

# *Introduction to Human Geography with ArcGIS*

## **Chapter 2 Exercises**

### **Exercise 2.1: Spatial distribution of population**

#### **Introduction**

A key first step in understanding human geography is being able to map where humans live. In this exercise, you will use ArcGIS Online to explore arithmetic density, physiographic density, and agricultural density. You will then use a dot density map of population to compare the spatial distribution of human populations with different environmental characteristics to assess the role that the natural environment plays in these distributions.

#### **Objectives**

- Explore map layers of population density.
- Investigate the relationship between population distribution and environmental characteristics.

#### **Explore arithmetic, physiographic, and agricultural density maps**

In this section, you will explore map layers of arithmetic density, physiological density, and agricultural density and consider how this information helps us understand the accomplishments and challenges facing different countries.

**1. Open the Chapter 2 Population Densities app:**

- <https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=55b7c346efd742aeb0f5ed9594110719>

The app includes layers of arithmetic density, physiological density, and agricultural density.

2. Click the Layer List and Legend buttons  to see the different layers and map legends.
3. Zoom and scroll around the map to answer the following questions. You can also click each country to see its name and density information.

**Question 2.1.1**

Based on the textbook, define arithmetic density.

**Question 2.1.2**

List two countries with high arithmetic density that are richer.

List two countries with high arithmetic density that are poorer.

**Question 2.1.3**

Why do you think arithmetic density has no spatial relationship with level of development?

4. Click the Layer List button, then turn off the Arithmetic Density layer and turn on the Physiological Density layer.

#### **Question 2.1.4**

Based on the textbook, define physiological density.

#### **Question 2.1.5**

List two countries where a high physiological density may be a problem.

List two countries where a high physiological density may not be a problem.

#### **Question 2.1.6**

Explain why a high physiological density can be a problem for some countries but not for others.

- 5. Click the Layer List button, then turn off the Physiological Density layer and turn on the Agricultural Density layer.**

#### **Question 2.1.7**

Based on the textbook, define agricultural density.

#### **Question 2.1.8**

List two countries with a high agricultural density.

List two countries with a low agricultural density.

#### **Question 2.1.9**

Explain why high agricultural density can reflect low agricultural productivity.

## Population distribution: How do elevation and bioclimates impact where we live?

The text described the larger population clusters found around the world. In this section, you will explore in more detail where people are clustered and compare the clusters to environmental and physical characteristics of the earth.

### 1. Open the Chapter 2 Population Distribution map and sign in to your account:

- <http://arcg.is/1WQBzUw>

The map opens with the World Countries and World Population Estimated Density 2015 layers activated.

### 2. Observe population distributions by scrolling around the map and zooming in and out.



### 3. Compare population distributions to elevation and bioclimates:

- **Turn on World Elevation GMTED.**

The darker shades of green represent lower elevations, while the darker shades of brown represent higher elevations.

You can turn layers on and off to get a better view of the relationship between population density and elevation.

### Question 2.1.10

Asia:

- Zoom in to China. Describe how elevation impacts population distribution. Where are there higher densities? Where are there lower densities?
- Zoom in to Northern India/Nepal/Bhutan. Describe how elevation impacts population distribution.
- What is the large high-elevation plateau that influences population distributions in these areas? Search online and give a short description.

Europe:

- Why are there lower population densities along the northern border of Italy and the border between Spain and France?

Africa:

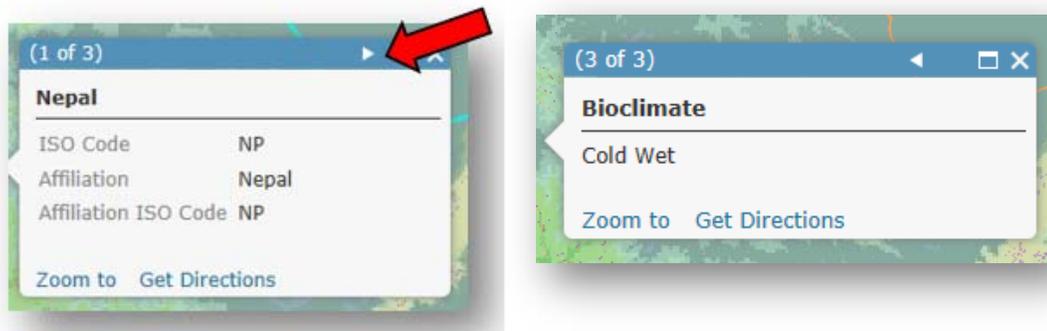
- Zoom to Ethiopia. Describe how elevation impacts population distribution.

