

Statistical Methods I (MAT152):

This course provides a project-based approach to introductory statistics with an emphasis on using real-world data and statistical literacy. Topics include descriptive statistics, correlation and regression, basic probability, discrete and continuous probability distributions, confidence intervals and hypothesis testing. Upon completion, students should be able to use appropriate technology to describe important characteristics of a data set, draw inferences about a population from sample data, and interpret and communicate results.

Descriptive Statistics and Poverty – Activity 1 by Lisa Creighton

Students will investigate and develop a better understanding of the global issue of poverty in African countries compared to the United States through statistical analysis.

Objective:

The purpose of this lab is to have students investigate poverty in African countries and the United States. Students will use statistical techniques to compare and contrast levels of poverty. Students will create frequency distributions, histograms, and boxplots; and calculate the measures of central tendency, and the five # summary.

Global Learning Outcomes:

- 1) Investigate and understand global issues through statistical analysis.
- 2) Use statistical techniques to draw inferences about global populations.
- 3) Interpret and communicate results in a cultural context.

Global Learning Outcomes for this Activity:

- 1) Investigate and understand global issues through statistical analysis.

Time:

80 minutes

Materials and Resources:

1. Global maps (this is an interactive map by country)
<http://geology.com/world/world-map.shtml>)
2. Copies of the Map of Africa for students (http://www.mapsmaps.ru/wp-content/uploads/2010/10/polit_africa4.gif)
3. Copies of the Map of the United States for students: Printable Map List: States in bright colors
(http://nationalmap.gov/small_scale/printable/reference.html)
4. Reference 1: Portions of the Data from <http://hdr.undp.org/en/composite/MPI>
5. Reference 2: Table based on “Percentage of People in Poverty by State Using 2- and 3- year Averages:”
<https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html>
6. Pencil and paper for individuals.
7. Copies of the attached activity.

Procedure:

The emphasis of this activity is for students to understand the contextual meaning of the statistical analysis performed. Concentrate on reinforcing the meaning as students' progress through the activity.

This activity should be used after teaching Descriptive Statistics. Students will need to be able to create a frequency distribution, histograms, and boxplots, and calculate the measures of central tendency, and the five # summary.

It is expected that students will be given a copy of the following: Map of Africa (Materials #2) and United States Map (Materials #3); African Country Data Set (Materials #4); and United States Data Set (Materials #3 and #5).

- 1) Divide class into groups of 3-4 students. Each student should complete all of the activities on their worksheet.
- 2) Utilizing the Map of Africa and the African Country Data Set, instruct students to place a dot on each country in the data set on the map. This will familiarize students with the geographical location of each country and give them a visual reference of the countries being analyzed.
- 3) Show suggested videos and discuss as a class or in groups what poverty looks like in the different countries. Have students read the definitions of poverty at the end of reference 1 and 2 to gain an understanding of what the data means and if it is really comparable. Students should recognize that more information is really needed to understand the true meaning of the data.
- 4) Monitor student progress as they complete the rest of the activity. The intent is to check student progress as they progress through the activity ensuring that students are drawing reasonable conclusions and to facilitate productive discussions.
- 5) Make sure to emphasize the meaning of the frequency on the frequency distribution and histograms. Students may miss the meaning that the frequency, in the Africa data, represents the number of countries in Africa with the specified percentage of the population below the poverty line and in the United States data, it represents the number of States with the specified percentage of the population below the poverty line.

Assessment:

Students will complete the following activity, documenting their analysis. Grades can be issued for the groups or individually.

MAT 152: Descriptive Statistics Activity

For this activity, you will be analyzing data to compare the **Percentage of the Population Living below the Poverty Line** in 37 developing Countries in Africa and the 50 United States including the District of Columbia (51 Total). As you complete the activity, discuss in your groups the differences between the data sets and what may contribute to the differences. The data was taken from the following websites:

1. Africa Data: Portions of the Data from: <http://hdr.undp.org/en/composite/MPI>
2. US Data: Table “Percentage of People in Poverty by State Using 2- and 3- year Averages:”
<https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html>

1) Utilizing the Map of Africa and the African Country Data Set, place a dot on each country in the data set on your map. Familiarize yourself with the geographical location of each country. Keep in mind as you complete the lab that these are the countries represented by the data which you will be analyzing.

