activity, click the *Details* button on the basemap toolbar. Click the *Content* button to display a list of your layers.

### Save your Map

42. Click the *Save* button on the *Find Window* toolbar.

### Spatial Analysis

43. Turn off (i.e., uncheck) all layers except those you have digitized (i.e., *Georgia Counties with Highest Obesity Rates*, *Areas with the Lowest Median Income*, and *Georgia Areas with the Highest Physical Inactivity Levels*).
44. Is overlap visible between your warning colors? If overlap exists, where does this occur?
45. If overlap is visible, does it primarily occur in cities, suburbs, or rural areas? Why do you think this is the case?

In questions 46-48, you will compare your data. Please note that comparing 2007 obesity data with 2012 income and physical inactivity data has several limitations. As you answer the following questions consider how those limitations could affect your analysis.

46. Compare *Georgia Counties with the Highest Obesity Rates* and *Georgia Tracts with the Lowest Median Income*. Do you see any patterns? If yes, what are they?
47. Compare *Georgia Areas with the Highest Physical Inactivity Levels* and *Georgia Tracts with the Lowest Median Income*. Do you see any patterns? If yes, what are they?
48. Compare *Georgia Areas with the Highest Physical Inactivity Levels* and *Georgia Counties with the Highest Obesity Rates*. Do you see any patterns? If yes, what are they?
49. What factors (other than physical inactivity and income) might contribute to elevated obesity rates?
50. Briefly describe an obesity prevention program that you might put into place on the basis of the area that is most in need.

Complete your Exit Ticket on the basis of your analysis.

## Appendix 4B: Worksheet 3: Steps for Exploring Obesity Rates in Georgia, Answer Key

# Exploring Obesity Rates across Georgia, Answer Key

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_

Date: \_\_\_\_\_

### Sign In

1. Access ArcGIS Online available at: <http://www.arcgis.com/home/>.
2. Click the *Sign In* button (top right). **Remind students of the username and password for your class.** Note: Username and passwords are case-sensitive.

### Display Your GIS Map

3. Click the *My Content* button (top middle of the page) or pull-down menu under ArcGIS (top right)
4. Locate your map and hover over the drop-down arrow (located to the right of your map) to view the display options.
5. Click *Open In Map Viewer*. Changes to the GIS map that you saved from your last session should now be displayed.

### Zoom in on Your Map

6. Type in *Georgia, United States* in the *Find Window* to zoom in to the state of Georgia. Add Data: As your map looks right now, differentiating among Georgia counties and the surrounding state's counties can be difficult. To view counties more clearly, add a layer of data to highlight Georgia-only counties.
7. Click the *Add* button on the toolbar.
8. In the drop down menu, click *Search for Layers*
9. Type *Georgia counties* in the *Find*: space. Leave the default for the *In*: space as *ArcGIS Online*. Click "Go."
10. Add the *GeorgiaCountyBoundaries* layer provided by Georgia Environmental Finance Authority (GEFA) to the GIS.
11. Click *Done Adding Layers*.

### Continue Analyzing your Map

12. Click *Map Legend* button below in the toolbar
13. View the map to try to identify patterns.
14. List 3 Georgia counties with the highest rate of obesity. Which area(s) of the state are these counties located (e.g., northwest, southeast, or midcentral)?  
**Answer:** Counties with the highest obesity rate are Hancock (mideast), Terrell (southwest), and Jefferson (mideast).
15. Identify 17 Georgia counties with the lowest rate of obesity. Which area(s) of the state are these counties located (e.g., northwest, southeast, or midcentral)?  
**Answer:** Counties with the lowest obesity rate include Chattooga, Cherokee, Clarke, Cobb, Dawson, Fannin, Fayette, Forsyth, Fulton, Gilmer, Gwinnett, Habersham, Hall, Pickens, Rabun, Towns, and White. The majority of these counties includes populated cities (e.g., Atlanta) or are in the mountains.

## Brainstorm

16. Why do you think the data are distributed this way?

**Answer:** Answers will vary, but might include that Fulton, Cobb, and Gwinnett Counties are among the most populous in Georgia, which may lend itself to outdoor physical activity (e.g., active commuting to work or recreation).

17. What factors do you think affect this distribution?

**Answer:** Answers will vary, but might include terrain, type of area (e.g., suburban, urban, or city) and increased access to physical activity.

18. What variables do you think are linked to obesity?

**Answer:** Answers will vary, but might include physical activity levels, nutrition, access to healthy foods, access to outdoor space, physical inactivity levels, tobacco use, education level, or race/ethnicity.