Latin America:

- Zoom to the capital cities of Guatemala (Guatemala City), El Salvador (San Salvador), Nicaragua (Tegucigalpa), and Costa Rica (San Jose). Describe the elevation of these cities.

- **Turn on World Bioclimates (and turn off World Elevation GMTED)**

You can click each bioclimate in the map to see a description. If the pop-up window shows the country name, click the little forward arrow to see the next window.



### Question 2.1.11

Asia:

- Look again at China and Northern India/Nepal/Bhutan. Which types of bioclimates, in terms of precipitation and temperature, have higher population densities?

Europe:

- Return to Northern Italy and the Spain/France border. Which type of bioclimate has lower population densities?

Africa:

- Return to Ethiopia. Which types of bioclimates, in terms of precipitation and temperature, have higher population densities?

### Question 2.1.12

- Based on your findings from the preceding questions, explain how elevation and bioclimate impact human settlement patterns.

### Conclusion

In this exercise, you saw how ArcGIS can be used to explore data layers, such as population density. You also explored how environmental variables, such as elevation and bioclimates, influence population distributions around the world.

## Exercise 2.2: Fertility rates

### Introduction

Fertility rates have a large spatial variation, both between countries and within them. In this exercise, you will explore variations in fertility at a country scale and think about what may cause this variation. You will also look at the spatial variation of teen fertility rates around your school and discuss how neighborhoods and opportunities impact these rates.

### Objectives

- Explore spatial data on total fertility rates.
- Hypothesize about why fertility rates may vary from place to place.
- Analyze patterns of teen fertility rates in your region.

## Total fertility rate at the global scale

### 1. Open the Chapter 2 – Population Components app:

- <https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=014450839ae54298bcc6b704648af1ba>

At this point, you will explore the total fertility rate layer, forming hypotheses as to why it varies around the world. More advanced analysis will come in a later exercise, after you are armed with more knowledge about population dynamics.

### 2. Turn on the Total Fertility Rate 2015 layer.



You can click each country to see its 2015 TFR.

### 3. Click the Legend button to show the legend.

#### Question 2.2.1

What is the TFR for the lowest two categories? Based on the idea of replacement fertility, explain what the long-term prognosis may be for population size in these countries.

### **Question 2.2.2**

There is a large cluster of high fertility rates in Africa. What economic, cultural, or political factors may account for this?

### **Question 2.2.3**

Zoom in to Europe. France and Ireland have higher fertility rates than the rest of the continent. What are their rates? What could be some factors leading women in those countries to have more children?

### **Question 2.2.4**

In Asia, you can see that South Korea, China, and Japan have low fertility rates. What are their rates? What could be causing this?

### **Question 2.2.5**

What are the TFRs in the United States and Canada? Why are women having so few children in these countries? If you live there, what affects the number of children you will have? Does this help you understand fertility patterns in other countries?

## **Teen birth rates at the local scale**

In this exercise, you will explore birth rates for the 15–19 age group to analyze teen pregnancies in your region. First, it is important to understand the role that opportunity cost plays in fertility decisions. Opportunity cost is a concept from economics that says that all decisions have tradeoffs, or foregone opportunities. If a woman has a child, for example, she forgoes all the other things she could do with the time and money that caring for the child

entails. As you explore the patterns of teen fertility, think about the opportunities that teens have in areas with higher rates of teen pregnancy versus those in areas with lower rates of teen pregnancies. What opportunities does a teen forgo when she has a child in one type of neighborhood versus another? How can these differences in opportunities impact the fertility rate?

The data in this map represents the proportion of women aged 15–19 who gave birth in the previous year.

**4. Open the Chapter 2 – Teen Births map and sign in to your account:**

- <https://arcg.is/fHn9K>

The map opens showing the Lexington, Kentucky, region.

**5. Browse to a city of your choice in the United States and its surrounding region.**

**The scale bar on the map should show 4 miles, as follows.**

Don't zoom in too much, since you want to see some broader regional patterns. Also, if you zoom out too much you may get a warning that not all features are drawn.

(Be sure to find a location where census tracts have a value over zero.)



You can also set the transparency to see the underlying basemap.



### Question 2.2.6

Visually can you see any patterns? Which places seem to have higher teen birth rates and which seem to have lower ones?