2) Watch the following videos on poverty in America and Countries in Africa. Additional video suggestions are listed at the end of the activity in reference 3. After watching the videos, discuss what poverty means in the US and in Africa.

2A) Poverty in the United States

- Segment title: CBS Evening News - Family Faces the Growing Edge of Poverty -3:50 min.
<https://youtu.be/bv48A9BSews>
- Segment title: The New Homeless-4:15
<https://youtu.be/obho7uBg3-A>

Poverty in Africa

- Segment title: Hunger Crisis in West Africa-4:33
<https://youtu.be/pC3kKsn19AE>
- Three Children, Three Counties
<https://www.youtube.com/watch?v=H42b9iWeFMA>
- Sunkari's story, Freetown, Sierra Leone
<https://www.youtube.com/watch?v=RFYWQEabSe0>

2B) Read the definitions of poverty at the end of Reference 1 and 2. Discuss what the data represents as a class. Is there additional information that would be helpful to understand what the data means?

3a) Is it appropriate for both sets of data to use a lower class limit of 0 and a class width of 5? Why or why not?

3b) Explain what the frequency represents for both of the data sets.

3c) Which class has the highest frequency for both sets of data?

African Data:_____.

US State Data:_____.

Discuss the differences:

3d) Looking at the histograms, how does poverty in African countries compare to poverty in the United States? Identify possible factors that may influence the data.

4) Measures of Central Tendency and Five # Summary: Calculate the measures of Central Tendencies and the five # summary for each of the two data sets and record your results in the table below.

	African Countries	United States
Mean		
Mode		
Standard Deviation		
Minimum		
Quartile 1		
Median		
Quartile 3		
Maximum		

4a) Find the range for each of the data sets.

African Data: _____ US State Data: _____

Discuss the differences. Which has a bigger range?

4b) Find the interquartile range for each of the data sets. Show your work.

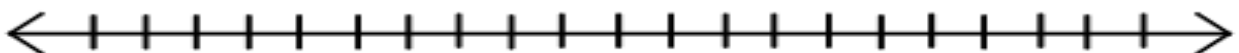
African Data: _____ US State Data: _____

Discuss the differences. Is the interquartile range bigger or smaller? What does that mean?:

4c) For the Africa data, what percentage of countries should have values contained within the interquartile range? Use that percentage to determine how many countries have values contained within the interquartile range.

4d) For the United States data, what percentage of States should have values contained above Quartile 3? How does Quartile 3 for the United States data compare to the values for the African data? Are they similar?

5) Boxplot's: Create a stacked boxplot showing the Africa and United States data. Label the number line appropriately, so that it works for both the data sets. Label your boxplots.



5a) In your opinion, which figure, the histograms or boxplots, helps you see the differences between the data sets?

5b) Using both sets of data, what is the range of the Poverty Rate (% of the population living in poverty) for the middle 50 % of the countries/States respectively?

African Data:_____.

US State Data:_____.

Discuss the differences:

5c) Using both sets of data, what is the Poverty Rate (% of the population living in poverty for the top 25%) of the countries/States respectively?

African Data:_____.

US State Data:_____.