### Add More Data to Your GIS Map

19. Click the *Add* button in the toolbar.
20. In the drop down menu, click *Search for Layers*.
21. Type *physical inactivity* in the *Find* search bar. Leave the *In:* space as *ArcGIS Online*. Add the *Physical Inactivity* layer by “aileen\_buckley\_Learn GIS” to the GIS. Click *Go*.  
Note: Physical inactivity data are supplied by esri from the County Health Rankings & Roadmap [Behavioral Risk Factor Surveillance System (BRFSS), 2012].
22. Type *income* in the *Find* search bar. Leave the *In:* space as *ArcGIS Online*. Add the *USA Median Household Income (Mature Support)* layer by esri to the GIS. Click *Go*.  
Note: This map service shows the median household income in the United States in 2012. Information for the 2012 Median Household Income is an estimate of income for calendar year 2012. Income amounts are expressed in current dollars, including an adjustment for inflation or cost-of-living increases. The median is the value that divides the distribution of household income into two equal parts. The median household income in the United States overall was \$50,157 in 2012. This map shows Esri's 2012 estimates using Census 2010 geographies. More information about esri demographics can be found at: [http://www.esri.com/data/esri\\_data/](http://www.esri.com/data/esri_data/).
23. Click *Done Adding Layers*.
24. You should now have 5 data layers in your GIS: *Physical Inactivity*, *Georgia County Boundaries*, *USA Median Household Income (Mature Support)*, *USA Obesity Rates*, and a basemap of your choice.

### Georgia Counties with the Highest Obesity Rates

25. Turn off (i.e., uncheck) the *physical inactivity* and *USA Median Household Income (Mature Support)* layers.
26. Zoom in on Georgia and center the map on the state. Now you will outline the counties in Georgia with the highest rates of obesity. Zoom in on the first county you want to highlight.
27. Click *Add* button and select *Add Map Notes* option. Type *Georgia Counties with the Highest Obesity Rates* as the *Name*” Leave the *Template* as default *Map Notes*. Click *Create*.
28. Click the *Area* tool to prepare your GIS for drawing. Left click the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around your area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area.
29. Title your map *Area with a High Obesity Rate*. Click *Change Symbol* and choose a warning color (e.g. red, yellow, orange. Click *Apply*, *Done*, and then *Close*.
30. Zoom out and locate your next area of interest. Repeat Steps 25–29 until you have outlined all Georgia areas with the highest rates of obesity.
31. After you finish outlining all Georgia counties with the highest rates of obesity, click the *Details* button on the basemap toolbar. Click the *Content* button to display a list of your layers.

### Georgia Tracts with the Lowest Median Income

32. Turn off (i.e., uncheck) your *Georgia Counties with the Highest Obesity Rates* layer and the *USA Obesity Rates* layer.
33. Turn on (i.e., check) the *USA Median Household Income (Mature Support)* layer. Zoom out to view the entire state of Georgia and click the *Map Legend* button. Now you will outline areas with the lowest median household income. These areas will not necessarily be confined to one county or fill an entire county.
34. Zoom in to the first area you want to outline. Click the *Add* button and select *Add Map Notes* option. Type *Georgia Tracts with the Lowest Median Income* in the *Name: space*. Leave the *Template: space* as default *Map Notes*. Click *Create*.
35. Click the *Area* tool to prepare your GIS for drawing. Left click on the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area. Title your areas *Areas with the Lowest Median Income*. Choose a different warning color to represent these areas than the one you chose for areas with high obesity rates. Click *Apply, Done*, and then *Close*.
36. After you finish outlining all Georgia areas with the lowest median incomes, click the *Details* button on the basemap toolbar. Click the *Content* button to show a list of your layers.

### Georgia Counties with the Lowest Physical Activity

37. Turn off (i.e., uncheck) your *Georgia Tracts with the Lowest Median Income* layer and the *USA Median Household Income (Mature Support)* layer.
38. Turn on (i.e., check) the *Physical Inactivity* layer. Zoom out to view the entire state of Georgia and click the *Map Legend* button. You will now outline areas with the lowest physical inactivity.
39. Zoom in to the first area you want to outline. Click the *Add* button and select *Add Map Notes* option. Type *Georgia Counties with the Highest Physical Inactivity* in the *Name: space*. Leave the *Template: space* as default *Map Notes*. Click *Create*.
40. Click the *Area* tool to prepare your GIS for drawing. Left click on the map to start the first point of your drawing. Move your mouse to another point around your area of interest and left click again. Move your mouse to your third point around your area of interest and left click again. Continue moving and clicking your mouse around your area of interest and, when ready, double click to enclose the area. Title your areas *Georgia Counties with the Highest Physical Inactivity*. Choose a different warning color to represent these areas. Click *Apply, Done*, and then *Close*.
41. After you finish outlining all Georgia areas with the lowest physical activity, click the *Details* button on the basemap toolbar. Click the *Content* button to display a list of your layers.