6. **Run a hot spot analysis. This may help you see more clearly where the concentrations of census tracts with high teen birth rates are and where concentrations of low teen birth rates are.**
  - **Click the Analysis button > Analyze Patterns > Find Hot Spots.**
    - **Choose layer for which hot spots will be calculated: Teen Births**
    - **Find clusters of high and low: Teen\_Birth\_Rate (Be sure to use Teen\_Birth\_Rate, not Teen\_Births, which is just a count of births.)**
    - **Give your result layer a unique name.**
  - **Make sure that Use current map extent is checked so that you only analyze the tracts in your map view.**
  - **Click Show Credits. You should use less than 2 credits. If not, zoom in on your map and then check credits again.**

- **Click Run Analysis.**

 Find Hot Spots i ◀

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**1 Choose layer for which hot spots will be calculated** i

Teen Births ▼

**2 Find clusters of high and low** i

Teen\_Birth\_Rate ▼

**3 Divide by (optional)** i

None ▼

+ Options i

**4 Result layer name** i

You can turn off the Teen Births layer to see your new Hot Spot layer more clearly.

### Question 2.2.7

Which places have clusters of higher teen birth rates and which have clusters of lower ones?  
Give specific examples of cities or neighborhoods.

### Question 2.2.8

What may cause these clusters? Do opportunities for young women differ in hot spot and cold spot areas?

## Conclusion

In this exercise, you explored fertility rates at a global and local scale and thought about why they vary from place to place. Later in the chapter, you will learn some theories that attempt to explain the reasons behind the spatial variation of fertility.

## Exercise 2.3: Death rates and natural increase

### Introduction

In this exercise, you will explore how measurements of death rates play out on a global scale. First, you will observe how the age structure can affect crude death rates (CDRs) and consider why these rates can vary among similar countries with similar structures. Next you will look at infant mortality and how it relates to female education and economic development. After that you will view life expectancy levels and think about why they may be higher in countries other than yours. Last, you will calculate the natural increase rate and make a map showing where countries are seeing growing populations and where they are seeing shrinking populations.

### Objectives

- Identify countries with similar age structures.
- Analyze how age structure and other variables impact the crude death rate.
- Use map classification to identify quintiles.
- Explore the relationship between infant mortality, economic development, and female education.
- Consider why life expectancy in your country differs from other countries.

- Calculate and map natural increase rates.

### What factors affect the crude death rate (CDR)?

As you now know, crude death rates can be affected by the age structure of a population. Places with more elderly generally have higher crude death rates, while places with more young people generally have lower crude death rates. However, even countries with similar age structures can have very different crude death rates, due to economic, political, and environmental factors. In this exercise, you will identify countries with similar age structures, then explain why their crude death rates may differ.

#### 1. Open the Chapter 2 – Age Structure and CDR map and sign in to your account:

- <http://arcg.is/2cwD6e4>

#### 2. Identify countries with old-age structures:

- **Hover over the Chapter 2 – Age Structure and CDR layer and click Show**

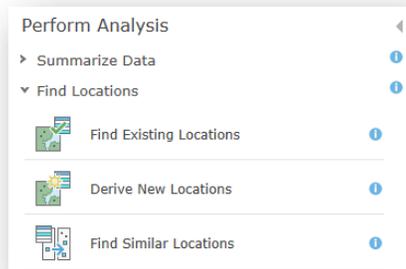
**Table**  .

- **Click the Age65plus field heading and choose Sort Descending.**



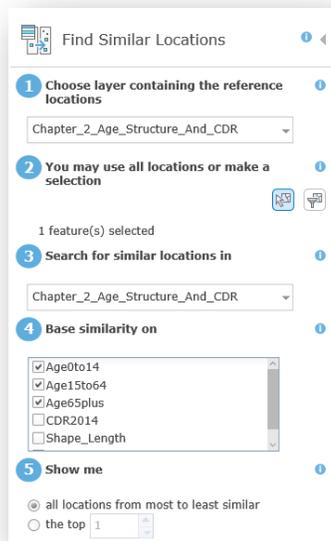
Country_Esri	ISO3	Age0to14	Age15to64	Age65plus
Guyana	GUY	29.81	65.33	4.86
Cyprus	CYP	16.75	70.69	12.56
Egypt	EGY	32.98	61.85	5.17
Suriname	SUR	27.13	66.07	6.80