Compare and Contrast the values for the data sets:

Reference 1: Poverty in African Countries:

Portions of the Data from: <http://hdr.undp.org/en/composite/MPI>

Table 6: Multidimensional Poverty Index: developing countries

Source: <http://hdr.undp.org/en/composite/MPI>

Country	Year and survey ^a	Population living below income poverty line (%)	
		National poverty line	PPP \$1.25 a day
		2004–2014 ^e	2002–2012
Benin	2011/2012 D	36.2	51.6
Burkina Faso	2010 D	46.7	44.5
Burundi	2010 D	66.9	81.3
Cameroon	2011 D	39.9	27.6
Central African Republic	2010 M	62.0	62.8
Chad	2010 M	46.7	36.5
Congo	2011/2012 D	46.5	32.8
Congo (Democratic Republic of the)	2013/2014 D	63.6	87.7
Côte d'Ivoire	2011/2012 D	42.7	35.0
Djibouti	2006 M		18.8
Egypt	2014 D	25.2	1.7
Ethiopia	2011 D	29.6	36.8
Gabon	2012 D	32.7	6.1
Gambia	2013 D	48.4	33.6
Ghana	2011 M	24.2	28.6
Guinea	2012 D/M	55.2	40.9
Guinea-Bissau	2006 M	69.3	48.9
Kenya	2008/2009 D	45.9	43.4
Liberia	2013 D	63.8	83.8
Madagascar	2008/2009 D	75.3	87.7
Malawi	2010 D	50.7	72.2
Mali	2012/2013 D	43.6	50.6
Mauritania	2011 M	42.0	23.4
Morocco	2011 N	8.9	2.57
Mozambique	2011 D	54.7	60.7
Namibia	2013 D	28.7	23.5
Niger	2012 D	48.9	40.8
Nigeria	2013 D	46.0	62.0
Rwanda	2010 D	44.9	63.0
Sao Tome and Principe	2008/2009 D	61.7	43.5
Sierra Leone	2013 D	52.9	56.6
South Africa	2012 N	53.8	9.4
Sudan	2010 M	46.5	19.8
Swaziland	2010 M	63.0	39.3
Tanzania (United Republic of)	2010 D	28.2	43.5
Togo	2013/2014 D	58.7	52.5
Tunisia	2011/2012 M	15.5	0.7
Uganda	2011 D	19.5	37.8
Zambia	2013/2014 D	60.5	74.3

Definitions

Population below national poverty line: Percentage of the population living below the national poverty line, which is the poverty line deemed appropriate for a country by its authorities. National estimates are based on population-weighted subgroup estimates from household surveys.

Population below PPP \$1.25 a day: Percentage of the population living below the international poverty line \$1.25 (in purchasing power parity terms) a day.

Reference 2: Table “Percentage of People in Poverty by State Using 2-year Averages:”
<https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html>

Percentage of People in Poverty by State Using 2-Year Averages:

(People as of March of the following year. For information on confidentiality protection, sampling error, non-sampling error, and definitions, see see <ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf>)

State	2-year average			
	2010-2011		2012-2013 ¹	
	Percentage	90 percent confidence interval ² (+/-)	Percentage	90 percent confidence interval ² (+/-)
United States.....	15.1	0.2	14.7	0.2
Alabama.....	16.3	2.1	16.4	1.3
Alaska.....	12.1	1.9	10.5	1.9
Arizona.....	18.0	2.3	19.6	2.1
Arkansas.....	17.0	2.1	18.6	2.7
California.....	16.6	0.7	15.4	0.6
Colorado.....	12.7	1.5	11.2	1.4
Connecticut.....	9.3	1.2	10.8	1.1
Delaware.....	12.9	1.3	13.7	1.5
District of Columbia....	19.7	1.8	19.9	1.8
Florida.....	15.4	0.9	15.1	0.9
Georgia.....	18.6	1.5	17.2	1.5
Hawaii.....	12.2	1.7	12.5	1.7
Idaho.....	14.8	2.3	13.7	2.2
Illinois.....	14.1	1.0	12.9	1.1
Indiana.....	15.9	1.9	13.4	1.4
Iowa.....	10.4	1.1	10.5	1.0
Kansas.....	14.4	2.0	13.6	1.3
Kentucky.....	16.8	2.0	18.9	1.8
Louisiana.....	21.3	2.1	20.2	2.9
Maine.....	13.0	1.5	12.5	1.4
Maryland.....	10.1	1.1	10.1	1.0
Massachusetts.....	10.7	1.3	11.6	1.4
Michigan.....	15.3	1.4	14.1	1.4
Minnesota.....	10.4	1.2	11.0	1.1
Mississippi.....	20.0	1.7	22.2	2.4
Missouri.....	15.2	2.2	14.5	2.1
Montana.....	15.5	2.4	14.0	2.2
Nebraska.....	10.2	1.7	11.6	1.6
Nevada.....	16.0	1.8	16.6	1.8
New Hampshire.....	7.1	1.0	8.6	1.0
New Jersey.....	11.2	1.3	10.2	1.2
New Mexico.....	20.2	2.2	21.0	2.8