### Save your Map

42. Click the *Save* button on the *Find Window* toolbar.

## Spatial Analysis

43. Turn off (i.e., uncheck) all layers except those you have digitized (i.e., *Georgia Counties with Highest Obesity Rates*, *Areas with the Lowest Median Income*, and *Georgia Areas with the Highest Physical Inactivity Levels*).
44. Is overlap visible between your warning colors? If overlap exists, where does this occur?  
**Answer:** Yes, overlap is visible in multiple areas, including Turner County (south-central), in the mideast portion of Georgia, and the southwest.
45. If overlap exists, does it primarily occur in cities, suburbs, or in rural areas? Why do you think this is the case?  
**Answer:** Overlap appears to occur in rural areas.

In questions 46-48, you will compare your data. Please note that comparing 2007 obesity data with 2012 income and physical inactivity data has several limitations. As you answer the following questions consider how those limitations could affect your analysis.

46. Compare *Georgia Counties with the Highest Obesity Rates* and *Georgia Tracts with the Lowest Median Income*. Do you see any patterns? If yes, what are they?  
**Answer:** Overlap occurs in 2 areas (the mideast and southwest). These data might indicate that an association exists between income and obesity.
47. Compare *Georgia Areas with the Highest Physical Inactivity Levels* and *Georgia Tracts with the Lowest Median Income*. Do you see any patterns? If yes, what are they?  
**Answer:** No overlap is apparent between physical inactivity levels and lowest income levels in Georgia.
48. Compare *Georgia Areas with the Highest Physical Inactivity Levels* and *Georgia Counties with the Highest Obesity Rates*. Do you see any patterns? If yes, what are they?  
**Answer:** Overlap does not occur between physical inactivity levels and highest obesity levels in Georgia.
49. What factors (other than physical inactivity and income) may contribute to high obesity rates?  
**Answer:** Answers will vary, but might include access to physical activity or access to health foods.
50. Briefly describe an obesity prevention program that you would put into place on the basis of the area that is most in need.  
**Answer:** Answers will vary.

Complete your Exit Ticket on the basis of your analysis.

## Appendix 5: Worksheet 4: Exit Ticket

### Exit Ticket

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Describe 3 things you learned today.

2. Describe 1 thing you want to learn more about.

## Appendix 6A: Worksheet 5: Scavenger Hunt

# Scavenger Hunt

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Access the following website to find answers to these questions.  
<http://www.sciencebuddies.org/science-engineering-careers/health/epidemiologist>.

1. What do epidemiologists do?
2. List 2 potential projects on which epidemiologists might work.
3. What education do epidemiologists need?
4. What other qualifications do epidemiologists need?
5. List crucial requirements that epidemiologists need to be successful in their career.

6. If you wanted to be an epidemiologist, on which subjects should you do well in high school?
  
7. What is the median salary for an epidemiologist?
  
8. What is the projected job growth for this field in the next decade?
  
9. Identify at least 3 companies that hire epidemiologists.
  
10. What is the difference between a research epidemiologist and a clinical epidemiologist?

## Appendix 6B: Worksheet 5: Scavenger Hunt, Answer Key

# Scavenger Hunt

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Access the following website to find answers to these questions.

<http://www.sciencebuddies.org/science-engineering-careers/health/epidemiologist>.

1. What do epidemiologists do?

**Answer:** Epidemiologists are medical scientists who investigate and describe factors that influence the development of disease, disability, and other health outcomes. They formulate means for prevention and control.

2. List 2 potential projects on which epidemiologists might work.

**Answer:** Answers will vary. An epidemiologist might analyze what types of diets are most effective at preventing heart disease, analyze data to determine what factors influence the development of a disease (e.g., diabetes), or travel to the Democratic Republic of the Congo to help monitor and contain an outbreak of the deadly Ebola virus.

3. What education do epidemiologists need?

**Answer:** To become an epidemiologist, you must have at least a master's degree from a school of public health. In certain cases, you might need a PhD or a medical degree, depending on the work you will do. Clinical epidemiologists or research epidemiologists who work in hospitals and health care centers often must have a medical degree with specific training in infectious diseases. You will need to be a licensed physician (having passed a licensing examination) if you are going to administer drugs in clinical trials. Epidemiologists who are not licensed physicians frequently work closely with persons who are licensed.