- **Write down the name of the country with the largest proportion of people 65 years of age or older. This will be the country you use for finding old-age countries.**
- **Click the Analysis button > Find Locations > Find Similar Locations.**



- **In the Find Similar Locations window, set the parameters as follows:**
  - **In step 1, select Chapter\_2\_Age\_Structure\_And\_CDR.**
  - **In step 2, click the select button . In the map, click the country you wrote down previously. (It will be highlighted on the map and in the table when you make the selection.)**
  - **In step 3, select Chapter\_2\_Age\_Structure\_And\_CDR.**
  - **In step 4, check Age0to14, Age15to64, and Age65plus.**
  - **For step 5, Show me: the top 25**
  - **For the result layer name in step 6, give your layer a unique name.**

- **Use current map extent: uncheck so that all countries are used in the analysis.**
- **Check credits. You should use less than one credit. If not, double-check the settings.**
- **Click Run Analysis.**



3. **Map CDR for the 25 most similar countries (in other words, those with old-age structures).**
4. **Hover over the Most Similar layer that you just created and click the Change Style button  .**
5. **In step 1, select CDR2014.**
6. **Click Done.**

The map now shows CDR for the 25 countries that are most like your selected country in terms of age structure. You can view the map legend by hovering over the name of your new layer and clicking the Show Legend button.

**Question 2.3.1**

Of the 25 countries with similar elderly populations, which have higher CDRs?

**Question 2.3.2**

Of the 25 countries with similar elderly populations, which have lower CDRs?

**Question 2.3.3**

Which factors may explain the differences from the previous two questions? Use ideas from the textbook section on Deaths plus other information you can find. Remember, all 25 countries have similar old-age structures, so you need to consider factors other than age structure.

**7. Print or take a screenshot of your map.**

**8. Identify countries with young-age structures:**

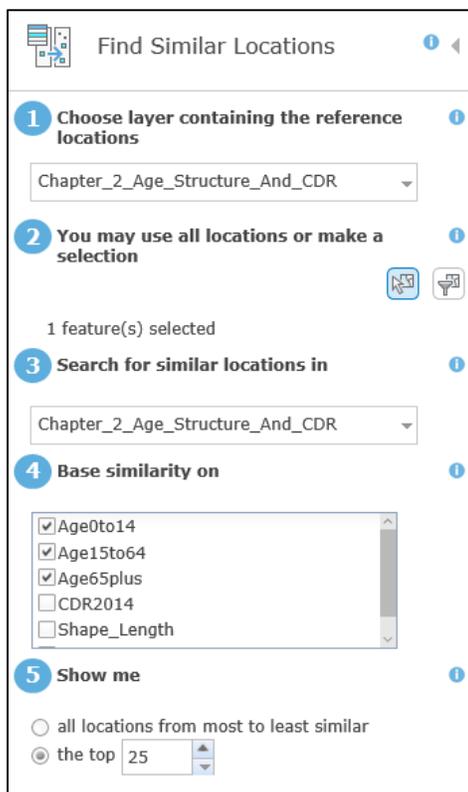
- **Turn off the new Most Similar layer you just created.**
- **Repeat the analysis you just did, but for countries with young-age structures.**

**9. Hover your cursor over the Chapter 2 – Age Structure and CDR layer and click Show Table.**

10. Click the Age0to14 field heading and select Sort Descending.

11. Scroll down the table until you see the country with the largest proportion of people 0 to 14 years of age. Write down the country. This will be the country you use for finding young-age countries in step 2 of the Find Similar Locations analysis tool.

12. Use the Find Similar Locations analysis tool as follows:



The screenshot shows the 'Find Similar Locations' tool interface with the following settings:

- 1 Choose layer containing the reference locations:** Chapter\_2\_Age\_Structure\_And\_CDR
- 2 You may use all locations or make a selection:** 1 feature(s) selected
- 3 Search for similar locations in:** Chapter\_2\_Age\_Structure\_And\_CDR
- 4 Base similarity on:**
  - Age0to14
  - Age15to64
  - Age65plus
  - CDR2014
  - Shape\_Length
- 5 Show me:**
  - all locations from most to least similar
  - the top 25

13. Map CDR for the 25 most similar countries (those with young-age structures).

14. Hover over the Most Similar layer that you just created and click the Change

Style button  .

**15. In step 1, select CDR2014.**

**16. Click Done.**

**Question 2.3.5**

Of the 25 countries with a similar young-age structure, which have higher CDRs?