New York.....	16.0	1.0	15.9	0.9
North Carolina.....	16.4	1.6	17.9	2.0
North Dakota.....	11.3	1.5	10.6	1.2
Ohio.....	15.2	1.6	14.5	1.4
Oklahoma.....	15.1	2.0	16.0	2.1
Oregon.....	14.3	1.7	14.3	1.5
Pennsylvania.....	12.4	1.0	13.1	1.3
Rhode Island.....	13.7	1.4	13.6	1.4
South Carolina.....	18.0	1.6	16.3	1.5
South Dakota.....	14.1	2.6	11.5	1.8
Tennessee.....	16.5	2.1	18.4	2.3
Texas.....	17.9	1.1	16.9	1.0
Utah.....	10.5	1.4	9.6	1.6
Vermont.....	11.2	1.4	10.0	1.1
Virginia.....	11.0	1.1	10.5	1.2
Washington.....	12.1	1.5	11.8	1.3
West Virginia.....	17.2	2.1	17.0	2.9
Wisconsin.....	11.6	1.4	11.2	1.3
Wyoming.....	10.1	1.5	10.7	1.4

*An asterisk preceding an estimate indicates change is statistically different from zero at the 90 percent confidence level.

¹Data are based on the CPS ASEC sample of 68,000 addresses. The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

²A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence interval shown in this table are based on standard errors calculated using replicate weights. For more information, see "Standard Errors and Their Use" at <<ftp://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>>.

³Details may not sum to totals because of rounding.

Source: U.S. Census Bureau, Current Population Survey, 2011 to 2014 Annual Social and Economic Supplements.

Reference 3: Additional Videos Resources:

MAT 152 Global Distinction Project

The first section of films are accessible from Films on Demand, which is part of NC LIVE. Students would have to access the films through their school's proxy server, or by using the NC LIVE password.

Economic Gaps: Globalization—A Real-World View

Segment title: Why the Poorest Countries in the World are in Africa

Segment title: Why is America Rich?

Segment title: Poverty in Africa (this is really good)

Decaying Cities: Reclaiming the Rust Belt

Segment title: Poverty in the United States: Philadelphia

49 Million Americans in Poverty 9:12 min. (informative, but pretty dry)

What Poor Child Is This? Poverty and America's Children

Segment title: 16k for family of 3, one in six children live in poverty, more than 30 years ago and rising 2:03 min.

Segment title: Welcome to Poverty, USA 3:01 min.

Segment title: Out of Sight and Oversized 1:27 min.

YouTube Videos

Poverty in the United States

Segment title: Tour Poverty USA -4:05 min.

<https://youtu.be/g3iRRsoqoMI>

Segment title: Home Families Seattle-5:05

<https://youtu.be/TKsnABYo-UI>

Segment title: Going Hungry in America-3:46

<https://youtu.be/FBQSCQcfY18>

Poverty in Africa

Segment title: 15m People in Ethiopia Will Need Food Aid by 2016-3:00

<https://youtu.be/9IKqAtJiZUY>

Segment title: Children Living in Poverty-4:34 (Ghana)

https://youtu.be/fQVqqskFM_8

Segment title: Poverty in Sierra Leone-4:42

https://youtu.be/0hPF_n4st2o

Segment title: Global National-Sierra Leone Poverty-2:20

<https://youtu.be/7uGiwVdGT6w>