4. What other qualifications do epidemiologists need?

**Answer:** Epidemiologists should be able to work independently or as part of a team and be able to communicate clearly and concisely, both orally and in writing. Epidemiologists in private industry, especially persons who aspire to consulting and administrative positions, should possess strong communication skills so that they can provide instruction and advice to physicians and other health care professionals.

5. List crucial requirements that epidemiologists need to be successful in their career.

**Answer:** Meticulous, analytical, logical, sensitive to other cultures, able to work independently or in groups, along with excellent communication skills and a strong desire to help people.

6. If you wanted to be an epidemiologist, on which subjects should you do well in high school?  
**Answer:** Biology, chemistry, physics, geometry, algebra II, precalculus, calculus, and English; if available, computer science, statistics, physiology, and biomedical science.
7. What is the median salary for an epidemiologist?  
**Answer:** \$64,220.
8. What is the projected job growth for this field in the next decade?  
**Answer:** Substantially greater than average, and projected to be  $\geq 21\%$ .
9. Identify at least 3 companies that hire epidemiologists.  
**Answer:** Answers will vary, but might include state or local health departments, hospitals, the Centers for Disease Control and Prevention, Kaiser Permanente, MedImmune, or the National Institutes of Health.
10. What is the difference between a research epidemiologist and a clinical epidemiologist?  
**Answer:** Answers will vary. Research epidemiologists conduct studies to determine how to eradicate or control infectious diseases. For example, they often focus on research to determine the incidence of a particular disease in a particular part of the world. They might study different diseases (e.g., tuberculosis, influenza, or cholera) and often focus on epidemics. Research epidemiologists work at colleges and universities, schools of public health, medical schools, and research and development services firms.  
Clinical epidemiologists mainly work as consultants in hospitals, informing medical staff of infectious outbreaks and providing ways to control the spread of infection. In addition, clinical epidemiologists are usually the persons who develop a hospital's standards and guidelines for the treatment and control of infectious diseases.

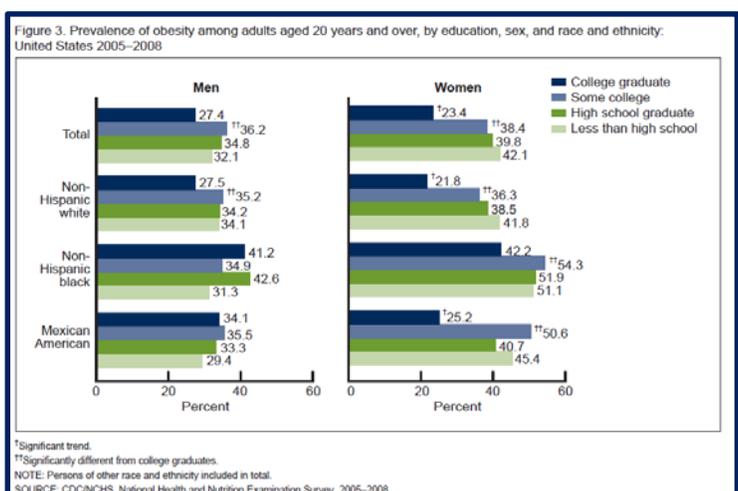
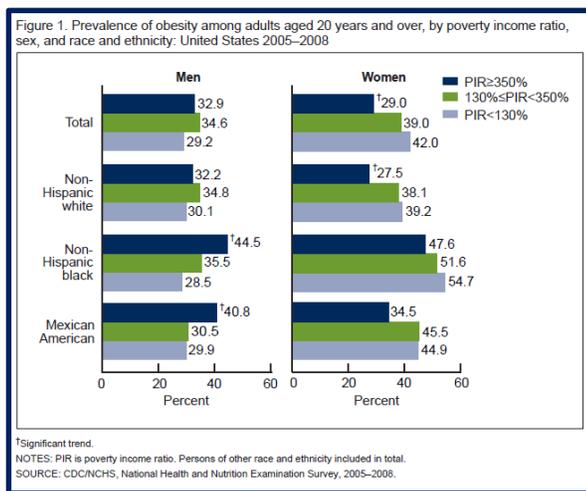
## Appendix 7: Teacher Handout: Assumption Buster

# Assumption Buster

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Data are not always as what they appear. Obesity is based on multiple factors and caution is needed in drawing conclusions without having the entire set of data. Review CDC's Obesity and Socioeconomic Status in Adults: United States, 2005–2008, available at: <http://www.cdc.gov/nchs/data/databriefs/db50.pdf>. Discuss findings in the GIS activity and this research article. The following are the important findings from the article to consider.