**Question 2.3.6**

Of the 25 countries with a similar young-age structure, which have lower CDRs?

**Question 2.3.7**

What factors may explain the differences? Use ideas from the textbook section on Deaths plus other information you can find. Remember, all 25 countries have similar young-age structures, so you need to consider factors other than age structure.

**17. Print or take a screenshot of your map.**

**Economic development and female education: Impact on infant mortality**

The text explains how infant mortality is closely tied to economic development and education, especially of women. In this section, you will examine that relationship, using map layers on the infant mortality rate, female primary-school completion rate, and per capita income.

**1. Open the Chapter 2 – Infant Mortality Exercise map and sign in to your account:**

- <http://arcg.is/2di2rN0>

## 2. Look at the Infant Mortality Rate layer.

Based on what you already know, which types of countries appear to have higher rates?

Which have lower?

### Question 2.3.8

Turn off the Infant Mortality Rate layer and turn on the Per Capita Income layer. By visually comparing the maps, does there appear to be a spatial relationship between infant mortality and per capita income?

### Question 2.3.9

Turn off the Per Capita Income layer and turn on the Female Primary School Completion Rate layer. (Note that data is not available for all countries.) Visually, does there appear to be a relationship between female education and infant mortality?

Now let's quantitatively compare the layers by looking at the average value of each variable for all countries, compared with the average value for countries with high infant mortality rates.

## 3. Determine the average value for each variable:

- **Hover over the Infant Mortality Rate layer and click Show Table  .**
- **In the table, click the PerCapIncome2013to14 field heading and select Statistics. Write down the average value in the first row of the table (question 2.3.10).**

Country_Esri	ISO3	PerCapIncome2013to14	InfantMortalityRate2014	PrimarySchoolFemale2010to14
Guyana	GUY	4,030.00	81.49	
Cyprus	CYP	26,510.00	100.10	
Egypt	EGY	3,210.00	104.27	

4. Repeat the process for InfantMortality2014 and PrimarySchoolFemale2010to14.

5. Filter for the top quintile of countries and find average values.

These will then be compared with the average for all countries.

6. Hover over the Infant Mortality Rate layer and select Filter .

7. In the Filter window, create the expression:

- InfantMortality2014 is at least 44.

This is the cutoff point for the top quintile, as seen in the map legend.

- Click Apply Filter.

You have now selected only the countries in the top quintile for infant mortality.

8. Just as you did previously, hover your cursor over the Infant Mortality Rate layer and click Show Table.

9. In the table, click on the PerCapIncome2013to14 filed heading and select Statistics. Write down the average value in the second row of the table (question 2.3.10).

**10. Repeat for Infant Mortality 2014 and Primary School Female 2010 to 14.**

**Question 2.3.10**

	<b>Per Capita Income</b>	<b>Infant Mortality</b>	<b>Primary School Female</b>
Average, all countries			
Average, top infant mortality quintile			

**Question 2.3.11**

In a paragraph, explain how economic development and female education relate to infant mortality.

**Question 2.3.12**

What types of policies would you implement to further reduce the infant mortality rate?

**Life expectancy: Where do people live longer than you?**

In this short section, you will explore the life expectancy map and think about factors that contribute to the variation in values.

**1. Open the Chapter 2 – Population Components app:**

- <https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=014450839ae54298bcc6b704648af1ba>

**2. Turn on the Life Expectancy 2015 layer. (First click the Layer List icon on**

**mobile devices .)**

3. **Observe where life expectancy is high and where it is low.**
4. **Click the Open Attribute Table tab at the bottom of the screen**  **to open the attribute table.**
5. **Click the Life Expectancy field heading in the table and select Sort Descending.**
6. **Scroll down until you see the United States (or the country where you live). Make note of the life expectancy.**
7. **Scroll up and observe the countries with life expectancies higher than your country.**

#### **Question 2.3.13**

Name the countries and write a list of factors that may explain why those countries have a higher life expectancy than yours. How do economic and lifestyle conditions differ and how may this affect life expectancy?

#### **Natural increase: Where are populations shrinking and growing?**

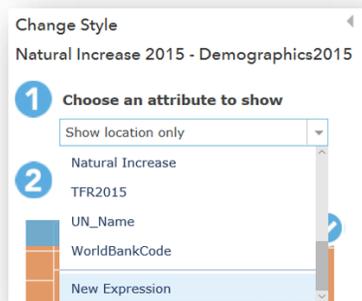
In this section, you will calculate the natural increase rate for all countries of the world, then make a map showing which countries (excluding migration) have shrinking populations, which have stable populations, and which are growing.

1. **Open the Chapter 2 – Population Components map and log in to your account:**
  - <http://arcg.is/2diuhZs>
2. **If necessary, click the Content tab**  Content .

3. Turn on the Natural Increase 2015 layer. It opens with all countries as a single color.

4. Make a choropleth map of Natural Increase.

- Click on the Change Style button  under the Natural Increase 2015 layer name.
- Scroll down and select New Expression.



- In the Custom expression window, click the CBR2105 (Crude birth rate) and CDR2015 (crude death rate) to calculate Natural Increase.



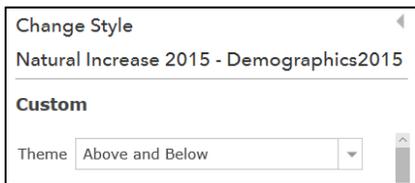
- Based on your textbook, select the correct formula for use in the Custom window:

- $\$feature.CBR2015 - \$feature.CDR2015$

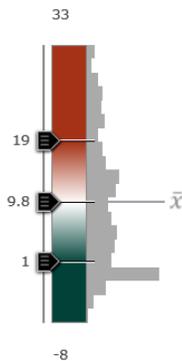
- $\$feature.CDR2015 - \$feature.CBR2015$
- Once you have the correct formula in the Custom expression window, click OK.

5. In the Change Style window:

- In step 2, select Counts and Amounts (Color), then Options.
- Next to Theme, click the drop-down arrow and select Above and Below.



- Set the lower value (currently 1) to -1, then set the middle value (currently 9.8) to 0.



- Click OK.

Your map now shows countries close to zero population growth in white (or off-white), with those below 0 facing shrinking populations, and those above facing growing populations. All of these exclude the impact of migration.

#### **Question 2.3.14**

Name some of the countries with negative natural increase—in other words, those that have shrinking populations.

#### **Question 2.3.15**

Name some of the countries that are growing at faster rates.

#### **Question 2.3.16**

Take a screenshot of your map and insert it in the document.

### **Conclusion**

In this exercise, you saw how age structure, female education, and economic development can impact measurements of deaths. You also considered how other factors, such as lifestyle, can affect the longevity of a population. Finally, you used the power of ArcGIS Online to quickly calculate and map data to show the spatial distribution of natural increase.

## **Exercise 2.4: Population structure**

### **Introduction**

While the number of people in a particular place is of essence when studying population geography, equally important are the age and sex structure of that population. In this exercise, you will first explore how population pyramids, as graphical representations of age-sex

structure, can be used to understand local scale population patterns and inform decisions on business site selection. You will then examine how age-sex structures impact the dependency ratio at a global scale of analysis.

## Objectives

- Explore how population pyramids can be a guide for locating business and services establishments.
- Calculate dependency ratios and describe the problems countries face due to them.

## Population pyramids: A tool for site selection

The chapter describes population structure at the national scale and how it can impact government finances and opportunities for economic growth. But population structure at a more local scale is also of interest to geographers and others. In this section, you will look at population structures with a 1-mile ring at different locations in your area. Based on this information, you will consider how this information can be useful in site selection of businesses and services.

### 1. Open the following map:

- [https://developers.arcgis.com/javascript/3/samples/geoenrichment\\_infographic/](https://developers.arcgis.com/javascript/3/samples/geoenrichment_infographic/)

### 2. Zoom to a city of your choice in the United States.

### 3. Click anywhere on the map and you will see an infographic with a population pyramid for the 1-mile ring, along with a comparison to the county in which the ring is located.

### Question 2.4.1

Think about your city and other places in the United States.

Find pyramids with:

- The highest proportion 65+.
- The highest proportion 14 and under.
- The largest female proportion.
- The largest male proportion.
- The lowest dependency ratio (largest 15–64 proportion).

**4. Use the Windows Snipping tool on your computer, or a screenshot, to save the image of your population pyramids. Insert the image in the document, along with text stating which of the above categories it corresponds to.**

Your instructor may have you bring printouts of your pyramids to class for a competition on who can find the most extreme examples.

### Question 2.4.2

Describe what types of businesses or services you would locate in or near each of your selected pyramids. Explain why you chose those specific businesses and services.