### Key findings

- Among men, obesity prevalence is similar at all income levels; however, among non-Hispanic black and Mexican-American men, persons with higher income are more likely to be obese than persons with low income.
- Women with a higher income are less likely to be obese than women with a low income, but the majority of women who are obese not among low-income earners.
- No substantial association between obesity and education among men has been reported. However, among women, an association has been reported. Women with a college degree are less likely to be obese, compared with less-educated women.
- The prevalence of obesity increased among adults at all income and education levels during 1988–1994 and 2007–2008.

## Appendix 8A: Summative Assessment

# Geographic Inquiry Process Quiz

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Please provide an answer for each of the following questions.

1. Define *obesity*.
2. List the 5 steps of the geographic inquiry process.
3. Explain how you have applied each step of the geographic inquiry process during the past days.
4. Briefly explain how someone would add data to ArcGIS Online.
5. Briefly explain the zoom-in and zoom-out process in ArcGIS Online.
6. Describe the association between obesity and income in Georgia that you observed by overlaying data in ArcGIS Online.



## Appendix 8B: Summative Assessment, Answer Key

# Geographic Inquiry Process Quiz

Name: \_\_\_\_\_ Answer Key \_\_\_\_\_

Date: \_\_\_\_\_

Directions: Please provide an answer for each of the following questions.

1. Define *obesity*.

**Answer:** For adults, overweight and obesity ranges are determined by using weight and height to calculate a number known as the body mass index (BMI). BMI is used for the majority of persons because it correlates with their amount of body fat. An adult who has a BMI of 25–29.9 is considered overweight. An adult who has a BMI  $\geq 30$  is considered obese.

2. List the 5 steps of the geographic inquiry process.

**Answer:** (1) Ask a geographic question; (2) acquire geographic resources; (3) explore geographic data; (4) analyze geographic information; and (5) act on geographic knowledge.

3. Explain how you have applied each step of the geographic inquiry process during the past days.

**Answer:** Answers will vary, but should identify their work with ArcGIS.

4. Briefly explain how someone would add data to ArcGIS Online.

**Answer:** Click the *Add* button in the toolbar. In the drop down menu, click *Search for Layers*. Type the data you are searching for in the *Find:* space. Leave the default for the *In:* space as ArcGIS Online. Add the layer to the GIS. Click *Done Adding Layers*.

5. Briefly explain the zoom-in and zoom-out process in ArcGIS Online.

**Answer:** Answers will vary, but should include one of the following: (1) hold down the Shift key; left click your mouse; and drag a box; or (2) use the zoom function with the plus and minus arrows.

6. Describe the association between obesity and income in Georgia that you observed by overlaying data in ArcGIS Online.

**Answer:** Overlap in 2 areas of Georgia might indicate an association exists between income and obesity.

7. Were you able to confirm this association? Why or why not?  
**Answer:** Answers will vary. No; too many other factors are involved to determine that conclusion.
8. Compare GIS as an exploratory science with epidemiology as a confirmatory science. Hint: Explain how each science is used.  
**Answer:** GIS is an exploratory science because of the following reasons: (1) ask a question about location-based associations in the world around you; (2) acquire geographic resources by identifying data and information that you need to answer your question; (3) explore data by turning the data into maps, tables, and graphs, and look for patterns and associations; (4) analyze geographic information by determining what the patterns and associations might mean with respect to your question; and (5) act on geographic knowledge by using the results of your work to educate, make a decision, or solve a problem. In epidemiology, you also identify patterns and make group comparisons. In epidemiology, unlike GIS, you can identify association and judge causation through research and clinical epidemiology. The ability to draw conclusions about association and causation in epidemiology make it a confirmatory science, whereas in GIS, you cannot draw such conclusions leaving it solely an exploratory science.
9. Describe the work of an epidemiologist.  
**Answer:** Epidemiologists are medical scientists who investigate and describe factors that influence the development of disease, disability, and other health outcomes. They formulate means for prevention and control.
10. Describe a potential project on which an epidemiologist might work.  
**Answer:** Answers will vary. An epidemiologist might analyze what types of diets are most effective at preventing heart disease; analyze data to determine what factors influence the development of a disease (e.g., diabetes); or travel to the Democratic Republic of the Congo to help monitor and contain an outbreak of the deadly Ebola virus.