### Dependency ratio: Where are the largest dependent populations?

In this exercise you will calculate age dependency in three ways: the proportion of young to working age, the proportion of old to working age, and the total dependency ratio.

1. Open the Chapter 2–Age Dependency map and sign in to your account:

- <http://arcg.is/22ugm31>

2. Click the Content tab if necessary  Content .

3. Calculate the Old Age Dependency Ratio.

4. Hover over the Old Age Dependency Ratio layer and click the Change Styles

button  .

5. In the Change Style window:

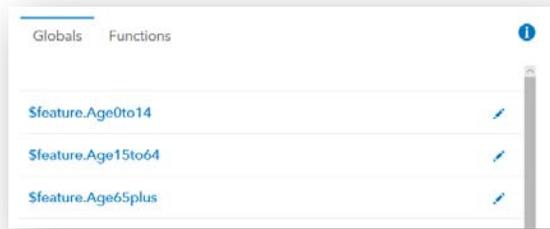
- Choose an attribute to show: New Expression



- In the Custom expression window, calculate the old age dependency ratio. This is the ratio of elderly to the working age population:

$\text{Age65Plus} / \text{Age15to64}$ .

- Click the field names in the Custom expression window to create the expression.



- **In the Change Style window, click Counts and Amounts (Color), click Select, then click Done.**
- 6. Calculate the Young Age Dependency Ratio:**
- **Turn off the Old Age Dependency Ratio layer and turn on the Young Age Dependency Ratio layer.**
  - **Repeat steps 3 through 6 to calculate values for the Young Age Dependency ratio. The expression in this case is the ratio of young people to the working age population:  $\text{Age0to15} / \text{Age15to64}$ .**
- 7. Calculate the Total Dependency Ratio.**
- **Turn off the Young Age Dependency Ratio layer and turn on the Total Dependency Ratio layer.**
  - **Repeat steps 3 through 7 to calculate values for the Total Dependency ratio. This includes both the young and old relative to the working age population:  $(\text{Age0to15} + \text{Age65Plus}) / \text{Age15to64}$ .**

### **Question 2.4.3**

Where are there clusters of countries with high old-age dependency ratios?

### **Question 2.4.4**

What are problems that these countries are facing due to their high old-age dependency ratios?

### **Question 2.4.5**

Where are there clusters of countries with high young-age dependency ratios?

### **Question 2.4.6**

What are problems that these countries are facing due to their high young-age dependency ratios?

## **Conclusion**

In this exercise, you saw the importance of understanding the age-sex structure of populations. This type of information is useful in business site selection at a local scale, and at a smaller scale, for investment and spending planning for countries.

## **Exercise 2.5: The demographic transition in Latin America**

### **Introduction**

Latin America has gone through a dramatic demographic transition since the second half of the twentieth century. Birth rates and death rates have fallen substantially, and the days of rapid population growth are now over. In fact, some countries are approaching situations like many European countries, where births have fallen below replacement level. In this exercise,

you will view changes in the total fertility rate between 1960 and 2015. You will then look at some of the variables that have been associated with falling fertility to assess their relationship with Latin America's decline in births.

## Objectives

- Explore changes in the total fertility rate in Latin America.
- Apply the Demographic Transition theory to explain changes in fertility.

### 1. Open the Chapter 2–Latin American Fertility Transition web app:

- <https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=655243d246ae4e4881eced90ef665e71>

The map opens with the Total Fertility Rate – 1960 to 2015 layer turned on.

This layer is time enabled, so you can see how the TFR changes between 1960 and 2015.

The map begins by showing total fertility rates in 1959.

2. Click the time slider button  and look at the 1959 TFRs.
3. Hover your cursor over the time slider box near the bottom of the screen.  
**Pause the slider if necessary and use the previous arrow to move the slider to the far left.**



4. Click the countries to see TFRs in 1959.

#### Question 2.5.1

How many children was the average woman having in 1959? What and where was the highest rate? The lowest?

5. Click the Next and Previous buttons on the time slider at the bottom of the screen to manually change the year.
6. Move the slider to the far right and again click the countries.

#### Question 2.5.2

What were some of the TFRs in 2014? What and where was the highest rate? The lowest?

7. Click Layer List button , turn off the first layer, and turn on the Fertility Transition layer.

This shows the TFR for 2015. The classification scheme and color are different from the first layer so that you can see current differences between countries more easily.

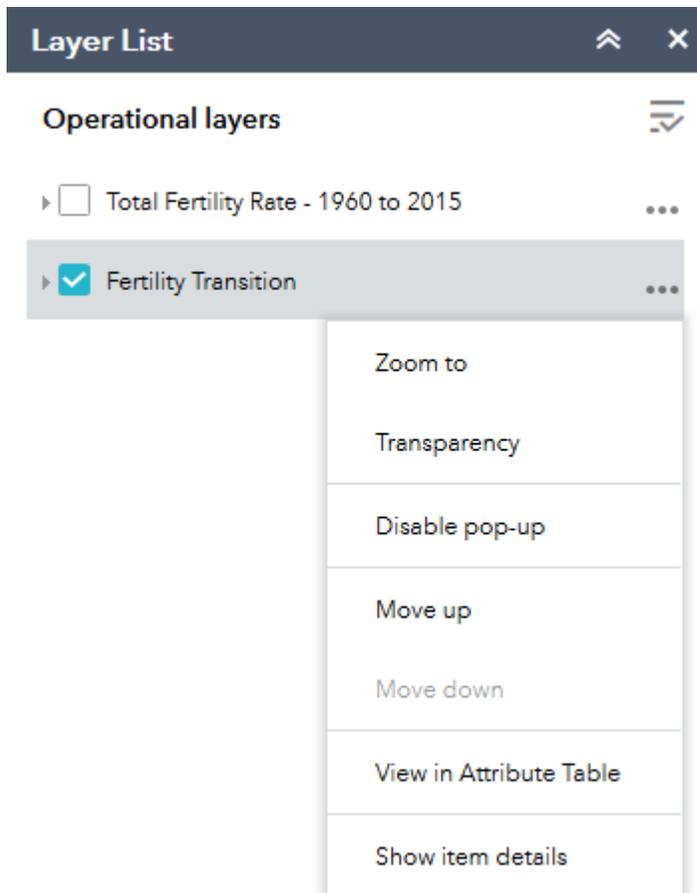
8. Click some of the countries to see the TFR, plus data on the percentage of the population living in rural areas, the infant mortality rate, and the primary school completion rate for women.

#### Question 2.5.3

Based on the chapter reading on the Demographic Transition theory, explain why these variables can help predict changes in fertility rates.

9. Compare the average values for the variables by grouping countries into high TFRs and low TFRs.

- Open the attribute table for the Fertility Transition layer by clicking the three dots to its right, then selecting View in Attribute Table.



10. Filter and calculate averages for the countries with the highest TFR.

- First, make sure that all countries are used. In the attribute table, click Filter by map extent so that it is not highlighted. At the bottom of the attribute table you should see 20 features 0 selected. This indicates that all 20 countries will be used for your calculations.

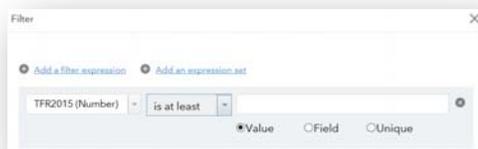
Fertility Transition	
Options	Filter by map extent
Country_Esri	
Guyana	
Suriname	
Venezuela	
Argentina	
Bolivia	
Brazil	
Chile	

20 features 0 selected

- **Click Table Options, then click Filter.**



- **Click Add a filter expression, and set the filter so that TFR2015 is at least 2.558.**



This filters for the four (20 percent) countries with the highest TFRs.

- Click OK in the Filter window.
- Click the field headings in the table for PercentRural2015, InfantMortality2015, and FemalePrimaryCompletion, and then click Statistics. Write the Average in the following table under the Highest 20% TFR column.
- Click Table Options, then click Filter.
- Click Table Options, then Filter.
- Set the filter so that TFR2015 is at most 1.90.
- Click OK.

This filters for the four (20 percent) countries with the lowest TFRs.

**11. As previously, click the field headings and click Statistics. Write the Average in the following table under the Lowest 20% TFR column.**

#### Question 2.5.4

Average	Highest 20% TFR	Lowest 20% TFR
PercentRural2015		
InfantMortality2015		
FemalePrimaryCompletion		

#### Question 2.5.5

Based on question 2.5.4, describe how well these three variables explain high and low TFRs.

## Conclusion

In this exercise, you observed how the total fertility rate in Latin American has fallen over the decades. As described in the demographic transition model, you saw how factors such as urbanization, reductions in infant mortality, and female education influence changes in fertility rates.